MACARTHUR BLVD BIKEWAY SEGMENT 3

DRAINAGE DESIGN REPORT

MCDOT CONTRACT NO. 1111497
JMT JOB NO. 18-04565-003

Submitted to:
Montgomery County Department of Transportation

June 2024

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I. INTRODUCTION

On behalf of the Montgomery County Department of Transportation (MCDOT), Johnson, Mirmiran, & Thompson (JMT) has completed this drainage report for the design of the MacArthur Blvd Segment 3 project. This project involves constructing a separated bicycle facility along MacArthur Boulevard for approximately 2.2 miles between Oberlin Avenue and the District of Columbia Line. Minor roadway widening and resurfacing is also proposed along MacArthur Boulevard. This Drainage report focuses on the design support and computations for drainage infrastructure that is necessary to address the runoff along the project corridor.

II. EXISTING CONDITIONS

The project site consists of a bicycle path that runs along the south side of MacArthur Boulevard. Most of the project corridor is open section until approximate station 250+50 where the roadway section becomes curb and gutter. The north side of MacArthur Boulevard is drained by roadside ditches in the open section portion of the project. The roadside ditches vary in condition and adequacy, some locations do not adequately convey the design storm in the existing condition. The ditches ultimately drain to the south through storm drain systems or culverts which cross under MacArthur Boulevard. Many of the existing culverts along the project corridor are inadequately sized and/or in disrepair. The south side of MacArthur Boulevard typically drains in sheet flow or through a small number of offsite storm structures. The remaining portion of the project that is curb and gutter is drained by grate or curb opening inlets and the runoff travels offsite through storm pipes.

The existing conditions present along the project corridor provide multiple constraints to the drainage design. Notably, the two Washington Aqueducts that provide drinking water to the District of Columbia, are laid beneath MacArthur Boulevard. Due to the aqueduct's size, value, fragility, and their proximity to the roadway, underground drainage infrastructure such as pipes, inlets, and culverts, are severely constrained. Additionally, due to the steep slopes on the north and the south side of the roadway corridor, ditch sizing and design has been constrained due to space limitations.

III. PROPOSED CONDITIONS

The design of the project drainage has been developed to keep the final drainage condition as similar to the existing condition as possible. To achieve this, most of the project runoff on the southern side of the roadway continues to leave the site in sheet flow condition. However, since the roadway modifications include minor widening work on the north side, the roadside ditches must be adjusted and designed for the new conditions. These ditches maintain existing drainage patterns wherever possible. Three ditches are proposed on the south side of the roadway (from sta. 237+47 RT to sta. 242+00 RT, sta. 250+10 RT to sta. 247+00 RT, and sta. 247+00 RT to sta. 248+18 RT) to reduce nuisance flooding in downstream communities. These ditches drain to existing outfall locations.

Additional modifications to the project corridor include the addition of curb and gutter along sections of trail that are adjacent to the roadway on the south side and three locations on the north side of the roadway. The addition of curb between the roadway and trail necessitates the use of curb openings to allow runoff to be conveyed out of the roadway at low points along the roadway profile from station 215+00 RT to 230+25 RT. These curb openings will include riprap diaphragms located along the south side of the trail that function as level spreaders to allow the runoff to leave the site in a sheet flow condition to match the existing condition runoff pattern. For the proposed curb and gutter section starting at 250+50 RT, a COG inlet and pipe is proposed to drain water to the existing outfall. The proposed curb and gutter section

starting at 243+10 LT drains to an existing inlet that will be upgraded from a 5' throat length to a 10' length at sta. 243+12 LT. The curb and gutter section from 232+07 LT drains to the existing culvert at sta. 231+84 LT through a proposed 21' long ditch. The transition from gutter to ditch is protected with a riprap pad to prevent erosion and direct the runoff into the ditch. The proposed curb and gutter section from 226+12 LT to 227+00 LT also drains to the existing culvert at sta. 231+84 through a proposed 14' long ditch. The proposed curb and gutter section from 216+50 LT to 220+25 LT drains to the existing culvert at 221+13 LT.

The project includes modifications to the storm system located at approximate station 248+00 to account for the change in trail elevation that is proposed for the purpose of reducing the steep grade at this location. Due to the adjusted grade of the trail, an additional ditch has been added on the left side to direct runoff to a new culvert that crosses the trail at station 247+00 RT. The runoff then continues from the culvert and flows to the adjusted outlet location of the existing storm system at station 248+20. The existing storm system outlet has been adjusted to ensure that the outlet is located downstream of the trail tie-out grading. Per historical plans provided by the county, there is a stabilized, downstream riprap channel that the existing storm system connects to. The adjusted storm system and proposed ditch will tie-into the existing riprap channel.

The modification of existing entrances off the roadway necessitates the modification and design of entrance culverts to ensure that runoff continues to drain to the original outfalls. Additionally, five culvert replacements crossing MacArthur Blvd and the aqueducts are proposed due to the existing material being terra cotta or the pipe being undersized. These locations are at 166+65 LT (size upgrading from 10" to 12"), 195+00 LT (12" to 2x12"), 208+50 LT (12" to 3x12"), 211+00 LT(8" to 3x12"), and 237+00 LT(10" to 15"). The culverts at these locations all consist of terra cotta pipes in the existing condition and will be replaced with RCP Class IV pipes. Other culvert crossings on the project with similar conditions are not proposed for replacement due to their proximity to the Washington Aqueducts and the risk to existing infrastructure during construction activities.

IV. METHODOLOGY

The drainage design of this project was developed using the methods and requirements listed in the Montgomery County Drainage Design Criteria manual (The Manual). See *Appendix A* for drainage area maps. The Rational Method was used to compute 10-year peak discharge based on drainage areas; and the computations can be found in *Appendix B, Appendix C, and Appendix D* respectively. A runoff coefficient (C-Factor) was calculated using the values found in Table 3-5 of The Manual. Per The Manual, the Time of Concentration is based upon the computed C factor for drainage areas less than 2 acres or the formula for drainage areas over 2 acres. The intensity was calculated using the IDF curve numbers found in Table 3-7 of The Manual.

Hydraflow Express, a hydraulic modeling program, was used to calculate inlet spread, ditch velocities and depths, and culvert hydraulics. There is one proposed inlet within the project at sta. 250+67 RT and one proposed upgrade of an existing inlet at sta. 248+34 LT. The inlet placement along the roadway is determined by criteria in The Manual. The Manual requires the 10-year spread along the roadway to be limited to a width of 13 feet from the curb. Additionally, the inlet must achieve a 70% efficiency or bypass less than 3 cfs. Pipes within the proposed storm system have been sized at a minimum of 15 inches in diameter. The rational method and gutter spread computations can be found in *Appendix E*.

Curb spread analyses were performed at locations where curb and gutter are proposed on the north side of the roadway. Flowmaster, a hydraulic modeling program, was used to calculate spread at these locations. Both locations have a proposed spread that is less than the allowable spread of 13 ft. These calculations can be found in *Appendix E.6*.

To address the curb and gutter section from 215+00 RT to 230+25 RT, curb openings are spaced every 50-60 feet per direction from the county. Openings are proposed at every low point along this section of roadway with flanker openings 50-60 ft upstream on each side of the sump openings. Each curb opening is 10 feet wide and connects to the trail via asphalt paving. Riprap diaphragms to act as level spreaders have been located on the downstream side of the trail at each opening location. The rational method and spread computations for these openings were calculated using Flowmaster and can be found in *Appendix E.5.*

The roadway design and roadway widening as a part of this project requires the analysis and design of roadside ditches along the project corridor. The Manual requires a minimum of 0.5 feet of freeboard in a ditch. Additionally, the lining of a roadside ditch is determined by the velocity of flow through the ditch as defined in Table 4-9 of The Manual. Several ditches have less than the required freeboard due to project constraints that include steep slopes and limited space on the north side of the road. Most of these ditches will still contain the 10-year flow within the banks of the ditch. The triangular ditch from sta. 217+00 LT to 211+00 LT has no freeboard upstream of sta. 213+50 LT due to steep slopes along the right side of the road which constrain the size of the ditch design. For the trapezoidal ditch from 237+47 RT to 242+00 RT, there is no freeboard. However, the proposed condition maintains a depth of 0.5 feet, as in the existing condition, and modifies the shape and width of the ditch to increase capacity. This ditch has also been extended 250 ft. and the modifications to this ditch will reduce flooding in the downstream community compared to the existing condition. The ditch beginning at sta. 237+50 LT has a depth of 0.5 ft where it is over the aqueduct to maintain sufficient clearance, which does not contain all the flow, but contains more flow than the existing condition. Ditch computations and exceptions can be found in *Appendix D*.

To address the private entrances which cross the existing roadside ditches along the north side of the roadway, entrance culvert modifications are proposed. Entrance culvert design per The Manual requires a headwater to depth ratio of 2.0 or less. Additionally, headwater must be 1 foot below the edge of the roadway shoulder. Culverts 6, 7, and 8 all require design exceptions due to their proximity to the existing aqueduct and shallow cover. Culverts exist at each of these locations in the existing condition and have shallow cover. These constraints prevent a design that achieves headwater requirements. All other culverts meet design requirements. Culvert computations can be found in *Appendix F*.

V. CONCLUSION

Using the methods described above, the drainage systems along MacArthur Boulevard and the bike trail have been analyzed and designed. The majority of the site area drains runoff in a sheet flow condition that flows from the crown of the road to the south side of the trail. The remaining site area drains runoff through ditch and culvert systems on the north side of MacArthur Boulevard or through a storm drain system that flows toward the south. Drainage conditions along the project corridor have been improved wherever possible. Improvements have been made to 5 culverts along the roadway, to the private entrance culverts,

to the inlet at the Maryland Avenue intersection, and to the roadside ditches to increase the capacity of these systems and to stabilize the outfalls.

VI. SOURCES OF INFORMATION

- Site Investigation
- Field Surveys
- Aerial Imagery
- USDA Natural Resources Conservation Service (NRCS) Web Soil Survey
- Montgomery County Government Drainage Design Criteria, June 10th 2014

APPENDIX A
DRAINAGE AREA MAPS

LEGEND

- DITCH DRAINAGE AREA
- PROPOSED CONTOURS
- EXISTING CONTOURS

DRAFT
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NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

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Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

DA–01
DITCH DRAINAGE AREA MAPS
MACARTHUR BOULEVARD BIKEWAY SEGMENT III

0 200' 400'
SCALE: 1"=200'

DATE: JUNE 2024

CIP No. : 500718 SHEET 37 of 285

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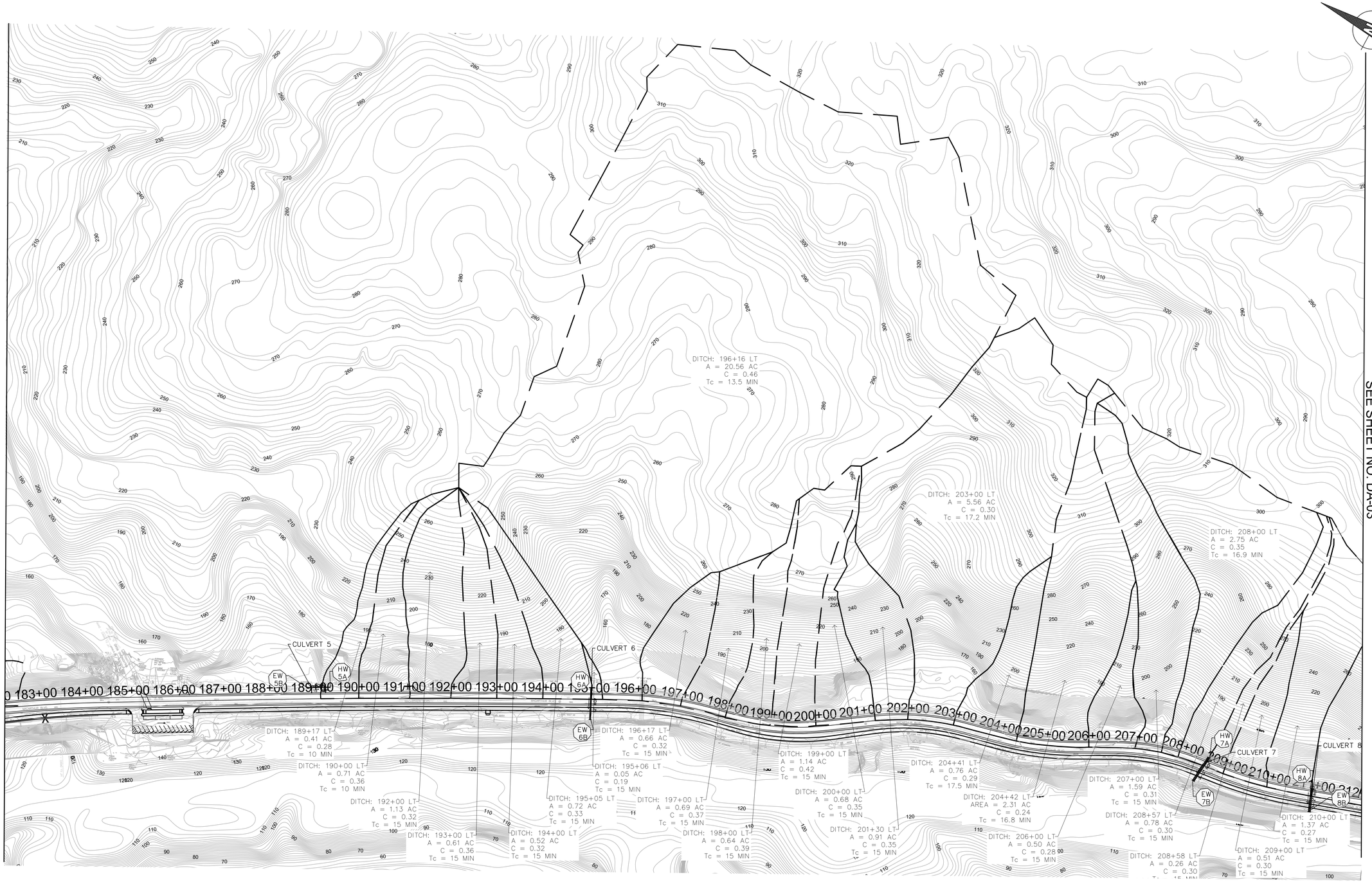

LEGEND

- DITCH DRAINAGE AREA
- PROPOSED CONTOURS
- EXISTING CONTOURS

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DA–02
DITCH DRAINAGE AREA MAPS
MACARTHUR BOULEVARD BIKEWAY SEGMENT III

0 200' 400'
SCALE: 1"=200'

DATE: JUNE 2024

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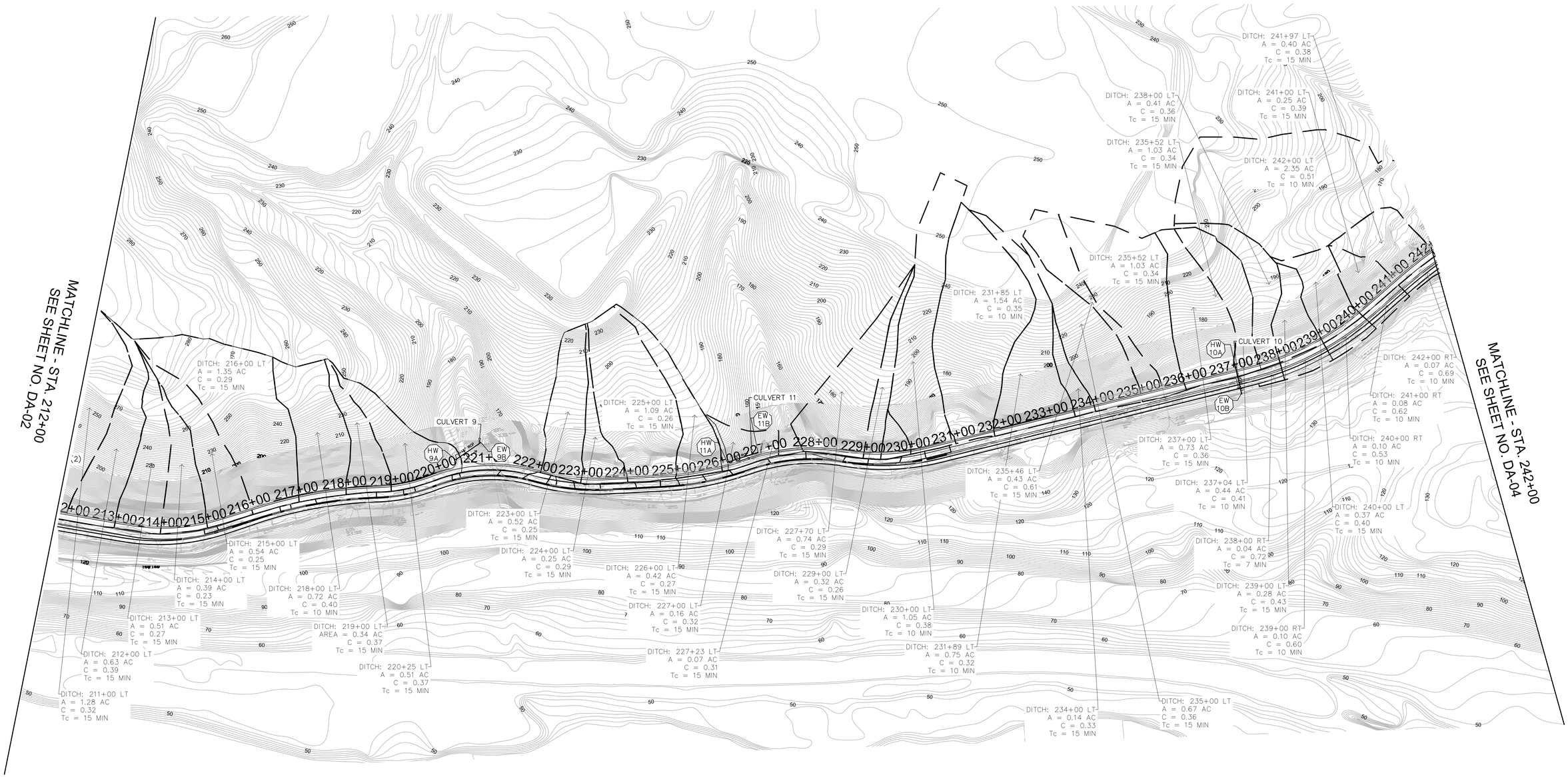

LEGEND

- DITCH DRAINAGE AREA
- PROPOSED CONTOURS
- EXISTING CONTOURS

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DA–03
DITCH DRAINAGE AREA MAPS
MACARTHUR BOULEVARD BIKEWAY SEGMENT III

0 200' 400'
SCALE: 1"= 200'

DATE: JUNE 2024

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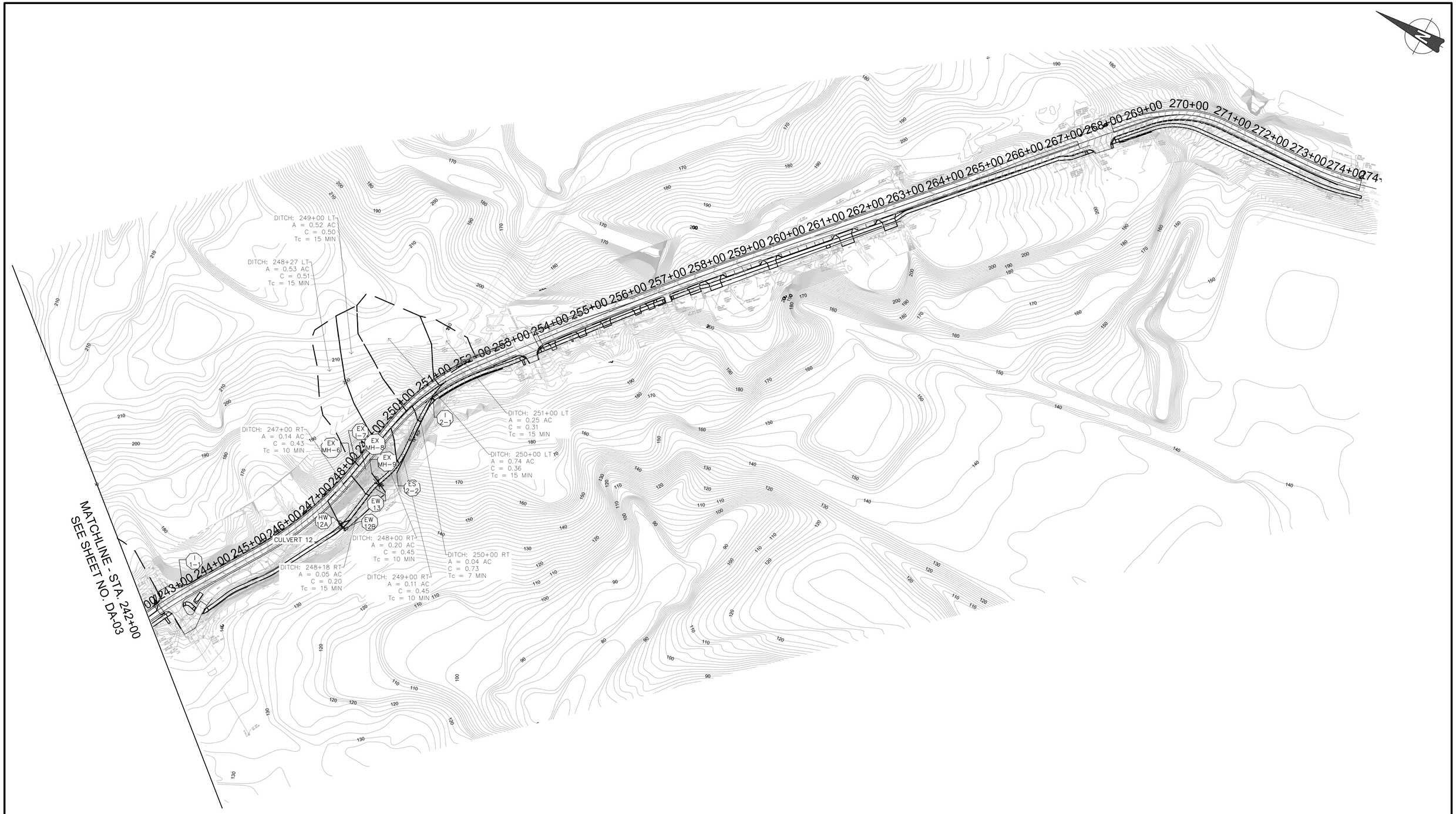

LEGEND

- DITCH DRAINAGE AREA
- PROPOSED CONTOURS
- EXISTING CONTOURS

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DA-04
DITCH DRAINAGE AREA MAPS
MACARTHUR BOULEVARD BIKEWAY SEGMENT III

0 200' 400'

SCALE: 1"=200'

DATE: JUNE 2024

CIP No.: 500718

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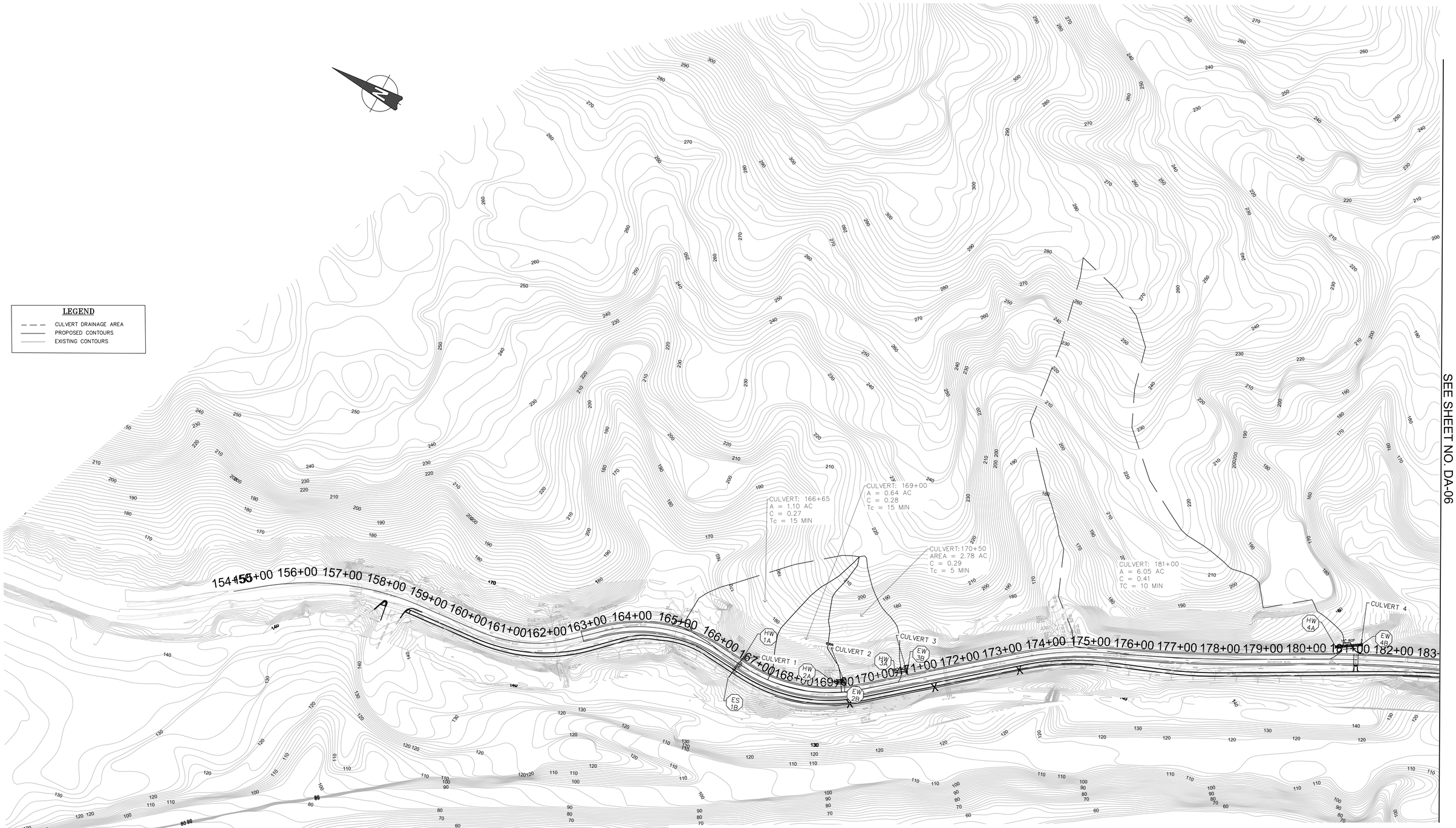

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SEE SHEET NO. DA-06

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DA–05
CULVERT/INLET DRAINAGE AREA MAPS

MACARTHUR BOULEVARD
BIKEWAY SEGMENT III

0 200' 400'
SCALE: 1"=200'

DATE: JUNE 2024

CIP No. : 500718 SHEET 41 of 285

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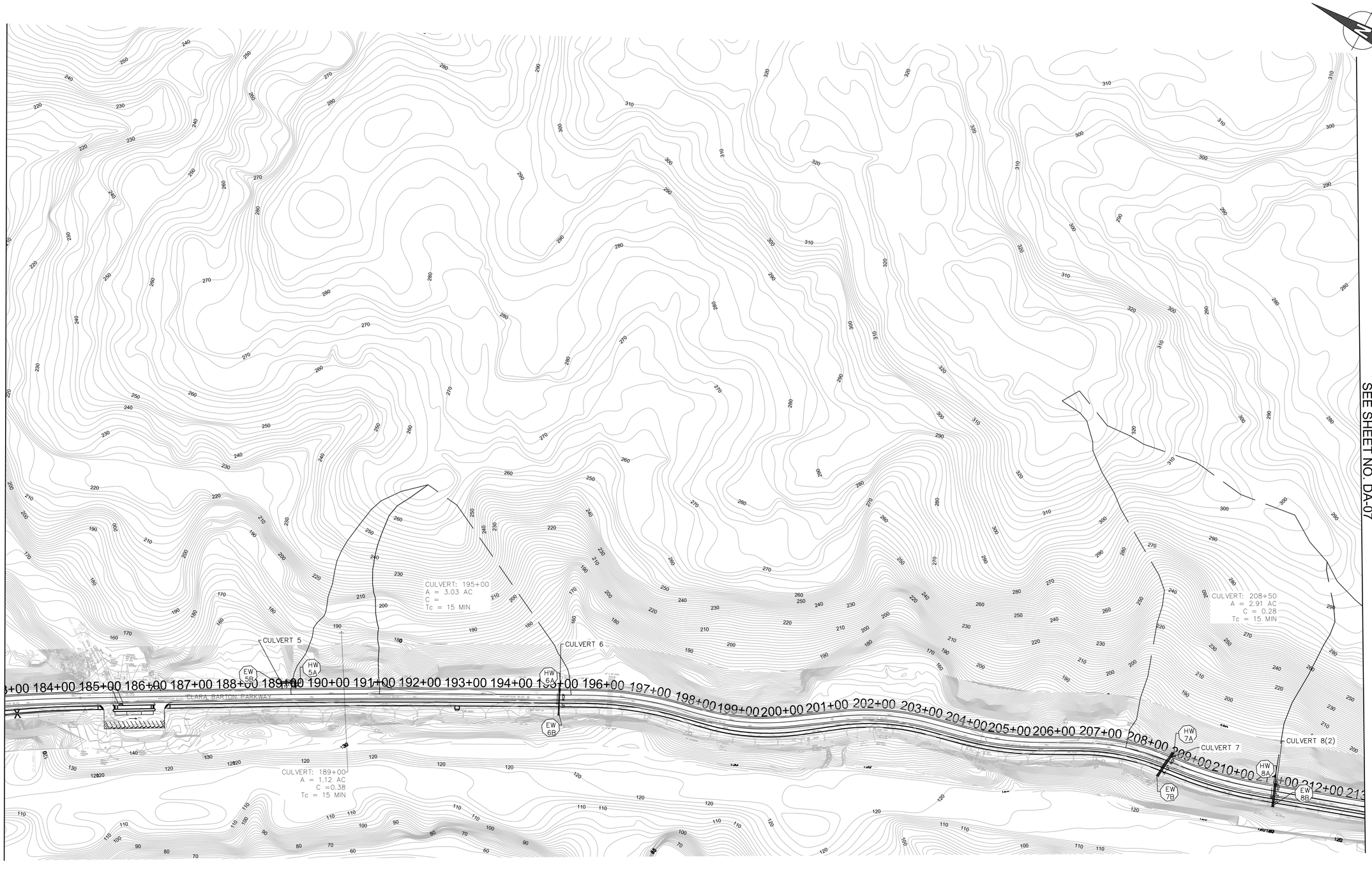

MATCHLINE - STA. 212+00
SEE SHEET NO. DA-07

LEGEND

- CULVERT DRAINAGE AREA
- PROPOSED CONTOURS
- EXISTING CONTOURS

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DA–06
CULVERT/INLET DRAINAGE AREA MAPS

MACARTHUR BOULEVARD
BIKEWAY SEGMENT III

0 200' 400'
SCALE: 1"=200'

DATE: JUNE 2024

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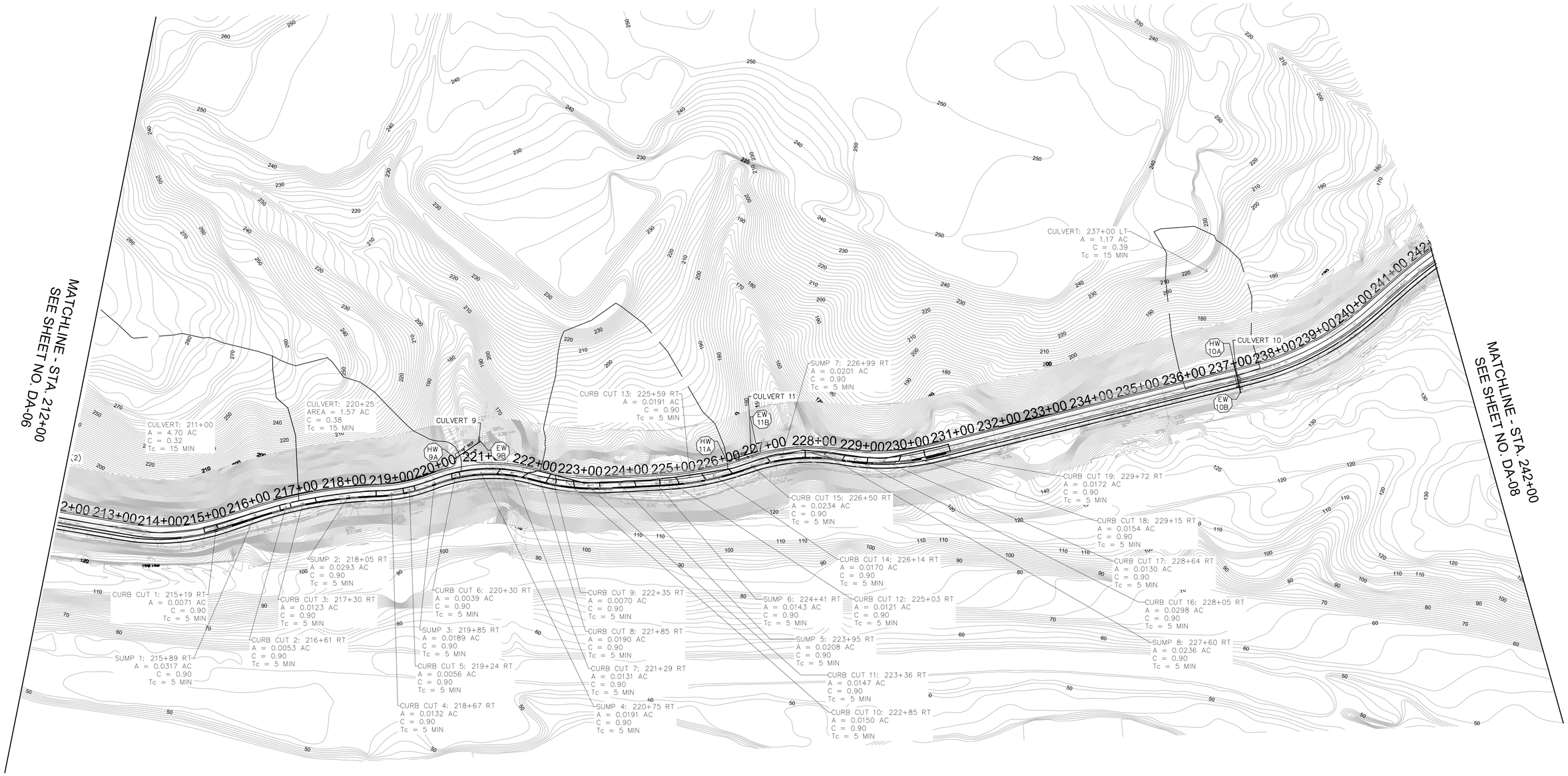

LEGEND

- CULVERT DRAINAGE AREA
- CURB CUT DRAINAGE AREA
- INLET DRAINAGE AREA
- PROPOSED CONTOURS
- EXISTING CONTOURS

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DA–07
CULVERT/INLET DRAINAGE AREA MAPS
MACARTHUR BOULEVARD BIKEWAY SEGMENT III

0 200' 400'

SCALE: 1"=200' DATE: JUNE 2024

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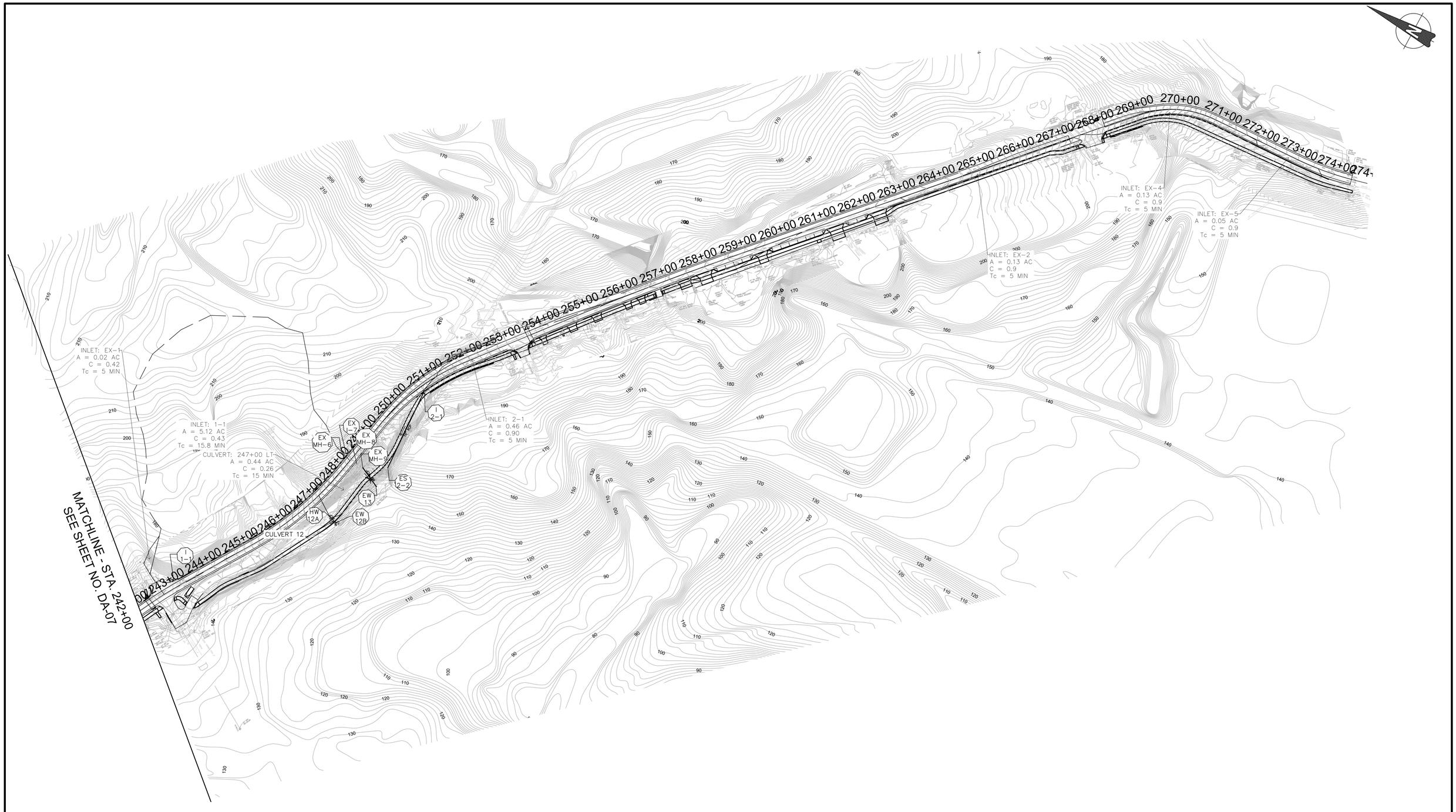

LEGEND

- INLET DRAINAGE AREA
- PROPOSED CONTOURS
- EXISTING CONTOURS

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DA-08
CULVERT/INLET DRAINAGE AREA MAPS
MACARTHUR BOULEVARD BIKEWAY SEGMENT III

0 200' 400'

SCALE: 1"=200'

DATE: JUNE 2024

CIP No. : 500718

SHEET 44 of 285

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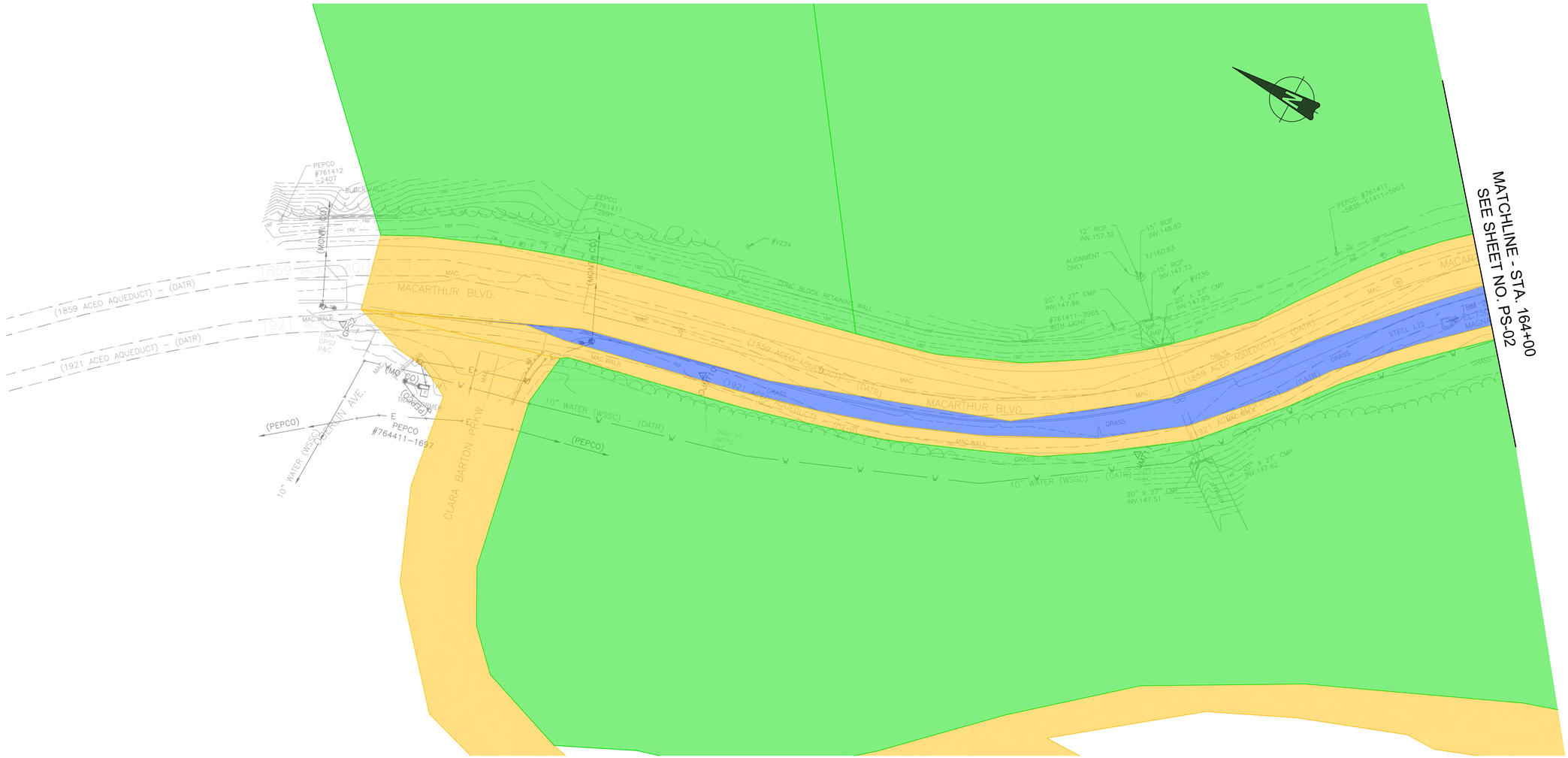
APPENDIX B
LAND COVER MAPS

APPENDIX B.1
PRE-DEVELOPMENT LAND COVER MAPS



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

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LU-01
PRE-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No.: 502109

SHEET 1 of 15

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LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

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LU-02
PRE-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 2 of 15

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MATCHLINE - STA. 180+00
SEE SHEET NO. PS-04
MATCHLINE - STA. 172+00
SEE SHEET NO. PS-02
MACARTHUR BLVD.
MACARTHUR BLVD.
(1859 ACEO AQUEDUCT) – (DATR)
(1921 ACEO AQUEDUCT) – (DATR)
(1921 ACEO AQUEDUCT) – (DATR)
6" W.S. (WASH. GAS) – (DATR)
6" CI (WSSC POSSIBLY ABAND.) – (DATR)
10" C.I. (WSSC) – (DATR)
OLD CONC. LANDING
GRASS
MAC.
DBLYL
MAC. WALK
STEEL VAULT
REFLECTOR STRIPS
PEPCO #762410 WITH LIGHT
18" RCP INV.148.74
15" RCP INV.148.95
24" SLCPP INV.150.36
PEPCO #4445 WITH LIGHT
PEPCO #46 WITH LIGHT
CPCO #46 WITH LIGHT
6" W.S. (WASH. GAS) – (DATR)
75" W.S. (GHD) – (DATR)
(MWD) – ADAMS TRANSMISSION
(MWD) – SANITARY SEWER
(MWD) – WATER
(MWD) – WSSC CROSSING
(PMD) – WSSC CROSSING
(PMD) – WATER
(PMD) – SANITARY SEWER
(PMD) – WASH GAS
(PMD) – ADAMS TRANSMISSION
INV.151.26
INV.151.31
INV.148.83
ACCESS MET
RIM 151.17
RIM 150.67
RIM 150.85
INV.150.37
INV.150.47
INV.150.57
INV.150.67
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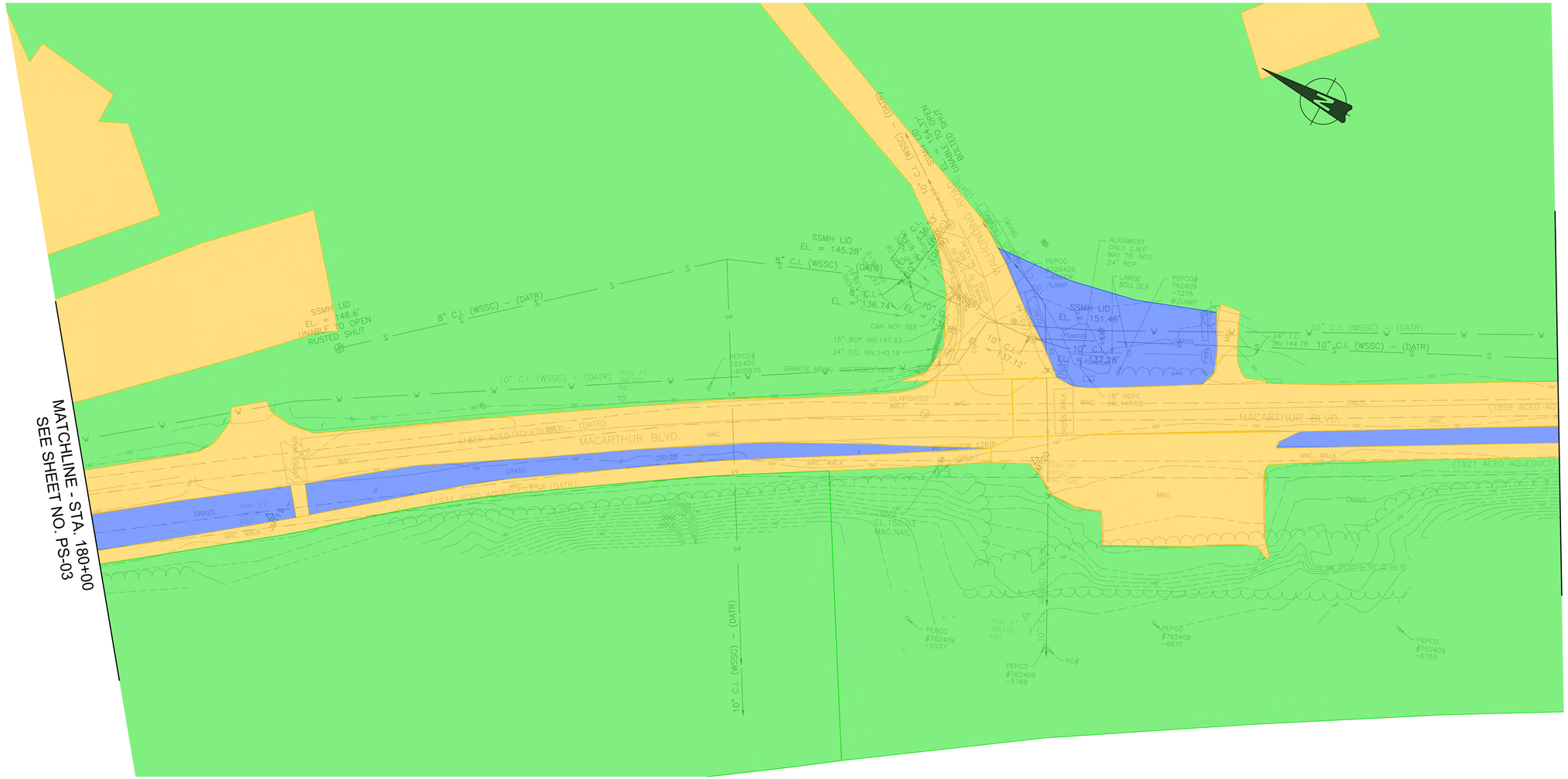

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

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GAITHERSBURG, MARYLAND

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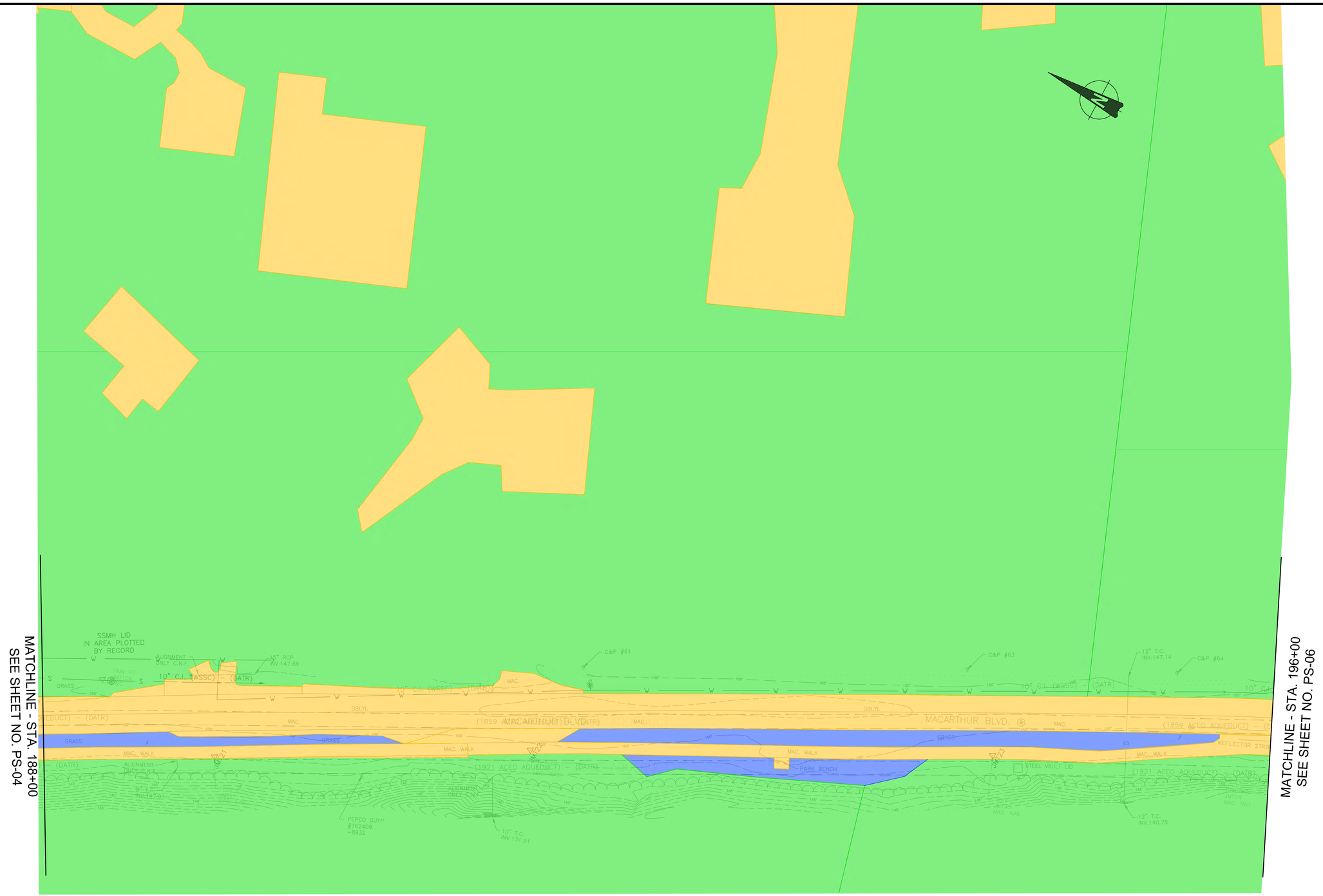
LU–04
PRE–DEVELOPMENT LAND COVER MAPS
MACARTHUR BOULEVARD BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 4 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU–0001_MacArthur.dwg LAYOUT NAME: LU–04 PLOTTED: Thursday, June 27, 2024 – 5:20pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-05
PRE-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 5 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0001_MacArthur.dwg LAYOUT NAME: LU-05 PLOTTED: Thursday, June 27, 2024 - 5:21pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU–06
PRE–DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 40' 80'
SCALE: 1"= 40'

DATE: JUNE 2024

CIP No. : 502109 SHEET 6 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU–0001_MacArthur.dwg LAYOUT NAME: LU–06 PLOTTED: Thursday, June 27, 2024 – 5:21pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

JMT

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-07
PRE-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 40' 80'
SCALE: 1"= 40'

DATE: JUNE 2024

CIP No. : 502109 SHEET 7 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0001_MacArthur.dwg LAYOUT NAME: LU-07 PLOTTED: Thursday, June 27, 2024 - 5:21pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

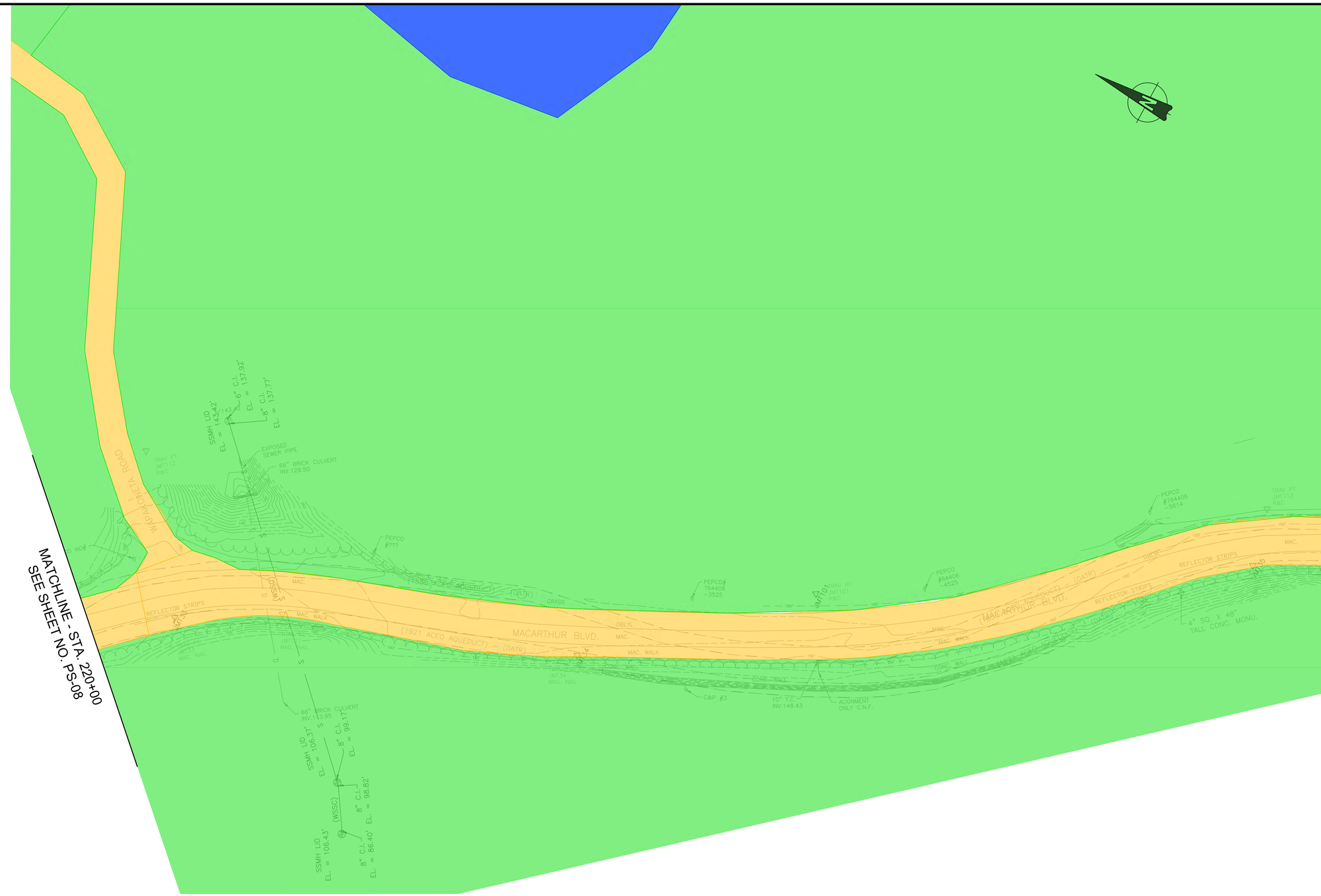
LU-08
PRE-DEVELOPMENT LAND COVER MAPS
MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No.: 502109 SHEET 8 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0001_MacArthur.dwg LAYOUT NAME: LU-08 PLOTTED: Thursday, June 27, 2024 - 5:21pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU–09
PRE–DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 9 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU–0001_MacArthur.dwg LAYOUT NAME: LU–09 PLOTTED: Thursday, June 27, 2024 – 5:21pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

JMT

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU–10
PRE–DEVELOPMENT LAND COVER MAPS

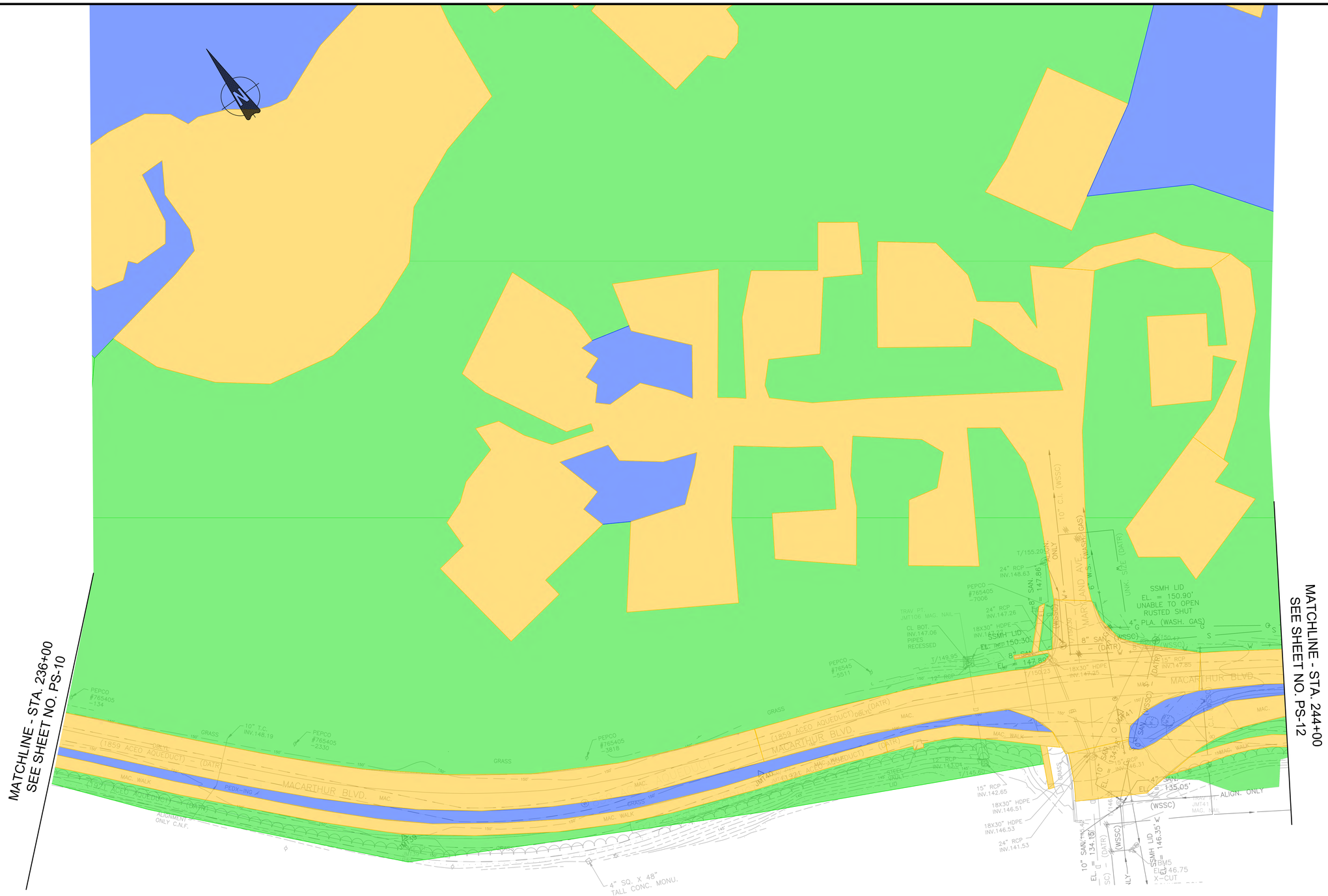
MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 40' 80'
SCALE: 1"= 40'

DATE: JUNE 2024

CIP No. : 502109 SHEET 10 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0001_MacArthur.dwg LAYOUT NAME: LU-10 PLOTTED: Thursday, June 27, 2024 – 5:21pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

JMT

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-11
PRE-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No.: 502109 SHEET 11 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0001_MacArthur.dwg LAYOUT NAME: LU-11 PLOTTED: Thursday, June 27, 2024 - 5:22pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-12
PRE-DEVELOPMENT LAND COVER MAPS

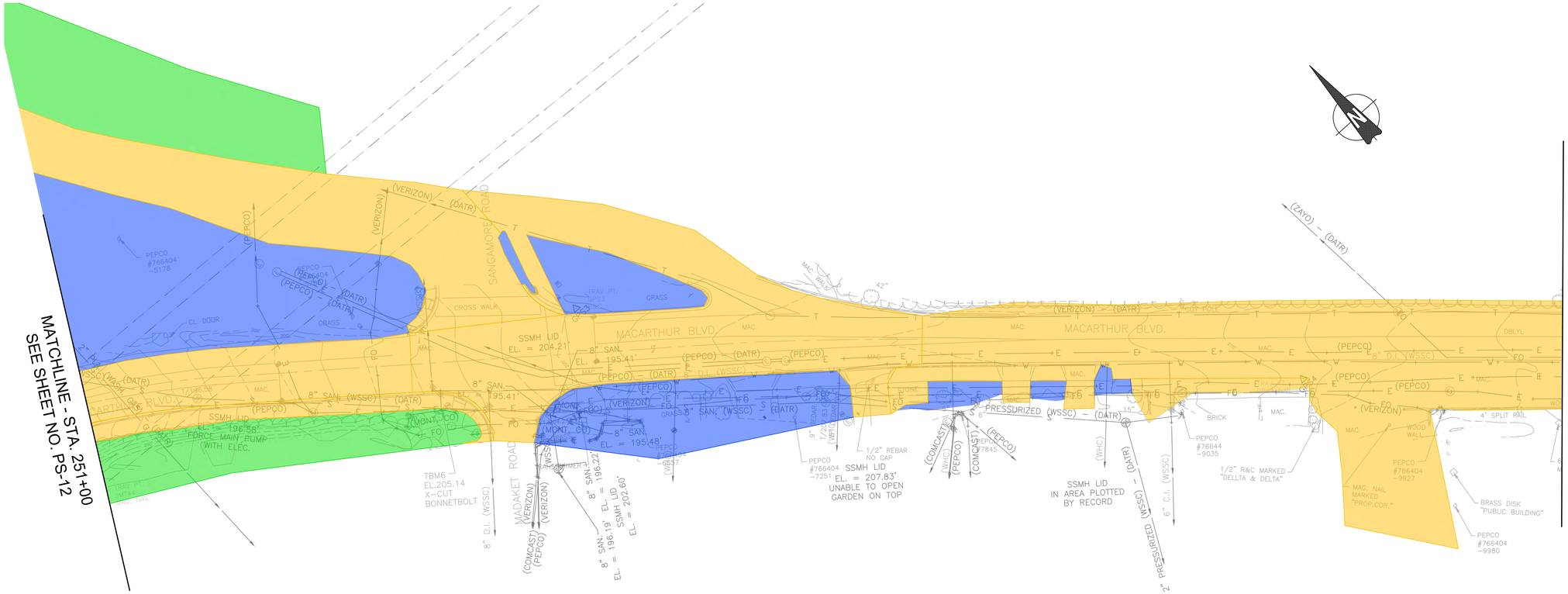
MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 12 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0001_MacArthur.dwg LAYOUT NAME: LU-12 PLOTTED: Thursday, June 27, 2024 - 5:22pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU–13
PRE–DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109

SHEET 13 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU–0001_MacArthur.dwg LAYOUT NAME: LU–13 PLOTTED: Thursday, June 27, 2024 – 5:22pm USER: ABayagich

MATCHLINE - STA. 259+00
SEE SHEET NO. PS-13

MATCHLINE - STA. 267+00
SEE SHEET NO. PS-15

MACARTHUR BLVD.
TOPOGRAPHIC WORKSHEET
SURVEY BY: JMT
DATE: AUGUST 2021
JMT JOB #: 18-04565-003
VERT. DATUM: NAD 1983 /2011 – GPS
HORZ. DATUM: NAD 1983 /2011 – GPS

30 60 90

GENERAL NOTES
TOPOGRAPHIC SURVEY PERFORMED BY
AUGUST-OCTOBER 2021 AND REFLECTS SITE CONDITIONS AS OF THAT DATE.
TO THE MARYLAND STATE PLANE COORDINATE
NORTH AMERICAN VERTICAL DATUM
VISION OF THIS DRAWING

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU–14
PRE–DEVELOPMENT LAND COVER MAPS

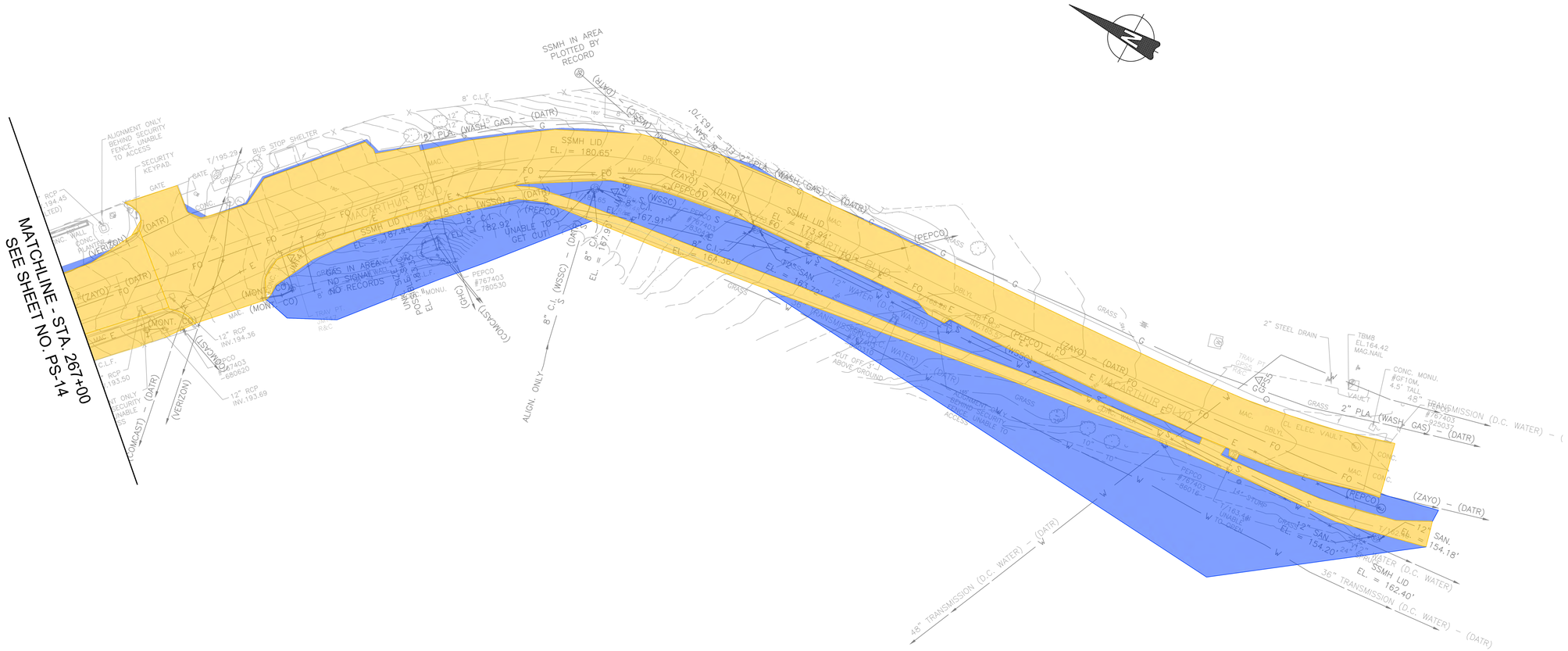
MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No.: 502109 SHEET 14 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0001_MacArthur.dwg LAYOUT NAME: LU-14 PLOTTED: Thursday, June 27, 2024 – 5:22pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-15
PRE-DEVELOPMENT LAND COVER MAPS
MACARTHUR BOULEVARD
BIKEWAY PHASE III

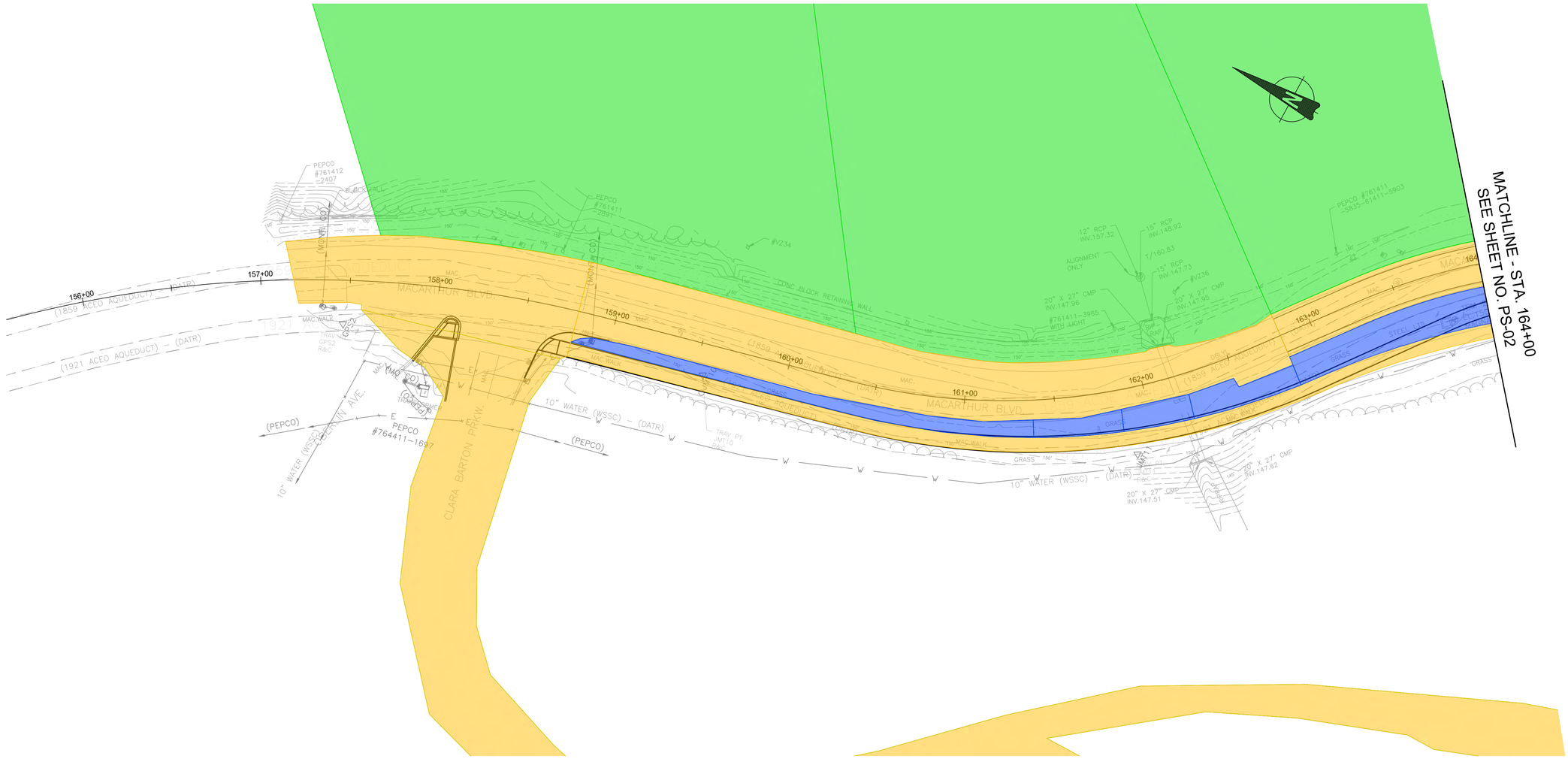
0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No.: 502109 SHEET 15 of 15

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0001_MacArthur.dwg LAYOUT NAME: LU-15 PLOTTED: Thursday, June 27, 2024 – 5:22pm USER: ABayagich

APPENDIX B.2
POST-DEVELOPMENT LAND COVER MAPS



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-16
POST-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 16 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-16 PLOTTED: Thursday, June 27, 2024 - 5:45pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-17
POST-DEVELOPMENT LAND COVER MAPS

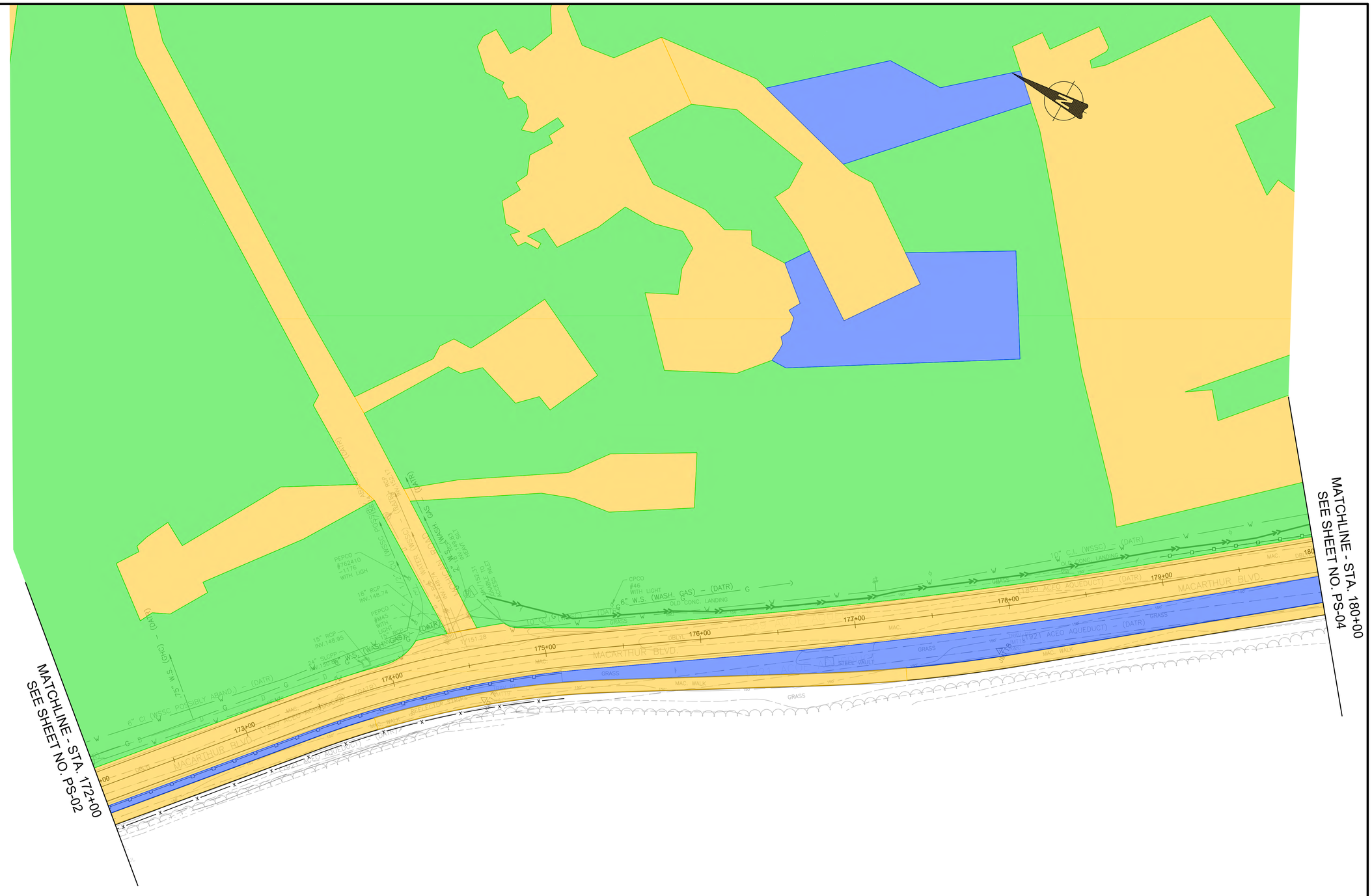
MACARTHUR BOULEVARD
BIKEWAY PHASE III

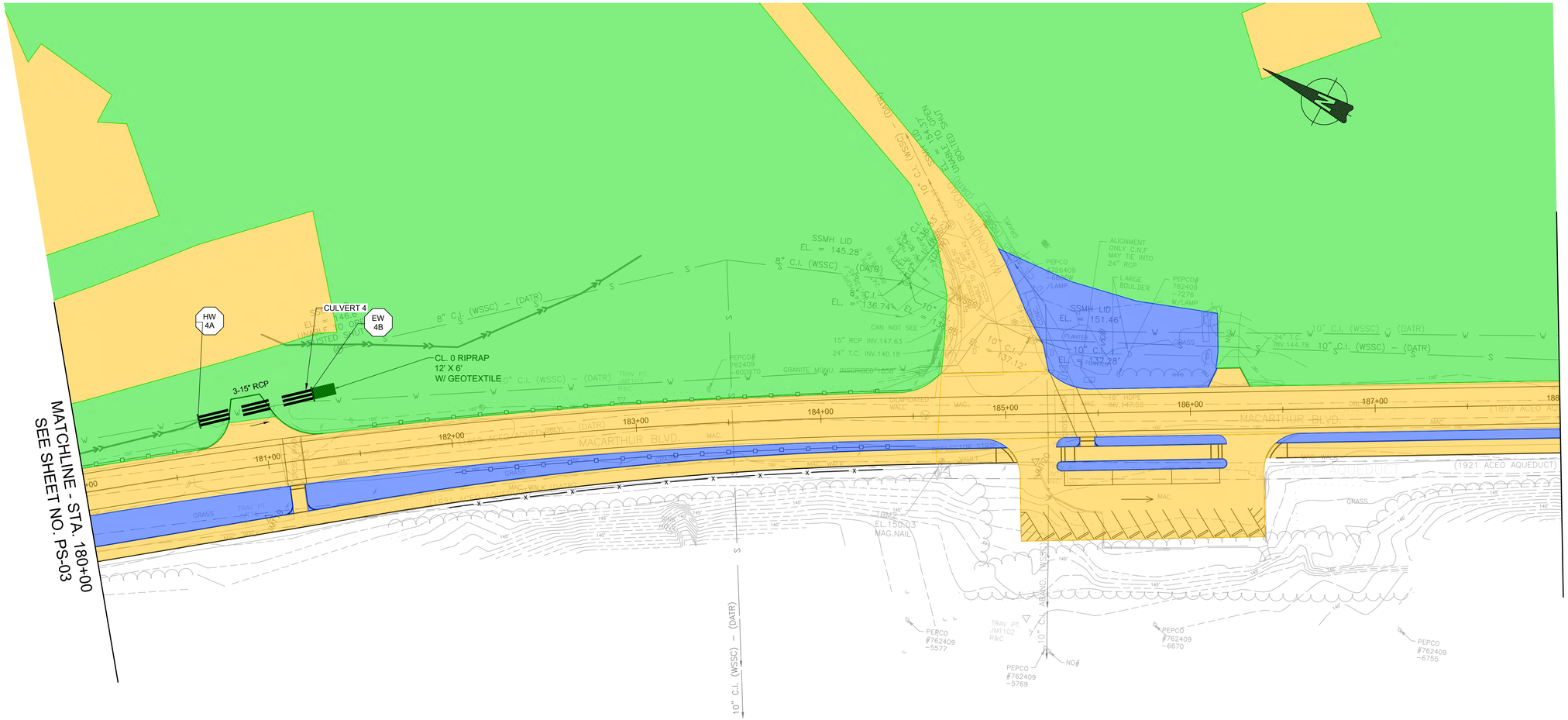
0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 17 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-17 PLOTTED: Thursday, June 27, 2024 - 5:46pm USER: ABayagich


