

July 29, 2022

Project Number: P859-10

David Schaeffer Engineering Limited  
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Markham, Ontario  
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**Attention: Mr. Brian Betts, P.Eng.**

**Subject: Joshua's Creek Development / Hydraulic Analysis of the Main Branch of Joshua's Creek**

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As requested by your office, we have evaluated, based on the available information as described below, the 2- to 100-year and Regional design water levels and velocities along the main branch of Joshua's Creek under existing and proposed conditions. The creek is located within the Town of Oakville, adjacent to the proposed Joshua's Creek development.

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*It is noted this memo provides a summary of the evolution of updates to the Joshua's Creek hydraulic model. Items 1 through 6 shown below provide details of previous model iterations and analysis. Item 7 and the text and tables following item 7 focuses on the model updates and simulated results for which this memo update has been prepared.*

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In undertaking this work, the following information was considered:

1. A HEC-2 model of Joshua's Creek under existing conditions was provided by Stantec in July 2017. Refer to Figure 1 for the locations of the existing conditions HEC-RAS model cross-sections.
2. The HEC-2 model specifies Manning's roughness coefficients of 0.035 for the main channel and 0.08 for the overbanks for the sections of the creek adjacent to and through the proposed Joshua's Creek development.
3. The existing conditions HEC-2 model was updated to HEC-RAS v.5.0 in the October 9, 2019 version of this memo for ease of use. The following changes were made to the converted HEC-2 model for consistency with HEC-RAS program requirements:
  - Remove duplicate points from River 1 cross-section 12.41 in accordance with HEC-RAS requirements;
  - Correct bridge distances to add space between bridge and cross-sections in accordance with HEC-RAS requirements;
  - Set Manning's n for bottom of culvert at River 1 station 9.038 in accordance with HEC-RAS requirements (set equal to main channel Manning's n of 0.035);
  - Move bridges at River 4 station 11.7695 and River 5 station 12.012 to River 4 station 11.847 and River 5 station 8.7, respectively, to correctly reflect locations in HEC-2;

- Add bridge data for River 4 station 11.847 and River 5 station 8.7 that did not convert correctly from HEC-2;
  - Adjust downstream bridge low chord data for River 3 station 12.034 to line up with cross-section data; and
  - Added flows to upstream extent of River 5 cross-section 8.789, based on closest downstream flows XS 8.667.
  - The 2- to 50-year flows were entered as 0 L/s at several flow change locations in the HEC-2 model, and in conversion to HEC-RAS, were matched to the next non-zero value by the program. This results in flows greater than the 100-year flows at some locations. To identify a more reasonable estimate of the 2- to 50-year flows at these flow change locations, drainage areas to each location were provided by Stantec, and the 2- to 50-year flows were estimated based on NOCSS unit flow rates on Joshua's Creek at JC-D1. Refer to Table C-1 of Attachment C for the estimated flow profiles.
4. Changes were made to the model for the October 9, 2019 version of this memo in support of proposed modifications at that time, namely:
- Cross-section 9.075 adjacent to proposed Stormwater Management (SWM) Pond 55 was added to the HEC-RAS model in River 1, Reach 4 based on topographic data provided by DSEL, in order to better define the proposed fill associated with construction of the pond.
  - The HEC-RAS model was then revised to represent proposed conditions between River 1, Reach 4 cross-sections 9.328 and 9.075, to represent the proposed fill associated with the construction of Pond 55 based on proposed grading information provided by DSEL, consistent with the September 2019 *Design Brief for Stormwater Management Pond 55 for Phase 1 of the Bressa Subdivision*.
  - A future road crossing in River 1, Reach 2 was incorporated into the proposed conditions model at station 11.53, with a 47 m long and 9.6 m wide x 1.2 m high box culvert. Note that cross-section 11.56 was eliminated from the model, as it overlaps with the future road crossing; cross-section 11.572 was interpolated 11.1 m upstream of cross-section 11.56 to define channel dimensions at the upstream side of the proposed road crossing.
5. The following changes were made to the model in accordance with the July 23, 2020 *Coscorp Development / Hydraulic Analysis of the Main Branch of Joshua's Creek (River 2 Reach 1)* memo, namely:
- In order to better define the proposed cut and fill area associated with construction of the Coscorp development, several cross-sections were added to River 2 Reach 1 of the existing and proposed conditions models between existing cross-sections 1025 and 12.5 (excluding cross-sections 1025 and 12.5, including the update of cross-section 1000) based on existing topographic data provided by DSEL. Note that low flow channel geometry was not detailed in the provided topographic data, and to supplement this gap, the low flow channel was assumed to have a top width of 6 m based on the original geometry for cross-section 1000.
  - Note that the contraction-expansion coefficients in the initial existing conditions HEC-RAS model were provided as 0.3 / 0.5 in River 2 Reach 1. As there is no apparent

contraction-expansion area (e.g. a road crossing) that would explain these values, they were assumed to be in error and reduced to 0.1 / 0.3.

- River 2 Reach 1 of the proposed conditions HEC-RAS model was then revised to represent the proposed cut and fill associated with the construction of the Coscorp development based on proposed grading information provided by DSEL.
6. The following changes were made to the model in accordance with the July 6, 2021 *Joshua's Creek Development / Hydraulic Analysis of the Main Branch of Joshua's Creek* memo, namely:
- The existing and proposed conditions HEC-RAS models were re-run using the latest version of HEC-RAS, version 6.0.0.
  - An additional future road crossing in River 1, Reach 2 was incorporated into the proposed conditions model at station 11.869, with a 31 m long and 9.6 m wide x 1.2 m high box culvert. Note that cross-section 11.868 was eliminated from the model, as it overlaps with the future road crossing; cross-sections 11.87 and 11.8675 were added based on topographic data provided by DSEL to define channel dimensions at the upstream and downstream sides of the proposed road crossing. Refer to Figure 1 for the locations of the added HEC-RAS model cross-sections.
7. The following changes were made for the current study:
- The existing and proposed conditions HEC-RAS models were re-run using the latest version of HEC-RAS, version 6.2.
  - The existing and proposed conditions HEC-RAS models were georeferenced using the thalweg linework and topographic data provided by DSEL on January 6<sup>th</sup>, 2022.
  - To simplify the model georeferencing and updates for the current study, only HEC-RAS River 1: Reaches 1 and 2 and River 2: Reach 1 were kept in the model with all other rivers/reaches removed. The downstream location of the updated HEC-RAS model corresponds to Junction B from the previous model, downstream of cross section 11.024 on River 1: Reach 2. Given that location is approximately 1.3 km downstream and more than 11 m vertical difference from the main area of interest of the current model updates, the removal of rivers/reaches from the HEC-RAS model in itself do no influence WSELs for the area of interest of the current study.
  - A downstream boundary condition was set at HEC-RAS cross section 11.024 equal to the previous WSEL results for each respective design storm from the previous HEC-RAS model.
  - A collection of topographic data was merged together to form a Digital Terrain Model (DTM) forming the basis for the geometry updates to the existing conditions cross sections. This information includes:
    - Detailed topographic survey of Coscorp lands, as provided by DSEL
    - LiDAR data, as provided by DSEL (applied in areas outside of the limits of the detailed topographic survey)
    - NRCAN topographic (LiDAR sourced) data (applied in areas outside of the limits of the detailed topographic survey)
  - Existing conditions cross section geometries were updated by cutting from the underlying merged DTM in HEC-RAS.
  - The proposed conditions HEC-RAS model was adjusted to reflect proposed cut/fill geometry along HEC-RAS River 2: Reach 1 as provided by DSEL on April 22, 2022.

- The existing and proposed conditions models were modified to include updates to the culvert at Station 12.251. It is JFSAs understanding construction of this crossing is to be completed prior to commencement of proposed development works upstream. As such, it is noted the modelled culverts at this location are the same in both existing and proposed conditions HEC-RAS models.
  - The existing and proposed conditions model low flow channel was added between cross sections 1025 and 756 (River 2: Reach 1).
  - Cross section 1004 has been added to the proposed conditions model to reflect the extension of a proposed berm. This cross section has also been added to the existing conditions HEC-RAS model for consistency.
  - Proposed filling is reflected by the use of blocked obstructions in the proposed conditions HEC-RAS model.
8. The 2- to 100-year and Regional flow profiles provided in the existing conditions model were used in simulating existing and proposed conditions on the understanding that post-development release rates to the creek will be attenuated to pre-development levels. The existing flow profiles were also used in calculating riparian storage to ensure that sufficient storage is provided for the highest flows in the channel (i.e. the Regional flows).
9. All channel infrastructure was removed from the model for the purpose of calculating riparian storage.

Based on the above information, design water levels and velocities for River 2: Reach 1 and River 1: Reaches 1 and 2 of the main branch of Joshua's Creek under existing and proposed conditions were determined using HEC-RAS and are presented in Attachments A and B, respectively.

As per Attachments A and B, it is noted that proposed Regional water levels are equal to or less than existing flood levels at all locations along all reaches.

A summary of Regional water levels is presented in Table 1 for existing and proposed conditions.

**Table 1: Comparison of Regional Water Levels in Joshua’s Creek Main Branch <sup>(1)</sup>**

| HEC-RAS River Station | Regional Flood Level (m) |          |                         |
|-----------------------|--------------------------|----------|-------------------------|
|                       | Existing                 | Proposed | Difference (Prop-Exist) |
| 1050                  | 178.32                   | 178.32   | 0.00                    |
| 1025                  | 178.32                   | 178.31   | -0.01                   |
| 1010                  | 178.31                   | 178.31   | 0.00                    |
| 1006                  | 178.31                   | 178.31   | 0.00                    |
| 1004                  | 178.31                   | 178.31   | 0.00                    |
| 1000                  | 178.31                   | 178.31   | 0.00                    |
| 979                   | 178.31                   | 178.31   | 0.00                    |
| 955                   | 178.31                   | 178.31   | 0.00                    |
| 929                   | 178.31                   | 178.31   | 0.00                    |
| 866                   | 178.31                   | 178.31   | 0.00                    |
| 756                   | 178.31                   | 178.31   | 0.00                    |
| 12.5                  | 178.30                   | 178.30   | 0.00                    |
| 12.41                 | 178.29                   | 178.29   | 0.00                    |
| 12.358                | 178.28                   | 178.28   | 0.00                    |
| 12.286                | 178.25                   | 178.25   | 0.00                    |
| 12.261                | 178.15                   | 178.15   | 0.00                    |
| 12.251                | CULVERT <sup>(1)</sup>   |          |                         |
| 12.236                | 178.08                   | 178.08   | 0.00                    |
| 12.21                 | 178.08                   | 178.08   | 0.00                    |
| 12.19                 | 178.05                   | 178.05   | 0.00                    |
| 12.164                | 178.03                   | 178.03   | 0.00                    |
| 12.161                | BRIDGE                   |          |                         |
| 12.158                | 177.51                   | 177.51   | 0.00                    |
| 12.144                | 177.48                   | 177.48   | 0.00                    |
| 12.09                 | 177.14                   | 177.14   | 0.00                    |
| 12.017                | 176.59                   | 176.59   | 0.00                    |
| 11.965                | 176.12                   | 176.12   | 0.00                    |
| 11.885                | 175.40                   | 175.40   | 0.00                    |
| 11.868                | 174.68                   | 174.68   | 0.00                    |
| 11.867                | 173.75                   | 173.75   | 0.00                    |
| 11.866                | 173.22                   | 173.22   | 0.00                    |
| 11.777                | 172.50                   | 172.50   | 0.00                    |
| 11.723                | 172.00                   | 172.00   | 0.00                    |
| 11.623                | 171.37                   | 171.37   | 0.00                    |
| 11.56                 | 170.98                   | 170.98   | 0.00                    |
| 11.506                | 170.45                   | 170.45   | 0.00                    |
| 11.464                | 169.99                   | 169.99   | 0.00                    |
| 11.439                | 169.75                   | 169.75   | 0.00                    |
| 11.349                | 169.28                   | 169.28   | 0.00                    |
| 11.281                | 168.66                   | 168.66   | 0.00                    |
| 11.244                | 168.25                   | 168.25   | 0.00                    |
| 11.184                | 167.73                   | 167.73   | 0.00                    |
| 11.145                | 167.52                   | 167.52   | 0.00                    |
| 11.089                | 167.08                   | 167.08   | 0.00                    |

|        |        |        |      |
|--------|--------|--------|------|
| 11.024 | 166.60 | 166.60 | 0.00 |
|--------|--------|--------|------|

<sup>(1)</sup> Water levels calculated using existing conditions flow profiles for comparison purposes; channel infrastructure included at existing and proposed crossings.

Table 2 provides a summary of the riparian storage in Joshua’s Main Branch for the existing and proposed HEC-RAS model conditions.



**Table 2: Riparian Storage in Joshua’s Creek Main Branch <sup>(1)</sup>  
(HEC-RAS River 2: Reach 1)**

| Event    | Max. Flow<br>(m <sup>3</sup> /s) | Volume (m <sup>3</sup> ) |          |                            |
|----------|----------------------------------|--------------------------|----------|----------------------------|
|          |                                  | Existing                 | Proposed | Difference<br>(Prop-Exist) |
| Regional | 10.73                            | 64,820                   | 65,880   | 1,060                      |
| 100-Year | 4.18                             | 21,210                   | 22,700   | 1,490                      |
| 50-Year  | 3.29                             | 20,370                   | 21,900   | 1,530                      |
| 20-Year  | 2.88                             | 18,160                   | 19,630   | 1,470                      |
| 10-Year  | 2.25                             | 13,990                   | 15,300   | 1,310                      |
| 5-Year   | 1.85                             | 11,990                   | 13,170   | 1,180                      |
| 2-Year   | 1.16                             | 8,050                    | 8,850    | 800                        |

<sup>1)</sup> Riparian storage calculated using existing conditions flow profiles for comparison purposes; no channel infrastructure included.

Yours truly,

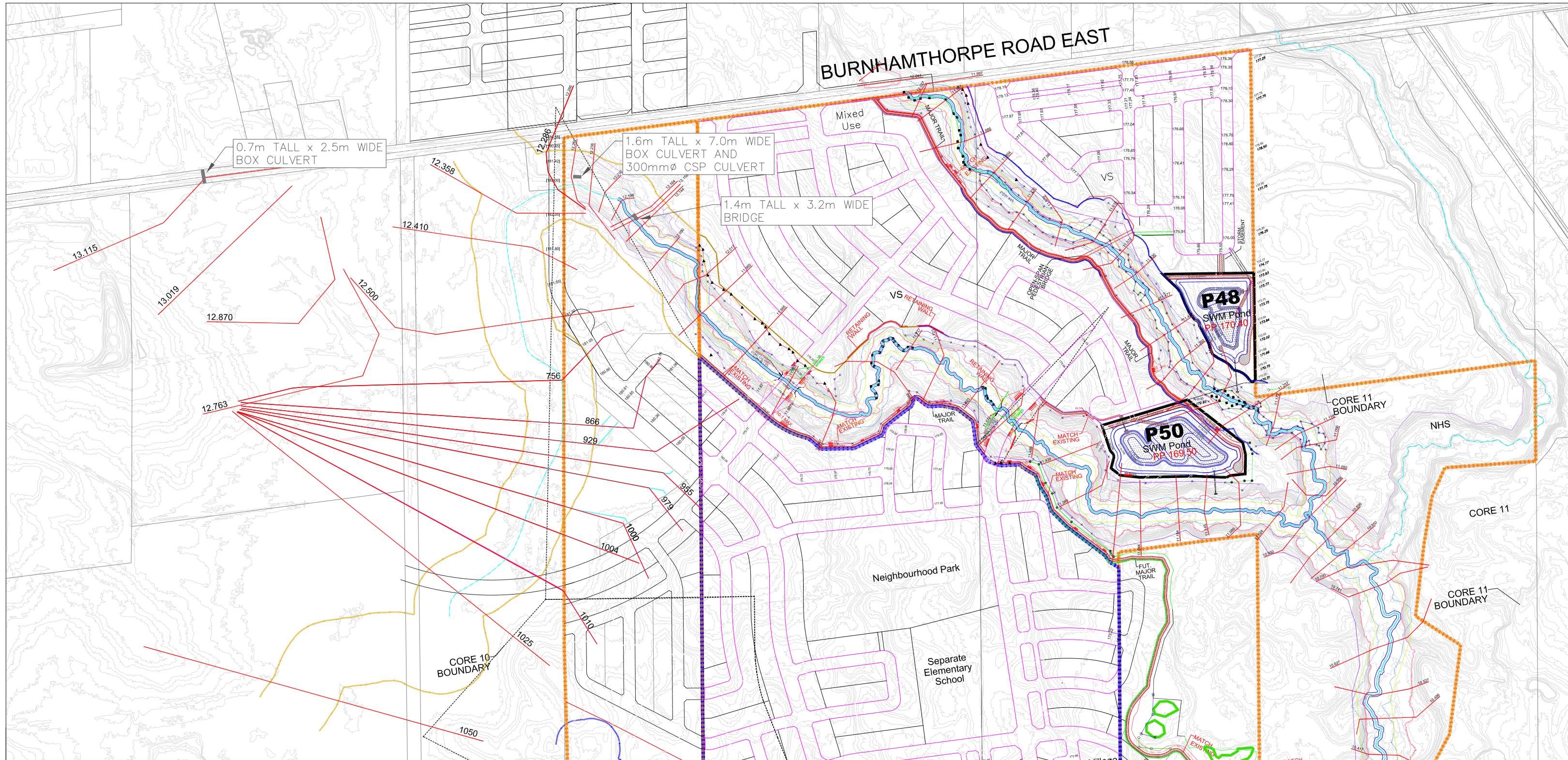
**J.F Sabourin and Associates Inc.**

|  |  |
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|   |                                  |
| <b>(Current Submission – July 29, 2022)</b><br><br>Bryan Willcott, P.Eng.<br>Project Engineer in Water Resources<br><br>cc: J.F Sabourin, M.Eng, P.Eng<br>Director of Water Resources Projects | <b>(Previous Submission Only – July 6, 2021)</b><br><br>Laura Pipkins, P.Eng.<br>Project Engineer in Water Resources |

**Attachments**

- Attachment A: HEC-RAS Existing Conditions Results for Joshua’s Creek Main Branch
- Attachment B: HEC-RAS Proposed Conditions Results for Joshua’s Creek Main Branch
- Attachment C: HEC-RAS Existing Conditions Flow Profiles for Joshua’s Creek Main Branch





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PROJECT: COSCORP DEVELOPMENT

SCALE: N.T.S.

TITLE: LOCATION OF EXISTING CONDITIONS  
 HEC-RAS CROSS-SECTIONS

|     |    |      |             |    |
|-----|----|------|-------------|----|
| No. | BY | DATE | DESCRIPTION | BY |
|     |    |      |             |    |

LEGEND:

- HEC-RAS CROSS-SECTION
- 9.105 HEC-RAS CROSS-SECTION ID
- JOSHUA'S CREEK CENTRELINE
- CULVERT

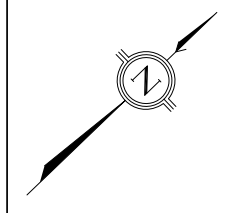


FIGURE 1

|            |             |
|------------|-------------|
| DESIGNED : |             |
| DRAWN :    | TL          |
| VERIFIED : | JFS         |
| APPROVED : | JFS         |
| DATE       | PROJECT No. |
| Jul/22     | 859-10      |



# ATTACHMENT

# A

## *HEC-RAS Existing Conditions Results for Joshua's Creek Main Branch*

**JFSA**

Water Resources and  
Environmental Consultants





**Table A-1: HEC-RAS Results for Joshua's Creek Under Existing Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 1050                  | Regional | 4.67                     | 178.08                        | 178.32                      | 0.62                   | 1.80                    |
| 1050                  | 100-Year | 1.96                     | 178.08                        | 178.19                      | 0.57                   | 1.11                    |
| 1050                  | 50-Year  | 1.65                     | 178.08                        | 178.17                      | 0.60                   | 1.26                    |
| 1050                  | 25-Year  | 1.48                     | 178.08                        | 178.18                      | 0.48                   | 1.28                    |
| 1050                  | 10-Year  | 1.13                     | 178.08                        | 178.19                      | 0.33                   | 1.34                    |
| 1050                  | 5-Year   | 0.96                     | 178.08                        | 178.18                      | 0.29                   | 1.39                    |
| 1050                  | 2-Year   | 0.61                     | 178.08                        | 178.16                      | 0.23                   | 1.52                    |
| 1025                  | Regional | 4.67                     | 177.42                        | 178.32                      | 0.08                   | 1.62                    |
| 1025                  | 100-Year | 1.96                     | 177.42                        | 177.87                      | 0.22                   | 0.95                    |
| 1025                  | 50-Year  | 1.65                     | 177.42                        | 177.86                      | 0.20                   | 1.10                    |
| 1025                  | 25-Year  | 1.48                     | 177.42                        | 177.84                      | 0.21                   | 1.10                    |
| 1025                  | 10-Year  | 1.13                     | 177.42                        | 177.81                      | 0.24                   | 1.11                    |
| 1025                  | 5-Year   | 0.96                     | 177.42                        | 177.79                      | 0.24                   | 1.15                    |
| 1025                  | 2-Year   | 0.61                     | 177.42                        | 177.77                      | 0.22                   | 1.24                    |
| 1010                  | Regional | 4.67                     | 177.37                        | 178.31                      | 0.06                   | 1.28                    |
| 1010                  | 100-Year | 1.96                     | 177.37                        | 177.86                      | 0.11                   | 0.81                    |
| 1010                  | 50-Year  | 1.65                     | 177.37                        | 177.85                      | 0.10                   | 0.94                    |
| 1010                  | 25-Year  | 1.48                     | 177.37                        | 177.83                      | 0.10                   | 0.95                    |
| 1010                  | 10-Year  | 1.13                     | 177.37                        | 177.78                      | 0.12                   | 0.98                    |
| 1010                  | 5-Year   | 0.96                     | 177.37                        | 177.75                      | 0.12                   | 1.02                    |
| 1010                  | 2-Year   | 0.61                     | 177.37                        | 177.70                      | 0.14                   | 1.11                    |
| 1006                  | Regional | 4.67                     | 177.33                        | 178.31                      | 0.06                   | 1.07                    |
| 1006                  | 100-Year | 1.96                     | 177.33                        | 177.85                      | 0.09                   | 0.69                    |
| 1006                  | 50-Year  | 1.65                     | 177.33                        | 177.85                      | 0.08                   | 0.81                    |
| 1006                  | 25-Year  | 1.48                     | 177.33                        | 177.82                      | 0.08                   | 0.82                    |
| 1006                  | 10-Year  | 1.13                     | 177.33                        | 177.77                      | 0.08                   | 0.85                    |
| 1006                  | 5-Year   | 0.96                     | 177.33                        | 177.75                      | 0.07                   | 0.89                    |
| 1006                  | 2-Year   | 0.61                     | 177.33                        | 177.69                      | 0.07                   | 0.99                    |
| 1004                  | Regional | 4.67                     | 177.23                        | 178.31                      | 0.05                   | 0.97                    |
| 1004                  | 100-Year | 1.96                     | 177.23                        | 177.85                      | 0.09                   | 0.63                    |
| 1004                  | 50-Year  | 1.65                     | 177.23                        | 177.85                      | 0.07                   | 0.73                    |
| 1004                  | 25-Year  | 1.48                     | 177.23                        | 177.82                      | 0.07                   | 0.74                    |
| 1004                  | 10-Year  | 1.13                     | 177.23                        | 177.77                      | 0.07                   | 0.77                    |
| 1004                  | 5-Year   | 0.96                     | 177.23                        | 177.75                      | 0.06                   | 0.81                    |
| 1004                  | 2-Year   | 0.61                     | 177.23                        | 177.69                      | 0.05                   | 0.90                    |
| 1000                  | Regional | 5.14                     | 177.24                        | 178.31                      | 0.06                   | 0.81                    |
| 1000                  | 100-Year | 2.15                     | 177.24                        | 177.85                      | 0.10                   | 0.52                    |
| 1000                  | 50-Year  | 1.82                     | 177.24                        | 177.85                      | 0.09                   | 0.61                    |
| 1000                  | 25-Year  | 1.62                     | 177.24                        | 177.82                      | 0.09                   | 0.61                    |
| 1000                  | 10-Year  | 1.24                     | 177.24                        | 177.77                      | 0.08                   | 0.64                    |
| 1000                  | 5-Year   | 1.05                     | 177.24                        | 177.75                      | 0.08                   | 0.67                    |
| 1000                  | 2-Year   | 0.67                     | 177.24                        | 177.69                      | 0.07                   | 0.74                    |
| 979                   | Regional | 5.14                     | 177.28                        | 178.31                      | 0.06                   | 0.60                    |
| 979                   | 100-Year | 2.15                     | 177.28                        | 177.85                      | 0.11                   | 0.40                    |
| 979                   | 50-Year  | 1.82                     | 177.28                        | 177.84                      | 0.10                   | 0.47                    |
| 979                   | 25-Year  | 1.62                     | 177.28                        | 177.82                      | 0.10                   | 0.47                    |
| 979                   | 10-Year  | 1.24                     | 177.28                        | 177.77                      | 0.10                   | 0.50                    |
| 979                   | 5-Year   | 1.05                     | 177.28                        | 177.74                      | 0.09                   | 0.52                    |
| 979                   | 2-Year   | 0.67                     | 177.28                        | 177.69                      | 0.09                   | 0.57                    |
| 955                   | Regional | 5.14                     | 177.21                        | 178.31                      | 0.05                   | 0.50                    |
| 955                   | 100-Year | 2.15                     | 177.21                        | 177.85                      | 0.09                   | 0.34                    |
| 955                   | 50-Year  | 1.82                     | 177.21                        | 177.84                      | 0.07                   | 0.40                    |
| 955                   | 25-Year  | 1.62                     | 177.21                        | 177.82                      | 0.07                   | 0.41                    |

**Table A-1: HEC-RAS Results for Joshua's Creek Under Existing Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 955                   | 10-Year  | 1.24                     | 177.21                        | 177.77                      | 0.07                   | 0.43                    |
| 955                   | 5-Year   | 1.05                     | 177.21                        | 177.74                      | 0.07                   | 0.45                    |
| 955                   | 2-Year   | 0.67                     | 177.21                        | 177.69                      | 0.07                   | 0.50                    |
| 929                   | Regional | 5.14                     | 177.19                        | 178.31                      | 0.06                   | 0.39                    |
| 929                   | 100-Year | 2.15                     | 177.19                        | 177.85                      | 0.12                   | 0.28                    |
| 929                   | 50-Year  | 1.82                     | 177.19                        | 177.84                      | 0.10                   | 0.32                    |
| 929                   | 25-Year  | 1.62                     | 177.19                        | 177.82                      | 0.10                   | 0.33                    |
| 929                   | 10-Year  | 1.24                     | 177.19                        | 177.77                      | 0.10                   | 0.35                    |
| 929                   | 5-Year   | 1.05                     | 177.19                        | 177.74                      | 0.10                   | 0.37                    |
| 929                   | 2-Year   | 0.67                     | 177.19                        | 177.69                      | 0.10                   | 0.42                    |
| 866                   | Regional | 5.14                     | 177.31                        | 178.31                      | 0.06                   | 0.27                    |
| 866                   | 100-Year | 2.15                     | 177.31                        | 177.85                      | 0.10                   | 0.21                    |
| 866                   | 50-Year  | 1.82                     | 177.31                        | 177.84                      | 0.09                   | 0.25                    |
| 866                   | 25-Year  | 1.62                     | 177.31                        | 177.82                      | 0.09                   | 0.25                    |
| 866                   | 10-Year  | 1.24                     | 177.31                        | 177.77                      | 0.09                   | 0.28                    |
| 866                   | 5-Year   | 1.05                     | 177.31                        | 177.74                      | 0.08                   | 0.29                    |
| 866                   | 2-Year   | 0.67                     | 177.31                        | 177.68                      | 0.08                   | 0.34                    |
| 756                   | Regional | 10.73                    | 177.19                        | 178.31                      | 0.13                   | 0.08                    |
| 756                   | 100-Year | 4.18                     | 177.19                        | 177.84                      | 0.14                   | 0.07                    |
| 756                   | 50-Year  | 3.29                     | 177.19                        | 177.84                      | 0.11                   | 0.07                    |
| 756                   | 25-Year  | 2.88                     | 177.19                        | 177.81                      | 0.11                   | 0.07                    |
| 756                   | 10-Year  | 2.25                     | 177.19                        | 177.76                      | 0.10                   | 0.08                    |
| 756                   | 5-Year   | 1.85                     | 177.19                        | 177.74                      | 0.09                   | 0.09                    |
| 756                   | 2-Year   | 1.16                     | 177.19                        | 177.68                      | 0.07                   | 0.11                    |
| 14.207                | Regional | 6.81                     | 179.20                        | 180.65                      | 0.15                   | 0.32                    |
| 14.207                | 100-Year | 2.86                     | 179.20                        | 180.09                      | 0.30                   | 0.29                    |
| 14.207                | 50-Year  | 2.41                     | 179.20                        | 179.96                      | 0.37                   | 0.30                    |
| 14.207                | 25-Year  | 2.16                     | 179.20                        | 179.88                      | 0.40                   | 0.31                    |
| 14.207                | 10-Year  | 1.65                     | 179.20                        | 179.77                      | 0.41                   | 0.34                    |
| 14.207                | 5-Year   | 1.40                     | 179.20                        | 179.72                      | 0.42                   | 0.36                    |
| 14.207                | 2-Year   | 0.89                     | 179.20                        | 179.60                      | 0.41                   | 0.40                    |
| 13.167                | Regional | 6.81                     | 179.10                        | 180.65                      | 0.27                   | 0.27                    |
| 13.167                | 100-Year | 2.86                     | 179.10                        | 179.97                      | 1.32                   | 0.28                    |
| 13.167                | 50-Year  | 2.41                     | 179.10                        | 179.84                      | 1.30                   | 0.29                    |
| 13.167                | 25-Year  | 2.16                     | 179.10                        | 179.75                      | 1.32                   | 0.30                    |
| 13.167                | 10-Year  | 1.65                     | 179.10                        | 179.67                      | 1.17                   | 0.33                    |
| 13.167                | 5-Year   | 1.40                     | 179.10                        | 179.62                      | 1.07                   | 0.34                    |
| 13.167                | 2-Year   | 0.89                     | 179.10                        | 179.54                      | 0.81                   | 0.38                    |
| 13.16                 |          | Bridge                   |                               |                             |                        |                         |
| 13.153                | Regional | 6.81                     | 179.10                        | 179.85                      | 1.76                   | 0.26                    |
| 13.153                | 100-Year | 2.86                     | 179.10                        | 179.64                      | 2.12                   | 0.27                    |
| 13.153                | 50-Year  | 2.41                     | 179.10                        | 179.62                      | 1.85                   | 0.29                    |
| 13.153                | 25-Year  | 2.16                     | 179.10                        | 179.61                      | 1.70                   | 0.30                    |
| 13.153                | 10-Year  | 1.65                     | 179.10                        | 179.58                      | 1.39                   | 0.32                    |
| 13.153                | 5-Year   | 1.40                     | 179.10                        | 179.55                      | 1.23                   | 0.34                    |
| 13.153                | 2-Year   | 0.89                     | 179.10                        | 179.50                      | 0.89                   | 0.37                    |
| 13.115                | Regional | 6.81                     | 179.30                        | 179.50                      | 1.01                   | 0.26                    |
| 13.115                | 100-Year | 2.86                     | 179.30                        | 179.44                      | 0.85                   | 0.27                    |
| 13.115                | 50-Year  | 2.41                     | 179.30                        | 179.43                      | 0.82                   | 0.28                    |
| 13.115                | 25-Year  | 2.16                     | 179.30                        | 179.43                      | 0.81                   | 0.29                    |
| 13.115                | 10-Year  | 1.65                     | 179.30                        | 179.41                      | 0.76                   | 0.32                    |