MATCHLINE - STA. 172+00
SEE SHEET NO. PS-02
MATCHLINE - STA. 180+00
SEE SHEET NO. PS-04
MACARTHUR BLVD.
173+00
174+00
175+00
176+00
177+00
178+00
179+00
GRASS
MAC. WALK
STEEL VAULT
6" W.S. (WASH. GAS) – (DATR)
6" CI (WSSC POSSIBLY ABAND.) – (DATR)
6" CI (WSSC) – (DATR)
CONC. LANDING
(1821 ACEO AQUEDUCT) – (DATR)
PERCO
#762410
-1176
WITH LIGHT
18" RCP
INV.148.74
15" RCP
INV.148.95
24" SLCPP
INV.150.36
CPCO
#48
WITH LIGHT
6" W.S. (WASH. GAS) – (DATR)
OLD CONC. LANDING
PERCO
#M45
WITH
LIGHT
75" WS (GHD) – (DATR)
(WSSC) – (DATR)
(GAS) – (DATR)
(GAS) – (DATR)
(WSSC) – (DATR)
(WSSC) – (DATR)
(WSSC



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-19
POST-DEVELOPMENT LAND COVER MAPS

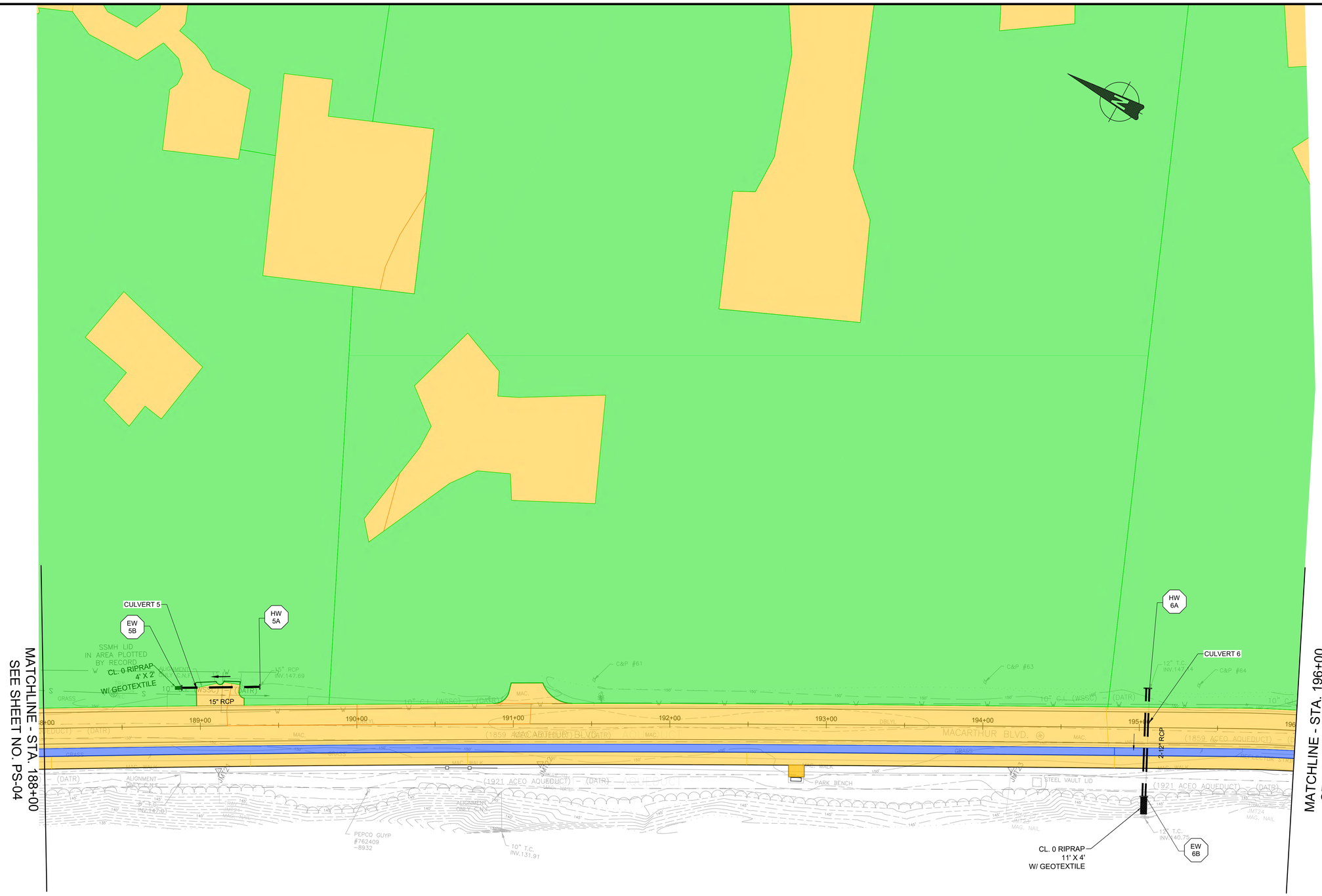
MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 19 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-19 PLOTTED: Thursday, June 27, 2024 - 5:46pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-20
POST-DEVELOPMENT LAND COVER MAPS

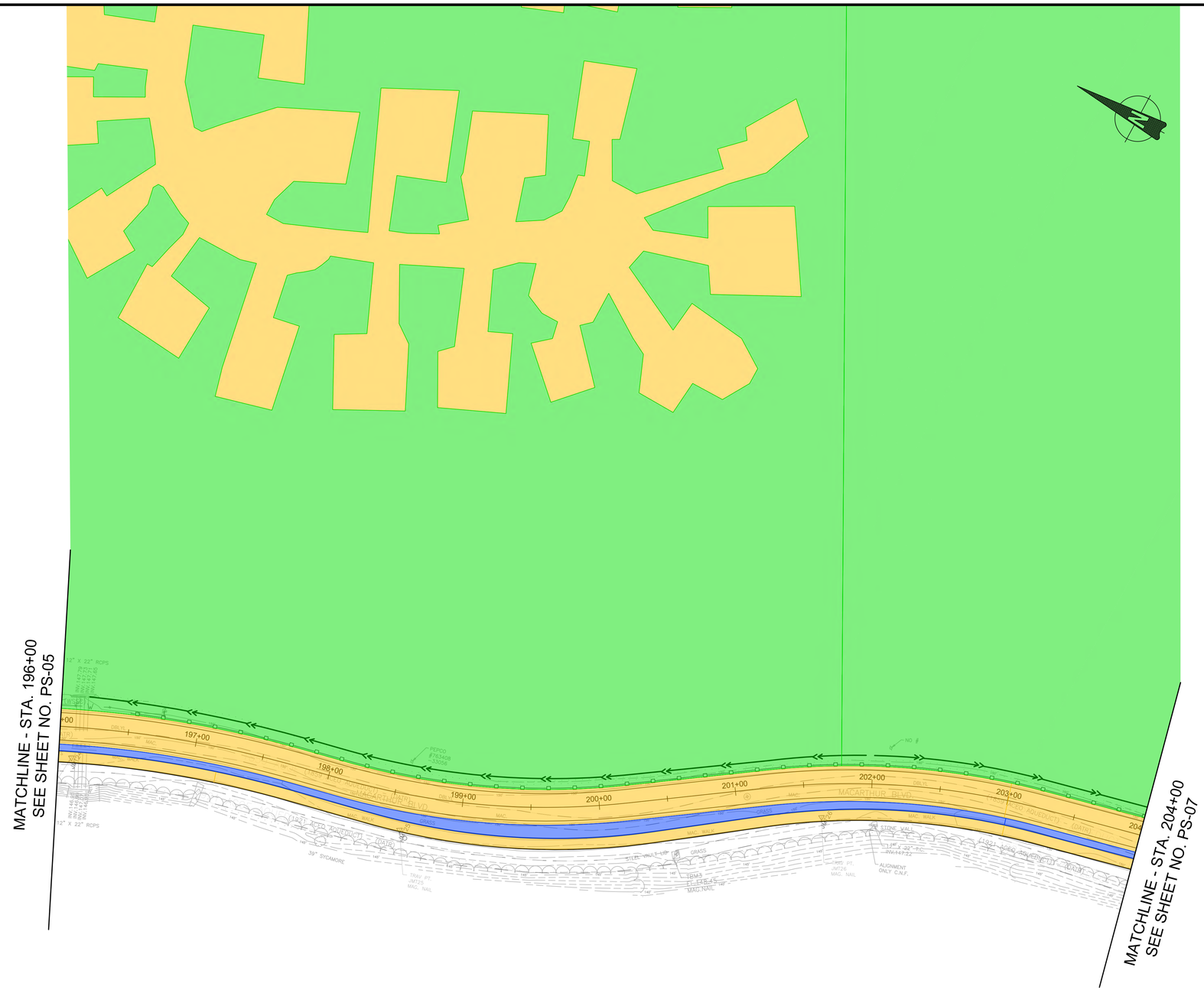
MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 20 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-20 PLOTTED: Thursday, June 27, 2024 - 5:47pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-21
POST-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 40' 80'
SCALE: 1"= 40'

DATE: JUNE 2024

CIP No. : 502109

SHEET 21 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-21 PLOTTED: Thursday, June 27, 2024 - 5:47pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-22
POST-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 40' 80'
SCALE: 1"= 40'

DATE: JUNE 2024

CIP No. : 502109 SHEET 22 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-22 PLOTTED: Thursday, June 27, 2024 - 5:47pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

JMT

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-23
POST-DEVELOPMENT LAND COVER MAPS
MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No.: 502109 SHEET 23 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-23 PLOTTED: Thursday, June 27, 2024 - 5:48pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-24
POST-DEVELOPMENT LAND COVER MAPS
MACARTHUR BOULEVARD BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No.: 502109 SHEET 24 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-24 PLOTTED: Thursday, June 27, 2024 – 5:48pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

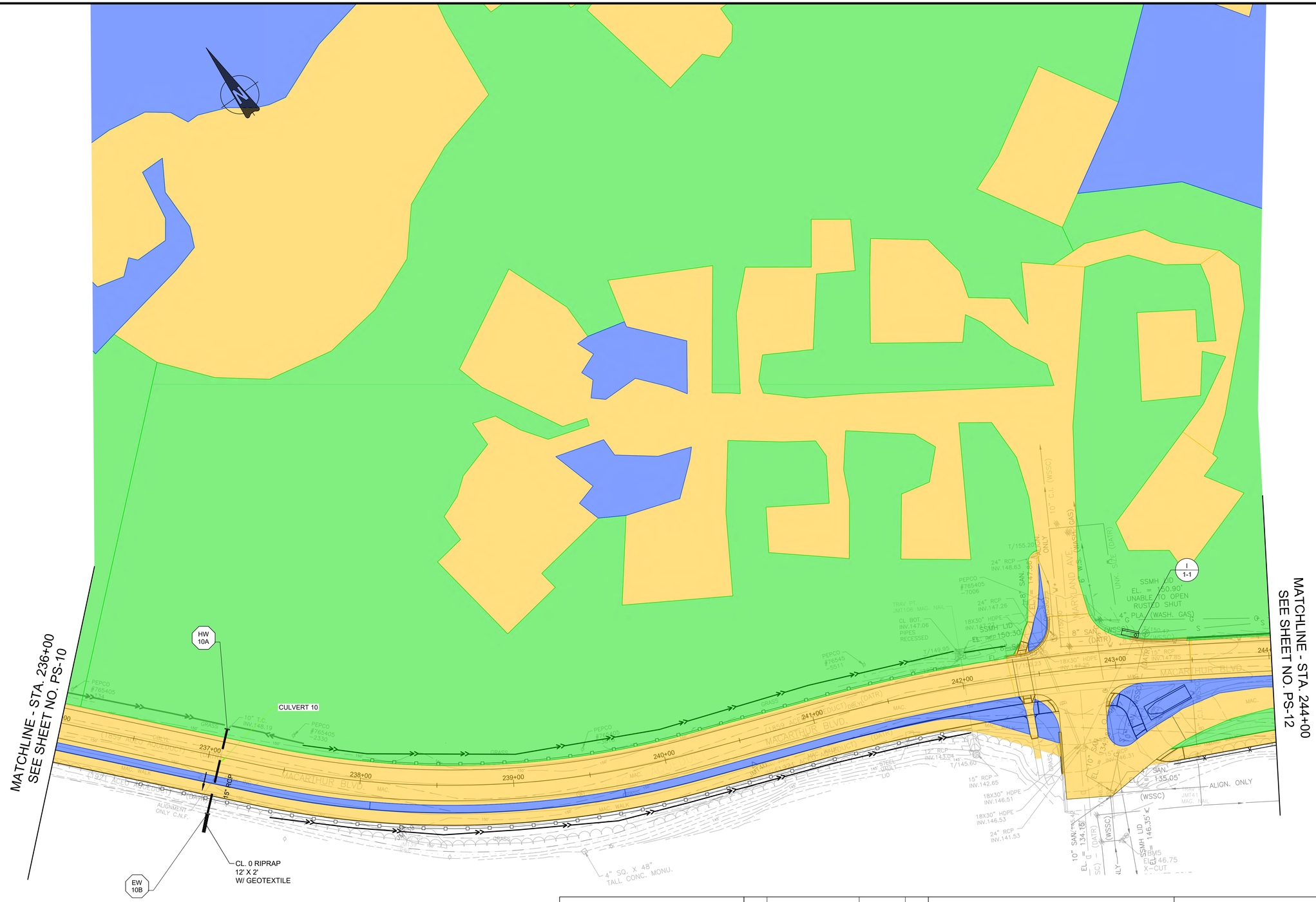
LU-25
POST-DEVELOPMENT LAND COVER MAPS
MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 40' 80'
SCALE: 1"= 40'

DATE: JUNE 2024

CIP No.: 502109 SHEET 25 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-25 PLOTTED: Thursday, June 27, 2024 - 5:48pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-26
POST-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 26 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-26 PLOTTED: Thursday, June 27, 2024 - 5:49pm USER: ABayagich

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

JMT®

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-27
POST-DEVELOPMENT LAND COVER MAPS

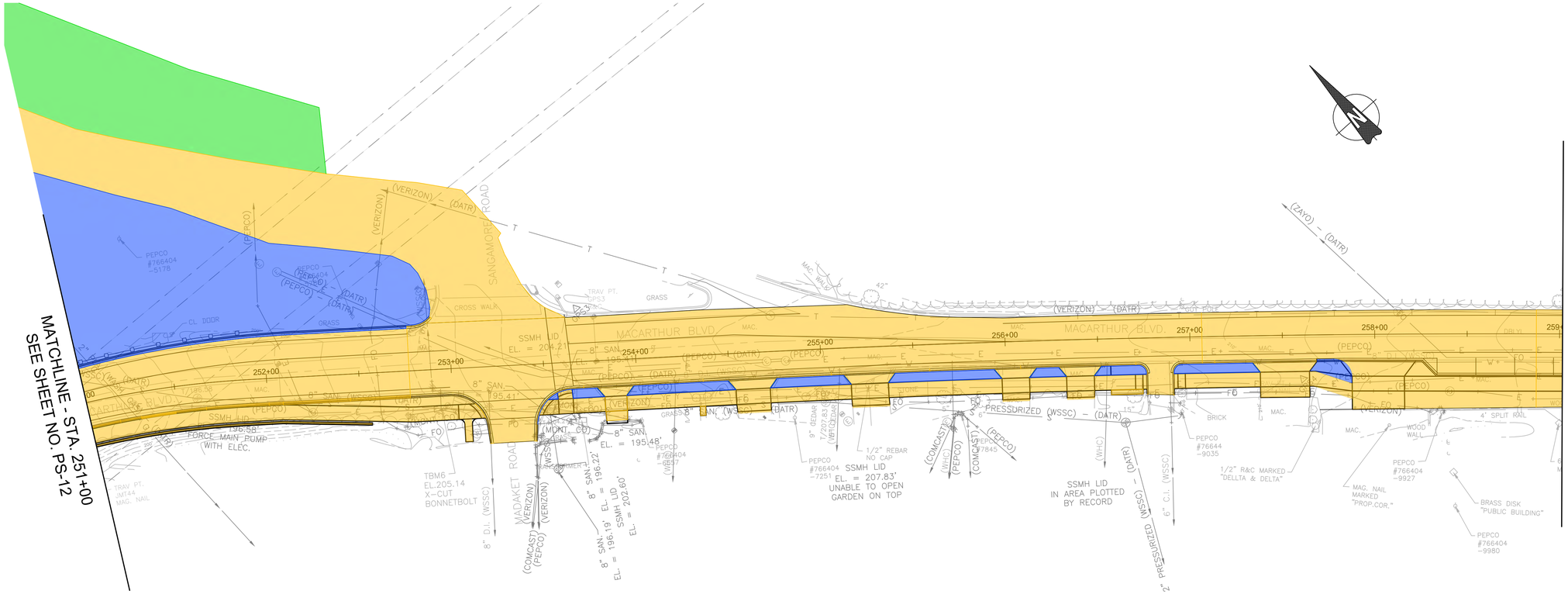
MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109 SHEET 27 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-27 PLOTTED: Thursday, June 27, 2024 - 5:49pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-28
POST-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

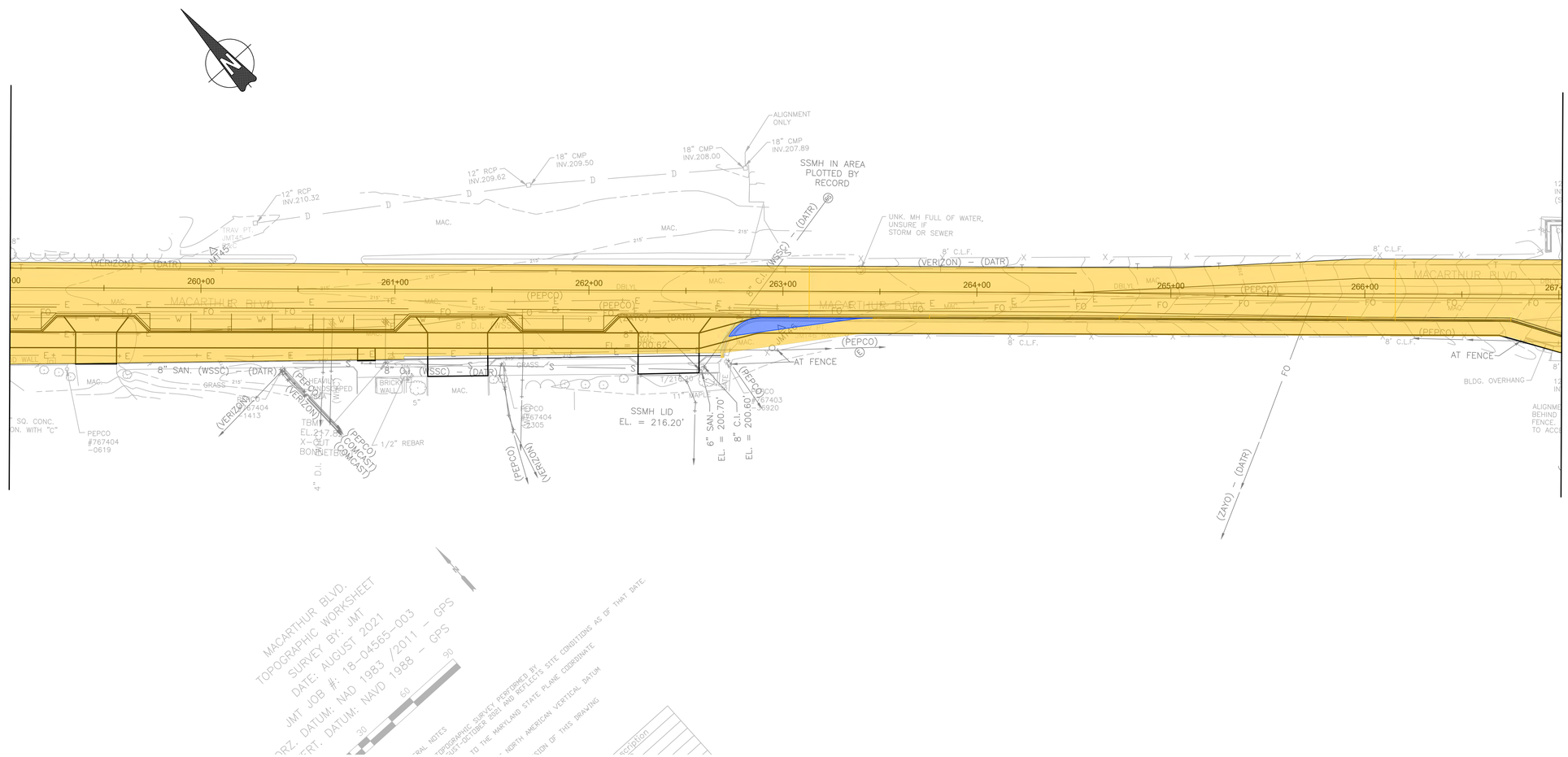
DATE: JUNE 2024

CIP No. : 502109

SHEET 28 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-28 PLOTTED: Thursday, June 27, 2024 - 5:49pm USER: ABayagich

MATCHLINE - STA. 259+00
SEE SHEET NO. PS-13



MATCHLINE - STA. 267+00
SEE SHEET NO. PS-15

MACARTHUR BLVD.
TOPOGRAPHIC WORKSHEET
SURVEY BY: JMT
DATE: AUGUST 2021
JMT JOB #: 18-04565-003
VERT. DATUM: NAD 1983 /2011 – GPS
HORZ. DATUM: NAD 1983 /2011 – GPS

30 60 90

GENERAL NOTES
1. TOPOGRAPHIC SURVEY PERFORMED BY JMT AUGUST-OCTOBER 2021 AND REFLECTS SITE CONDITIONS AS OF THAT DATE.
2. HORIZONTAL COORDINATES ARE TO THE MARYLAND STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN VERTICAL DATUM 1983.
3. REVISION OF THIS DRAWING

Description

LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU–29
POST–DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

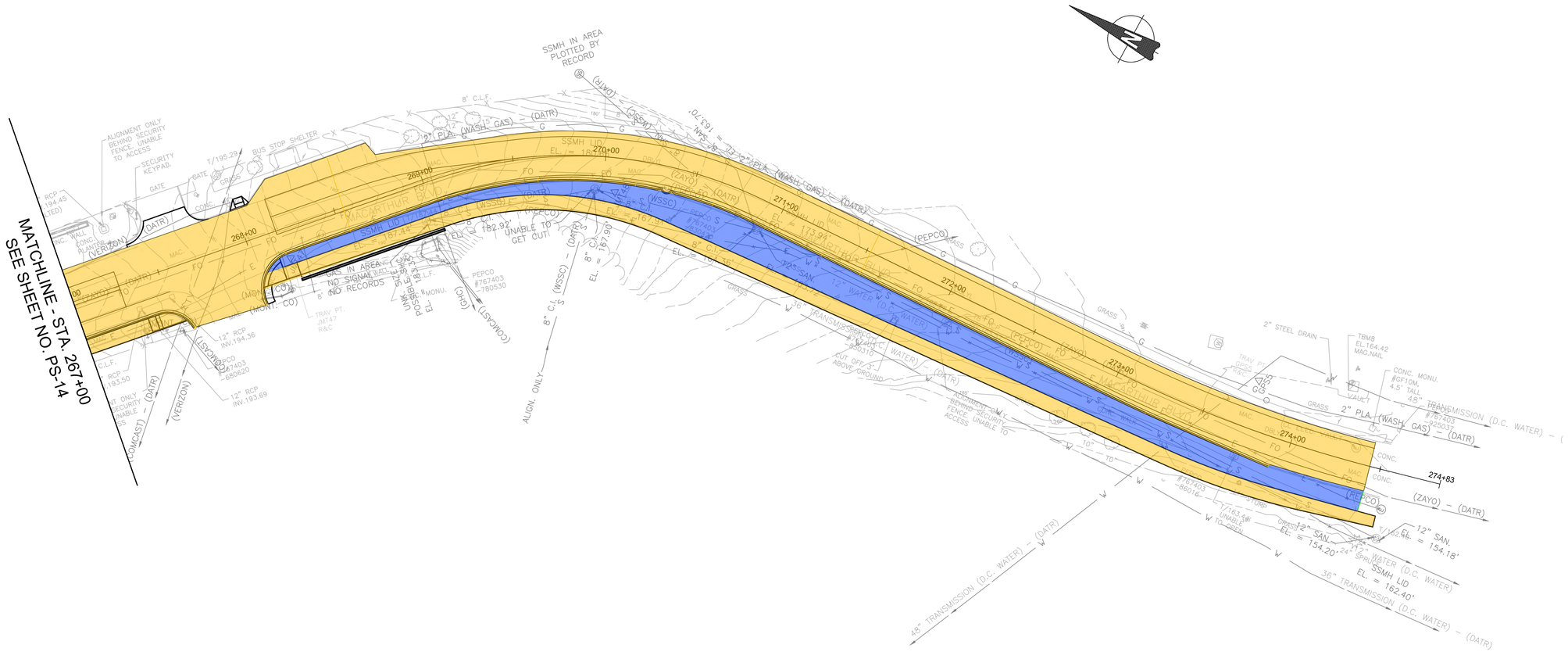
0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No.: 502109

SHEET 29 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-29 PLOTTED: Thursday, June 27, 2024 – 5:49pm USER: ABayagich



LEGEND

- IMPERVIOUS AREA
- TURF AREA
- FORRESTED AREA

DRAFT
NOT FOR CONSTRUCTION

NO.	REVISION	DATE	BY

MONTGOMERY COUNTY
DEPARTMENT OF TRANSPORTATION
GAITHERSBURG, MARYLAND

RECOMMENDED FOR APPROVAL

Chief, Design Section — Date

APPROVED

Chief, Division of Transportation Engineering — Date

Designed by: AGB Drawn by: AGB Checked by: WRB

LU-30
POST-DEVELOPMENT LAND COVER MAPS

MACARTHUR BOULEVARD
BIKEWAY PHASE III

0 30' 60'
SCALE: 1"=30'

DATE: JUNE 2024

CIP No. : 502109

SHEET 30 of 30

FILE NAME: C:\pwworking\jmt\d0320788\pLU-0002_MacArthur.dwg LAYOUT NAME: LU-30 PLOTTED: Thursday, June 27, 2024 - 5:50pm USER: ABayagich

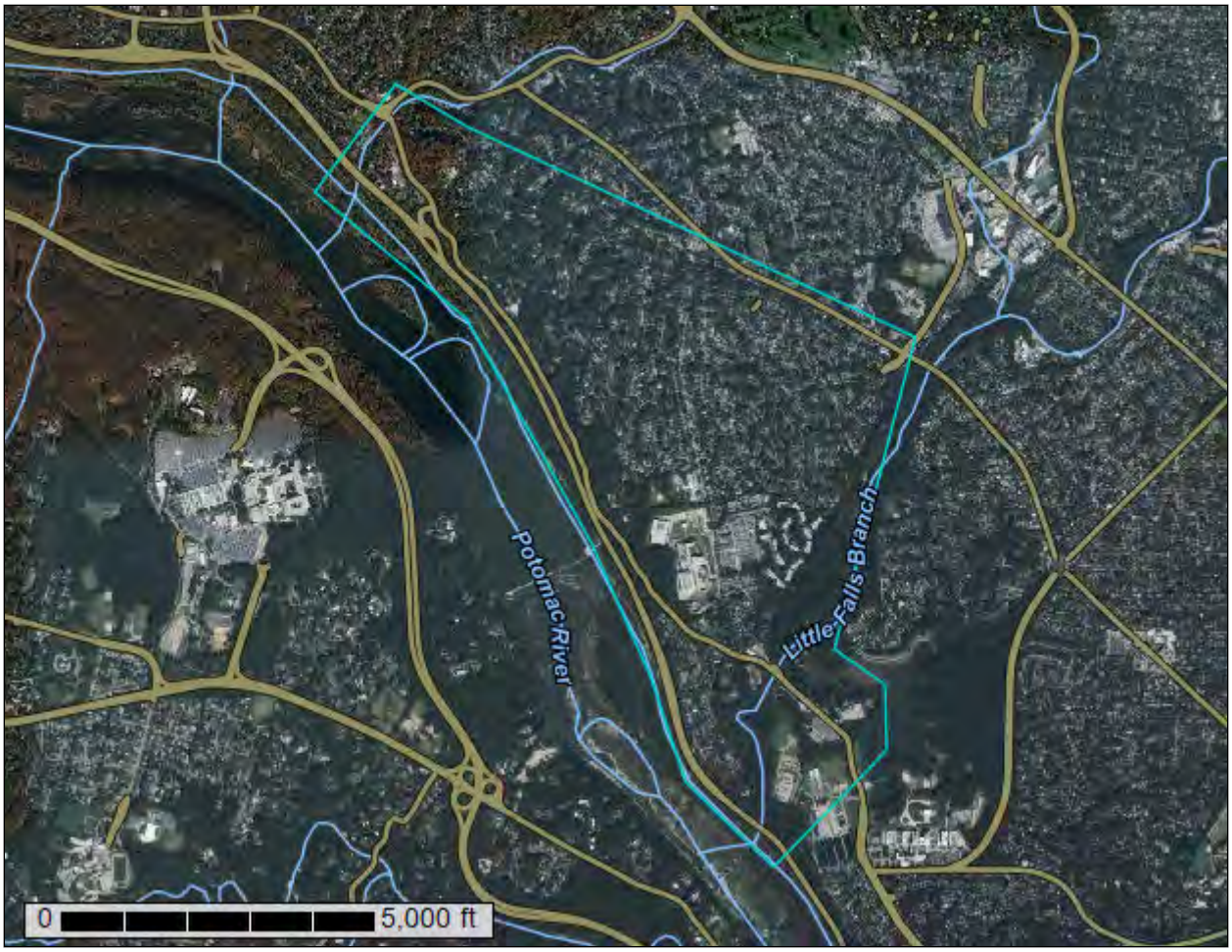
APPENDIX C
SOIL DATA

United States Department of Agriculture

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for District of Columbia, and Montgomery County, Maryland



June 15, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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48A—Melvin silt loam, 0 to 2 percent slopes, occasionally flooded.....28
53A—Codorus silt loam, 0 to 3 percent slopes, occasionally flooded.....29
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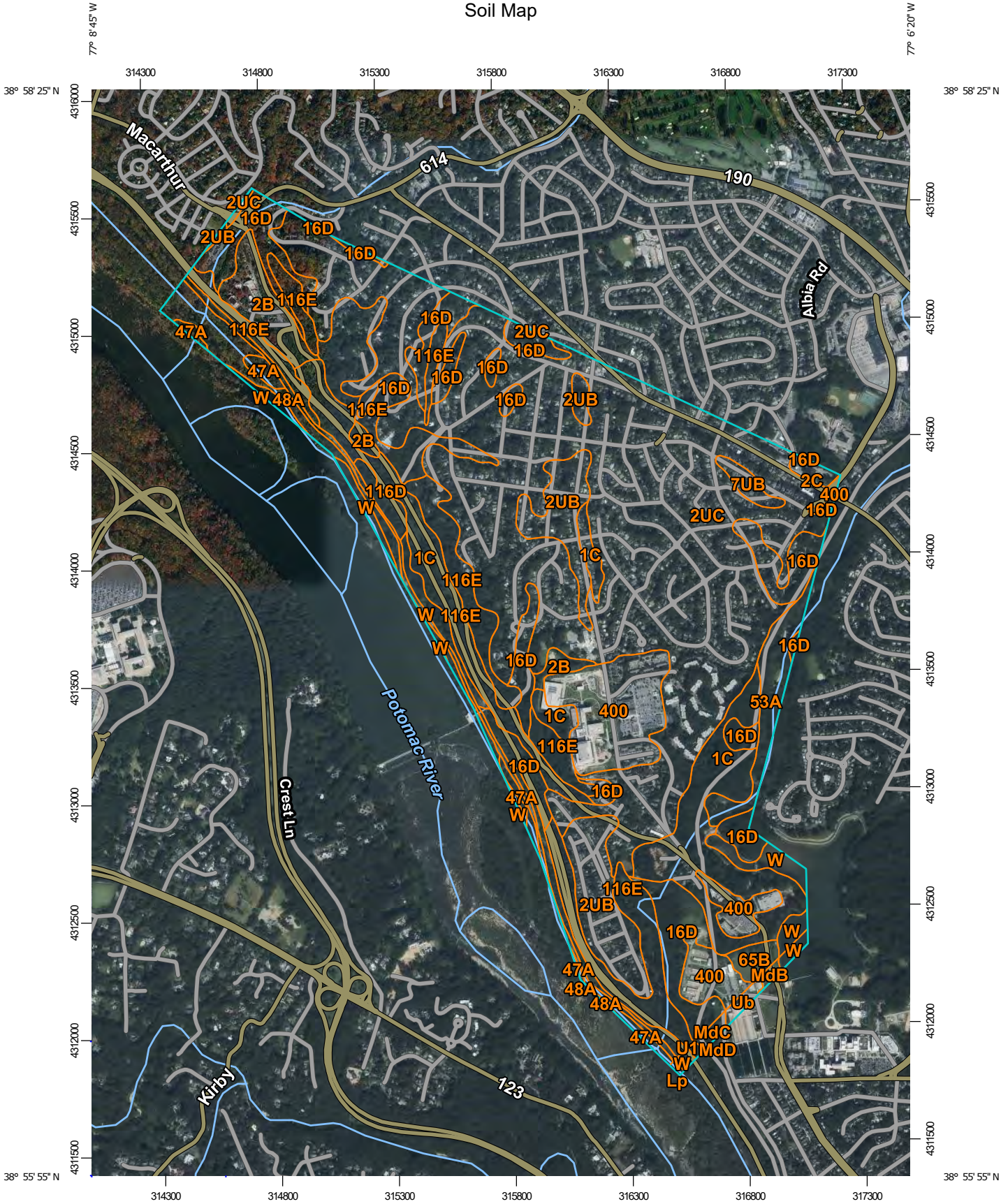
Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.



Map Scale: 1:22,600 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 300 600 1200 1800

Feet: 0 1000 2000 4000 6000

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at scales ranging from 1:12,000 to 1:15,800.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: District of Columbia
Survey Area Data: Version 15, Aug 26, 2021

Soil Survey Area: Montgomery County, Maryland
Survey Area Data: Version 17, Aug 27, 2021

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: May 3, 2015—Jun 18, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Lp	Lindside silt loam, bedrock substratum	0.4	0.0%
MdB	Manor-Urban land complex, 0 to 8 percent slopes	1.4	0.1%
MdC	Manor-Urban land complex, 8 to 15 percent slopes	2.1	0.2%
MdD	Manor-Urban land complex, 15 to 40 percent slopes	0.7	0.1%
U1	Udorthents	0.7	0.1%
Ub	Urban land	2.7	0.2%
W	Water	2.4	0.2%
Subtotals for Soil Survey Area		**10.4**	**0.9%**
Totals for Area of Interest		**1,163.0**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
1C	Gaila silt loam, 8 to 15 percent slopes	119.3	10.3%
2B	Glenelg silt loam, 3 to 8 percent slopes	28.6	2.5%
2C	Glenelg silt loam, 8 to 15 percent slopes	3.7	0.3%
2UB	Glenelg-Urban land complex, 0 to 8 percent slopes	61.1	5.3%
2UC	Glenelg-Urban land complex, 8 to 15 percent slopes	502.1	43.2%
7UB	Gaila-Urban land complex, 0 to 8 percent slopes	5.6	0.5%
16D	Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes	152.7	13.1%
47A	Lindside silt loam, 0 to 3 percent slopes, occasionally flooded	18.9	1.6%
48A	Melvin silt loam, 0 to 2 percent slopes, occasionally flooded	26.6	2.3%
53A	Codorus silt loam, 0 to 3 percent slopes, occasionally flooded	22.7	2.0%
65B	Wheaton silt loam, 0 to 8 percent slopes	6.2	0.5%
116D	Blocktown channery silt loam, 15 to 25 percent slopes, very rocky	5.5	0.5%

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
116E	Blocktown channery silt loam, 25 to 45 percent slopes, very rocky	93.5	8.0%
400	Urban land	73.1	6.3%
W	Census water	32.8	2.8%
Subtotals for Soil Survey Area		**1,152.6**	**99.1%**
Totals for Area of Interest		**1,163.0**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

District of Columbia

Lp—Lindside silt loam, bedrock substratum

Map Unit Setting

National map unit symbol: 49v7
Elevation: 0 to 50 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 165 to 205 days
Farmland classification: Prime farmland if protected from flooding or not frequently flooded during the growing season

Map Unit Composition

Lindside and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lindside

Typical profile

H1 - 0 to 29 inches: silt loam
H2 - 29 to 44 inches: silty clay loam
H3 - 44 to 48 inches: unweathered bedrock

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: NoneFrequent
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

MdB—Manor-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 49vc
Elevation: 250 to 5,000 feet
Mean annual precipitation: 35 to 70 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 90 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Manor and similar soils: 41 percent
Urban land: 39 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manor

Typical profile

A1, A2 - 0 to 6 inches: loam
Bw1, Bw2 - 6 to 22 inches: sandy loam
C1,C2,C3,C4 - 22 to 72 inches: channery sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 inches to
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Minor Components

Unnamed soils

Percent of map unit: 5 percent
Hydric soil rating: No

Ashe

Percent of map unit: 5 percent
Hydric soil rating: No

Brandywine

Percent of map unit: 5 percent
Hydric soil rating: No

Glenelg

Percent of map unit: 5 percent

Hydric soil rating: No

MdC—Manor-Urban land complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 49vd
Elevation: 250 to 5,000 feet
Mean annual precipitation: 35 to 70 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 90 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Manor and similar soils: 41 percent
Urban land: 39 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manor

Typical profile

A1, A2 - 0 to 6 inches: loam
Bw1, Bw2 - 6 to 22 inches: sandy loam
C1,C2,C3,C4 - 22 to 72 inches: channery sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 10 inches to
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Minor Components

Unnamed soils

Percent of map unit: 5 percent
Hydric soil rating: No

Ashe

Percent of map unit: 5 percent
Hydric soil rating: No

Brandywine

Percent of map unit: 5 percent
Hydric soil rating: No

Glenelg

Percent of map unit: 5 percent
Hydric soil rating: No

MdD—Manor-Urban land complex, 15 to 40 percent slopes

Map Unit Setting

National map unit symbol: 49vf
Elevation: 250 to 5,000 feet
Mean annual precipitation: 35 to 70 inches
Mean annual air temperature: 46 to 57 degrees F
Frost-free period: 90 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Manor and similar soils: 41 percent
Urban land: 39 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Manor

Typical profile

A1, A2 - 0 to 6 inches: loam
Bw1, Bw2 - 6 to 22 inches: sandy loam
C1,C2,C3,C4 - 22 to 72 inches: channery sandy loam

Properties and qualities

Slope: 15 to 40 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.8 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Properties and qualities
Slope: 15 to 40 percent
Depth to restrictive feature: 10 inches to
Runoff class: Very high

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Minor Components

Unnamed soils
Percent of map unit: 10 percent
Hydric soil rating: No

Ashe
Percent of map unit: 5 percent
Hydric soil rating: No

Brandywine
Percent of map unit: 5 percent
Hydric soil rating: No

U1—Udorthents

Map Unit Setting
National map unit symbol: 49w8
Elevation: -20 to 390 feet
Mean annual precipitation: 42 to 43 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 215 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition
Udorthents and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Udorthents

Properties and qualities

Slope: 0 to 10 percent
Depth to restrictive feature: 10 inches to
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

Ub—Urban land

Map Unit Setting

National map unit symbol: 49wq
Frost-free period: 175 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 10 inches to
Runoff class: Very high

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

W—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Montgomery County, Maryland

1C—Gaila silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: kx7n
Elevation: 100 to 2,000 feet
Mean annual precipitation: 35 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 120 to 255 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Gaila and similar soils: 95 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gaila

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 17 inches: sandy clay loam
H3 - 17 to 20 inches: sandy loam
H4 - 20 to 76 inches: loamy sand

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Baile

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

2B—Glenelg silt loam, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2v7gr
Elevation: 30 to 1,200 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Glenelg and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope, interfluve
Down-slope shape: Linear
Across-slope shape: Convex, concave, linear
Parent material: Residuum weathered from mica schist

Typical profile

Ap - 0 to 8 inches: silt loam
Bt1 - 8 to 18 inches: clay loam
Bt2 - 18 to 30 inches: clay loam
BCt - 30 to 42 inches: loam
CBt - 42 to 54 inches: loam
C - 54 to 76 inches: channery fine sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Gaila

Percent of map unit: 10 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Landform: Drainageways, swales
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

2C—Glenelg silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2tt89
Elevation: 30 to 1,200 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 48 to 57 degrees F
Frost-free period: 150 to 192 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Glenelg and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, side slope
Down-slope shape: Linear
Across-slope shape: Convex, concave, linear
Parent material: Residuum weathered from mica schist

Typical profile

Ap - 0 to 8 inches: silt loam
Bt1 - 8 to 18 inches: clay loam
Bt2 - 18 to 30 inches: clay loam
BCt - 30 to 42 inches: loam

CBt - 42 to 54 inches: loam
C - 54 to 76 inches: channery fine sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Gaila

Percent of map unit: 10 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Landform: Drainageways, swales
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

2UB—Glenelg-Urban land complex, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: kx8p
Elevation: 250 to 1,050 feet
Mean annual precipitation: 40 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Glenelg and similar soils: 45 percent
Urban land: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from phyllite

Typical profile

Ap - 0 to 10 inches: loam
Bt1,Bt2,BCt1 - 10 to 30 inches: clay loam
BCt2, CBt - 30 to 54 inches: loam
C - 54 to 76 inches: very channery sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Setting

Parent material: Human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Udorthents

Percent of map unit: 15 percent
Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope

Landform position (three-dimensional): Interfluve, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Glenville

Percent of map unit: 5 percent
Landform: Drainageways, swales
Landform position (three-dimensional): Head slope, base slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

2UC—Glenelg-Urban land complex, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: kx8q
Elevation: 250 to 1,050 feet
Mean annual precipitation: 37 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 235 days
Farmland classification: Not prime farmland

Map Unit Composition

Glenelg and similar soils: 45 percent
Urban land: 30 percent
Minor components: 25 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg

Setting

Landform: Hillslopes, interfluves
Landform position (two-dimensional): Shoulder, backslope, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear

Typical profile

Ap - 0 to 10 inches: loam
Bt1,Bt2,BCt1 - 10 to 30 inches: clay loam
BCt2, CBt - 30 to 54 inches: loam
C - 54 to 76 inches: very channery sandy loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: B
Hydric soil rating: No

Description of Urban Land

Setting
Parent material: Human transported material

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Udorthents
Percent of map unit: 15 percent
Landform: Ridges
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Interfluve, nose slope, side slope
Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Hydric soil rating: No

Manor
Percent of map unit: 10 percent
Landform: Hillslopes, ridges
Landform position (two-dimensional): Shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Hydric soil rating: No

7UB—Gaila-Urban land complex, 0 to 8 percent slopes

Map Unit Setting
National map unit symbol: kxbf
Elevation: 100 to 2,000 feet
Mean annual precipitation: 35 to 50 inches

Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 120 to 255 days
Farmland classification: Not prime farmland

Map Unit Composition

Gaila and similar soils: 50 percent
Urban land: 45 percent
Minor components: 5 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Gaila

Typical profile

H1 - 0 to 8 inches: silt loam
H2 - 8 to 17 inches: sandy clay loam
H3 - 17 to 20 inches: sandy loam
H4 - 20 to 76 inches: loamy sand

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

Minor Components

Baile

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

16D—Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes

Map Unit Setting

National map unit symbol: kx79
Elevation: 300 to 2,000 feet
Mean annual precipitation: 7 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 240 days

Farmland classification: Not prime farmland

Map Unit Composition

Brinklow and similar soils: 50 percent
Blocktown and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Brinklow

Setting

Landform: Knolls
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Gravelly residuum weathered from low base phyllites and schists.

Typical profile

Ap - 0 to 10 inches: channery silt loam
Bt,BC - 10 to 25 inches: channery loam
Cr - 25 to 35 inches: bedrock
R - 35 to 39 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Hydric soil rating: No

Description of Blocktown

Setting

Landform: Knolls
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Gravelly residuum weathered from low base phyllites and schists.

Typical profile

Ap - 0 to 6 inches: channery silt loam
Bt - 6 to 17 inches: extremely channery silt loam
Cr - 17 to 21 inches: bedrock
R - 21 to 25 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Glenelg

Percent of map unit: 10 percent
Hydric soil rating: No

Baile

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

Occoquan

Percent of map unit: 5 percent
Hydric soil rating: No

47A—Lindside silt loam, 0 to 3 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: kx96
Elevation: 200 to 1,500 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 140 to 210 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Lindside and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lindside

Typical profile

H1 - 0 to 9 inches: silt loam
H2 - 9 to 65 inches: silt loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches

Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: NoneOccasional
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very high (about 12.2 inches)

Interpretive groups
Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Huntington
Percent of map unit: 10 percent
Hydric soil rating: No

Bowmansville
Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

Melvin
Percent of map unit: 5 percent
Landform: Flood plains
Hydric soil rating: Yes

48A—Melvin silt loam, 0 to 2 percent slopes, occasionally flooded

Map Unit Setting
National map unit symbol: kx97
Elevation: 200 to 1,500 feet
Mean annual precipitation: 36 to 50 inches
Mean annual air temperature: 45 to 55 degrees F
Frost-free period: 120 to 180 days
Farmland classification: Farmland of statewide importance

Map Unit Composition
Melvin and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Melvin

Setting
Landform: Flood plains
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Loamy alluvium derived from limestone, sandstone, and shale

Typical profile

Ap - 0 to 9 inches: silt loam
Bg - 9 to 24 inches: silty clay loam
Cg1,2 - 24 to 60 inches: silty clay loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: About 0 to 12 inches
Frequency of flooding: NoneOccasional
Frequency of ponding: Occasional
Available water supply, 0 to 60 inches: Very high (about 12.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: B/D
Hydric soil rating: Yes

Minor Components

Lindside

Percent of map unit: 10 percent
Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Comus

Percent of map unit: 5 percent
Landform: Flood plains
Landform position (two-dimensional): Footslope
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

53A—Codorus silt loam, 0 to 3 percent slopes, occasionally flooded

Map Unit Setting

National map unit symbol: kx9d
Elevation: 200 to 600 feet
Mean annual precipitation: 36 to 46 inches
Mean annual air temperature: 54 to 57 degrees F
Frost-free period: 140 to 200 days

Farmland classification: Not prime farmland

Map Unit Composition

Codorus and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Codorus

Setting

Landform: Flood plains
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loamy alluvium derived from phyllite, schist, diabase and/or greenstone

Typical profile

Ap - 0 to 11 inches: silt loam
Bw1 - 11 to 18 inches: silt loam
Bw2 - 18 to 40 inches: gravelly silt loam
2C - 40 to 60 inches: stratified sand to very gravelly loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 18 to 30 inches
Frequency of flooding: NoneOccasional
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Hatboro

Percent of map unit: 15 percent
Landform: Flood plains
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: Yes

65B—Wheaton silt loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: kxb5
Elevation: 330 to 1,000 feet
Mean annual precipitation: 35 to 45 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 160 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Wheaton and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Wheaton

Typical profile

H1 - 0 to 6 inches: silt loam
H2 - 6 to 68 inches: channery loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 9.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B
Hydric soil rating: No

116D—Blocktown channery silt loam, 15 to 25 percent slopes, very rocky

Map Unit Setting

National map unit symbol: kx75
Elevation: 70 to 2,000 feet
Mean annual precipitation: 7 to 50 inches

Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Blocktown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blocktown

Setting

Landform: Knolls
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Gravelly residuum weathered from low base phyllites and schists.

Typical profile

Ap - 0 to 6 inches: channery silt loam
Bt - 6 to 17 inches: extremely channery silt loam
Cr - 17 to 21 inches: bedrock
R - 21 to 25 inches: bedrock

Properties and qualities

Slope: 15 to 25 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Brinklow

Percent of map unit: 10 percent
Hydric soil rating: No

Baile

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

116E—Blocktown channery silt loam, 25 to 45 percent slopes, very rocky

Map Unit Setting

National map unit symbol: kx76
Elevation: 50 to 2,000 feet
Mean annual precipitation: 7 to 50 inches
Mean annual air temperature: 45 to 57 degrees F
Frost-free period: 120 to 240 days
Farmland classification: Not prime farmland

Map Unit Composition

Blocktown and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Blocktown

Setting

Landform: Knolls
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Gravelly residuum weathered from low base phyllites and schists.

Typical profile

Ap - 0 to 6 inches: channery silt loam
Bt - 6 to 17 inches: extremely channery silt loam
Cr - 17 to 21 inches: bedrock
R - 21 to 25 inches: bedrock

Properties and qualities

Slope: 25 to 45 percent
Depth to restrictive feature: 10 to 20 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Brinklow

Percent of map unit: 10 percent
Hydric soil rating: No

Baile

Percent of map unit: 5 percent
Landform: Flats
Hydric soil rating: Yes

400—Urban land

Map Unit Setting

National map unit symbol: kx8y
Elevation: 300 to 900 feet
Mean annual precipitation: 42 to 48 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 160 to 220 days
Farmland classification: Not prime farmland

Map Unit Composition

Urban land: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Urban Land

Setting

Parent material: Human transported material

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Udorthents

Percent of map unit: 15 percent
Hydric soil rating: No

W—Census water

Map Unit Composition

Water: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

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APPENDIX D
DITCH COMPUTATIONS

APPENDIX D.1
DITCH DESIGN

MACARTHUR BOULEVARD BIKEWAY DITCH DESIGN COMPUTATIONS **DESIGNED BY:** AGB **DATE:** 6/27/2024 **CHECKED BY:** WRB **DATE:** 6/27/2024

Sta.	Offset (LF)	LT/RT	Drainage Area (acres)	Cum. Drainage Area (acres)	Time of Concentration (minutes)	Intensity (in/hr)	C	Cum. C	Q_{10} (cfs)	Channel Slope (%)	Velocity (ft/s)	Flow Depth in Ditch (ft)	Min. Ditch depth to provide 6" freeboard	Implemented Ditch Depth	Channel lining	Top Ditch Left Side	Ditch Inv. (ft)	Top Ditch Right Side	Left Side Slope (H:V)	Right Side Slope (H:V)	Bottom Width (Ft)	DD No.	Notes
159+00 LT	35	LT	2.73	2.73	16.8	4.76	0.38	0.38	4.88	0.46	1.67	1.21	1.71		Grass	150.88	149.17	150.88	2	2	0	DD-1	Existing
160+00 LT	34	LT	1.25	3.98	17	4.73	0.40	0.38	7.21	0.32	1.6	1.50	2		Grass	150.85	148.85	150.85	2	2	0		
161+00 LT	30	LT	0.75	4.73	17.3	4.69	0.32	0.37	8.28	0.17	1.31	1.78	2.28		Grass	150.96	148.68	150.96	2	2	0		
162+10 LT	26	LT	0.35	5.08	17.3	4.69	0.33	0.37	8.82	0.65	2.19	1.42	1.92		Grass	149.88	147.96	149.88	2	2	0		
164+00 LT	32	LT	0.27	0.27	15	5.00	0.22	0.22	0.30	1.18	1.16	0.36	0.86		Grass	151.36	150.5	151.36	2	2	0	DD-2	Existing
163+00 LT	26	LT	0.37	0.64	15	5.00	0.26	0.24	0.77	1.28	1.54	0.50	1		Grass	150.223	149.22	150.223	2	2	0		
162+11 LT	28	LT	0.31	0.95	15	5.00	0.31	0.26	1.25	1.43	1.8	0.59	1.09		Grass	149.04	147.95	149.04	2	2	0		
165+00 LT	30	LT	25.76	25.76	18.8	4.50	0.37	0.37	42.89	4.96	7	1.75	2.25		Grass	149.72	147.47	149.72	2	2	0	DD-3	Existing
166+00 LT	27	LT	0.61	0.61	15	5.00	0.26	0.26	0.78	1.86	1.77	0.47	0.97		Grass	150.74	149.77	150.74	2	2	0	DD-4	Existing
166+65 LT	26	LT	0.32	0.92	15	5.00	0.24	0.27	1.22	3.00	2.35	0.51	1.01		Grass	148.83	147.82	148.83	2	2	0		
166+66 LT	24	LT	0.18	0.18	15	5.00	0.21	0.21	0.19	3.3%	1.52	0.25	0.75		Grass	148.57	147.82	148.57	2	2	0	DD-5	Existing
168+00 LT	17	LT	0.20	0.20	15	5.00	0.27	0.27	0.27	0.65	0.83	0.33	0.83	1	Grass	150.67	149.84	150.67	3	3	0	DD-6	Regraded
169+00 LT	24	LT	0.45	0.65	15.1	4.99	0.30	0.29	0.94	0.47	1.04	0.55	1.05	1.12	Grass	150.42	149.37	150.42	3	3	0		
170+00 LT	23	LT	0.48	1.13	15.3	4.96	0.32	0.30	1.70	0.56	1.26	0.67	1.17	1.25	Grass	149.98	148.81	149.98	3	3	0		
171+43 LT	21	LT	1.65	2.78	15.6	4.92	0.28	0.29	3.96	0.75	1.74	0.87	1.37	1.5	Grass	149.11	147.74	149.11	3	3	0		
176+00 LT	20	LT	4.09	4.09	12.4	5.41	0.41	0.41	9.07	1.19	2.77	1.28	1.78		Grass	151.79	150.01	151.79	2	2	0	DD-7	Existing
177+00 LT	19	LT	0.46	4.55	12.6	5.38	0.33	0.40	9.84	0.01	0.47	3.23	3.73		Grass	153.73	150.00	153.73	2	2	0		
178+00 LT	19	LT	0.52	5.07	12.8	5.34	0.30	0.39	10.60	0.15	1.33	2	2.5		Grass	152.35	149.85	152.35	2	2	0		
179+00 LT	21	LT	0.36	5.43	13	5.31	0.24	0.38	11.00	0.86	2.58	1.46	1.96		Grass	150.95	148.99	150.95	2	2	2		
180+00 LT	22	LT	0.39	5.82	13.2	5.28	0.59	0.40	12.15	1.00	2.77	1.48	1.98		Grass	149.97	147.99	149.97	2	2	4.5		
180+70 LT	25	LT	0.22	6.04	13.3	5.26	0.52	0.40	12.71	0.70	2.48	1.6	2.1		Grass	149.6	147.50	149.6	2	2	0		
182+62 LT	84	LT	0.48	0.48	15	5.00	0.39	0.39	0.94	12.32	3.63	0.36	0.86		Grass	125.61	124.75	125.61	2	2	0	DD-8	Existing
190+00 LT	25	LT	0.71	0.71	10	5.85	0.36	0.36	1.50	1.69	2.02	0.61	1.11		Grass	150.11	149.00	150.11	2	2	0	DD-9	Existing
189+17 LT	32	LT	0.41	1.12	10	5.85	0.28	0.33	2.17	1.68	2.21	0.70	1.2		Grass	148.89	147.69	148.89	2	2	0		
192+00 LT	18	LT	1.13	1.13	15	5.00	0.32	0.32	1.81	0.08	0.67	1.16	1.66		Grass	152.42	150.76	152.42	2	2	0	DD-10	Existing
193+00 LT	21	LT	0.61	1.74	15	5.00	0.36	0.33	2.91	0.52	1.51	0.98	1.48		Grass	151.72	150.24	151.72	2	2	0		
194+00 LT	24	LT	0.52	2.26	15	5.00	0.32	0.33	3.74	0.24	1.22	1.24	1.74		Grass	151.74	150.00	151.74	2	2	0		
195+05 LT	22	LT	0.72	2.98	15	5.00	0.32	0.33	4.89	2.72	3.23	0.87	1.37		Grass	148.51	147.14	148.51	2	2	0		
195+06 LT	31	LT	0.05	0.05	15	5.00	0.19	0.19	0.05	9.74	1.48	0.13	0.63		Grass	147.77	147.14	147.77	2	2	0	DD-11	Existing
196+16 LT	23	LT	20.56	20.56	13.5	5.23	0.46	0.49	52.69	1.89	5.11	2.27	2.77		Grass	150.56	147.79	150.56	2	2	0	DD-12	Existing
201+30 LT	19	LT	0.91	0.91	15	5.00	0.35	0.35	1.59	0.3%	0.99	0.73	1.23	1.25	Grass	150.44	149.21	150.44	3	3	0	DD-13	Regraded
200+00 LT	19	LT	0.68	1.59	15	5.00	0.35	0.35	2.78	0.3%	1.21	1.07	1.57	1	Grass	150.38	148.81	150.38	2	2	0		
199+00 LT	20	LT	1.14	2.73	15	5.00	0.42	0.38	5.19	0.3%	1.45	1.34	1.84	1	Grass	150.36	148.52	150.36	2	2	0		
198+00 LT	20	LT	0.64	3.37	15	5.00	0.39	0.38	6.43	0.3%	1.51	1.46	1.96	1.7	Grass	150.2	148.24	150.2	2	2	0		
197+00 LT	20	LT	0.69	4.06	15	5.00	0.37	0.38	7.70	0.3%	1.58	1.56	2.06	1.75	Grass	149.99	147.93	149.99	2	2	0		
196+17 LT	21	LT	0.66	4.72	15	5.00	0.32	0.37	8.74	0.3%	1.53	1.38	1.88	2	Grass	149.53	147.65	149.53	3	3	0		
203+00 LT	23	LT	5.56	5.56	17.2	4.70	0.30	0.30	7.84	0.6%	2.06	1.38	1.88		Grass	150.03	148.15	150.03	2	2	0	DD-14	Regraded
204+41 LT	17	LT	0.76	6.32	17.5	4.67	0.29	0.30	8.82	0.6%	2.13	1.44	1.94		Grass	149.24	147.30	149.24	2	2	0		
207+00 LT	25	LT	1.59	1.59	15	5.00	0.31	0.31	2.46	1.38	2.07	0.77	1.27		Grass	150.27	149.00	150.27	2	2	0	DD-15	Regraded
206+00 LT	19	LT	0.50	2.09	15	5.00	0.28	0.30	3.16	0.59	1.65	0.98	1.48		Grass	149.89	148.41	149.89	2	2	0		
204+42 LT	17	LT	2.31	4.40	16.8	4.76	0.24	0.27	5.65	0.90	2.21	1.13	1.63		Grass	148.93	147.30	148.93	2	2	0		
208+00 LT	24	LT	2.75	2.75	16.9	4.74	0.35	0.35	4.56	0.36	1.48	1.24	1.74		Grass	149.56	147.82	149.56	2	2	0	DD-16	Regraded
208+57 LT	17	LT	0.78	3.53	17.1	4.72	0.30	0.34	5.65	0.28	1.42	1.41	1.91		Grass	149.57	147.66	149.57	2	2	0		
210+00 LT	19	LT	1.37	1.37	15	5.00	0.27	0.27	1.84	0.4%	1.22	0.87	1.37		Grass	150.32	148.95	150.32	2	2	0	DD-17	Regraded
209+00 LT	16	LT	0.51	1.88	15	5.00	0.30	0.28	2.61	0.70%	1.65	0.89	1.39		Grass	149.64	148.25	149.64	2	2	0		
208+58 LT	17	LT	0.26	2.14	15	5.00	0.30	0.28	3.00	1.40%	2.23	0.82	1.32		Grass	148.98	147.66	148.98	2	2	0		
216+00 LT	20	LT	1.35	1.35	15	5.00	0.29	0.29	1.96	1.23	1.89	0.72	1.22	1	Grass	149.92	148.70	149.92	2	2	0	DD-18	Regraded, Exception: no freeboard upstream of 213+50
215+00 LT	22	LT	0.54	1.89	15	5.00	0.25	0.28	2.63	0.29	1.19	1.05	1.55	1	Grass	149.96	148.41	149.96	2	2	0		
214+00 LT	22	LT	0.39	2.28	15	5.00	0.23	0.27	3.08	0.29	1.25	1.11	1.61	1.5	Grass	149.73	148.12	149.73	2	2	0		
213+00 LT	21	LT	0.51	2.79	15	5.00	0.27	0.27	3.77	0.28	1.21	1.02	1.52	1.5	Grass	149.36	147.84	149.36	3	3	0		
212+00 LT	21	LT	0.63	3.42	15	5.00	0.39	0.29	5.00	0.30	1.33	1.12	1.62	1.5	Grass	149.16	147.54	149.16	3	3	0		
211+00 LT	21	LT	1.28	4.7	15	5.00	0.32	0.30	7.05	0.31	1.46	1.27	1.77	1.75	Grass	149	147.23	149	3	3	0		
218+00 LT	15	LT	0.72	0.72	10	5.85	0.40	0.40	1.68	0.35	2.33	0.60	1.1	0.9	Concrete	150.41	149.31	150.41	2	2	0	DD-19	Regraded, Exception: 0.5 ft depth
219+00 LT	16	LT	0.34	1.06	15	5.00	0.37	0.39	2.07	0.35	2.17	0.27	0.77	0.5	Concrete	149.73	148.96	149.73	2	2	3		
220+25 LT	16	LT	0.51	1.57	15	5.00	0.37	0.38	3.01	0.35	2.75	0.74	1.24	0.5	Concrete	149.7	148.46	149.7	2	2	0		
223+00 LT	20	LT	0.52	0.52	15	5.00	0.25	0.25	0.64	1.8%	1.65	0.44	0.94	1.25	Grass	151.4	150.46	151.4	3	3	0	DD-20	Regraded
224+00 LT	15	LT	0.25	0.77	15	5.00	0.29	0.26	1.00	1.5%	1.71	0.54	1.04	1.25	Grass	150.03	148.99	150.03	3	3	0		
225+00 LT	14	LT	1.09	1.86	15	5.00	0.26	0.26	2.41	0.5%	1.42	0.92	1.42	1.5	Grass	149.92	148.50	149.92	3	3	0		
226+00 LT	16	LT	0.42	2.28	15	5.00	0.27	0.26	2.98	0.5%	1.52	0.99	1.49	1.5	Grass	149.49	148.00	149.49	3	3	0		
227+00 LT	30	LT	0.16	2.44	15	5.00	0.32	0.27	3.24	3.8%	3.31	0.70	1.2	1	Grass	145.37	144.17	145.37	3	3	0		
227+23 LT	51	LT	0.07	2.51	15	5.00	0.31	0.27	3.35	38%	8.27	0.45	0.95	1	Riprap	135.7	134.75	135.7	3	3	0		
230+00 LT	16	LT	1.05	1.05	10	5.85	0.38	0.38	2.33	0.2%	1	1.08	1.58		Grass	151.93	150.35	151.93	2	2	0	DD-21	Regraded, Exception: 1 ft depth
229+00 LT	16	LT	0.32	1.37	15	5.00	0.26	0.35	2.41	1.6%	2.2	0.74	1.24		Grass	150.03	148.79	150.03	2	2	0		
227+70 LT	62	LT	0.74	2.11	15	5.00	0.29	0.33	3.48	13%	5.36	0.57	1.07		Grass	132.92	131.85	132.92	2	2	0		
231+85 LT	16	LT	1.54	1.54	10	5.85	0.35	0.35	3.12	3.4%	3.09	0.71	1.21		Grass	148.9	147.69	148.9	2	2	0	DD-22	Existing

231+ 89 LT	15	LT	0.75	0.75	10	5.85	0.32	0.32	1.40	1.2%	1.71	0.64	1.14		Grass	148.83	147.69	148.83	2	2	0	DD-23	Regraded
234+00 LT	17	LT	0.14	0.14	15	5.00	0.33	0.33	0.23	4.0%	1.7	0.26	0.76	1	Grass	149.53	148.77	149.53	2	2	0		
235+00 LT	18	LT	0.67	0.81	15	5.00	0.36	0.35	1.43	1.1%	1.69	0.65	1.15	1.25	Grass	148.79	147.64	148.79	2	2	0	DD-24	Regraded
235+46 LT	19	LT	0.43	1.24	10	5.85	0.61	0.44	3.21	1.6%	2.39	0.82	1.32	1.25	Grass	148.23	146.91	148.23	2	2	0		
235+52 LT	20	LT	1.03	1.03	15	5.00	0.34	0.34	1.74	4.3%	2.98	0.54	1.04		Grass	147.95	146.91	147.95	2	2	0	DD-25	Existing
237+00 LT	21	LT	0.73	0.73	15	5.00	0.36	0.36	1.33	0.8%	1.48	0.67	1.17		Grass	149.36	148.19	149.36	2	2	0	DD-26	Existing
237+04 LT	21	LT	0.44	0.44	10	5.85	0.41	0.41	1.05	3.4%	2.38	0.47	0.97		Grass	149.16	148.19	149.16	2	2	0	DD-27	Existing
238+00 LT	18	LT	0.41	0.41	15	5.00	0.36	0.36	0.74	0.8%	1.17	0.46	0.96	0.5	Grass	150.39	149.43	150.39	3	3	0		Regraded.
239+00 LT	16	LT	0.28	0.69	15	5.00	0.43	0.39	1.35	0.6%	1.21	0.61	1.11	0.5	Grass	149.96	148.85	149.96	3	3	0		Exception:
240+00 LT	19	LT	0.37	1.06	15	5.00	0.40	0.39	2.09	0.6%	1.38	0.71	1.21	0.5	Grass	149.48	148.27	149.48	3	3	0	DD-28	0.5 ft depth
241+00 LT	20	LT	0.25	1.31	15	5.00	0.39	0.39	2.58	0.6%	1.45	0.77	1.27	1.25	Grass	148.94	147.67	148.94	3	3	0		over
241+97 LT	20	LT	0.40	1.71	15	5.00	0.38	0.39	3.33	0.6%	1.54	0.85	1.35	1.75	Grass	148.41	147.06	148.41	3	3	0		aqueduct
242+00 LT	18	LT	2.35	2.35	10	5.85	0.51	0.51	7.07	5.1%	4.46	0.89	1.39	1.75	Grass	148.66	147.27	148.66	2	2	0	DD-29	Regraded
238+00 RT	31	RT	0.04	0.04	7	6.82	0.72	0.72	0.20	0.35%	0.41	0.11	0.61	0.5	Grass	150.32	149.71	150.32	4	4	4		
239+00 RT	31	RT	0.10	0.14	10	5.85	0.60	0.64	0.51	0.35%	0.60	0.18	0.68	0.5	Grass	150.04	149.36	150.04	4	4	4		Regraded,
240+00 RT	31	RT	0.10	0.23	10	5.85	0.53	0.59	0.81	0.35%	0.72	0.23	0.73	0.5	Grass	149.74	149.01	149.74	4	4	4	DD-30	Exception:
241+00 RT	30	RT	0.08	0.32	10	5.85	0.62	0.60	1.10	0.35%	0.84	0.31	0.81	0.5	Grass	149.47	148.66	149.47	4	4	3		0.5 ft depth
242+00 RT	29	RT	0.07	0.39	10	5.85	0.69	0.62	1.39	0.35%	0.93	0.41	0.91	0.5	Grass	149.19	148.28	149.19	4	4	2		
251+00 LT	23	LT	0.25	0.25	15	5.00	0.31	0.31	0.39	4.70	2.03	0.31	0.81	1	Grass	194.13	193.32	194.13	2	2	0		
250+00 LT	20	LT	0.74	0.99	15	5.00	0.36	0.35	1.72	7.51	3.58	0.49	0.99	1	Grass	186.8	185.81	186.8	2	2	0	DD-31	Regraded
249+00 LT	18	LT	0.52	1.51	15	5.00	0.50	0.40	3.02	7.12	4.06	0.61	1.11	1	Grass	179.8	178.69	179.8	2	2	0		
248+27 LT	18	LT	0.53	2.04	15	5.00	0.51	0.43	4.37	6.40	4.33	0.71	1.21	1	Grass	175.23	174.02	175.23	2	2	0		
250+00 RT	33	RT	0.04	0.04	7	6.82	0.73	0.73	0.20	10	1.75	0.09	0.59	0.67	Riprap	184.13	183.54	184.13	3	3	1		
249+00 RT	58	RT	0.11	0.15	10	5.85	0.45	0.52	0.46	10	2.55	0.13	0.63	0.67	Riprap	174.17	173.54	174.17	3	3	1		
248+00 RT	45	RT	0.20	0.35	10	5.85	0.45	0.48	0.99	10	3.09	0.2	0.70	0.67	Riprap	164.24	163.54	164.24	3	3	1	DD-32	Regraded
247+00 RT	58	RT	0.14	0.49	10	5.85	0.43	0.47	1.34	14.79	3.91	0.21	0.71	0.67	Riprap	153.45	152.74	153.45	3	3	1		
248+18 RT	90	RT	0.05	0.54	15	5.00	0.20	0.44	1.19	0.35	1.06	0.75	1.25	1.25	Grass	148.8	147.55	148.8	2	2	1		

APPENDIX D.2
DITCH C VALUE COMPUTATION

DITCH C VALUE COMPUTATIONS

DESIGNED BY:	AGB	**DATE:**	6/27/2024
CHECKED BY:	WRB	**DATE:**	6/27/2024

MONTGOMERY COUNTY C VALUES

	B	C	D
impervious	0.90	0.90	0.90
turf	0.16	0.19	0.24
forrested	0.2	0.23	0.3

159+00 LT

Description	Area	C	
Impervious, soil B		0.56	0.90
Forrested, soil B		1.07	0.20
Forrested, soil C		0.17	0.23
Forrested, soil D		0.88	0.3
Turf, soil B		0.03	0.16
Turf, soil D		0.02	0.24
Total Area (acres)		2.73	
C		0.38	

160+00 LT

Description	Area	C	
Turf, soil B		0.10	0.16
Impervious, soil B		0.33	0.90
Forrested, soil B		0.52	0.20
Forrested, soil C		0.11	0.23
Forrested, soil D		0.19	0.30
Total Area (acres)		1.25	
C		0.40	

161+00 LT

Description	Area	C	
Impervious, soil B		0.06	0.90
Forrested, soil B		0.18	0.2
Forrested, soil C		0.03	0.23
Forrested, soil D		0.47	0.3
Total Area (acres)		0.75	
C		0.32	

162+10 LT

Forrested, soil C		0.03	0.23
Forrested, soil D		0.14	0.3
Forrested, soil B		0.14	0.2
Impervious, soil B		0.04	0.90
Total Area (acres)		0.35	
C		0.33	

164+00 LT

Description	Area	C	
Forrested, soil B		0.06	0.2
Forrested, soil C		0.21	0.23
Total Area (acres)		0.27	
C		0.22	

163+00 LT

Description	Area	C	
Forrested, soil C		0.10	0.23
Forrested, soil D		0.13	0.3
Forrested, soil B		0.14	0.2
Impervious, soil B		0.01	0.9
Total Area (acres)		0.37	
C		0.26	

162+11 LT

Description	Area	C	
Impervious, soil B		0.03	0.90
Forrested, soil B		0.10	0.20
Forrested, soil C		0.04	0.23
Forrested, soil D		0.15	0.30
Total Area (acres)		0.31	

C 0.31

165+00 LT

Description	Area	C
Forrested, soil C	11.53	0.23
Forrested, soil B	7.22	0.2
Impervious, soil B	3.05	0.90
Impervious, soil C	2.79	0.90
Turf, soil C	0.92	0.19
Turf, soil B	0.25	0.16
Total Area (acres)	25.76	
C	0.37	

166+00 LT

Description	Area	C
Forrested, soil C	0.44	0.23
Forrested, soil B	0.14	0.2
Impervious, soil B	0.02	0.90
Impervious, soil C	0.01	0.90
Total Area (acres)	0.61	
C	0.26	

166+65 LT

Description	Area	C
Forrested, soil C	0.21	0.23
Forrested, soil B	0.08	0.2
Impervious, soil B	0.01	0.9
Turf, soil B	0.02	0.16
Total Area (acres)	0.32	
C	0.24	

166+66 LT

Description	Area	C
Forrested, soil C	0.08	0.23
Forrested, soil B	0.08	0.2
Impervious, soil B	0.00	0.9
Turf, soil B	0.02	0.16
Total Area (acres)	0.18	
C	0.21	

168+00 LT

Description	Area	C
Impervious, soil B	0.02	0.90
Forrested, soil B	0.07	0.2
Forrested, soil C	0.11	0.23
Total Area (acres)	0.20	
C	0.27	

169+00 LT

Description	Area	C
Forrested, soil C	0.26	0.23
Forrested, soil B	0.14	0.20
Impervious, soil B	0.05	0.90
Total Area (acres)	0.45	
C	0.30	

170+00 LT

Description	Area	C
Impervious, soil B	0.07	0.90
Forrested, soil B	0.1	0.20
Forrested, soil C	0.31	0.23
Total Area (acres)	0.48	
C	0.32	

171+43 LT

Description	Area	C
Forrested, soil C	0.69	0.23
Forrested, soil B	0.74	0.20
Impervious, soil B	0.17	0.90
Turf, soil B	0.05	0.16
Total Area (acres)	1.65	

C	0.28	

176+00 LT

Description	Area	C
Impervious, soil D	0.02	0.9
Forrested, soil D	0.09	0.3
Forrested, soil C	2.64	0.23
Forrested, soil B	0.24	0.20
Impervious, soil B	0.15	0.90
impervious, soil C	0.93	0.90
Turf, soil C	0.01	0.19
Turf, soil B	0.01	0.16
Total area (acres)	4.09	
C	0.41	

177+00 LT

Description	Area	C
Turf, soil B	0.05	0.16
Turf, soil C	0.02	0.19
Forrested, soil C	0.2	0.23
Forrested, soil B	0.11	0.20
Impervious, soil B	0.08	0.90
Total area (acres)	0.46	
C	0.33	

178+00 LT

Description	Area	C
Forrested, soil C	0.27	0.23
Forrested, soil B	0.08	0.20
Impervious, soil B	0.07	0.90
Turf, soil B	0.1	0.16
Total area (acres)	0.52	
C	0.30	

179+00 LT

Description	Area	C
Turf, soil B	0.09	0.16
Impervious, soil C	0.02	0.90
Forrested, soil B	0.12	0.20
Forrested, soil C	0.13	0.23
Total area (acres)	0.36	
C	0.24	

180+00 LT

Description	Area	C
Impervious, soil B	0.05	0.90
Impervious, soil C	0.17	0.90
Forrested, soil B	0.08	0.20
Forrested, soil C	0.05	0.23
Turf, soil B	0.04	0.16
Total Area (acres)	0.39	
C	0.59	

180+70 LT

Description	Area	C
Turf, soil B	0.02	0.16
Impervious, soil C	0.1	0.90
Forrested, soil C	0.06	0.23
Forrested, soil B	0.04	0.20
Total area (acres)	0.22	
C	0.52	

182+62 LT

Description	Area	C
Turf, soil B	0.02	0.16
Impervious, soil C	0.12	0.90
Forrested, soil C	0.22	0.23
Forrested, soil B	0.12	0.20
Total area (acres)	0.48	
C	0.39	

190+00 LT

Description	Area	C
Impervious, soil B		0.90
Impervious, soil D	0.12	0.90
Forrested, soil B	0.27	0.20
Forrested, soil C		0.23
Forrested, soil D	0.28	0.3
Turf, soil B	0.04	0.16
Turf, soil D		0.24
Total Area (acres)	0.71	
C	0.36	

189+17 LT

Description	Area	C
Impervious, soil B		0.90
Impervious, soil D	0.02	0.90
Forrested, soil B	0.18	0.20
Forrested, soil C		0.23
Forrested, soil D	0.18	0.3
Turf, soil B	0.03	0.16
Turf, soil D		0.24
Total Area (acres)	0.41	
C	0.28	

192+00 LT

Description	Area	C
Impervious, soil B		0.90
Impervious, soil D	0.08	0.90
Forrested, soil B	0.22	0.20
Forrested, soil C		0.23
Forrested, soil D	0.8	0.3
Turf, soil B	0.03	0.16
Turf, soil D		0.24
Total Area (acres)	1.13	
C	0.32	

193+00 LT

Description	Area	C
Impervious, soil B		0.90
Impervious, soil D	0.09	0.90
Forrested, soil B	0.14	0.20
Forrested, soil C		0.23
Forrested, soil D	0.35	0.3
Turf, soil B	0.03	0.16
Turf, soil D		0.24
Total Area (acres)	0.61	
C	0.36	

194+00 LT

Description	Area	C
Impervious, soil B		0.90
Impervious, soil D	0.06	0.90
Forrested, soil B	0.19	0.20
Forrested, soil C		0.23
Forrested, soil D	0.24	0.3
Turf, soil B	0.03	0.16
Turf, soil D		0.24
Total Area (acres)	0.52	
C	0.32	