**Table A-1: HEC-RAS Results for Joshua's Creek Under Existing Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 13.115                | 5-Year   | 1.40                     | 179.30                        | 179.41                      | 0.73                   | 0.33                    |
| 13.115                | 2-Year   | 0.89                     | 179.30                        | 179.39                      | 0.67                   | 0.37                    |
| 13.019                | Regional | 7.01                     | 178.45                        | 179.18                      | 0.40                   | 0.22                    |
| 13.019                | 100-Year | 2.94                     | 178.45                        | 179.04                      | 0.30                   | 0.22                    |
| 13.019                | 50-Year  | 2.48                     | 178.45                        | 179.02                      | 0.29                   | 0.23                    |
| 13.019                | 25-Year  | 2.22                     | 178.45                        | 179.01                      | 0.28                   | 0.24                    |
| 13.019                | 10-Year  | 1.70                     | 178.45                        | 178.98                      | 0.26                   | 0.27                    |
| 13.019                | 5-Year   | 1.44                     | 178.45                        | 178.97                      | 0.25                   | 0.28                    |
| 13.019                | 2-Year   | 0.92                     | 178.45                        | 178.93                      | 0.22                   | 0.31                    |
| 12.87                 | Regional | 7.19                     | 178.21                        | 178.75                      | 1.81                   | 0.19                    |
| 12.87                 | 100-Year | 3.02                     | 178.21                        | 178.65                      | 1.23                   | 0.17                    |
| 12.87                 | 50-Year  | 2.55                     | 178.21                        | 178.62                      | 1.18                   | 0.18                    |
| 12.87                 | 25-Year  | 2.28                     | 178.21                        | 178.61                      | 1.12                   | 0.19                    |
| 12.87                 | 10-Year  | 1.74                     | 178.21                        | 178.59                      | 0.96                   | 0.20                    |
| 12.87                 | 5-Year   | 1.47                     | 178.21                        | 178.58                      | 0.86                   | 0.21                    |
| 12.87                 | 2-Year   | 0.94                     | 178.21                        | 178.56                      | 0.67                   | 0.22                    |
| 12.763                | Regional | 7.39                     | 177.71                        | 178.38                      | 0.57                   | 0.16                    |
| 12.763                | 100-Year | 3.10                     | 177.71                        | 178.16                      | 0.62                   | 0.14                    |
| 12.763                | 50-Year  | 2.62                     | 177.71                        | 178.13                      | 0.58                   | 0.14                    |
| 12.763                | 25-Year  | 2.34                     | 177.71                        | 178.12                      | 0.57                   | 0.15                    |
| 12.763                | 10-Year  | 1.79                     | 177.71                        | 178.08                      | 0.54                   | 0.16                    |
| 12.763                | 5-Year   | 1.52                     | 177.71                        | 178.05                      | 0.55                   | 0.16                    |
| 12.763                | 2-Year   | 0.96                     | 177.71                        | 177.98                      | 0.59                   | 0.17                    |
| 12.5                  | Regional | 12.07                    | 177.42                        | 178.30                      | 0.34                   | 0.44                    |
| 12.5                  | 100-Year | 4.71                     | 177.42                        | 177.82                      | 0.44                   | 0.46                    |
| 12.5                  | 50-Year  | 4.63                     | 177.42                        | 177.82                      | 0.43                   | 0.46                    |
| 12.5                  | 25-Year  | 4.14                     | 177.42                        | 177.79                      | 0.42                   | 0.47                    |
| 12.5                  | 10-Year  | 3.17                     | 177.42                        | 177.74                      | 0.38                   | 0.50                    |
| 12.5                  | 5-Year   | 2.68                     | 177.42                        | 177.72                      | 0.35                   | 0.52                    |
| 12.5                  | 2-Year   | 1.71                     | 177.42                        | 177.67                      | 0.28                   | 0.58                    |
| 12.41                 | Regional | 12.25                    | 177.30                        | 178.29                      | 0.31                   | 0.34                    |
| 12.41                 | 100-Year | 4.76                     | 177.30                        | 177.71                      | 0.48                   | 0.39                    |
| 12.41                 | 50-Year  | 4.72                     | 177.30                        | 177.72                      | 0.46                   | 0.38                    |
| 12.41                 | 25-Year  | 4.22                     | 177.30                        | 177.69                      | 0.47                   | 0.39                    |
| 12.41                 | 10-Year  | 3.23                     | 177.30                        | 177.62                      | 0.49                   | 0.42                    |
| 12.41                 | 5-Year   | 2.73                     | 177.30                        | 177.59                      | 0.49                   | 0.44                    |
| 12.41                 | 2-Year   | 1.74                     | 177.30                        | 177.53                      | 0.47                   | 0.49                    |
| 12.358                | Regional | 12.42                    | 177.26                        | 178.28                      | 0.25                   | 0.27                    |
| 12.358                | 100-Year | 4.81                     | 177.26                        | 177.68                      | 0.30                   | 0.34                    |
| 12.358                | 50-Year  | 4.80                     | 177.26                        | 177.69                      | 0.29                   | 0.34                    |
| 12.358                | 25-Year  | 4.29                     | 177.26                        | 177.65                      | 0.29                   | 0.35                    |
| 12.358                | 10-Year  | 3.28                     | 177.26                        | 177.57                      | 0.28                   | 0.38                    |
| 12.358                | 5-Year   | 2.78                     | 177.26                        | 177.53                      | 0.28                   | 0.39                    |
| 12.358                | 2-Year   | 1.77                     | 177.26                        | 177.45                      | 0.26                   | 0.44                    |
| 12.286                | Regional | 13.91                    | 177.00                        | 178.25                      | 0.70                   | 0.23                    |
| 12.286                | 100-Year | 5.25                     | 177.00                        | 177.60                      | 0.77                   | 0.30                    |
| 12.286                | 50-Year  | 5.53                     | 177.00                        | 177.61                      | 0.78                   | 0.30                    |
| 12.286                | 25-Year  | 4.95                     | 177.00                        | 177.57                      | 0.78                   | 0.31                    |
| 12.286                | 10-Year  | 3.78                     | 177.00                        | 177.47                      | 0.75                   | 0.34                    |
| 12.286                | 5-Year   | 3.20                     | 177.00                        | 177.43                      | 0.73                   | 0.35                    |
| 12.286                | 2-Year   | 2.04                     | 177.00                        | 177.31                      | 0.70                   | 0.40                    |



**Table A-1: HEC-RAS Results for Joshua's Creek Under Existing Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 12.261                | Regional | 15.40                    | 176.70                        | 178.15                      | 1.37                   | 0.22                    |
| 12.261                | 100-Year | 5.93                     | 176.70                        | 177.52                      | 1.05                   | 0.29                    |
| 12.261                | 50-Year  | 6.16                     | 176.70                        | 177.53                      | 1.07                   | 0.29                    |
| 12.261                | 25-Year  | 5.51                     | 176.70                        | 177.49                      | 1.01                   | 0.30                    |
| 12.261                | 10-Year  | 4.21                     | 176.70                        | 177.41                      | 0.89                   | 0.33                    |
| 12.261                | 5-Year   | 3.57                     | 176.70                        | 177.37                      | 0.81                   | 0.34                    |
| 12.261                | 2-Year   | 2.27                     | 176.70                        | 177.26                      | 0.64                   | 0.39                    |
| 12.251                |          | Culvert                  |                               |                             |                        |                         |
| 12.236                | Regional | 15.40                    | 176.67                        | 178.08                      | 1.48                   | 0.21                    |
| 12.236                | 100-Year | 5.93                     | 176.67                        | 177.49                      | 1.17                   | 0.28                    |
| 12.236                | 50-Year  | 6.16                     | 176.67                        | 177.51                      | 1.18                   | 0.28                    |
| 12.236                | 25-Year  | 5.51                     | 176.67                        | 177.47                      | 1.14                   | 0.29                    |
| 12.236                | 10-Year  | 4.21                     | 176.67                        | 177.39                      | 1.02                   | 0.31                    |
| 12.236                | 5-Year   | 3.57                     | 176.67                        | 177.35                      | 0.94                   | 0.33                    |
| 12.236                | 2-Year   | 2.27                     | 176.67                        | 177.24                      | 0.79                   | 0.37                    |
| 12.21                 | Regional | 15.40                    | 176.69                        | 178.08                      | 1.13                   | 0.21                    |
| 12.21                 | 100-Year | 5.93                     | 176.69                        | 177.45                      | 1.13                   | 0.28                    |
| 12.21                 | 50-Year  | 6.16                     | 176.69                        | 177.46                      | 1.14                   | 0.28                    |
| 12.21                 | 25-Year  | 5.51                     | 176.69                        | 177.42                      | 1.12                   | 0.28                    |
| 12.21                 | 10-Year  | 4.21                     | 176.69                        | 177.34                      | 0.97                   | 0.31                    |
| 12.21                 | 5-Year   | 3.57                     | 176.69                        | 177.30                      | 0.89                   | 0.32                    |
| 12.21                 | 2-Year   | 2.27                     | 176.69                        | 177.20                      | 0.73                   | 0.37                    |
| 12.19                 | Regional | 15.40                    | 176.74                        | 178.05                      | 1.07                   | 0.20                    |
| 12.19                 | 100-Year | 5.93                     | 176.74                        | 177.36                      | 1.22                   | 0.27                    |
| 12.19                 | 50-Year  | 6.16                     | 176.74                        | 177.38                      | 1.21                   | 0.27                    |
| 12.19                 | 25-Year  | 5.51                     | 176.74                        | 177.32                      | 1.26                   | 0.28                    |
| 12.19                 | 10-Year  | 4.21                     | 176.74                        | 177.20                      | 1.43                   | 0.30                    |
| 12.19                 | 5-Year   | 3.57                     | 176.74                        | 177.15                      | 1.45                   | 0.32                    |
| 12.19                 | 2-Year   | 2.27                     | 176.74                        | 177.04                      | 1.37                   | 0.36                    |
| 12.164                | Regional | 15.40                    | 175.75                        | 178.03                      | 1.08                   | 0.20                    |
| 12.164                | 100-Year | 5.93                     | 175.75                        | 177.21                      | 1.45                   | 0.27                    |
| 12.164                | 50-Year  | 6.16                     | 175.75                        | 177.21                      | 1.49                   | 0.26                    |
| 12.164                | 25-Year  | 5.51                     | 175.75                        | 177.19                      | 1.36                   | 0.27                    |
| 12.164                | 10-Year  | 4.21                     | 175.75                        | 177.13                      | 1.09                   | 0.30                    |
| 12.164                | 5-Year   | 3.57                     | 175.75                        | 177.11                      | 0.95                   | 0.31                    |
| 12.164                | 2-Year   | 2.27                     | 175.75                        | 177.03                      | 0.64                   | 0.35                    |
| 12.161                |          | Bridge                   |                               |                             |                        |                         |
| 12.158                | Regional | 15.40                    | 175.75                        | 177.51                      | 1.60                   | 0.20                    |
| 12.158                | 100-Year | 5.93                     | 175.75                        | 177.18                      | 1.47                   | 0.27                    |
| 12.158                | 50-Year  | 6.16                     | 175.75                        | 177.19                      | 1.52                   | 0.26                    |
| 12.158                | 25-Year  | 5.51                     | 175.75                        | 177.17                      | 1.38                   | 0.27                    |
| 12.158                | 10-Year  | 4.21                     | 175.75                        | 177.12                      | 1.10                   | 0.30                    |
| 12.158                | 5-Year   | 3.57                     | 175.75                        | 177.10                      | 0.95                   | 0.31                    |
| 12.158                | 2-Year   | 2.27                     | 175.75                        | 177.03                      | 0.64                   | 0.35                    |
| 12.144                | Regional | 15.40                    | 176.81                        | 177.48                      | 1.34                   | 0.19                    |
| 12.144                | 100-Year | 5.93                     | 176.81                        | 177.18                      | 0.99                   | 0.26                    |
| 12.144                | 50-Year  | 6.16                     | 176.81                        | 177.18                      | 1.00                   | 0.26                    |
| 12.144                | 25-Year  | 5.51                     | 176.81                        | 177.16                      | 0.96                   | 0.27                    |
| 12.144                | 10-Year  | 4.21                     | 176.81                        | 177.11                      | 0.89                   | 0.29                    |
| 12.144                | 5-Year   | 3.57                     | 176.81                        | 177.08                      | 0.83                   | 0.31                    |
| 12.144                | 2-Year   | 2.27                     | 176.81                        | 177.01                      | 0.72                   | 0.34                    |

**Table A-1: HEC-RAS Results for Joshua's Creek Under Existing Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 12.09                 | Regional | 15.40                    | 176.38                        | 177.14                      | 2.02                   | 0.18                    |
| 12.09                 | 100-Year | 5.93                     | 176.38                        | 176.82                      | 1.44                   | 0.25                    |
| 12.09                 | 50-Year  | 6.16                     | 176.38                        | 176.83                      | 1.46                   | 0.25                    |
| 12.09                 | 25-Year  | 5.51                     | 176.38                        | 176.80                      | 1.40                   | 0.26                    |
| 12.09                 | 10-Year  | 4.21                     | 176.38                        | 176.75                      | 1.26                   | 0.28                    |
| 12.09                 | 5-Year   | 3.57                     | 176.38                        | 176.71                      | 1.19                   | 0.29                    |
| 12.09                 | 2-Year   | 2.27                     | 176.38                        | 176.64                      | 0.99                   | 0.33                    |
| 12.017                | Regional | 15.40                    | 175.74                        | 176.59                      | 1.71                   | 0.17                    |
| 12.017                | 100-Year | 5.93                     | 175.74                        | 176.40                      | 1.03                   | 0.23                    |
| 12.017                | 50-Year  | 6.16                     | 175.74                        | 176.41                      | 1.05                   | 0.23                    |
| 12.017                | 25-Year  | 5.51                     | 175.74                        | 176.39                      | 1.00                   | 0.24                    |
| 12.017                | 10-Year  | 4.21                     | 175.74                        | 176.34                      | 0.89                   | 0.26                    |
| 12.017                | 5-Year   | 3.57                     | 175.74                        | 176.32                      | 0.83                   | 0.27                    |
| 12.017                | 2-Year   | 2.27                     | 175.74                        | 176.25                      | 0.69                   | 0.30                    |
| 11.965                | Regional | 15.40                    | 175.46                        | 176.12                      | 1.74                   | 0.17                    |
| 11.965                | 100-Year | 5.93                     | 175.46                        | 175.90                      | 1.45                   | 0.22                    |
| 11.965                | 50-Year  | 6.16                     | 175.46                        | 175.91                      | 1.46                   | 0.22                    |
| 11.965                | 25-Year  | 5.51                     | 175.46                        | 175.89                      | 1.43                   | 0.23                    |
| 11.965                | 10-Year  | 4.21                     | 175.46                        | 175.86                      | 1.32                   | 0.25                    |
| 11.965                | 5-Year   | 3.57                     | 175.46                        | 175.84                      | 1.27                   | 0.26                    |
| 11.965                | 2-Year   | 2.27                     | 175.46                        | 175.77                      | 1.28                   | 0.29                    |
| 11.885                | Regional | 15.40                    | 174.50                        | 175.40                      | 1.98                   | 0.15                    |
| 11.885                | 100-Year | 5.93                     | 174.50                        | 175.09                      | 1.34                   | 0.21                    |
| 11.885                | 50-Year  | 6.16                     | 174.50                        | 175.10                      | 1.37                   | 0.21                    |
| 11.885                | 25-Year  | 5.51                     | 174.50                        | 175.07                      | 1.30                   | 0.21                    |
| 11.885                | 10-Year  | 4.21                     | 174.50                        | 175.01                      | 1.17                   | 0.23                    |
| 11.885                | 5-Year   | 3.57                     | 174.50                        | 174.97                      | 1.10                   | 0.24                    |
| 11.885                | 2-Year   | 2.27                     | 174.50                        | 174.88                      | 0.93                   | 0.27                    |
| 11.868                | Regional | 15.40                    | 173.80                        | 174.68                      | 2.70                   | 0.15                    |
| 11.868                | 100-Year | 5.93                     | 173.80                        | 174.36                      | 2.07                   | 0.20                    |
| 11.868                | 50-Year  | 6.16                     | 173.80                        | 174.37                      | 2.09                   | 0.19                    |
| 11.868                | 25-Year  | 5.51                     | 173.80                        | 174.34                      | 2.03                   | 0.20                    |
| 11.868                | 10-Year  | 4.21                     | 173.80                        | 174.27                      | 1.88                   | 0.22                    |
| 11.868                | 5-Year   | 3.57                     | 173.80                        | 174.23                      | 1.80                   | 0.23                    |
| 11.868                | 2-Year   | 2.27                     | 173.80                        | 174.15                      | 1.58                   | 0.25                    |
| 11.867                | Regional | 15.40                    | 172.80                        | 173.75                      | 1.91                   | 0.14                    |
| 11.867                | 100-Year | 5.93                     | 172.80                        | 173.46                      | 1.17                   | 0.18                    |
| 11.867                | 50-Year  | 6.16                     | 172.80                        | 173.47                      | 1.19                   | 0.18                    |
| 11.867                | 25-Year  | 5.51                     | 172.80                        | 173.45                      | 1.12                   | 0.19                    |
| 11.867                | 10-Year  | 4.21                     | 172.80                        | 173.38                      | 0.97                   | 0.20                    |
| 11.867                | 5-Year   | 3.57                     | 172.80                        | 173.35                      | 0.89                   | 0.21                    |
| 11.867                | 2-Year   | 2.27                     | 172.80                        | 173.26                      | 0.71                   | 0.23                    |
| 11.866                | Regional | 15.40                    | 172.26                        | 173.22                      | 1.59                   | 0.12                    |
| 11.866                | 100-Year | 5.93                     | 172.26                        | 172.89                      | 1.38                   | 0.16                    |
| 11.866                | 50-Year  | 6.16                     | 172.26                        | 172.90                      | 1.38                   | 0.15                    |
| 11.866                | 25-Year  | 5.51                     | 172.26                        | 172.87                      | 1.38                   | 0.16                    |
| 11.866                | 10-Year  | 4.21                     | 172.26                        | 172.81                      | 1.35                   | 0.17                    |
| 11.866                | 5-Year   | 3.57                     | 172.26                        | 172.77                      | 1.33                   | 0.18                    |
| 11.866                | 2-Year   | 2.27                     | 172.26                        | 172.70                      | 1.29                   | 0.20                    |
| 11.777                | Regional | 15.40                    | 171.44                        | 172.50                      | 2.31                   | 0.10                    |
| 11.777                | 100-Year | 5.93                     | 171.44                        | 172.18                      | 1.58                   | 0.14                    |