195+05 LT

Description	Area	C
Impervious, soil B		0.90
Impervious, soil D	0.08	0.90
Forrested, soil B	0.26	0.20
Forrested, soil C		0.23
Forrested, soil D	0.35	0.3
Turf, soil B	0.03	0.16
Turf, soil D		0.24
Total Area (acres)	0.72	
C	0.32	

195+06 LT

Description	Area	C
Impervious, soil B		0.90
Impervious, soil D		0.90
Forrested, soil B	0.04	0.20
Forrested, soil C		0.23
Forrested, soil D		0.3
Turf, soil B	0.01	0.16
Turf, soil D		0.24
Total Area (acres)	0.05	
C	0.19	

196+16 LT

Description	Area	C
Impervious, soil B	7.37	0.90
Impervious, soil D	0.1	0.90
Forrested, soil B	11.11	0.20
Forrested, soil C		0.23
Forrested, soil D	1.94	0.3
Turf, soil B	0.04	0.16
Turf, soil D		0.24
Total Area (acres)	20.56	
C	0.46	

201+30 LT

Description	Area	C
Impervious, soil B	0.01	0.90
Impervious, soil D	0.08	0.90
Forrested, soil B	0.05	0.20
Forrested, soil C		0.23
Forrested, soil D	0.75	0.3
Turf, soil B	0.02	0.16
Turf, soil D		0.24
Total Area (acres)	0.91	
C	0.35	

200+00 LT

Description	Area	C
Impervious, soil B	0.04	0.90
Impervious, soil D	0.04	0.90
Forrested, soil B	0.14	0.20
Forrested, soil D	0.46	0.3
Total area (acres)	0.68	
C	0.35	

199+00 LT

Description	Area	C
Forrested, soil D	0.53	0.3
Forrested, soil B	0.33	0.20
Impervious, soil B	0.20	0.90
Impervious, soil D	0.09	0.90
Total area (acres)	1.14	
C	0.42	

198+00 LT

Description	Area	C
Impervious, soil D	0.06	0.90
Impervious, soil B	0.07	0.90
Forrested, soil B	0.19	0.20
Forrested, soil D	0.33	0.3
Total area (acres)	0.64	
C	0.39	

197+00 LT

Description	Area	C
Impervious, soil D	0.03	0.90
Impervious, soil B	0.08	0.90
Forrested, soil B	0.17	0.20
Forrested, soil D	0.41	0.30
Total area (acres)	0.69	
C	0.37	

196+17 LT

Description	Area	C
Impervious, soil D	0.01	0.90
Impervious, soil B	0.04	0.90
Forrested, soil B	0.19	0.20
Forrested, soil D	0.43	0.30
Total area (acres)	0.66	
C	0.32	

203+00 LT

Description	Area	C
Impervious, soil D	0.02	0.9
Impervious, soil B	0.58	0.9
Forrested, soil B	3.84	0.2
Forrested, soil D	1.12	0.3
Total area (acres)	5.56	
C	0.30	

204+41 LT

Description	Area	C
Impervious, soil D	0	0.90
Impervious, soil B	0.04	0.90
Forrested, soil B	0.33	0.20
Forrested, soil D	0.39	0.30
Total area (acres)	0.76	
C	0.29	

207+00 LT

Description	Area	C
Impervious, soil D		0.90
Impervious, soil B	0.11	0.90
Forrested, soil B	0.54	0.20
Forrested, soil D	0.94	0.30
Turf, soil B	0.02	0.16
Total area (acres)	1.61	
C	0.30	

206+00 LT

Description	Area	C
Impervious, soil D		0.90
Forrested, soil B	0.04	0.20
Forrested, soil D	0.43	0.30
Turf, soil B	0.03	0.16
Total area (acres)	0.5	
C	0.28	

204+42 LT

Description	Area	C
Impervious, soil D	0.01	0.90
Forrested, soil B	1.33	0.20
Forrested, soil D	0.92	0.30
Turf, soil B	0.05	0.16
Total area (acres)	2.31	
C	0.24	

208+00 LT

Description	Area	C
Turf, soil B	0.02	0.16
Impervious, soil B	0.48	0.9
Forrested, soil B	1.36	0.2
Forrested, soil D	0.89	0.3
Total area (acres)	2.75	
C	0.35	

208+57 LT

Description	Area	C
Impervious, soil B	0.04	0.90
Forrested, soil B	0.22	0.20
Forrested, soil D	0.52	0.30
Total area (acres)	0.78	
C	0.30	

210+00 LT

Description	Area	C	
Impervious, soil B		0.06	0.90
Forrested, soil B		0.80	0.20
Forrested, soil D		0.51	0.30
Total area (acres)		1.37	
C		0.27	

209+00 LT

Description	Area	C	
Impervious, soil B		0.02	0.90
Forrested, soil B		0.13	0.20
Forrested, soil D		0.36	0.30
Total area (acres)		0.51	
C		0.30	

208+58 LT

Description	Area	C	
Impervious, soil B		0.01	0.90
Forrested, soil B		0.08	0.20
Forrested, soil D		0.16	0.30
Total area (acres)		0.25	
C		0.30	

216+00 LT

Description	Area	C	
Impervious, soil B		0.14	0.90
Turf, soil B		0.10	0.16
Impervious, soil D			0.90
Forrested, soil D		0.29	0.30
Forrested, soil C			0.23
Forrested, soil B		0.82	0.20
Total area (acres)		1.35	
C		0.29	

215+00 LT

Description	Area	C	
Impervious, soil B		0.02	0.90
Turf, soil B		0.10	0.16
Impervious, soil D			0.90
Forrested, soil D		0.17	0.30
Forrested, soil C			0.23
Forrested, soil B		0.25	0.20
Total area (acres)		0.54	
C		0.25	

214+00 LT

Description	Area	C	
Impervious, soil B			0.90
Turf, soil B		0.05	0.16
Impervious, soil D			0.90
Forrested, soil D		0.14	0.30
Forrested, soil C			0.23
Forrested, soil B		0.20	0.20
Total area (acres)		0.39	
C		0.23	

213+00 LT

Description	Area	C	
Impervious, soil B		0.03	0.90
Turf, soil B		0.07	0.16
Impervious, soil D			0.90
Forrested, soil D		0.17	0.30
Forrested, soil C			0.23
Forrested, soil B		0.24	0.20
Total area (acres)		0.51	
C		0.27	

212+00 LT

Description	Area	C	
Impervious, soil B		0.14	0.90
Turf, soil B		0.04	0.16

Impervious, soil D			0.90
Forrested, soil D		0.22	0.30
Forrested, soil C			0.23
Forrested, soil B		0.23	0.20
Total area (acres)		0.63	
C		0.39	

211+00 LT

Description	Area	C	
Impervious, soil B		0.15	0.90
Turf, soil B		0.03	0.16
Impervious, soil D			0.90
Forrested, soil D		0.51	0.30
Forrested, soil C			0.23
Forrested, soil B		0.59	0.20
Total area (acres)		1.28	
C		0.32	

218+00 LT

Description	Area	C	
Impervious, soil B		0.07	0.90
Impervious, soil C		0.06	0.90
Impervious, soil D		0.02	0.90
Forrested, soil D		0.36	0.30
Forrested, soil C		0.02	0.23
Forrested, soil B		0.19	0.20
Total area (acres)		0.72	
C		0.40	

219+00 LT

Description	Area	C	
Impervious, soil C		0.02	0.90
Impervious, soil D		0.02	0.90
Forrested, soil D		0.26	0.30
Forrested, soil C		0.04	0.23
Total area (acres)		0.34	
C		0.37	

220+25 LT

Description	Area	C	
Impervious, soil C		0.010	0.90
Impervious, soil D		0.05	0.90
Forrested, soil D		0.43	0.30
Forrested, soil C		0.02	0.23
Total area (acres)		0.51	
C		0.37	

223+00 LT

Description	Area	C	
Impervious, soil B		0.01	0.90
Turf, soil B		0.00	0.16
Impervious, soil D			0.90
Forrested, soil D		0.08	0.30
Forrested, soil C		0.30	0.23
Forrested, soil B		0.13	0.20
Total area (acres)		0.52	
C		0.25	

224+00 LT

Description	Area	C	
Impervious, soil B		0.02	0.90
Turf, soil B			0.16
Impervious, soil D			0.90
Forrested, soil D		0.01	0.30
Forrested, soil C		0.13	0.23
Forrested, soil B		0.08	0.20
Total area (acres)		0.25	
C		0.29	

225+00 LT

Description	Area	C	

Impervious, soil B	0.01	0.90
Turf, soil B		0.16
Impervious, soil D		0.90
Forrested, soil D	0.45	0.30
Forrested, soil C	0.43	0.23
Forrested, soil B	0.20	0.20
Total area (acres)	1.09	
C	0.26	

226+00 LT

Description	Area	C	
Impervious, soil B		0.00	0.90
Turf, soil B			0.16
Impervious, soil D			0.90
Forrested, soil D		0.27	0.30
Forrested, soil C		0.05	0.23
Forrested, soil B		0.09	0.20
Total area (acres)		0.42	
C		0.27	

227+00 LT

Description	Area	C	
Impervious, soil B		0.01	0.90
Turf, soil B			0.16
Impervious, soil D			0.90
Forrested, soil D		0.11	0.30
Forrested, soil C			0.23
Forrested, soil B		0.04	0.20
Total area (acres)		0.16	
C		0.32	

227+23 LT

Description	Area	C	
Impervious, soil B		0.00	0.90
Turf, soil B			0.16
Impervious, soil D			0.90
Forrested, soil D		0.06	0.30
Forrested, soil C			0.23
Forrested, soil B		0.00	0.20
Total area (acres)		0.07	
C		0.31	

230+00 LT

Description	Area	C	
Turf, soil D		0.10	0.24
Turf, soil B		0.02	0.16
Impervious, soil D		0.16	0.90
Forrested, soil D		0.69	0.30
Forrested, soil C			0.23
Forrested, soil B		0.08	0.20
Total area (acres)		1.05	
C		0.38	

229+00 LT

Description	Area	C	
Turf, soil D			0.24
Turf, soil B		0.03	0.16
Impervious, soil D			0.90
Forrested, soil D		0.21	0.30
Forrested, soil C			0.23
Forrested, soil B		0.08	0.20
Total area (acres)		0.32	
C		0.26	

227+70 LT

Description	Area	C	
Turf, soil D			0.24
Turf, soil B		0.03	0.16
Impervious, soil D			0.90
Forrested, soil D		0.68	0.30
Forrested, soil C			0.23
Forrested, soil B		0.03	0.20

Total area (acres)	0.74	
C	0.29	

231+85 LT

Description	Area	C
Impervious, soil D	0.16	0.90
Turf, soil D	0.24	0.24
Turf, soil B	0.02	0.16
Forrested, soil D	1.06	0.30
Forrested, soil C		0.23
Forrested, soil B	0.06	0.20
Total area (acres)	1.54	
C	0.35	

231+89 LT

Description	Area	C
Impervious, soil D	0.08	0.90
Turf, soil D	0.05	0.00
Turf, soil B	0.05	0.16
Forrested, soil D	0.48	0.30
Forrested, soil C		0.23
Forrested, soil B	0.09	0.20
Total area (acres)	0.75	
C	0.32	

234+00 LT

Description	Area	C
Impervious, soil B	0.01	0.90
Turf, soil D		0.24
Impervious, soil D		0.90
Forrested, soil D	0.10	0.30
Forrested, soil C		0.23
Forrested, soil B	0.03	0.20
Total area (acres)	0.14	
C	0.33	

235+00 LT

Description	Area	C
Impervious, soil B	0.04	0.90
Turf, soil D	0.01	0.24
Impervious, soil D	0.05	0.90
Forrested, soil D	0.41	0.30
Turf, soil B	0.01	0.16
Forrested, soil B	0.15	0.20
Total area (acres)	0.67	
C	0.36	

235+46 LT

Description	Area	C
Impervious, soil B	0.02	0.90
Turf, soil D	0.02	0.24
Impervious, soil D	0.22	0.90
Forrested, soil D	0.07	0.30
Turf, soil B	0.00	0.16
Forrested, soil B	0.10	0.20
Total area (acres)	0.43	
C	0.61	

235+52 LT

Description	Area	C
Impervious, soil B	0.07	0.90
Turf, soil D	0.15	0.24
Impervious, soil D	0.03	0.90
Forrested, soil D	0.35	0.30
Turf, soil B	0.05	0.16
Forrested, soil B	0.19	0.20
Impervious, soil C	0.04	0.90
Forrested, soil C	0.08	0.23
Turf, soil C	0.06	0.19
Total area (acres)	1.03	
C	0.34	

237+00 LT

Description	Area	C
Impervious, soil B	0.04	0.90
Turf, soil D		0.24
Impervious, soil D	0.06	0.90
Forrested, soil D	0.26	0.30
Turf, soil B		0.16
Forrested, soil B	0.33	0.20
Impervious, soil C	0.04	0.90
Forrested, soil C		0.23
Turf, soil C	0.00	0.19
Total area (acres)	0.73	
C	0.36	

237+04 LT

Description	Area	C
Impervious, soil B	0.02	0.90
Turf, soil D		0.24
Impervious, soil D	0.08	0.90
Forrested, soil D	0.18	0.30
Turf, soil B		0.16
Forrested, soil B	0.15	0.20
Impervious, soil C	0.01	0.90
Forrested, soil C	0.01	0.23
Turf, soil C		0.19
Total area (acres)	0.44	
C	0.41	

238+00 LT

Description	Area	C
Impervious, soil B	0.02	0.90
Turf, soil D		0.24
Impervious, soil D	0.02	0.90
Forrested, soil D	0.11	0.30
Turf, soil B		0.16
Forrested, soil B	0.15	0.20
Impervious, soil C	0.04	0.90
Forrested, soil C	0.07	0.23
Turf, soil C		0.19
Total area (acres)	0.41	
C	0.36	

239+00 LT

Description	Area	C
Impervious, soil B	0.05	0.90
Turf, soil D		0.24
Impervious, soil D		0.90
Forrested, soil D		0.30
Turf, soil B		0.16
Forrested, soil B	0.19	0.20
Impervious, soil C	0.04	0.90
Forrested, soil C		0.23
Turf, soil C		0.19
Total area (acres)	0.28	
C	0.43	

240+00 LT

Description	Area	C
Impervious, soil B	0.05	0.90
Turf, soil D		0.24
Impervious, soil D		0.90
Forrested, soil D		0.30
Turf, soil B		0.16
Forrested, soil B	0.23	0.20
Impervious, soil C	0.05	0.90
Forrested, soil C	0.03	0.23
Turf, soil C	0.01	0.19
Total area (acres)	0.37	
C	0.40	

241+00 LT

Description	Area	C
Impervious, soil B	0.06	0.90
Turf, soil D		0.24

Impervious, soil D		0.90
Forrested, soil D		0.30
Turf, soil B		0.16
Forrested, soil B	0.18	0.20
Impervious, soil C	0.00	0.90
Forrested, soil C		0.23
Turf, soil C		0.19
Total area (acres)	0.25	
C	0.39	

241+97 LT

Description	Area	C	
Impervious, soil B		0.10	0.90
Turf, soil D			0.24
Impervious, soil D			0.90
Forrested, soil D			0.30
Turf, soil B			0.16
Forrested, soil B		0.30	0.20
Impervious, soil C		0.01	0.90
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.40	
C		0.38	

242+00 LT

Description	Area	C	
Impervious, soil B		0.25	0.90
Turf, soil D			0.24
Impervious, soil D		0.03	0.90
Forrested, soil D		0.06	0.30
Turf, soil B			0.16
Forrested, soil B		0.35	0.20
Impervious, soil C		0.73	0.90
Forrested, soil C		0.82	0.23
Turf, soil C		0.11	0.19
Total area (acres)		2.35	
C		0.51	

238+00 RT

Description	Area	C	
Impervious, soil B		0.03	0.9
Turf, soil D			0.24
Impervious, soil D			0.9
Forrested, soil D			0.3
Turf, soil B		0.01	0.16
Forrested, soil B			0.2
Impervious, soil C			0.9
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.04	
C		0.72	

239+00 RT

Description	Area	C	
Impervious, soil B		0.06	0.9
Turf, soil D			0.24
Impervious, soil D			0.9
Forrested, soil D			0.3
Turf, soil B		0.04	0.16
Forrested, soil B			0.2
Impervious, soil C			0.9
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.1	
C		0.60	

240+00 RT

Description	Area	C	
Impervious, soil B		0.05	0.9
Turf, soil D			0.24
Impervious, soil D			0.9
Forrested, soil D			0.3
Turf, soil B		0.05	0.16
Forrested, soil B			0.2

Impervious, soil C			0.9
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.1	
C		0.53	

241+00 RT

Description	Area	C	
Impervious, soil B		0.05	0.9
Turf, soil D			0.24
Impervious, soil D			0.9
Forrested, soil D			0.3
Turf, soil B		0.03	0.16
Forrested, soil B			0.2
Impervious, soil C			0.9
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.08	
C		0.62	

242+00 RT

Description	Area	C	
Impervious, soil B		0.05	0.9
Turf, soil D			0.24
Impervious, soil D			0.9
Forrested, soil D			0.3
Turf, soil B		0.02	0.16
Forrested, soil B			0.2
Impervious, soil C			0.9
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.07	
C		0.69	

251+00 LT

Description	Area	C	
Impervious, soil B		0.05	0.90
Turf, soil D			0.24
Impervious, soil D			0.90
Forrested, soil D			0.30
Turf, soil B		0.20	0.16
Forrested, soil B			0.20
Impervious, soil C			0.90
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.25	
C		0.31	

250+00 LT

Description	Area	C	
Impervious, soil B		0.19	0.90
Turf, soil D			0.24
Impervious, soil D			0.90
Forrested, soil D			0.30
Turf, soil B		0.42	0.16
Forrested, soil B		0.13	0.20
Impervious, soil C			0.90
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.74	
C		0.36	

249+00 LT

Description	Area	C	
Impervious, soil B		0.24	0.90
Turf, soil D			0.24
Impervious, soil D			0.90
Forrested, soil D			0.30
Turf, soil B		0.25	0.16
Forrested, soil B		0.03	0.20
Impervious, soil C			0.90
Forrested, soil C			0.23

Turf, soil C			0.19
Total area (acres)		0.52	
C		0.50	

248+27 LT

Description	Area	C	
Impervious, soil B		0.25	0.90
Turf, soil D			0.24
Impervious, soil D			0.90
Forrested, soil D			0.30
Turf, soil B		0.24	0.16
Forrested, soil B		0.04	0.20
Impervious, soil C			0.90
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.53	
C		0.51	

250+00 RT

Description	Area	C	
Impervious, soil B		0.03	0.90
Turf, soil D			0.24
Impervious, soil D			0.90
Forrested, soil D			0.30
Turf, soil B			0.16
Forrested, soil B		0.01	0.20
Impervious, soil C			0.90
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.04	
C		0.73	

249+00 RT

Description	Area	C	
Impervious, soil B		0.04	0.90
Turf, soil D			0.24
Impervious, soil D			0.90
Forrested, soil D			0.30
Turf, soil B			0.16
Forrested, soil B		0.07	0.20
Impervious, soil C			0.90
Forrested, soil C			0.23
Turf, soil C			0.19
Total area (acres)		0.11	
C		0.45	

248+00 RT

Description	Area	C	
Impervious, soil B		0.07	0.90
Turf, soil D			0.24

APPENDIX D.3
DITCH COMPUTATION

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

159+00 LT

Triangular

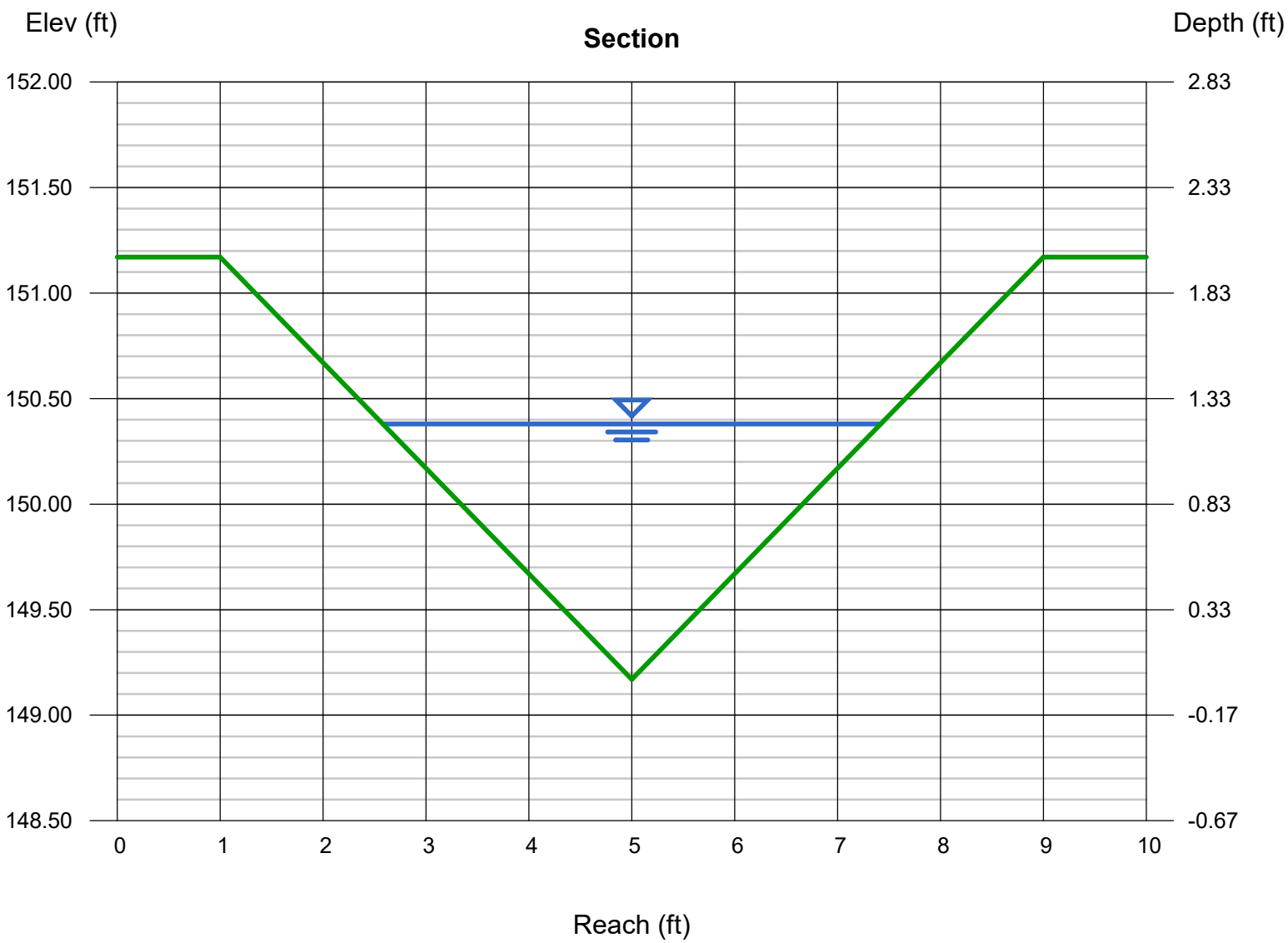
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 149.17
Slope (%)	= 0.46
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.88

Highlighted

Depth (ft)	= 1.21
Q (cfs)	= 4.880
Area (sqft)	= 2.93
Velocity (ft/s)	= 1.67
Wetted Perim (ft)	= 5.41
Crit Depth, Yc (ft)	= 0.82
Top Width (ft)	= 4.84
EGL (ft)	= 1.25



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 27 2023

160+00 LT

Triangular

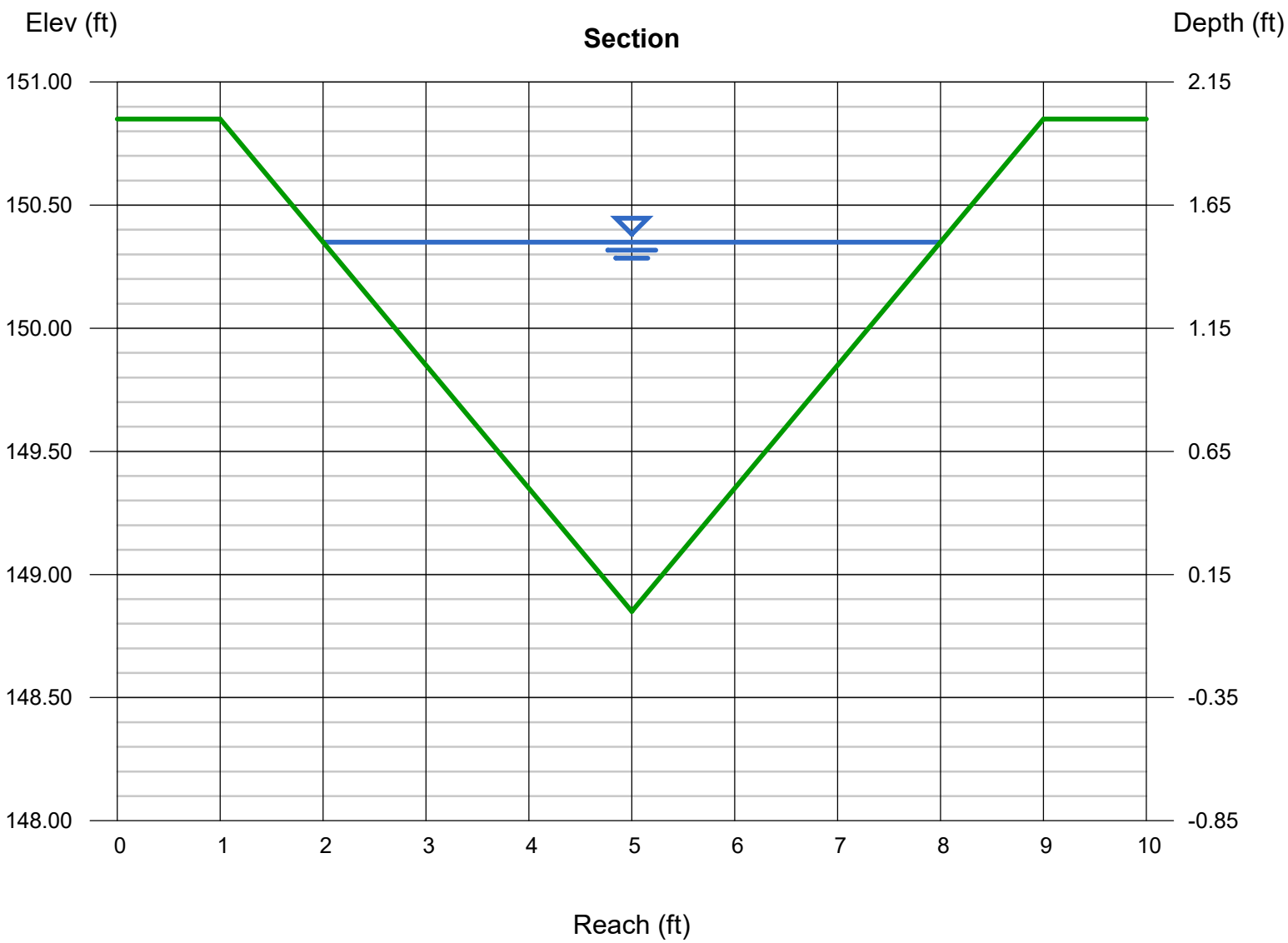
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 148.85
Slope (%)	= 0.32
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.21

Highlighted

Depth (ft)	= 1.50
Q (cfs)	= 7.210
Area (sqft)	= 4.50
Velocity (ft/s)	= 1.60
Wetted Perim (ft)	= 6.71
Crit Depth, Yc (ft)	= 0.96
Top Width (ft)	= 6.00
EGL (ft)	= 1.54



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 27 2023

161+00 LT

Triangular

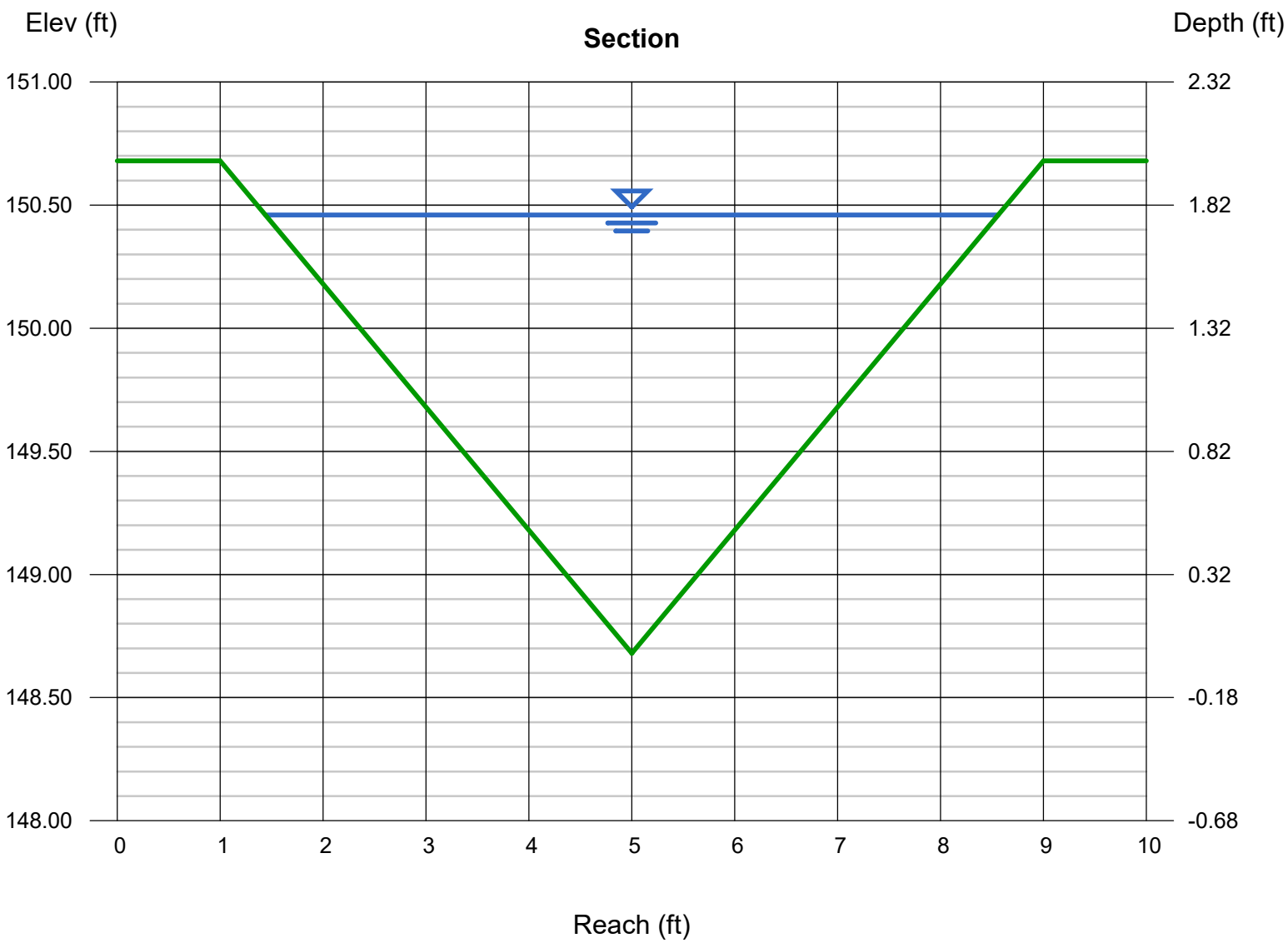
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	148.68
Slope (%)	=	0.17
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	8.28

Highlighted

Depth (ft)	=	1.78
Q (cfs)	=	8.280
Area (sqft)	=	6.34
Velocity (ft/s)	=	1.31
Wetted Perim (ft)	=	7.96
Crit Depth, Yc (ft)	=	1.02
Top Width (ft)	=	7.12
EGL (ft)	=	1.81



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

162+10 LT

Triangular

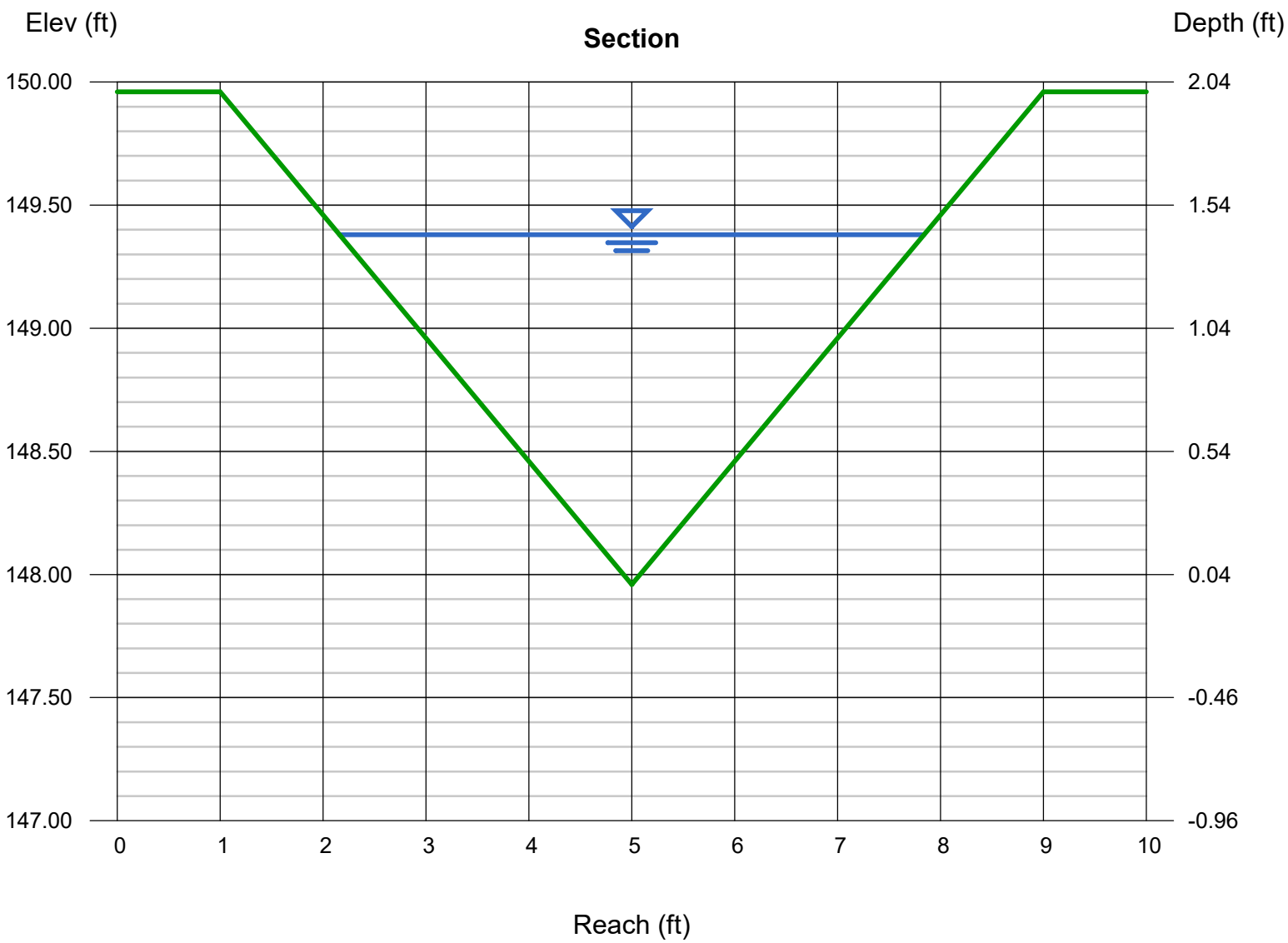
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 147.96
Slope (%)	= 0.65
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.82

Highlighted

Depth (ft)	= 1.42
Q (cfs)	= 8.820
Area (sqft)	= 4.03
Velocity (ft/s)	= 2.19
Wetted Perim (ft)	= 6.35
Crit Depth, Yc (ft)	= 1.04
Top Width (ft)	= 5.68
EGL (ft)	= 1.49



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 31 2023

162+11 LT

Triangular

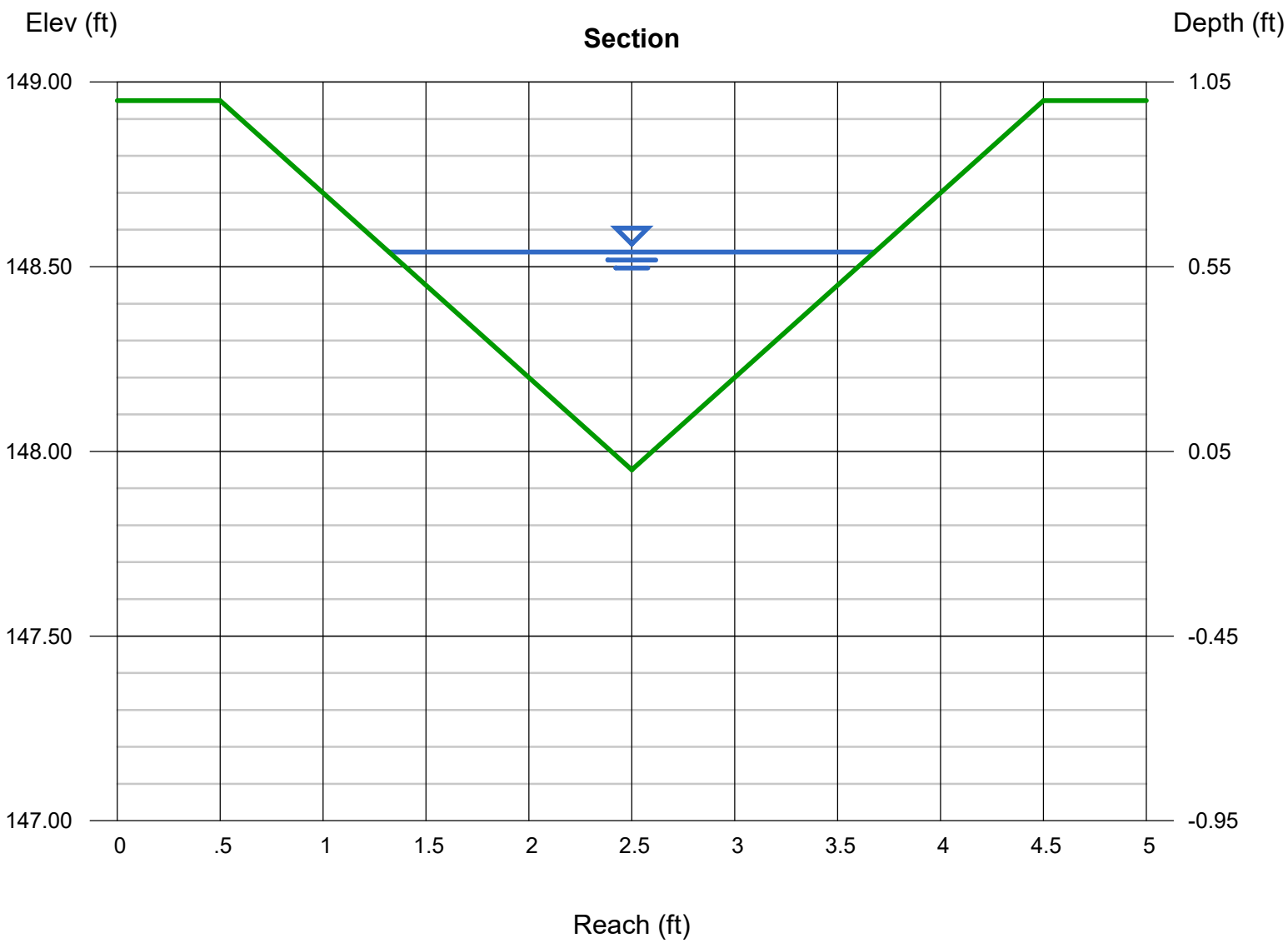
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 147.95
Slope (%)	= 1.43
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.25

Highlighted

Depth (ft)	= 0.59
Q (cfs)	= 1.250
Area (sqft)	= 0.70
Velocity (ft/s)	= 1.80
Wetted Perim (ft)	= 2.64
Crit Depth, Yc (ft)	= 0.48
Top Width (ft)	= 2.36
EGL (ft)	= 0.64



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 31 2023

163+00 LT

Triangular

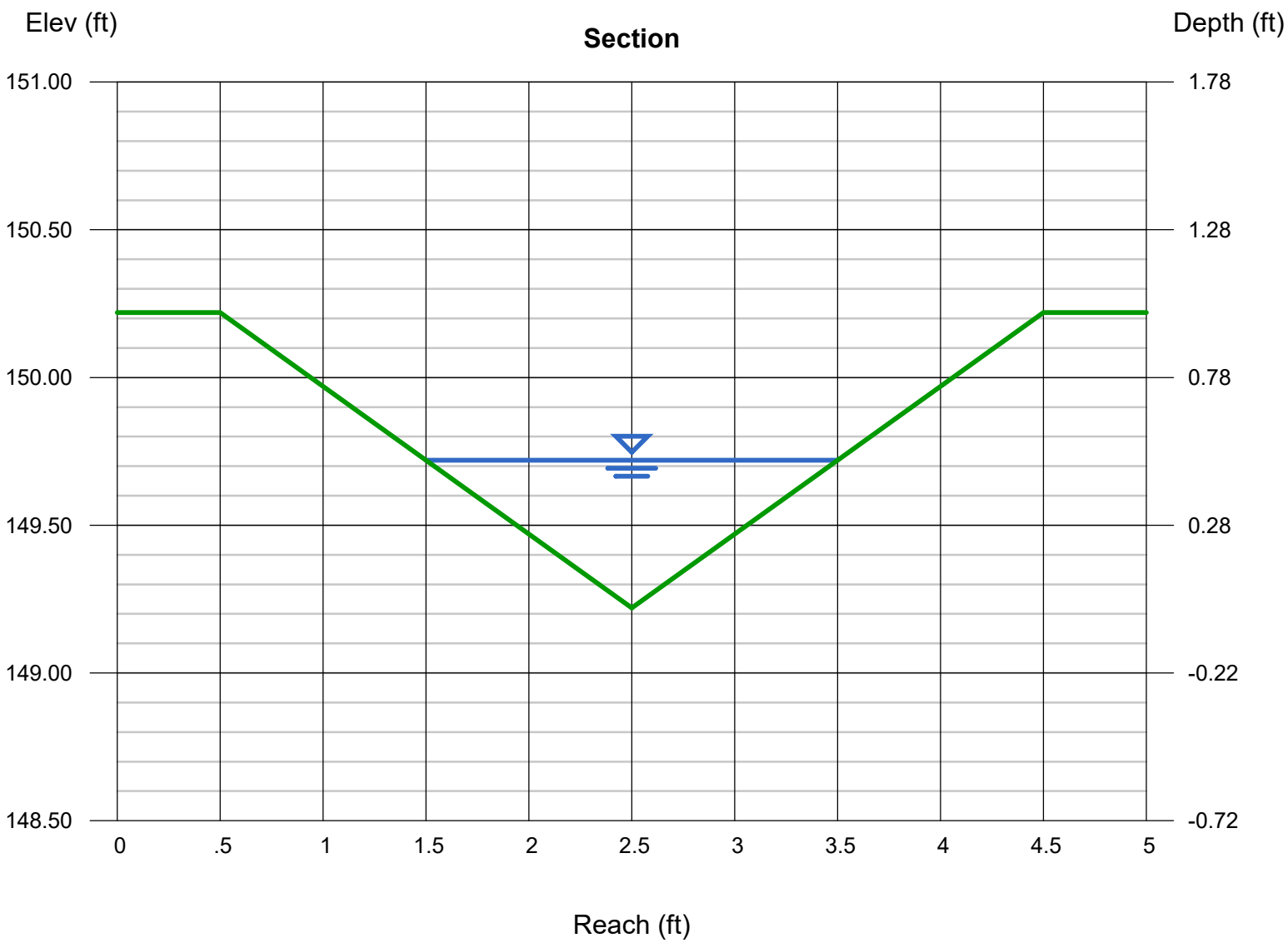
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 149.22
Slope (%)	= 1.28
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.77

Highlighted

Depth (ft)	= 0.50
Q (cfs)	= 0.770
Area (sqft)	= 0.50
Velocity (ft/s)	= 1.54
Wetted Perim (ft)	= 2.24
Crit Depth, Yc (ft)	= 0.40
Top Width (ft)	= 2.00
EGL (ft)	= 0.54



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 31 2023

164+00 LT

Triangular

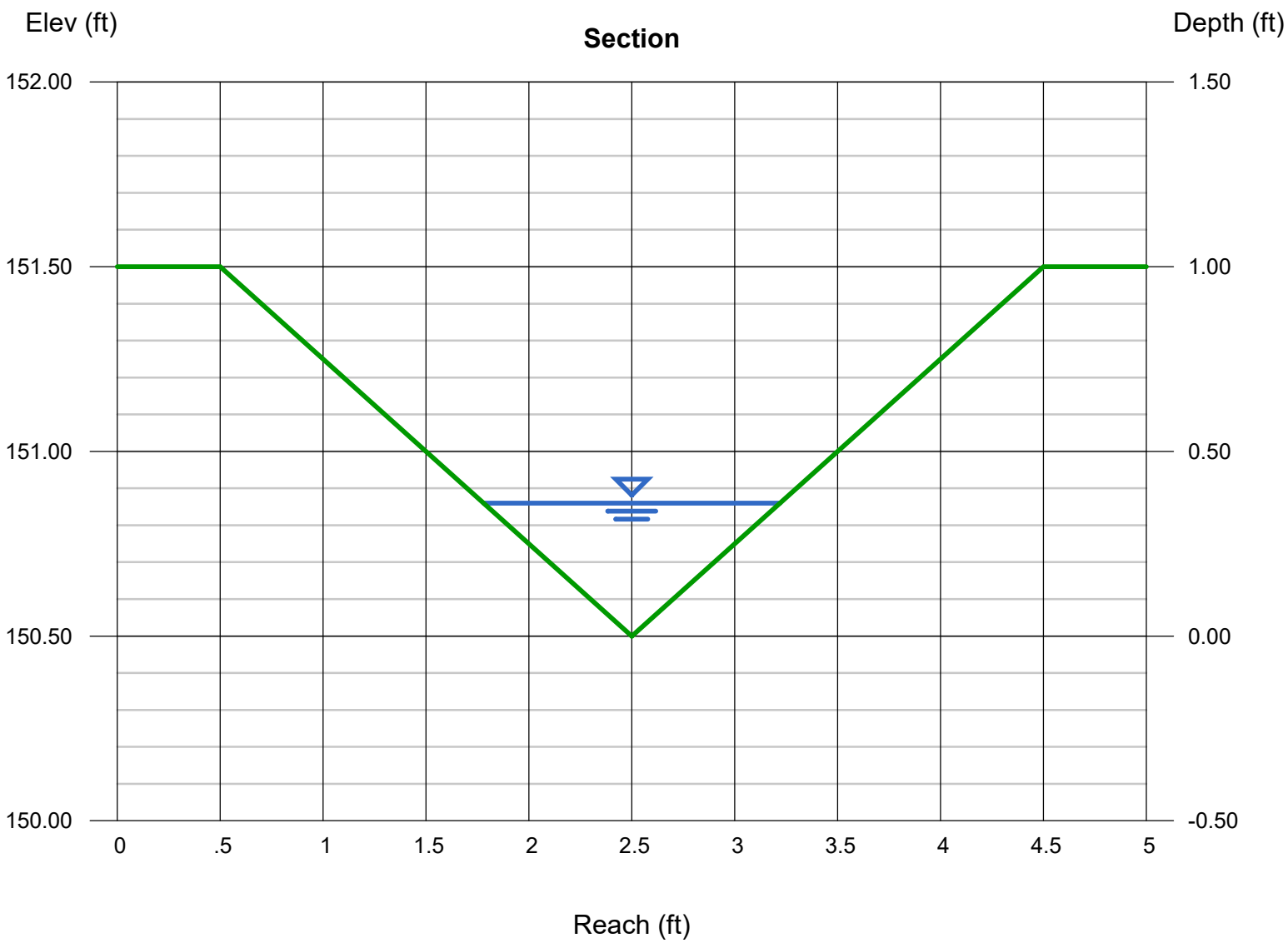
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 150.50
Slope (%)	= 1.18
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.30

Highlighted

Depth (ft)	= 0.36
Q (cfs)	= 0.300
Area (sqft)	= 0.26
Velocity (ft/s)	= 1.16
Wetted Perim (ft)	= 1.61
Crit Depth, Yc (ft)	= 0.27
Top Width (ft)	= 1.44
EGL (ft)	= 0.38



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

165+00 LT

Triangular

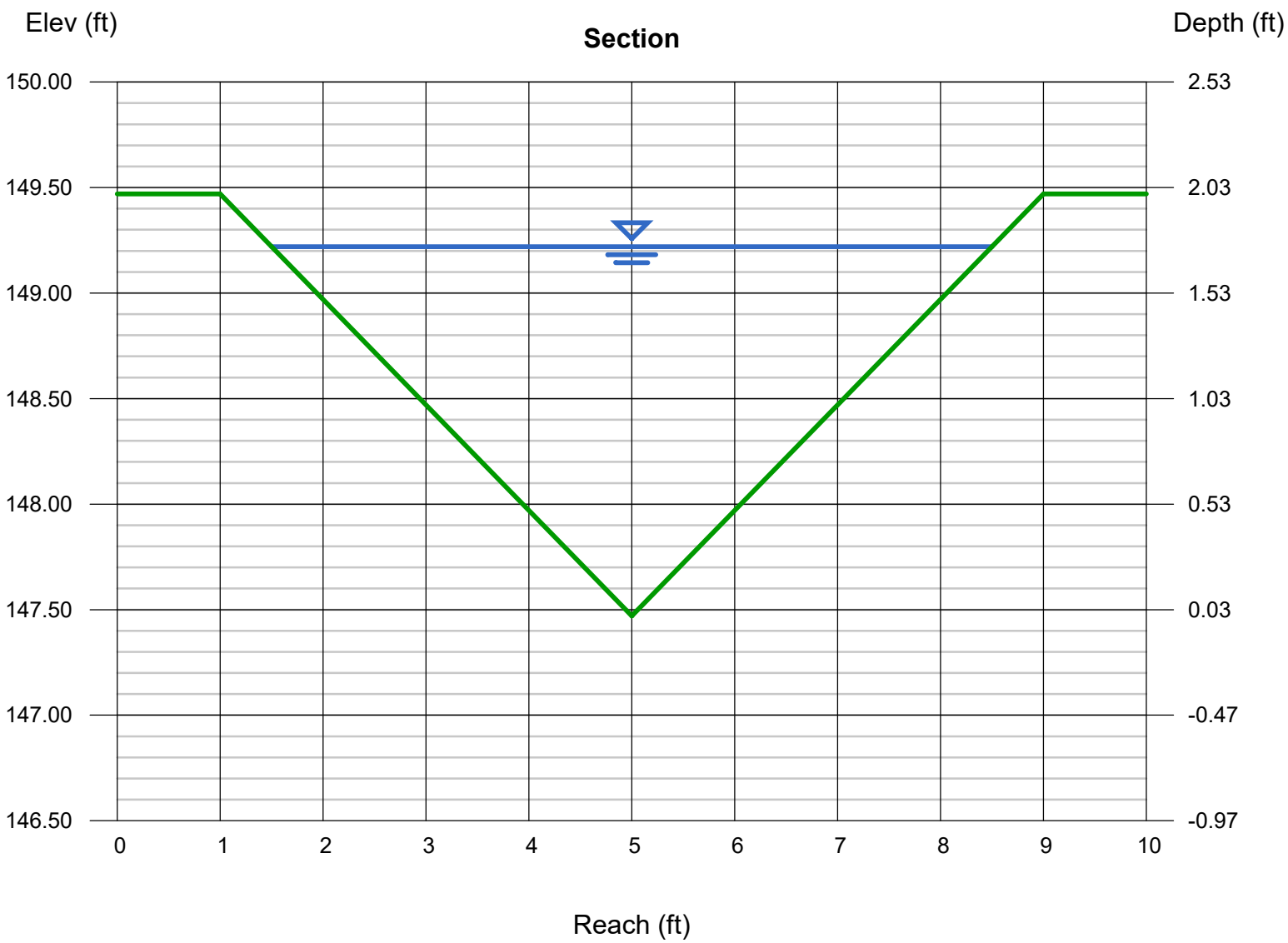
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	147.47
Slope (%)	=	4.96
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	42.89

Highlighted

Depth (ft)	=	1.75
Q (cfs)	=	42.89
Area (sqft)	=	6.12
Velocity (ft/s)	=	7.00
Wetted Perim (ft)	=	7.83
Crit Depth, Yc (ft)	=	1.96
Top Width (ft)	=	7.00
EGL (ft)	=	2.51



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 31 2023

166+00 LT

Triangular

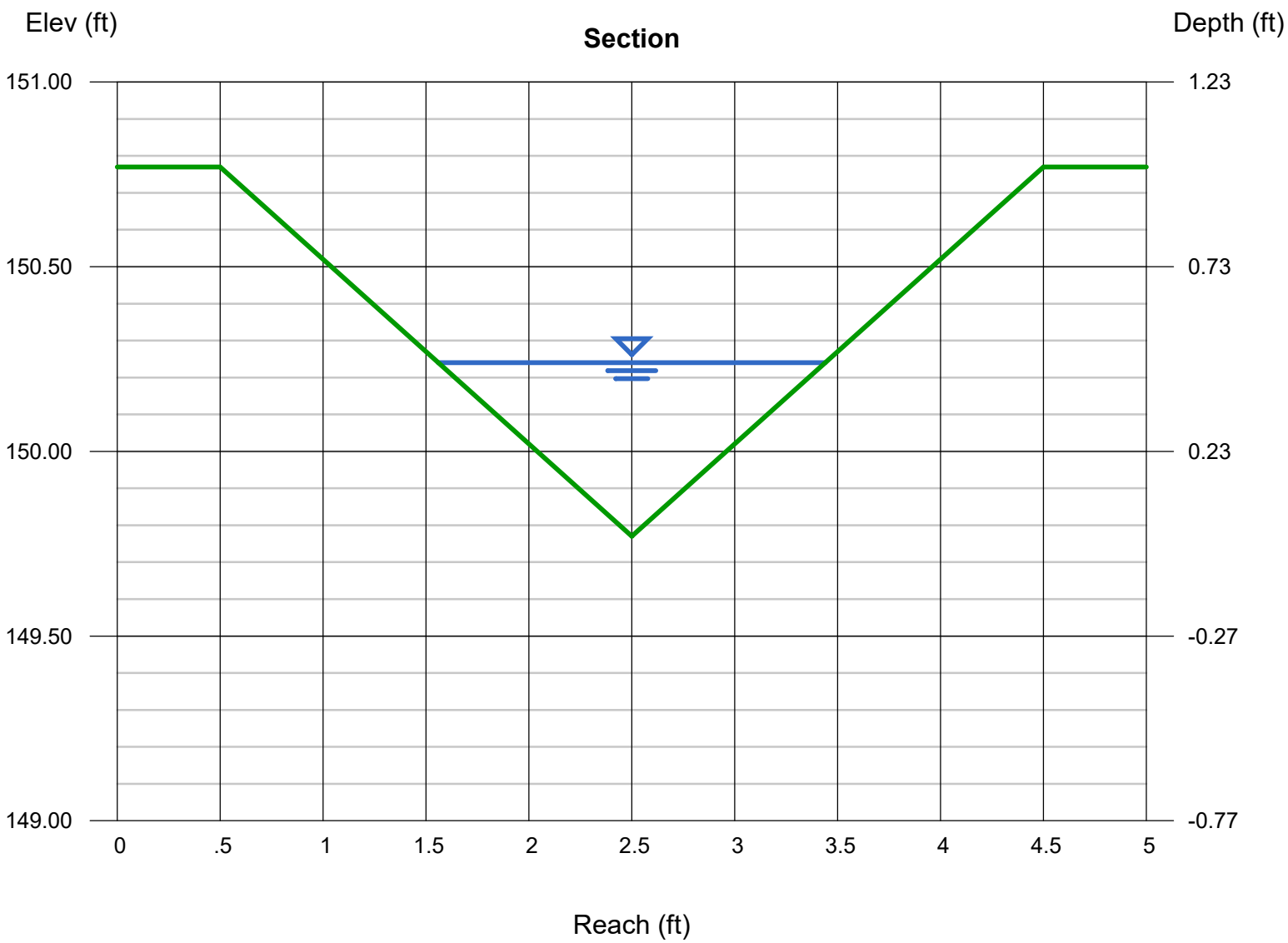
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	149.77
Slope (%)	=	1.86
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.78

Highlighted

Depth (ft)	=	0.47
Q (cfs)	=	0.780
Area (sqft)	=	0.44
Velocity (ft/s)	=	1.77
Wetted Perim (ft)	=	2.10
Crit Depth, Yc (ft)	=	0.40
Top Width (ft)	=	1.88
EGL (ft)	=	0.52



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 31 2023

166+65 LT

Triangular

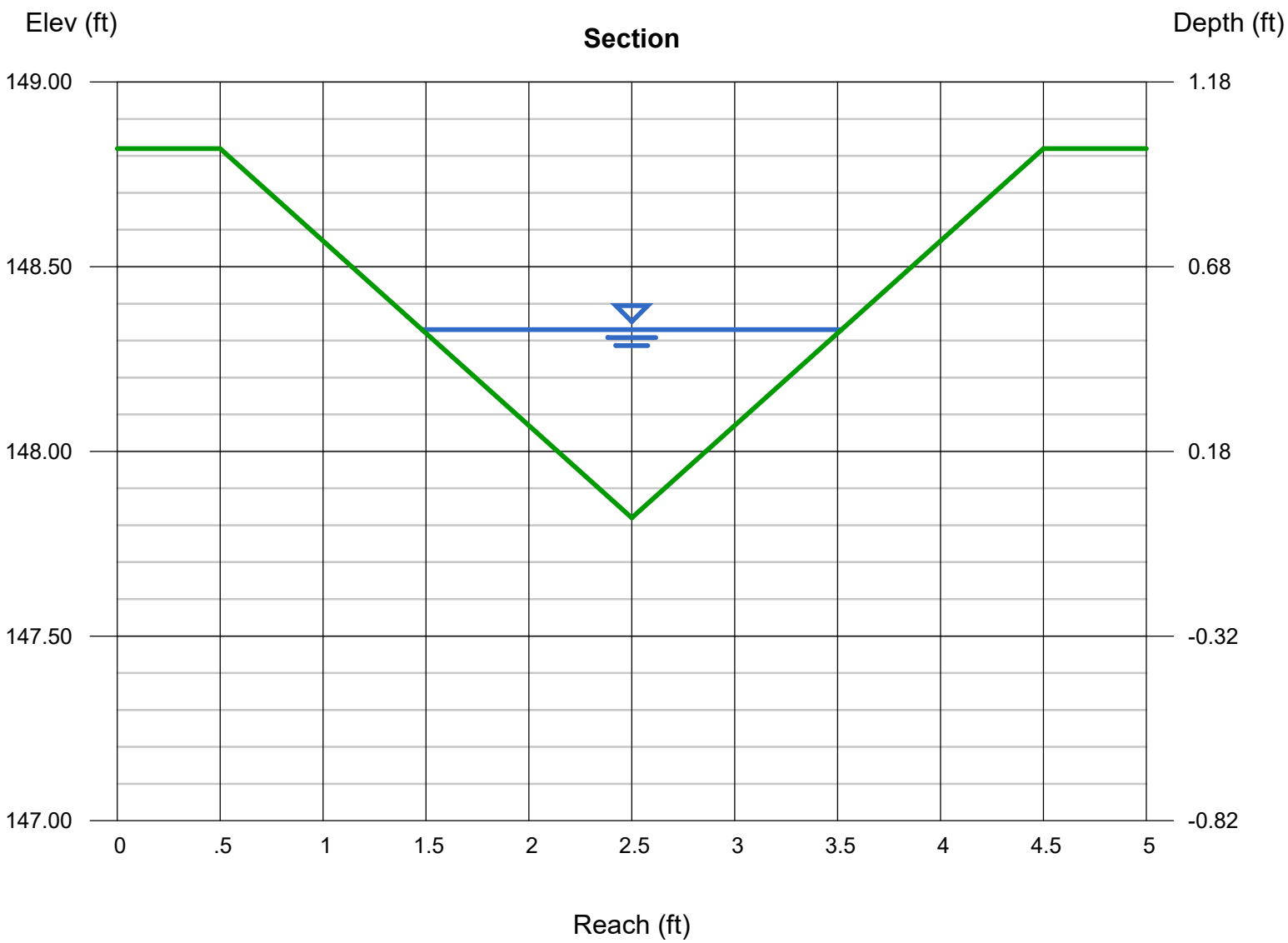
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	147.82
Slope (%)	=	3.00
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.22

Highlighted

Depth (ft)	=	0.51
Q (cfs)	=	1.220
Area (sqft)	=	0.52
Velocity (ft/s)	=	2.35
Wetted Perim (ft)	=	2.28
Crit Depth, Yc (ft)	=	0.48
Top Width (ft)	=	2.04
EGL (ft)	=	0.60



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

166+66 LT

Triangular

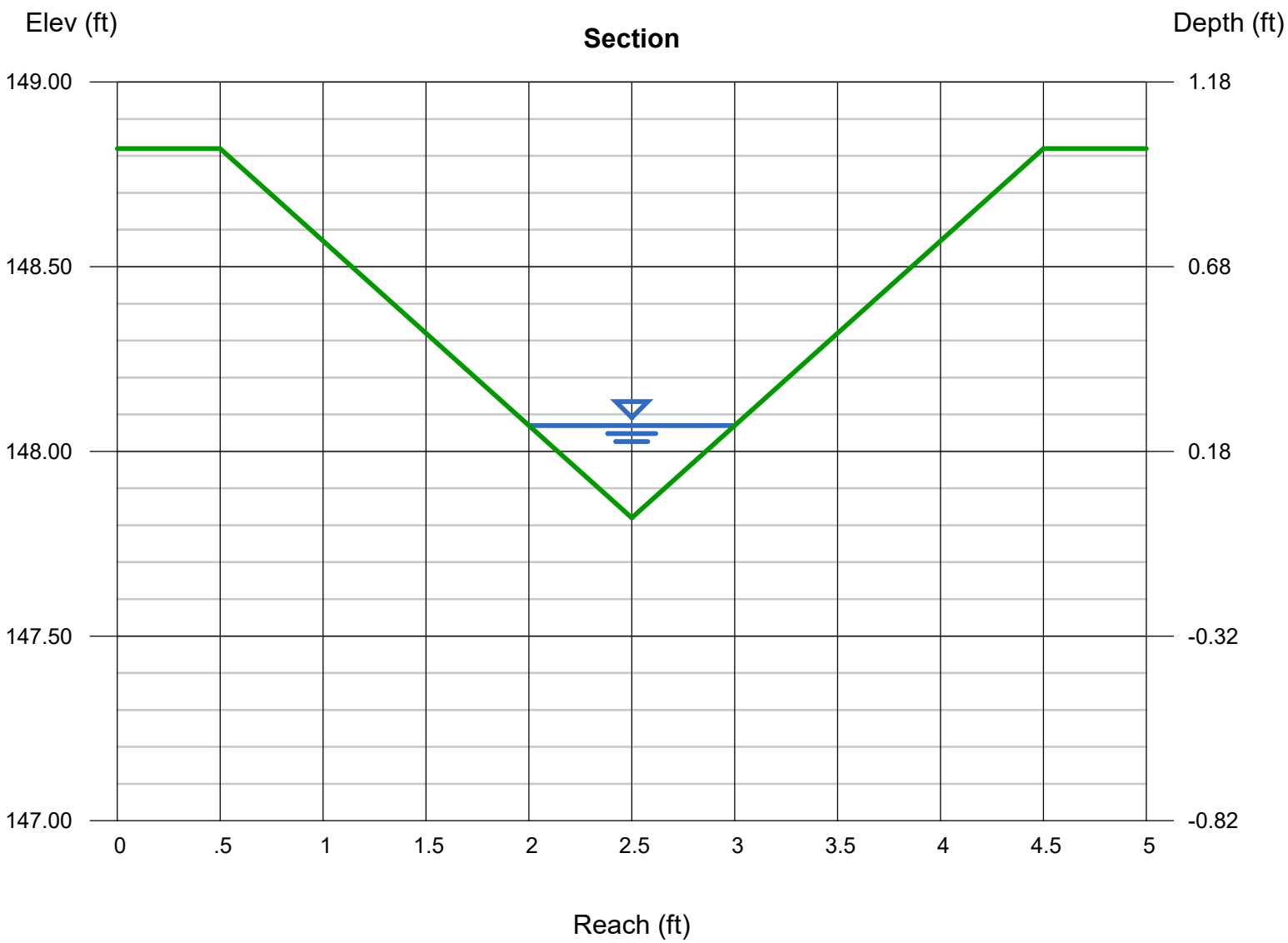
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	147.82
Slope (%)	=	3.30
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.19

Highlighted

Depth (ft)	=	0.25
Q (cfs)	=	0.190
Area (sqft)	=	0.13
Velocity (ft/s)	=	1.52
Wetted Perim (ft)	=	1.12
Crit Depth, Yc (ft)	=	0.23
Top Width (ft)	=	1.00
EGL (ft)	=	0.29



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

168+00 LT

Triangular

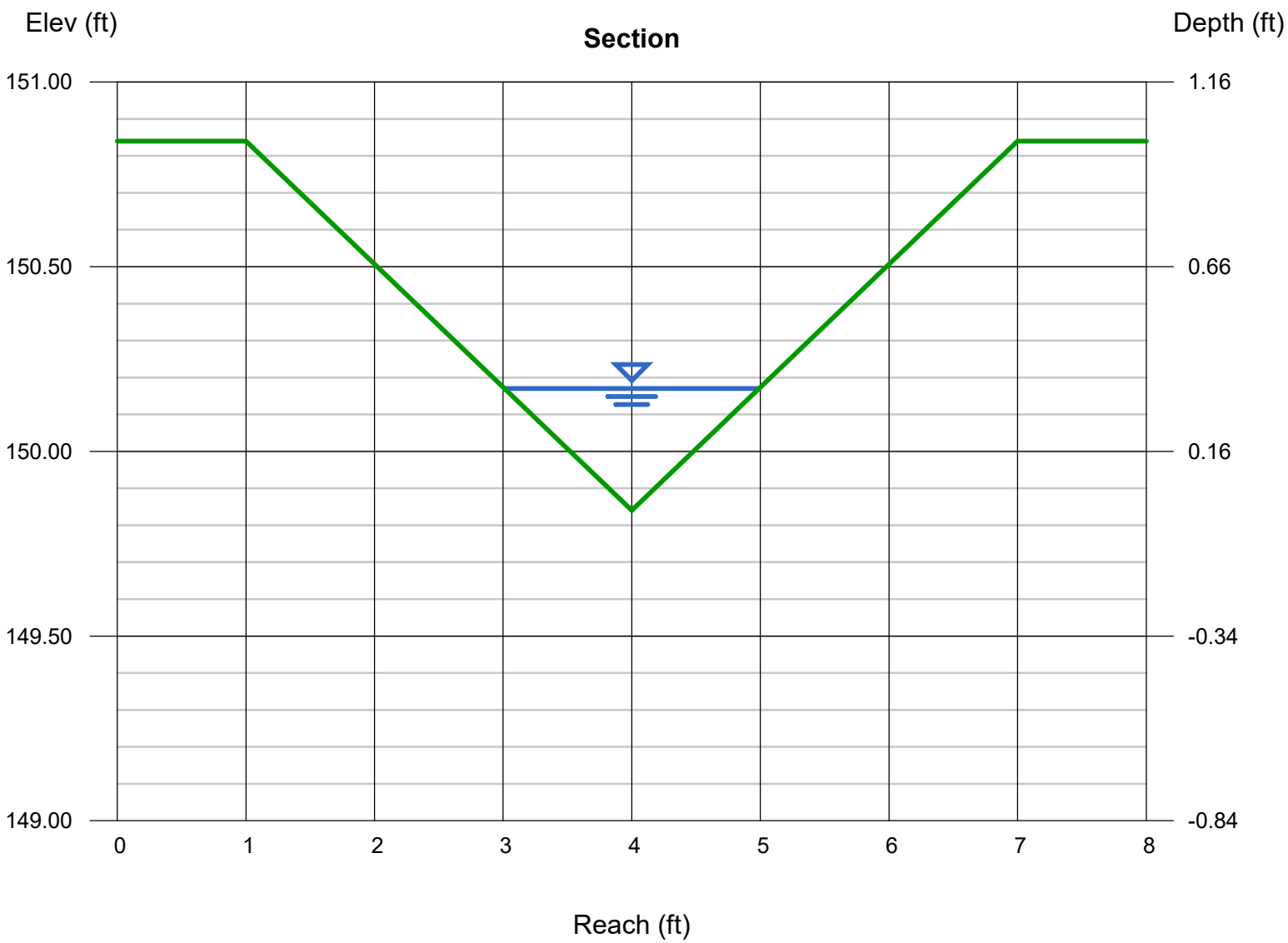
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	149.84
Slope (%)	=	0.65
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.27

Highlighted

Depth (ft)	=	0.33
Q (cfs)	=	0.270
Area (sqft)	=	0.33
Velocity (ft/s)	=	0.83
Wetted Perim (ft)	=	2.09
Crit Depth, Yc (ft)	=	0.22
Top Width (ft)	=	1.98
EGL (ft)	=	0.34



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

169+00 LT

Triangular

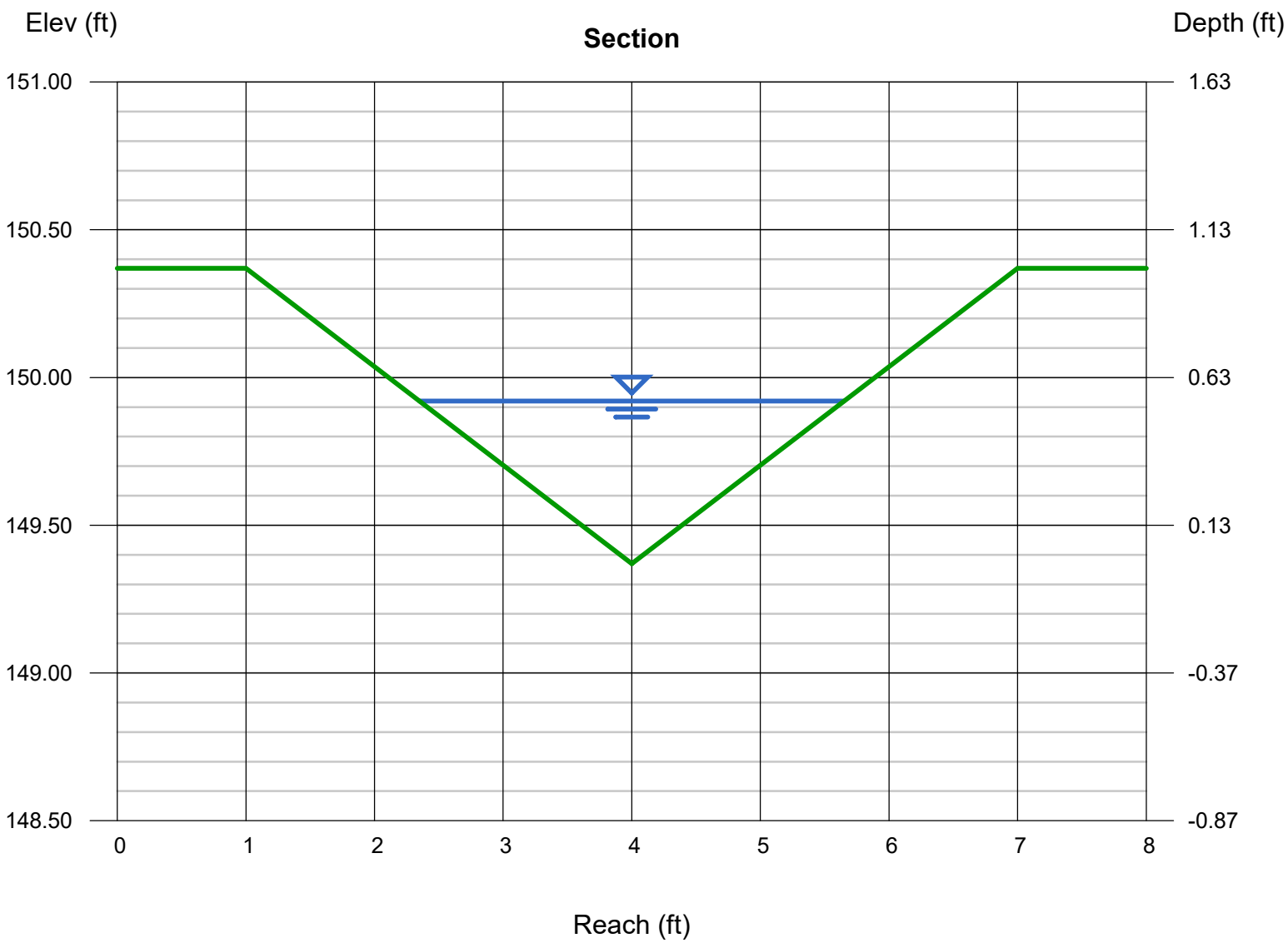
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	149.37
Slope (%)	=	0.47
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.94

Highlighted

Depth (ft)	=	0.55
Q (cfs)	=	0.940
Area (sqft)	=	0.91
Velocity (ft/s)	=	1.04
Wetted Perim (ft)	=	3.48
Crit Depth, Yc (ft)	=	0.37
Top Width (ft)	=	3.30
EGL (ft)	=	0.57



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

170+00 LT

Triangular

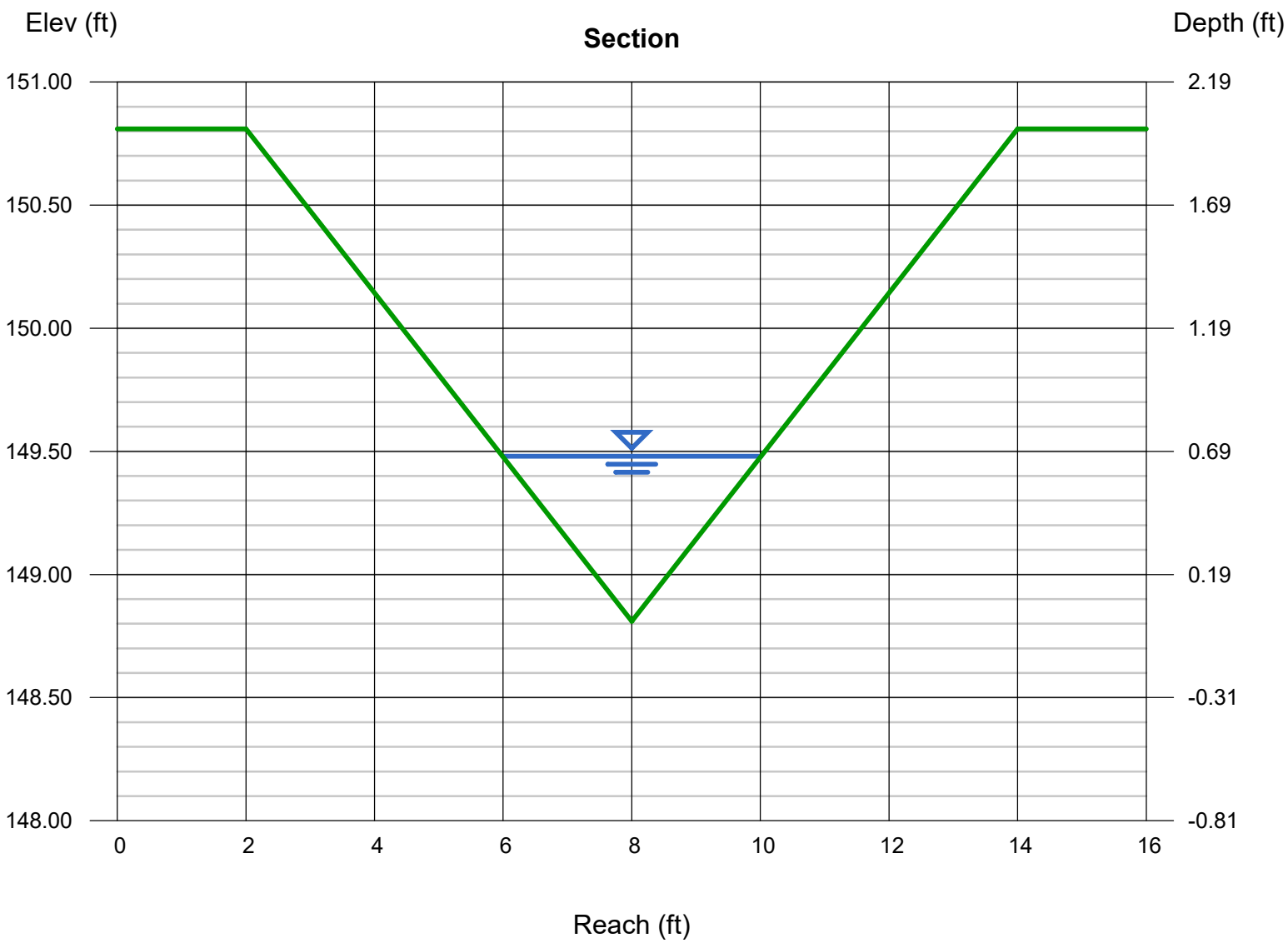
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 148.81
Slope (%)	= 0.56
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.70

Highlighted

Depth (ft)	= 0.67
Q (cfs)	= 1.700
Area (sqft)	= 1.35
Velocity (ft/s)	= 1.26
Wetted Perim (ft)	= 4.24
Crit Depth, Yc (ft)	= 0.46
Top Width (ft)	= 4.02
EGL (ft)	= 0.69



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

171+43 LT

Triangular

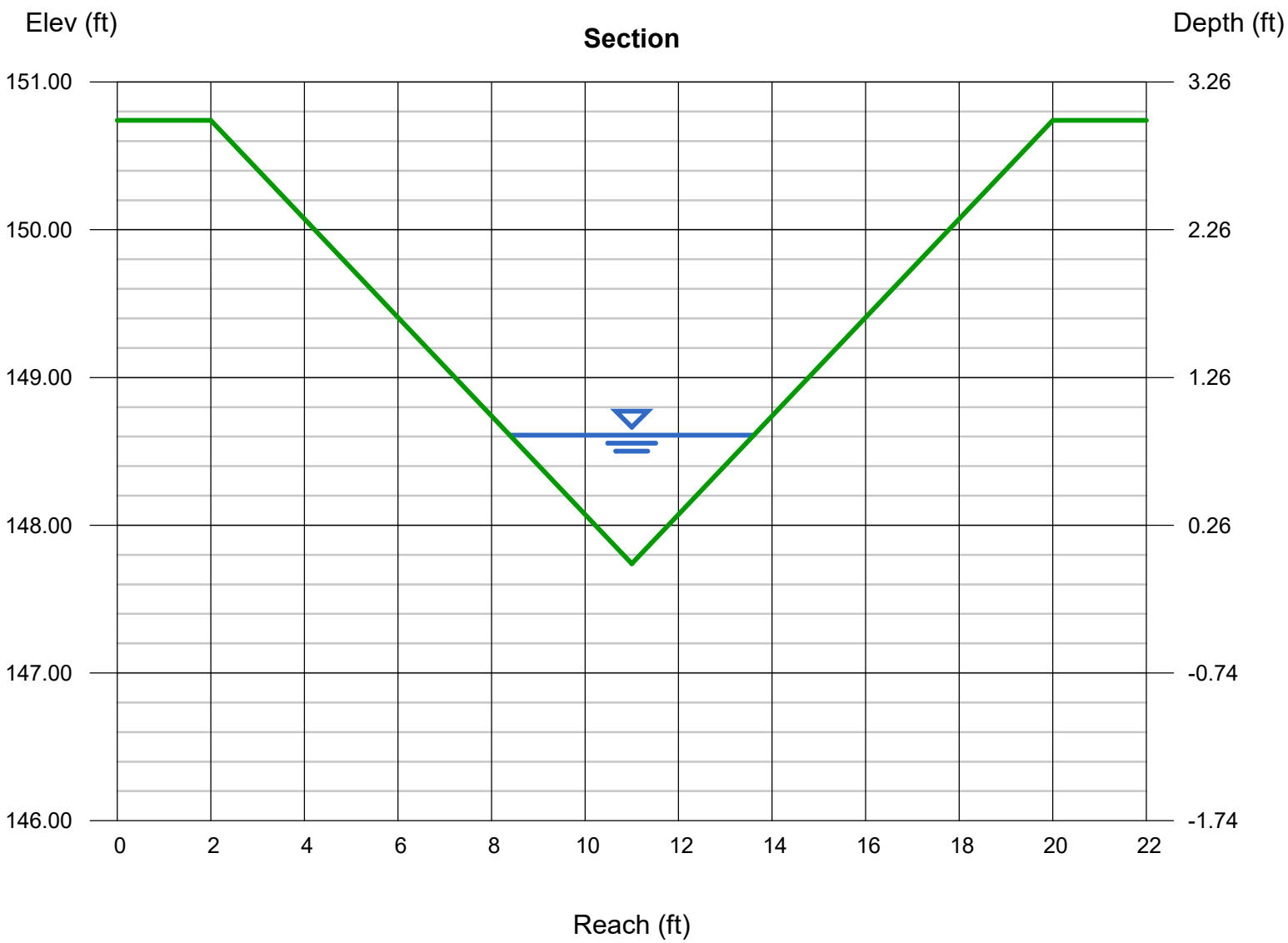
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 147.74
Slope (%)	= 0.75
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.96

Highlighted

Depth (ft)	= 0.87
Q (cfs)	= 3.960
Area (sqft)	= 2.27
Velocity (ft/s)	= 1.74
Wetted Perim (ft)	= 5.50
Crit Depth, Yc (ft)	= 0.65
Top Width (ft)	= 5.22
EGL (ft)	= 0.92



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 28 2023

176+00 LT

Triangular

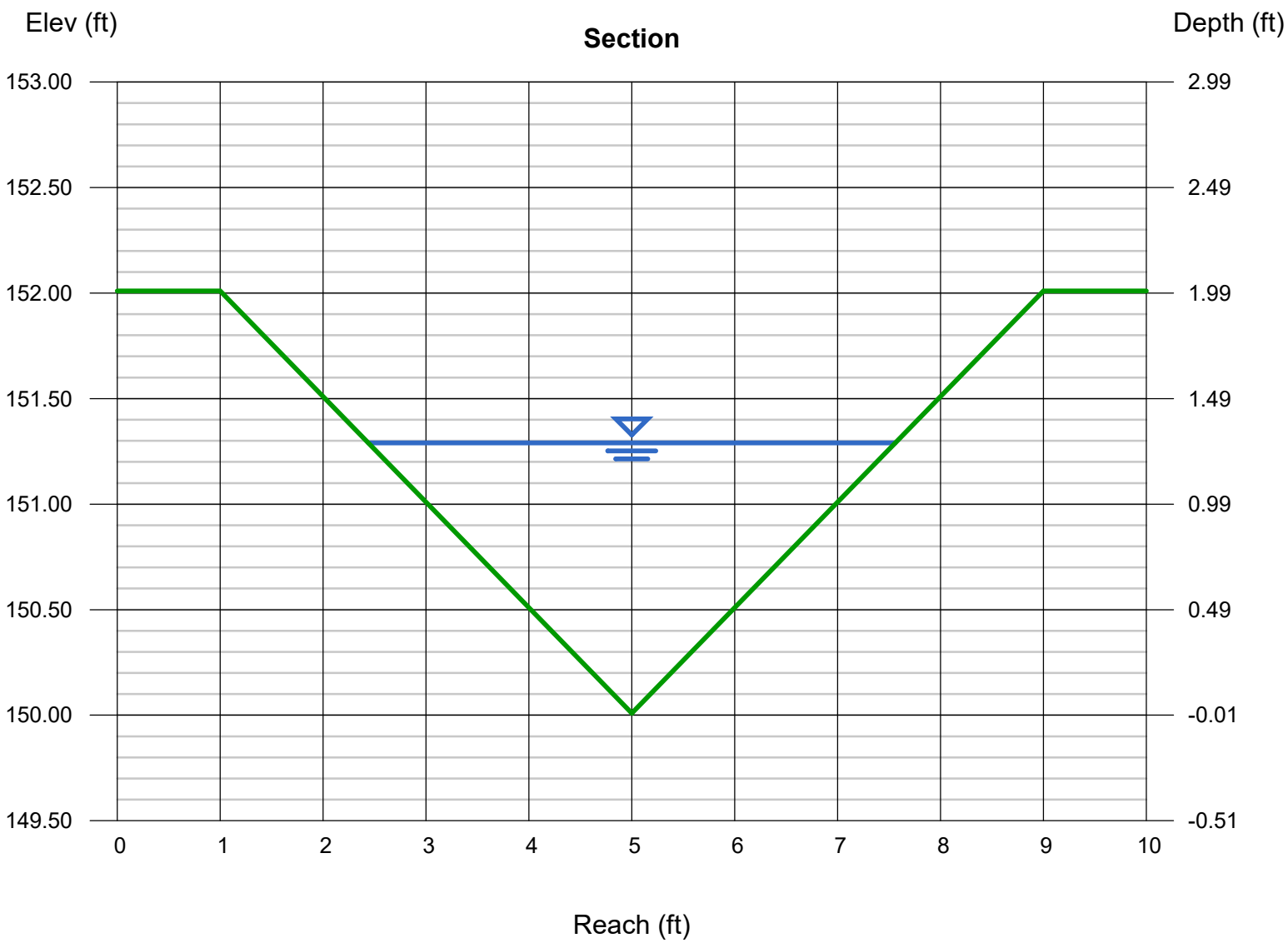
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	150.01
Slope (%)	=	1.19
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	9.07

Highlighted

Depth (ft)	=	1.28
Q (cfs)	=	9.070
Area (sqft)	=	3.28
Velocity (ft/s)	=	2.77
Wetted Perim (ft)	=	5.72
Crit Depth, Yc (ft)	=	1.06
Top Width (ft)	=	5.12
EGL (ft)	=	1.40



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

177+00 LT

Triangular

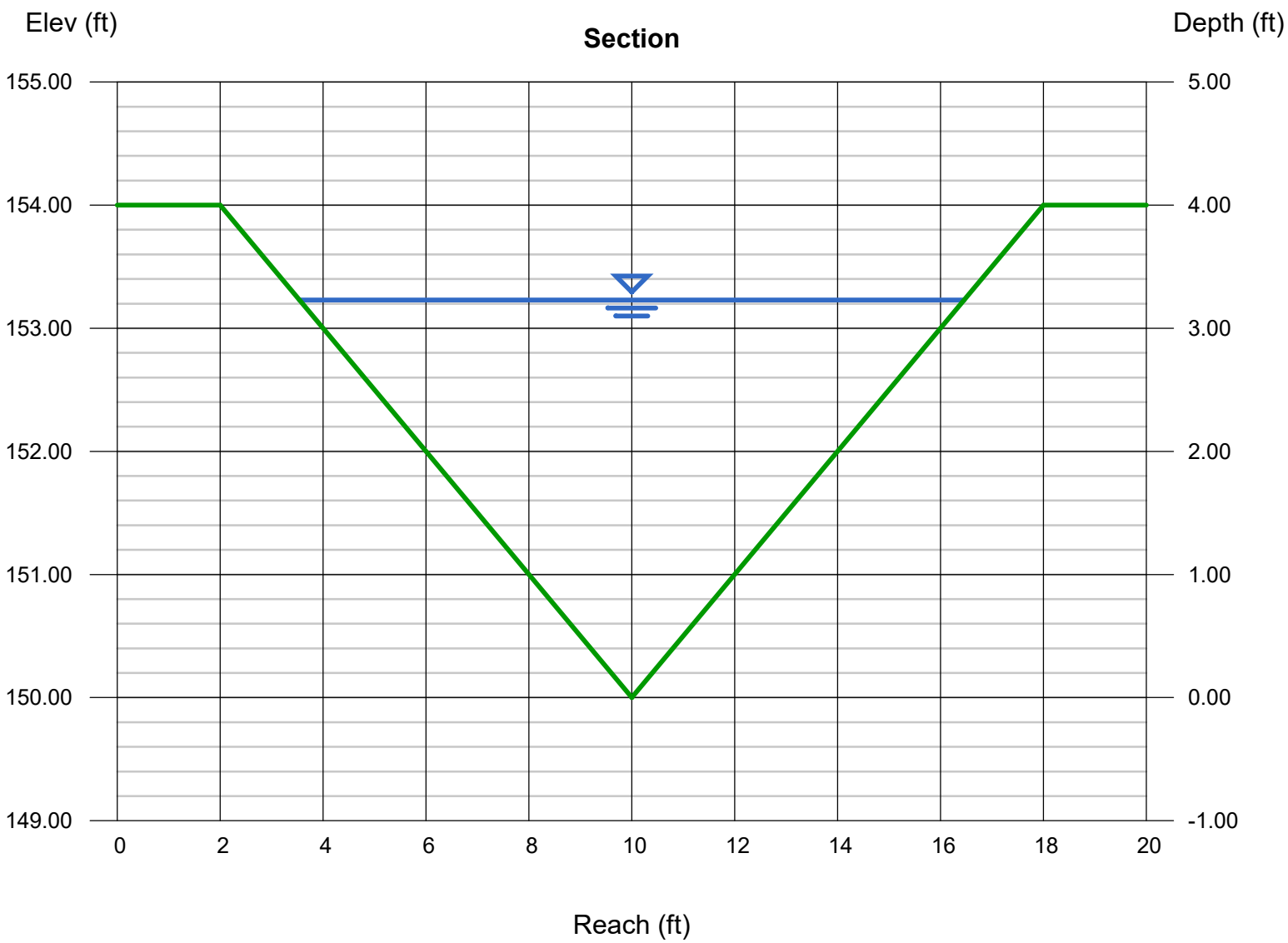
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	4.00
Invert Elev (ft)	=	150.00
Slope (%)	=	0.01
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	9.84

Highlighted

Depth (ft)	=	3.23
Q (cfs)	=	9.840
Area (sqft)	=	20.87
Velocity (ft/s)	=	0.47
Wetted Perim (ft)	=	14.44
Crit Depth, Yc (ft)	=	1.09
Top Width (ft)	=	12.92
EGL (ft)	=	3.23



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

178+00 LT

Triangular

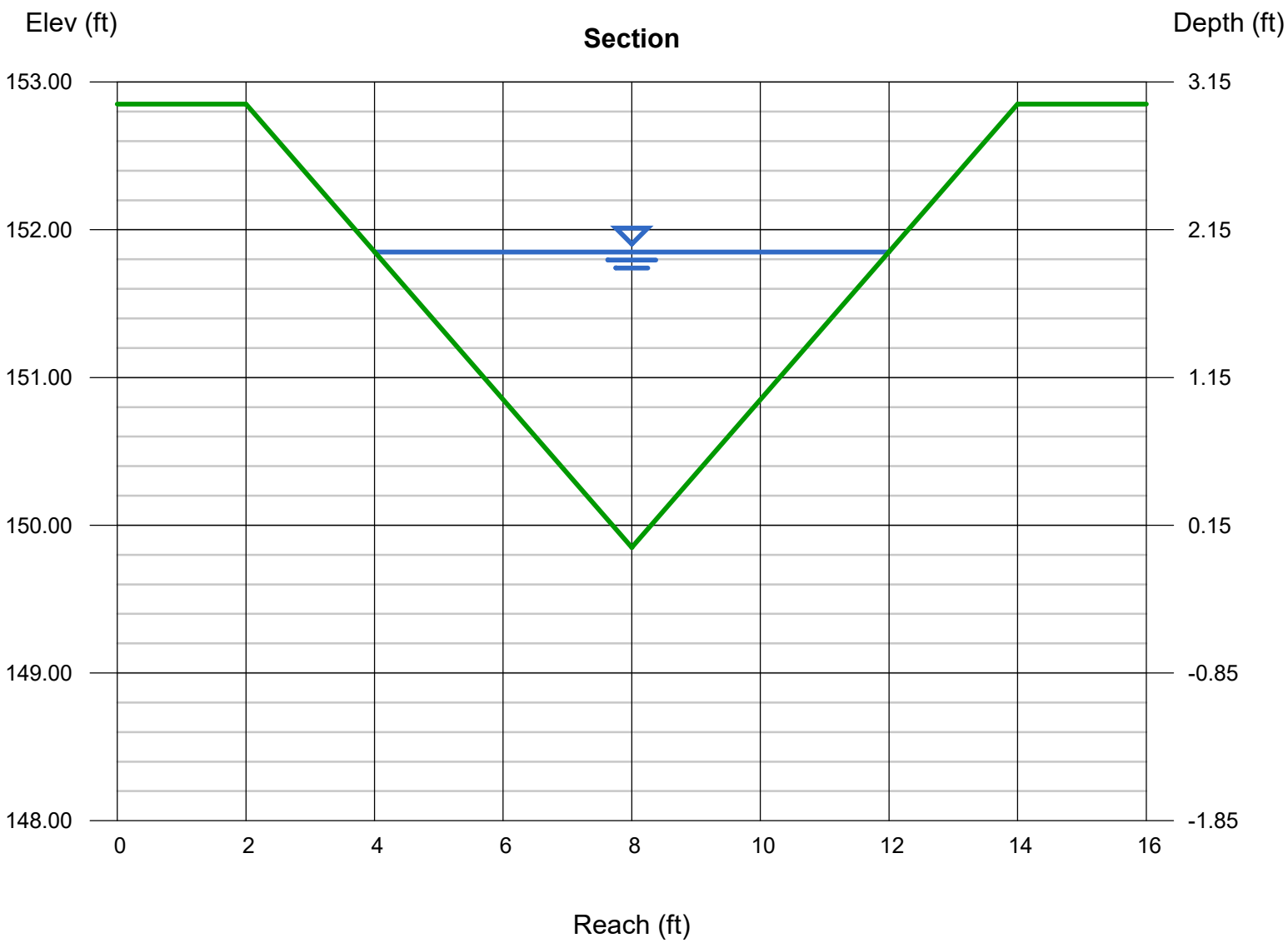
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 149.85
Slope (%)	= 0.15
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 10.60

Highlighted

Depth (ft)	= 2.00
Q (cfs)	= 10.60
Area (sqft)	= 8.00
Velocity (ft/s)	= 1.33
Wetted Perim (ft)	= 8.94
Crit Depth, Yc (ft)	= 1.12
Top Width (ft)	= 8.00
EGL (ft)	= 2.03



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

179+00 LT

Triangular

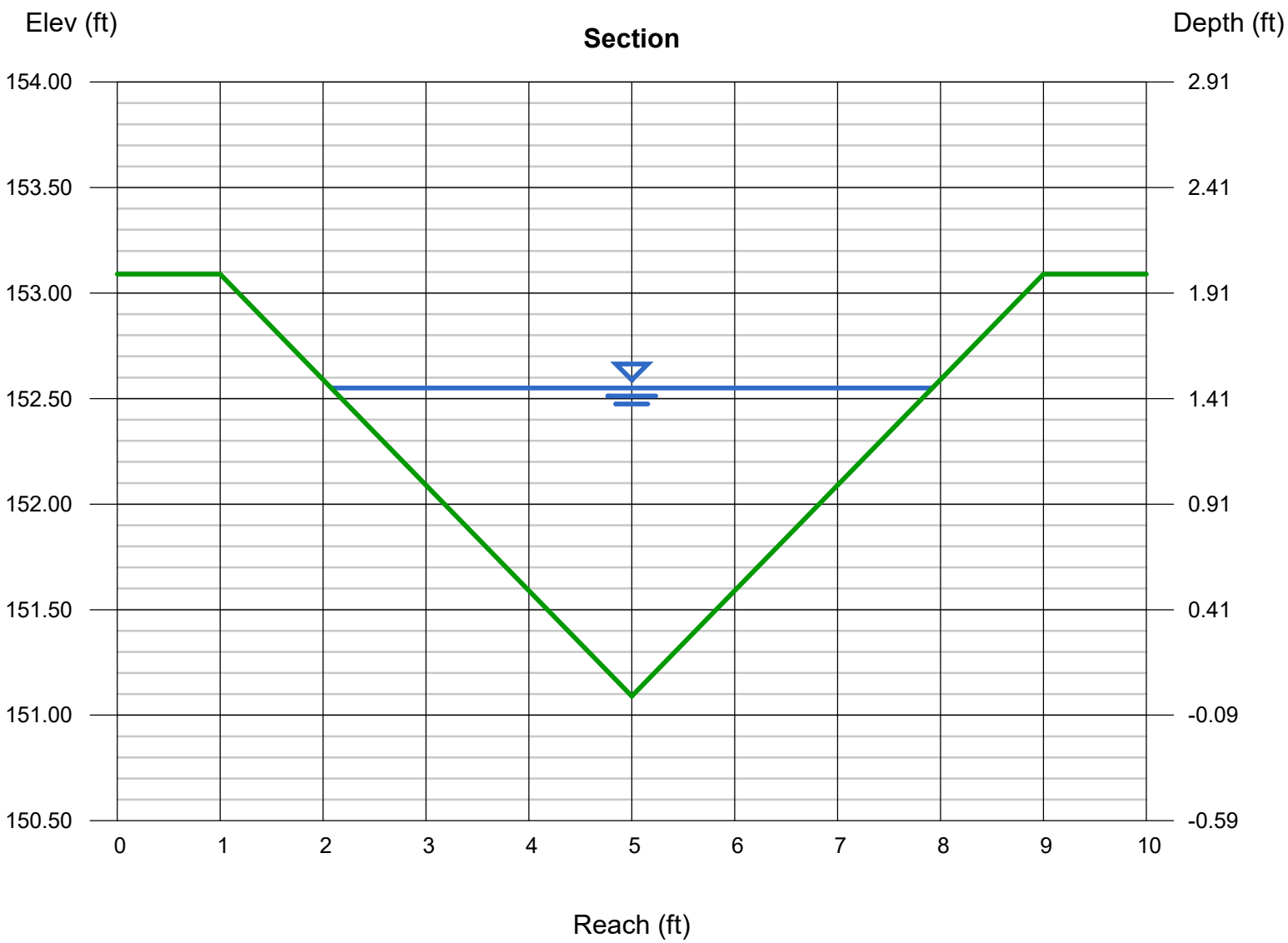
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 151.09
Slope (%)	= 0.86
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 11.00

Highlighted

Depth (ft)	= 1.46
Q (cfs)	= 11.00
Area (sqft)	= 4.26
Velocity (ft/s)	= 2.58
Wetted Perim (ft)	= 6.53
Crit Depth, Yc (ft)	= 1.14
Top Width (ft)	= 5.84
EGL (ft)	= 1.56



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

180+00 LT

Triangular

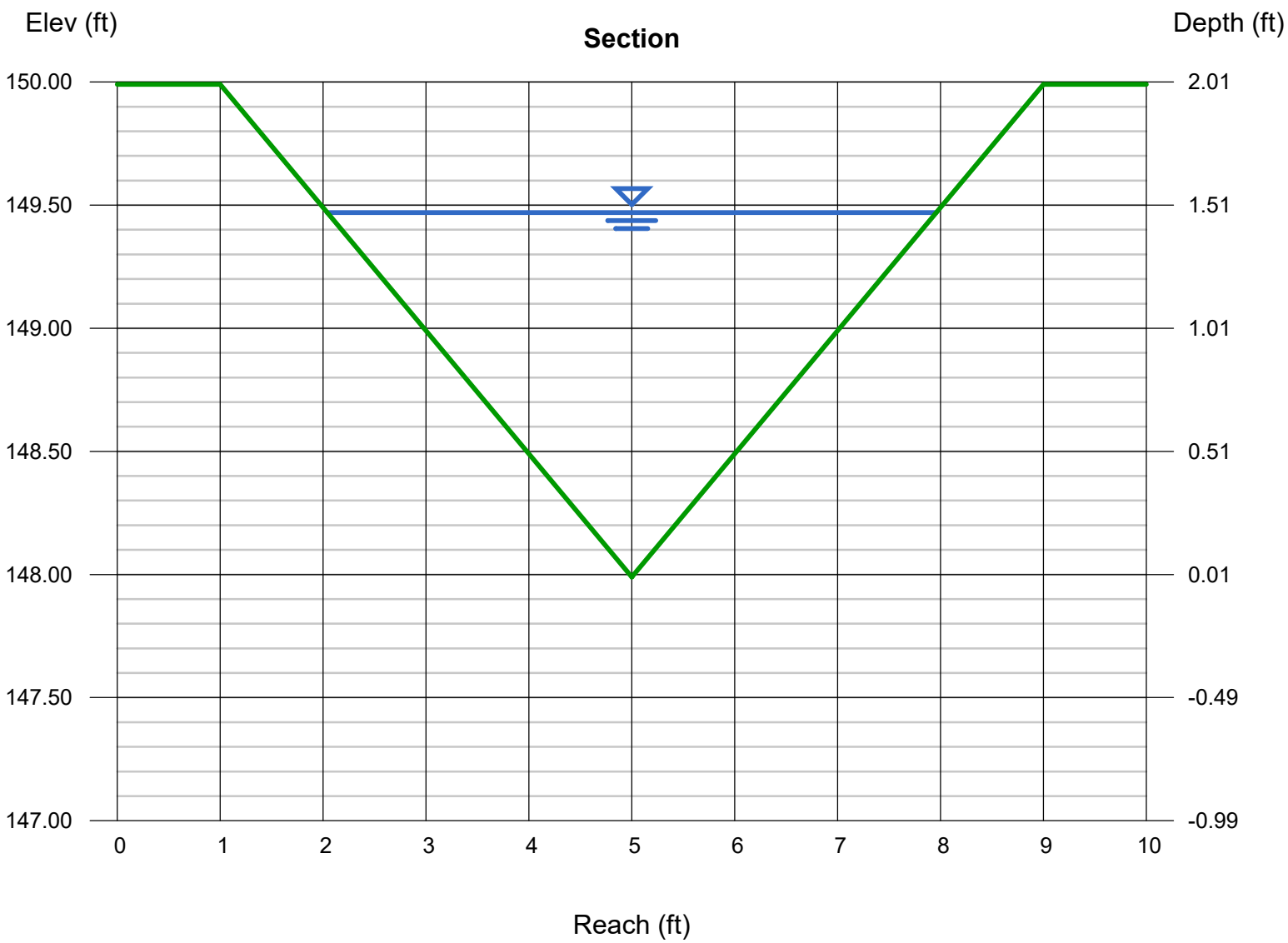
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 147.99
Slope (%)	= 1.00
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 12.15

Highlighted

Depth (ft)	= 1.48
Q (cfs)	= 12.15
Area (sqft)	= 4.38
Velocity (ft/s)	= 2.77
Wetted Perim (ft)	= 6.62
Crit Depth, Yc (ft)	= 1.19
Top Width (ft)	= 5.92
EGL (ft)	= 1.60



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

180+70 LT

Triangular

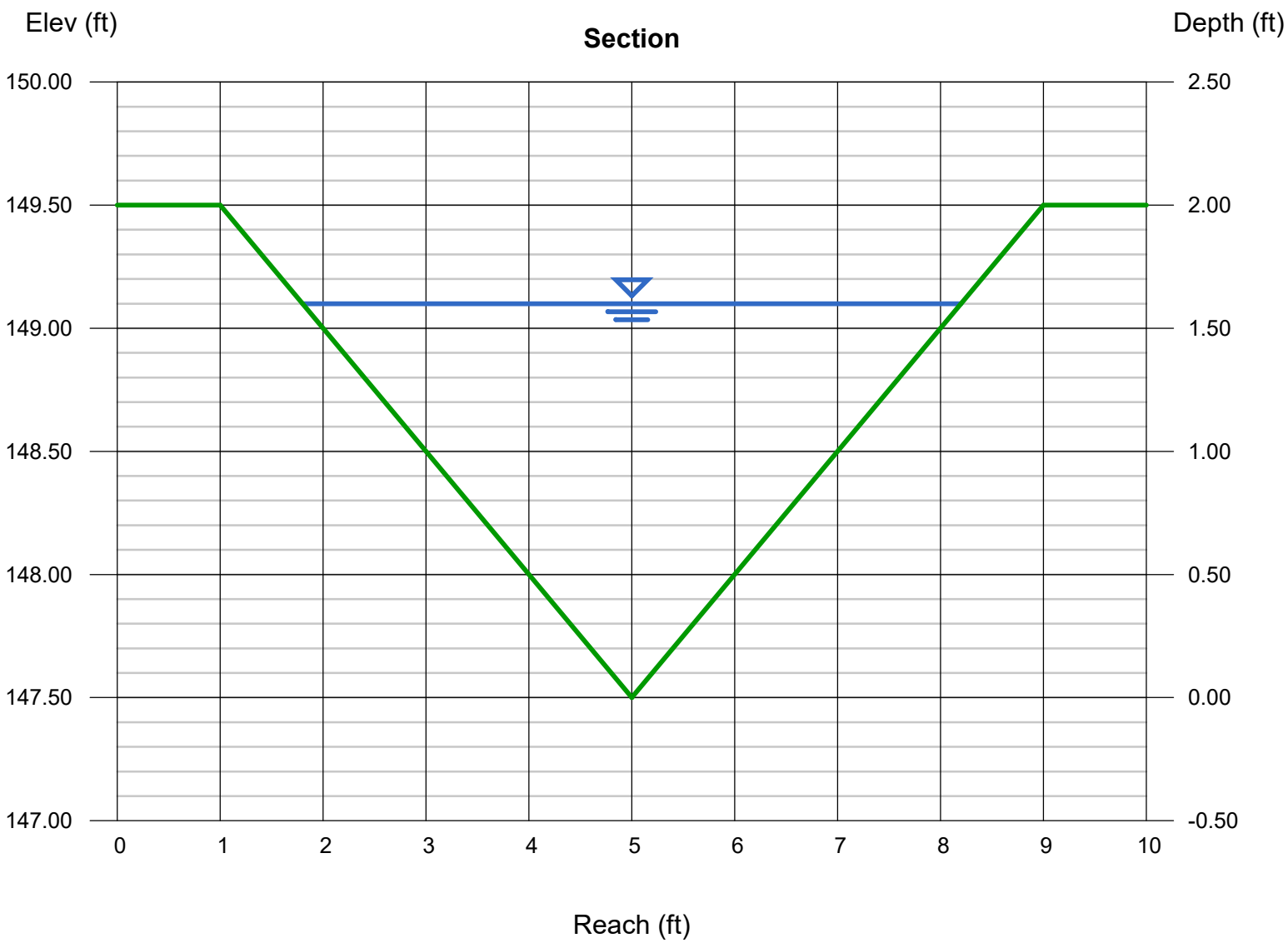
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	147.50
Slope (%)	=	0.70
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	12.71

Highlighted

Depth (ft)	=	1.60
Q (cfs)	=	12.71
Area (sqft)	=	5.12
Velocity (ft/s)	=	2.48
Wetted Perim (ft)	=	7.16
Crit Depth, Yc (ft)	=	1.21
Top Width (ft)	=	6.40
EGL (ft)	=	1.70



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

182+62 LT

Triangular

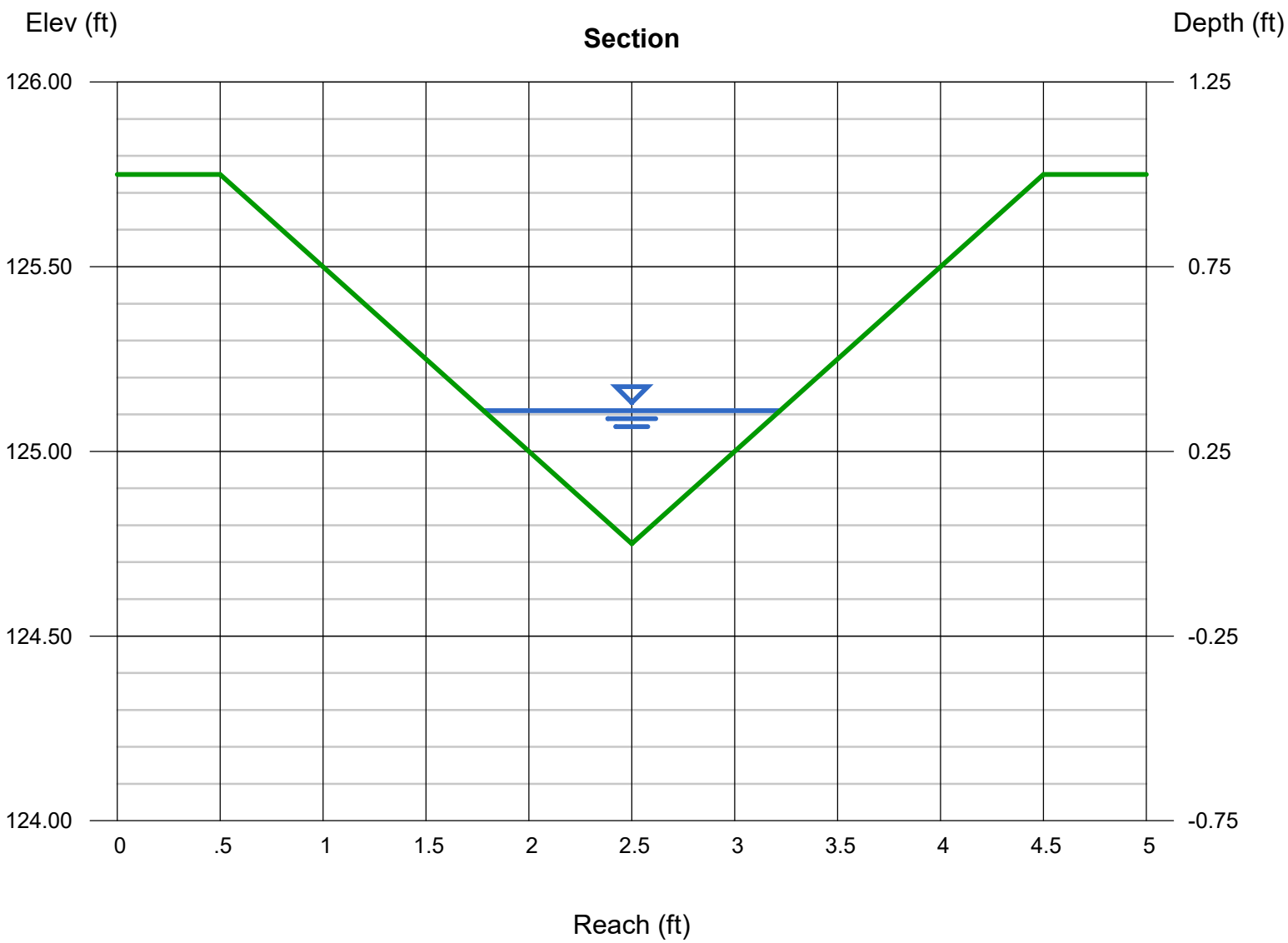
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	124.75
Slope (%)	=	12.32
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.94

Highlighted

Depth (ft)	=	0.36
Q (cfs)	=	0.940
Area (sqft)	=	0.26
Velocity (ft/s)	=	3.63
Wetted Perim (ft)	=	1.61
Crit Depth, Yc (ft)	=	0.43
Top Width (ft)	=	1.44
EGL (ft)	=	0.56



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

189+17 LT

Triangular

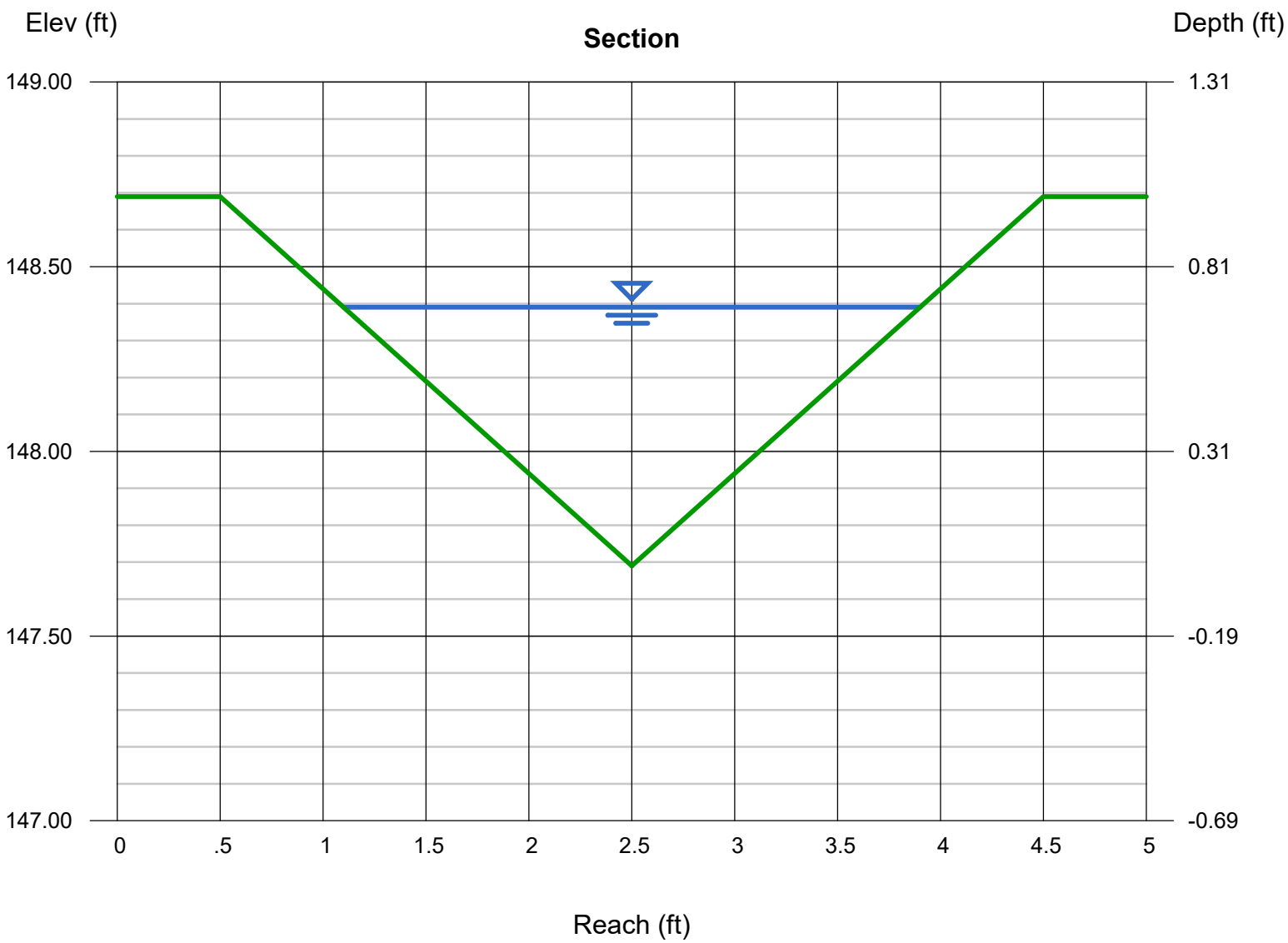
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 147.69
Slope (%)	= 1.68
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.17

Highlighted

Depth (ft)	= 0.70
Q (cfs)	= 2.170
Area (sqft)	= 0.98
Velocity (ft/s)	= 2.21
Wetted Perim (ft)	= 3.13
Crit Depth, Yc (ft)	= 0.60
Top Width (ft)	= 2.80
EGL (ft)	= 0.78



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

190+00 LT

Triangular

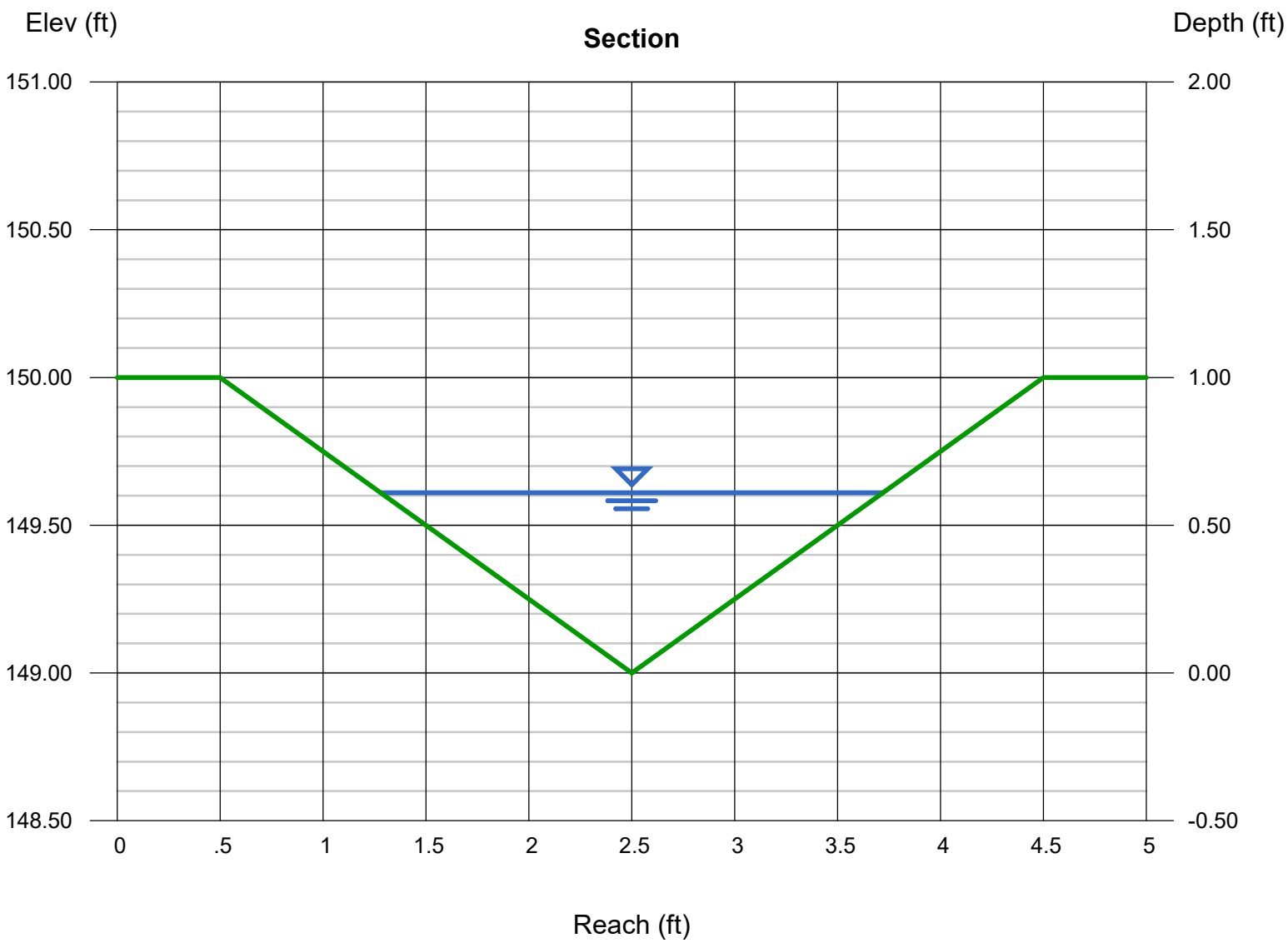
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 149.00
Slope (%)	= 1.69
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.50

Highlighted

Depth (ft)	= 0.61
Q (cfs)	= 1.500
Area (sqft)	= 0.74
Velocity (ft/s)	= 2.02
Wetted Perim (ft)	= 2.73
Crit Depth, Yc (ft)	= 0.52
Top Width (ft)	= 2.44
EGL (ft)	= 0.67



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

192+00 LT

Triangular

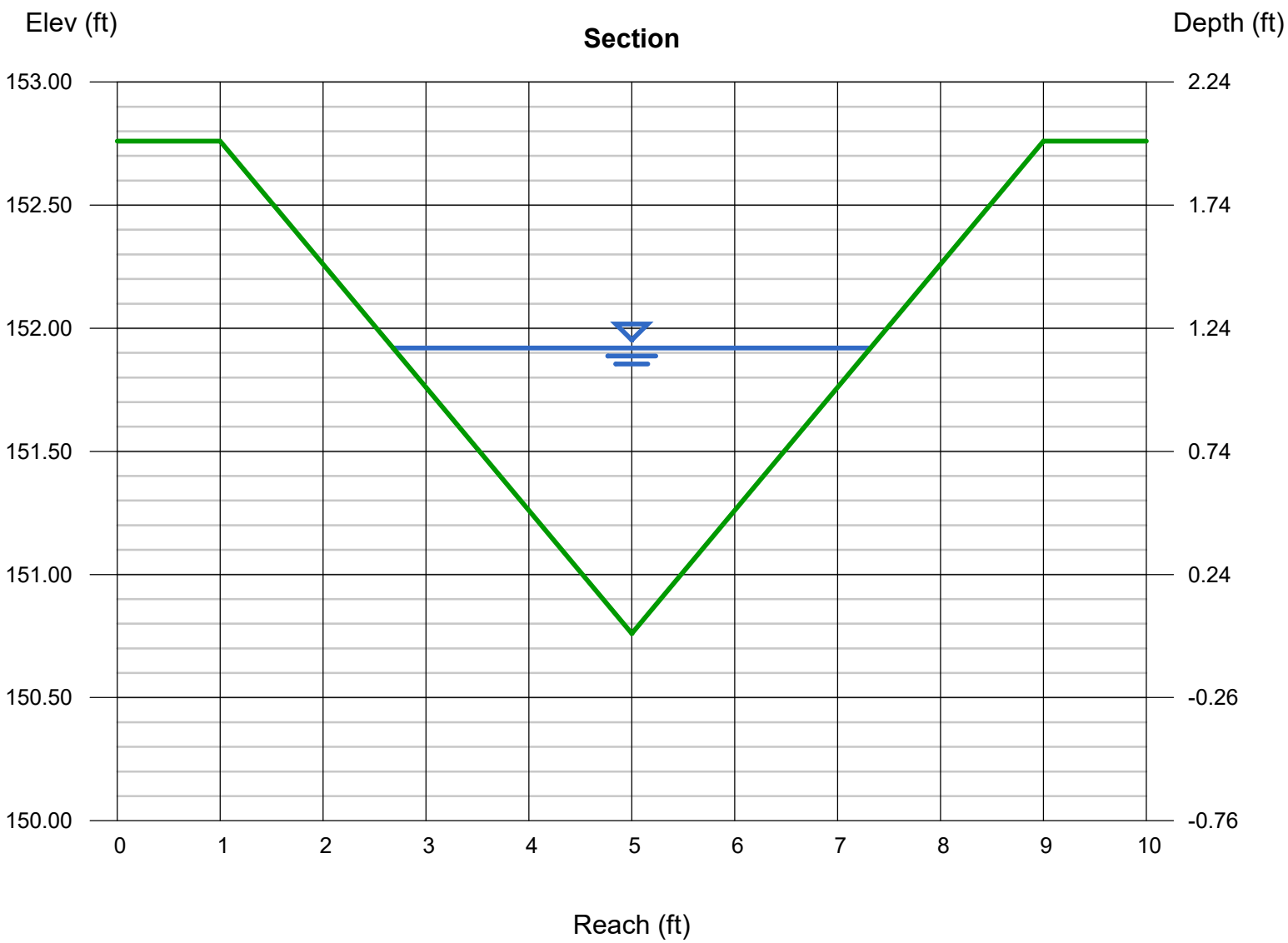
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 150.76
Slope (%)	= 0.08
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.81

Highlighted

Depth (ft)	= 1.16
Q (cfs)	= 1.810
Area (sqft)	= 2.69
Velocity (ft/s)	= 0.67
Wetted Perim (ft)	= 5.19
Crit Depth, Yc (ft)	= 0.56
Top Width (ft)	= 4.64
EGL (ft)	= 1.17



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

193+00 LT

Triangular

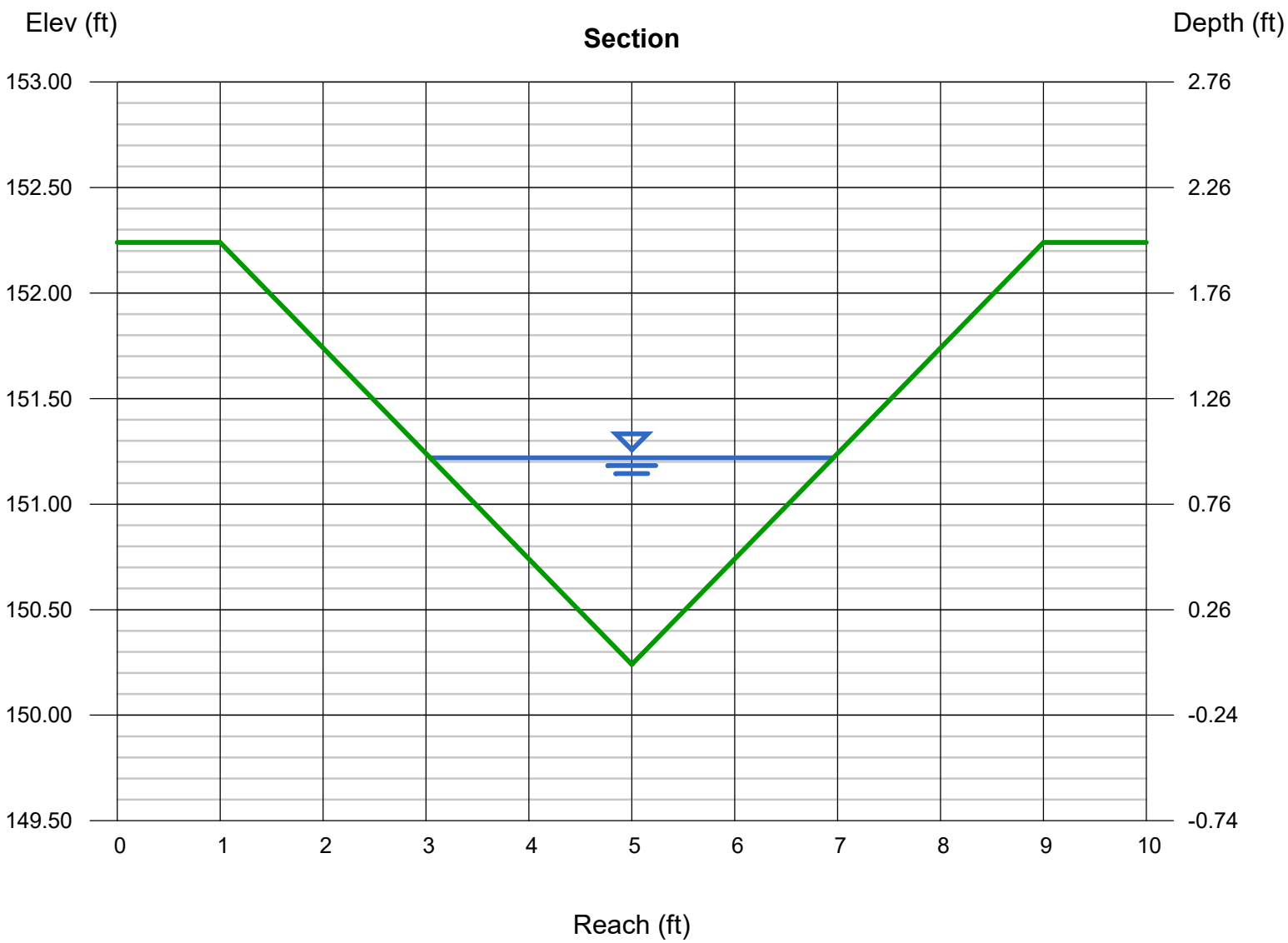
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 150.24
Slope (%)	= 0.52
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.91

Highlighted

Depth (ft)	= 0.98
Q (cfs)	= 2.910
Area (sqft)	= 1.92
Velocity (ft/s)	= 1.51
Wetted Perim (ft)	= 4.38
Crit Depth, Yc (ft)	= 0.67
Top Width (ft)	= 3.92
EGL (ft)	= 1.02



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

194+00 LT

Triangular

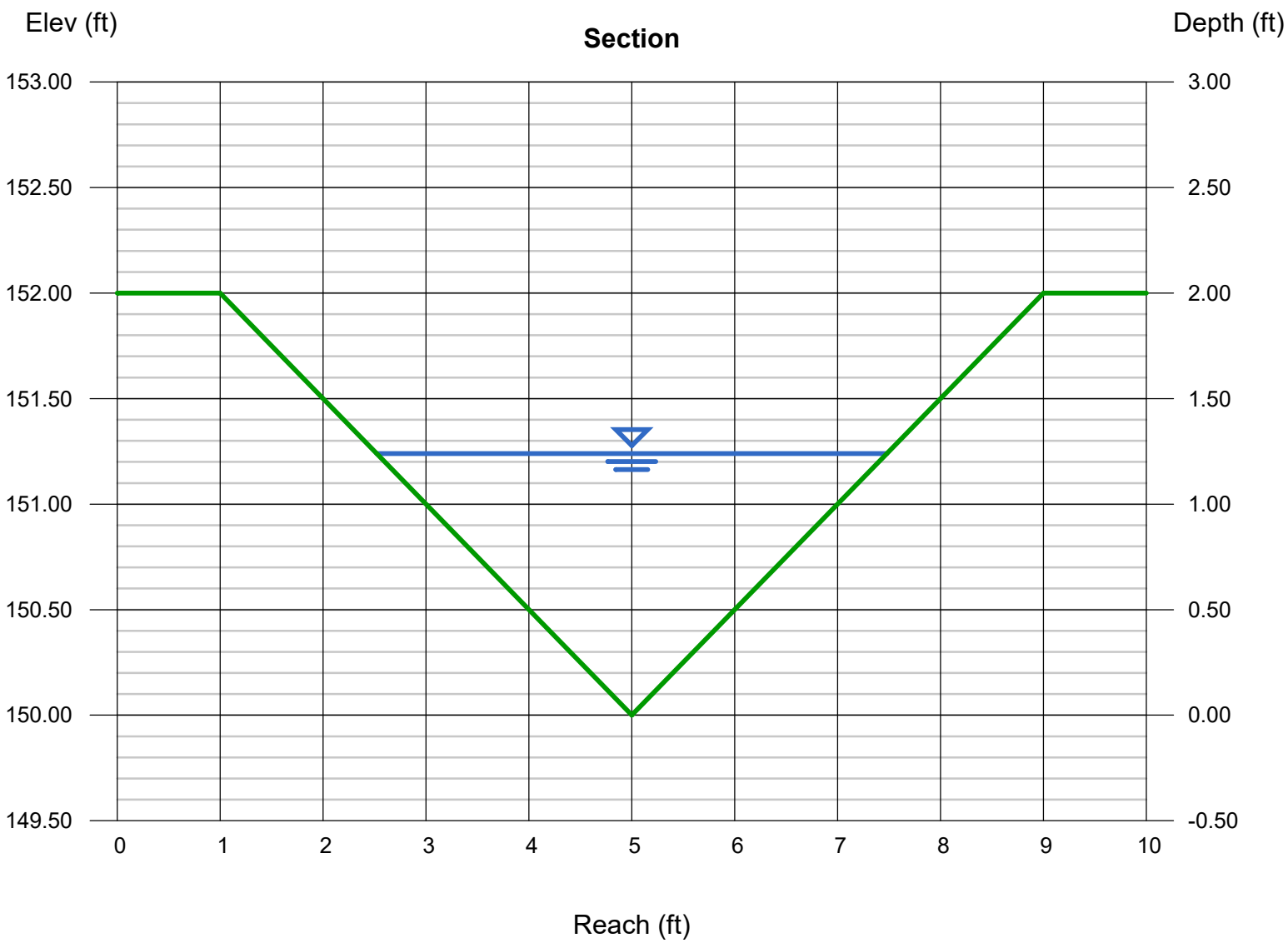
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 150.00
Slope (%)	= 0.24
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.74

Highlighted

Depth (ft)	= 1.24
Q (cfs)	= 3.740
Area (sqft)	= 3.08
Velocity (ft/s)	= 1.22
Wetted Perim (ft)	= 5.55
Crit Depth, Yc (ft)	= 0.74
Top Width (ft)	= 4.96
EGL (ft)	= 1.26



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

195+05 LT

Triangular

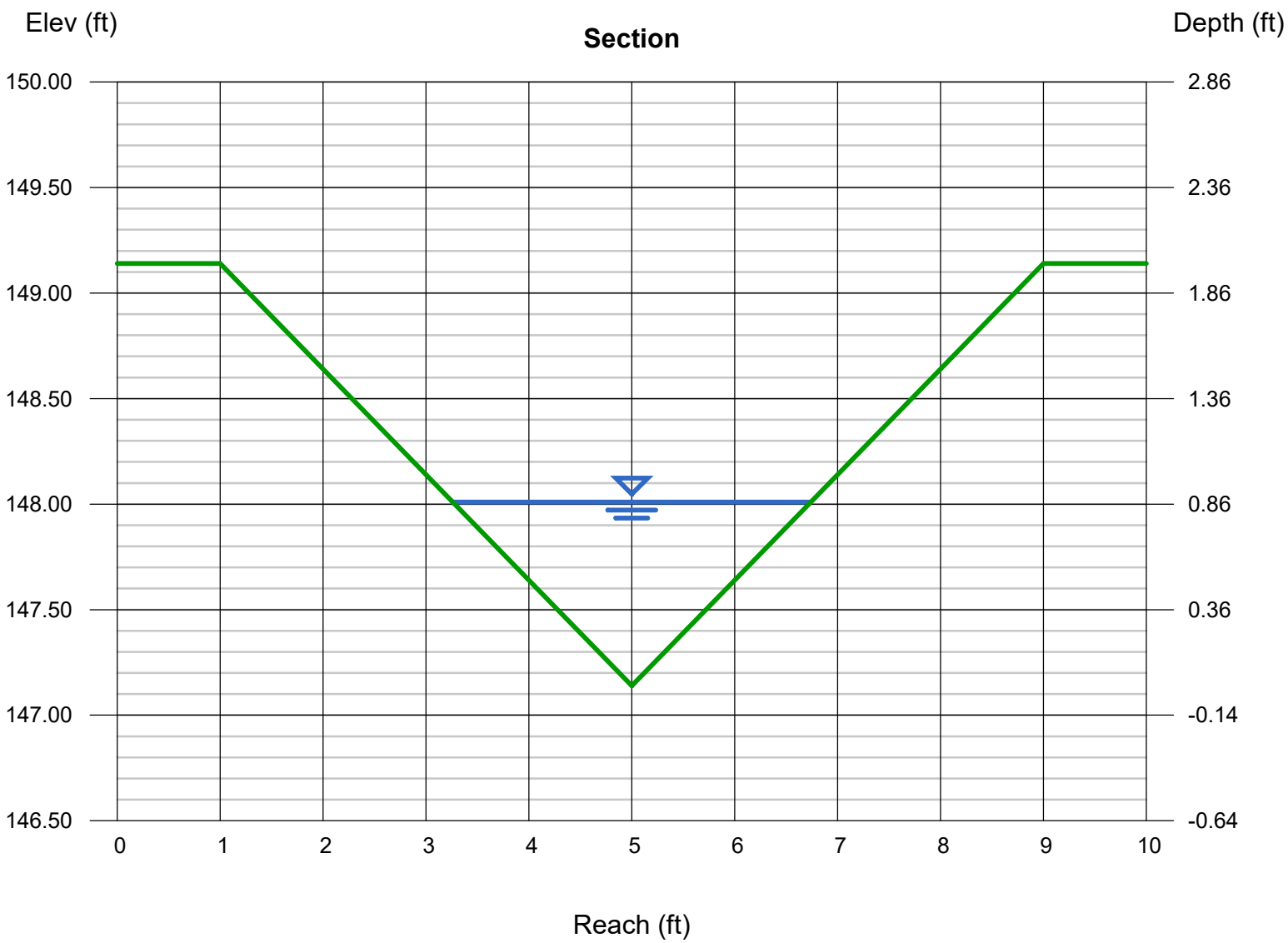
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	147.14
Slope (%)	=	2.72
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	4.89

Highlighted

Depth (ft)	=	0.87
Q (cfs)	=	4.890
Area (sqft)	=	1.51
Velocity (ft/s)	=	3.23
Wetted Perim (ft)	=	3.89
Crit Depth, Yc (ft)	=	0.83
Top Width (ft)	=	3.48
EGL (ft)	=	1.03



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 27 2023

195+06 LT

Triangular

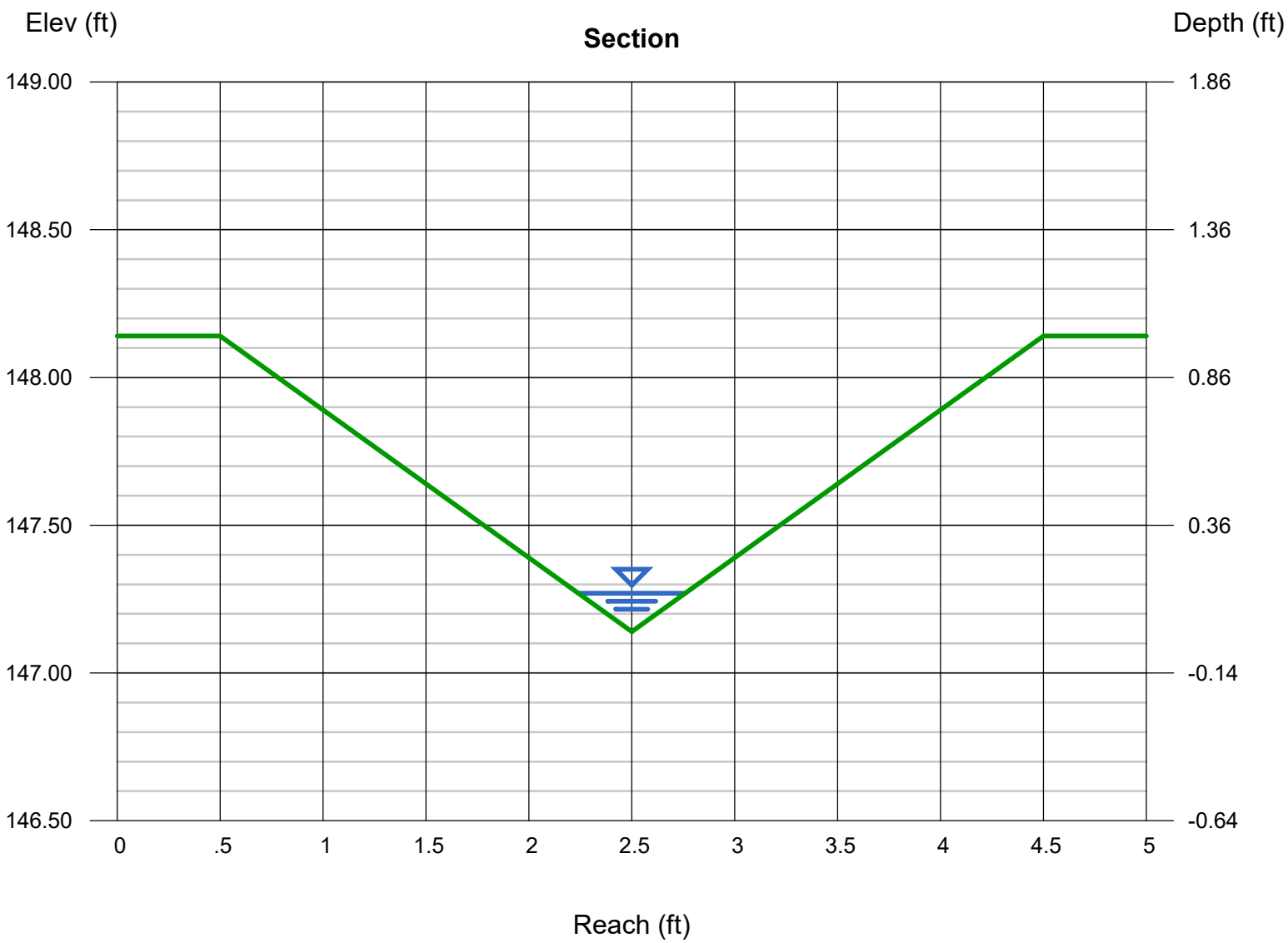
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	147.14
Slope (%)	=	9.74
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.05

Highlighted

Depth (ft)	=	0.13
Q (cfs)	=	0.050
Area (sqft)	=	0.03
Velocity (ft/s)	=	1.48
Wetted Perim (ft)	=	0.58
Crit Depth, Yc (ft)	=	0.14
Top Width (ft)	=	0.52
EGL (ft)	=	0.16



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Oct 31 2023

196+16 LT

Triangular

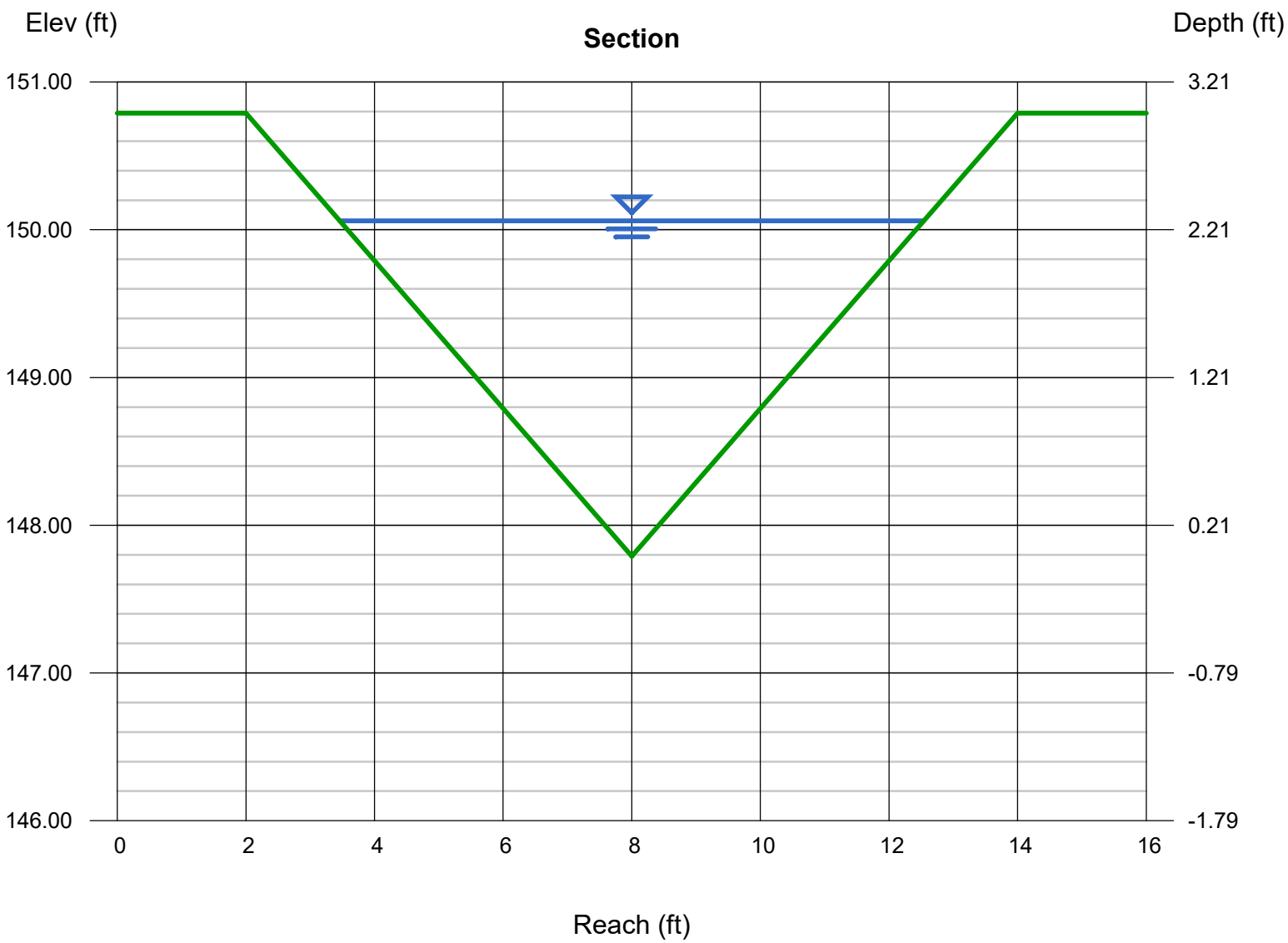
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 147.79
Slope (%)	= 1.89
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 52.69

Highlighted

Depth (ft)	= 2.27
Q (cfs)	= 52.69
Area (sqft)	= 10.31
Velocity (ft/s)	= 5.11
Wetted Perim (ft)	= 10.15
Crit Depth, Yc (ft)	= 2.13
Top Width (ft)	= 9.08
EGL (ft)	= 2.68



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

196+17 LT

Triangular

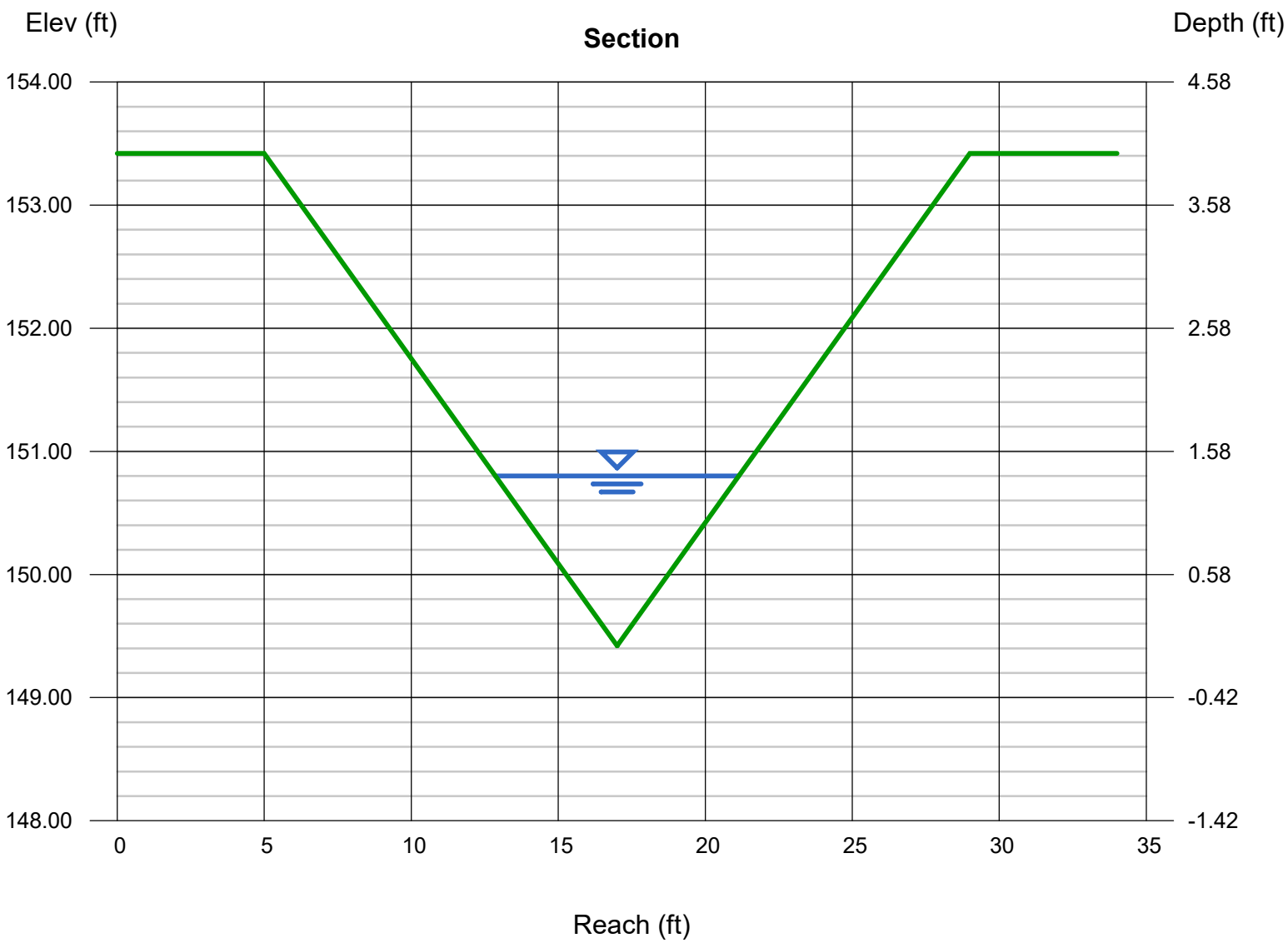
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 149.42
Slope (%)	= 0.30
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.74

Highlighted

Depth (ft)	= 1.38
Q (cfs)	= 8.740
Area (sqft)	= 5.71
Velocity (ft/s)	= 1.53
Wetted Perim (ft)	= 8.73
Crit Depth, Yc (ft)	= 0.89
Top Width (ft)	= 8.28
EGL (ft)	= 1.42



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

197+00 LT

Triangular

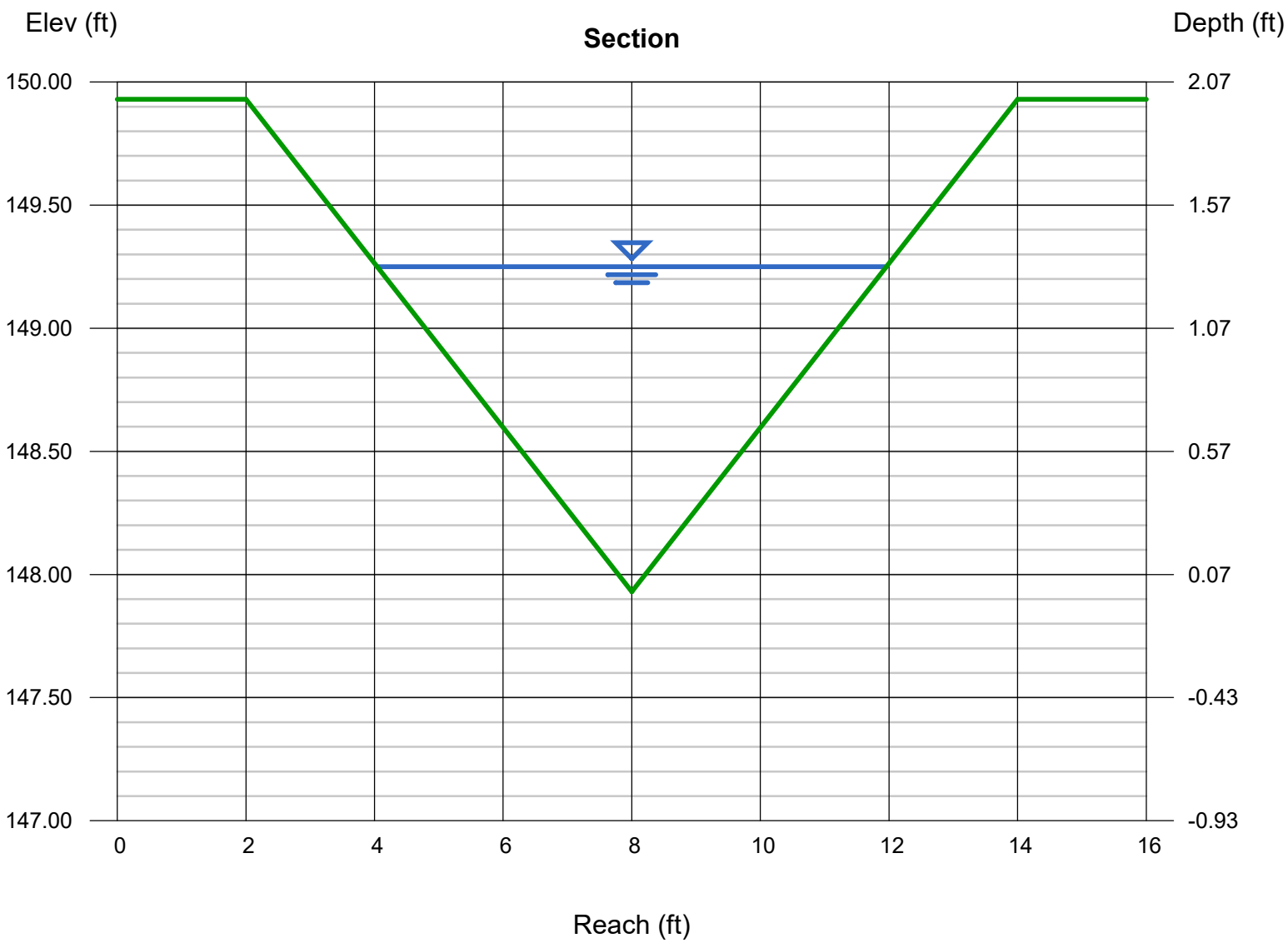
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 147.93
Slope (%)	= 0.30
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.70

Highlighted

Depth (ft)	= 1.32
Q (cfs)	= 7.700
Area (sqft)	= 5.23
Velocity (ft/s)	= 1.47
Wetted Perim (ft)	= 8.35
Crit Depth, Yc (ft)	= 0.84
Top Width (ft)	= 7.92
EGL (ft)	= 1.35



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

198+00 LT

Triangular

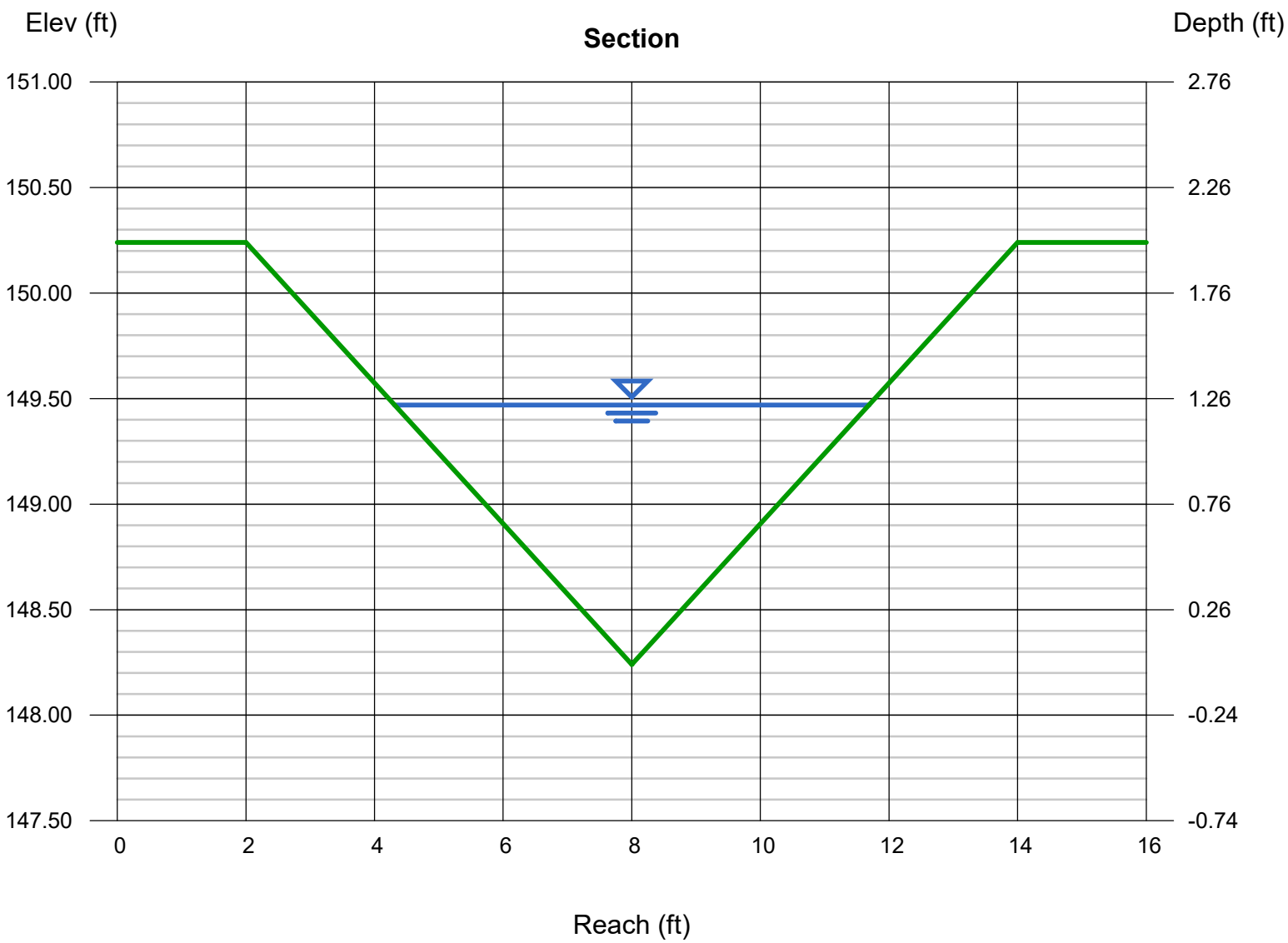
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 148.24
Slope (%)	= 0.30
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 6.43

Highlighted

Depth (ft)	= 1.23
Q (cfs)	= 6.430
Area (sqft)	= 4.54
Velocity (ft/s)	= 1.42
Wetted Perim (ft)	= 7.78
Crit Depth, Yc (ft)	= 0.78
Top Width (ft)	= 7.38
EGL (ft)	= 1.26