**Table A-1: HEC-RAS Results for Joshua's Creek Under Existing Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 11.777                | 50-Year  | 6.16                     | 171.44                        | 172.19                      | 1.61                   | 0.14                    |
| 11.777                | 25-Year  | 5.51                     | 171.44                        | 172.17                      | 1.51                   | 0.14                    |
| 11.777                | 10-Year  | 4.21                     | 171.44                        | 172.11                      | 1.33                   | 0.15                    |
| 11.777                | 5-Year   | 3.57                     | 171.44                        | 172.08                      | 1.22                   | 0.16                    |
| 11.777                | 2-Year   | 2.27                     | 171.44                        | 171.99                      | 1.00                   | 0.18                    |
| 11.723                | Regional | 15.40                    | 171.16                        | 172.00                      | 2.31                   | 0.10                    |
| 11.723                | 100-Year | 5.93                     | 171.16                        | 171.70                      | 1.67                   | 0.13                    |
| 11.723                | 50-Year  | 6.16                     | 171.16                        | 171.71                      | 1.70                   | 0.13                    |
| 11.723                | 25-Year  | 5.51                     | 171.16                        | 171.67                      | 1.67                   | 0.13                    |
| 11.723                | 10-Year  | 4.21                     | 171.16                        | 171.61                      | 1.53                   | 0.14                    |
| 11.723                | 5-Year   | 3.57                     | 171.16                        | 171.57                      | 1.48                   | 0.15                    |
| 11.723                | 2-Year   | 2.27                     | 171.16                        | 171.48                      | 1.36                   | 0.17                    |
| 11.623                | Regional | 15.40                    | 170.39                        | 171.37                      | 1.74                   | 0.08                    |
| 11.623                | 100-Year | 5.93                     | 170.39                        | 171.10                      | 1.25                   | 0.11                    |
| 11.623                | 50-Year  | 6.16                     | 170.39                        | 171.11                      | 1.27                   | 0.11                    |
| 11.623                | 25-Year  | 5.51                     | 170.39                        | 171.08                      | 1.19                   | 0.11                    |
| 11.623                | 10-Year  | 4.21                     | 170.39                        | 171.01                      | 1.07                   | 0.12                    |
| 11.623                | 5-Year   | 3.57                     | 170.39                        | 170.97                      | 0.99                   | 0.13                    |
| 11.623                | 2-Year   | 2.27                     | 170.39                        | 170.88                      | 0.82                   | 0.14                    |
| 11.56                 | Regional | 15.40                    | 169.90                        | 170.98                      | 2.48                   | 0.08                    |
| 11.56                 | 100-Year | 5.93                     | 169.90                        | 170.68                      | 1.99                   | 0.10                    |
| 11.56                 | 50-Year  | 6.16                     | 169.90                        | 170.69                      | 2.02                   | 0.10                    |
| 11.56                 | 25-Year  | 5.51                     | 169.90                        | 170.67                      | 1.94                   | 0.10                    |
| 11.56                 | 10-Year  | 4.21                     | 169.90                        | 170.61                      | 1.77                   | 0.11                    |
| 11.56                 | 5-Year   | 3.57                     | 169.90                        | 170.57                      | 1.72                   | 0.11                    |
| 11.56                 | 2-Year   | 2.27                     | 169.90                        | 170.44                      | 1.64                   | 0.13                    |
| 11.506                | Regional | 15.40                    | 169.50                        | 170.45                      | 2.58                   | 0.07                    |
| 11.506                | 100-Year | 5.93                     | 169.50                        | 170.22                      | 1.94                   | 0.09                    |
| 11.506                | 50-Year  | 6.16                     | 169.50                        | 170.24                      | 1.90                   | 0.09                    |
| 11.506                | 25-Year  | 5.51                     | 169.50                        | 170.20                      | 1.91                   | 0.09                    |
| 11.506                | 10-Year  | 4.21                     | 169.50                        | 170.12                      | 1.83                   | 0.10                    |
| 11.506                | 5-Year   | 3.57                     | 169.50                        | 170.09                      | 1.74                   | 0.11                    |
| 11.506                | 2-Year   | 2.27                     | 169.50                        | 170.02                      | 1.33                   | 0.12                    |
| 11.464                | Regional | 15.40                    | 169.18                        | 169.99                      | 2.30                   | 0.07                    |
| 11.464                | 100-Year | 5.93                     | 169.18                        | 169.78                      | 1.67                   | 0.09                    |
| 11.464                | 50-Year  | 6.16                     | 169.18                        | 169.78                      | 1.72                   | 0.09                    |
| 11.464                | 25-Year  | 5.51                     | 169.18                        | 169.76                      | 1.65                   | 0.09                    |
| 11.464                | 10-Year  | 4.21                     | 169.18                        | 169.70                      | 1.62                   | 0.10                    |
| 11.464                | 5-Year   | 3.57                     | 169.18                        | 169.66                      | 1.58                   | 0.10                    |
| 11.464                | 2-Year   | 2.27                     | 169.18                        | 169.55                      | 1.54                   | 0.11                    |
| 11.439                | Regional | 15.40                    | 168.98                        | 169.75                      | 1.09                   | 0.06                    |
| 11.439                | 100-Year | 5.93                     | 168.98                        | 169.50                      | 0.84                   | 0.08                    |
| 11.439                | 50-Year  | 6.16                     | 168.98                        | 169.51                      | 0.85                   | 0.08                    |
| 11.439                | 25-Year  | 5.51                     | 168.98                        | 169.49                      | 0.83                   | 0.08                    |
| 11.439                | 10-Year  | 4.21                     | 168.98                        | 169.44                      | 0.79                   | 0.09                    |
| 11.439                | 5-Year   | 3.57                     | 168.98                        | 169.41                      | 0.77                   | 0.09                    |
| 11.439                | 2-Year   | 2.27                     | 168.98                        | 169.34                      | 0.70                   | 0.10                    |
| 11.349                | Regional | 15.40                    | 168.56                        | 169.28                      | 1.83                   | 0.04                    |
| 11.349                | 100-Year | 5.93                     | 168.56                        | 169.07                      | 1.31                   | 0.06                    |
| 11.349                | 50-Year  | 6.16                     | 168.56                        | 169.07                      | 1.32                   | 0.06                    |
| 11.349                | 25-Year  | 5.51                     | 168.56                        | 169.06                      | 1.25                   | 0.06                    |
| 11.349                | 10-Year  | 4.21                     | 168.56                        | 169.01                      | 1.13                   | 0.06                    |



**Table A-1: HEC-RAS Results for Joshua's Creek Under Existing Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 11.349                | 5-Year   | 3.57                     | 168.56                        | 168.99                      | 1.04                   | 0.07                    |
| 11.349                | 2-Year   | 2.27                     | 168.56                        | 168.93                      | 0.89                   | 0.07                    |
| 11.281                | Regional | 15.40                    | 167.52                        | 168.66                      | 2.17                   | 0.03                    |
| 11.281                | 100-Year | 5.93                     | 167.52                        | 168.42                      | 1.75                   | 0.05                    |
| 11.281                | 50-Year  | 6.16                     | 167.52                        | 168.43                      | 1.77                   | 0.04                    |
| 11.281                | 25-Year  | 5.51                     | 167.52                        | 168.40                      | 1.77                   | 0.05                    |
| 11.281                | 10-Year  | 4.21                     | 167.52                        | 168.32                      | 1.71                   | 0.05                    |
| 11.281                | 5-Year   | 3.57                     | 167.52                        | 168.26                      | 1.76                   | 0.05                    |
| 11.281                | 2-Year   | 2.27                     | 167.52                        | 168.08                      | 1.83                   | 0.06                    |
| 11.244                | Regional | 15.40                    | 167.05                        | 168.25                      | 1.81                   | 0.03                    |
| 11.244                | 100-Year | 5.93                     | 167.05                        | 167.97                      | 1.39                   | 0.04                    |
| 11.244                | 50-Year  | 6.16                     | 167.05                        | 167.97                      | 1.43                   | 0.04                    |
| 11.244                | 25-Year  | 5.51                     | 167.05                        | 167.94                      | 1.37                   | 0.04                    |
| 11.244                | 10-Year  | 4.21                     | 167.05                        | 167.88                      | 1.21                   | 0.04                    |
| 11.244                | 5-Year   | 3.57                     | 167.05                        | 167.84                      | 1.12                   | 0.05                    |
| 11.244                | 2-Year   | 2.27                     | 167.05                        | 167.73                      | 0.95                   | 0.05                    |
| 11.184                | Regional | 15.40                    | 166.68                        | 167.73                      | 2.43                   | 0.02                    |
| 11.184                | 100-Year | 5.93                     | 166.68                        | 167.46                      | 1.84                   | 0.03                    |
| 11.184                | 50-Year  | 6.16                     | 166.68                        | 167.48                      | 1.82                   | 0.03                    |
| 11.184                | 25-Year  | 5.51                     | 166.68                        | 167.45                      | 1.76                   | 0.03                    |
| 11.184                | 10-Year  | 4.21                     | 166.68                        | 167.39                      | 1.64                   | 0.03                    |
| 11.184                | 5-Year   | 3.57                     | 166.68                        | 167.35                      | 1.58                   | 0.03                    |
| 11.184                | 2-Year   | 2.27                     | 166.68                        | 167.25                      | 1.44                   | 0.04                    |
| 11.145                | Regional | 15.40                    | 166.28                        | 167.52                      | 1.83                   | 0.02                    |
| 11.145                | 100-Year | 5.93                     | 166.28                        | 167.25                      | 1.39                   | 0.02                    |
| 11.145                | 50-Year  | 6.16                     | 166.28                        | 167.25                      | 1.47                   | 0.02                    |
| 11.145                | 25-Year  | 5.51                     | 166.28                        | 167.22                      | 1.43                   | 0.02                    |
| 11.145                | 10-Year  | 4.21                     | 166.28                        | 167.15                      | 1.33                   | 0.02                    |
| 11.145                | 5-Year   | 3.57                     | 166.28                        | 167.12                      | 1.25                   | 0.03                    |
| 11.145                | 2-Year   | 2.27                     | 166.28                        | 167.01                      | 1.03                   | 0.03                    |
| 11.089                | Regional | 15.40                    | 166.12                        | 167.08                      | 2.22                   | 0.01                    |
| 11.089                | 100-Year | 5.93                     | 166.12                        | 166.89                      | 1.63                   | 0.01                    |
| 11.089                | 50-Year  | 6.16                     | 166.12                        | 166.92                      | 1.53                   | 0.01                    |
| 11.089                | 25-Year  | 5.51                     | 166.12                        | 166.89                      | 1.48                   | 0.01                    |
| 11.089                | 10-Year  | 4.21                     | 166.12                        | 166.85                      | 1.29                   | 0.01                    |
| 11.089                | 5-Year   | 3.57                     | 166.12                        | 166.82                      | 1.22                   | 0.01                    |
| 11.089                | 2-Year   | 2.27                     | 166.12                        | 166.73                      | 1.09                   | 0.01                    |
| 11.024                | Regional | 15.40                    | 165.55                        | 166.60                      | 1.72                   | 0.00                    |
| 11.024                | 100-Year | 5.93                     | 165.55                        | 166.31                      | 1.47                   | 0.00                    |
| 11.024                | 50-Year  | 6.16                     | 165.55                        | 166.29                      | 1.63                   | 0.00                    |
| 11.024                | 25-Year  | 5.51                     | 165.55                        | 166.27                      | 1.58                   | 0.00                    |
| 11.024                | 10-Year  | 4.21                     | 165.55                        | 166.18                      | 1.65                   | 0.00                    |
| 11.024                | 5-Year   | 3.57                     | 165.55                        | 166.13                      | 1.66                   | 0.00                    |
| 11.024                | 2-Year   | 2.27                     | 165.55                        | 166.02                      | 1.57                   | 0.00                    |

<sup>(1)</sup> Channel infrastructure included at existing crossings. Simulated based on existing flow profiles.

**Table A-2: HEC-RAS Results for Joshua's Creek Under Existing Conditions (Riparian) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Cumulative Volume (1000 m <sup>3</sup> ) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|--|
| 1050                  | Regional | 4.67                     | 178.08                        | 178.19                      | 1.38                   | 64.82                                    |
| 1050                  | 100-Year | 1.96                     | 178.08                        | 178.19                      | 0.56                   | 21.21                                    |
| 1050                  | 50-Year  | 1.65                     | 178.08                        | 178.17                      | 0.58                   | 20.37                                    |
| 1050                  | 25-Year  | 1.48                     | 178.08                        | 178.18                      | 0.47                   | 18.16                                    |
| 1050                  | 10-Year  | 1.13                     | 178.08                        | 178.19                      | 0.34                   | 13.99                                    |
| 1050                  | 5-Year   | 0.96                     | 178.08                        | 178.18                      | 0.29                   | 11.99                                    |
| 1050                  | 2-Year   | 0.61                     | 178.08                        | 178.16                      | 0.23                   | 8.05                                     |
| 1025                  | Regional | 4.67                     | 177.42                        | 178.14                      | 0.15                   | 54.17                                    |
| 1025                  | 100-Year | 1.96                     | 177.42                        | 177.87                      | 0.22                   | 18.08                                    |
| 1025                  | 50-Year  | 1.65                     | 177.42                        | 177.86                      | 0.20                   | 17.59                                    |
| 1025                  | 25-Year  | 1.48                     | 177.42                        | 177.84                      | 0.21                   | 15.60                                    |
| 1025                  | 10-Year  | 1.13                     | 177.42                        | 177.81                      | 0.24                   | 11.91                                    |
| 1025                  | 5-Year   | 0.96                     | 177.42                        | 177.79                      | 0.24                   | 10.16                                    |
| 1025                  | 2-Year   | 0.61                     | 177.42                        | 177.77                      | 0.22                   | 6.74                                     |
| 1010                  | Regional | 4.67                     | 177.37                        | 178.14                      | 0.09                   | 45.05                                    |
| 1010                  | 100-Year | 1.96                     | 177.37                        | 177.86                      | 0.11                   | 15.62                                    |
| 1010                  | 50-Year  | 1.65                     | 177.37                        | 177.85                      | 0.10                   | 15.25                                    |
| 1010                  | 25-Year  | 1.48                     | 177.37                        | 177.83                      | 0.10                   | 13.59                                    |
| 1010                  | 10-Year  | 1.13                     | 177.37                        | 177.78                      | 0.12                   | 10.54                                    |
| 1010                  | 5-Year   | 0.96                     | 177.37                        | 177.75                      | 0.12                   | 9.08                                     |
| 1010                  | 2-Year   | 0.61                     | 177.37                        | 177.70                      | 0.14                   | 6.15                                     |
| 1006                  | Regional | 4.67                     | 177.33                        | 178.13                      | 0.09                   | 39.68                                    |
| 1006                  | 100-Year | 1.96                     | 177.33                        | 177.85                      | 0.09                   | 13.97                                    |
| 1006                  | 50-Year  | 1.65                     | 177.33                        | 177.85                      | 0.08                   | 13.67                                    |
| 1006                  | 25-Year  | 1.48                     | 177.33                        | 177.82                      | 0.08                   | 12.21                                    |
| 1006                  | 10-Year  | 1.13                     | 177.33                        | 177.78                      | 0.07                   | 9.56                                     |
| 1006                  | 5-Year   | 0.96                     | 177.33                        | 177.75                      | 0.07                   | 8.28                                     |
| 1006                  | 2-Year   | 0.61                     | 177.33                        | 177.69                      | 0.07                   | 5.70                                     |
| 1004                  | Regional | 4.67                     | 177.23                        | 178.13                      | 0.08                   | 37.30                                    |
| 1004                  | 100-Year | 1.96                     | 177.23                        | 177.85                      | 0.09                   | 13.22                                    |
| 1004                  | 50-Year  | 1.65                     | 177.23                        | 177.85                      | 0.07                   | 12.95                                    |
| 1004                  | 25-Year  | 1.48                     | 177.23                        | 177.82                      | 0.07                   | 11.58                                    |
| 1004                  | 10-Year  | 1.13                     | 177.23                        | 177.77                      | 0.07                   | 9.07                                     |
| 1004                  | 5-Year   | 0.96                     | 177.23                        | 177.75                      | 0.06                   | 7.86                                     |
| 1004                  | 2-Year   | 0.61                     | 177.23                        | 177.69                      | 0.05                   | 5.42                                     |
| 1000                  | Regional | 5.14                     | 177.24                        | 178.13                      | 0.10                   | 33.14                                    |
| 1000                  | 100-Year | 2.15                     | 177.24                        | 177.85                      | 0.10                   | 11.95                                    |
| 1000                  | 50-Year  | 1.82                     | 177.24                        | 177.84                      | 0.09                   | 11.72                                    |
| 1000                  | 25-Year  | 1.62                     | 177.24                        | 177.82                      | 0.09                   | 10.48                                    |
| 1000                  | 10-Year  | 1.24                     | 177.24                        | 177.77                      | 0.08                   | 8.21                                     |
| 1000                  | 5-Year   | 1.05                     | 177.24                        | 177.75                      | 0.08                   | 7.12                                     |
| 1000                  | 2-Year   | 0.67                     | 177.24                        | 177.69                      | 0.07                   | 4.91                                     |
| 979                   | Regional | 5.14                     | 177.28                        | 178.13                      | 0.10                   | 27.30                                    |
| 979                   | 100-Year | 2.15                     | 177.28                        | 177.85                      | 0.11                   | 10.13                                    |
| 979                   | 50-Year  | 1.82                     | 177.28                        | 177.84                      | 0.10                   | 9.95                                     |
| 979                   | 25-Year  | 1.62                     | 177.28                        | 177.82                      | 0.10                   | 8.92                                     |
| 979                   | 10-Year  | 1.24                     | 177.28                        | 177.77                      | 0.10                   | 7.04                                     |
| 979                   | 5-Year   | 1.05                     | 177.28                        | 177.75                      | 0.09                   | 6.13                                     |
| 979                   | 2-Year   | 0.67                     | 177.28                        | 177.69                      | 0.09                   | 4.27                                     |
| 955                   | Regional | 5.14                     | 177.21                        | 178.13                      | 0.08                   | 24.48                                    |
| 955                   | 100-Year | 2.15                     | 177.21                        | 177.85                      | 0.09                   | 9.24                                     |
| 955                   | 50-Year  | 1.82                     | 177.21                        | 177.84                      | 0.07                   | 9.09                                     |
| 955                   | 25-Year  | 1.62                     | 177.21                        | 177.82                      | 0.07                   | 8.16                                     |

**Table A-2: HEC-RAS Results for Joshua's Creek Under Existing Conditions (Riparian) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Cumulative Volume (1000 m <sup>3</sup> ) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|--|
| 955                   | 10-Year  | 1.24                     | 177.21                        | 177.77                      | 0.07                   | 6.47                                     |
| 955                   | 5-Year   | 1.05                     | 177.21                        | 177.74                      | 0.07                   | 5.67                                     |
| 955                   | 2-Year   | 0.67                     | 177.21                        | 177.69                      | 0.07                   | 3.99                                     |
| 929                   | Regional | 5.14                     | 177.19                        | 178.13                      | 0.10                   | 21.54                                    |
| 929                   | 100-Year | 2.15                     | 177.19                        | 177.85                      | 0.12                   | 8.32                                     |
| 929                   | 50-Year  | 1.82                     | 177.19                        | 177.84                      | 0.10                   | 8.19                                     |
| 929                   | 25-Year  | 1.62                     | 177.19                        | 177.82                      | 0.10                   | 7.36                                     |
| 929                   | 10-Year  | 1.24                     | 177.19                        | 177.77                      | 0.10                   | 5.87                                     |
| 929                   | 5-Year   | 1.05                     | 177.19                        | 177.74                      | 0.10                   | 5.15                                     |
| 929                   | 2-Year   | 0.67                     | 177.19                        | 177.69                      | 0.10                   | 3.67                                     |
| 866                   | Regional | 5.14                     | 177.31                        | 178.13                      | 0.09                   | 17.83                                    |
| 866                   | 100-Year | 2.15                     | 177.31                        | 177.84                      | 0.10                   | 7.15                                     |
| 866                   | 50-Year  | 1.82                     | 177.31                        | 177.84                      | 0.09                   | 7.05                                     |
| 866                   | 25-Year  | 1.62                     | 177.31                        | 177.82                      | 0.09                   | 6.36                                     |
| 866                   | 10-Year  | 1.24                     | 177.31                        | 177.77                      | 0.09                   | 5.13                                     |
| 866                   | 5-Year   | 1.05                     | 177.31                        | 177.74                      | 0.08                   | 4.53                                     |
| 866                   | 2-Year   | 0.67                     | 177.31                        | 177.68                      | 0.08                   | 3.28                                     |
| 756                   | Regional | 10.73                    | 177.19                        | 178.13                      | 0.18                   | 6.05                                     |
| 756                   | 100-Year | 4.18                     | 177.19                        | 177.84                      | 0.14                   | 2.69                                     |
| 756                   | 50-Year  | 3.29                     | 177.19                        | 177.84                      | 0.11                   | 2.67                                     |
| 756                   | 25-Year  | 2.88                     | 177.19                        | 177.81                      | 0.11                   | 2.45                                     |
| 756                   | 10-Year  | 2.25                     | 177.19                        | 177.76                      | 0.10                   | 2.03                                     |
| 756                   | 5-Year   | 1.85                     | 177.19                        | 177.74                      | 0.09                   | 1.83                                     |
| 756                   | 2-Year   | 1.16                     | 177.19                        | 177.68                      | 0.07                   | 1.38                                     |

<sup>(1)</sup> No channel infrastructure included. Simulated based on existing flow profiles.



# ATTACHMENT

# B

## *HEC-RAS Proposed Conditions Results for Joshua's Creek Main Branch*

**JFSA**

Water Resources and  
Environmental Consultants



**Table B-1: HEC-RAS Results for Joshua's Creek Under Proposed Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 1050                  | Regional | 4.67                     | 178.08                        | 178.32                      | 0.62                   | 1.87                    |
| 1050                  | 100-Year | 1.96                     | 178.08                        | 178.19                      | 0.55                   | 1.23                    |
| 1050                  | 50-Year  | 1.65                     | 178.08                        | 178.17                      | 0.57                   | 1.39                    |
| 1050                  | 25-Year  | 1.48                     | 178.08                        | 178.18                      | 0.46                   | 1.42                    |
| 1050                  | 10-Year  | 1.13                     | 178.08                        | 178.19                      | 0.33                   | 1.47                    |
| 1050                  | 5-Year   | 0.96                     | 178.08                        | 178.18                      | 0.29                   | 1.52                    |
| 1050                  | 2-Year   | 0.61                     | 178.08                        | 178.16                      | 0.24                   | 1.65                    |
| 1025                  | Regional | 4.67                     | 177.42                        | 178.31                      | 0.08                   | 1.68                    |
| 1025                  | 100-Year | 1.96                     | 177.42                        | 177.87                      | 0.23                   | 1.06                    |
| 1025                  | 50-Year  | 1.65                     | 177.42                        | 177.86                      | 0.20                   | 1.23                    |
| 1025                  | 25-Year  | 1.48                     | 177.42                        | 177.84                      | 0.22                   | 1.23                    |
| 1025                  | 10-Year  | 1.13                     | 177.42                        | 177.80                      | 0.24                   | 1.25                    |
| 1025                  | 5-Year   | 0.96                     | 177.42                        | 177.79                      | 0.24                   | 1.28                    |
| 1025                  | 2-Year   | 0.61                     | 177.42                        | 177.77                      | 0.21                   | 1.36                    |
| 1010                  | Regional | 4.67                     | 177.37                        | 178.31                      | 0.06                   | 1.35                    |
| 1010                  | 100-Year | 1.96                     | 177.37                        | 177.85                      | 0.11                   | 0.92                    |
| 1010                  | 50-Year  | 1.65                     | 177.37                        | 177.85                      | 0.10                   | 1.07                    |
| 1010                  | 25-Year  | 1.48                     | 177.37                        | 177.82                      | 0.11                   | 1.08                    |
| 1010                  | 10-Year  | 1.13                     | 177.37                        | 177.78                      | 0.12                   | 1.11                    |
| 1010                  | 5-Year   | 0.96                     | 177.37                        | 177.75                      | 0.13                   | 1.15                    |
| 1010                  | 2-Year   | 0.61                     | 177.37                        | 177.70                      | 0.15                   | 1.23                    |
| 1006                  | Regional | 4.67                     | 177.33                        | 178.31                      | 0.06                   | 1.15                    |
| 1006                  | 100-Year | 1.96                     | 177.33                        | 177.85                      | 0.09                   | 0.81                    |
| 1006                  | 50-Year  | 1.65                     | 177.33                        | 177.85                      | 0.08                   | 0.94                    |
| 1006                  | 25-Year  | 1.48                     | 177.33                        | 177.82                      | 0.08                   | 0.96                    |
| 1006                  | 10-Year  | 1.13                     | 177.33                        | 177.77                      | 0.08                   | 0.99                    |
| 1006                  | 5-Year   | 0.96                     | 177.33                        | 177.75                      | 0.08                   | 1.03                    |
| 1006                  | 2-Year   | 0.61                     | 177.33                        | 177.69                      | 0.07                   | 1.12                    |
| 1004                  | Regional | 4.67                     | 177.23                        | 178.31                      | 0.05                   | 1.05                    |
| 1004                  | 100-Year | 1.96                     | 177.23                        | 177.85                      | 0.08                   | 0.74                    |
| 1004                  | 50-Year  | 1.65                     | 177.23                        | 177.85                      | 0.07                   | 0.87                    |
| 1004                  | 25-Year  | 1.48                     | 177.23                        | 177.82                      | 0.07                   | 0.88                    |
| 1004                  | 10-Year  | 1.13                     | 177.23                        | 177.77                      | 0.06                   | 0.92                    |
| 1004                  | 5-Year   | 0.96                     | 177.23                        | 177.75                      | 0.06                   | 0.95                    |
| 1004                  | 2-Year   | 0.61                     | 177.23                        | 177.69                      | 0.05                   | 1.04                    |
| 1000                  | Regional | 5.14                     | 177.24                        | 178.31                      | 0.05                   | 0.86                    |
| 1000                  | 100-Year | 2.15                     | 177.24                        | 177.85                      | 0.08                   | 0.62                    |
| 1000                  | 50-Year  | 1.82                     | 177.24                        | 177.84                      | 0.07                   | 0.72                    |
| 1000                  | 25-Year  | 1.62                     | 177.24                        | 177.82                      | 0.07                   | 0.74                    |
| 1000                  | 10-Year  | 1.24                     | 177.24                        | 177.77                      | 0.07                   | 0.77                    |
| 1000                  | 5-Year   | 1.05                     | 177.24                        | 177.74                      | 0.07                   | 0.80                    |
| 1000                  | 2-Year   | 0.67                     | 177.24                        | 177.69                      | 0.06                   | 0.87                    |
| 979                   | Regional | 5.14                     | 177.28                        | 178.31                      | 0.05                   | 0.62                    |
| 979                   | 100-Year | 2.15                     | 177.28                        | 177.85                      | 0.08                   | 0.46                    |
| 979                   | 50-Year  | 1.82                     | 177.28                        | 177.84                      | 0.07                   | 0.54                    |
| 979                   | 25-Year  | 1.62                     | 177.28                        | 177.82                      | 0.07                   | 0.55                    |
| 979                   | 10-Year  | 1.24                     | 177.28                        | 177.77                      | 0.07                   | 0.58                    |
| 979                   | 5-Year   | 1.05                     | 177.28                        | 177.74                      | 0.07                   | 0.61                    |
| 979                   | 2-Year   | 0.67                     | 177.28                        | 177.69                      | 0.07                   | 0.67                    |
| 955                   | Regional | 5.14                     | 177.21                        | 178.31                      | 0.05                   | 0.50                    |
| 955                   | 100-Year | 2.15                     | 177.21                        | 177.85                      | 0.06                   | 0.38                    |
| 955                   | 50-Year  | 1.82                     | 177.21                        | 177.84                      | 0.06                   | 0.44                    |
| 955                   | 25-Year  | 1.62                     | 177.21                        | 177.82                      | 0.05                   | 0.46                    |

**Table B-1: HEC-RAS Results for Joshua's Creek Under Proposed Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 955                   | 10-Year  | 1.24                     | 177.21                        | 177.77                      | 0.05                   | 0.48                    |
| 955                   | 5-Year   | 1.05                     | 177.21                        | 177.74                      | 0.05                   | 0.51                    |
| 955                   | 2-Year   | 0.67                     | 177.21                        | 177.69                      | 0.05                   | 0.57                    |
| 929                   | Regional | 5.14                     | 177.19                        | 178.31                      | 0.06                   | 0.38                    |
| 929                   | 100-Year | 2.15                     | 177.19                        | 177.85                      | 0.09                   | 0.30                    |
| 929                   | 50-Year  | 1.82                     | 177.19                        | 177.84                      | 0.08                   | 0.35                    |
| 929                   | 25-Year  | 1.62                     | 177.19                        | 177.82                      | 0.08                   | 0.36                    |
| 929                   | 10-Year  | 1.24                     | 177.19                        | 177.77                      | 0.08                   | 0.38                    |
| 929                   | 5-Year   | 1.05                     | 177.19                        | 177.74                      | 0.07                   | 0.40                    |
| 929                   | 2-Year   | 0.67                     | 177.19                        | 177.68                      | 0.07                   | 0.46                    |
| 866                   | Regional | 5.14                     | 177.31                        | 178.31                      | 0.06                   | 0.27                    |
| 866                   | 100-Year | 2.15                     | 177.31                        | 177.85                      | 0.09                   | 0.22                    |
| 866                   | 50-Year  | 1.82                     | 177.31                        | 177.84                      | 0.08                   | 0.26                    |
| 866                   | 25-Year  | 1.62                     | 177.31                        | 177.82                      | 0.08                   | 0.27                    |
| 866                   | 10-Year  | 1.24                     | 177.31                        | 177.77                      | 0.08                   | 0.29                    |
| 866                   | 5-Year   | 1.05                     | 177.31                        | 177.74                      | 0.07                   | 0.31                    |
| 866                   | 2-Year   | 0.67                     | 177.31                        | 177.68                      | 0.07                   | 0.35                    |
| 756                   | Regional | 10.73                    | 177.19                        | 178.31                      | 0.13                   | 0.08                    |
| 756                   | 100-Year | 4.18                     | 177.19                        | 177.84                      | 0.14                   | 0.07                    |
| 756                   | 50-Year  | 3.29                     | 177.19                        | 177.84                      | 0.11                   | 0.07                    |
| 756                   | 25-Year  | 2.88                     | 177.19                        | 177.81                      | 0.11                   | 0.07                    |
| 756                   | 10-Year  | 2.25                     | 177.19                        | 177.76                      | 0.10                   | 0.08                    |
| 756                   | 5-Year   | 1.85                     | 177.19                        | 177.74                      | 0.09                   | 0.09                    |
| 756                   | 2-Year   | 1.16                     | 177.19                        | 177.68                      | 0.07                   | 0.11                    |
| 14.207                | Regional | 6.81                     | 179.20                        | 180.65                      | 0.15                   | 0.32                    |
| 14.207                | 100-Year | 2.86                     | 179.20                        | 180.09                      | 0.30                   | 0.29                    |
| 14.207                | 50-Year  | 2.41                     | 179.20                        | 179.96                      | 0.37                   | 0.30                    |
| 14.207                | 25-Year  | 2.16                     | 179.20                        | 179.88                      | 0.40                   | 0.31                    |
| 14.207                | 10-Year  | 1.65                     | 179.20                        | 179.77                      | 0.41                   | 0.34                    |
| 14.207                | 5-Year   | 1.40                     | 179.20                        | 179.72                      | 0.42                   | 0.36                    |
| 14.207                | 2-Year   | 0.89                     | 179.20                        | 179.60                      | 0.41                   | 0.40                    |
| 13.167                | Regional | 6.81                     | 179.10                        | 180.65                      | 0.27                   | 0.27                    |
| 13.167                | 100-Year | 2.86                     | 179.10                        | 179.97                      | 1.32                   | 0.28                    |
| 13.167                | 50-Year  | 2.41                     | 179.10                        | 179.84                      | 1.30                   | 0.29                    |
| 13.167                | 25-Year  | 2.16                     | 179.10                        | 179.75                      | 1.32                   | 0.30                    |
| 13.167                | 10-Year  | 1.65                     | 179.10                        | 179.67                      | 1.17                   | 0.33                    |
| 13.167                | 5-Year   | 1.40                     | 179.10                        | 179.62                      | 1.07                   | 0.34                    |
| 13.167                | 2-Year   | 0.89                     | 179.10                        | 179.54                      | 0.81                   | 0.38                    |
| 13.16                 |          | Bridge                   |                               |                             |                        |                         |
| 13.153                | Regional | 6.81                     | 179.10                        | 179.85                      | 1.76                   | 0.26                    |
| 13.153                | 100-Year | 2.86                     | 179.10                        | 179.64                      | 2.12                   | 0.27                    |
| 13.153                | 50-Year  | 2.41                     | 179.10                        | 179.62                      | 1.85                   | 0.29                    |
| 13.153                | 25-Year  | 2.16                     | 179.10                        | 179.61                      | 1.70                   | 0.30                    |
| 13.153                | 10-Year  | 1.65                     | 179.10                        | 179.58                      | 1.39                   | 0.32                    |
| 13.153                | 5-Year   | 1.40                     | 179.10                        | 179.55                      | 1.23                   | 0.34                    |
| 13.153                | 2-Year   | 0.89                     | 179.10                        | 179.50                      | 0.89                   | 0.37                    |
| 13.115                | Regional | 6.81                     | 179.30                        | 179.50                      | 1.01                   | 0.26                    |
| 13.115                | 100-Year | 2.86                     | 179.30                        | 179.44                      | 0.85                   | 0.27                    |
| 13.115                | 50-Year  | 2.41                     | 179.30                        | 179.43                      | 0.82                   | 0.28                    |
| 13.115                | 25-Year  | 2.16                     | 179.30                        | 179.43                      | 0.81                   | 0.29                    |
| 13.115                | 10-Year  | 1.65                     | 179.30                        | 179.41                      | 0.76                   | 0.32                    |