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

199+00 LT

Triangular

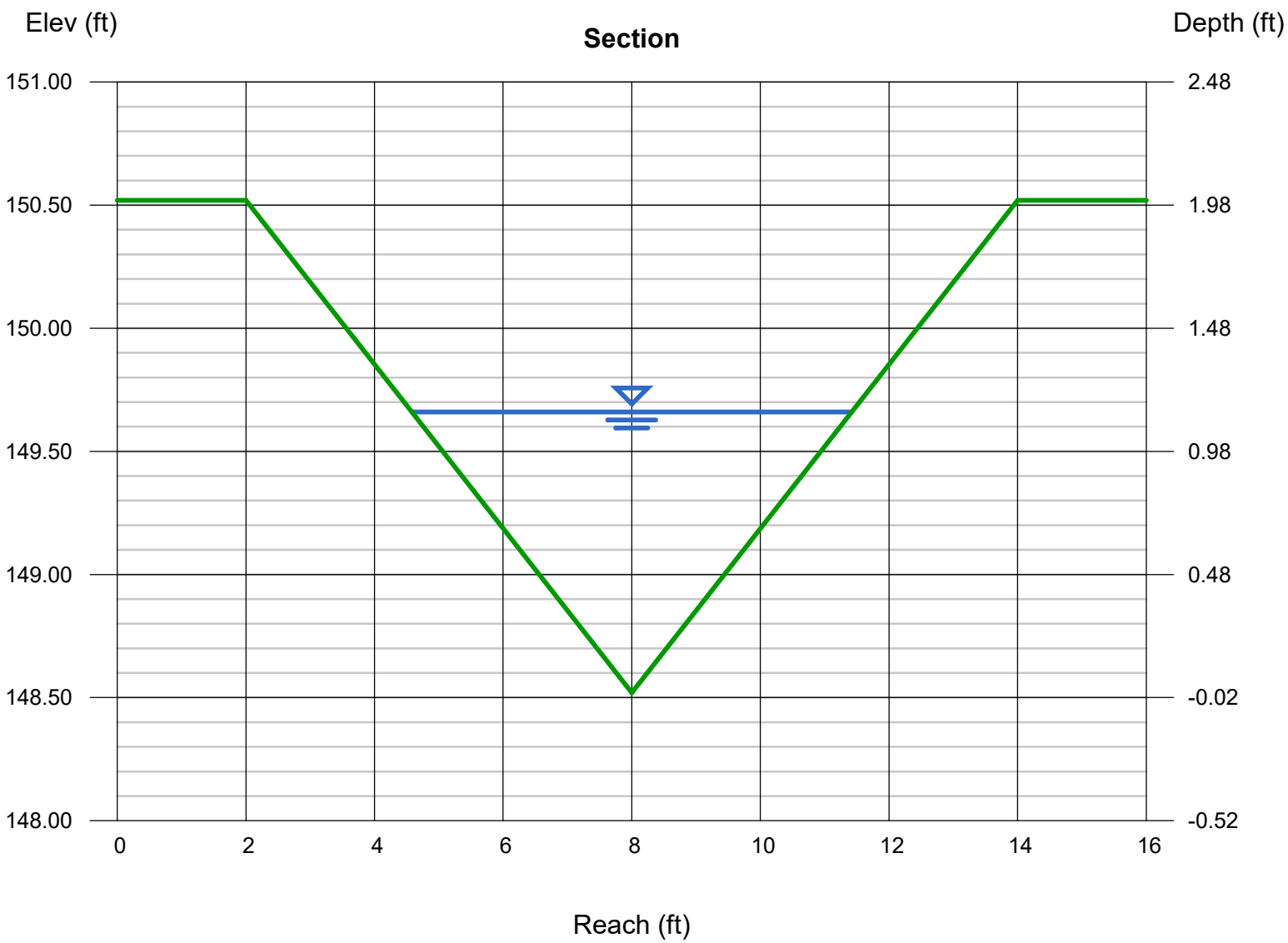
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 148.52
Slope (%)	= 0.30
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.19

Highlighted

Depth (ft)	= 1.14
Q (cfs)	= 5.190
Area (sqft)	= 3.90
Velocity (ft/s)	= 1.33
Wetted Perim (ft)	= 7.21
Crit Depth, Yc (ft)	= 0.72
Top Width (ft)	= 6.84
EGL (ft)	= 1.17



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

200+00 LT

Triangular

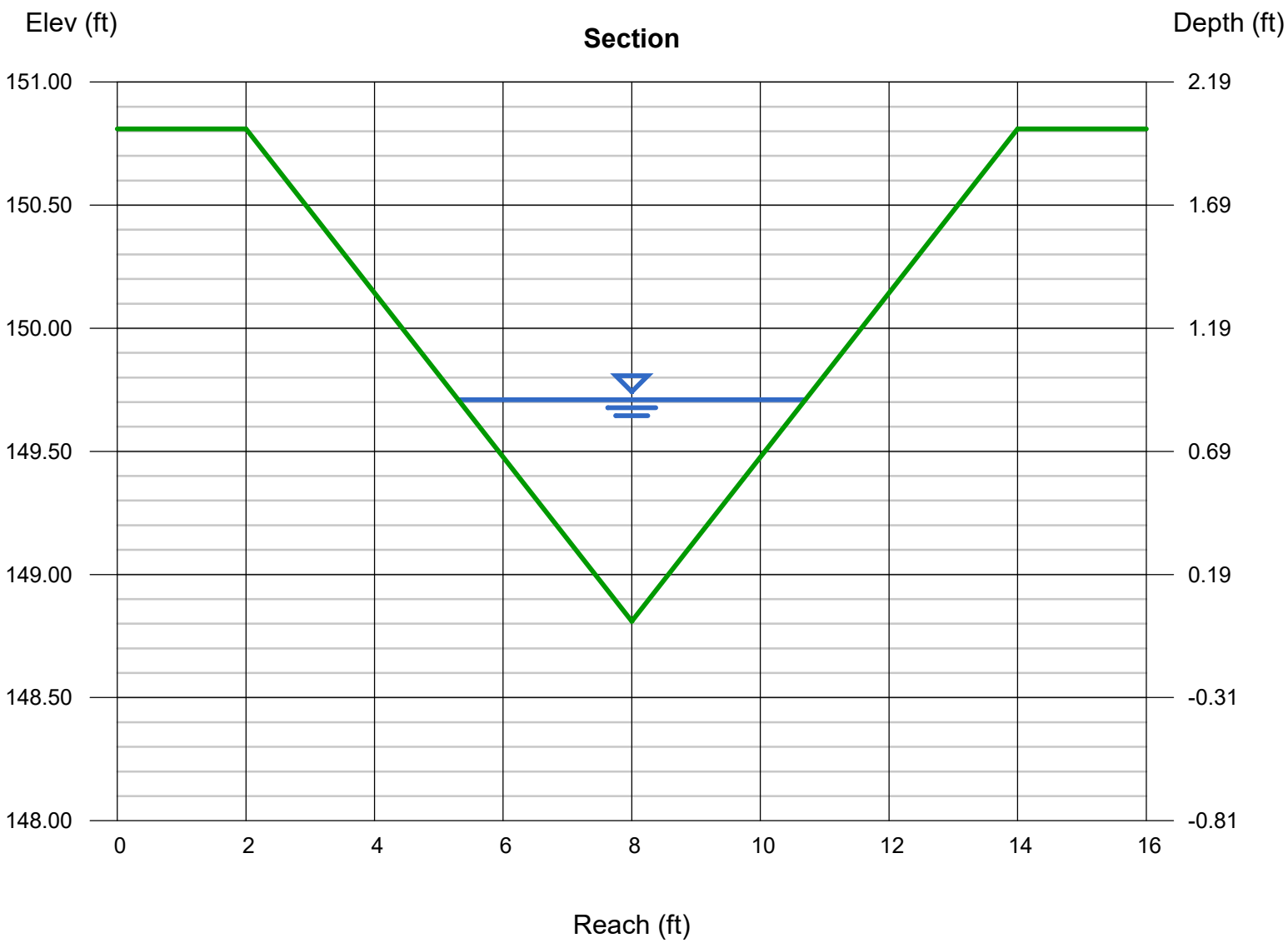
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	148.81
Slope (%)	=	0.30
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	2.78

Highlighted

Depth (ft)	=	0.90
Q (cfs)	=	2.780
Area (sqft)	=	2.43
Velocity (ft/s)	=	1.14
Wetted Perim (ft)	=	5.69
Crit Depth, Yc (ft)	=	0.56
Top Width (ft)	=	5.40
EGL (ft)	=	0.92



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

201+30 LT

Triangular

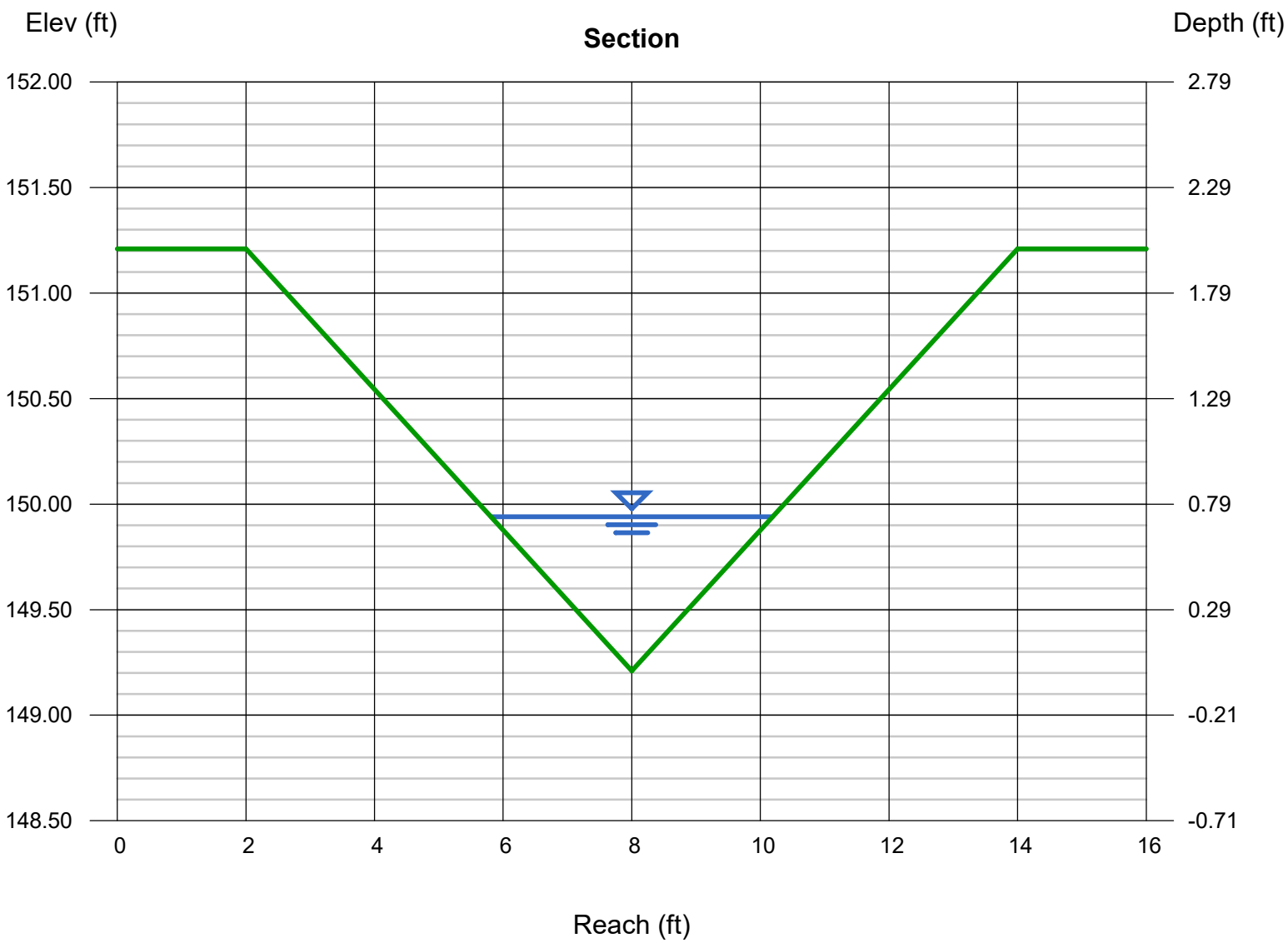
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 149.21
Slope (%)	= 0.30
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.59

Highlighted

Depth (ft)	= 0.73
Q (cfs)	= 1.590
Area (sqft)	= 1.60
Velocity (ft/s)	= 0.99
Wetted Perim (ft)	= 4.62
Crit Depth, Yc (ft)	= 0.45
Top Width (ft)	= 4.38
EGL (ft)	= 0.75



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

203+00 LT

Triangular

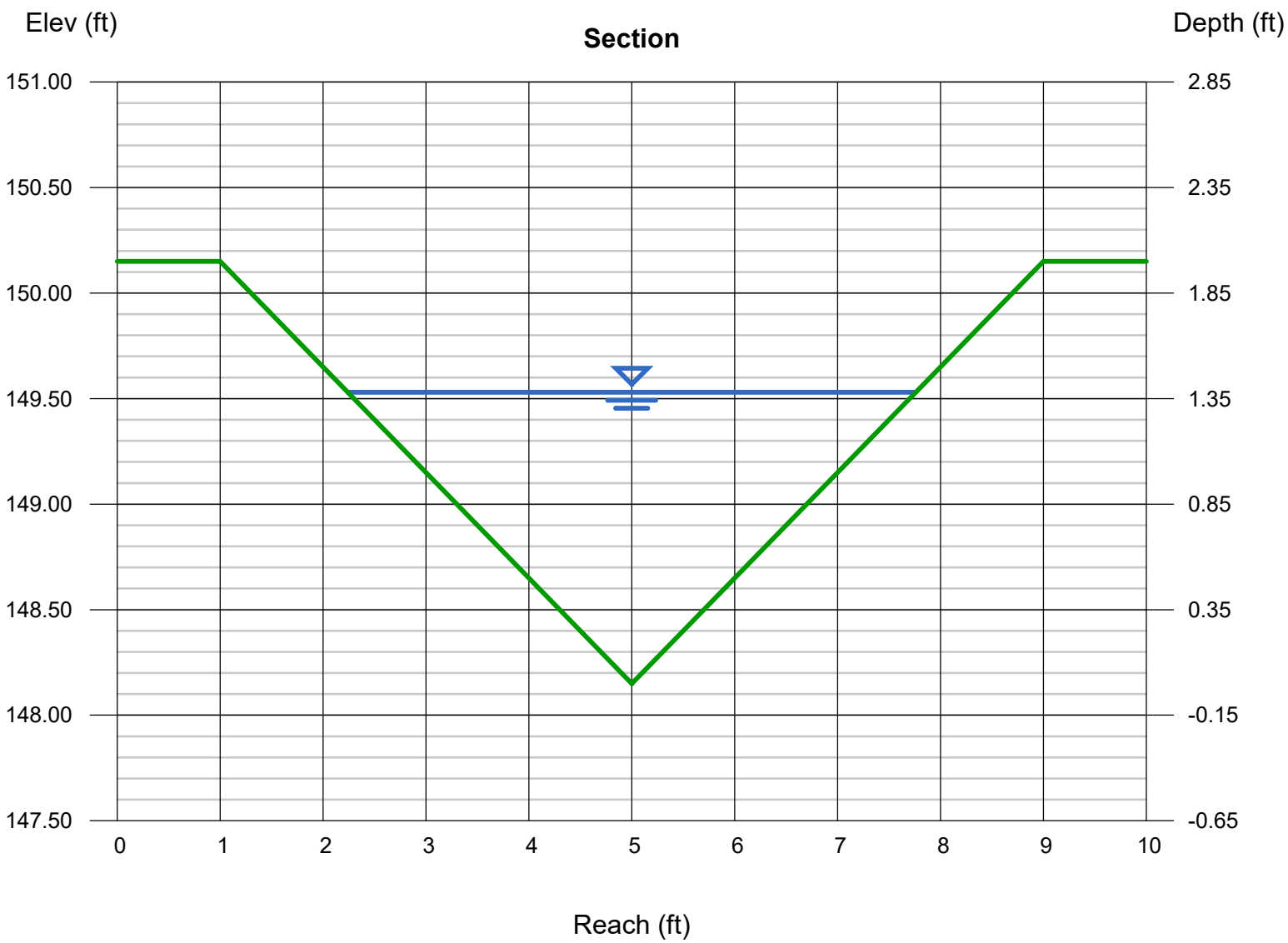
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 148.15
Slope (%)	= 0.60
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.84

Highlighted

Depth (ft)	= 1.38
Q (cfs)	= 7.840
Area (sqft)	= 3.81
Velocity (ft/s)	= 2.06
Wetted Perim (ft)	= 6.17
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 5.52
EGL (ft)	= 1.45



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

204+41 LT

Triangular

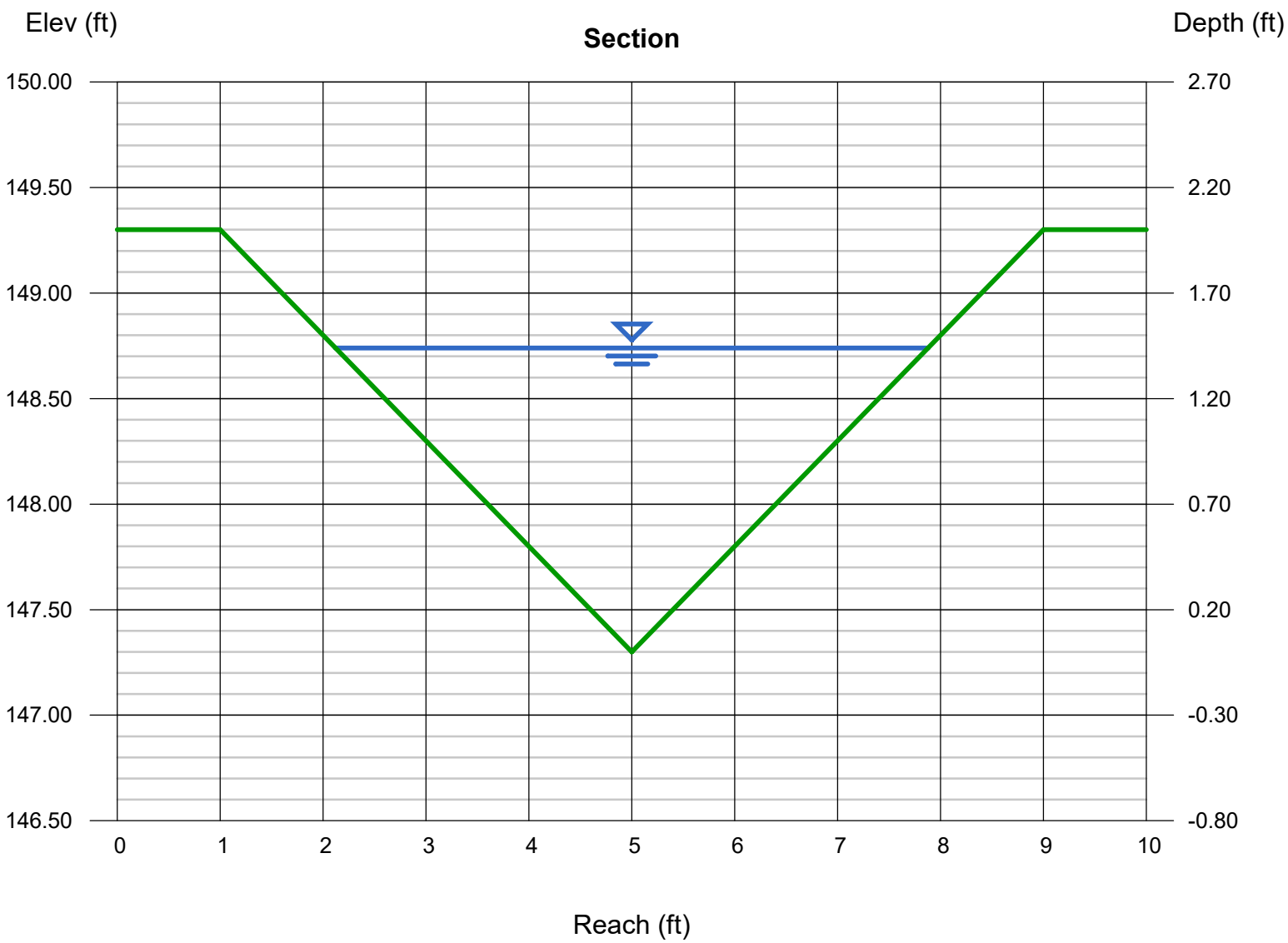
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 147.30
Slope (%)	= 0.60
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 8.82

Highlighted

Depth (ft)	= 1.44
Q (cfs)	= 8.820
Area (sqft)	= 4.15
Velocity (ft/s)	= 2.13
Wetted Perim (ft)	= 6.44
Crit Depth, Yc (ft)	= 1.04
Top Width (ft)	= 5.76
EGL (ft)	= 1.51



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

204+42 LT

Triangular

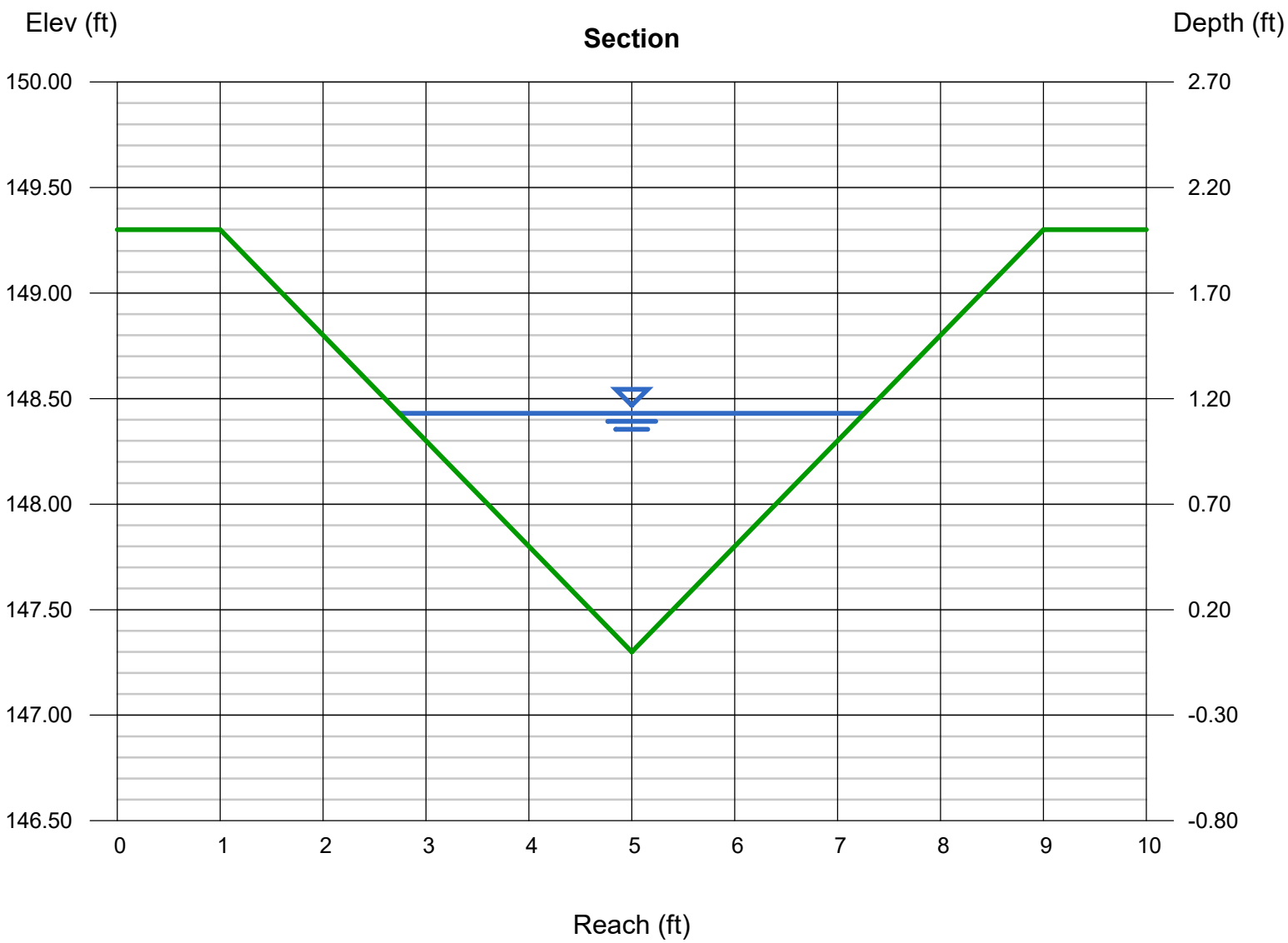
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 147.30
Slope (%)	= 0.90
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.65

Highlighted

Depth (ft)	= 1.13
Q (cfs)	= 5.650
Area (sqft)	= 2.55
Velocity (ft/s)	= 2.21
Wetted Perim (ft)	= 5.05
Crit Depth, Yc (ft)	= 0.87
Top Width (ft)	= 4.52
EGL (ft)	= 1.21



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

206+00 LT

Triangular

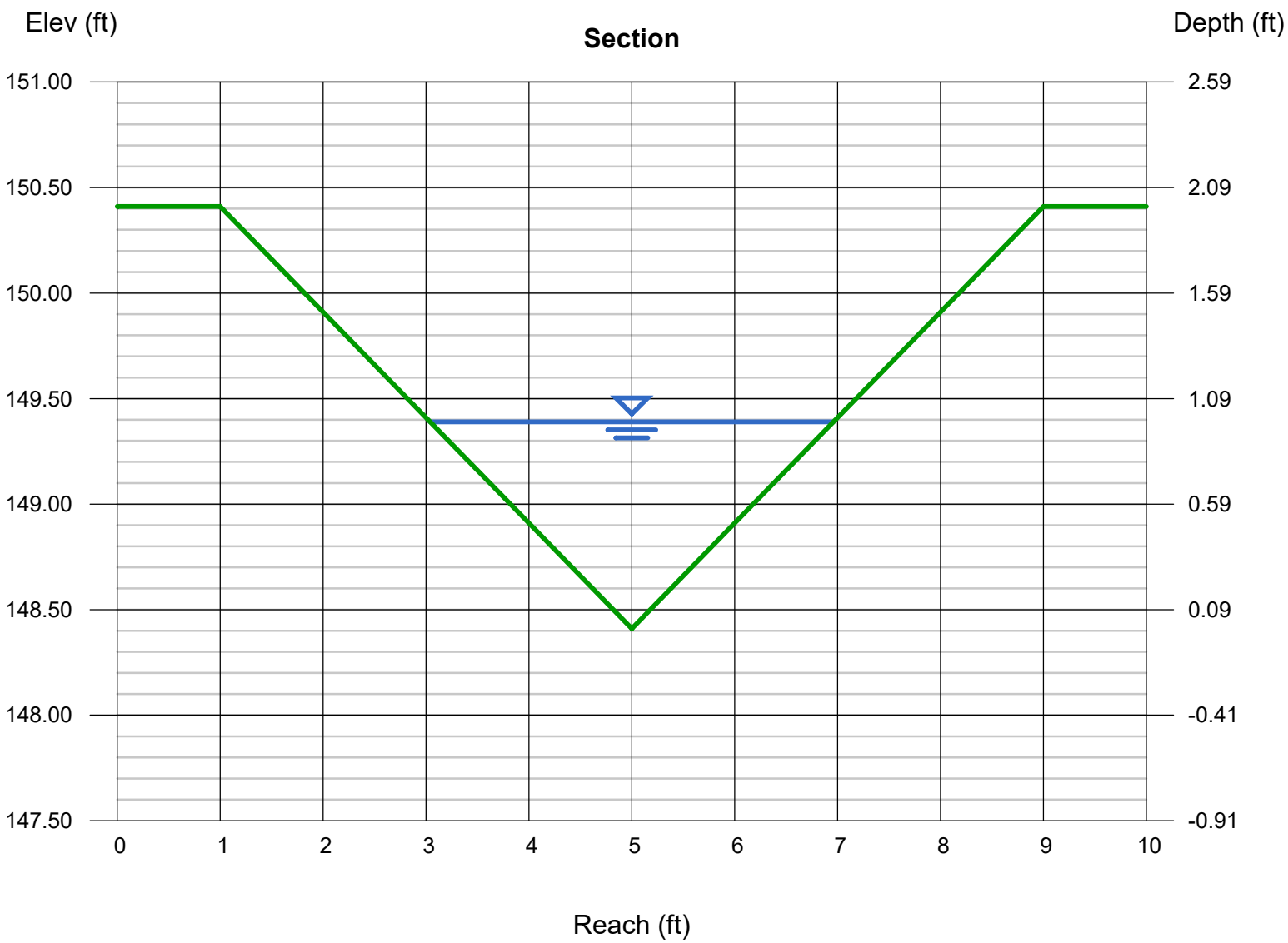
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	148.41
Slope (%)	=	0.59
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.16

Highlighted

Depth (ft)	=	0.98
Q (cfs)	=	3.160
Area (sqft)	=	1.92
Velocity (ft/s)	=	1.65
Wetted Perim (ft)	=	4.38
Crit Depth, Yc (ft)	=	0.69
Top Width (ft)	=	3.92
EGL (ft)	=	1.02



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

207+00 LT

Triangular

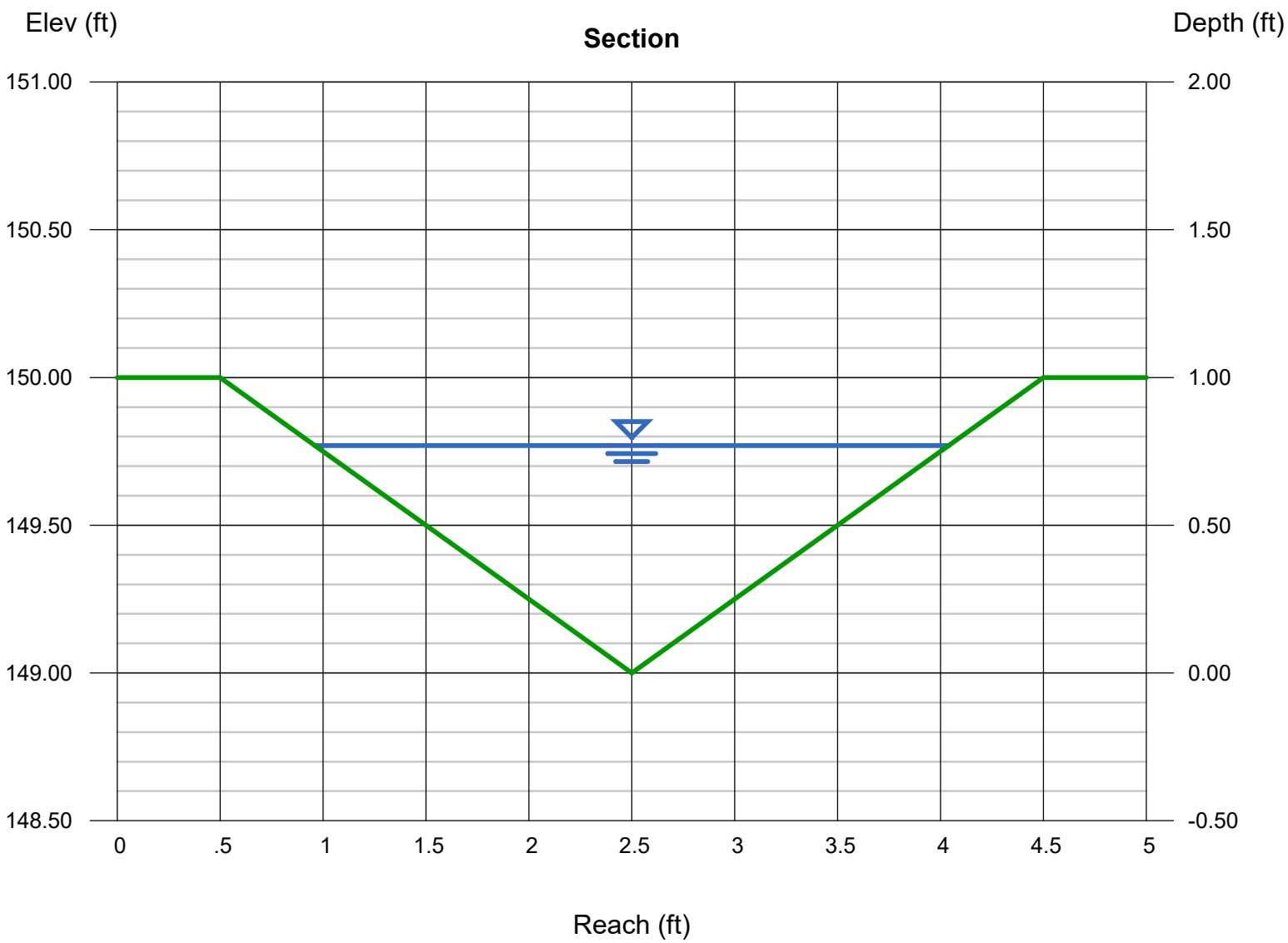
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 149.00
Slope (%)	= 1.38
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.46

Highlighted

Depth (ft)	= 0.77
Q (cfs)	= 2.460
Area (sqft)	= 1.19
Velocity (ft/s)	= 2.07
Wetted Perim (ft)	= 3.44
Crit Depth, Yc (ft)	= 0.63
Top Width (ft)	= 3.08
EGL (ft)	= 0.84



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 27 2023

208+00 LT

Triangular

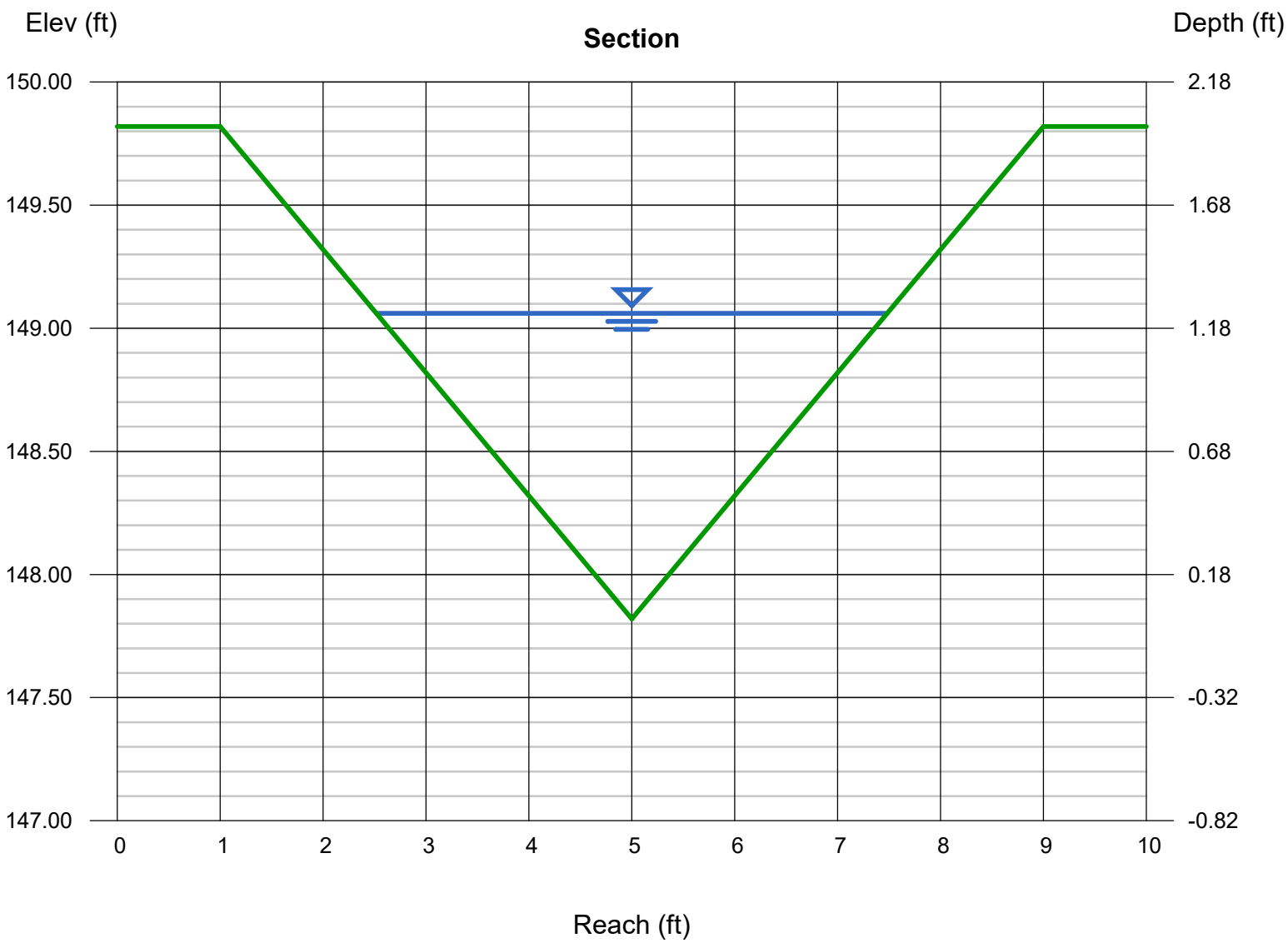
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 147.82
Slope (%)	= 0.36
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.56

Highlighted

Depth (ft)	= 1.24
Q (cfs)	= 4.560
Area (sqft)	= 3.08
Velocity (ft/s)	= 1.48
Wetted Perim (ft)	= 5.55
Crit Depth, Yc (ft)	= 0.80
Top Width (ft)	= 4.96
EGL (ft)	= 1.27



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 27 2023

208+57 LT

Triangular

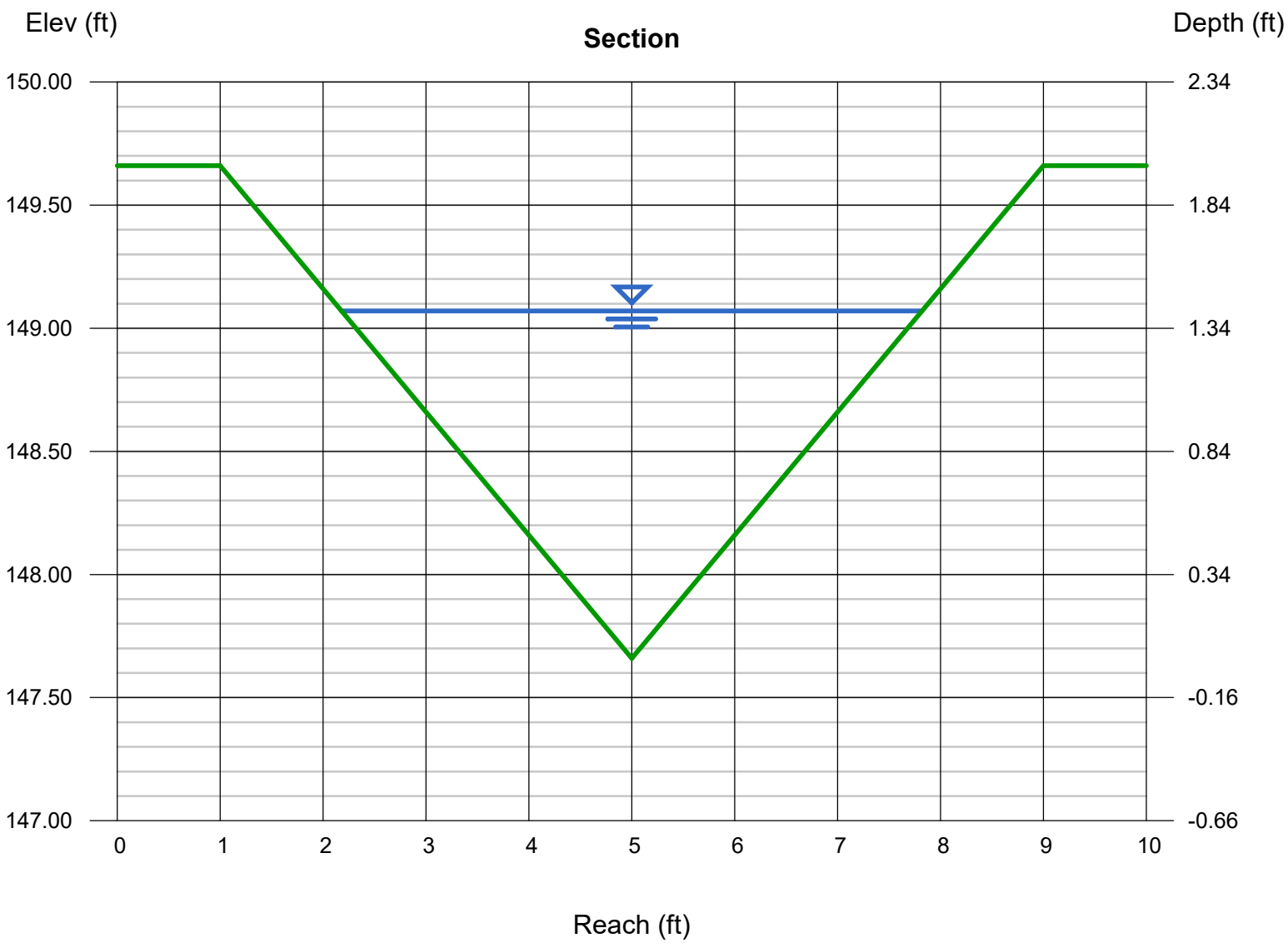
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	147.66
Slope (%)	=	0.28
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	5.65

Highlighted

Depth (ft)	=	1.41
Q (cfs)	=	5.650
Area (sqft)	=	3.98
Velocity (ft/s)	=	1.42
Wetted Perim (ft)	=	6.31
Crit Depth, Yc (ft)	=	0.87
Top Width (ft)	=	5.64
EGL (ft)	=	1.44



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

208+58 LT

Triangular

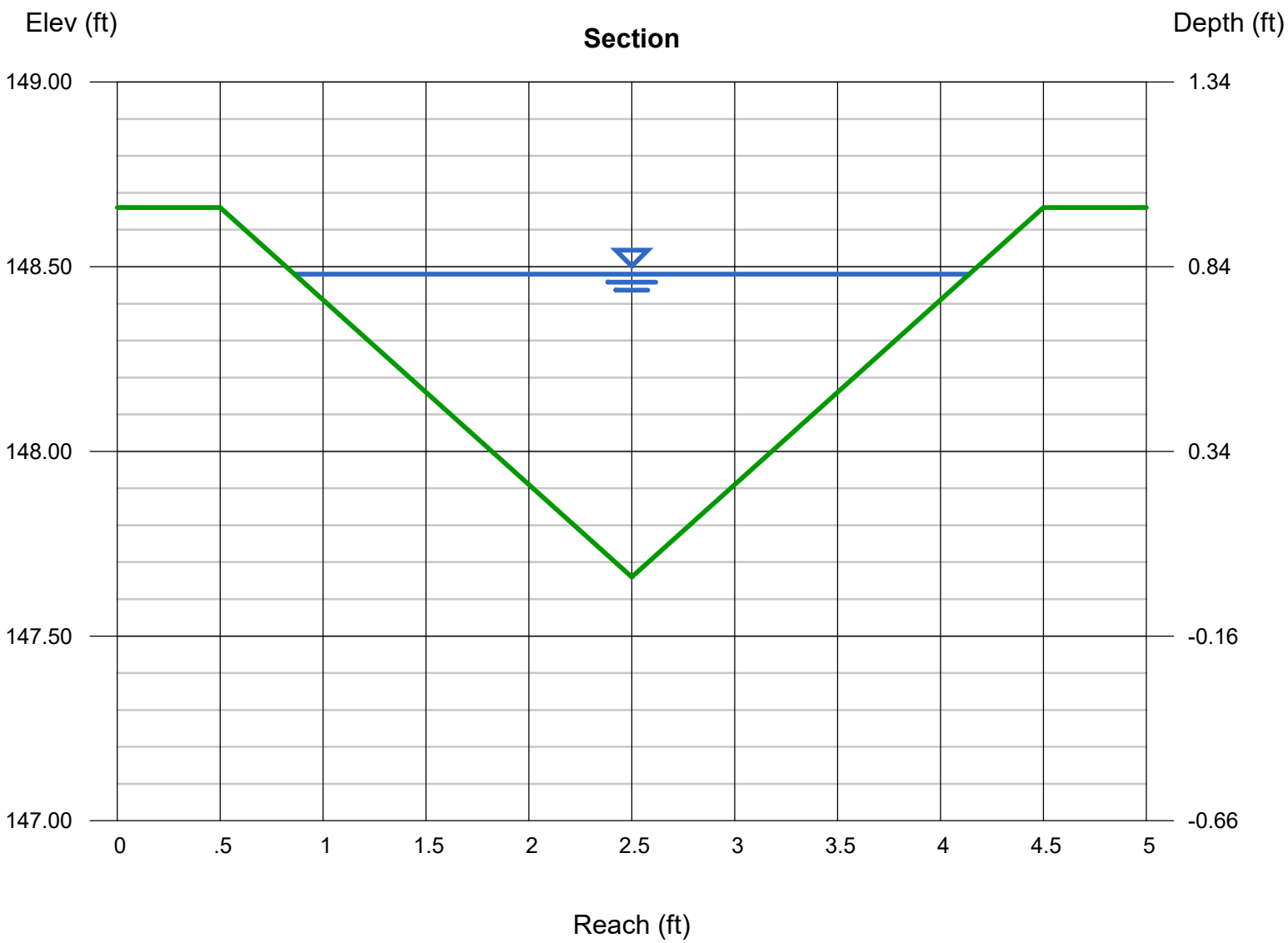
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	147.66
Slope (%)	=	1.40
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.00

Highlighted

Depth (ft)	=	0.82
Q (cfs)	=	3.000
Area (sqft)	=	1.34
Velocity (ft/s)	=	2.23
Wetted Perim (ft)	=	3.67
Crit Depth, Yc (ft)	=	0.68
Top Width (ft)	=	3.28
EGL (ft)	=	0.90



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

209+00 LT

Triangular

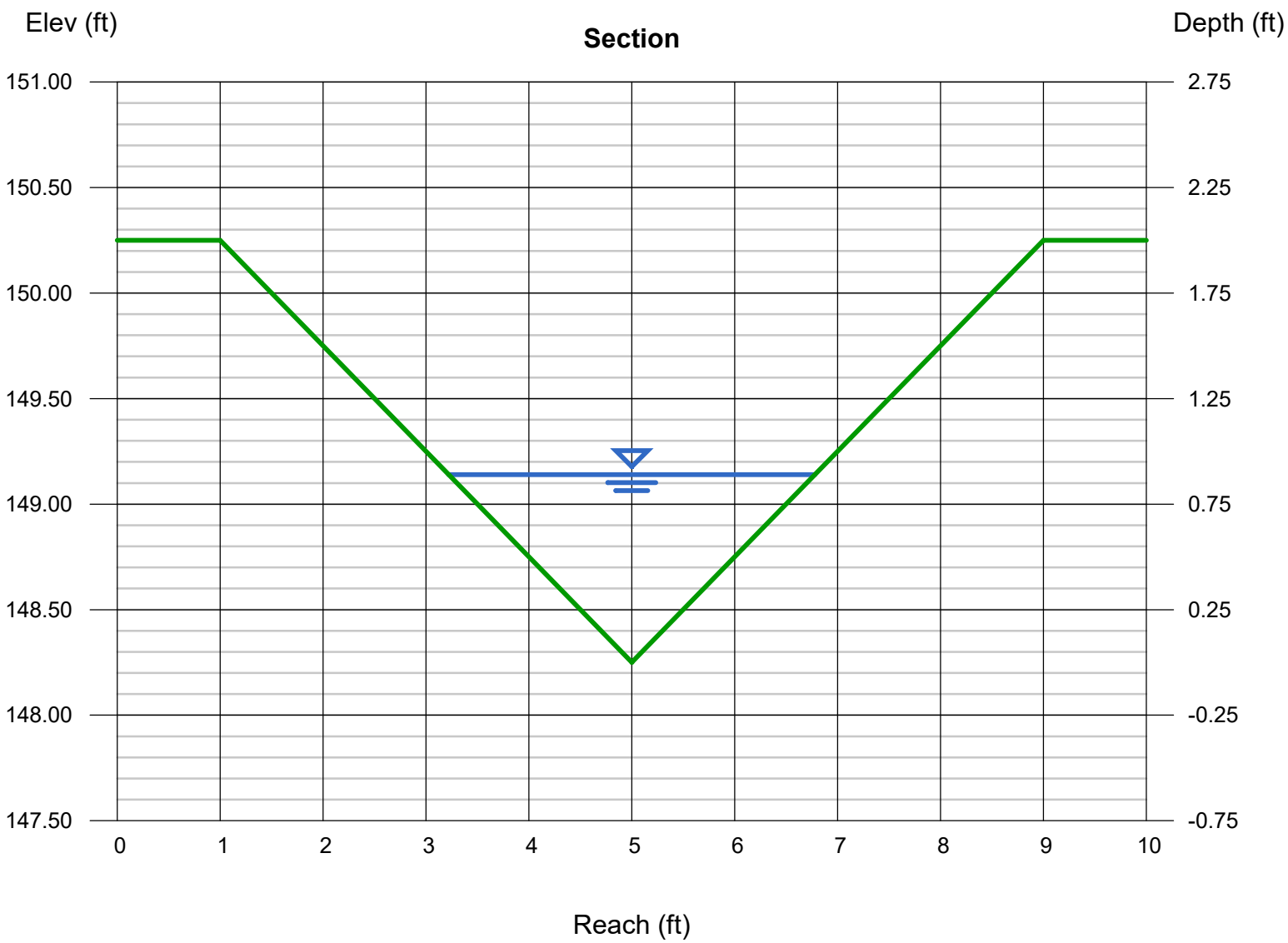
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	148.25
Slope (%)	=	0.70
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	2.61

Highlighted

Depth (ft)	=	0.89
Q (cfs)	=	2.610
Area (sqft)	=	1.58
Velocity (ft/s)	=	1.65
Wetted Perim (ft)	=	3.98
Crit Depth, Yc (ft)	=	0.64
Top Width (ft)	=	3.56
EGL (ft)	=	0.93



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

210+00 LT

Triangular

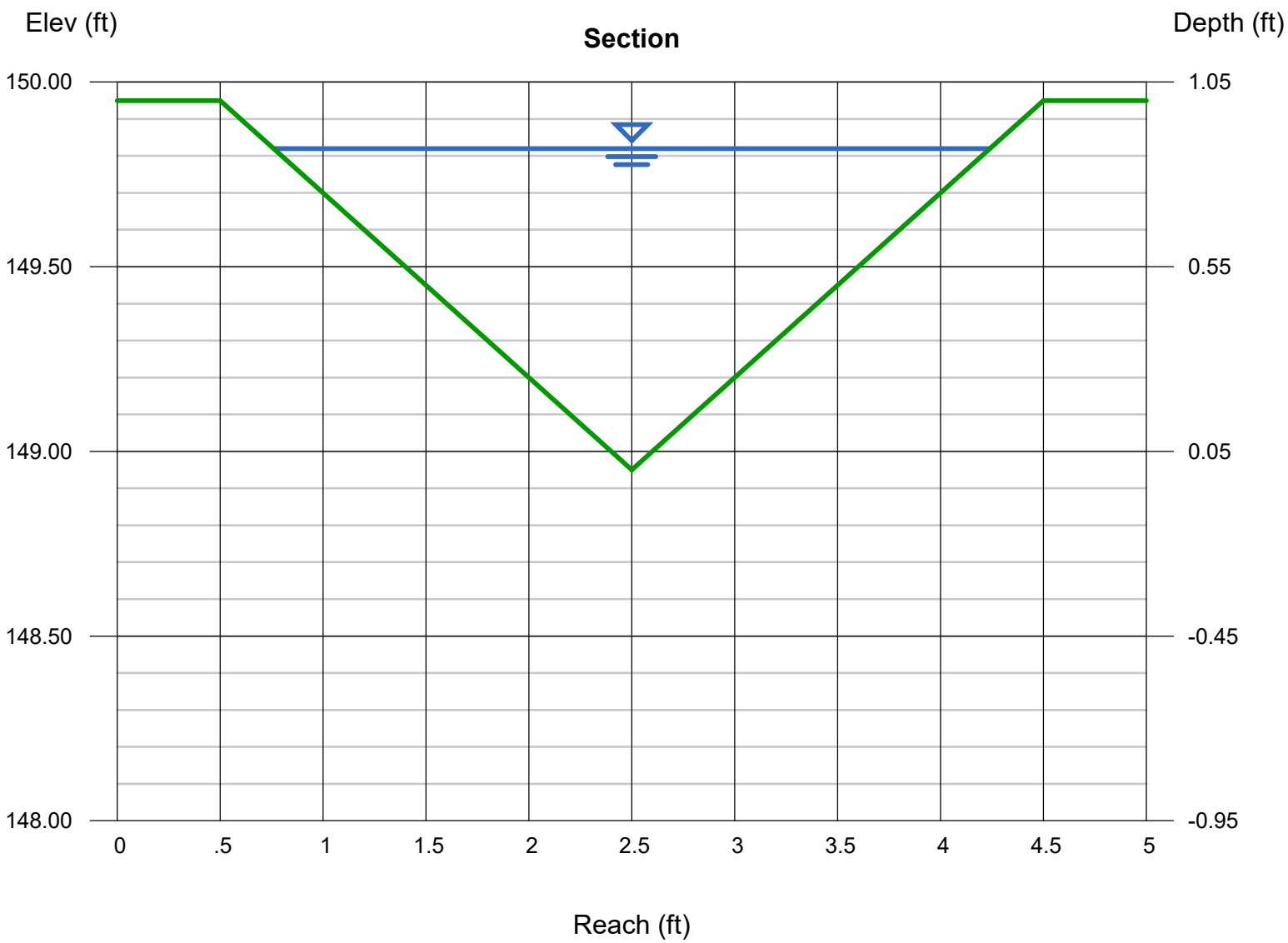
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 148.95
Slope (%)	= 0.40
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.84

Highlighted

Depth (ft)	= 0.87
Q (cfs)	= 1.840
Area (sqft)	= 1.51
Velocity (ft/s)	= 1.22
Wetted Perim (ft)	= 3.89
Crit Depth, Yc (ft)	= 0.56
Top Width (ft)	= 3.48
EGL (ft)	= 0.89



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

211+00 LT

Triangular

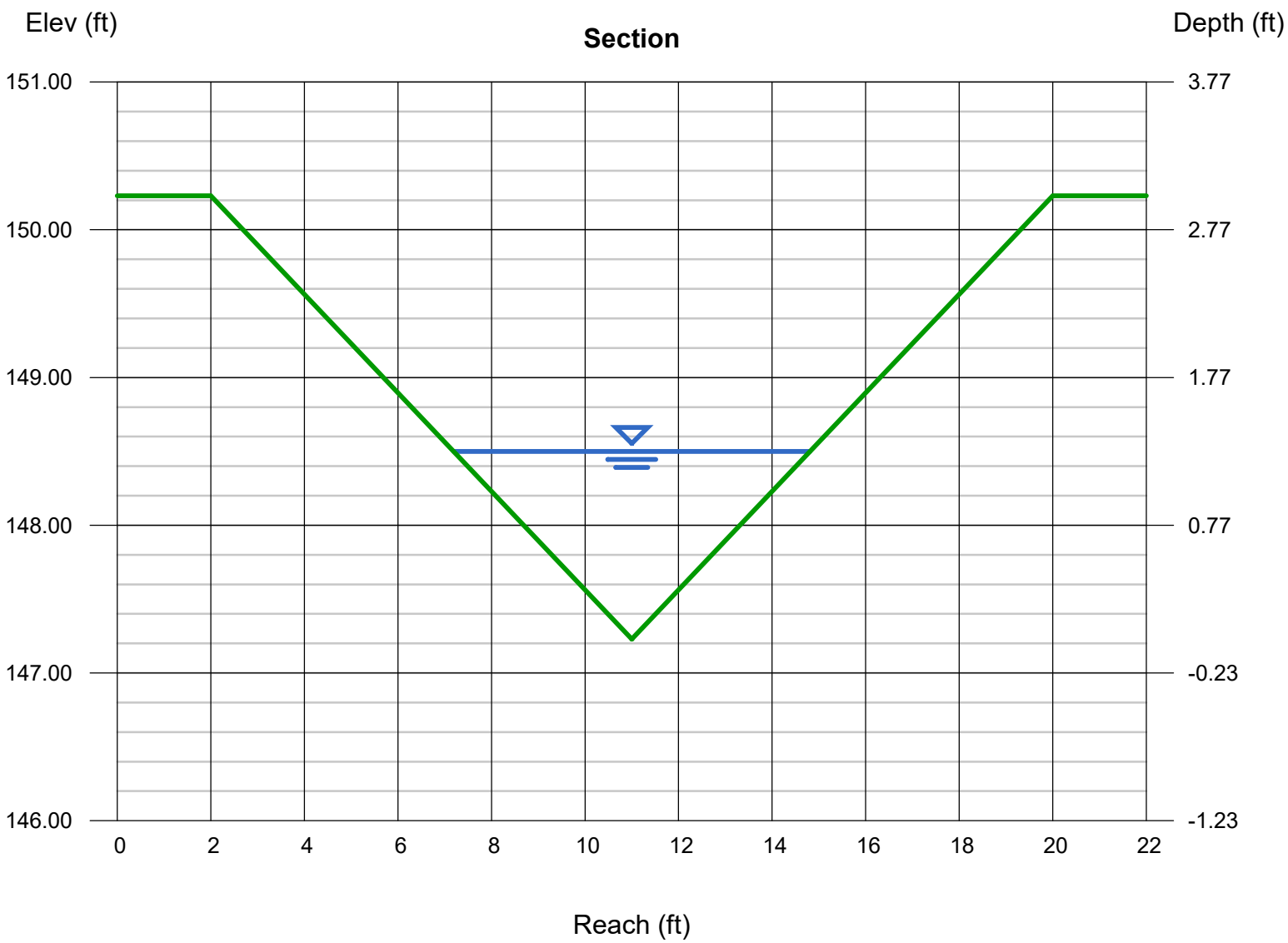
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	3.00
Invert Elev (ft)	=	147.23
Slope (%)	=	0.31
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	7.05

Highlighted

Depth (ft)	=	1.27
Q (cfs)	=	7.050
Area (sqft)	=	4.84
Velocity (ft/s)	=	1.46
Wetted Perim (ft)	=	8.03
Crit Depth, Yc (ft)	=	0.81
Top Width (ft)	=	7.62
EGL (ft)	=	1.30



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

212+00 LT

Triangular

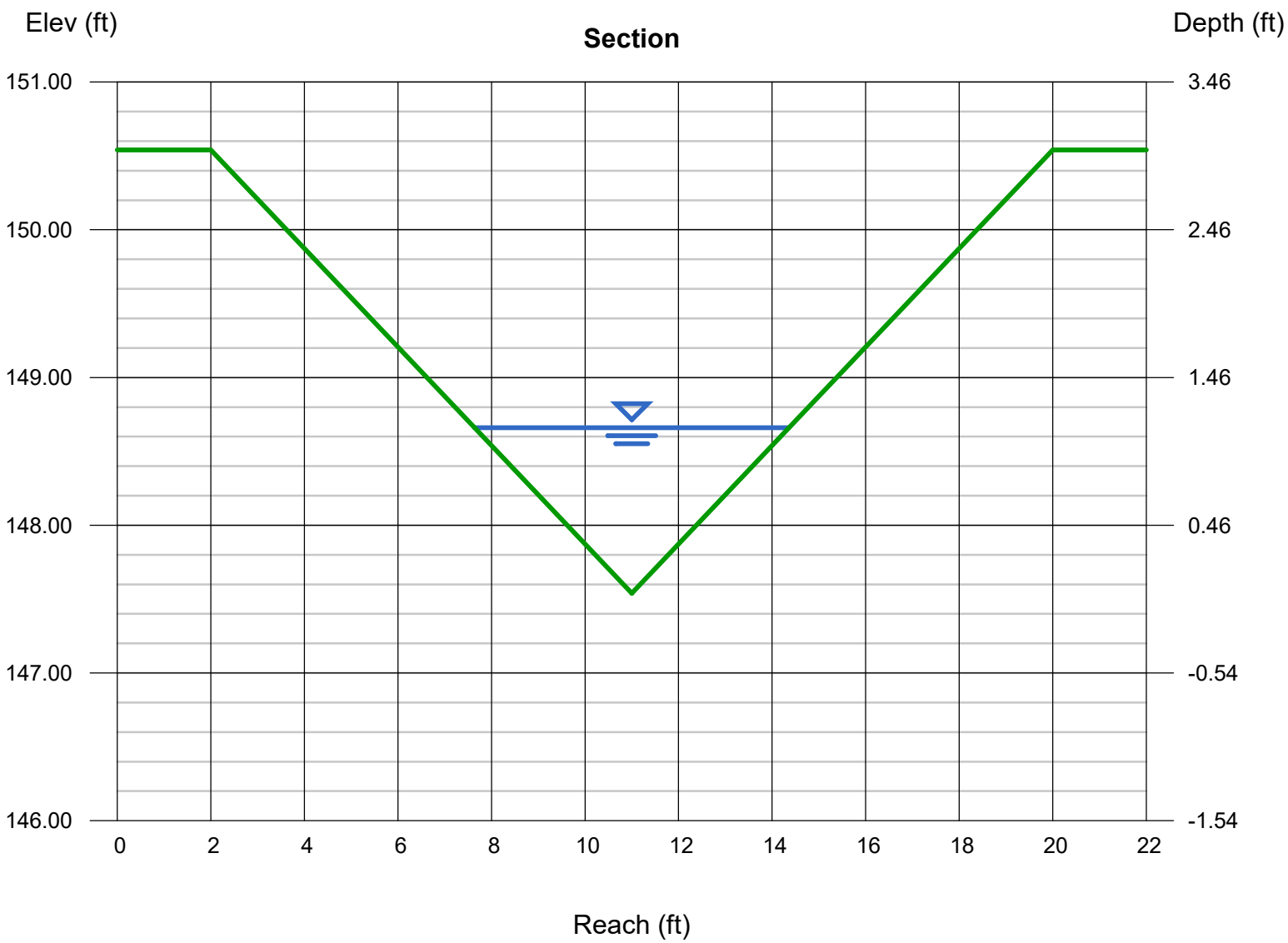
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 147.54
Slope (%)	= 0.30
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 5.00

Highlighted

Depth (ft)	= 1.12
Q (cfs)	= 5.000
Area (sqft)	= 3.76
Velocity (ft/s)	= 1.33
Wetted Perim (ft)	= 7.08
Crit Depth, Yc (ft)	= 0.71
Top Width (ft)	= 6.72
EGL (ft)	= 1.15



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

213+00 LT

Triangular

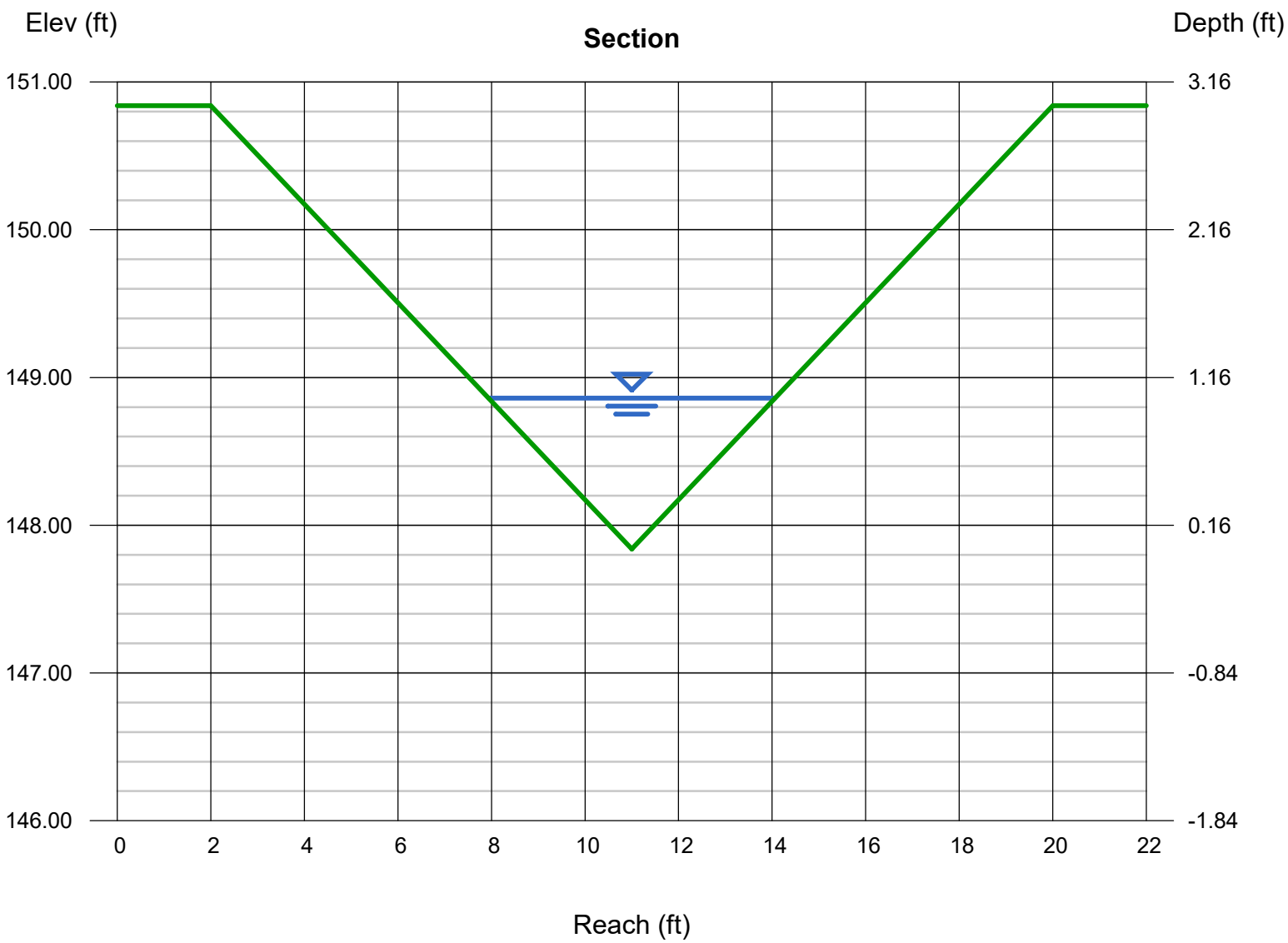
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	3.00
Invert Elev (ft)	=	147.84
Slope (%)	=	0.28
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.77

Highlighted

Depth (ft)	=	1.02
Q (cfs)	=	3.770
Area (sqft)	=	3.12
Velocity (ft/s)	=	1.21
Wetted Perim (ft)	=	6.45
Crit Depth, Yc (ft)	=	0.63
Top Width (ft)	=	6.12
EGL (ft)	=	1.04



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

214+00 LT

Triangular

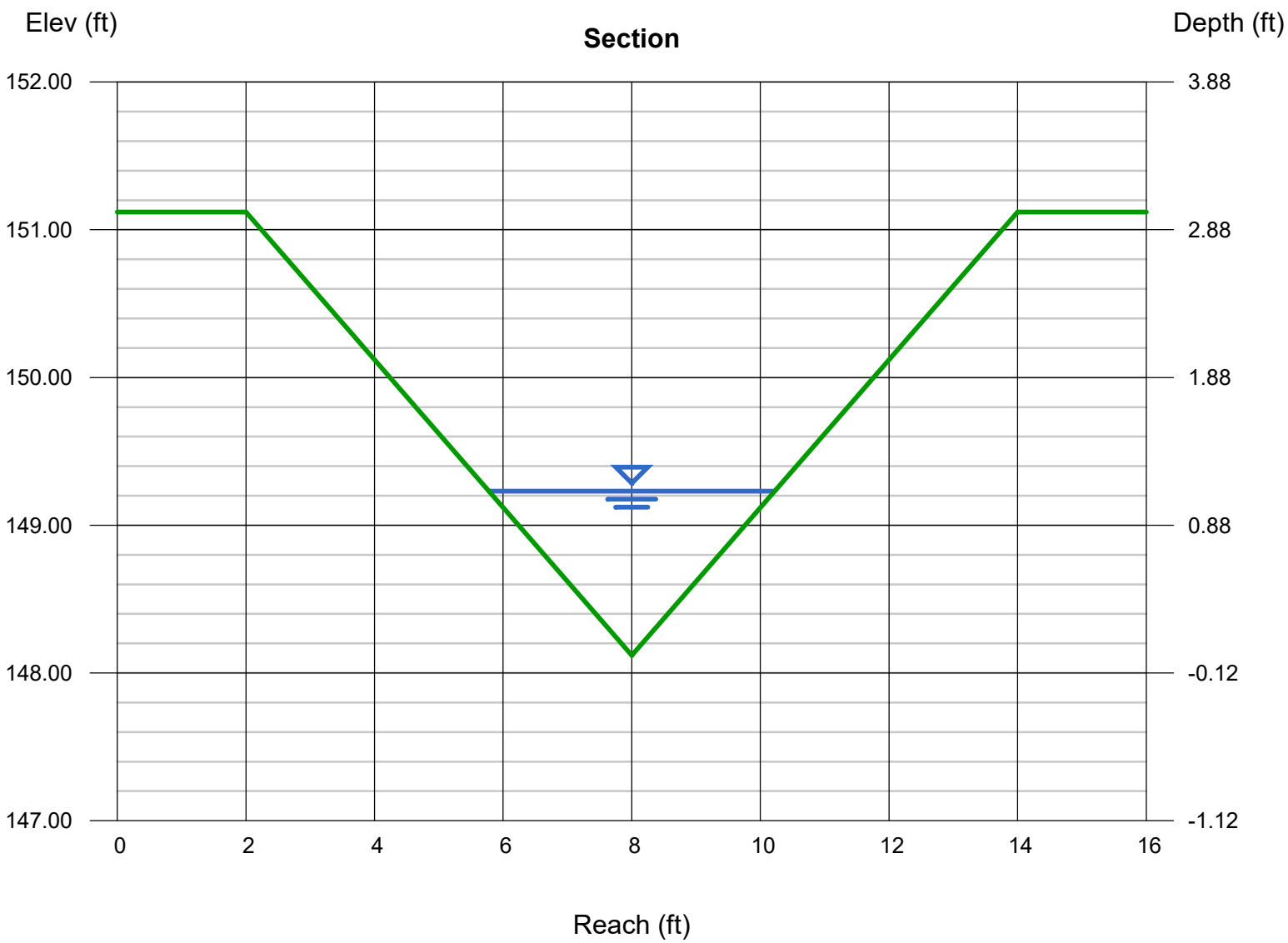
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	3.00
Invert Elev (ft)	=	148.12
Slope (%)	=	0.29
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.08

Highlighted

Depth (ft)	=	1.11
Q (cfs)	=	3.080
Area (sqft)	=	2.46
Velocity (ft/s)	=	1.25
Wetted Perim (ft)	=	4.96
Crit Depth, Yc (ft)	=	0.69
Top Width (ft)	=	4.44
EGL (ft)	=	1.13



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

215+00 LT

Triangular

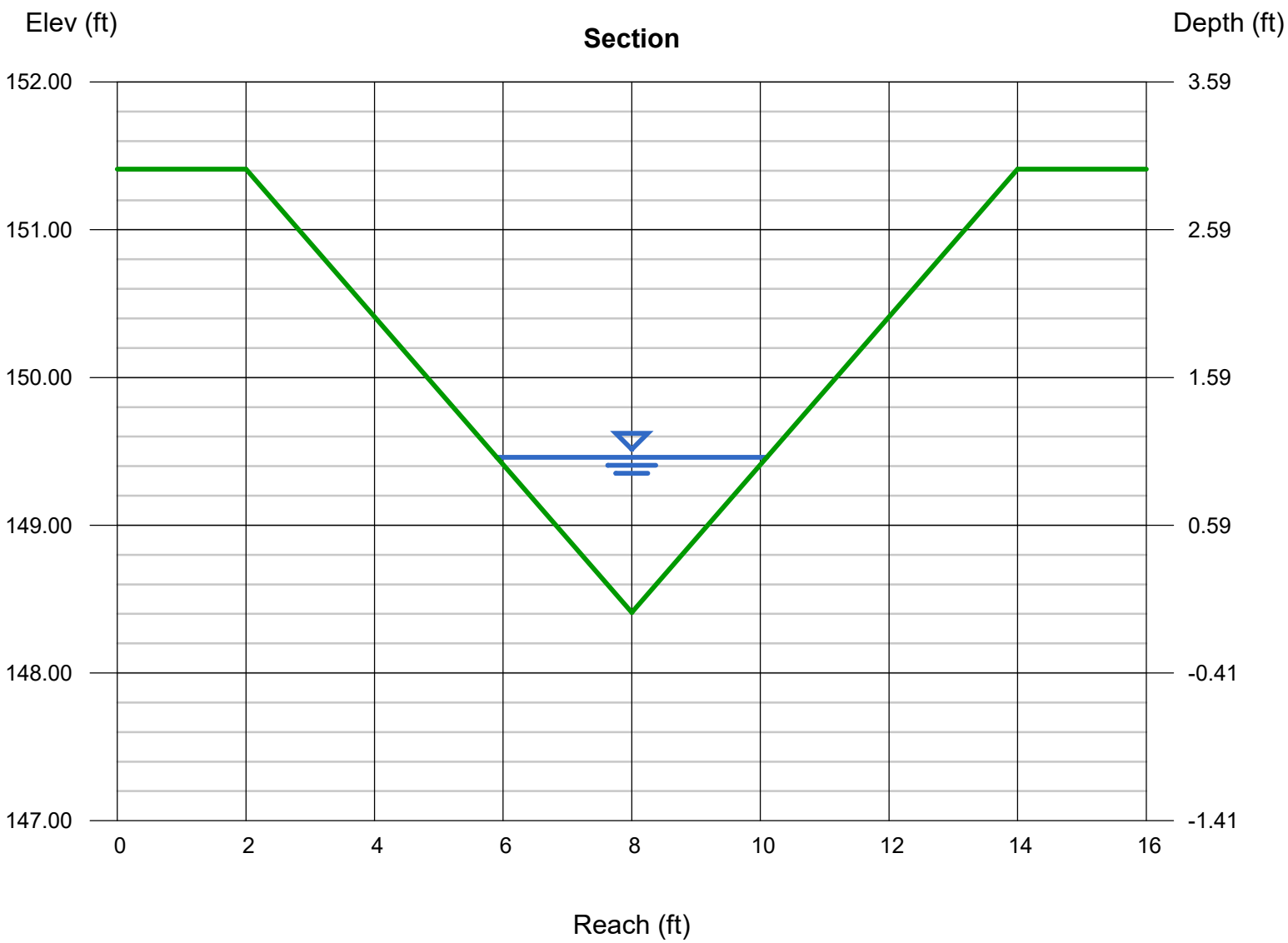
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 148.41
Slope (%)	= 0.29
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.63

Highlighted

Depth (ft)	= 1.05
Q (cfs)	= 2.630
Area (sqft)	= 2.20
Velocity (ft/s)	= 1.19
Wetted Perim (ft)	= 4.70
Crit Depth, Yc (ft)	= 0.65
Top Width (ft)	= 4.20
EGL (ft)	= 1.07



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

216+00 LT

Triangular

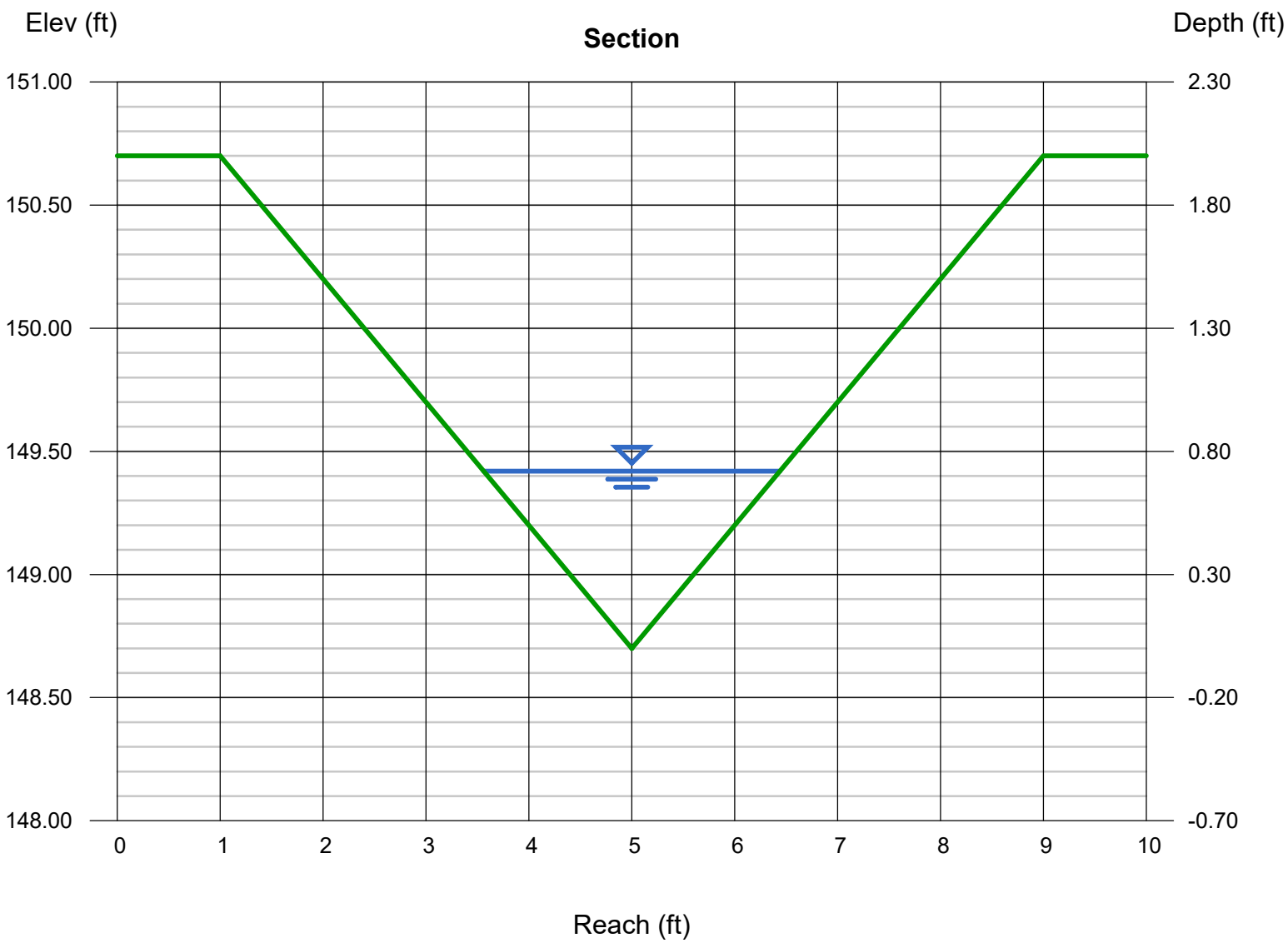
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	148.70
Slope (%)	=	1.23
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.96