**Table B-1: HEC-RAS Results for Joshua's Creek Under Proposed Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 13.115                | 5-Year   | 1.40                     | 179.30                        | 179.41                      | 0.73                   | 0.33                    |
| 13.115                | 2-Year   | 0.89                     | 179.30                        | 179.39                      | 0.67                   | 0.37                    |
| 13.019                | Regional | 7.01                     | 178.45                        | 179.18                      | 0.40                   | 0.22                    |
| 13.019                | 100-Year | 2.94                     | 178.45                        | 179.04                      | 0.30                   | 0.22                    |
| 13.019                | 50-Year  | 2.48                     | 178.45                        | 179.02                      | 0.29                   | 0.23                    |
| 13.019                | 25-Year  | 2.22                     | 178.45                        | 179.01                      | 0.28                   | 0.24                    |
| 13.019                | 10-Year  | 1.70                     | 178.45                        | 178.98                      | 0.26                   | 0.27                    |
| 13.019                | 5-Year   | 1.44                     | 178.45                        | 178.97                      | 0.25                   | 0.28                    |
| 13.019                | 2-Year   | 0.92                     | 178.45                        | 178.93                      | 0.22                   | 0.31                    |
| 12.87                 | Regional | 7.19                     | 178.21                        | 178.75                      | 1.81                   | 0.19                    |
| 12.87                 | 100-Year | 3.02                     | 178.21                        | 178.65                      | 1.23                   | 0.17                    |
| 12.87                 | 50-Year  | 2.55                     | 178.21                        | 178.62                      | 1.18                   | 0.18                    |
| 12.87                 | 25-Year  | 2.28                     | 178.21                        | 178.61                      | 1.12                   | 0.19                    |
| 12.87                 | 10-Year  | 1.74                     | 178.21                        | 178.59                      | 0.96                   | 0.20                    |
| 12.87                 | 5-Year   | 1.47                     | 178.21                        | 178.58                      | 0.86                   | 0.21                    |
| 12.87                 | 2-Year   | 0.94                     | 178.21                        | 178.56                      | 0.67                   | 0.22                    |
| 12.763                | Regional | 7.39                     | 177.71                        | 178.38                      | 0.57                   | 0.16                    |
| 12.763                | 100-Year | 3.10                     | 177.71                        | 178.16                      | 0.62                   | 0.14                    |
| 12.763                | 50-Year  | 2.62                     | 177.71                        | 178.13                      | 0.58                   | 0.14                    |
| 12.763                | 25-Year  | 2.34                     | 177.71                        | 178.12                      | 0.57                   | 0.15                    |
| 12.763                | 10-Year  | 1.79                     | 177.71                        | 178.08                      | 0.54                   | 0.16                    |
| 12.763                | 5-Year   | 1.52                     | 177.71                        | 178.05                      | 0.55                   | 0.16                    |
| 12.763                | 2-Year   | 0.96                     | 177.71                        | 177.98                      | 0.59                   | 0.17                    |
| 12.5                  | Regional | 12.07                    | 177.42                        | 178.30                      | 0.34                   | 0.44                    |
| 12.5                  | 100-Year | 4.71                     | 177.42                        | 177.82                      | 0.44                   | 0.46                    |
| 12.5                  | 50-Year  | 4.63                     | 177.42                        | 177.82                      | 0.43                   | 0.46                    |
| 12.5                  | 25-Year  | 4.14                     | 177.42                        | 177.79                      | 0.42                   | 0.47                    |
| 12.5                  | 10-Year  | 3.17                     | 177.42                        | 177.74                      | 0.38                   | 0.50                    |
| 12.5                  | 5-Year   | 2.68                     | 177.42                        | 177.72                      | 0.35                   | 0.52                    |
| 12.5                  | 2-Year   | 1.71                     | 177.42                        | 177.67                      | 0.28                   | 0.58                    |
| 12.41                 | Regional | 12.25                    | 177.30                        | 178.29                      | 0.31                   | 0.34                    |
| 12.41                 | 100-Year | 4.76                     | 177.30                        | 177.71                      | 0.48                   | 0.39                    |
| 12.41                 | 50-Year  | 4.72                     | 177.30                        | 177.72                      | 0.46                   | 0.38                    |
| 12.41                 | 25-Year  | 4.22                     | 177.30                        | 177.69                      | 0.47                   | 0.39                    |
| 12.41                 | 10-Year  | 3.23                     | 177.30                        | 177.62                      | 0.49                   | 0.42                    |
| 12.41                 | 5-Year   | 2.73                     | 177.30                        | 177.59                      | 0.49                   | 0.44                    |
| 12.41                 | 2-Year   | 1.74                     | 177.30                        | 177.53                      | 0.47                   | 0.49                    |
| 12.358                | Regional | 12.42                    | 177.26                        | 178.28                      | 0.25                   | 0.27                    |
| 12.358                | 100-Year | 4.81                     | 177.26                        | 177.68                      | 0.30                   | 0.34                    |
| 12.358                | 50-Year  | 4.80                     | 177.26                        | 177.69                      | 0.29                   | 0.34                    |
| 12.358                | 25-Year  | 4.29                     | 177.26                        | 177.65                      | 0.29                   | 0.35                    |
| 12.358                | 10-Year  | 3.28                     | 177.26                        | 177.57                      | 0.28                   | 0.38                    |
| 12.358                | 5-Year   | 2.78                     | 177.26                        | 177.53                      | 0.28                   | 0.39                    |
| 12.358                | 2-Year   | 1.77                     | 177.26                        | 177.45                      | 0.26                   | 0.44                    |
| 12.286                | Regional | 13.91                    | 177.00                        | 178.25                      | 0.70                   | 0.23                    |
| 12.286                | 100-Year | 5.25                     | 177.00                        | 177.60                      | 0.77                   | 0.30                    |
| 12.286                | 50-Year  | 5.53                     | 177.00                        | 177.61                      | 0.78                   | 0.30                    |
| 12.286                | 25-Year  | 4.95                     | 177.00                        | 177.57                      | 0.78                   | 0.31                    |
| 12.286                | 10-Year  | 3.78                     | 177.00                        | 177.47                      | 0.75                   | 0.34                    |
| 12.286                | 5-Year   | 3.20                     | 177.00                        | 177.43                      | 0.73                   | 0.35                    |
| 12.286                | 2-Year   | 2.04                     | 177.00                        | 177.31                      | 0.70                   | 0.40                    |

**Table B-1: HEC-RAS Results for Joshua's Creek Under Proposed Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 12.261                | Regional | 15.40                    | 176.70                        | 178.15                      | 1.37                   | 0.22                    |
| 12.261                | 100-Year | 5.93                     | 176.70                        | 177.52                      | 1.05                   | 0.29                    |
| 12.261                | 50-Year  | 6.16                     | 176.70                        | 177.53                      | 1.07                   | 0.29                    |
| 12.261                | 25-Year  | 5.51                     | 176.70                        | 177.49                      | 1.01                   | 0.30                    |
| 12.261                | 10-Year  | 4.21                     | 176.70                        | 177.41                      | 0.89                   | 0.33                    |
| 12.261                | 5-Year   | 3.57                     | 176.70                        | 177.37                      | 0.81                   | 0.34                    |
| 12.261                | 2-Year   | 2.27                     | 176.70                        | 177.26                      | 0.64                   | 0.39                    |
| 12.251                |          | Culvert                  |                               |                             |                        |                         |
| 12.236                | Regional | 15.40                    | 176.67                        | 178.08                      | 1.48                   | 0.21                    |
| 12.236                | 100-Year | 5.93                     | 176.67                        | 177.49                      | 1.17                   | 0.28                    |
| 12.236                | 50-Year  | 6.16                     | 176.67                        | 177.51                      | 1.18                   | 0.28                    |
| 12.236                | 25-Year  | 5.51                     | 176.67                        | 177.47                      | 1.14                   | 0.29                    |
| 12.236                | 10-Year  | 4.21                     | 176.67                        | 177.39                      | 1.02                   | 0.31                    |
| 12.236                | 5-Year   | 3.57                     | 176.67                        | 177.35                      | 0.94                   | 0.33                    |
| 12.236                | 2-Year   | 2.27                     | 176.67                        | 177.24                      | 0.79                   | 0.37                    |
| 12.21                 | Regional | 15.40                    | 176.69                        | 178.08                      | 1.13                   | 0.21                    |
| 12.21                 | 100-Year | 5.93                     | 176.69                        | 177.45                      | 1.13                   | 0.28                    |
| 12.21                 | 50-Year  | 6.16                     | 176.69                        | 177.46                      | 1.14                   | 0.28                    |
| 12.21                 | 25-Year  | 5.51                     | 176.69                        | 177.42                      | 1.12                   | 0.28                    |
| 12.21                 | 10-Year  | 4.21                     | 176.69                        | 177.34                      | 0.97                   | 0.31                    |
| 12.21                 | 5-Year   | 3.57                     | 176.69                        | 177.30                      | 0.89                   | 0.32                    |
| 12.21                 | 2-Year   | 2.27                     | 176.69                        | 177.20                      | 0.73                   | 0.37                    |
| 12.19                 | Regional | 15.40                    | 176.74                        | 178.05                      | 1.07                   | 0.20                    |
| 12.19                 | 100-Year | 5.93                     | 176.74                        | 177.36                      | 1.22                   | 0.27                    |
| 12.19                 | 50-Year  | 6.16                     | 176.74                        | 177.38                      | 1.21                   | 0.27                    |
| 12.19                 | 25-Year  | 5.51                     | 176.74                        | 177.32                      | 1.26                   | 0.28                    |
| 12.19                 | 10-Year  | 4.21                     | 176.74                        | 177.20                      | 1.43                   | 0.30                    |
| 12.19                 | 5-Year   | 3.57                     | 176.74                        | 177.15                      | 1.45                   | 0.32                    |
| 12.19                 | 2-Year   | 2.27                     | 176.74                        | 177.04                      | 1.37                   | 0.36                    |
| 12.164                | Regional | 15.40                    | 175.75                        | 178.03                      | 1.08                   | 0.20                    |
| 12.164                | 100-Year | 5.93                     | 175.75                        | 177.21                      | 1.45                   | 0.27                    |
| 12.164                | 50-Year  | 6.16                     | 175.75                        | 177.21                      | 1.49                   | 0.26                    |
| 12.164                | 25-Year  | 5.51                     | 175.75                        | 177.19                      | 1.36                   | 0.27                    |
| 12.164                | 10-Year  | 4.21                     | 175.75                        | 177.13                      | 1.09                   | 0.30                    |
| 12.164                | 5-Year   | 3.57                     | 175.75                        | 177.11                      | 0.95                   | 0.31                    |
| 12.164                | 2-Year   | 2.27                     | 175.75                        | 177.03                      | 0.64                   | 0.35                    |
| 12.161                |          | Bridge                   |                               |                             |                        |                         |
| 12.158                | Regional | 15.40                    | 175.75                        | 177.51                      | 1.60                   | 0.20                    |
| 12.158                | 100-Year | 5.93                     | 175.75                        | 177.18                      | 1.47                   | 0.27                    |
| 12.158                | 50-Year  | 6.16                     | 175.75                        | 177.19                      | 1.52                   | 0.26                    |
| 12.158                | 25-Year  | 5.51                     | 175.75                        | 177.17                      | 1.38                   | 0.27                    |
| 12.158                | 10-Year  | 4.21                     | 175.75                        | 177.12                      | 1.10                   | 0.30                    |
| 12.158                | 5-Year   | 3.57                     | 175.75                        | 177.10                      | 0.95                   | 0.31                    |
| 12.158                | 2-Year   | 2.27                     | 175.75                        | 177.03                      | 0.64                   | 0.35                    |
| 12.144                | Regional | 15.40                    | 176.81                        | 177.48                      | 1.34                   | 0.19                    |
| 12.144                | 100-Year | 5.93                     | 176.81                        | 177.18                      | 0.99                   | 0.26                    |
| 12.144                | 50-Year  | 6.16                     | 176.81                        | 177.18                      | 1.00                   | 0.26                    |
| 12.144                | 25-Year  | 5.51                     | 176.81                        | 177.16                      | 0.96                   | 0.27                    |
| 12.144                | 10-Year  | 4.21                     | 176.81                        | 177.11                      | 0.89                   | 0.29                    |
| 12.144                | 5-Year   | 3.57                     | 176.81                        | 177.08                      | 0.83                   | 0.31                    |
| 12.144                | 2-Year   | 2.27                     | 176.81                        | 177.01                      | 0.72                   | 0.34                    |



**Table B-1: HEC-RAS Results for Joshua's Creek Under Proposed Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 12.09                 | Regional | 15.40                    | 176.38                        | 177.14                      | 2.02                   | 0.18                    |
| 12.09                 | 100-Year | 5.93                     | 176.38                        | 176.82                      | 1.44                   | 0.25                    |
| 12.09                 | 50-Year  | 6.16                     | 176.38                        | 176.83                      | 1.46                   | 0.25                    |
| 12.09                 | 25-Year  | 5.51                     | 176.38                        | 176.80                      | 1.40                   | 0.26                    |
| 12.09                 | 10-Year  | 4.21                     | 176.38                        | 176.75                      | 1.26                   | 0.28                    |
| 12.09                 | 5-Year   | 3.57                     | 176.38                        | 176.71                      | 1.19                   | 0.29                    |
| 12.09                 | 2-Year   | 2.27                     | 176.38                        | 176.64                      | 0.99                   | 0.33                    |
| 12.017                | Regional | 15.40                    | 175.74                        | 176.59                      | 1.71                   | 0.17                    |
| 12.017                | 100-Year | 5.93                     | 175.74                        | 176.40                      | 1.03                   | 0.23                    |
| 12.017                | 50-Year  | 6.16                     | 175.74                        | 176.41                      | 1.05                   | 0.23                    |
| 12.017                | 25-Year  | 5.51                     | 175.74                        | 176.39                      | 1.00                   | 0.24                    |
| 12.017                | 10-Year  | 4.21                     | 175.74                        | 176.34                      | 0.89                   | 0.26                    |
| 12.017                | 5-Year   | 3.57                     | 175.74                        | 176.32                      | 0.83                   | 0.27                    |
| 12.017                | 2-Year   | 2.27                     | 175.74                        | 176.25                      | 0.69                   | 0.30                    |
| 11.965                | Regional | 15.40                    | 175.46                        | 176.12                      | 1.74                   | 0.17                    |
| 11.965                | 100-Year | 5.93                     | 175.46                        | 175.90                      | 1.45                   | 0.22                    |
| 11.965                | 50-Year  | 6.16                     | 175.46                        | 175.91                      | 1.46                   | 0.22                    |
| 11.965                | 25-Year  | 5.51                     | 175.46                        | 175.89                      | 1.43                   | 0.23                    |
| 11.965                | 10-Year  | 4.21                     | 175.46                        | 175.86                      | 1.32                   | 0.25                    |
| 11.965                | 5-Year   | 3.57                     | 175.46                        | 175.84                      | 1.27                   | 0.26                    |
| 11.965                | 2-Year   | 2.27                     | 175.46                        | 175.77                      | 1.28                   | 0.29                    |
| 11.885                | Regional | 15.40                    | 174.50                        | 175.40                      | 1.98                   | 0.15                    |
| 11.885                | 100-Year | 5.93                     | 174.50                        | 175.09                      | 1.34                   | 0.21                    |
| 11.885                | 50-Year  | 6.16                     | 174.50                        | 175.10                      | 1.37                   | 0.21                    |
| 11.885                | 25-Year  | 5.51                     | 174.50                        | 175.07                      | 1.30                   | 0.21                    |
| 11.885                | 10-Year  | 4.21                     | 174.50                        | 175.01                      | 1.17                   | 0.23                    |
| 11.885                | 5-Year   | 3.57                     | 174.50                        | 174.97                      | 1.10                   | 0.24                    |
| 11.885                | 2-Year   | 2.27                     | 174.50                        | 174.88                      | 0.93                   | 0.27                    |
| 11.868                | Regional | 15.40                    | 173.80                        | 174.68                      | 2.70                   | 0.15                    |
| 11.868                | 100-Year | 5.93                     | 173.80                        | 174.36                      | 2.07                   | 0.20                    |
| 11.868                | 50-Year  | 6.16                     | 173.80                        | 174.37                      | 2.09                   | 0.19                    |
| 11.868                | 25-Year  | 5.51                     | 173.80                        | 174.34                      | 2.03                   | 0.20                    |
| 11.868                | 10-Year  | 4.21                     | 173.80                        | 174.27                      | 1.88                   | 0.22                    |
| 11.868                | 5-Year   | 3.57                     | 173.80                        | 174.23                      | 1.80                   | 0.23                    |
| 11.868                | 2-Year   | 2.27                     | 173.80                        | 174.15                      | 1.58                   | 0.25                    |
| 11.867                | Regional | 15.40                    | 172.80                        | 173.75                      | 1.91                   | 0.14                    |
| 11.867                | 100-Year | 5.93                     | 172.80                        | 173.46                      | 1.17                   | 0.18                    |
| 11.867                | 50-Year  | 6.16                     | 172.80                        | 173.47                      | 1.19                   | 0.18                    |
| 11.867                | 25-Year  | 5.51                     | 172.80                        | 173.45                      | 1.12                   | 0.19                    |
| 11.867                | 10-Year  | 4.21                     | 172.80                        | 173.38                      | 0.97                   | 0.20                    |
| 11.867                | 5-Year   | 3.57                     | 172.80                        | 173.35                      | 0.89                   | 0.21                    |
| 11.867                | 2-Year   | 2.27                     | 172.80                        | 173.26                      | 0.71                   | 0.23                    |
| 11.866                | Regional | 15.40                    | 172.26                        | 173.22                      | 1.59                   | 0.12                    |
| 11.866                | 100-Year | 5.93                     | 172.26                        | 172.89                      | 1.38                   | 0.16                    |
| 11.866                | 50-Year  | 6.16                     | 172.26                        | 172.90                      | 1.38                   | 0.15                    |
| 11.866                | 25-Year  | 5.51                     | 172.26                        | 172.87                      | 1.38                   | 0.16                    |
| 11.866                | 10-Year  | 4.21                     | 172.26                        | 172.81                      | 1.35                   | 0.17                    |
| 11.866                | 5-Year   | 3.57                     | 172.26                        | 172.77                      | 1.33                   | 0.18                    |
| 11.866                | 2-Year   | 2.27                     | 172.26                        | 172.70                      | 1.29                   | 0.20                    |
| 11.777                | Regional | 15.40                    | 171.44                        | 172.50                      | 2.31                   | 0.10                    |
| 11.777                | 100-Year | 5.93                     | 171.44                        | 172.18                      | 1.58                   | 0.14                    |

**Table B-1: HEC-RAS Results for Joshua's Creek Under Proposed Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 11.777                | 50-Year  | 6.16                     | 171.44                        | 172.19                      | 1.61                   | 0.14                    |
| 11.777                | 25-Year  | 5.51                     | 171.44                        | 172.17                      | 1.51                   | 0.14                    |
| 11.777                | 10-Year  | 4.21                     | 171.44                        | 172.11                      | 1.33                   | 0.15                    |
| 11.777                | 5-Year   | 3.57                     | 171.44                        | 172.08                      | 1.22                   | 0.16                    |
| 11.777                | 2-Year   | 2.27                     | 171.44                        | 171.99                      | 1.00                   | 0.18                    |
| 11.723                | Regional | 15.40                    | 171.16                        | 172.00                      | 2.31                   | 0.10                    |
| 11.723                | 100-Year | 5.93                     | 171.16                        | 171.70                      | 1.67                   | 0.13                    |
| 11.723                | 50-Year  | 6.16                     | 171.16                        | 171.71                      | 1.70                   | 0.13                    |
| 11.723                | 25-Year  | 5.51                     | 171.16                        | 171.67                      | 1.67                   | 0.13                    |
| 11.723                | 10-Year  | 4.21                     | 171.16                        | 171.61                      | 1.53                   | 0.14                    |
| 11.723                | 5-Year   | 3.57                     | 171.16                        | 171.57                      | 1.48                   | 0.15                    |
| 11.723                | 2-Year   | 2.27                     | 171.16                        | 171.48                      | 1.36                   | 0.17                    |
| 11.623                | Regional | 15.40                    | 170.39                        | 171.37                      | 1.74                   | 0.08                    |
| 11.623                | 100-Year | 5.93                     | 170.39                        | 171.10                      | 1.25                   | 0.11                    |
| 11.623                | 50-Year  | 6.16                     | 170.39                        | 171.11                      | 1.27                   | 0.11                    |
| 11.623                | 25-Year  | 5.51                     | 170.39                        | 171.08                      | 1.19                   | 0.11                    |
| 11.623                | 10-Year  | 4.21                     | 170.39                        | 171.01                      | 1.07                   | 0.12                    |
| 11.623                | 5-Year   | 3.57                     | 170.39                        | 170.97                      | 0.99                   | 0.13                    |
| 11.623                | 2-Year   | 2.27                     | 170.39                        | 170.88                      | 0.82                   | 0.14                    |
| 11.56                 | Regional | 15.40                    | 169.90                        | 170.98                      | 2.48                   | 0.08                    |
| 11.56                 | 100-Year | 5.93                     | 169.90                        | 170.68                      | 1.99                   | 0.10                    |
| 11.56                 | 50-Year  | 6.16                     | 169.90                        | 170.69                      | 2.02                   | 0.10                    |
| 11.56                 | 25-Year  | 5.51                     | 169.90                        | 170.67                      | 1.94                   | 0.10                    |
| 11.56                 | 10-Year  | 4.21                     | 169.90                        | 170.61                      | 1.77                   | 0.11                    |
| 11.56                 | 5-Year   | 3.57                     | 169.90                        | 170.57                      | 1.72                   | 0.11                    |
| 11.56                 | 2-Year   | 2.27                     | 169.90                        | 170.44                      | 1.64                   | 0.13                    |
| 11.506                | Regional | 15.40                    | 169.50                        | 170.45                      | 2.58                   | 0.07                    |
| 11.506                | 100-Year | 5.93                     | 169.50                        | 170.22                      | 1.94                   | 0.09                    |
| 11.506                | 50-Year  | 6.16                     | 169.50                        | 170.24                      | 1.90                   | 0.09                    |
| 11.506                | 25-Year  | 5.51                     | 169.50                        | 170.20                      | 1.91                   | 0.09                    |
| 11.506                | 10-Year  | 4.21                     | 169.50                        | 170.12                      | 1.83                   | 0.10                    |
| 11.506                | 5-Year   | 3.57                     | 169.50                        | 170.09                      | 1.74                   | 0.11                    |
| 11.506                | 2-Year   | 2.27                     | 169.50                        | 170.02                      | 1.33                   | 0.12                    |
| 11.464                | Regional | 15.40                    | 169.18                        | 169.99                      | 2.30                   | 0.07                    |
| 11.464                | 100-Year | 5.93                     | 169.18                        | 169.78                      | 1.67                   | 0.09                    |
| 11.464                | 50-Year  | 6.16                     | 169.18                        | 169.78                      | 1.72                   | 0.09                    |
| 11.464                | 25-Year  | 5.51                     | 169.18                        | 169.76                      | 1.65                   | 0.09                    |
| 11.464                | 10-Year  | 4.21                     | 169.18                        | 169.70                      | 1.62                   | 0.10                    |
| 11.464                | 5-Year   | 3.57                     | 169.18                        | 169.66                      | 1.58                   | 0.10                    |
| 11.464                | 2-Year   | 2.27                     | 169.18                        | 169.55                      | 1.54                   | 0.11                    |
| 11.439                | Regional | 15.40                    | 168.98                        | 169.75                      | 1.09                   | 0.06                    |
| 11.439                | 100-Year | 5.93                     | 168.98                        | 169.50                      | 0.84                   | 0.08                    |
| 11.439                | 50-Year  | 6.16                     | 168.98                        | 169.51                      | 0.85                   | 0.08                    |
| 11.439                | 25-Year  | 5.51                     | 168.98                        | 169.49                      | 0.83                   | 0.08                    |
| 11.439                | 10-Year  | 4.21                     | 168.98                        | 169.44                      | 0.79                   | 0.09                    |
| 11.439                | 5-Year   | 3.57                     | 168.98                        | 169.41                      | 0.77                   | 0.09                    |
| 11.439                | 2-Year   | 2.27                     | 168.98                        | 169.34                      | 0.70                   | 0.10                    |
| 11.349                | Regional | 15.40                    | 168.56                        | 169.28                      | 1.83                   | 0.04                    |
| 11.349                | 100-Year | 5.93                     | 168.56                        | 169.07                      | 1.31                   | 0.06                    |
| 11.349                | 50-Year  | 6.16                     | 168.56                        | 169.07                      | 1.32                   | 0.06                    |
| 11.349                | 25-Year  | 5.51                     | 168.56                        | 169.06                      | 1.25                   | 0.06                    |
| 11.349                | 10-Year  | 4.21                     | 168.56                        | 169.01                      | 1.13                   | 0.06                    |

**Table B-1: HEC-RAS Results for Joshua's Creek Under Proposed Conditions (Floodplain) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Channel Travel Time (h) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|-------------------------|
| 11.349                | 5-Year   | 3.57                     | 168.56                        | 168.99                      | 1.04                   | 0.07                    |
| 11.349                | 2-Year   | 2.27                     | 168.56                        | 168.93                      | 0.89                   | 0.07                    |
| 11.281                | Regional | 15.40                    | 167.52                        | 168.66                      | 2.17                   | 0.03                    |
| 11.281                | 100-Year | 5.93                     | 167.52                        | 168.42                      | 1.75                   | 0.05                    |
| 11.281                | 50-Year  | 6.16                     | 167.52                        | 168.43                      | 1.77                   | 0.04                    |
| 11.281                | 25-Year  | 5.51                     | 167.52                        | 168.40                      | 1.77                   | 0.05                    |
| 11.281                | 10-Year  | 4.21                     | 167.52                        | 168.32                      | 1.71                   | 0.05                    |
| 11.281                | 5-Year   | 3.57                     | 167.52                        | 168.26                      | 1.76                   | 0.05                    |
| 11.281                | 2-Year   | 2.27                     | 167.52                        | 168.08                      | 1.83                   | 0.06                    |
| 11.244                | Regional | 15.40                    | 167.05                        | 168.25                      | 1.81                   | 0.03                    |
| 11.244                | 100-Year | 5.93                     | 167.05                        | 167.97                      | 1.39                   | 0.04                    |
| 11.244                | 50-Year  | 6.16                     | 167.05                        | 167.97                      | 1.43                   | 0.04                    |
| 11.244                | 25-Year  | 5.51                     | 167.05                        | 167.94                      | 1.37                   | 0.04                    |
| 11.244                | 10-Year  | 4.21                     | 167.05                        | 167.88                      | 1.21                   | 0.04                    |
| 11.244                | 5-Year   | 3.57                     | 167.05                        | 167.84                      | 1.12                   | 0.05                    |
| 11.244                | 2-Year   | 2.27                     | 167.05                        | 167.73                      | 0.95                   | 0.05                    |
| 11.184                | Regional | 15.40                    | 166.68                        | 167.73                      | 2.43                   | 0.02                    |
| 11.184                | 100-Year | 5.93                     | 166.68                        | 167.46                      | 1.84                   | 0.03                    |
| 11.184                | 50-Year  | 6.16                     | 166.68                        | 167.48                      | 1.82                   | 0.03                    |
| 11.184                | 25-Year  | 5.51                     | 166.68                        | 167.45                      | 1.76                   | 0.03                    |
| 11.184                | 10-Year  | 4.21                     | 166.68                        | 167.39                      | 1.64                   | 0.03                    |
| 11.184                | 5-Year   | 3.57                     | 166.68                        | 167.35                      | 1.58                   | 0.03                    |
| 11.184                | 2-Year   | 2.27                     | 166.68                        | 167.25                      | 1.44                   | 0.04                    |
| 11.145                | Regional | 15.40                    | 166.28                        | 167.52                      | 1.83                   | 0.02                    |
| 11.145                | 100-Year | 5.93                     | 166.28                        | 167.25                      | 1.39                   | 0.02                    |
| 11.145                | 50-Year  | 6.16                     | 166.28                        | 167.25                      | 1.47                   | 0.02                    |
| 11.145                | 25-Year  | 5.51                     | 166.28                        | 167.22                      | 1.43                   | 0.02                    |
| 11.145                | 10-Year  | 4.21                     | 166.28                        | 167.15                      | 1.33                   | 0.02                    |
| 11.145                | 5-Year   | 3.57                     | 166.28                        | 167.12                      | 1.25                   | 0.03                    |
| 11.145                | 2-Year   | 2.27                     | 166.28                        | 167.01                      | 1.03                   | 0.03                    |
| 11.089                | Regional | 15.40                    | 166.12                        | 167.08                      | 2.22                   | 0.01                    |
| 11.089                | 100-Year | 5.93                     | 166.12                        | 166.89                      | 1.63                   | 0.01                    |
| 11.089                | 50-Year  | 6.16                     | 166.12                        | 166.92                      | 1.53                   | 0.01                    |
| 11.089                | 25-Year  | 5.51                     | 166.12                        | 166.89                      | 1.48                   | 0.01                    |
| 11.089                | 10-Year  | 4.21                     | 166.12                        | 166.85                      | 1.29                   | 0.01                    |
| 11.089                | 5-Year   | 3.57                     | 166.12                        | 166.82                      | 1.22                   | 0.01                    |
| 11.089                | 2-Year   | 2.27                     | 166.12                        | 166.73                      | 1.09                   | 0.01                    |
| 11.024                | Regional | 15.40                    | 165.55                        | 166.60                      | 1.72                   | 0.00                    |
| 11.024                | 100-Year | 5.93                     | 165.55                        | 166.31                      | 1.47                   | 0.00                    |
| 11.024                | 50-Year  | 6.16                     | 165.55                        | 166.29                      | 1.63                   | 0.00                    |
| 11.024                | 25-Year  | 5.51                     | 165.55                        | 166.27                      | 1.58                   | 0.00                    |
| 11.024                | 10-Year  | 4.21                     | 165.55                        | 166.18                      | 1.65                   | 0.00                    |
| 11.024                | 5-Year   | 3.57                     | 165.55                        | 166.13                      | 1.66                   | 0.00                    |
| 11.024                | 2-Year   | 2.27                     | 165.55                        | 166.02                      | 1.57                   | 0.00                    |

<sup>(1)</sup> Channel infrastructure included at existing crossings. Simulated based on existing flow profiles.