Highlighted

Depth (ft)	=	0.72
Q (cfs)	=	1.960
Area (sqft)	=	1.04
Velocity (ft/s)	=	1.89
Wetted Perim (ft)	=	3.22
Crit Depth, Yc (ft)	=	0.57
Top Width (ft)	=	2.88
EGL (ft)	=	0.78



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

218+00 LT

Triangular

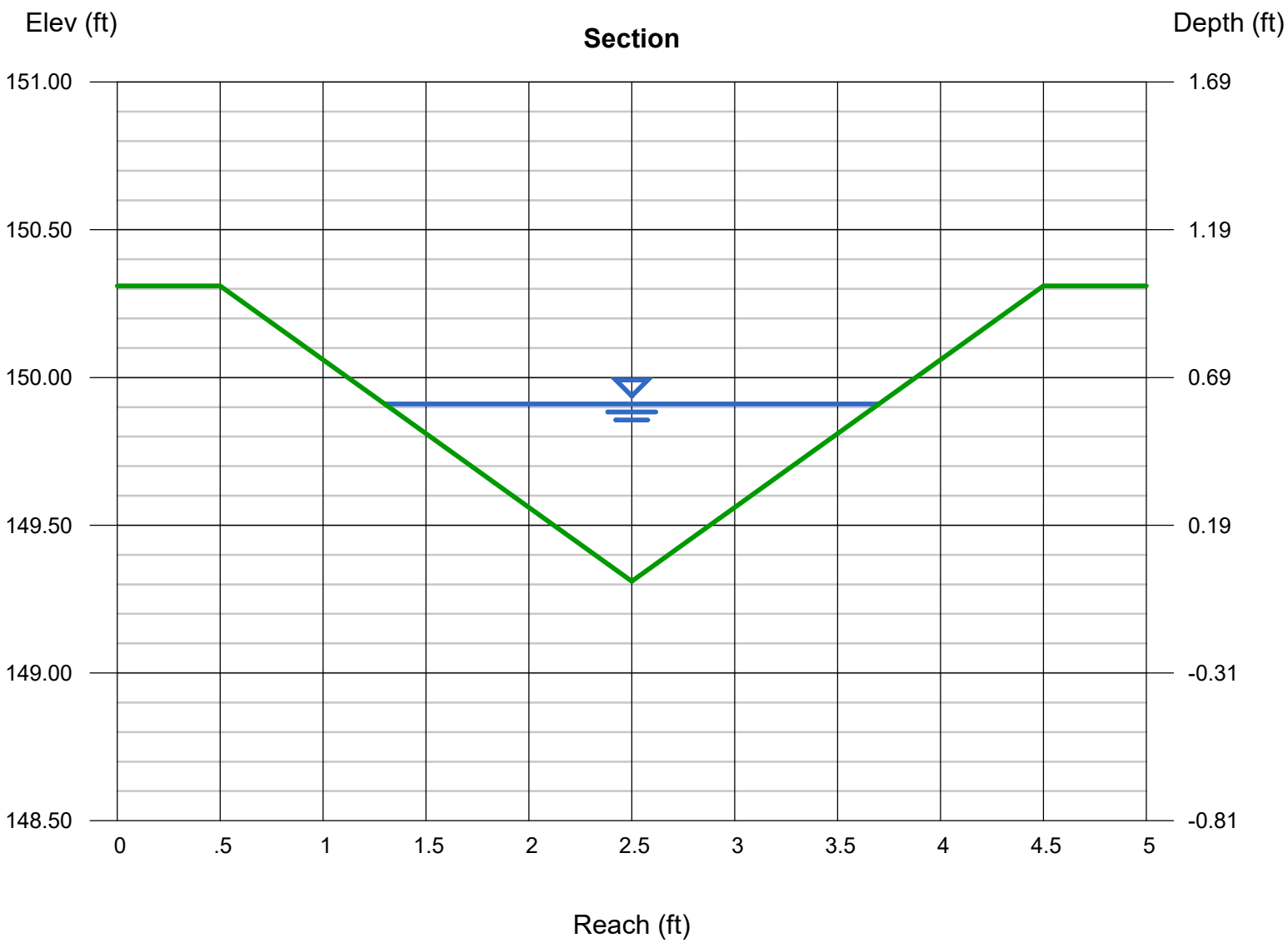
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	149.31
Slope (%)	=	0.35
N-Value	=	0.015

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.68

Highlighted

Depth (ft)	=	0.60
Q (cfs)	=	1.680
Area (sqft)	=	0.72
Velocity (ft/s)	=	2.33
Wetted Perim (ft)	=	2.68
Crit Depth, Yc (ft)	=	0.54
Top Width (ft)	=	2.40
EGL (ft)	=	0.68



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

219+00 LT

Triangular

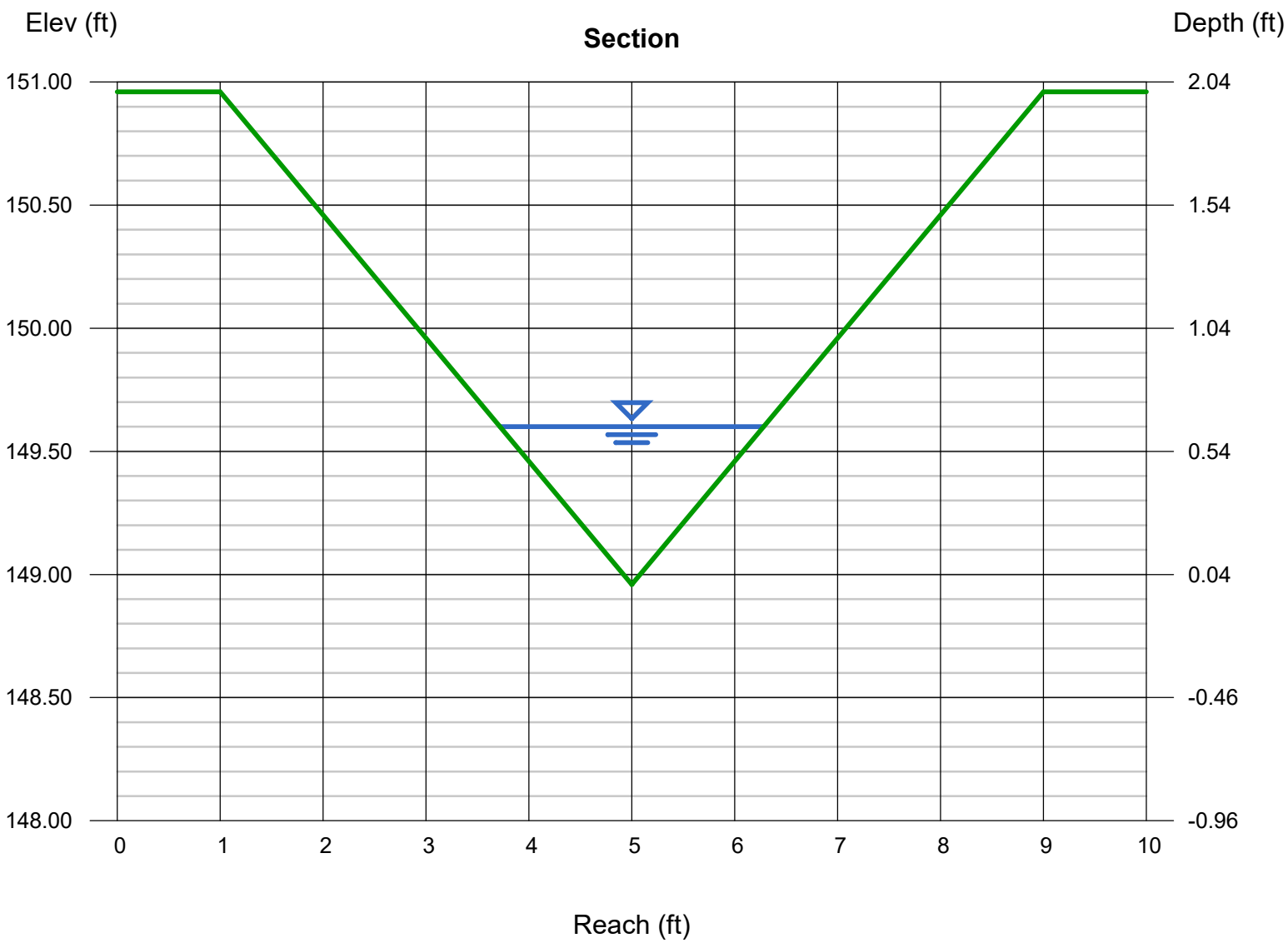
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	148.96
Slope (%)	=	0.35
N-Value	=	0.015

Calculations

Compute by:		Known Q
Known Q (cfs)	=	2.07

Highlighted

Depth (ft)	=	0.64
Q (cfs)	=	2.070
Area (sqft)	=	0.82
Velocity (ft/s)	=	2.53
Wetted Perim (ft)	=	2.86
Crit Depth, Yc (ft)	=	0.59
Top Width (ft)	=	2.56
EGL (ft)	=	0.74



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 21 2023

220+25 LT

Triangular

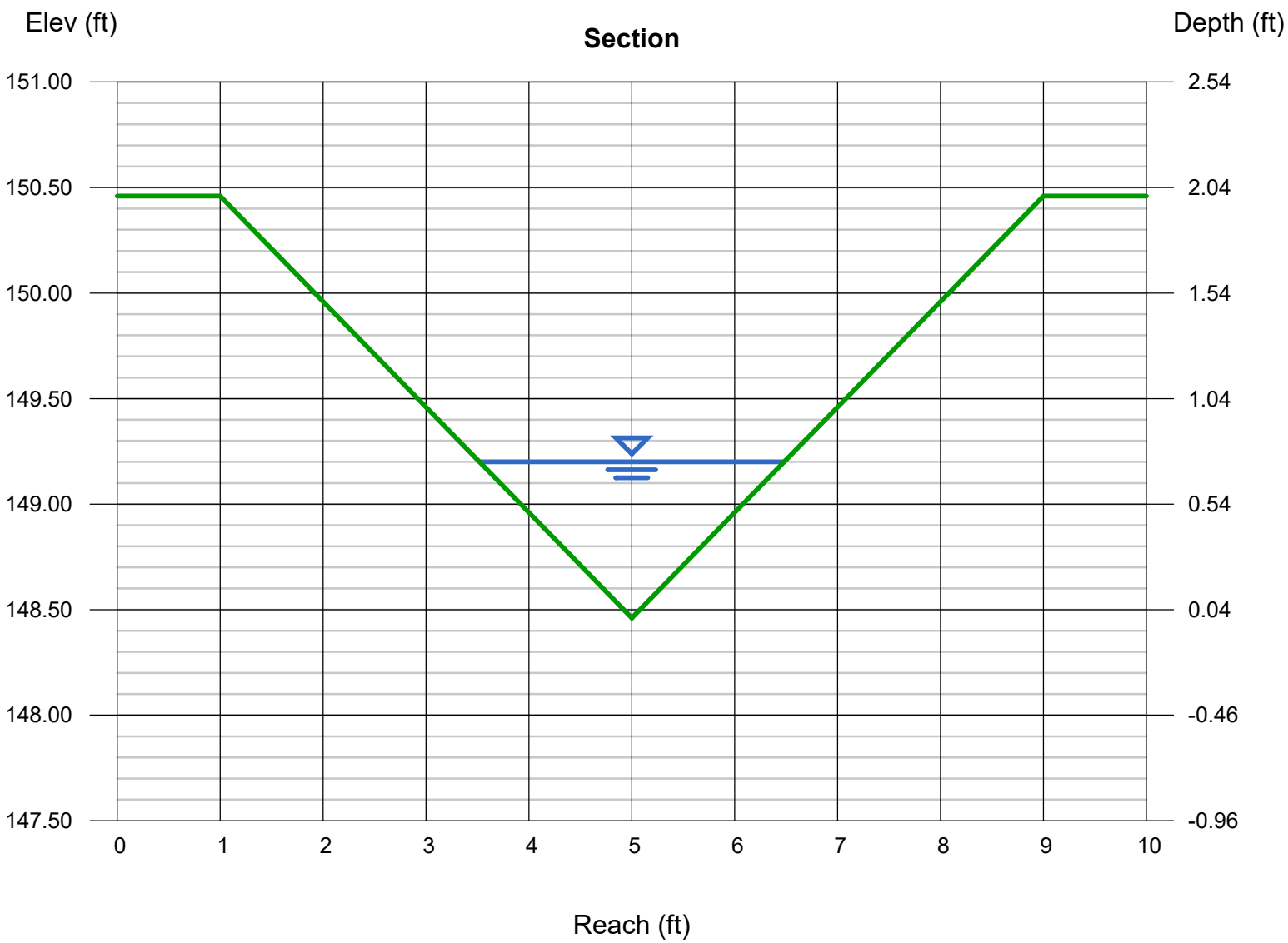
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 148.46
Slope (%)	= 0.35
N-Value	= 0.015

Calculations

Compute by:	Known Q
Known Q (cfs)	= 3.01

Highlighted

Depth (ft)	= 0.74
Q (cfs)	= 3.010
Area (sqft)	= 1.10
Velocity (ft/s)	= 2.75
Wetted Perim (ft)	= 3.31
Crit Depth, Yc (ft)	= 0.68
Top Width (ft)	= 2.96
EGL (ft)	= 0.86



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

223+00 LT

Triangular

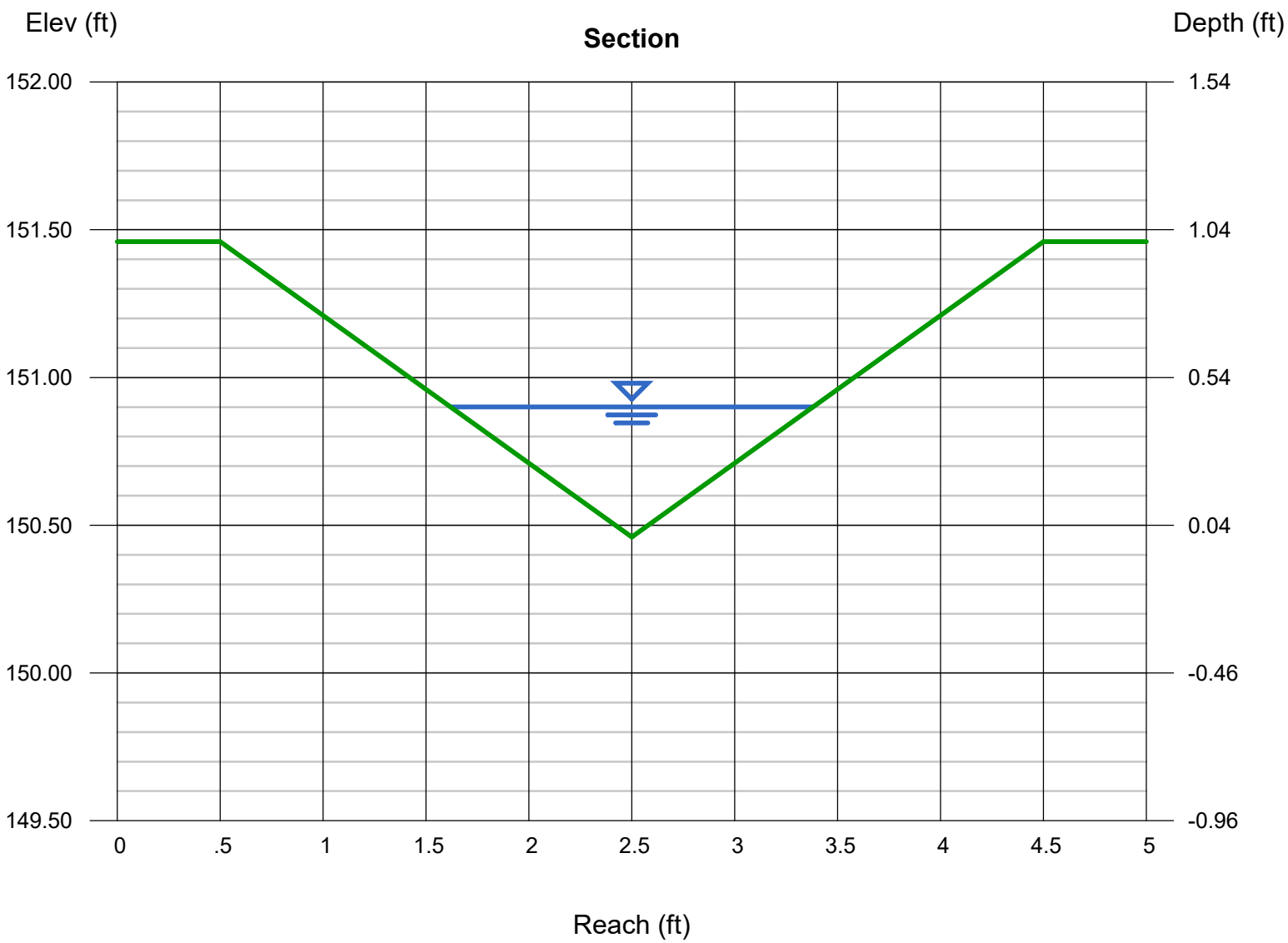
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 150.46
Slope (%)	= 1.80
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.64

Highlighted

Depth (ft)	= 0.44
Q (cfs)	= 0.640
Area (sqft)	= 0.39
Velocity (ft/s)	= 1.65
Wetted Perim (ft)	= 1.97
Crit Depth, Yc (ft)	= 0.37
Top Width (ft)	= 1.76
EGL (ft)	= 0.48



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

224+00 LT

Triangular

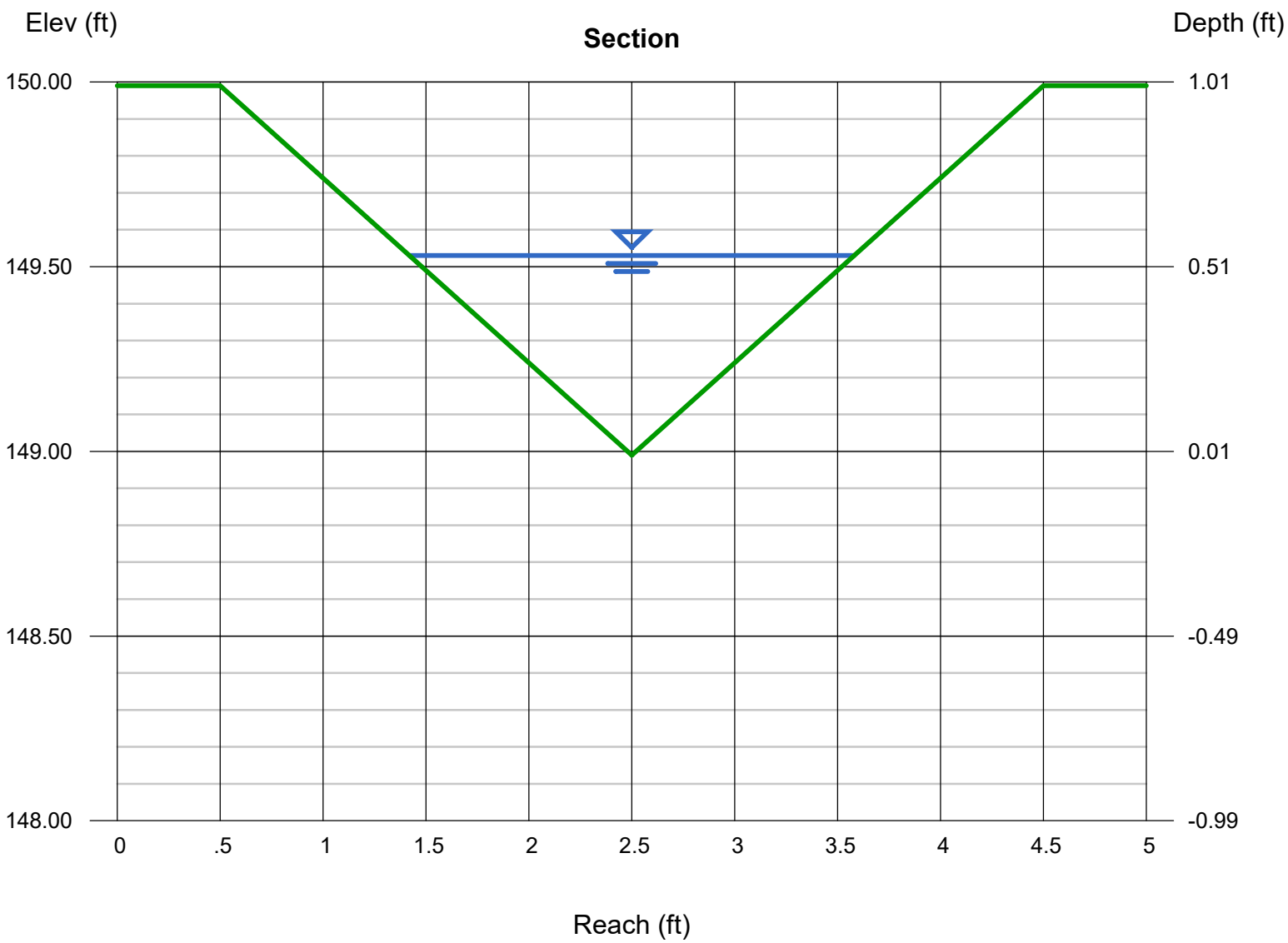
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 148.99
Slope (%)	= 1.50
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.00

Highlighted

Depth (ft)	= 0.54
Q (cfs)	= 1.000
Area (sqft)	= 0.58
Velocity (ft/s)	= 1.71
Wetted Perim (ft)	= 2.41
Crit Depth, Yc (ft)	= 0.44
Top Width (ft)	= 2.16
EGL (ft)	= 0.59



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

225+00 LT

Triangular

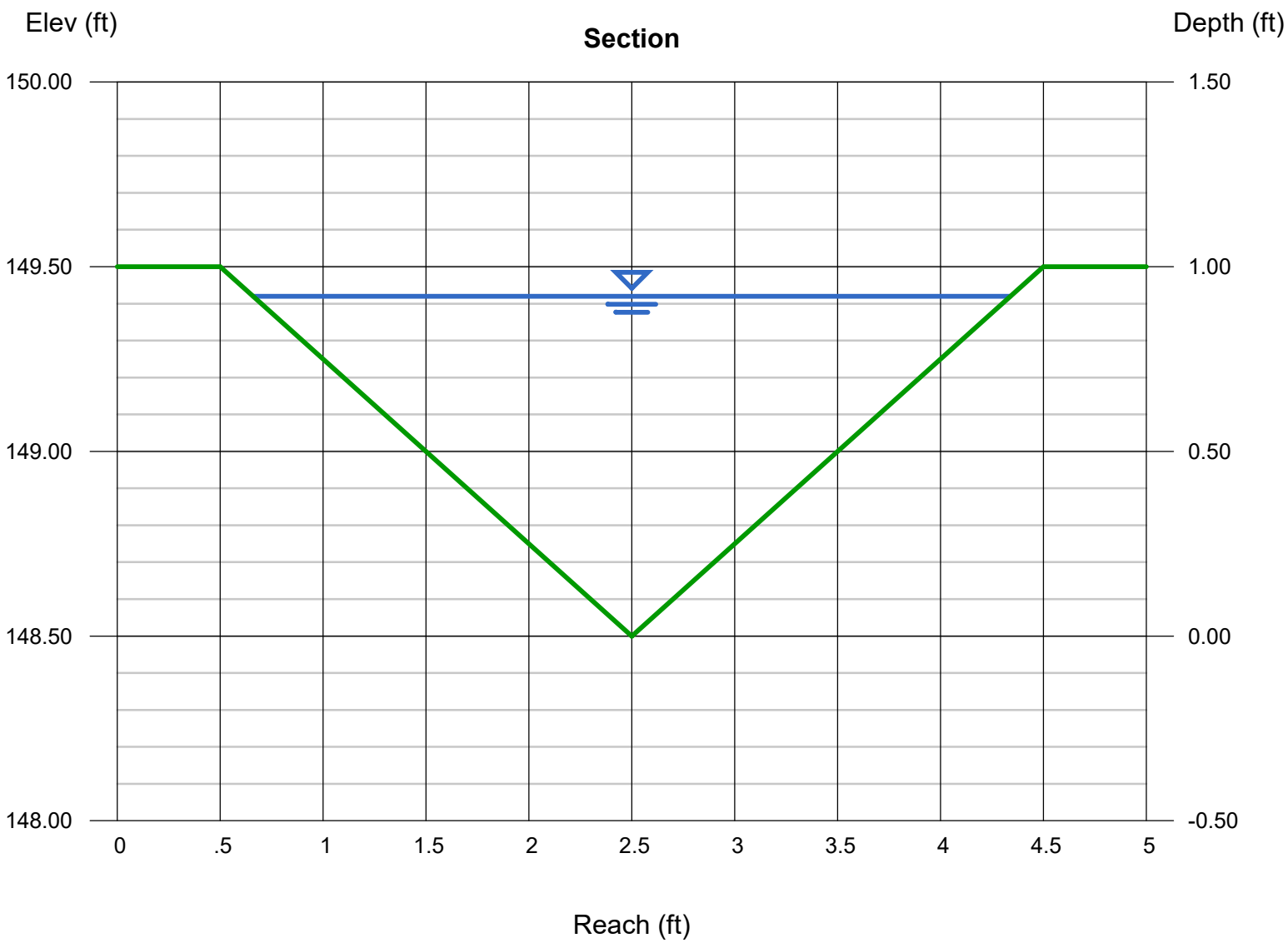
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 148.50
Slope (%)	= 0.50
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.41

Highlighted

Depth (ft)	= 0.92
Q (cfs)	= 2.410
Area (sqft)	= 1.69
Velocity (ft/s)	= 1.42
Wetted Perim (ft)	= 4.11
Crit Depth, Yc (ft)	= 0.62
Top Width (ft)	= 3.68
EGL (ft)	= 0.95



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

226+00 LT

Triangular

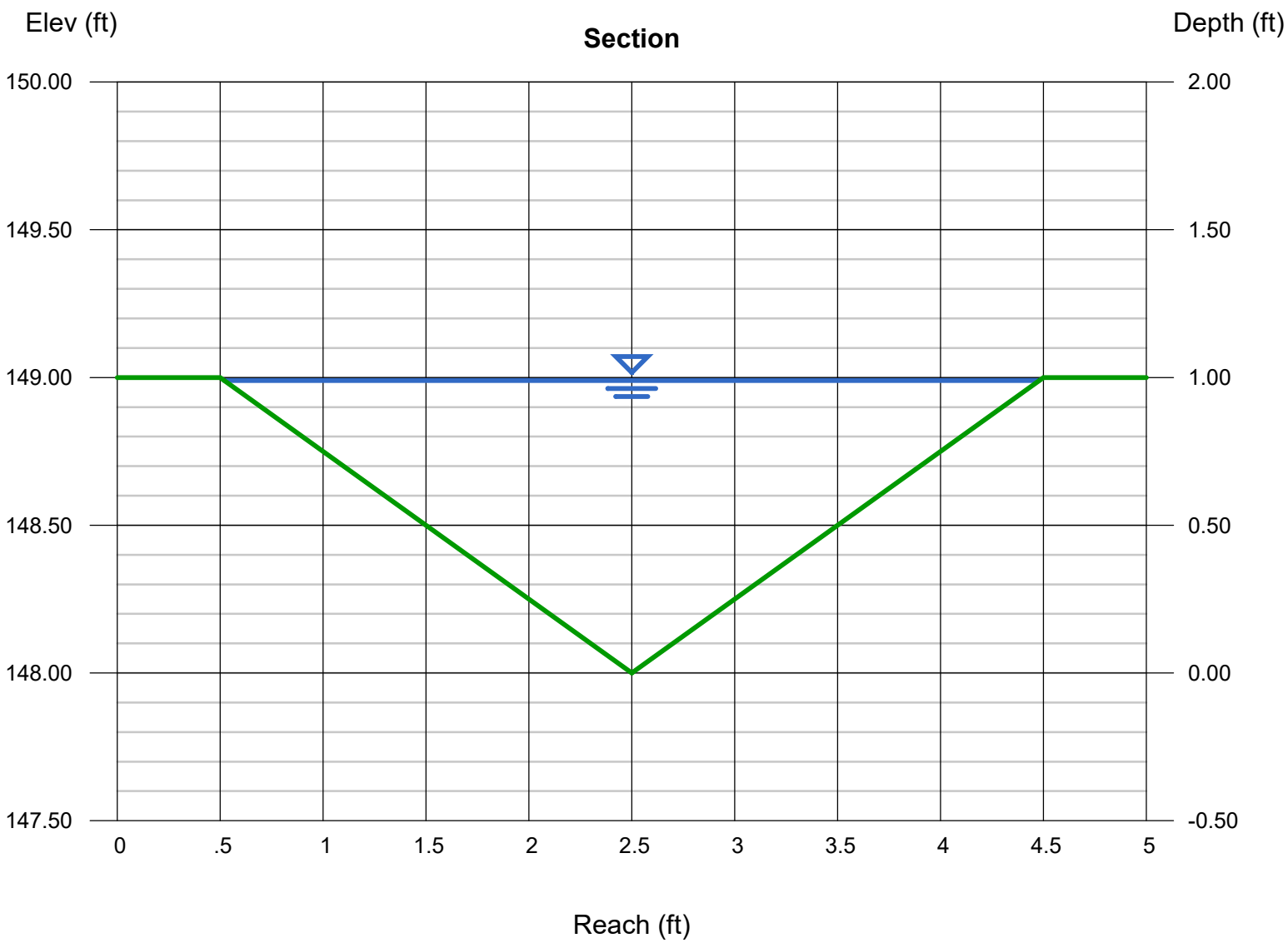
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 148.00
Slope (%)	= 0.50
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.98

Highlighted

Depth (ft)	= 0.99
Q (cfs)	= 2.980
Area (sqft)	= 1.96
Velocity (ft/s)	= 1.52
Wetted Perim (ft)	= 4.43
Crit Depth, Yc (ft)	= 0.68
Top Width (ft)	= 3.96
EGL (ft)	= 1.03



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

227+00 LT

Triangular

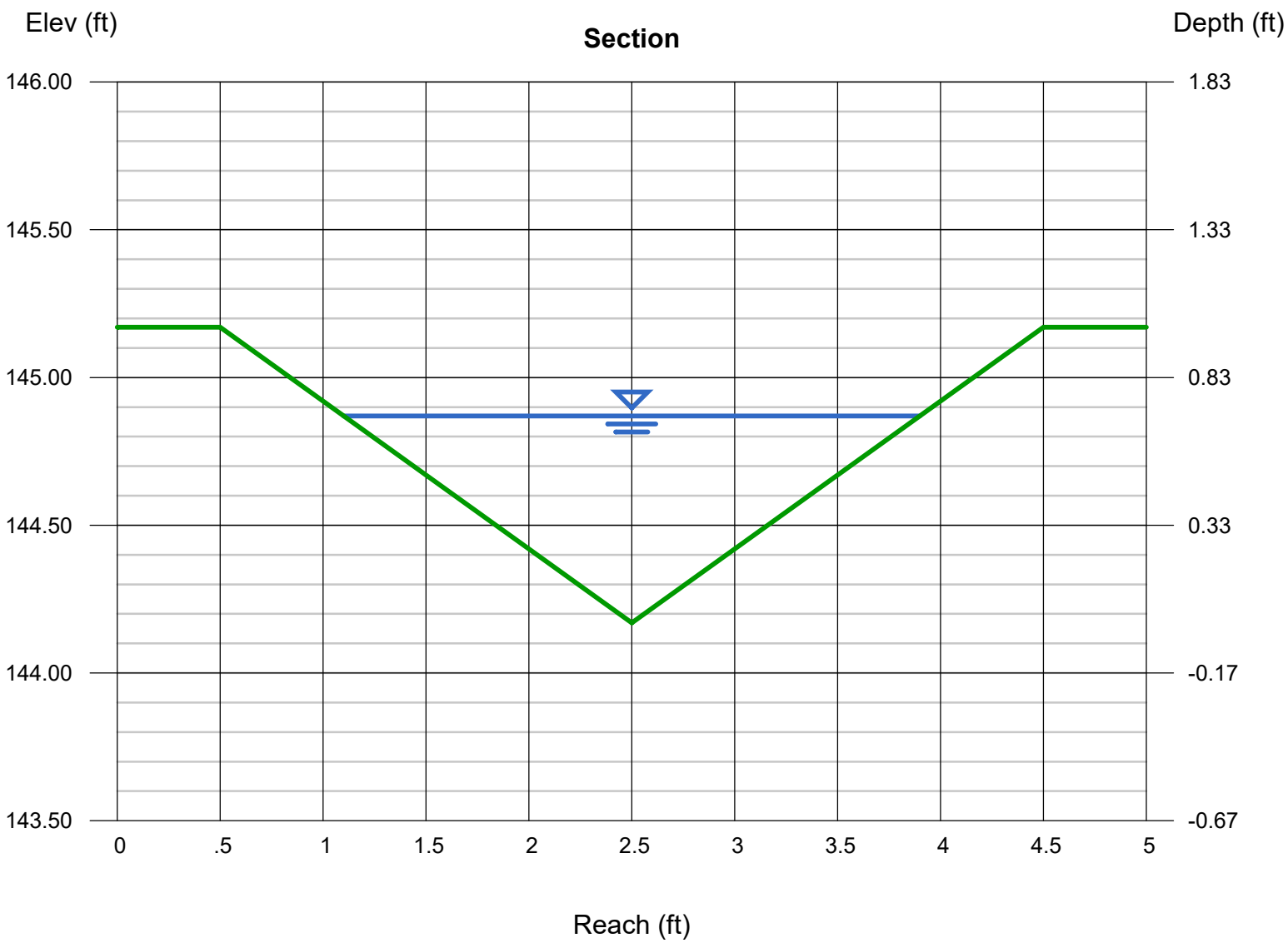
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	144.17
Slope (%)	=	3.80
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.24

Highlighted

Depth (ft)	=	0.70
Q (cfs)	=	3.240
Area (sqft)	=	0.98
Velocity (ft/s)	=	3.31
Wetted Perim (ft)	=	3.13
Crit Depth, Yc (ft)	=	0.70
Top Width (ft)	=	2.80
EGL (ft)	=	0.87



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

227+23 LT

Triangular

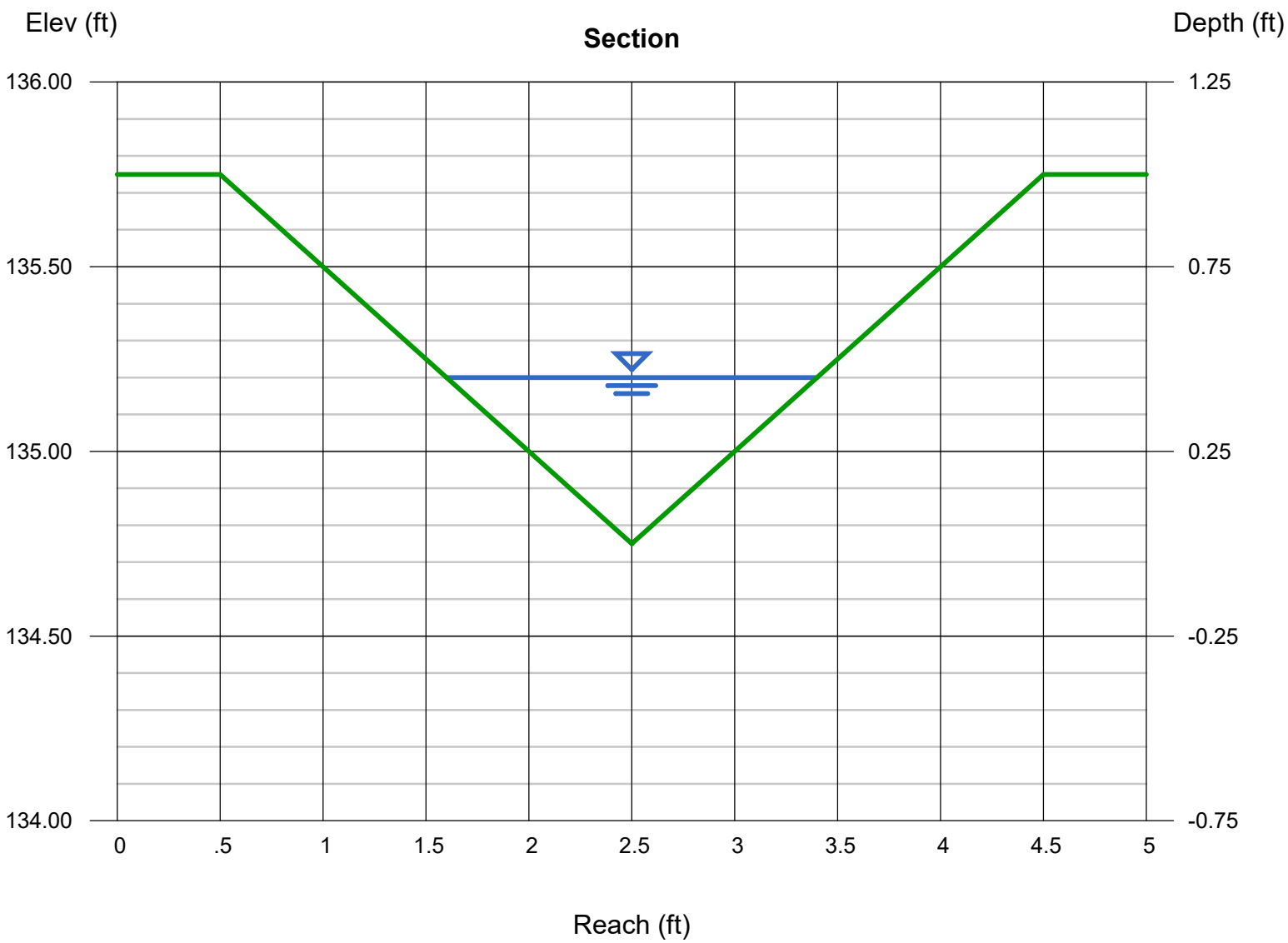
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	134.75
Slope (%)	=	38.00
N-Value	=	0.038

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.35

Highlighted

Depth (ft)	=	0.45
Q (cfs)	=	3.350
Area (sqft)	=	0.40
Velocity (ft/s)	=	8.27
Wetted Perim (ft)	=	2.01
Crit Depth, Yc (ft)	=	0.71
Top Width (ft)	=	1.80
EGL (ft)	=	1.51



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

229+00 LT

Triangular

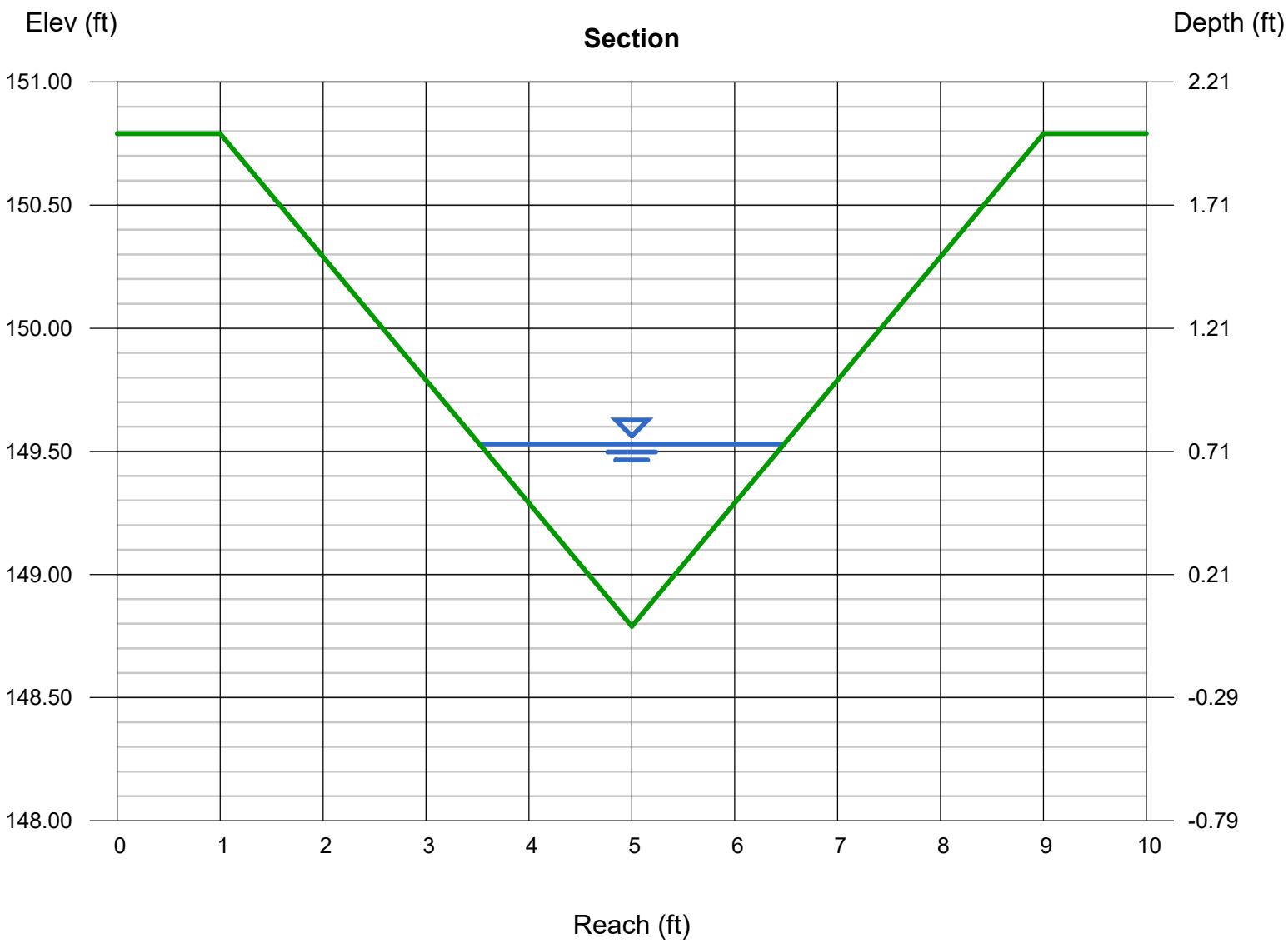
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 148.79
Slope (%)	= 1.60
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.41

Highlighted

Depth (ft)	= 0.74
Q (cfs)	= 2.410
Area (sqft)	= 1.10
Velocity (ft/s)	= 2.20
Wetted Perim (ft)	= 3.31
Crit Depth, Yc (ft)	= 0.62
Top Width (ft)	= 2.96
EGL (ft)	= 0.82



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

230+00 LT

Triangular

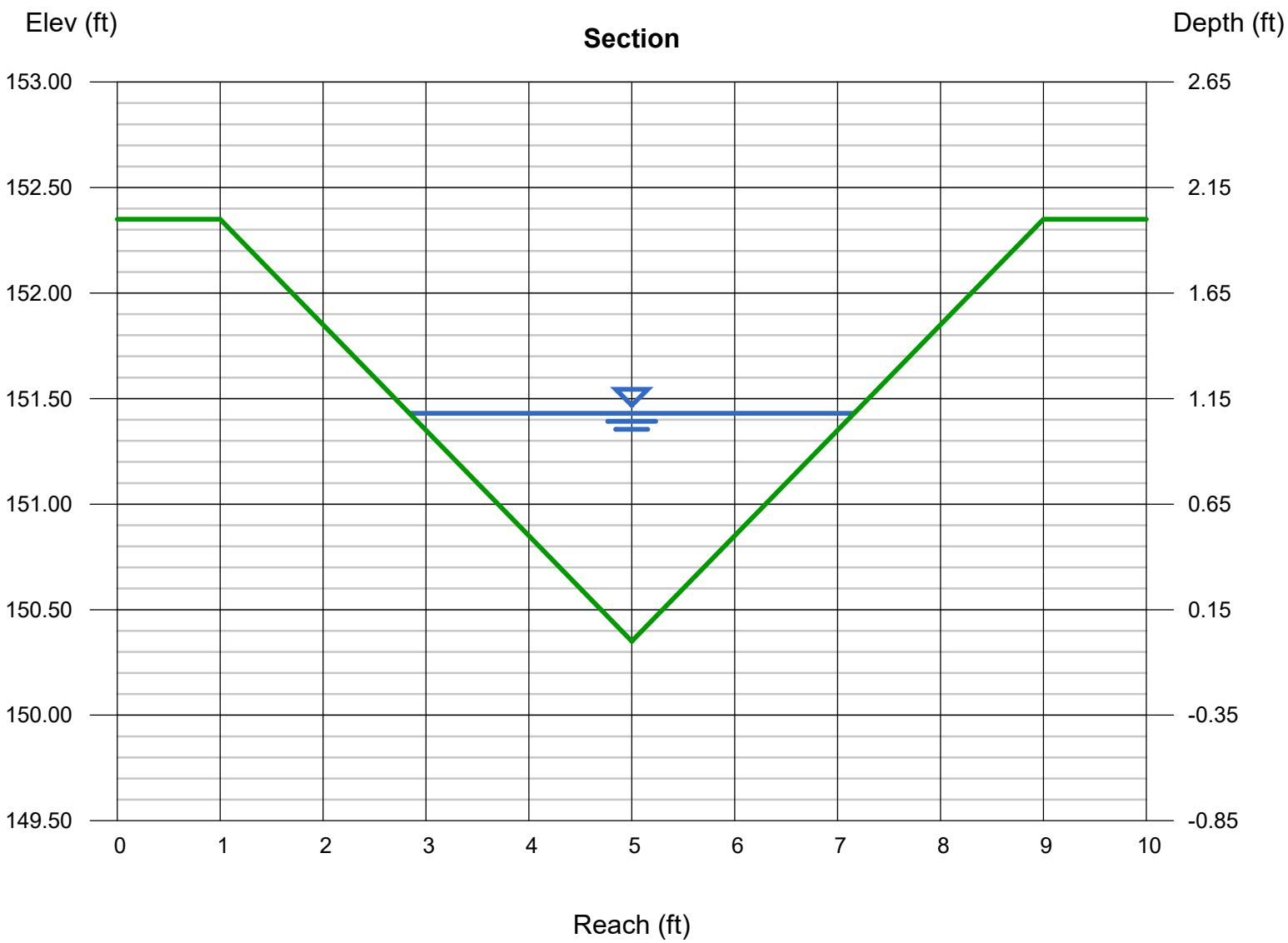
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 150.35
Slope (%)	= 0.20
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.33

Highlighted

Depth (ft)	= 1.08
Q (cfs)	= 2.330
Area (sqft)	= 2.33
Velocity (ft/s)	= 1.00
Wetted Perim (ft)	= 4.83
Crit Depth, Yc (ft)	= 0.61
Top Width (ft)	= 4.32
EGL (ft)	= 1.10



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 27 2023

231+85 LT

Triangular

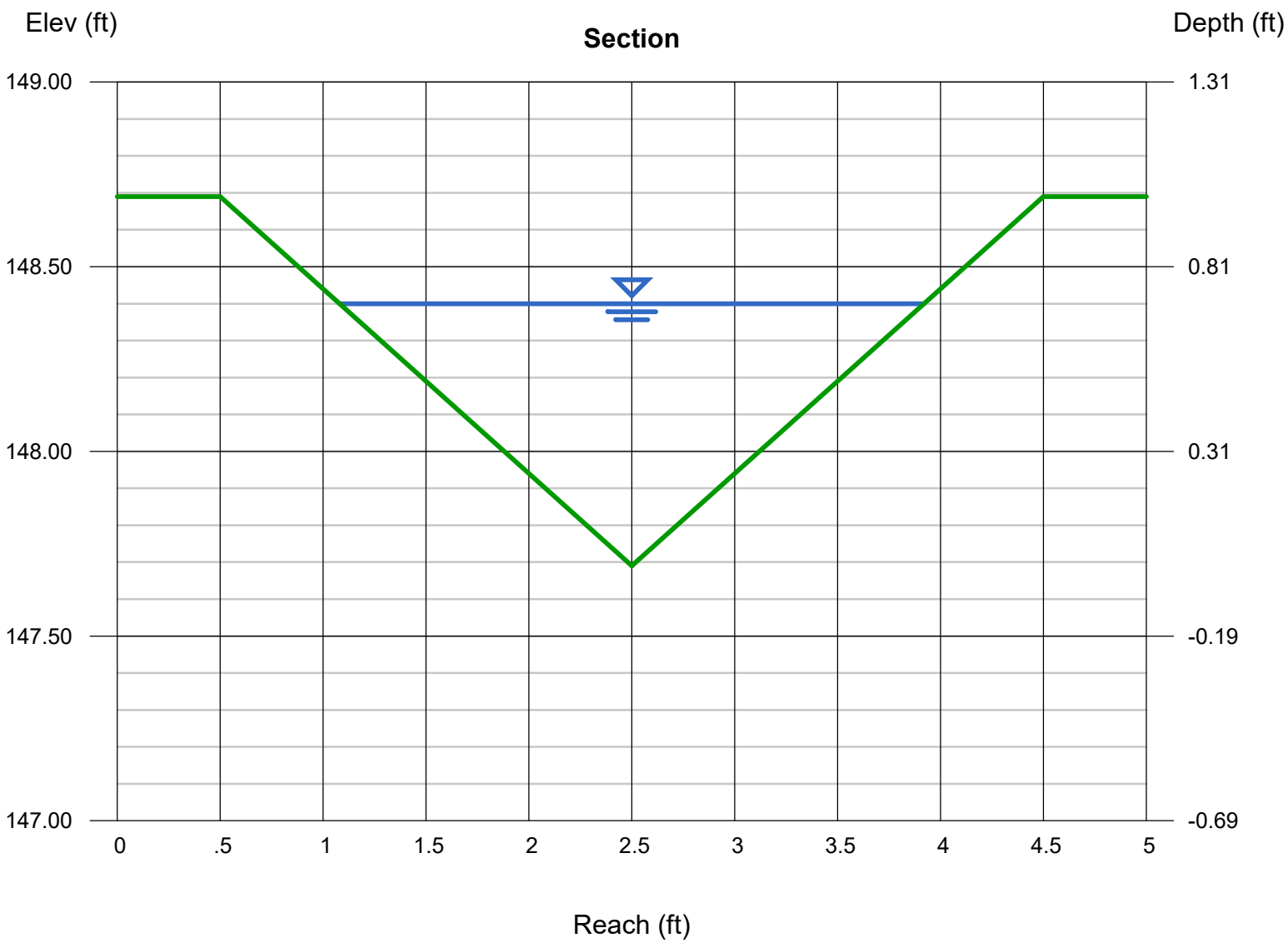
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	147.69
Slope (%)	=	3.40
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.12

Highlighted

Depth (ft)	=	0.71
Q (cfs)	=	3.120
Area (sqft)	=	1.01
Velocity (ft/s)	=	3.09
Wetted Perim (ft)	=	3.18
Crit Depth, Yc (ft)	=	0.69
Top Width (ft)	=	2.84
EGL (ft)	=	0.86



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 28 2023

231+89 LT

Triangular

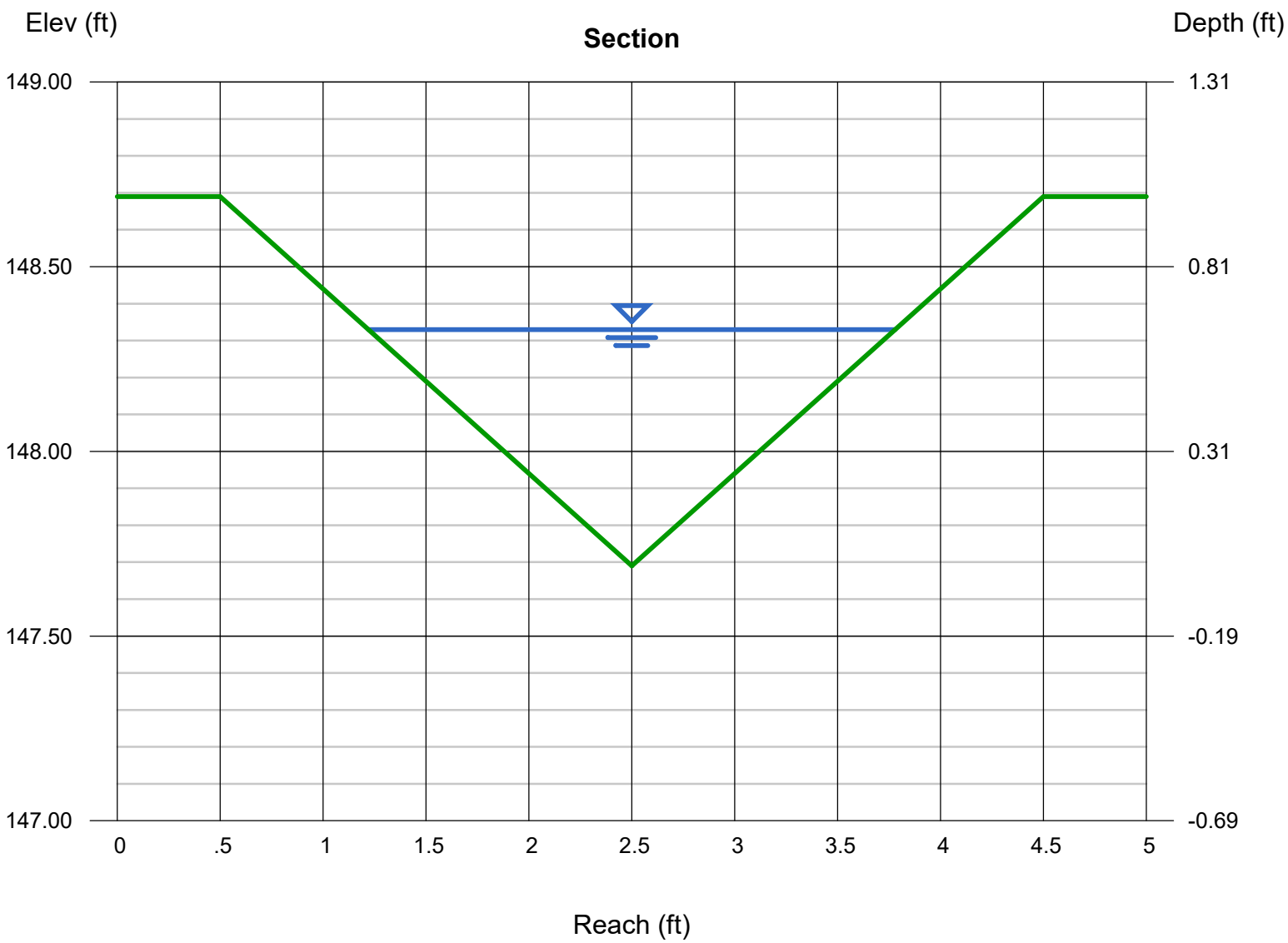
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 147.69
Slope (%)	= 1.20
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.40

Highlighted

Depth (ft)	= 0.64
Q (cfs)	= 1.400
Area (sqft)	= 0.82
Velocity (ft/s)	= 1.71
Wetted Perim (ft)	= 2.86
Crit Depth, Yc (ft)	= 0.50
Top Width (ft)	= 2.56
EGL (ft)	= 0.69



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

234+00 LT

Triangular

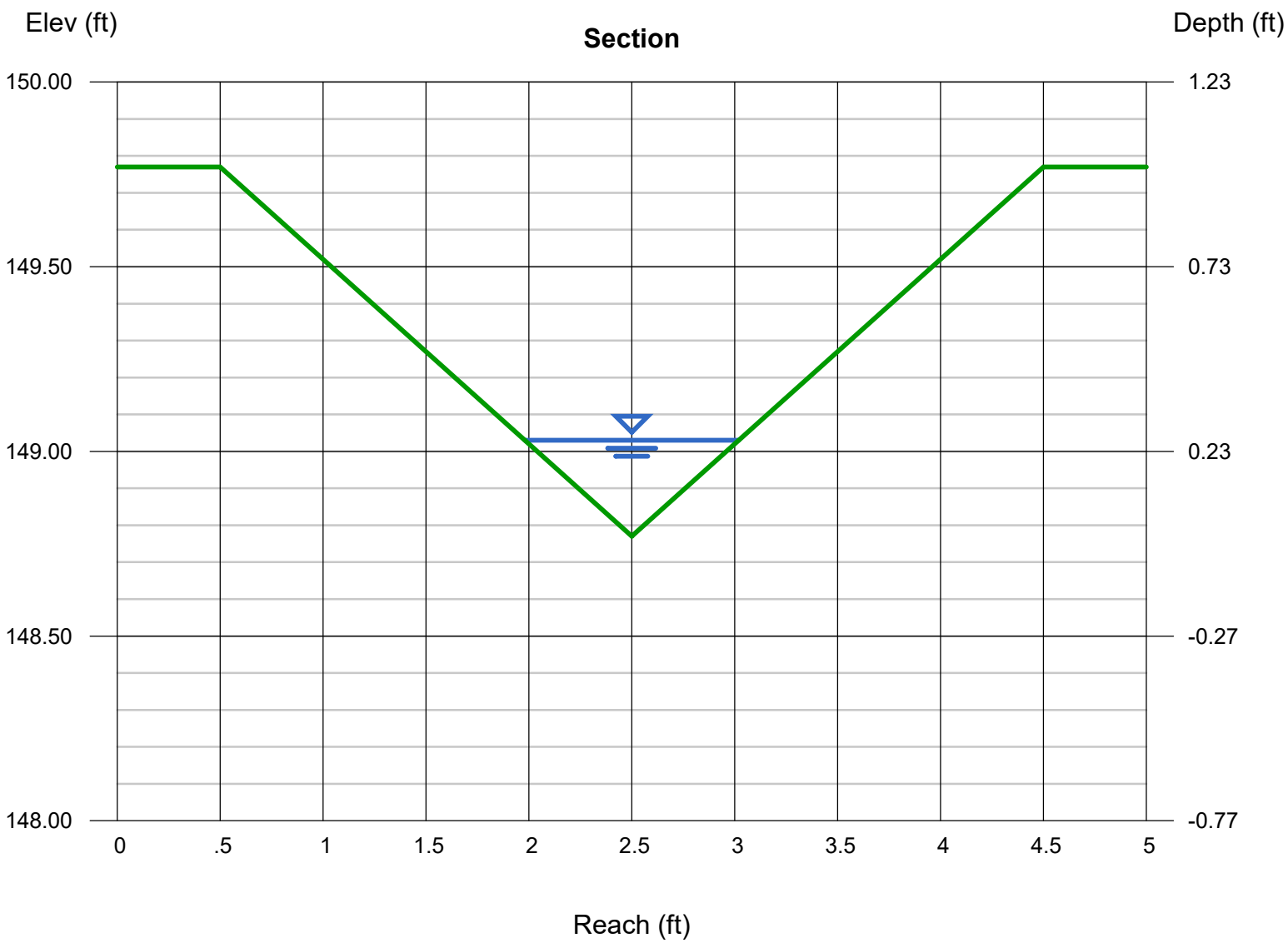
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	148.77
Slope (%)	=	4.00
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.23

Highlighted

Depth (ft)	=	0.26
Q (cfs)	=	0.230
Area (sqft)	=	0.14
Velocity (ft/s)	=	1.70
Wetted Perim (ft)	=	1.16
Crit Depth, Yc (ft)	=	0.25
Top Width (ft)	=	1.04
EGL (ft)	=	0.30



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

235+00 LT

Triangular

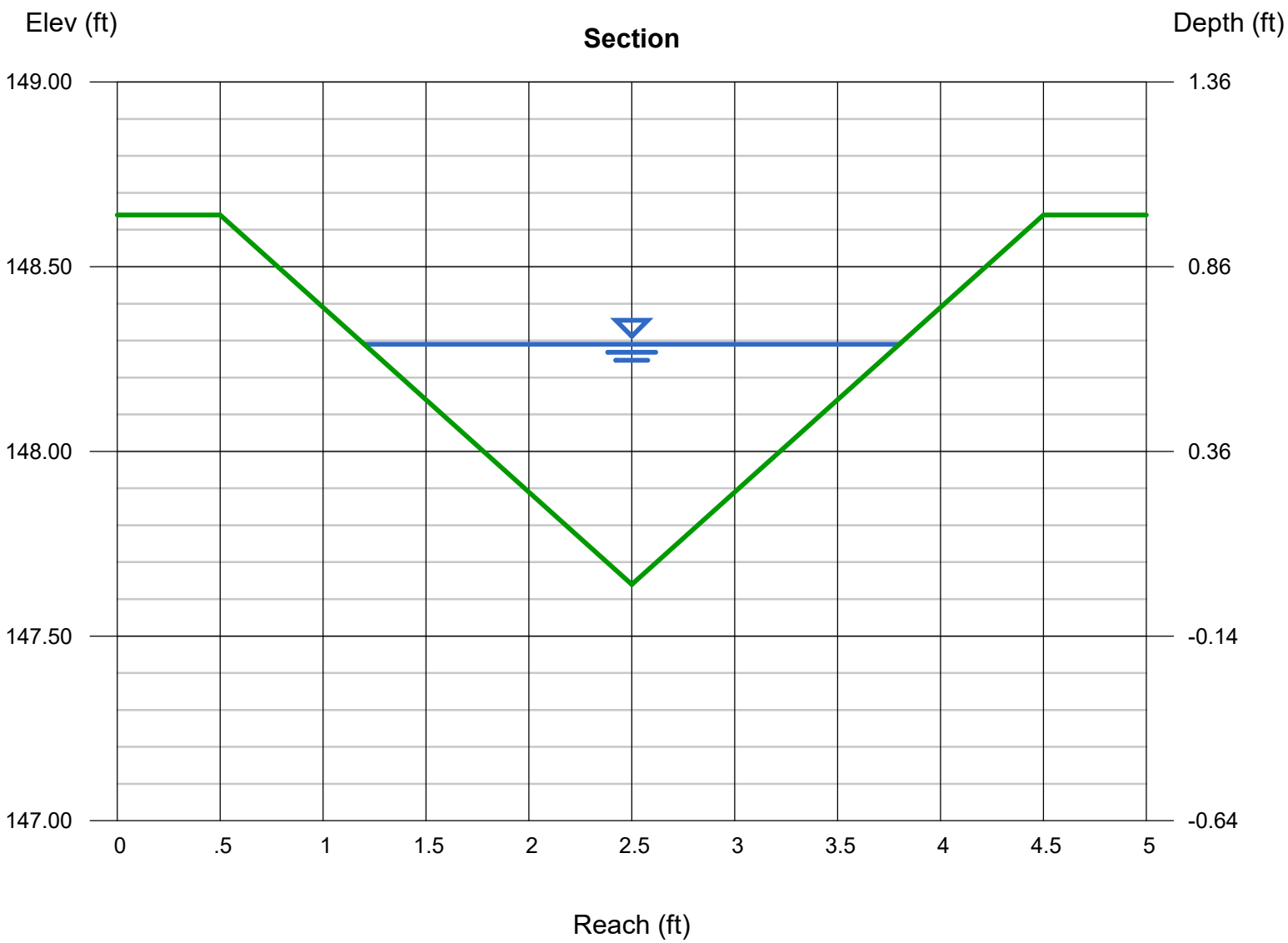
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 147.64
Slope (%)	= 1.10
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.43

Highlighted

Depth (ft)	= 0.65
Q (cfs)	= 1.430
Area (sqft)	= 0.84
Velocity (ft/s)	= 1.69
Wetted Perim (ft)	= 2.91
Crit Depth, Yc (ft)	= 0.51
Top Width (ft)	= 2.60
EGL (ft)	= 0.69



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

235+46 LT

Triangular

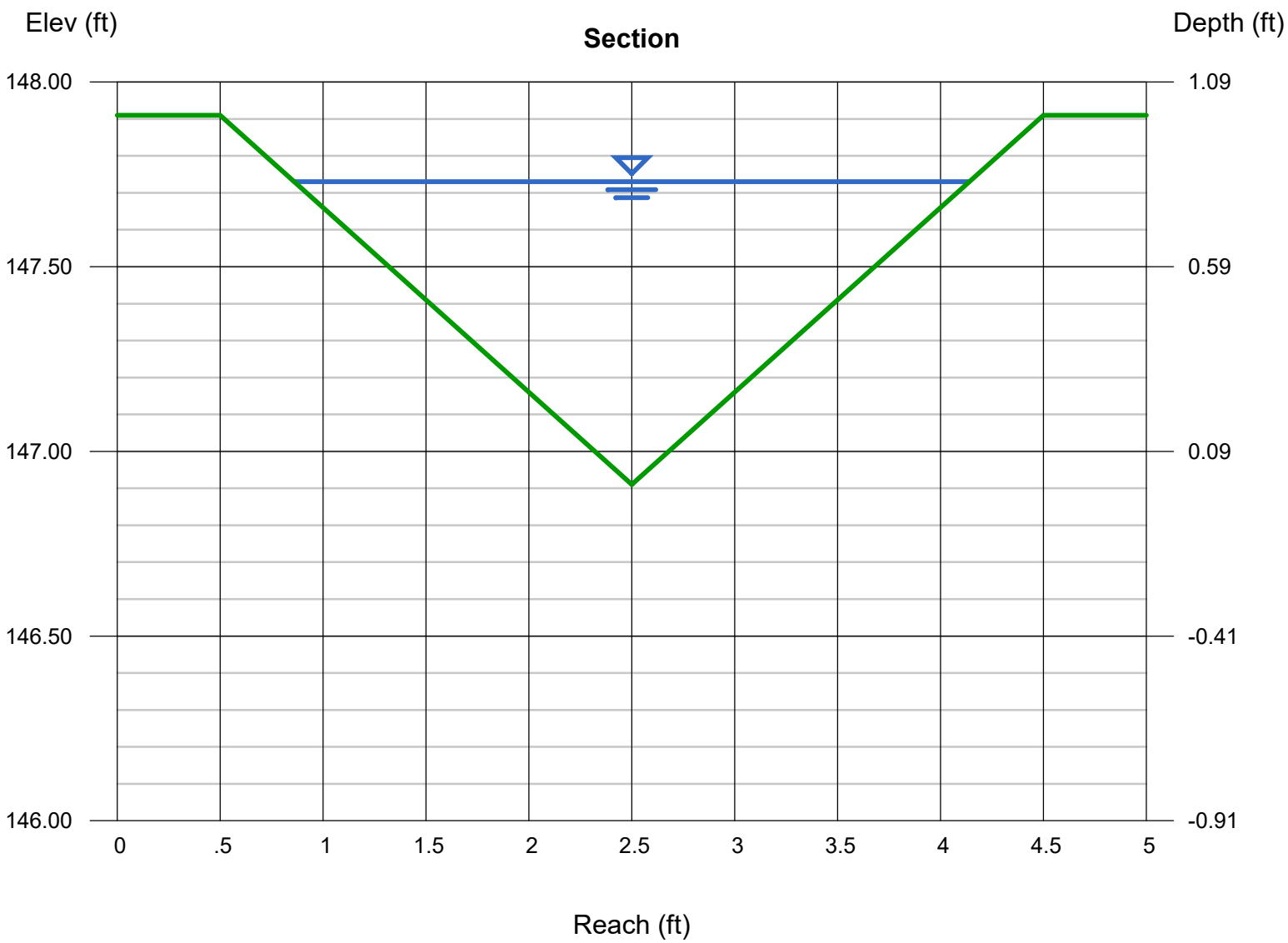
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	146.91
Slope (%)	=	1.60
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.21

Highlighted

Depth (ft)	=	0.82
Q (cfs)	=	3.210
Area (sqft)	=	1.34
Velocity (ft/s)	=	2.39
Wetted Perim (ft)	=	3.67
Crit Depth, Yc (ft)	=	0.70
Top Width (ft)	=	3.28
EGL (ft)	=	0.91



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Nov 1 2023

235+52 LT

Triangular

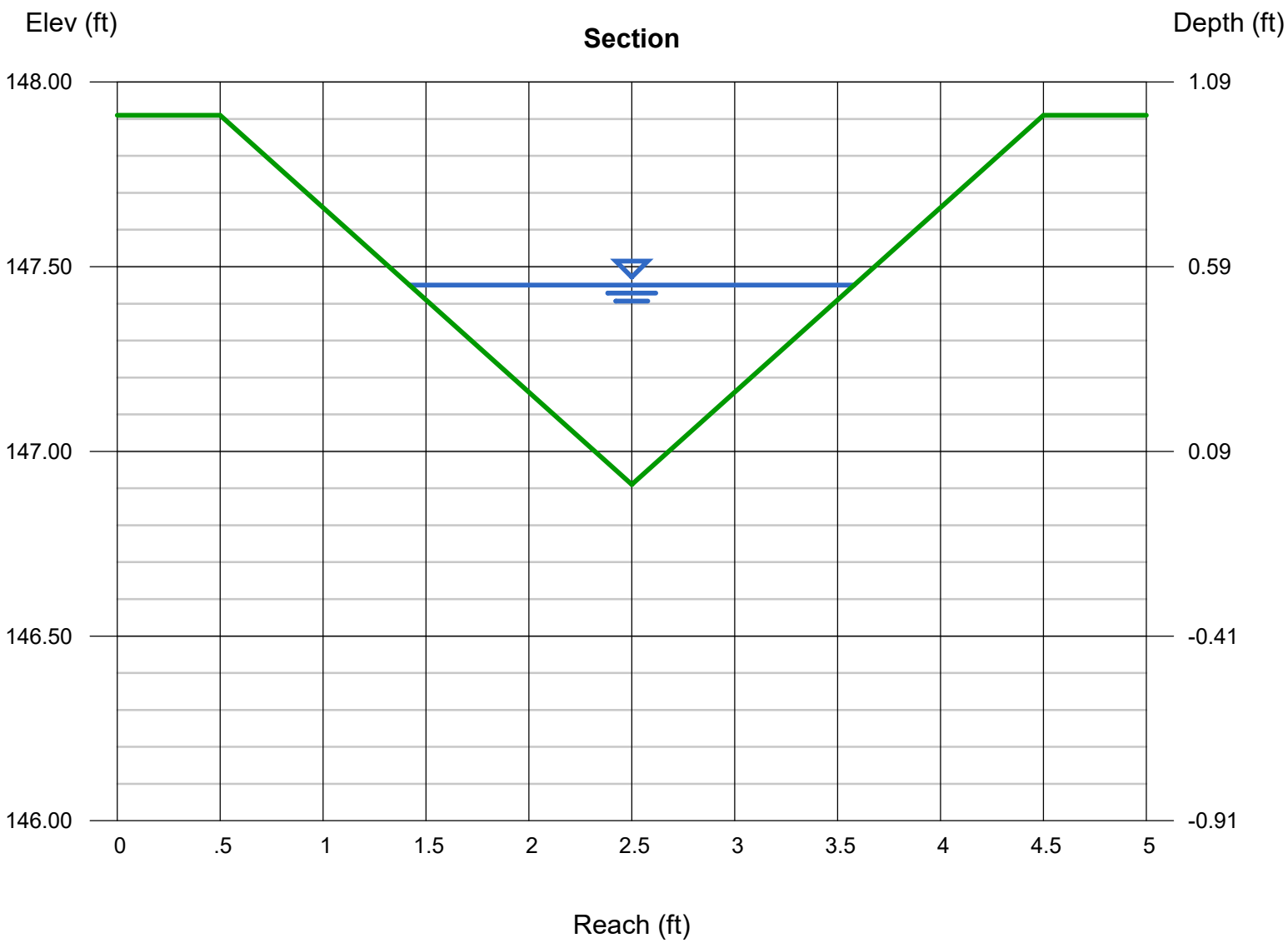
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	146.91
Slope (%)	=	4.30
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.74

Highlighted

Depth (ft)	=	0.54
Q (cfs)	=	1.740
Area (sqft)	=	0.58
Velocity (ft/s)	=	2.98
Wetted Perim (ft)	=	2.41
Crit Depth, Yc (ft)	=	0.55
Top Width (ft)	=	2.16
EGL (ft)	=	0.68



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Nov 1 2023

237+00 LT

Triangular

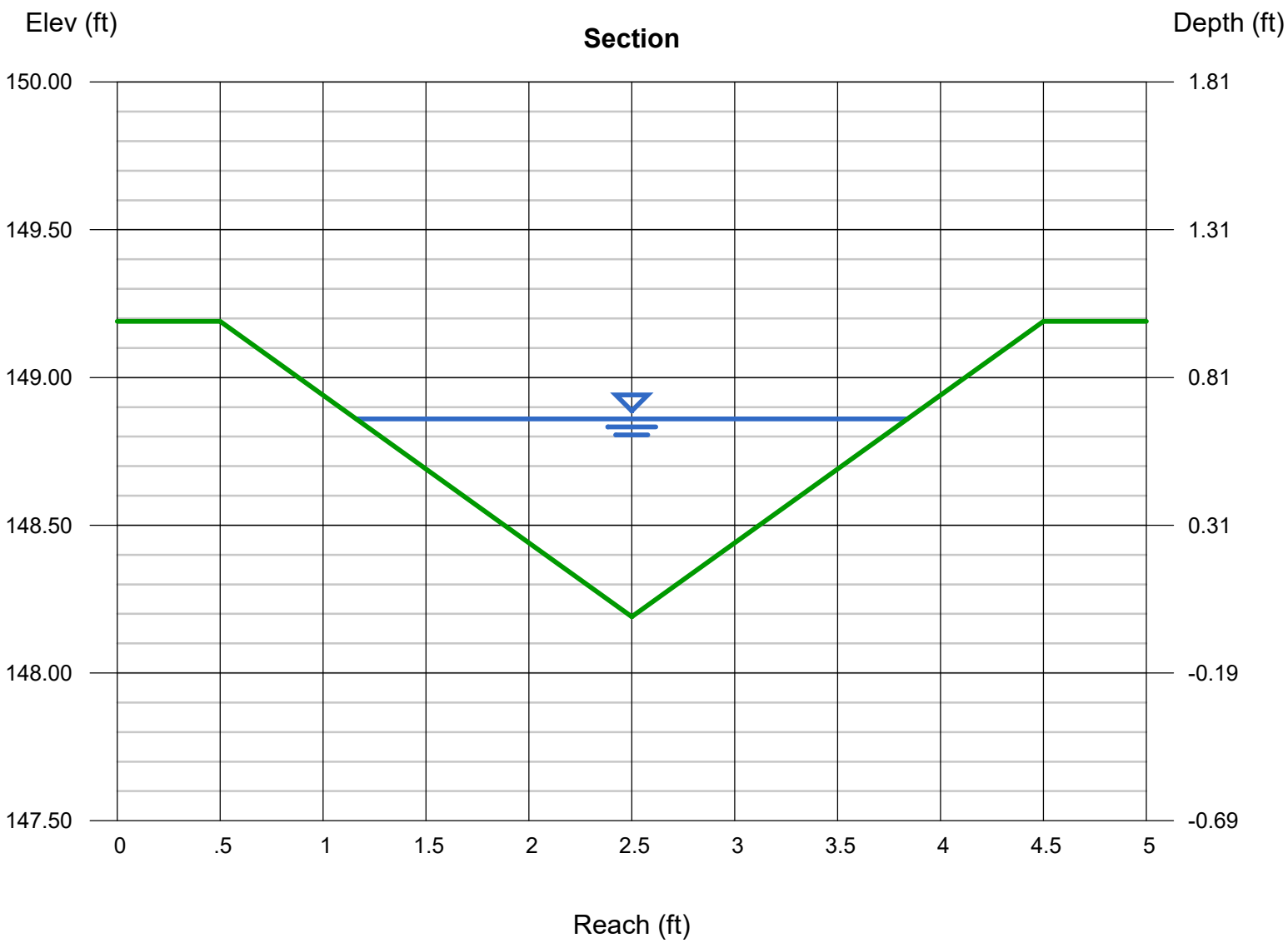
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 148.19
Slope (%)	= 0.80
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.33

Highlighted

Depth (ft)	= 0.67
Q (cfs)	= 1.330
Area (sqft)	= 0.90
Velocity (ft/s)	= 1.48
Wetted Perim (ft)	= 3.00
Crit Depth, Yc (ft)	= 0.49
Top Width (ft)	= 2.68
EGL (ft)	= 0.70



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Nov 1 2023

237+04 LT

Triangular

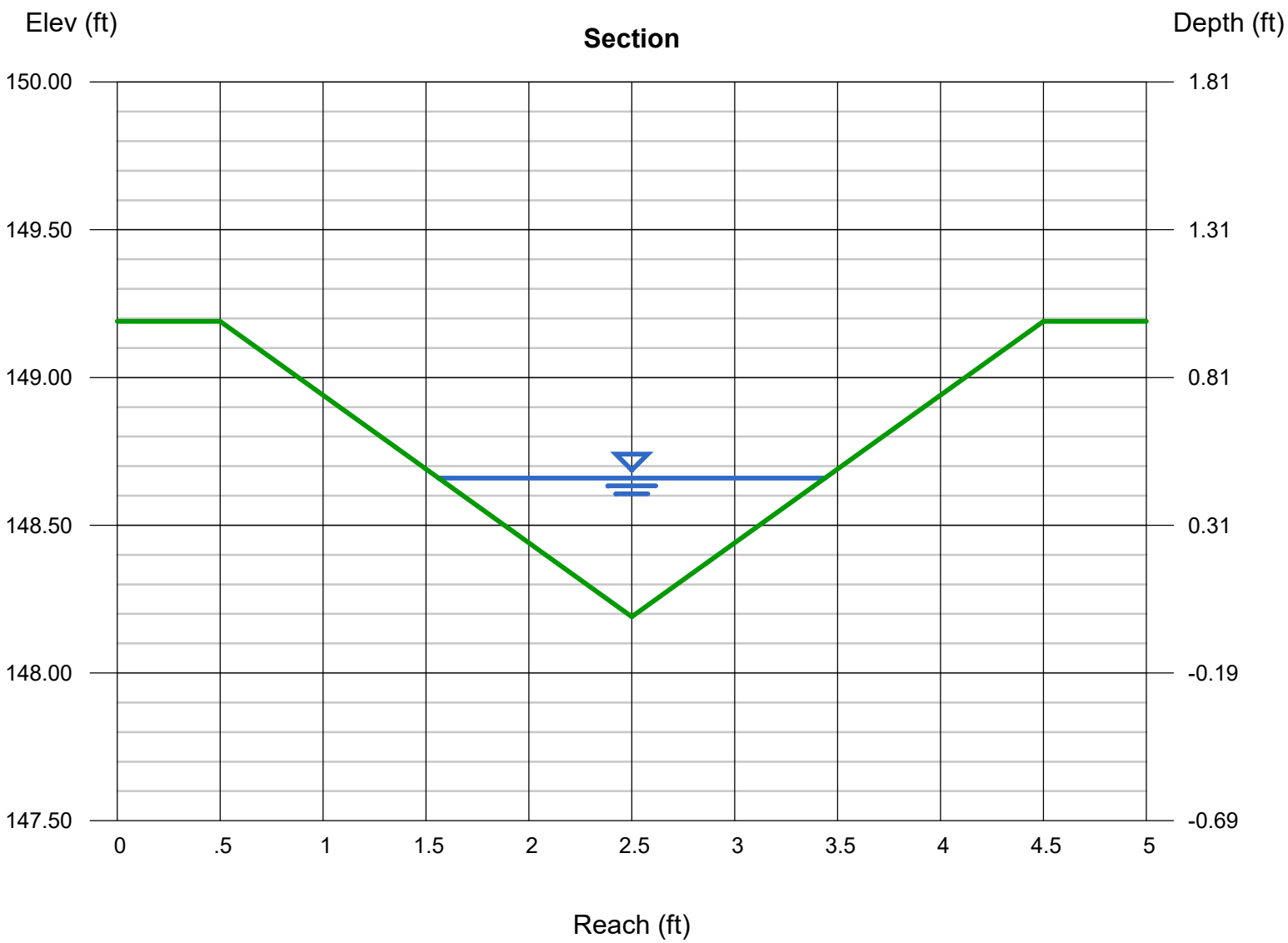
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	148.19
Slope (%)	=	3.40
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.05