**Table B-2: HEC-RAS Results for Joshua's Creek Under Proposed Conditions (Riparian) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Cumulative Volume (1000 m <sup>3</sup> ) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|--|
| 1050                  | Regional | 4.67                     | 178.08                        | 178.19                      | 1.38                   | 65.88                                    |
| 1050                  | 100-Year | 1.96                     | 178.08                        | 178.19                      | 0.55                   | 22.70                                    |
| 1050                  | 50-Year  | 1.65                     | 178.08                        | 178.17                      | 0.55                   | 21.90                                    |
| 1050                  | 25-Year  | 1.48                     | 178.08                        | 178.18                      | 0.46                   | 19.63                                    |
| 1050                  | 10-Year  | 1.13                     | 178.08                        | 178.19                      | 0.33                   | 15.30                                    |
| 1050                  | 5-Year   | 0.96                     | 178.08                        | 178.18                      | 0.29                   | 13.17                                    |
| 1050                  | 2-Year   | 0.61                     | 178.08                        | 178.16                      | 0.24                   | 8.85                                     |
| 1025                  | Regional | 4.67                     | 177.42                        | 178.14                      | 0.15                   | 55.27                                    |
| 1025                  | 100-Year | 1.96                     | 177.42                        | 177.87                      | 0.23                   | 19.57                                    |
| 1025                  | 50-Year  | 1.65                     | 177.42                        | 177.86                      | 0.21                   | 19.11                                    |
| 1025                  | 25-Year  | 1.48                     | 177.42                        | 177.84                      | 0.22                   | 17.08                                    |
| 1025                  | 10-Year  | 1.13                     | 177.42                        | 177.80                      | 0.24                   | 13.23                                    |
| 1025                  | 5-Year   | 0.96                     | 177.42                        | 177.79                      | 0.24                   | 11.34                                    |
| 1025                  | 2-Year   | 0.61                     | 177.42                        | 177.77                      | 0.21                   | 7.54                                     |
| 1010                  | Regional | 4.67                     | 177.37                        | 178.13                      | 0.09                   | 46.19                                    |
| 1010                  | 100-Year | 1.96                     | 177.37                        | 177.85                      | 0.12                   | 17.15                                    |
| 1010                  | 50-Year  | 1.65                     | 177.37                        | 177.85                      | 0.10                   | 16.81                                    |
| 1010                  | 25-Year  | 1.48                     | 177.37                        | 177.82                      | 0.11                   | 15.10                                    |
| 1010                  | 10-Year  | 1.13                     | 177.37                        | 177.78                      | 0.12                   | 11.88                                    |
| 1010                  | 5-Year   | 0.96                     | 177.37                        | 177.75                      | 0.13                   | 10.29                                    |
| 1010                  | 2-Year   | 0.61                     | 177.37                        | 177.70                      | 0.15                   | 6.96                                     |
| 1006                  | Regional | 4.67                     | 177.33                        | 178.13                      | 0.09                   | 41.10                                    |
| 1006                  | 100-Year | 1.96                     | 177.33                        | 177.85                      | 0.10                   | 15.60                                    |
| 1006                  | 50-Year  | 1.65                     | 177.33                        | 177.84                      | 0.08                   | 15.30                                    |
| 1006                  | 25-Year  | 1.48                     | 177.33                        | 177.82                      | 0.08                   | 13.80                                    |
| 1006                  | 10-Year  | 1.13                     | 177.33                        | 177.77                      | 0.08                   | 10.96                                    |
| 1006                  | 5-Year   | 0.96                     | 177.33                        | 177.75                      | 0.08                   | 9.54                                     |
| 1006                  | 2-Year   | 0.61                     | 177.33                        | 177.69                      | 0.07                   | 6.54                                     |
| 1004                  | Regional | 4.67                     | 177.23                        | 178.13                      | 0.08                   | 38.76                                    |
| 1004                  | 100-Year | 1.96                     | 177.23                        | 177.85                      | 0.08                   | 14.82                                    |
| 1004                  | 50-Year  | 1.65                     | 177.23                        | 177.84                      | 0.07                   | 14.55                                    |
| 1004                  | 25-Year  | 1.48                     | 177.23                        | 177.82                      | 0.07                   | 13.13                                    |
| 1004                  | 10-Year  | 1.13                     | 177.23                        | 177.77                      | 0.06                   | 10.45                                    |
| 1004                  | 5-Year   | 0.96                     | 177.23                        | 177.75                      | 0.06                   | 9.10                                     |
| 1004                  | 2-Year   | 0.61                     | 177.23                        | 177.69                      | 0.05                   | 6.26                                     |
| 1000                  | Regional | 5.14                     | 177.24                        | 178.13                      | 0.08                   | 33.96                                    |
| 1000                  | 100-Year | 2.15                     | 177.24                        | 177.85                      | 0.08                   | 13.23                                    |
| 1000                  | 50-Year  | 1.82                     | 177.24                        | 177.84                      | 0.07                   | 13.00                                    |
| 1000                  | 25-Year  | 1.62                     | 177.24                        | 177.82                      | 0.07                   | 11.75                                    |
| 1000                  | 10-Year  | 1.24                     | 177.24                        | 177.77                      | 0.07                   | 9.38                                     |
| 1000                  | 5-Year   | 1.05                     | 177.24                        | 177.74                      | 0.07                   | 8.20                                     |
| 1000                  | 2-Year   | 0.67                     | 177.24                        | 177.69                      | 0.06                   | 5.68                                     |
| 979                   | Regional | 5.14                     | 177.28                        | 178.13                      | 0.08                   | 27.12                                    |
| 979                   | 100-Year | 2.15                     | 177.28                        | 177.85                      | 0.08                   | 10.76                                    |
| 979                   | 50-Year  | 1.82                     | 177.28                        | 177.84                      | 0.07                   | 10.59                                    |
| 979                   | 25-Year  | 1.62                     | 177.28                        | 177.82                      | 0.07                   | 9.59                                     |
| 979                   | 10-Year  | 1.24                     | 177.28                        | 177.77                      | 0.07                   | 7.70                                     |
| 979                   | 5-Year   | 1.05                     | 177.28                        | 177.74                      | 0.07                   | 6.76                                     |
| 979                   | 2-Year   | 0.67                     | 177.28                        | 177.69                      | 0.07                   | 4.78                                     |
| 955                   | Regional | 5.14                     | 177.21                        | 178.13                      | 0.07                   | 24.00                                    |
| 955                   | 100-Year | 2.15                     | 177.21                        | 177.85                      | 0.06                   | 9.58                                     |
| 955                   | 50-Year  | 1.82                     | 177.21                        | 177.84                      | 0.06                   | 9.43                                     |
| 955                   | 25-Year  | 1.62                     | 177.21                        | 177.82                      | 0.05                   | 8.54                                     |

**Table B-2: HEC-RAS Results for Joshua's Creek Under Proposed Conditions (Riparian) <sup>(1)</sup>**

| HEC-RAS River Station | Profile  | Flow (m <sup>3</sup> /s) | Minimum Channel Elevation (m) | Water Surface Elevation (m) | Channel Velocity (m/s) | Cumulative Volume (1000 m <sup>3</sup> ) |
|-----------------------|----------|--------------------------|-------------------------------|-----------------------------|------------------------|--|
| 955                   | 10-Year  | 1.24                     | 177.21                        | 177.77                      | 0.05                   | 6.87                                     |
| 955                   | 5-Year   | 1.05                     | 177.21                        | 177.74                      | 0.05                   | 6.05                                     |
| 955                   | 2-Year   | 0.67                     | 177.21                        | 177.69                      | 0.05                   | 4.31                                     |
| 929                   | Regional | 5.14                     | 177.19                        | 178.13                      | 0.10                   | 21.01                                    |
| 929                   | 100-Year | 2.15                     | 177.19                        | 177.85                      | 0.09                   | 8.50                                     |
| 929                   | 50-Year  | 1.82                     | 177.19                        | 177.84                      | 0.08                   | 8.38                                     |
| 929                   | 25-Year  | 1.62                     | 177.19                        | 177.82                      | 0.08                   | 7.59                                     |
| 929                   | 10-Year  | 1.24                     | 177.19                        | 177.77                      | 0.08                   | 6.12                                     |
| 929                   | 5-Year   | 1.05                     | 177.19                        | 177.74                      | 0.07                   | 5.40                                     |
| 929                   | 2-Year   | 0.67                     | 177.19                        | 177.68                      | 0.07                   | 3.87                                     |
| 866                   | Regional | 5.14                     | 177.31                        | 178.13                      | 0.09                   | 17.50                                    |
| 866                   | 100-Year | 2.15                     | 177.31                        | 177.84                      | 0.09                   | 7.24                                     |
| 866                   | 50-Year  | 1.82                     | 177.31                        | 177.84                      | 0.08                   | 7.15                                     |
| 866                   | 25-Year  | 1.62                     | 177.31                        | 177.82                      | 0.08                   | 6.49                                     |
| 866                   | 10-Year  | 1.24                     | 177.31                        | 177.77                      | 0.08                   | 5.26                                     |
| 866                   | 5-Year   | 1.05                     | 177.31                        | 177.74                      | 0.07                   | 4.65                                     |
| 866                   | 2-Year   | 0.67                     | 177.31                        | 177.68                      | 0.07                   | 3.37                                     |
| 756                   | Regional | 10.73                    | 177.19                        | 178.13                      | 0.18                   | 6.05                                     |
| 756                   | 100-Year | 4.18                     | 177.19                        | 177.84                      | 0.14                   | 2.69                                     |
| 756                   | 50-Year  | 3.29                     | 177.19                        | 177.84                      | 0.11                   | 2.67                                     |
| 756                   | 25-Year  | 2.88                     | 177.19                        | 177.81                      | 0.11                   | 2.45                                     |
| 756                   | 10-Year  | 2.25                     | 177.19                        | 177.76                      | 0.10                   | 2.03                                     |
| 756                   | 5-Year   | 1.85                     | 177.19                        | 177.74                      | 0.09                   | 1.83                                     |
| 756                   | 2-Year   | 1.16                     | 177.19                        | 177.68                      | 0.07                   | 1.38                                     |

<sup>(1)</sup> No channel infrastructure included. Simulated based on existing flow profiles.



# ATTACHMENT

# C

## *HEC-RAS Existing Conditions Flow Profiles for Joshua's Creek Main Branch*



**Table C-1: Existing Flow Profiles in Joshua's Creek Main Branch**

| River  | Reach   | River Station | Area (ha) | Flow (m <sup>3</sup> /s) |          |         |         |         |        |        |
|--|---------|---------------|-----------|--------------------------|----------|---------|---------|---------|--------|--------|
|  |         |               |           | Regional                 | 100-Year | 50-Year | 25-Year | 10-Year | 5-Year | 2-Year |
| <i>NOCSS Unit Flow Rates at JC-D1 (m<sup>3</sup>/s/ha)</i> |         |               |           |                          |          | 0.019   | 0.017   | 0.013   | 0.011  | 0.007  |
| RIVER-1  | Reach-1 | 14.207        | 126.98    | 6.81                     | 2.86     | 2.41    | 2.16    | 1.65    | 1.40   | 0.89   |
| RIVER-1  | Reach-1 | 13.019        | 130.73    | 7.01                     | 2.94     | 2.48    | 2.22    | 1.70    | 1.44   | 0.92   |
| RIVER-1  | Reach-1 | 12.87         | 134.06    | 7.19                     | 3.02     | 2.55    | 2.28    | 1.74    | 1.47   | 0.94   |
| RIVER-1  | Reach-1 | 12.763        | 137.83    | 7.39                     | 3.1      | 2.62    | 2.34    | 1.79    | 1.52   | 0.96   |
| RIVER-1  | Reach-2 | 12.5          | 243.77    | 12.07                    | 4.71     | 4.63    | 4.14    | 3.17    | 2.68   | 1.71   |
| RIVER-1  | Reach-2 | 12.41         | 248.20    | 12.25                    | 4.76     | 4.72    | 4.22    | 3.23    | 2.73   | 1.74   |
| RIVER-1  | Reach-2 | 12.358        | 252.62    | 12.42                    | 4.81     | 4.80    | 4.29    | 3.28    | 2.78   | 1.77   |
| RIVER-1  | Reach-2 | 12.286        | 290.89    | 13.91                    | 5.25     | 5.53    | 4.95    | 3.78    | 3.20   | 2.04   |
| RIVER-1  | Reach-2 | 12.261        | 324.16    | 15.4                     | 5.93     | 6.16    | 5.51    | 4.21    | 3.57   | 2.27   |
| RIVER-1  | Reach-3 | 10.95         | 535.47    | 28.8                     | 12.29    | 10.17   | 9.10    | 6.96    | 5.89   | 3.75   |
| RIVER-1  | Reach-4 | 10.79         | 732.87    | 38.11                    | 15.83    | 13.92   | 12.46   | 9.53    | 8.06   | 5.13   |
| RIVER-1  | Reach-4 | 10.486        | 758.61    | 39.32                    | 16.32    | 14.41   | 12.90   | 9.86    | 8.34   | 5.31   |
| RIVER-1  | Reach-4 | 10.008        | 826.26    | 42.47                    | 17.6     | 15.70   | 14.05   | 10.74   | 9.09   | 5.78   |
| RIVER-1  | Reach-4 | 9.328         | 981.26    | 51.22                    | 21.2     | 18.64   | 16.68   | 12.76   | 10.79  | 6.87   |
| RIVER-1  | Reach-4 | 9.069         | 994.69    | 51.72                    | 21.29    | 18.90   | 16.91   | 12.93   | 10.94  | 6.96   |
| RIVER-1  | Reach-4 | 8.917         |           | 89                       | 40       | 34      | 28      | 24      | 20     | 16     |
| RIVER-1  | Reach-5 | 7.462         |           | 123                      | 48       | 42      | 33      | 29      | 24     | 18     |
| RIVER-1  | Reach-5 | 5.222         |           | 139                      | 54       | 47      | 40      | 32      | 27     | 21     |
| RIVER-1  | Reach-5 | 3.78          |           | 155                      | 55       | 47      | 40      | 33      | 27     | 21     |
| RIVER-2  | Reach-1 | 1050          | 86.94     | 4.67                     | 1.96     | 1.65    | 1.48    | 1.13    | 0.96   | 0.61   |
| RIVER-2  | Reach-1 | 1025          | 86.94     | 4.67                     | 1.96     | 1.65    | 1.48    | 1.13    | 0.96   | 0.61   |
| RIVER-2  | Reach-1 | 1000          | 95.58     | 5.14                     | 2.15     | 1.82    | 1.62    | 1.24    | 1.05   | 0.67   |
| RIVER-2  | Reach-1 | 12.5          |           | 10.73                    | 4.18     | 3.29    | 2.88    | 2.25    | 1.85   | 1.16   |
| RIVER-3  | Reach-1 | 12.091        | 179.77    | 11.27                    | 5.48     | 3.42    | 3.06    | 2.34    | 1.98   | 1.26   |
| RIVER-3  | Reach-1 | 11.67         | 211.31    | 13.21                    | 6.21     | 4.01    | 3.59    | 2.75    | 2.32   | 1.48   |
| RIVER-4  | Reach-1 | 11.903        |           | 11.08                    | 5.33     | 4.72    | 4.16    | 3.32    | 2.68   | 1.72   |
| RIVER-4  | Reach-1 | 11.826        |           | 13.1                     | 6.3      | 5.58    | 4.92    | 3.93    | 3.17   | 2.03   |
| RIVER-4  | Reach-1 | 10.79         |           | 39.8                     | 17.5     | 15.7    | 14.2    | 11.4    | 9.22   | 5.89   |
| RIVER-5  | Reach-1 | 8.789         |           | 14                       | 6.4      | 5.6     | 4.4     | 3.8     | 3      | 2.3    |
| RIVER-5  | Reach-1 | 8.667         |           | 14                       | 6.4      | 5.6     | 4.4     | 3.8     | 3      | 2.3    |
| RIVER-5  | Reach-1 | 7.52          |           | 123                      | 48       | 42      | 33      | 29      | 24     | 18     |

2.41

Flows re-estimated based on NOCSS unit flow rates at JC-D1 and drainage areas provided by Stantec.