Highlighted

Depth (ft)	=	0.47
Q (cfs)	=	1.050
Area (sqft)	=	0.44
Velocity (ft/s)	=	2.38
Wetted Perim (ft)	=	2.10
Crit Depth, Yc (ft)	=	0.45
Top Width (ft)	=	1.88
EGL (ft)	=	0.56



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

238+00 LT

Triangular

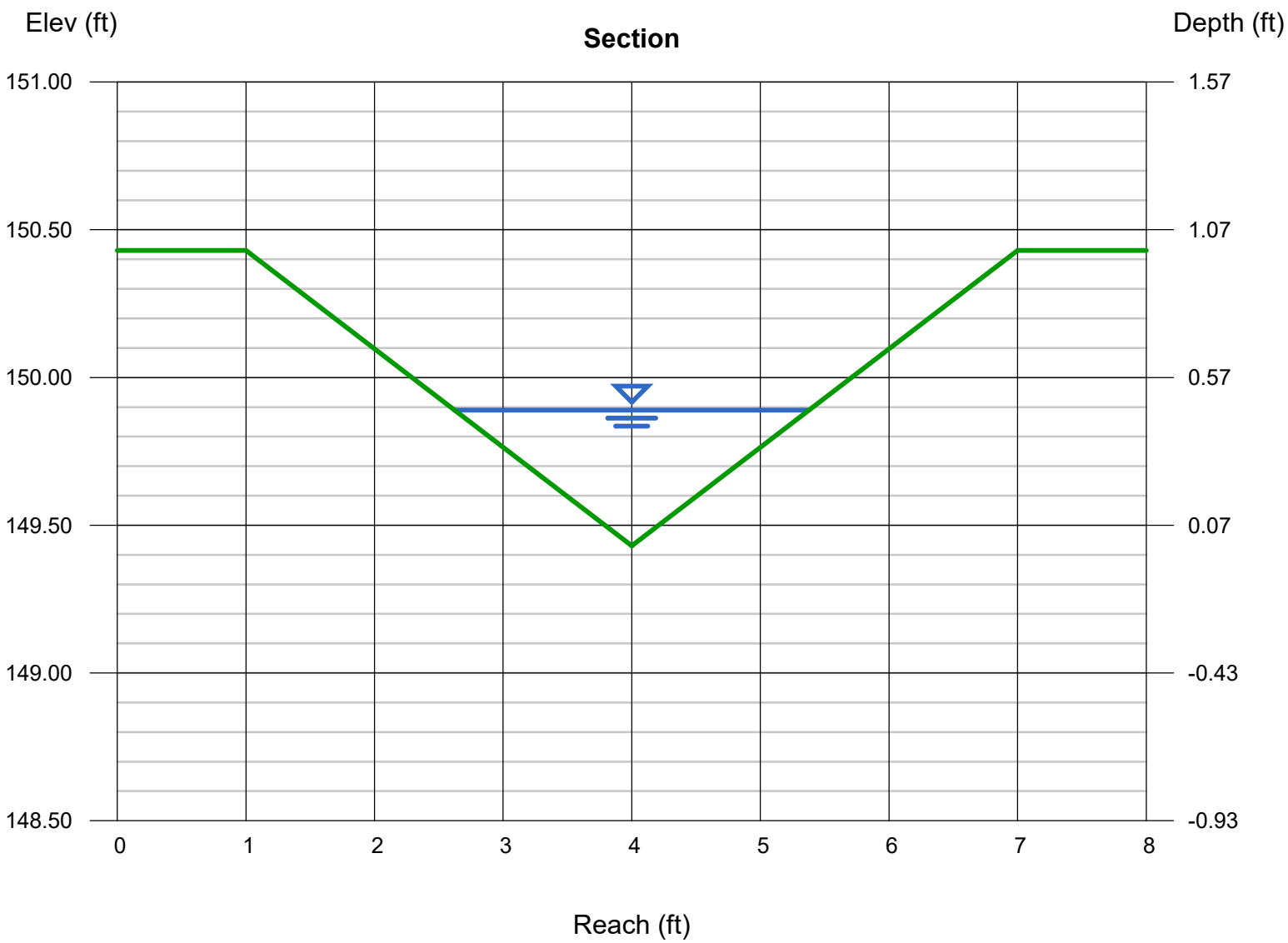
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	149.43
Slope (%)	=	0.80
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.74

Highlighted

Depth (ft)	=	0.46
Q (cfs)	=	0.740
Area (sqft)	=	0.63
Velocity (ft/s)	=	1.17
Wetted Perim (ft)	=	2.91
Crit Depth, Yc (ft)	=	0.33
Top Width (ft)	=	2.76
EGL (ft)	=	0.48



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 11 2023

238+00 RT

Trapezoidal

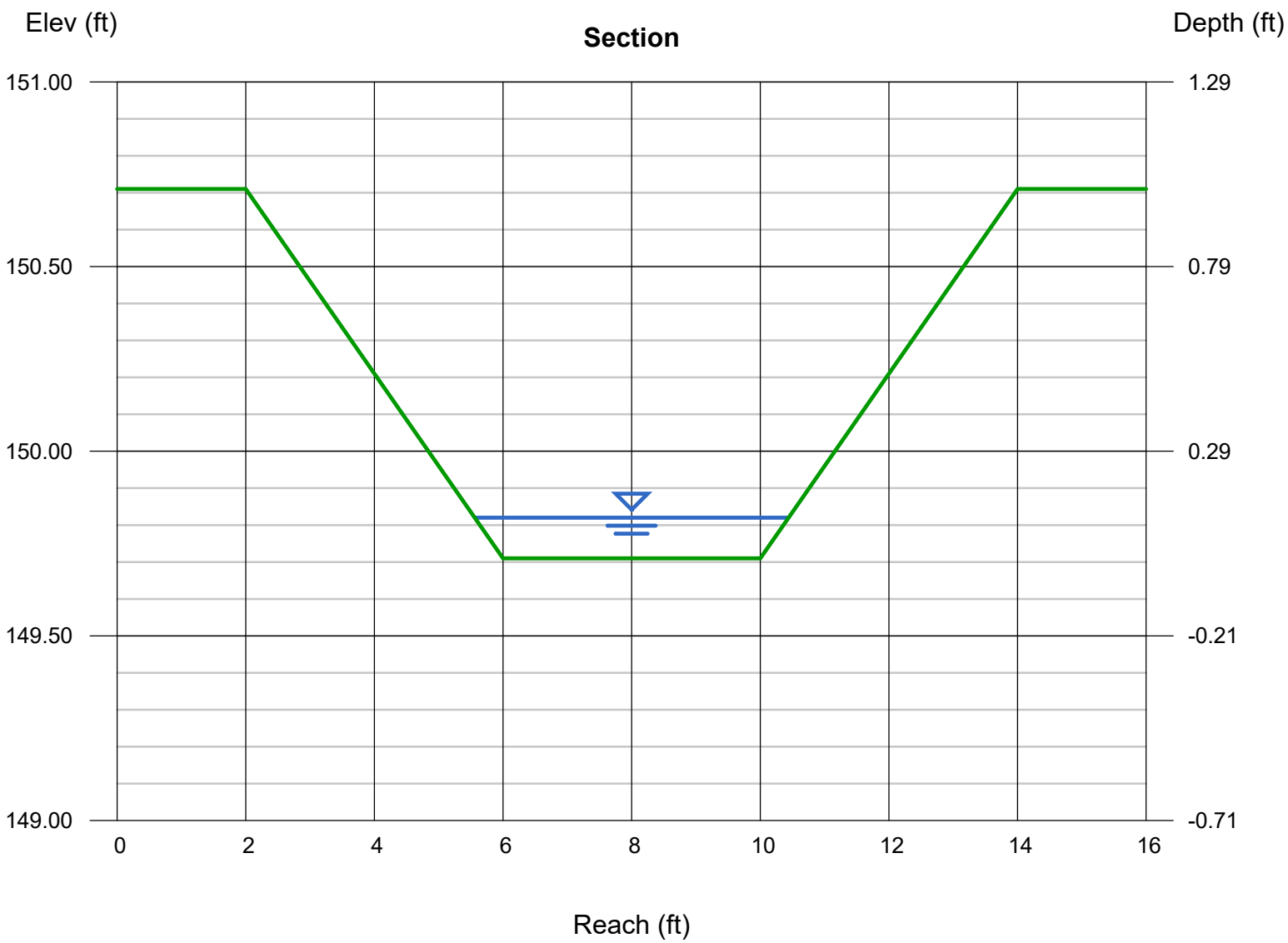
Bottom Width (ft)	=	4.00
Side Slopes (z:1)	=	4.00, 4.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	149.71
Slope (%)	=	0.35
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.20

Highlighted

Depth (ft)	=	0.11
Q (cfs)	=	0.200
Area (sqft)	=	0.49
Velocity (ft/s)	=	0.41
Wetted Perim (ft)	=	4.91
Crit Depth, Yc (ft)	=	0.05
Top Width (ft)	=	4.88
EGL (ft)	=	0.11



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

239+00 LT

Triangular

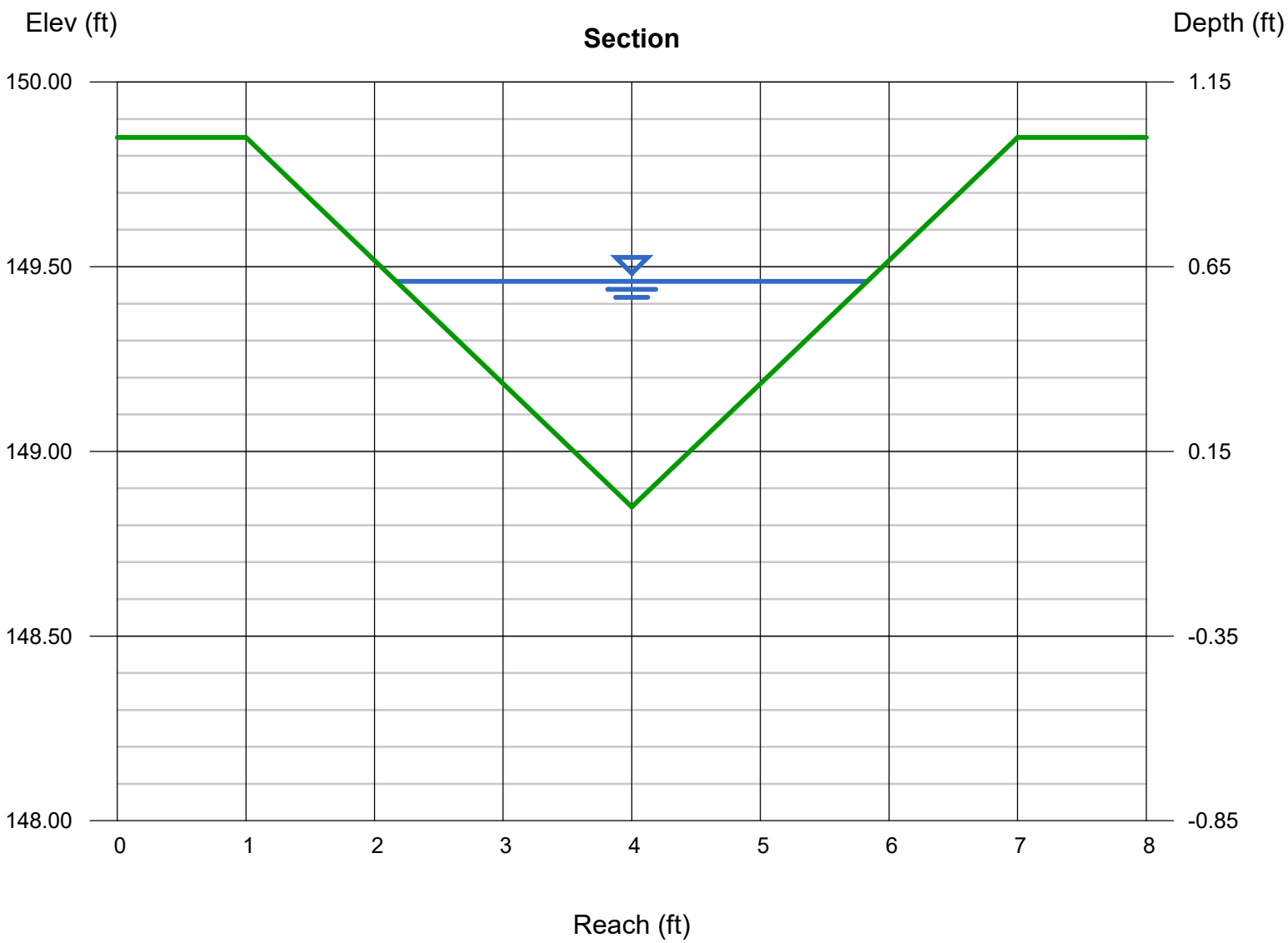
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 148.85
Slope (%)	= 0.60
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 1.35

Highlighted

Depth (ft)	= 0.61
Q (cfs)	= 1.350
Area (sqft)	= 1.12
Velocity (ft/s)	= 1.21
Wetted Perim (ft)	= 3.86
Crit Depth, Yc (ft)	= 0.42
Top Width (ft)	= 3.66
EGL (ft)	= 0.63



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 11 2023

239+00 RT

Trapezoidal

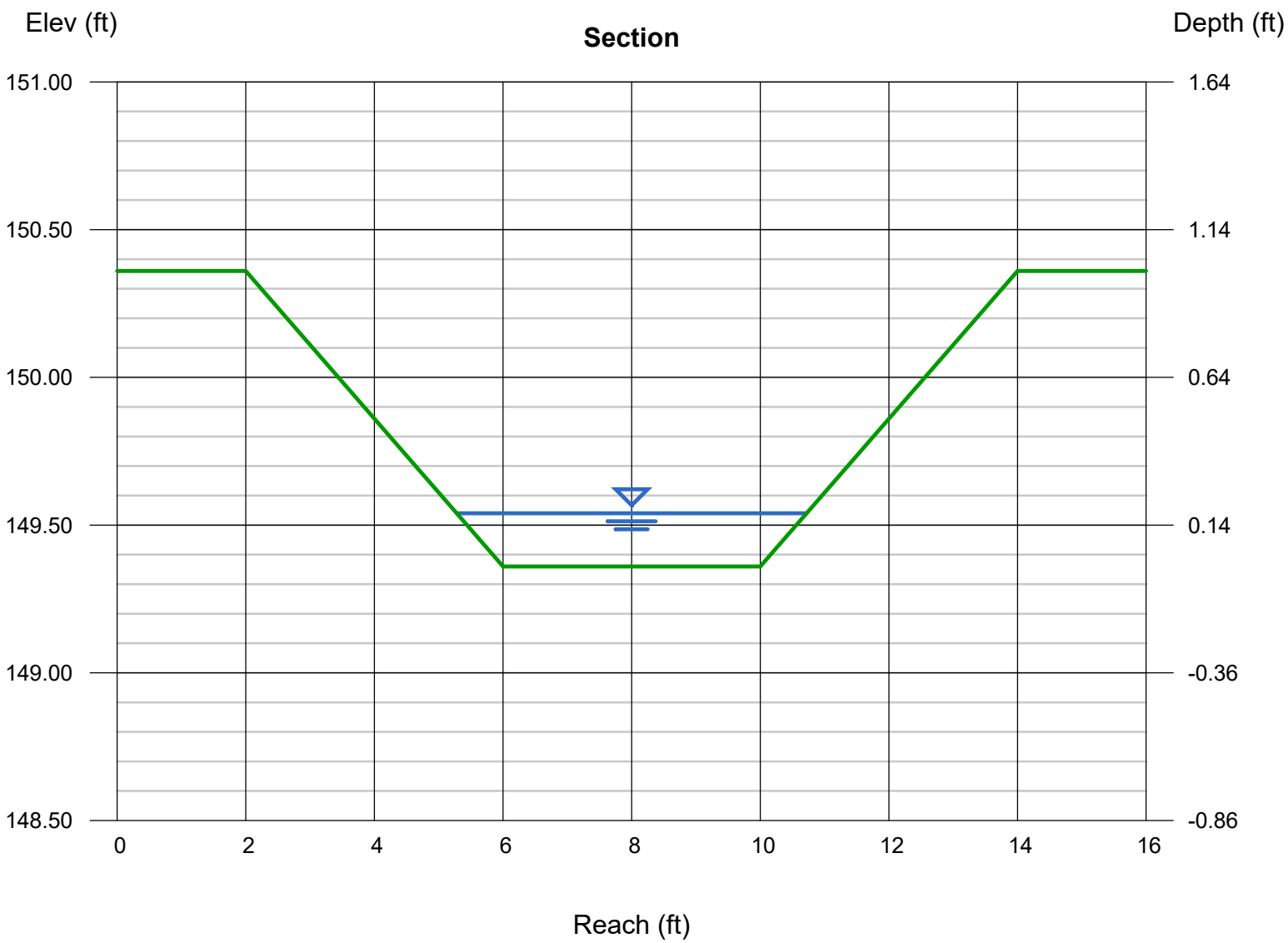
Bottom Width (ft)	=	4.00
Side Slopes (z:1)	=	4.00, 4.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	149.36
Slope (%)	=	0.35
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.51

Highlighted

Depth (ft)	=	0.18
Q (cfs)	=	0.510
Area (sqft)	=	0.85
Velocity (ft/s)	=	0.60
Wetted Perim (ft)	=	5.48
Crit Depth, Yc (ft)	=	0.08
Top Width (ft)	=	5.44
EGL (ft)	=	0.19



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

240+00 LT

Triangular

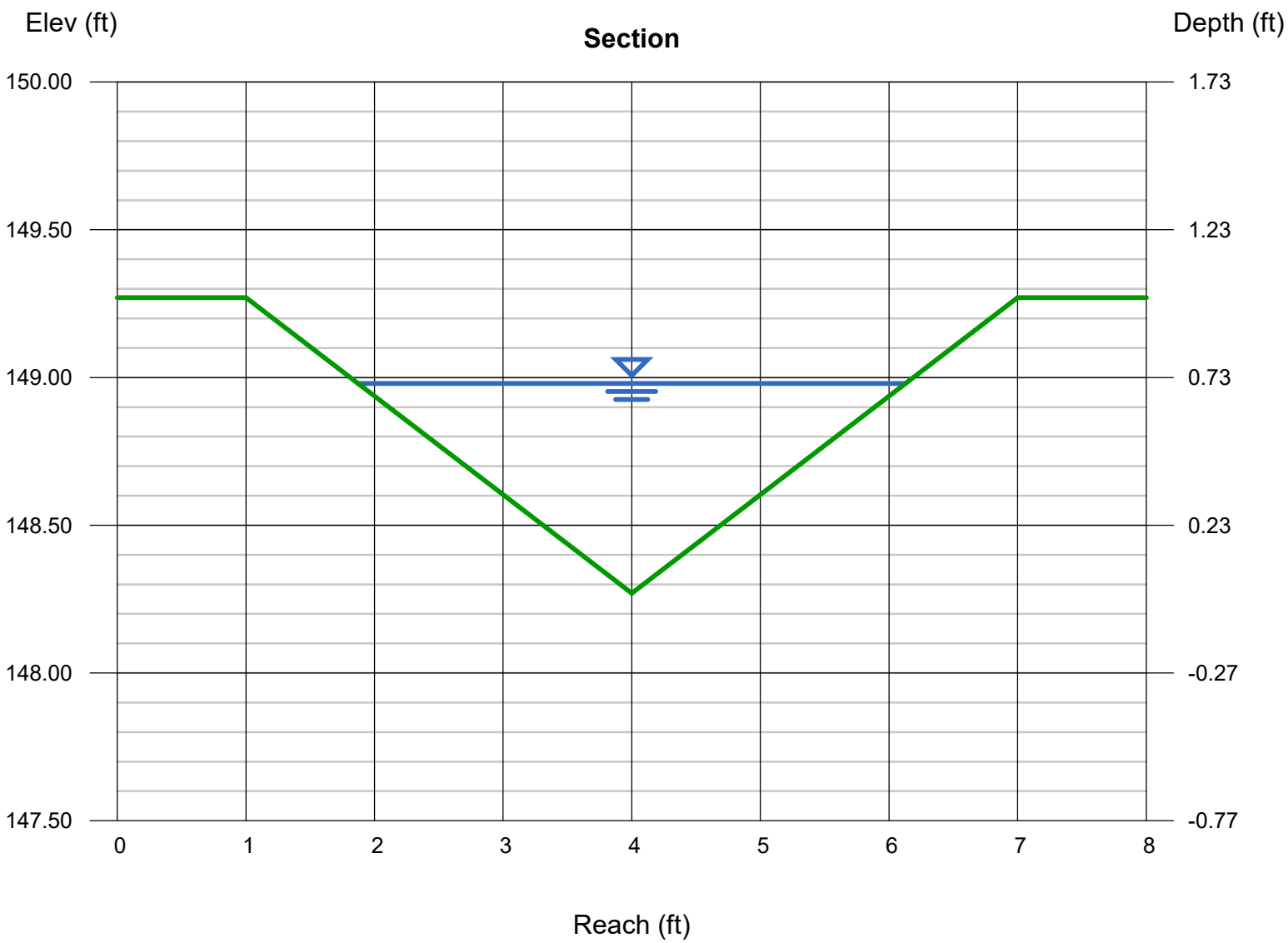
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 148.27
Slope (%)	= 0.60
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.09

Highlighted

Depth (ft)	= 0.71
Q (cfs)	= 2.090
Area (sqft)	= 1.51
Velocity (ft/s)	= 1.38
Wetted Perim (ft)	= 4.49
Crit Depth, Yc (ft)	= 0.50
Top Width (ft)	= 4.26
EGL (ft)	= 0.74



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 11 2023

240+00 RT

Trapezoidal

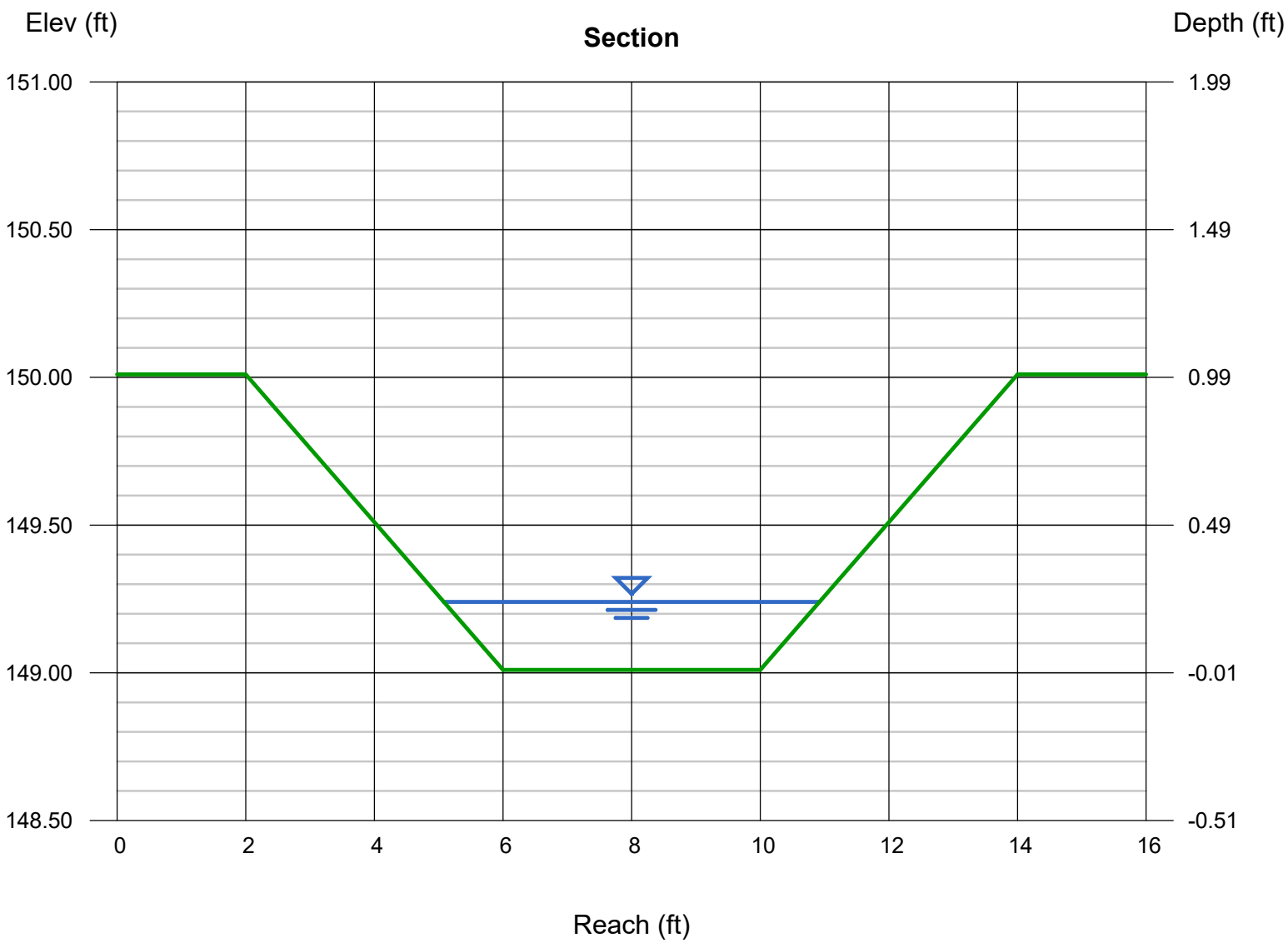
Bottom Width (ft)	=	4.00
Side Slopes (z:1)	=	4.00, 4.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	149.01
Slope (%)	=	0.35
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.81

Highlighted

Depth (ft)	=	0.23
Q (cfs)	=	0.810
Area (sqft)	=	1.13
Velocity (ft/s)	=	0.72
Wetted Perim (ft)	=	5.90
Crit Depth, Yc (ft)	=	0.11
Top Width (ft)	=	5.84
EGL (ft)	=	0.24



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

241+00 LT

Triangular

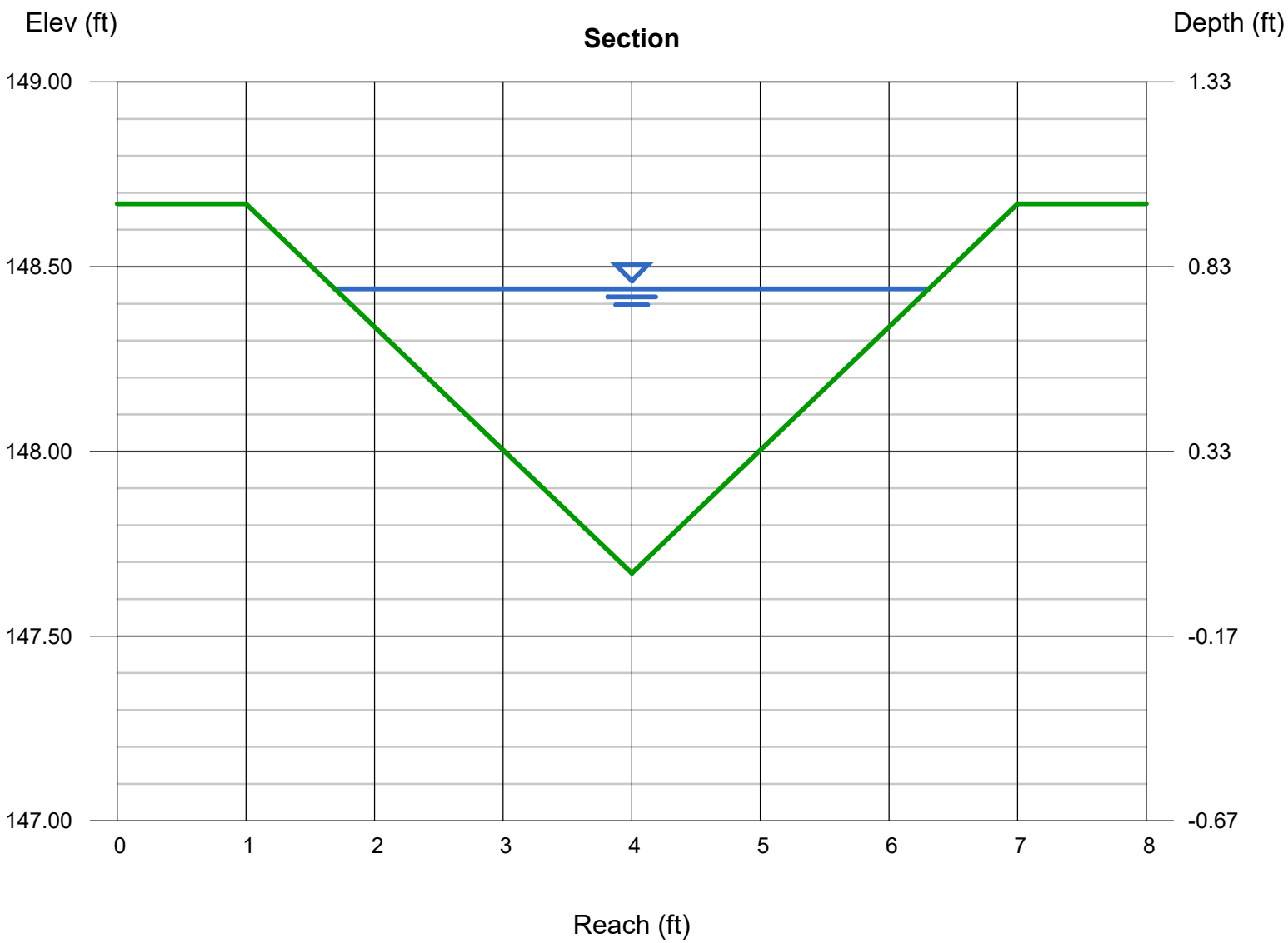
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 147.67
Slope (%)	= 0.60
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.58

Highlighted

Depth (ft)	= 0.77
Q (cfs)	= 2.580
Area (sqft)	= 1.78
Velocity (ft/s)	= 1.45
Wetted Perim (ft)	= 4.87
Crit Depth, Yc (ft)	= 0.55
Top Width (ft)	= 4.62
EGL (ft)	= 0.80



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 11 2023

241+00 RT

Trapezoidal

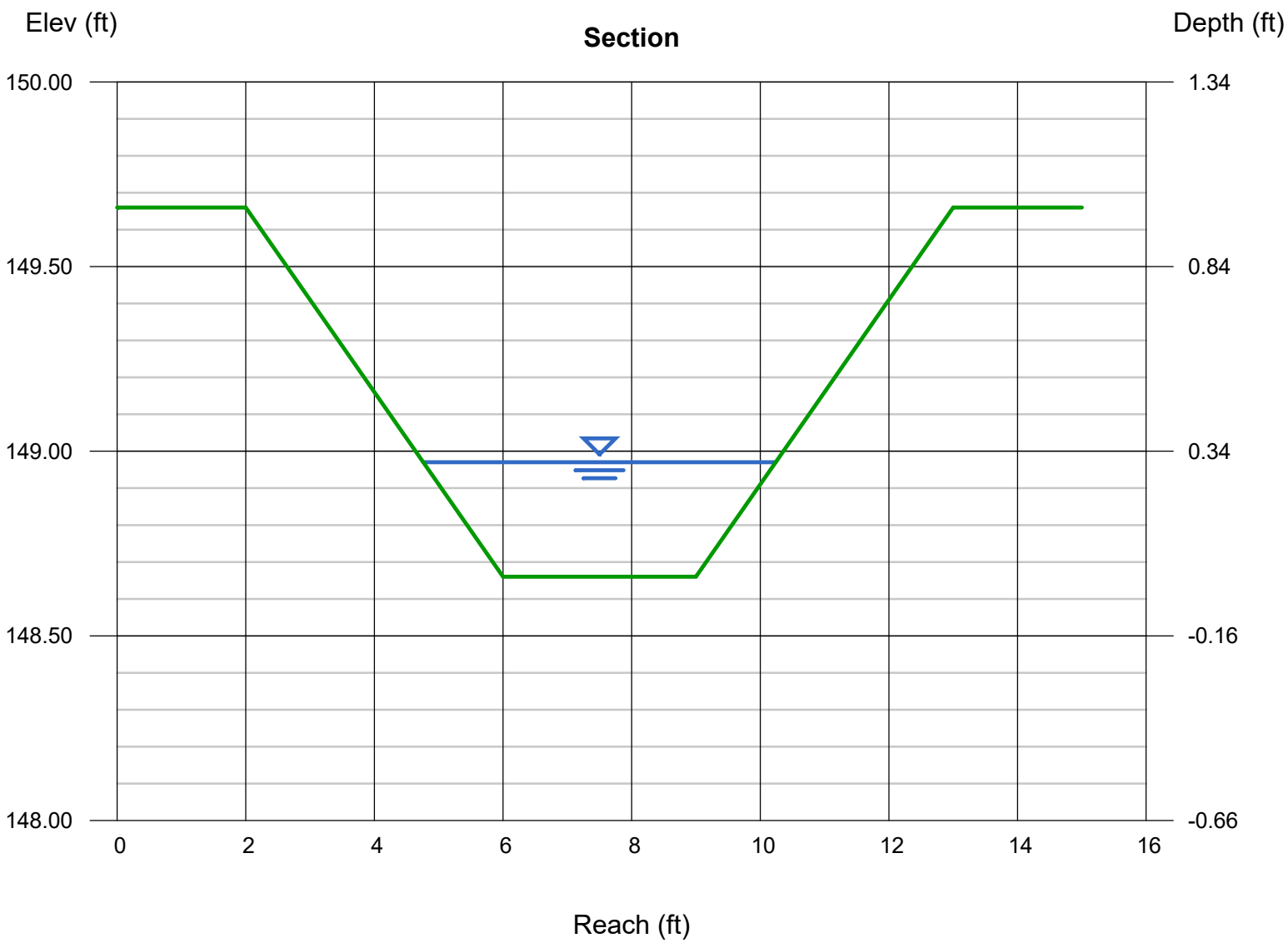
Bottom Width (ft)	=	3.00
Side Slopes (z:1)	=	4.00, 4.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	148.66
Slope (%)	=	0.35
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.10

Highlighted

Depth (ft)	=	0.31
Q (cfs)	=	1.100
Area (sqft)	=	1.31
Velocity (ft/s)	=	0.84
Wetted Perim (ft)	=	5.56
Crit Depth, Yc (ft)	=	0.16
Top Width (ft)	=	5.48
EGL (ft)	=	0.32



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

241+97 LT

Triangular

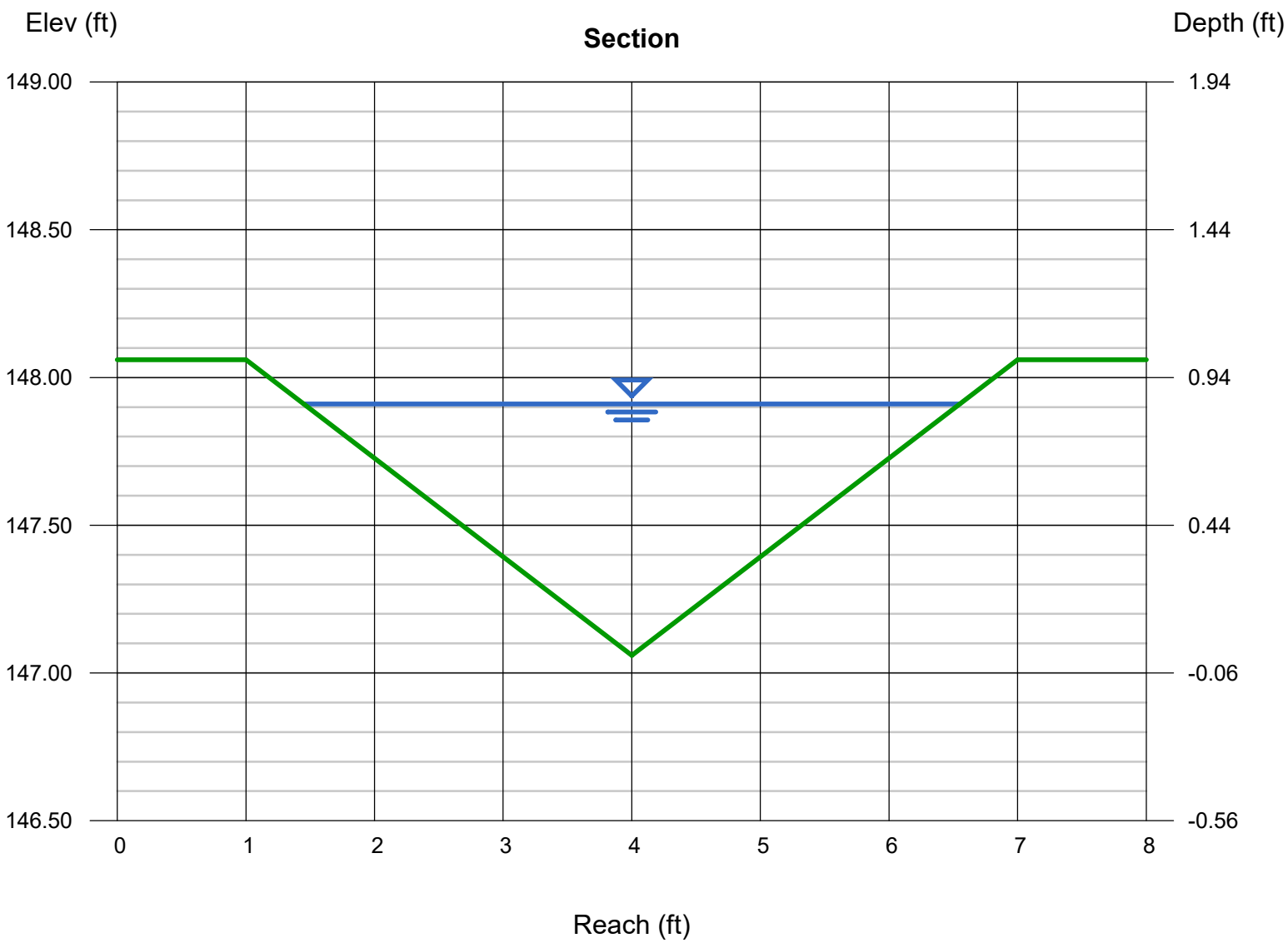
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	147.06
Slope (%)	=	0.60
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.33

Highlighted

Depth (ft)	=	0.85
Q (cfs)	=	3.330
Area (sqft)	=	2.17
Velocity (ft/s)	=	1.54
Wetted Perim (ft)	=	5.38
Crit Depth, Yc (ft)	=	0.60
Top Width (ft)	=	5.10
EGL (ft)	=	0.89



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

242+00 LT

Triangular

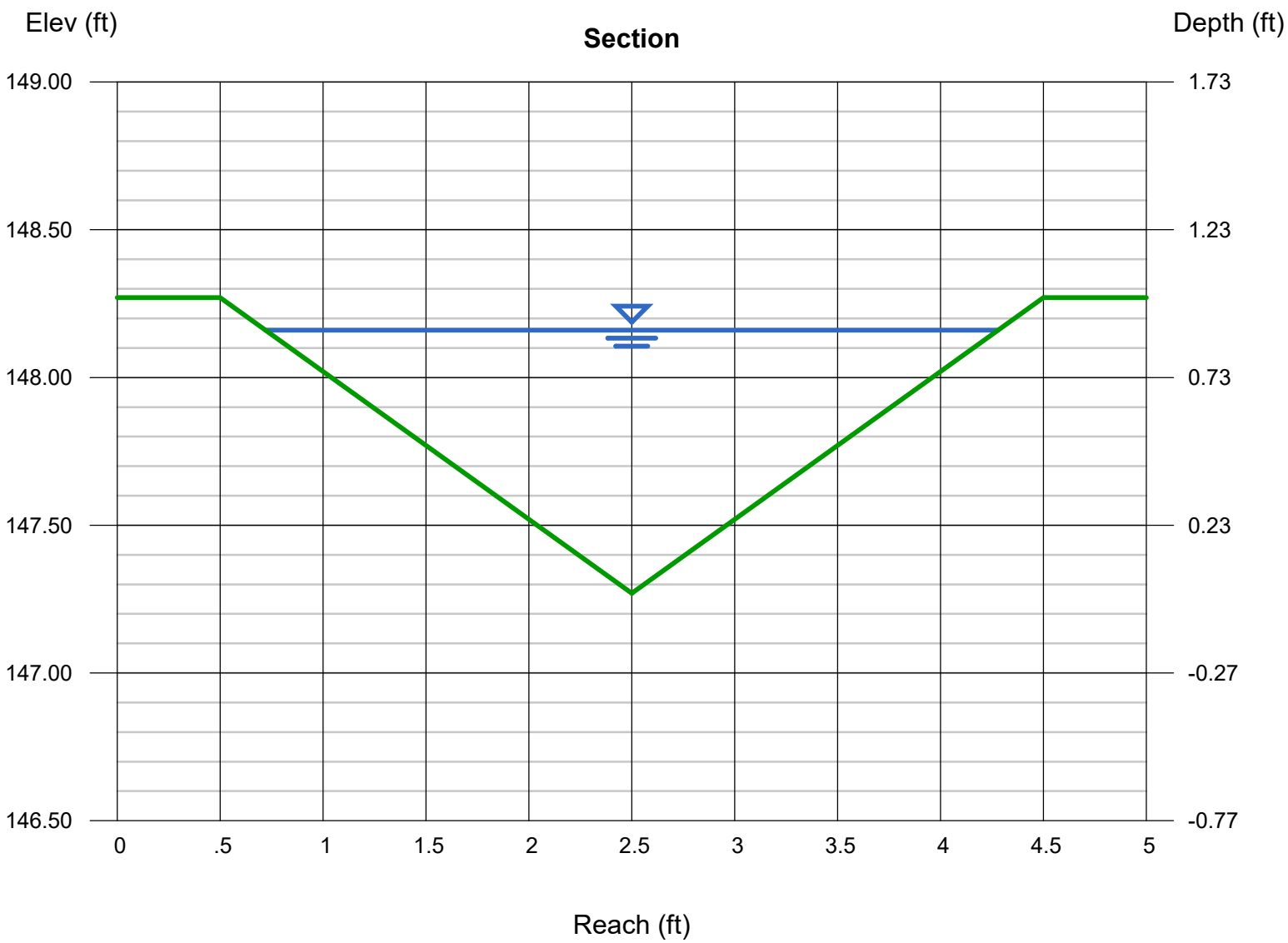
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 147.27
Slope (%)	= 5.10
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 7.07

Highlighted

Depth (ft)	= 0.89
Q (cfs)	= 7.070
Area (sqft)	= 1.58
Velocity (ft/s)	= 4.46
Wetted Perim (ft)	= 3.98
Crit Depth, Yc (ft)	= 0.96
Top Width (ft)	= 3.56
EGL (ft)	= 1.20



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Oct 11 2023

242+00 RT

Trapezoidal

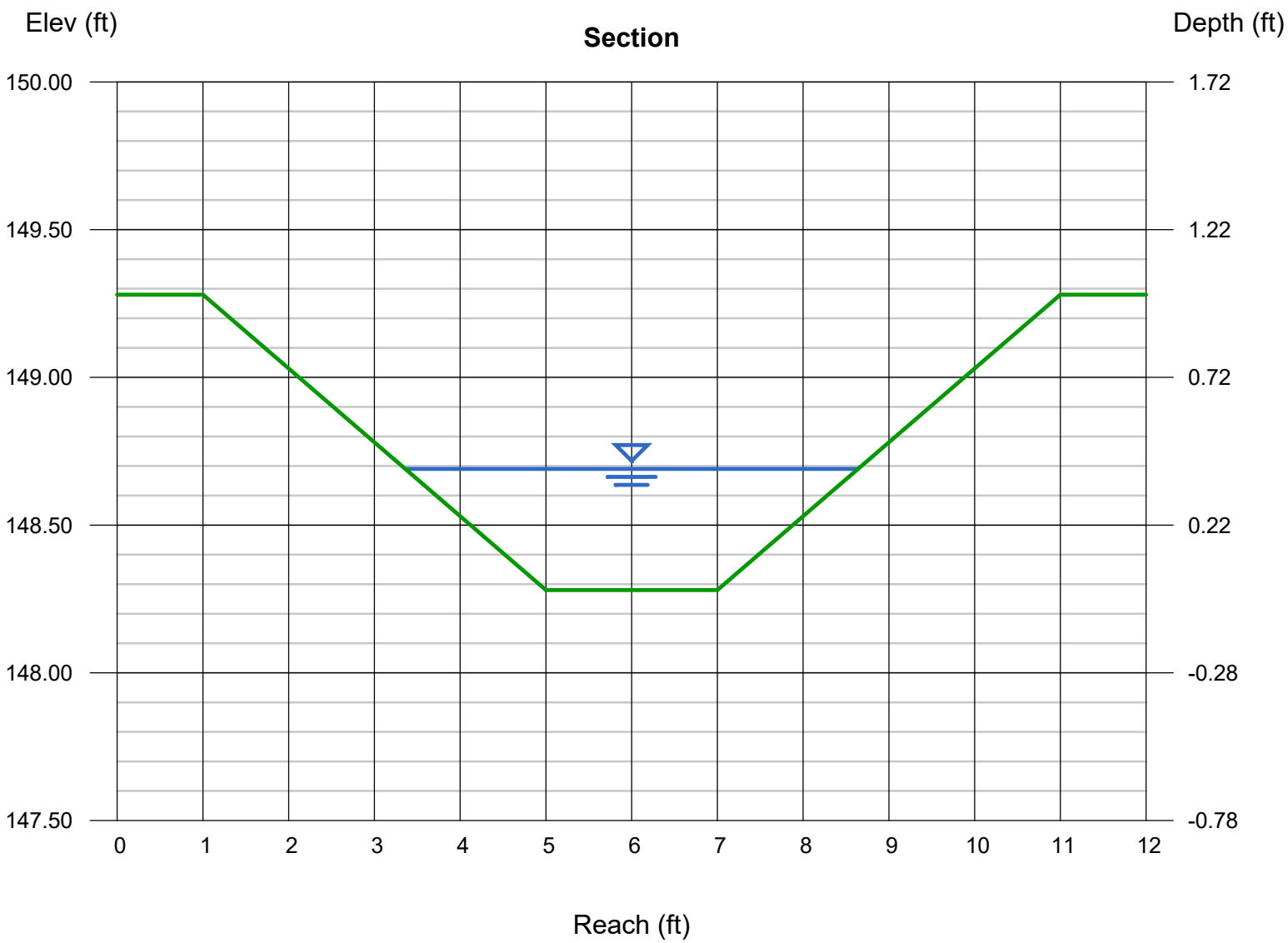
Bottom Width (ft)	=	2.00
Side Slopes (z:1)	=	4.00, 4.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	148.28
Slope (%)	=	0.35
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.39

Highlighted

Depth (ft)	=	0.41
Q (cfs)	=	1.390
Area (sqft)	=	1.49
Velocity (ft/s)	=	0.93
Wetted Perim (ft)	=	5.38
Crit Depth, Yc (ft)	=	0.22
Top Width (ft)	=	5.28
EGL (ft)	=	0.42



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

248+27 LT

Triangular

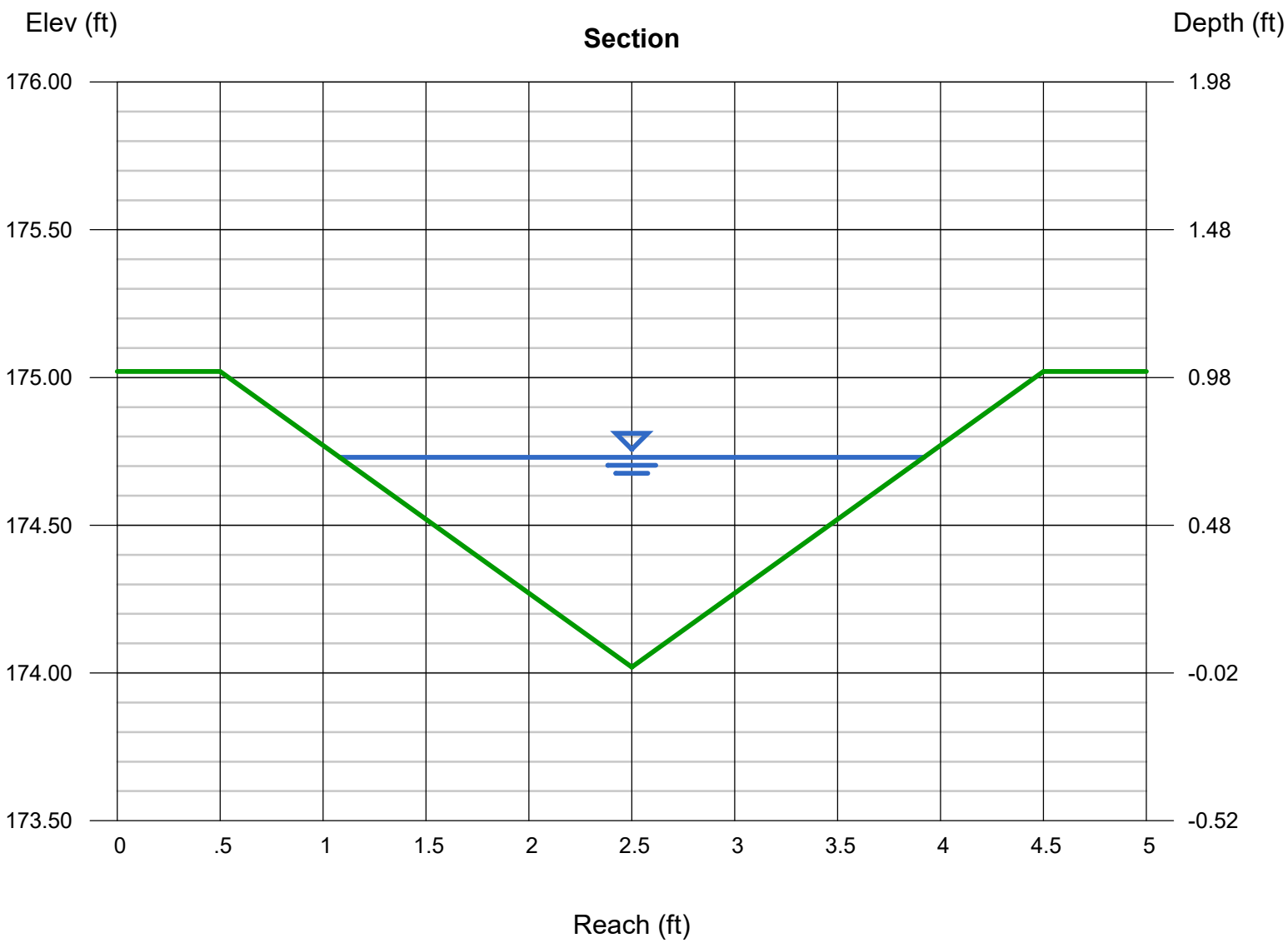
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 1.00
Invert Elev (ft)	= 174.02
Slope (%)	= 6.40
N-Value	= 0.040

Calculations

Compute by:	Known Q
Known Q (cfs)	= 4.37

Highlighted

Depth (ft)	= 0.71
Q (cfs)	= 4.370
Area (sqft)	= 1.01
Velocity (ft/s)	= 4.33
Wetted Perim (ft)	= 3.18
Crit Depth, Yc (ft)	= 0.79
Top Width (ft)	= 2.84
EGL (ft)	= 1.00



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

249+00 LT

Triangular

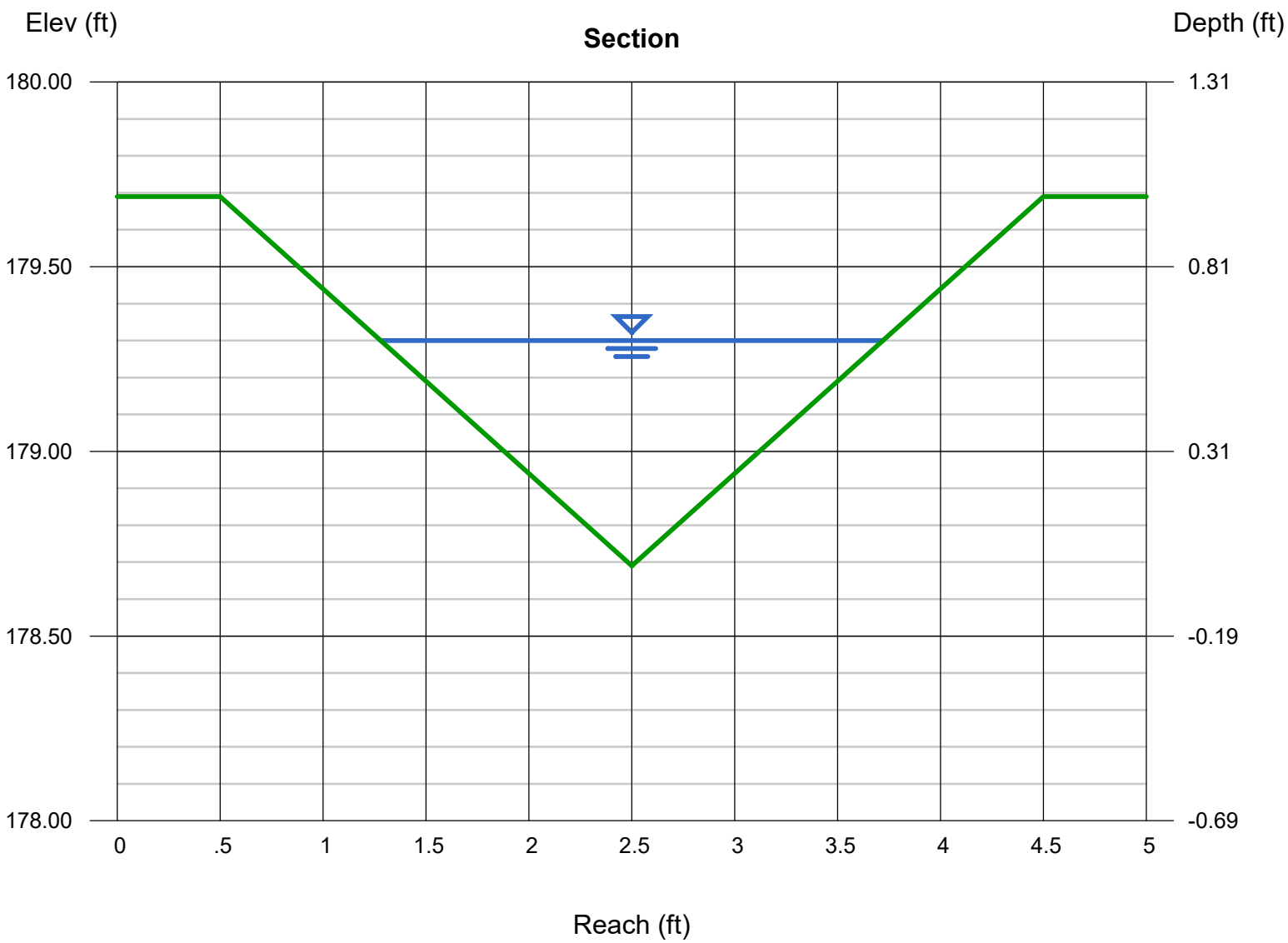
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	178.69
Slope (%)	=	7.12
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	3.02

Highlighted

Depth (ft)	=	0.61
Q (cfs)	=	3.020
Area (sqft)	=	0.74
Velocity (ft/s)	=	4.06
Wetted Perim (ft)	=	2.73
Crit Depth, Yc (ft)	=	0.68
Top Width (ft)	=	2.44
EGL (ft)	=	0.87



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

250+00 LT

Triangular

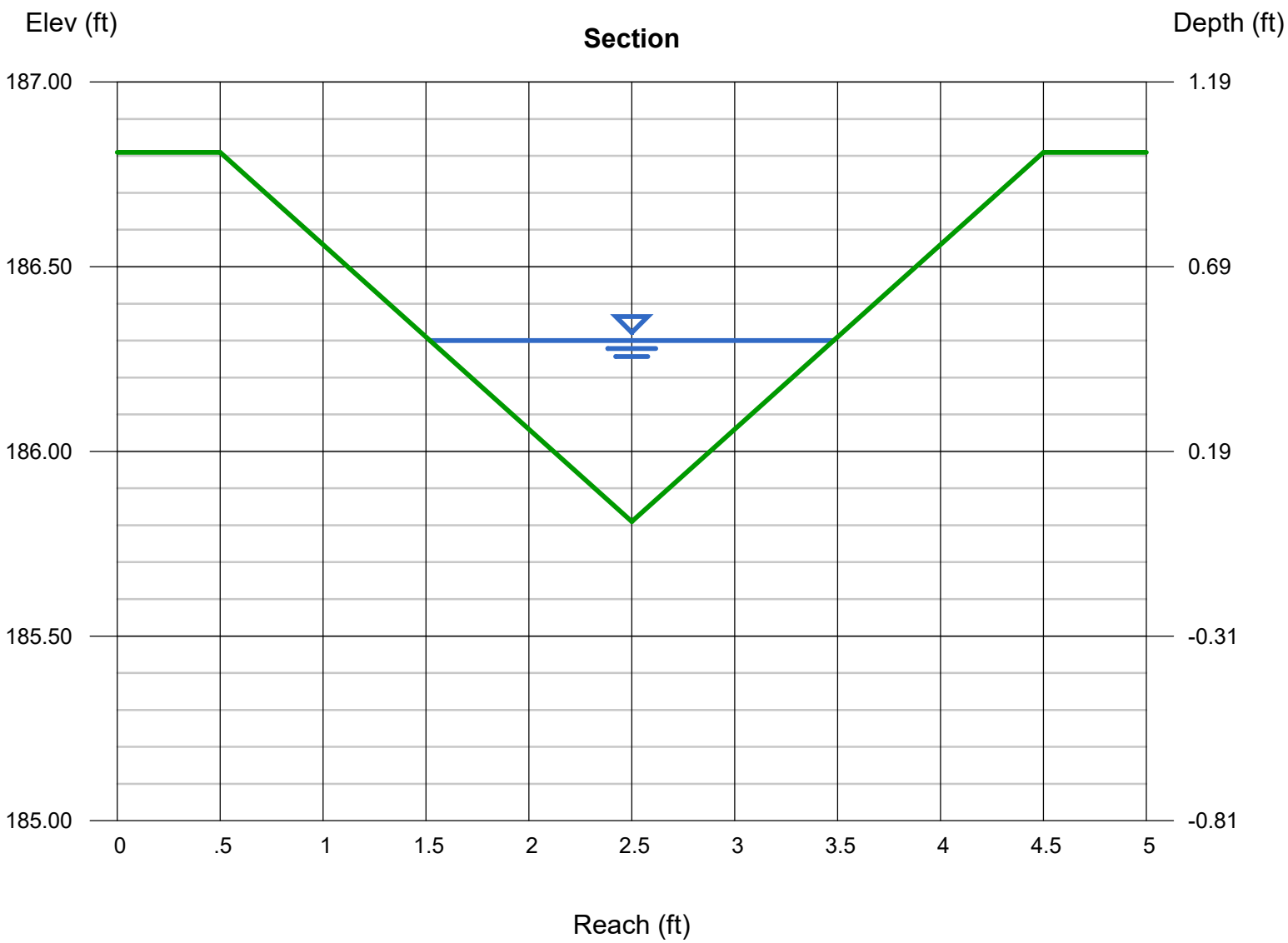
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	185.81
Slope (%)	=	7.51
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.72

Highlighted

Depth (ft)	=	0.49
Q (cfs)	=	1.720
Area (sqft)	=	0.48
Velocity (ft/s)	=	3.58
Wetted Perim (ft)	=	2.19
Crit Depth, Yc (ft)	=	0.55
Top Width (ft)	=	1.96
EGL (ft)	=	0.69



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Nov 20 2023

251+00 LT

Triangular

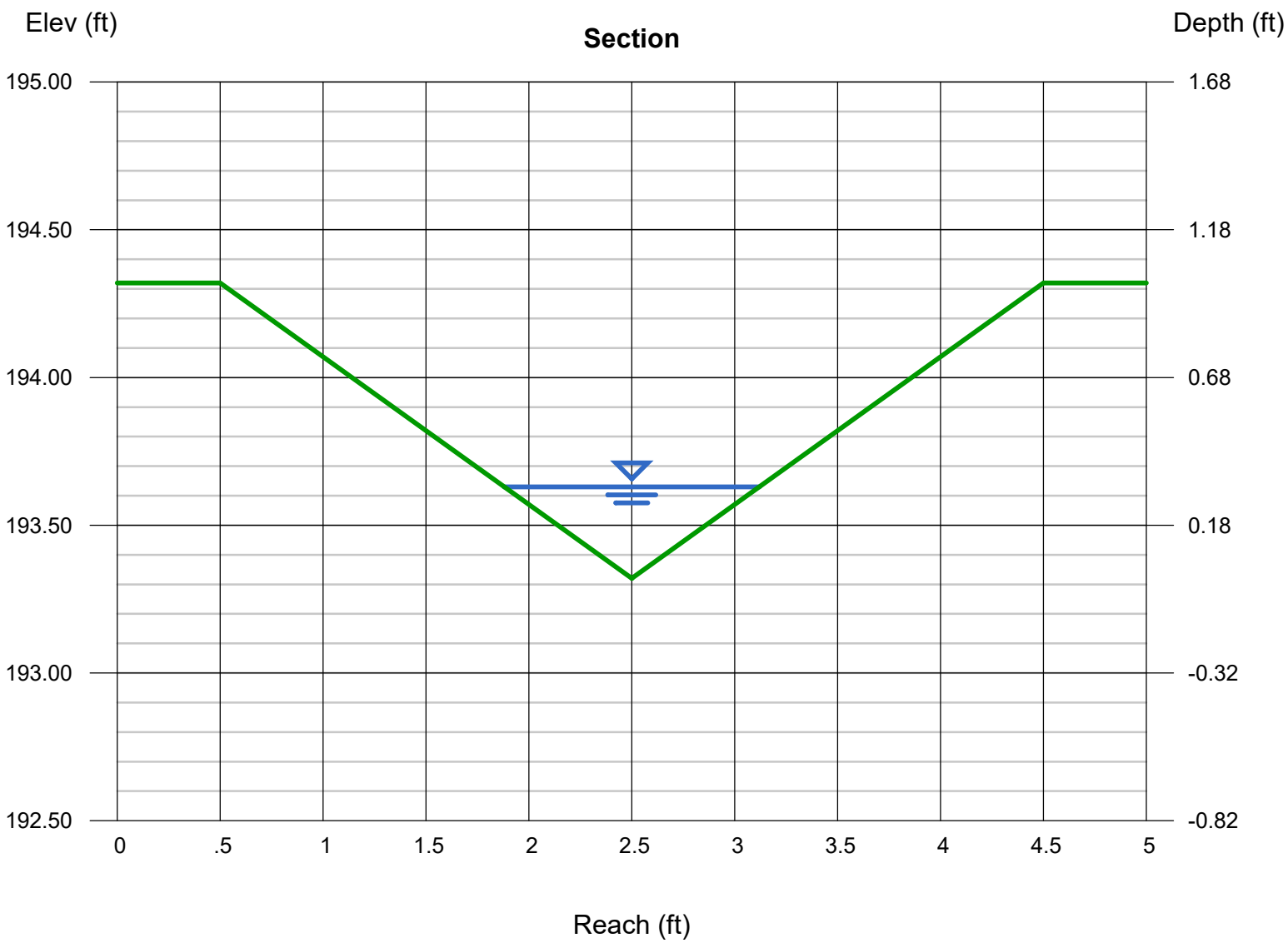
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	193.32
Slope (%)	=	4.70
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.39

Highlighted

Depth (ft)	=	0.31
Q (cfs)	=	0.390
Area (sqft)	=	0.19
Velocity (ft/s)	=	2.03
Wetted Perim (ft)	=	1.39
Crit Depth, Yc (ft)	=	0.30
Top Width (ft)	=	1.24
EGL (ft)	=	0.37



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 27 2024

247+00 RT

Trapezoidal

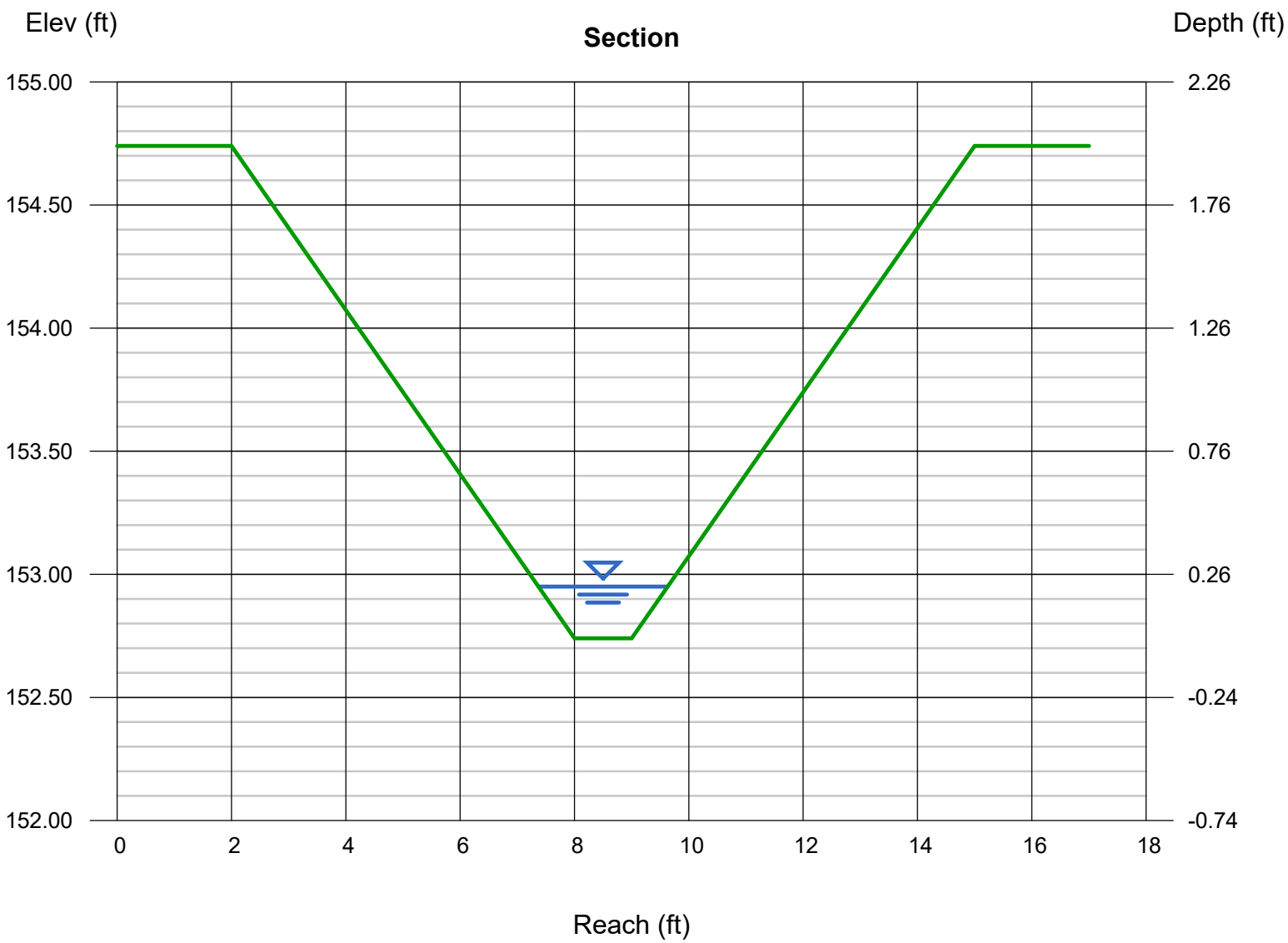
Bottom Width (ft)	=	1.00
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	152.74
Slope (%)	=	14.79
N-Value	=	0.038

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.34

Highlighted

Depth (ft)	=	0.21
Q (cfs)	=	1.340
Area (sqft)	=	0.34
Velocity (ft/s)	=	3.91
Wetted Perim (ft)	=	2.33
Crit Depth, Yc (ft)	=	0.29
Top Width (ft)	=	2.26
EGL (ft)	=	0.45



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 27 2024

248+00 RT

Trapezoidal

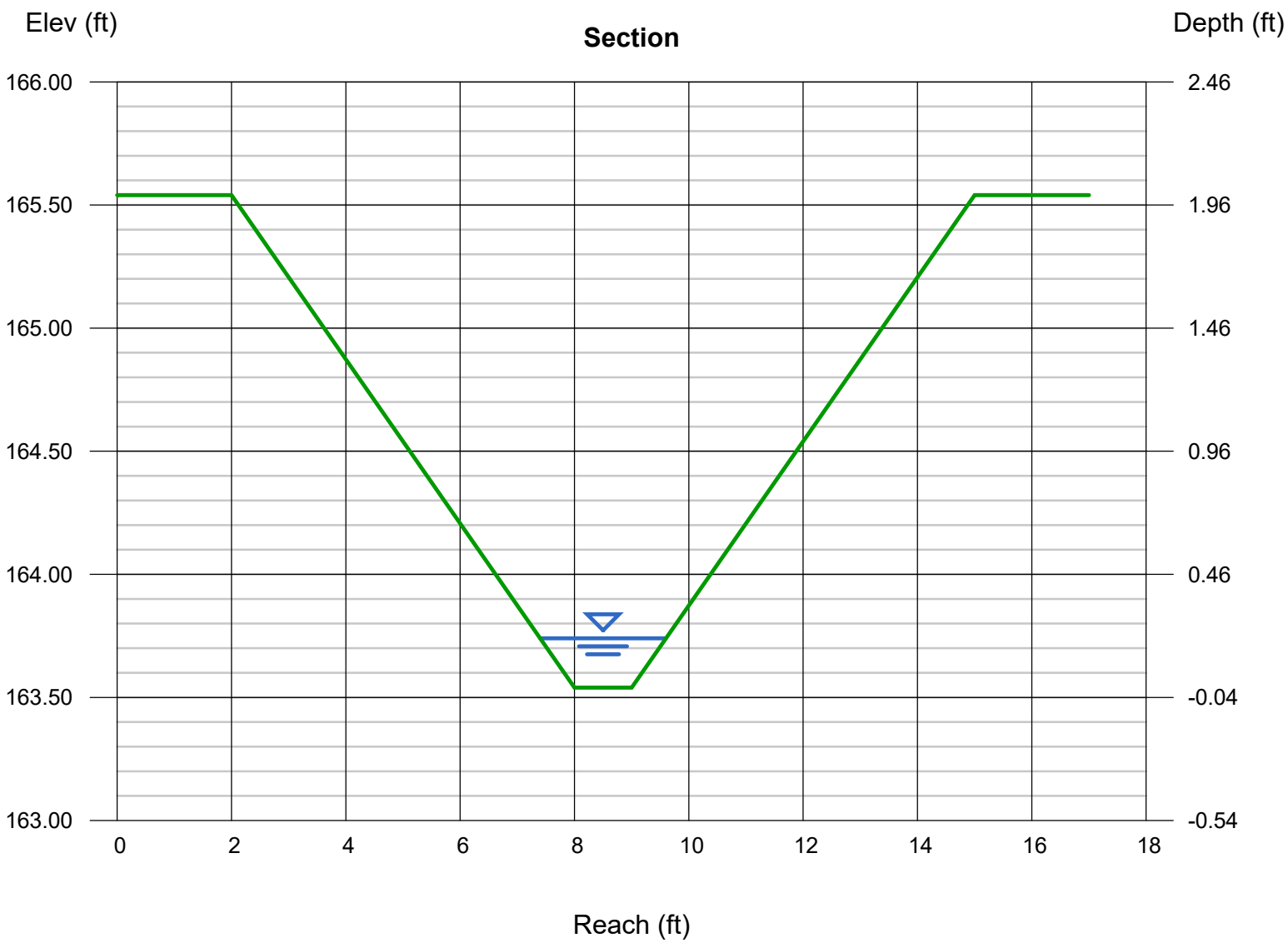
Bottom Width (ft)	=	1.00
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	163.54
Slope (%)	=	10.00
N-Value	=	0.038

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.99

Highlighted

Depth (ft)	=	0.20
Q (cfs)	=	0.990
Area (sqft)	=	0.32
Velocity (ft/s)	=	3.09
Wetted Perim (ft)	=	2.26
Crit Depth, Yc (ft)	=	0.25
Top Width (ft)	=	2.20
EGL (ft)	=	0.35



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 27 2024

248+18 RT

Triangular

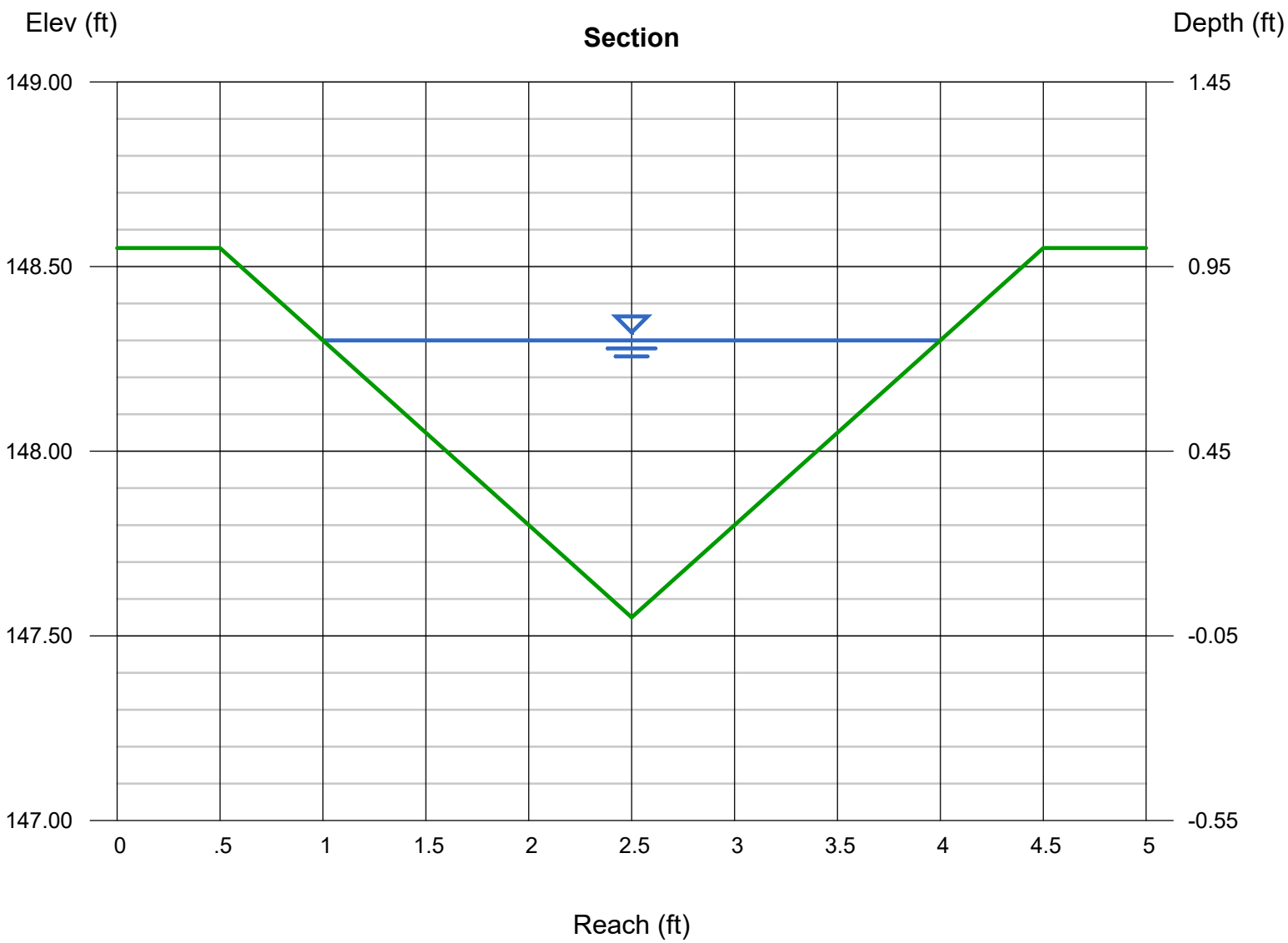
Side Slopes (z:1)	=	2.00, 2.00
Total Depth (ft)	=	1.00
Invert Elev (ft)	=	147.55
Slope (%)	=	0.35
N-Value	=	0.040

Calculations

Compute by:		Known Q
Known Q (cfs)	=	1.19

Highlighted

Depth (ft)	=	0.75
Q (cfs)	=	1.190
Area (sqft)	=	1.12
Velocity (ft/s)	=	1.06
Wetted Perim (ft)	=	3.35
Crit Depth, Yc (ft)	=	0.47
Top Width (ft)	=	3.00
EGL (ft)	=	0.77



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 27 2024

249+00 RT

Trapezoidal

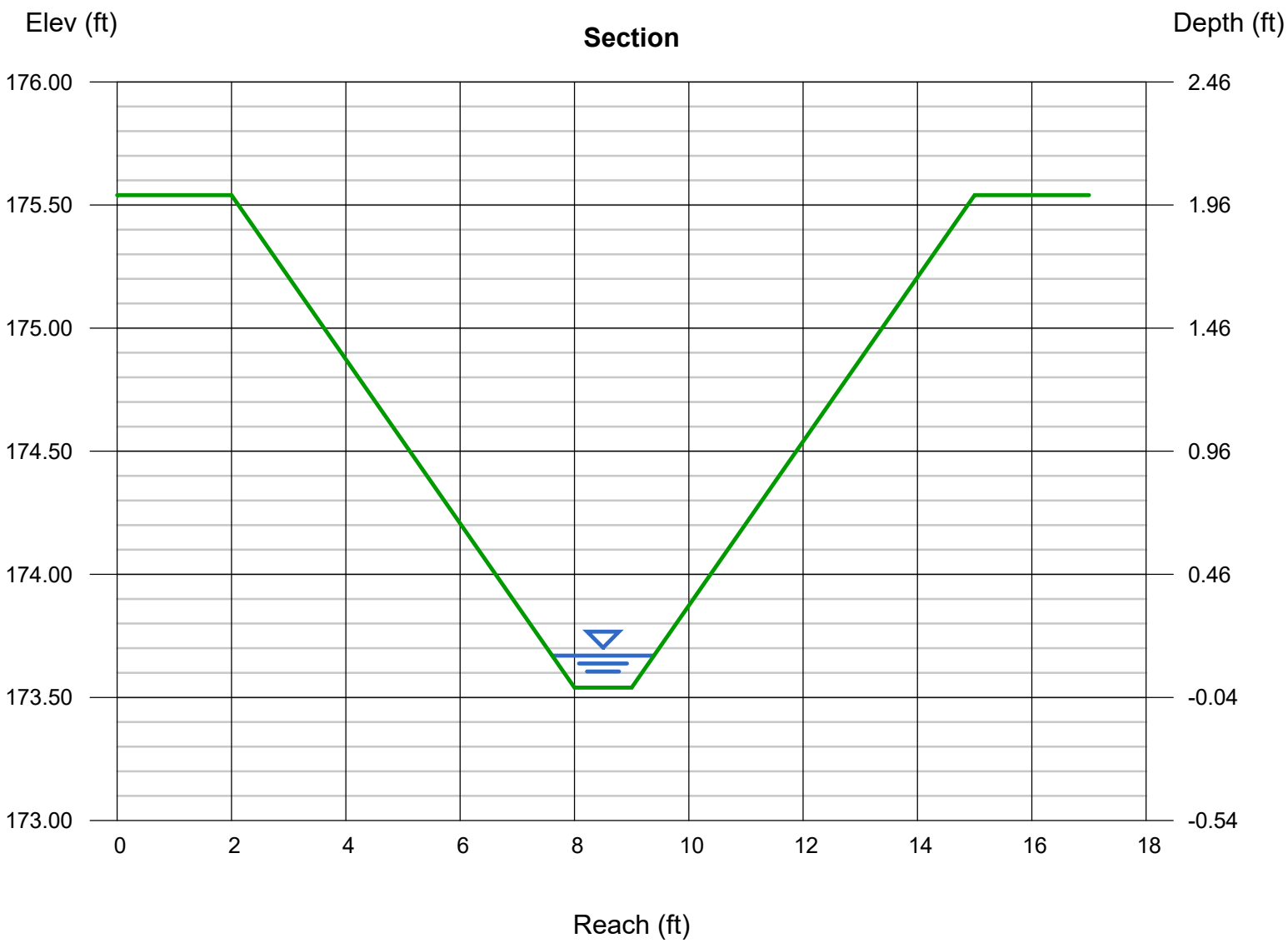
Bottom Width (ft)	=	1.00
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	173.54
Slope (%)	=	10.00
N-Value	=	0.038

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.46

Highlighted

Depth (ft)	=	0.13
Q (cfs)	=	0.460
Area (sqft)	=	0.18
Velocity (ft/s)	=	2.55
Wetted Perim (ft)	=	1.82
Crit Depth, Yc (ft)	=	0.16
Top Width (ft)	=	1.78
EGL (ft)	=	0.23



Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Thursday, Jun 27 2024

250+00 RT

Trapezoidal

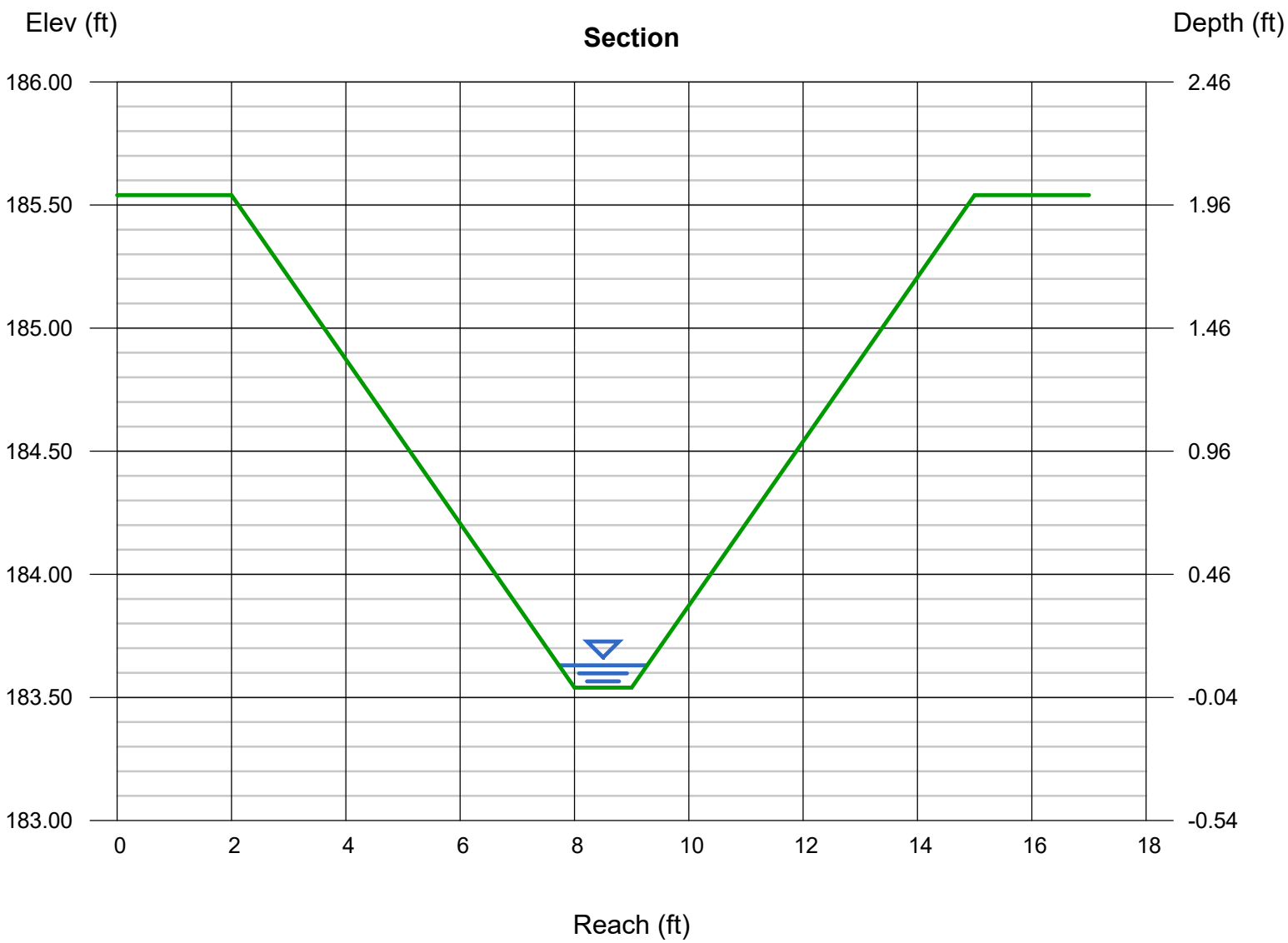
Bottom Width (ft)	=	1.00
Side Slopes (z:1)	=	3.00, 3.00
Total Depth (ft)	=	2.00
Invert Elev (ft)	=	183.54
Slope (%)	=	10.00
N-Value	=	0.038

Calculations

Compute by:		Known Q
Known Q (cfs)	=	0.20

Highlighted

Depth (ft)	=	0.09
Q (cfs)	=	0.200
Area (sqft)	=	0.11
Velocity (ft/s)	=	1.75
Wetted Perim (ft)	=	1.57
Crit Depth, Yc (ft)	=	0.10
Top Width (ft)	=	1.54
EGL (ft)	=	0.14



APPENDIX E
STORM SEWER COMPUTATIONS

APPENDIX E.1
INLET DESIGN

INLET COMPUTATIONS

MacArthur BLVD

	DATE
COMPUTED: AGB	6/28/2024
CHECKED: WRB	6/28/2024

INLET NO.	INCR. AREA (ac)	TOTAL AREA (ac)	R=C	AR	ΣAR	T.C. (min)	I (in/hr)	Base Flow (cfs)	OVER FLOW (cfs)	TOTAL INFLOW (cfs)	FLOW INTER. (cfs)	FLOW BYPASS cfs	FLOW BYPASS TO	INLET LENGTH COMP. (ft)	INLET LENGTH ACTUAL (ft)	STREET SLOPE (%)	CROSS (ft/ft) SLOPE	CURB HEIGHT (ft)	THROAT DEPRESS. (in)	GUTTER FLOW DEPTH (ft)	GUTTER FLOW SPREAD (ft)
I-2-1	0.46	0.46	0.9	0.41	0.41	5	7.07	2.93	0	2.93	2.93	0	-	15	15	3.9	0.093	0.5	2	0.45	3.15
EX-1	0.02	0.02	0.42	0.01	0.01	5	7.07	0.07	0	0.07	0.07	0	I-1-1	5.34	5.34	13	0.068	-	-	0.06	0.66
I-1-1	5.12	5.12	0.43	2.20	2.20	15.8	4.88	10.74	0	10.74	10.74	0	-	10	10	SAG	0.026	0.5	2	0.6	20.7
EX-2	0.13	0.13	0.9	0.12	0.12	5	7.07	0.85	0	0.85	0.75	0.1	EX-3	2.67	2.67	5.8	0.083	-	-	0.16	1.96
EX 3	-	-	-	-	-	5	7.07	0	0	0.1	0.1	0	-	2.67	2.67	5.8	0.083	-	-	0.08	0.97
EX 4	0.13	0.13	0.9	0.27	0.27	5	7.07	0.83	0	0.83	0.83	0	-	10	10	5.8	0.093	0.5	2	0.33	1.85
EX 5	0.05	0.05	0.9	0.045	0.045	5	7.07	0.32	0	0.32	0.32	0	-	10	10	1.8	0.47	0.5	2	0.31	1.13
EX 7	2.04	2.04	0.43	0.88	0.88	5	7.07	6.20	0	6.2	6.2	0	-	-	-	-	-	-	-	-	-

APPENDIX E.2
INLET COMPUTATIONS

Inlet Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 28 2023

EX-1

Grate Inlet

Location	=	On grade
Curb Length (ft)	=	-0-
Throat Height (in)	=	-0-
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	2.67
Grate Length (ft)	=	5.34

Gutter

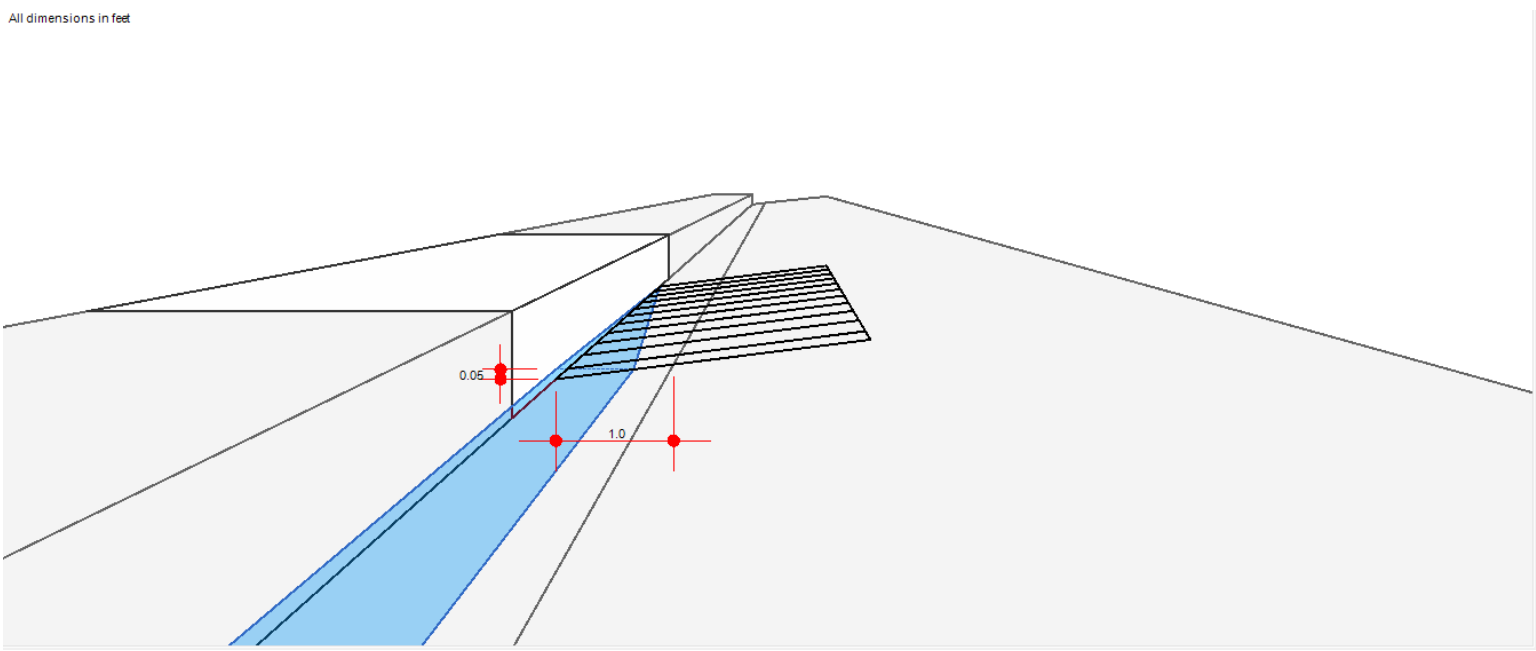
Slope, Sw (ft/ft)	=	0.083
Slope, Sx (ft/ft)	=	0.068
Local Depr (in)	=	-0-
Gutter Width (ft)	=	1.00
Gutter Slope (%)	=	13.00
Gutter n-value	=	0.015

Calculations

Compute by:		Known Q
Q (cfs)	=	0.07

Highlighted

Q Total (cfs)	=	0.07
Q Capt (cfs)	=	0.07
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	0.66
Efficiency (%)	=	100
Gutter Spread (ft)	=	0.66
Gutter Vel (ft/s)	=	3.87
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-



Inlet Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 28 2023

EX-2

Grate Inlet

Location	=	On grade
Curb Length (ft)	=	-0-
Throat Height (in)	=	-0-
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	2.67
Grate Length (ft)	=	2.67

Gutter

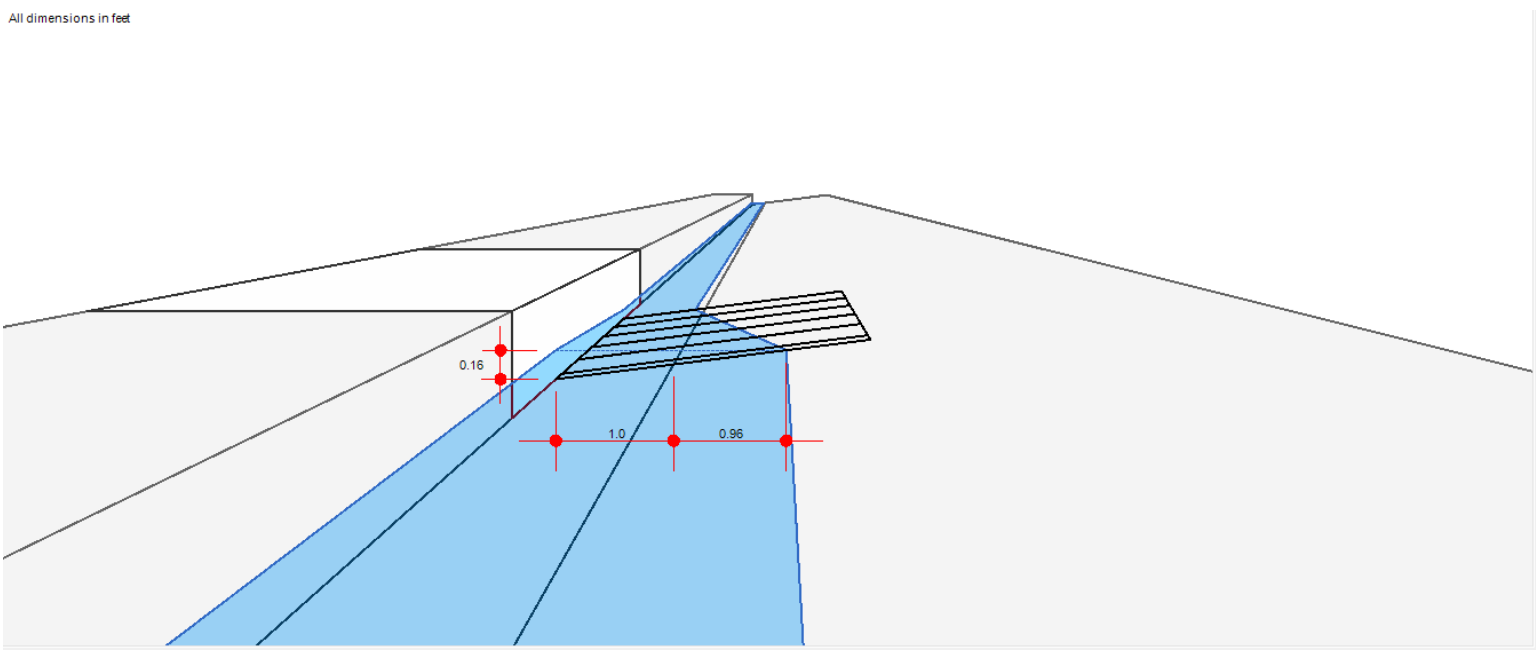
Slope, Sw (ft/ft)	=	0.083
Slope, Sx (ft/ft)	=	0.083
Local Depr (in)	=	-0-
Gutter Width (ft)	=	1.00
Gutter Slope (%)	=	5.80
Gutter n-value	=	0.015

Calculations

Compute by:		Known Q
Q (cfs)	=	0.85

Highlighted

Q Total (cfs)	=	0.85
Q Capt (cfs)	=	0.75
Q Bypass (cfs)	=	0.10
Depth at Inlet (in)	=	1.95
Efficiency (%)	=	88
Gutter Spread (ft)	=	1.96
Gutter Vel (ft/s)	=	5.35
Bypass Spread (ft)	=	0.88
Bypass Depth (in)	=	0.87



Inlet Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 28 2023

EX-3

Grate Inlet

Location	=	On grade
Curb Length (ft)	=	-0-
Throat Height (in)	=	-0-
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	2.67
Grate Length (ft)	=	2.67

Gutter

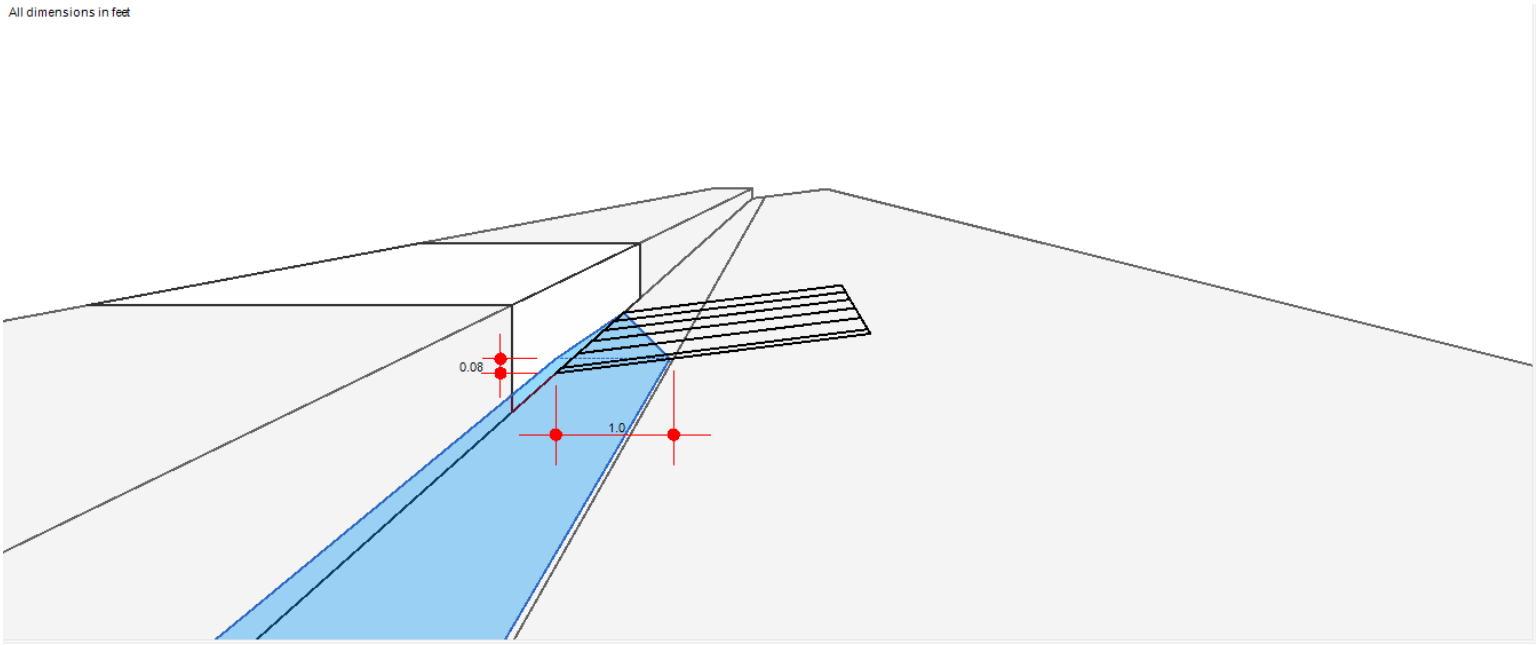
Slope, Sw (ft/ft)	=	0.083
Slope, Sx (ft/ft)	=	0.083
Local Depr (in)	=	-0-
Gutter Width (ft)	=	1.00
Gutter Slope (%)	=	5.80
Gutter n-value	=	0.015

Calculations

Compute by:		Known Q
Q (cfs)	=	0.10

Highlighted

Q Total (cfs)	=	0.13
Q Capt (cfs)	=	0.13
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	0.96
Efficiency (%)	=	100
Gutter Spread (ft)	=	0.97
Gutter Vel (ft/s)	=	3.35
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-



Inlet Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 28 2023

EX-4

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	10.00
Throat Height (in)	=	6.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

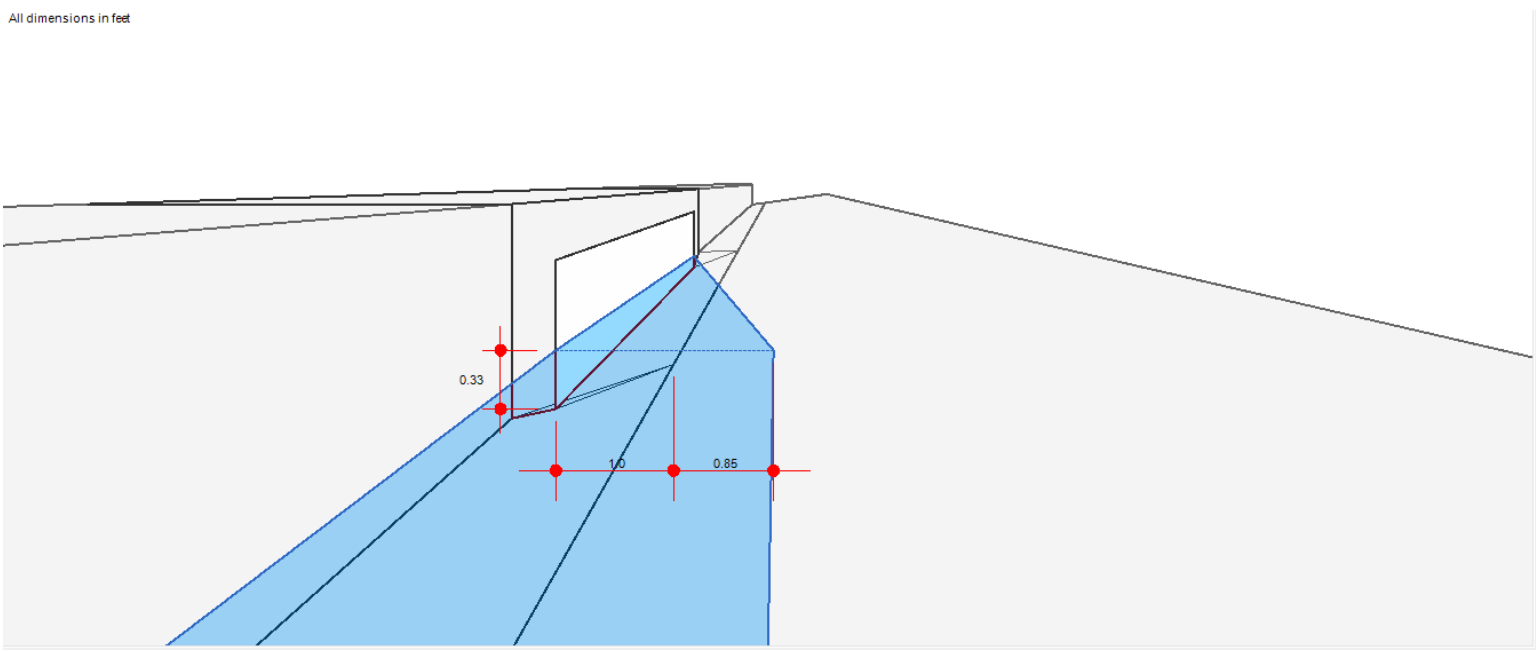
Slope, Sw (ft/ft)	=	0.083
Slope, Sx (ft/ft)	=	0.093
Local Depr (in)	=	2.00
Gutter Width (ft)	=	1.00
Gutter Slope (%)	=	5.80
Gutter n-value	=	0.015

Calculations

Compute by:		Known Q
Q (cfs)	=	0.83

Highlighted

Q Total (cfs)	=	0.83
Q Capt (cfs)	=	0.83
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	3.94
Efficiency (%)	=	100
Gutter Spread (ft)	=	1.85
Gutter Vel (ft/s)	=	5.39
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-



Inlet Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 28 2023

EX-5

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	10.00
Throat Height (in)	=	6.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

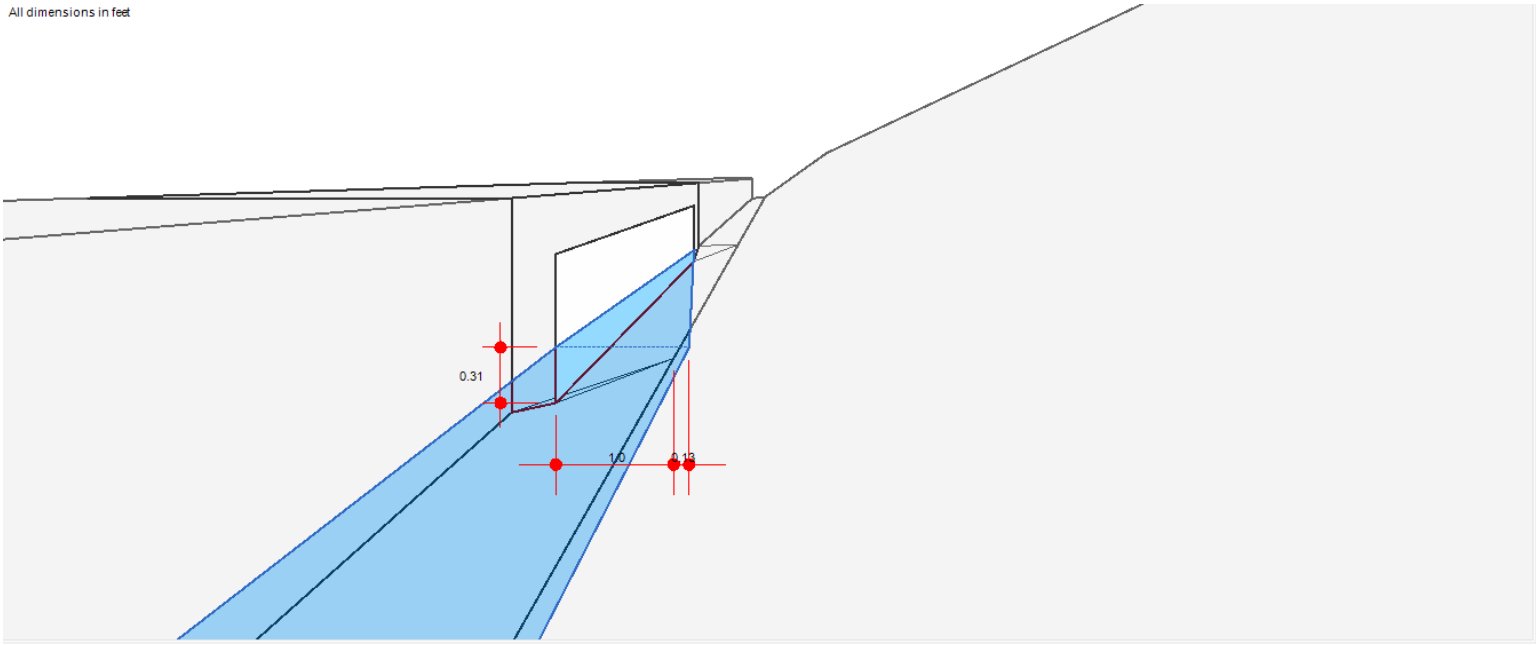
Slope, Sw (ft/ft)	=	0.083
Slope, Sx (ft/ft)	=	0.470
Local Depr (in)	=	2.00
Gutter Width (ft)	=	1.00
Gutter Slope (%)	=	1.80
Gutter n-value	=	0.015

Calculations

Compute by:		Known Q
Q (cfs)	=	0.32

Highlighted

Q Total (cfs)	=	0.32
Q Capt (cfs)	=	0.32
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	3.74
Efficiency (%)	=	100
Gutter Spread (ft)	=	1.13
Gutter Vel (ft/s)	=	2.97
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-



Inlet Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 28 2023

I-1-1

Curb Inlet

Location	=	Sag
Curb Length (ft)	=	10.00
Throat Height (in)	=	6.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

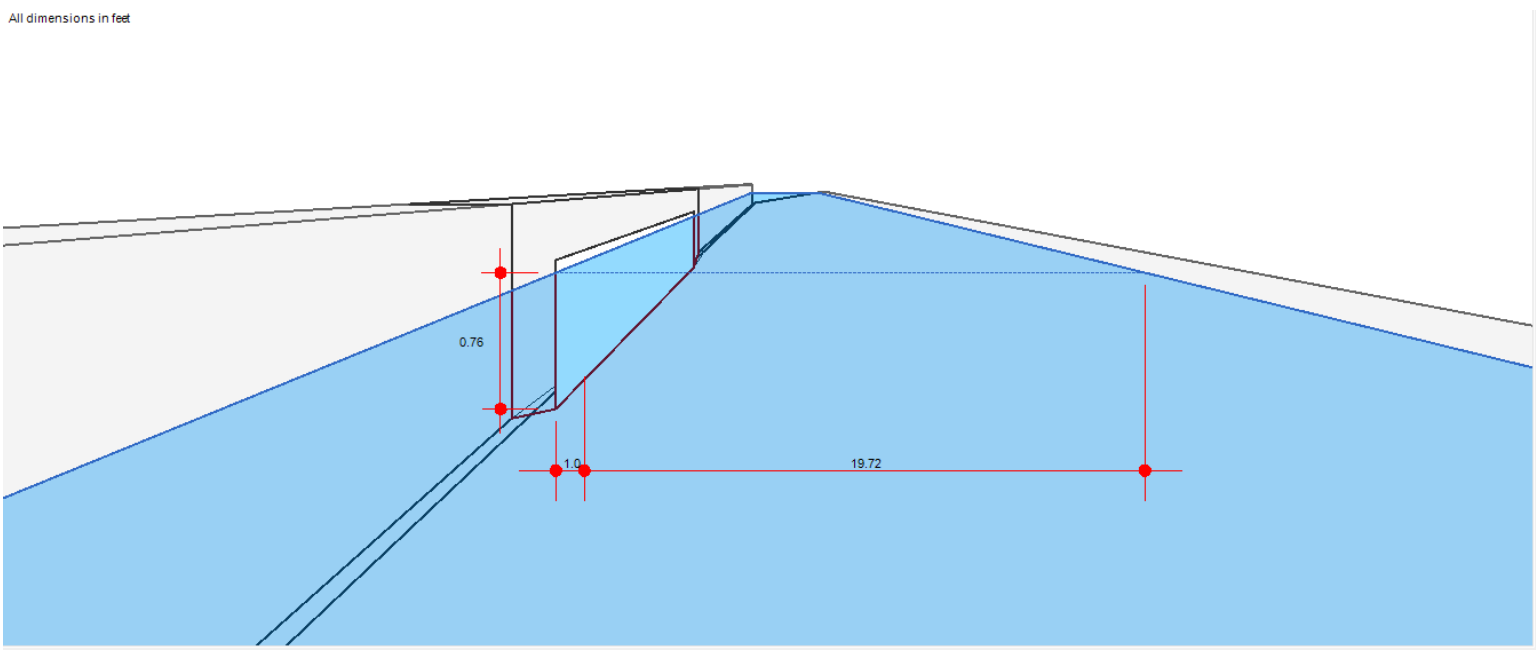
Slope, Sw (ft/ft)	=	0.083
Slope, Sx (ft/ft)	=	0.026
Local Depr (in)	=	2.00
Gutter Width (ft)	=	1.00
Gutter Slope (%)	=	-0-
Gutter n-value	=	-0-

Calculations

Compute by:		Known Q
Q (cfs)	=	10.74

Highlighted

Q Total (cfs)	=	10.74
Q Capt (cfs)	=	10.74
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	9.15
Efficiency (%)	=	100
Gutter Spread (ft)	=	20.72
Gutter Vel (ft/s)	=	3.87
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-



Inlet Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Nov 28 2023

I-2-1

Curb Inlet

Location	=	On grade
Curb Length (ft)	=	15.00
Throat Height (in)	=	6.00
Grate Area (sqft)	=	-0-
Grate Width (ft)	=	-0-
Grate Length (ft)	=	-0-

Gutter

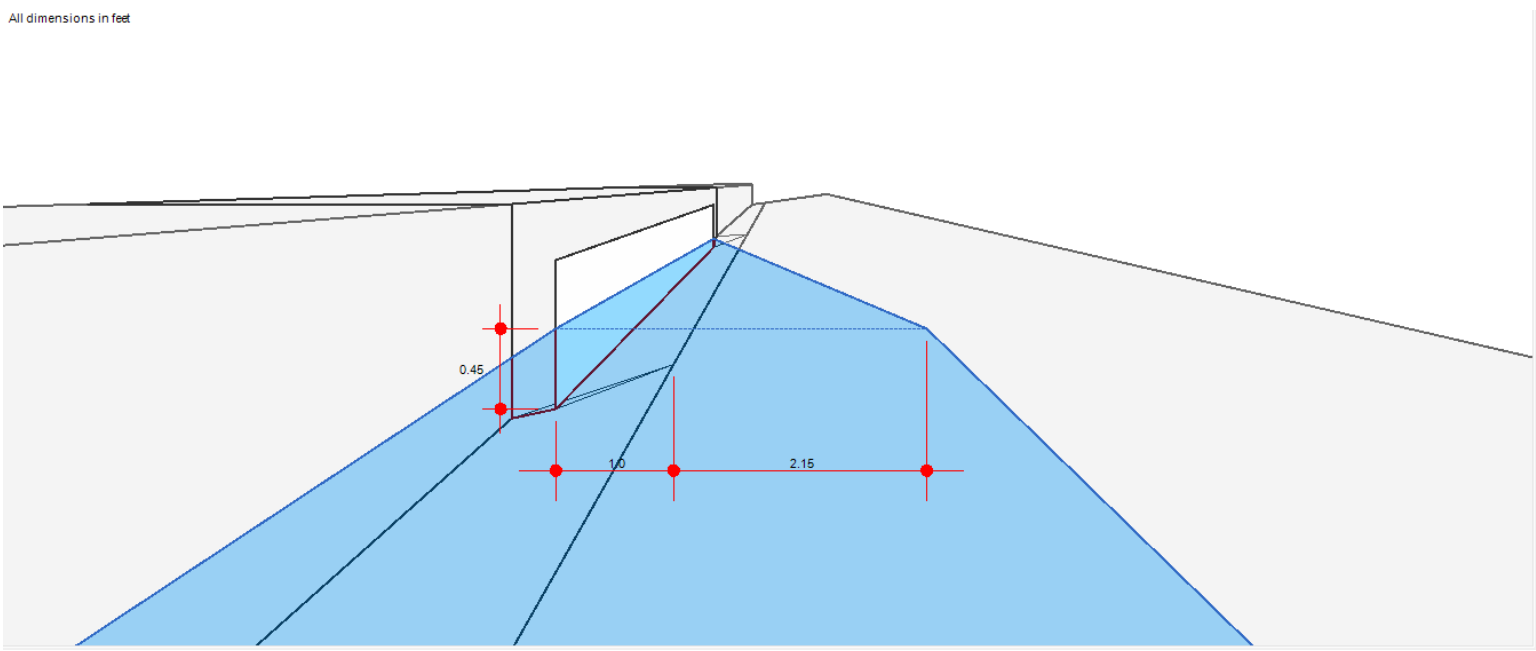
Slope, Sw (ft/ft)	=	0.083
Slope, Sx (ft/ft)	=	0.093
Local Depr (in)	=	2.00
Gutter Width (ft)	=	1.00
Gutter Slope (%)	=	3.90
Gutter n-value	=	0.015

Calculations

Compute by:		Known Q
Q (cfs)	=	2.93

Highlighted

Q Total (cfs)	=	2.93
Q Capt (cfs)	=	2.93
Q Bypass (cfs)	=	-0-
Depth at Inlet (in)	=	5.39
Efficiency (%)	=	100
Gutter Spread (ft)	=	3.15
Gutter Vel (ft/s)	=	6.43
Bypass Spread (ft)	=	-0-
Bypass Depth (in)	=	-0-



APPENDIX E.3
STORM SEWER DESIGN

PIPE COMPUTATIONS

MacArthur BLVD

	DATE
COMPUTED: ALB	6/27/2024
CHECKED: WRB	6/27/2024

PIPE		AREA		R=C	AR	ΣAR	TC	I	Q	PIPE SIZE	MIN SLOPE	V	PIPE LENGTH	TIME IN PIPE	REMARKS
FROM	TO	INCR. AREA	TOTAL AREA				(min)	(in/hr)	(cfs)	(inches)	(%)	(fps)	(feet)	(min)	
I-2-1	ES-2-2	0.46	0.46	0.90	0.41	0.41	5.0	7.07	2.93	15	11.36	3.55	199	1.39	
EX-MH-9	EW-13	0.00	2.18	0.45	0.98	0.98	15.3	5.00	4.86	18	1.46	4	55	0.19	

APPENDIX E.4
STORM SEWER HGL COMPUTATIONS

Hydraulic Grade Line Computations

Line	Size (in)	Q (cfs)	Downstream Invert elev (ft)	Downstream HGL elev (ft)	Downstream Depth (ft)	Downstream Area (sqft)	Downstream Vel (ft/s)	Downstream Vel head (ft)	Downstream EGL elev (ft)	Downstream Sf (%)	Len (ft)	Upstream Invert elev (ft)	Upstream HGL elev (ft)	Upstream Depth (ft)	Upstream Area (sqft)	Upstream Vel (ft/s)	Upstream Vel head (ft)	Upstream EGL elev (ft)	Upstream Sf (%)	Check Ave Sf (%)	Check Enrgy loss (ft)	JL coeff (K)	Minor loss (ft)
1	15	5.93	162.22	163.34	1.12	1.04	5.12	0.51	163.84	0.000	198.69	6186.33	187.31 j	0.98**	1.04	5.72	0.51	187.82	0.000	0.000	n/a	1.00	0.51

Project File: CALCSSYSTEM2.stm | Number of lines: 1 | Run Date: 11/29/2023

Notes: ; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
	(in)	(cfs)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	(ft)	Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)	(K)	(ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
8	15	0.70	199.10	199.22	0.12*	0.06	11.42	0.12	199.34	0.000	28.117	207.63	207.96	0.33**	0.26	2.74	0.12	208.07	0.000	0.000	n/a	1.00	n/a
7	15	0.68	186.43	186.56	0.13*	0.07	9.79	0.11	186.68	0.000	62.105	198.90	199.22	0.32**	0.25	2.72	0.11	199.34	0.000	0.000	n/a	0.17	n/a
6	15	0.63	185.35	185.56	0.21*	0.13	4.77	0.11	185.67	0.000	13.846	185.73	186.04	0.31**	0.24	2.66	0.11	186.15	0.000	0.000	n/a	0.26	0.03
5	15	0.62	171.65	171.82	0.17*	0.10	6.29	0.11	171.93	0.000	212.592	184.65	184.96	0.31**	0.23	2.65	0.11	185.07	0.000	0.000	n/a	0.94	0.10
4	15	0.51	168.38	168.50	0.12*	0.06	8.49	0.10	168.60	0.000	18.000	171.48	171.76	0.28**	0.20	2.51	0.10	171.85	0.000	0.000	n/a	0.99	0.10
3	18	4.87	165.76	166.38	0.62*	0.69	7.09	0.35	166.73	0.000	34.660	166.35	167.20	0.85**	1.03	4.73	0.35	167.55	0.000	0.000	n/a	0.15	n/a
2	18	4.86	151.66	152.33	0.67	0.76	6.41	0.35	152.67	0.000	17.271	165.40	166.25	0.85**	1.03	4.73	0.35	166.59	0.000	0.000	n/a	0.19	n/a
1	18	4.86	150.67	151.84	1.17	1.03	3.28	0.35	152.19	0.000	55.000	151.48	152.33 j	0.85**	1.03	4.73	0.35	152.67	0.000	0.000	n/a	0.41	0.14

Project File: Storm Sewer Calc.stm | Number of lines: 8 | Run Date: 6/27/2024

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

APPENDIX E.5
CURB OPENING COMPUTATIONS

Rational Flow Calculation for Curb Openings

Project: MacArthur Blvd Project number: 18-04565-003 Designed by: CM Date: 11/28/2023 Checked by: WRB Date: 11/28/2023

Roadway classification: Arterial

From MCDOT C-value chart			
	Imp	turf	woods
A	0.9	0.12	0.15
B	0.9	0.16	0.2
C	0.9	0.19	0.23
D	0.9	0.24	0.3

From table 3-3	
C Factor	T_c (min)
>0.80	5
0.65-0.79	7
0.4-0.64	10
<0.39	15

From table 3-7		
Tc (min)	I_{10} (in/hr)	I_{25} (in/hr)
5	7.07	8.05
7	6.52	7.49
10	5.85	6.77
15	5	5.84

Curb Cut	Station	Total Area (ac)	A-Imp (ac)	A-turf (ac)	A-Woods (ac)	B-Imp (ac)	B-turf (ac)	B-Woods (ac)	C-Imp (ac)	C-turf (ac)	C-Woods (ac)	D-Imp (ac)	D-turf (ac)	D-Woods (ac)	Weighted C	T_c (min)	I_{10} (in/hr)	Q_{10} (cfs)
CC 1	215+19	0.0071	0	0	0	0.0071	0	0	0	0	0	0	0	0	0.90	5	7.07	0.05
Sump 1	215+89	0.0317	0	0	0	0.0317	0	0	0	0	0	0	0	0	0.90	5	7.07	0.20
CC 2	216+61	0.0053	0	0	0	0.0053	0	0	0	0	0	0	0	0	0.90	5	7.07	0.03
CC 3	217+30	0.0123	0	0	0	0.0078	0	0	0	0	0	0.0046	0	0	0.90	5	7.07	0.08
Sump 2	218+05	0.0293	0	0	0	0.0000	0	0	0	0	0	0.0293	0	0	0.90	5	7.07	0.19
CC 4	218+67	0.0132	0	0	0	0.0000	0	0	0	0	0	0.0132	0		0.90	5	7.07	0.08
CC 5	219+24	0.0056	0	0	0	0.0000	0	0	0	0	0	0.0056	0	0	0.90	5	7.07	0.04
Sump 3	219+85	0.0189	0	0	0	0.0000	0	0	0	0	0	0.0189	0	0	0.90	5	7.07	0.12
CC 6	220+30	0.0039	0	0	0	0.0000	0	0	0	0	0	0.0039	0	0	0.90	5	7.07	0.02
Sump 4	220+75	0.0191	0	0	0	0.0107	0	0	0	0	0	0.0082	0	0	0.89	5	7.07	0.12
CC 7	221+29	0.0131	0	0	0	0.0131	0	0	0	0	0	0	0	0	0.90	5	7.07	0.08
CC 8	221+85	0.0190	0	0	0	0.0190	0	0	0	0	0	0	0	0	0.90	5	7.07	0.12
CC 9	222+35	0.0070	0	0	0	0.0070	0	0	0	0	0	0	0	0	0.90	5	7.07	0.04
CC 10	222+85	0.0150	0	0	0	0.0150	0	0	0	0	0	0	0	0	0.90	5	7.07	0.10
CC 11	223+36	0.0147	0	0	0	0.0147	0	0	0	0	0	0	0	0	0.90	5	7.07	0.09
Sump 5	223+95	0.0208	0	0	0	0.0208	0	0	0	0	0	0	0	0	0.90	5	7.07	0.13
Sump 6	224+41	0.0143	0	0	0	0.0143	0	0	0	0	0	0	0	0	0.90	5	7.07	0.09
CC 12	225+03	0.0121	0	0	0	0.0121	0	0	0	0	0	0	0	0	0.90	5	7.07	0.08
CC 13	225+59	0.0191	0	0	0	0.0191	0	0	0	0	0	0	0	0	0.90	5	7.07	0.12
CC 14	226+14	0.0170	0	0	0	0.0170	0	0	0	0	0	0	0	0	0.90	5	7.07	0.11
Sump 7	226+50	0.0234	0	0	0	0.0234	0	0	0	0	0	0	0	0	0.90	5	7.07	0.15
CC 15	226+99	0.0201	0	0	0	0.0201	0	0	0	0	0	0	0	0	0.90	5	7.07	0.13
Sump 8	227+60	0.0236	0	0	0	0.0236	0	0	0	0	0	0	0	0	0.90	5	7.07	0.15
Sump 9	228+05	0.0298	0	0	0	0.0298	0	0	0	0	0	0	0	0	0.90	5	7.07	0.19
CC 16	228+64	0.0130	0	0	0	0.0130	0	0	0	0	0	0	0	0	0.90	5	7.07	0.08
CC 17	229+15	0.0154	0	0	0	0.0154	0	0	0	0	0	0	0	0	0.90	5	7.07	0.10
CC 18	229+72	0.0172	0	0	0	0.0172	0	0	0	0	0	0	0	0	0.90	5	7.07	0.11
CC 19	230+27	0.0178	0	0	0	0.0178	0	0	0	0	0	0	0	0	0.90	5	7.07	0.11

Worksheet for CC 1

Project Description	
Solve For	Efficiency

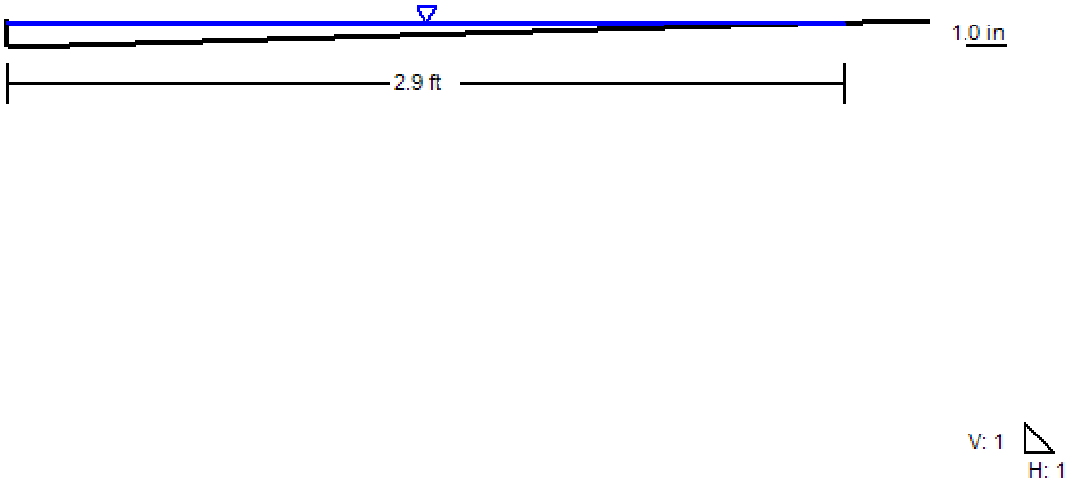
Input Data	
Discharge	0.05 cfs
Slope	0.001 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.029 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.05 cfs
Bypass Flow	0.00 cfs
Spread	2.9 ft
Depth	1.0 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	0.42 ft/s
Equivalent Cross Slope	0.029 ft/ft
Length Factor	4.680
Total Interception Length	2.1 ft

Cross Section for CC 1

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.05 cfs
Slope	0.001 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.029 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 2

Project Description	
Solve For	Efficiency

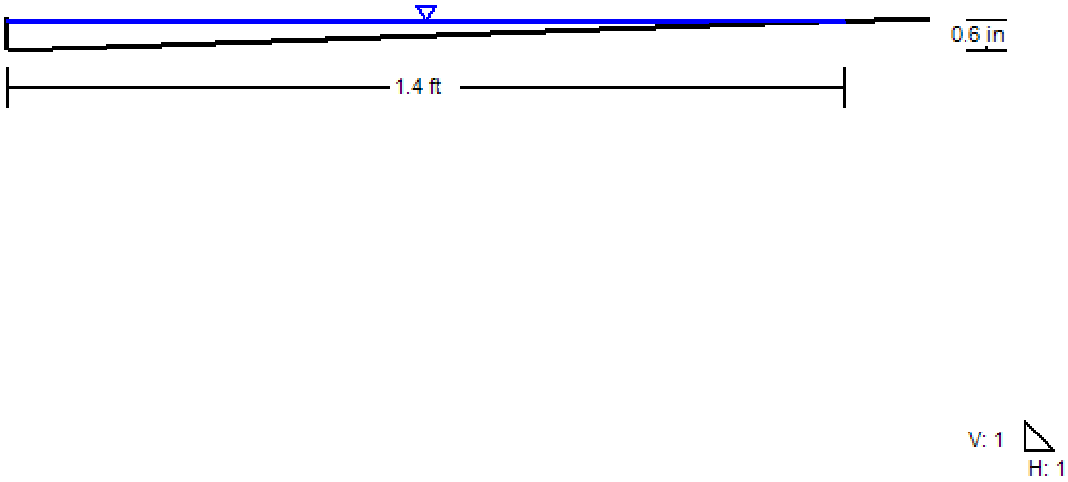
Input Data	
Discharge	0.03 cfs
Slope	0.005 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.035 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.03 cfs
Bypass Flow	0.00 cfs
Spread	1.4 ft
Depth	0.6 in
Flow Area	0.0 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	0.83 ft/s
Equivalent Cross Slope	0.035 ft/ft
Length Factor	3.520
Total Interception Length	2.8 ft

Cross Section for CC 2

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.03 cfs
Slope	0.005 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.035 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 3

Project Description	
Solve For	Efficiency

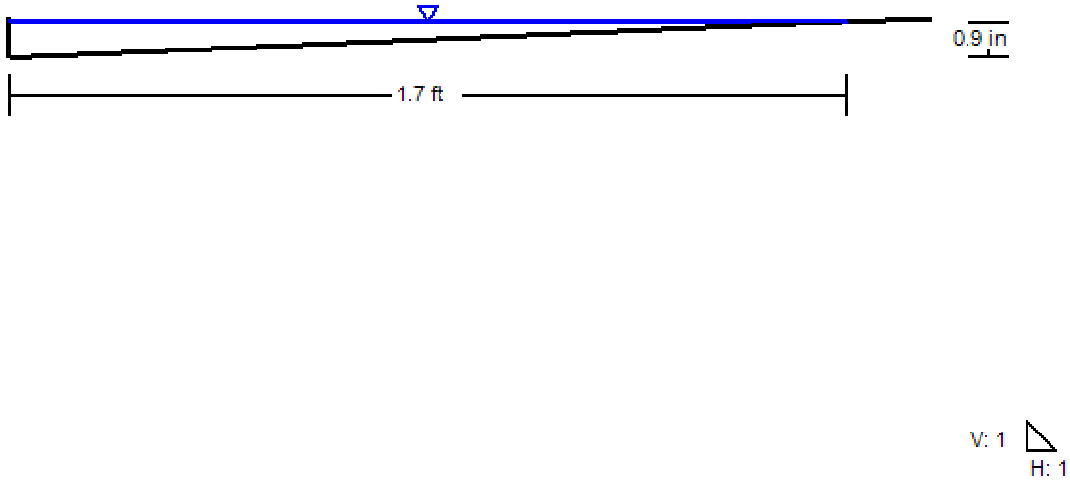
Input Data	
Discharge	0.08 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.043 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.08 cfs
Bypass Flow	0.00 cfs
Spread	1.7 ft
Depth	0.9 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.33 ft/s
Equivalent Cross Slope	0.043 ft/ft
Length Factor	2.282
Total Interception Length	4.4 ft

Cross Section for CC 3

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.08 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.043 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 4

Project Description	
Solve For	Efficiency

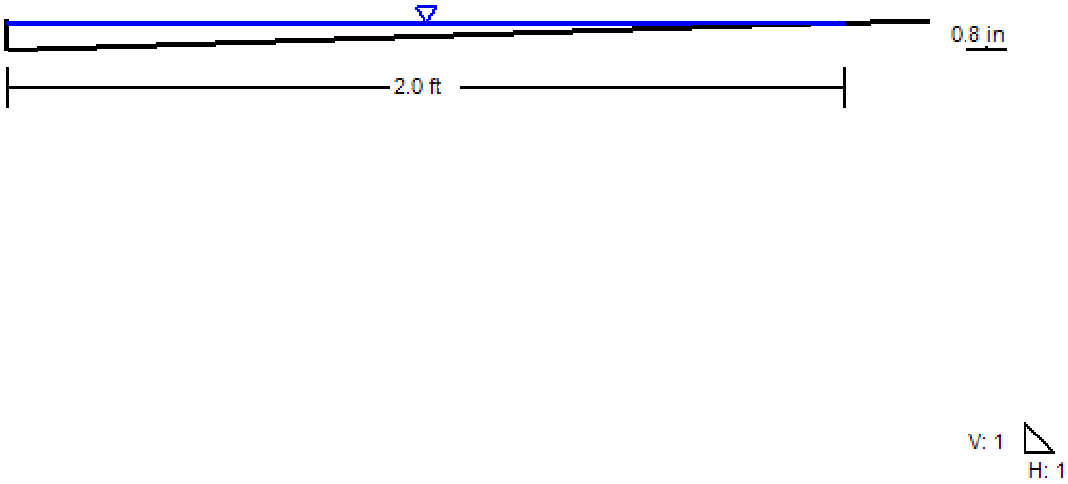
Input Data	
Discharge	0.08 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.08 cfs
Bypass Flow	0.00 cfs
Spread	2.0 ft
Depth	0.8 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.23 ft/s
Equivalent Cross Slope	0.032 ft/ft
Length Factor	1.941
Total Interception Length	5.2 ft

Cross Section for CC 4

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.08 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 5

Project Description	
Solve For	Efficiency

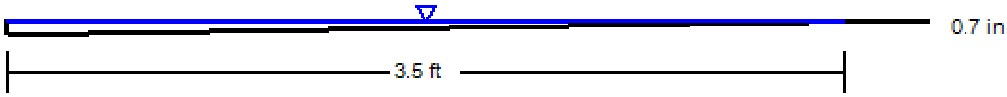
Input Data	
Discharge	0.04 cfs
Slope	0.001 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.016 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

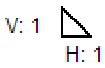
Results	
Efficiency	100.00 %
Intercepted Flow	0.04 cfs
Bypass Flow	0.00 cfs
Spread	3.5 ft
Depth	0.7 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	0.40 ft/s
Equivalent Cross Slope	0.016 ft/ft
Length Factor	3.161
Total Interception Length	3.2 ft

Cross Section for CC 5

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.04 cfs
Slope	0.001 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.016 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft





Worksheet for CC 6

Project Description	
Solve For	Efficiency

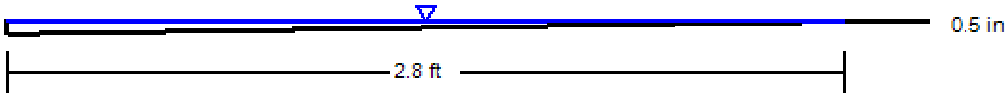
Input Data	
Discharge	0.02 cfs
Slope	0.001 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

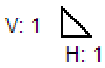
Results	
Efficiency	100.00 %
Intercepted Flow	0.02 cfs
Bypass Flow	0.00 cfs
Spread	2.8 ft
Depth	0.5 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	0.33 ft/s
Equivalent Cross Slope	0.015 ft/ft
Length Factor	4.069
Total Interception Length	2.5 ft

Cross Section for CC 6

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.02 cfs
Slope	0.001 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.015 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft





Worksheet for CC 7

Project Description	
Solve For	Efficiency

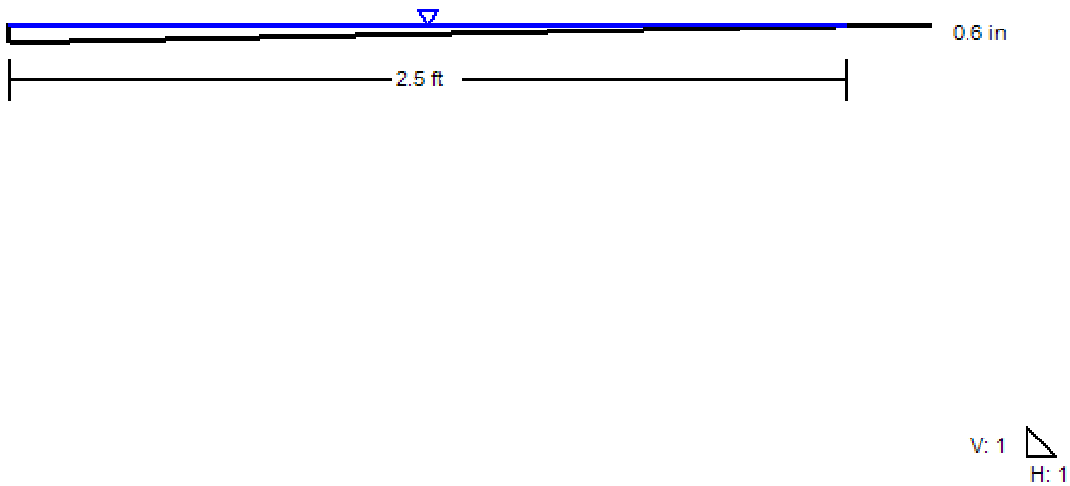
Input Data	
Discharge	0.08 cfs
Slope	0.013 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.08 cfs
Bypass Flow	0.00 cfs
Spread	2.5 ft
Depth	0.6 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.32 ft/s
Equivalent Cross Slope	0.020 ft/ft
Length Factor	1.254
Total Interception Length	8.0 ft

Cross Section for CC 7

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.08 cfs
Slope	0.013 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 8

Project Description	
Solve For	Efficiency

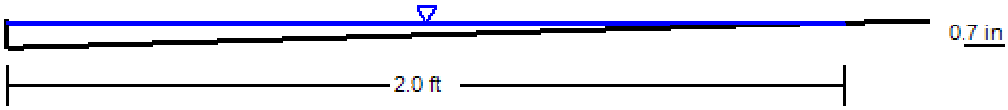
Input Data	
Discharge	0.12 cfs
Slope	0.023 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.030 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

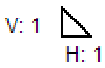
Results	
Efficiency	100.00 %
Intercepted Flow	0.12 cfs
Bypass Flow	0.00 cfs
Spread	2.0 ft
Depth	0.7 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	2.00 ft/s
Equivalent Cross Slope	0.030 ft/ft
Length Factor	1.121
Total Interception Length	8.9 ft

Cross Section for CC 8

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.12 cfs
Slope	0.023 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.030 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft





Worksheet for CC 9

Project Description	
Solve For	Efficiency

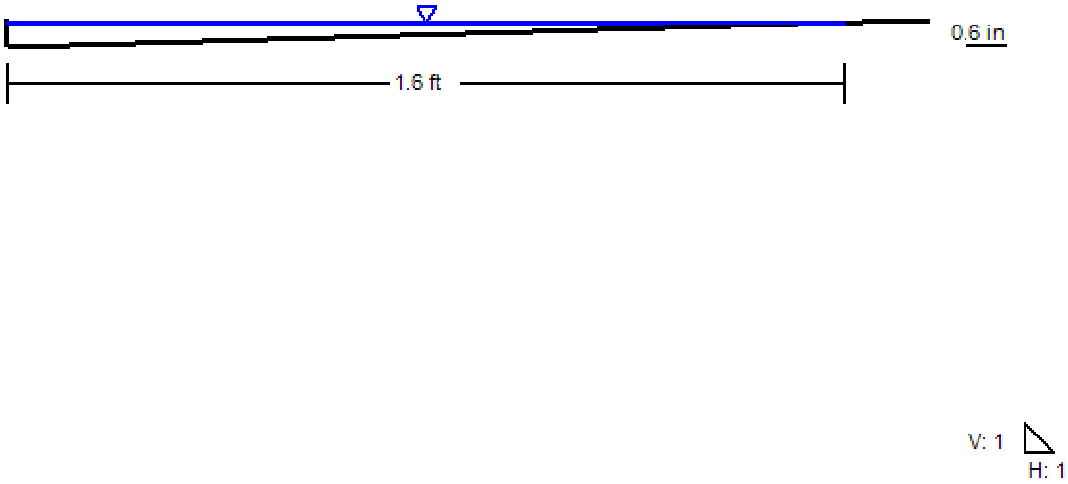
Input Data	
Discharge	0.04 cfs
Slope	0.010 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.029 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.04 cfs
Bypass Flow	0.00 cfs
Spread	1.6 ft
Depth	0.6 in
Flow Area	0.0 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.09 ft/s
Equivalent Cross Slope	0.029 ft/ft
Length Factor	2.284
Total Interception Length	4.4 ft

Cross Section for CC 9

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.04 cfs
Slope	0.010 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.029 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 10

Project Description	
Solve For	Efficiency

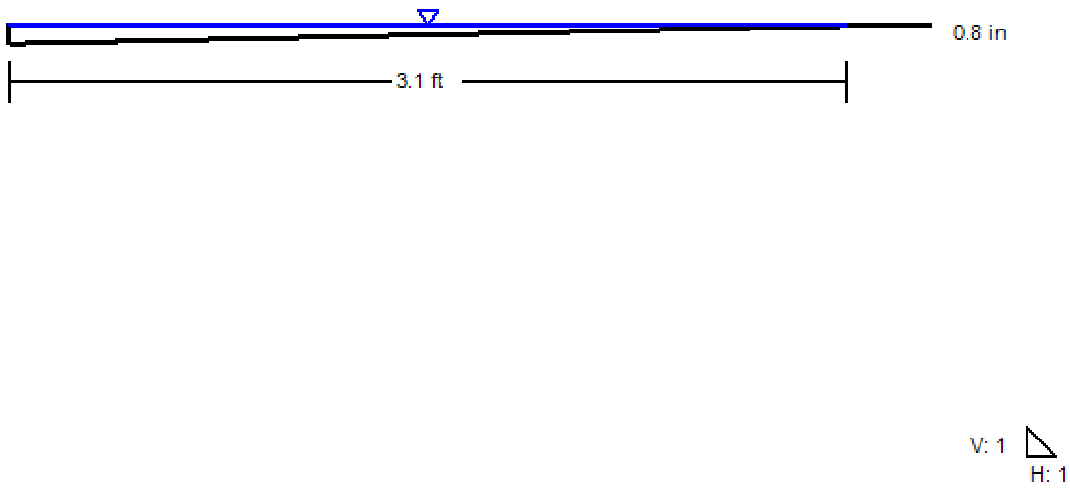
Input Data	
Discharge	0.10 cfs
Slope	0.005 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.021 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.10 cfs
Bypass Flow	0.00 cfs
Spread	3.1 ft
Depth	0.8 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	0.99 ft/s
Equivalent Cross Slope	0.021 ft/ft
Length Factor	1.567
Total Interception Length	6.4 ft

Cross Section for CC 10

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.10 cfs
Slope	0.005 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.021 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 11

Project Description	
Solve For	Efficiency

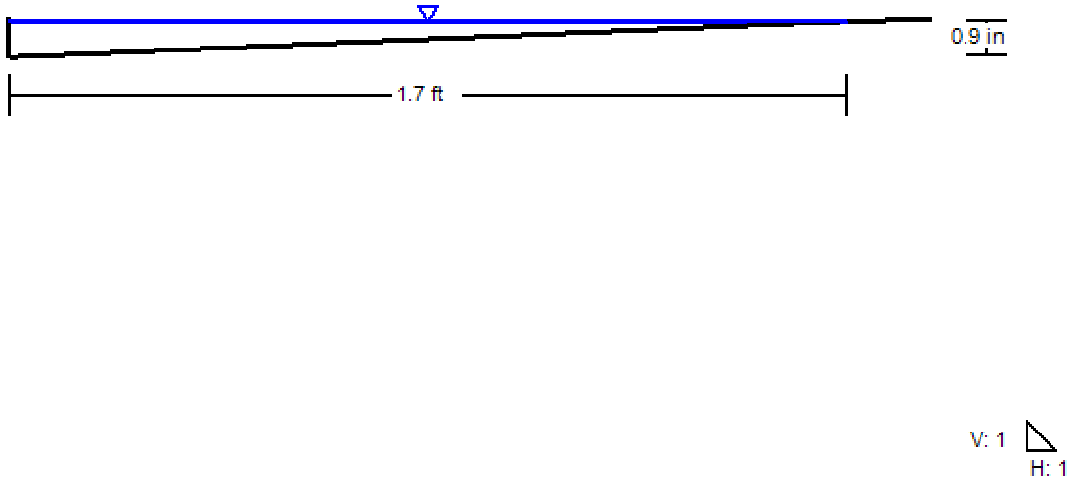
Input Data	
Discharge	0.09 cfs
Slope	0.009 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.042 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.09 cfs
Bypass Flow	0.00 cfs
Spread	1.7 ft
Depth	0.9 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.40 ft/s
Equivalent Cross Slope	0.042 ft/ft
Length Factor	2.104
Total Interception Length	4.8 ft

Cross Section for CC 11

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.09 cfs
Slope	0.009 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.042 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 12

Project Description	
Solve For	Efficiency

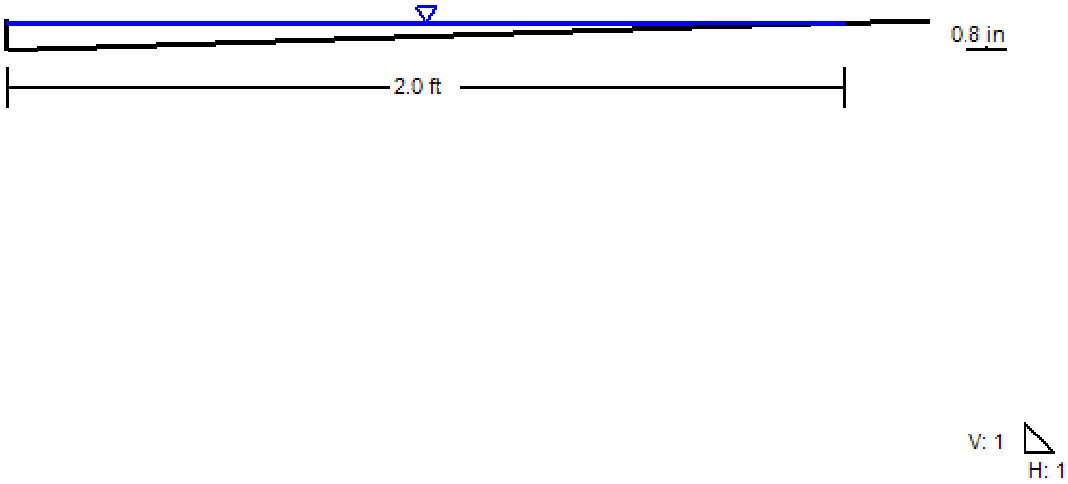
Input Data	
Discharge	0.08 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.08 cfs
Bypass Flow	0.00 cfs
Spread	2.0 ft
Depth	0.8 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.23 ft/s
Equivalent Cross Slope	0.032 ft/ft
Length Factor	1.941
Total Interception Length	5.2 ft

Cross Section for CC 12

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.08 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 13

Project Description	
Solve For	Efficiency

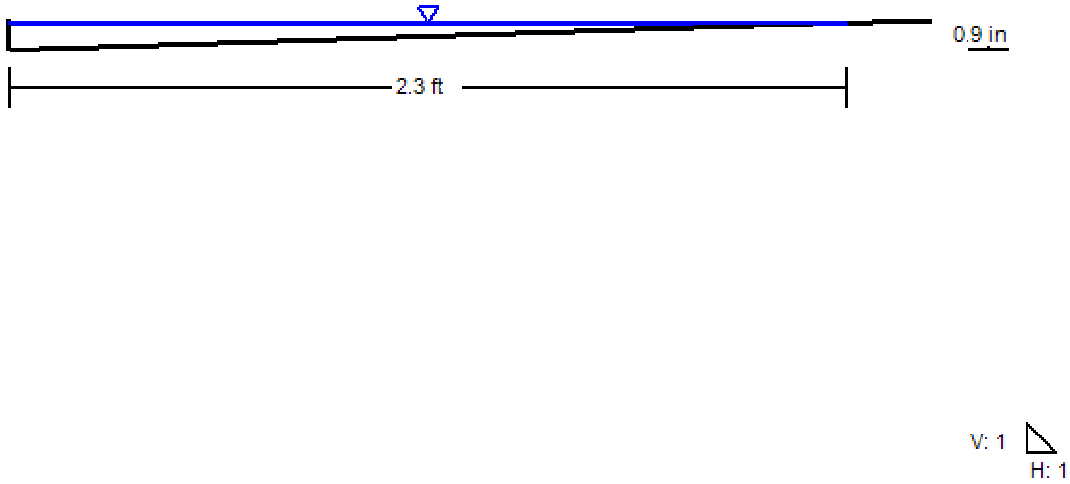
Input Data	
Discharge	0.12 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.12 cfs
Bypass Flow	0.00 cfs
Spread	2.3 ft
Depth	0.9 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.36 ft/s
Equivalent Cross Slope	0.032 ft/ft
Length Factor	1.637
Total Interception Length	6.1 ft

Cross Section for CC 13

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.12 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 14

Project Description	
Solve For	Efficiency

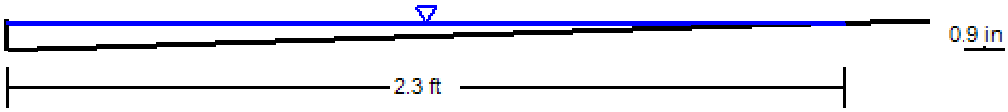
Input Data	
Discharge	0.11 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

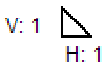
Results	
Efficiency	100.00 %
Intercepted Flow	0.11 cfs
Bypass Flow	0.00 cfs
Spread	2.3 ft
Depth	0.9 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.33 ft/s
Equivalent Cross Slope	0.032 ft/ft
Length Factor	1.698
Total Interception Length	5.9 ft

Cross Section for CC 14

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.11 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft





Worksheet for CC 15

Project Description	
Solve For	Efficiency

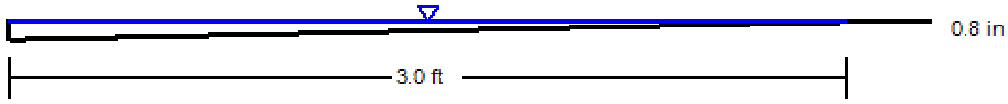
Input Data	
Discharge	0.13 cfs
Slope	0.010 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.021 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

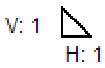
Results	
Efficiency	100.00 %
Intercepted Flow	0.13 cfs
Bypass Flow	0.00 cfs
Spread	3.0 ft
Depth	0.8 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.37 ft/s
Equivalent Cross Slope	0.021 ft/ft
Length Factor	1.140
Total Interception Length	8.8 ft

Cross Section for CC 15

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.13 cfs
Slope	0.010 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.021 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft





Worksheet for CC 16

Project Description	
Solve For	Efficiency

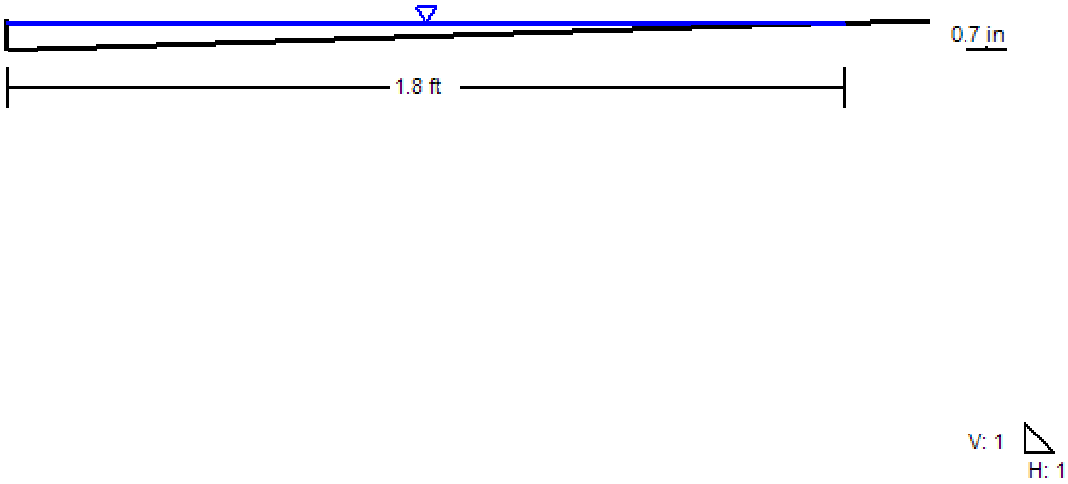
Input Data	
Discharge	0.08 cfs
Slope	0.014 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.08 cfs
Bypass Flow	0.00 cfs
Spread	1.8 ft
Depth	0.7 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.52 ft/s
Equivalent Cross Slope	0.032 ft/ft
Length Factor	1.636
Total Interception Length	6.1 ft

Cross Section for CC 16

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.08 cfs
Slope	0.014 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for CC 17

Project Description	
Solve For	Efficiency

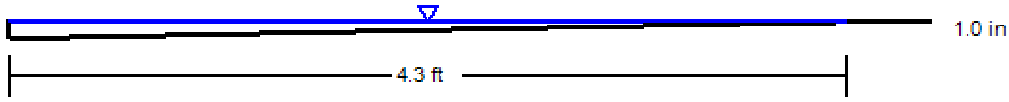
Input Data	
Discharge	0.10 cfs
Slope	0.001 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

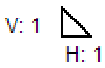
Results	
Efficiency	100.00 %
Intercepted Flow	0.10 cfs
Bypass Flow	0.00 cfs
Spread	4.3 ft
Depth	1.0 in
Flow Area	0.2 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	0.53 ft/s
Equivalent Cross Slope	0.020 ft/ft
Length Factor	2.459
Total Interception Length	4.1 ft

Cross Section for CC 17

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.10 cfs
Slope	0.001 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft





Worksheet for CC 18

Project Description	
Solve For	Efficiency

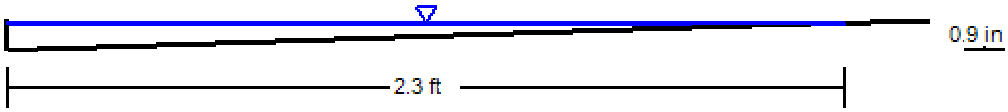
Input Data	
Discharge	0.11 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

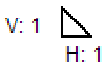
Results	
Efficiency	100.00 %
Intercepted Flow	0.11 cfs
Bypass Flow	0.00 cfs
Spread	2.3 ft
Depth	0.9 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	1.33 ft/s
Equivalent Cross Slope	0.032 ft/ft
Length Factor	1.698
Total Interception Length	5.9 ft

Cross Section for CC 18

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.11 cfs
Slope	0.008 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.032 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft





Worksheet for CC 19

Project Description	
Solve For	Efficiency

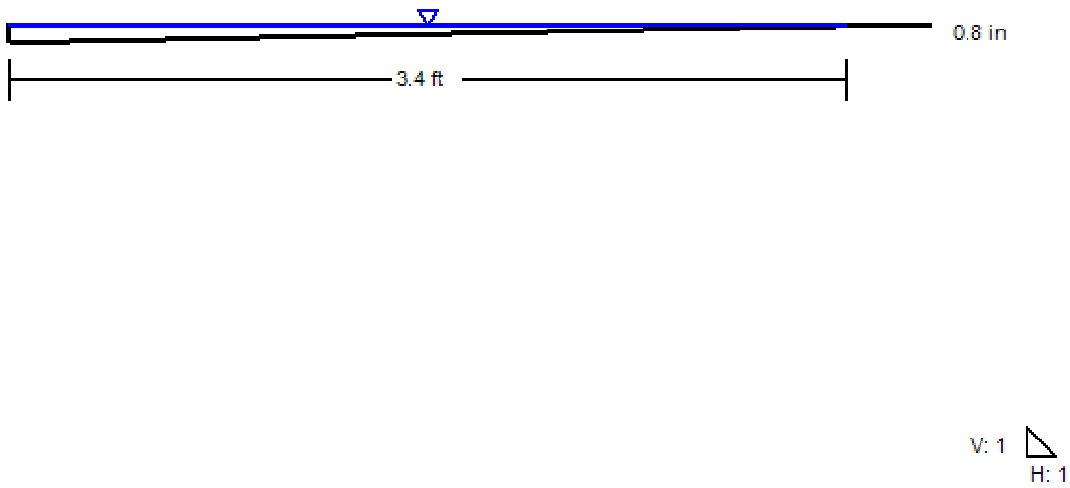
Input Data	
Discharge	0.11 cfs
Slope	0.004 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Curb Opening Length	10.0 ft
Local Depression	0.0 in
Local Depression Width	0.0 in

Results	
Efficiency	100.00 %
Intercepted Flow	0.11 cfs
Bypass Flow	0.00 cfs
Spread	3.4 ft
Depth	0.8 in
Flow Area	0.1 ft^2
Gutter Depression	0.0 in
Total Depression	0.0 in
Velocity	0.93 ft/s
Equivalent Cross Slope	0.020 ft/ft
Length Factor	1.547
Total Interception Length	6.5 ft

Cross Section for CC 19

Project Description	
Solve For	Efficiency

Input Data	
Discharge	0.11 cfs
Slope	0.004 ft/ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.013
Local Depression	0.0 in
Local Depression Width	0.0 in
Efficiency	100.00 %
Curb Opening Length	10.0 ft



Worksheet for Sump 1 (COS)

Project Description	
Solve For	Spread

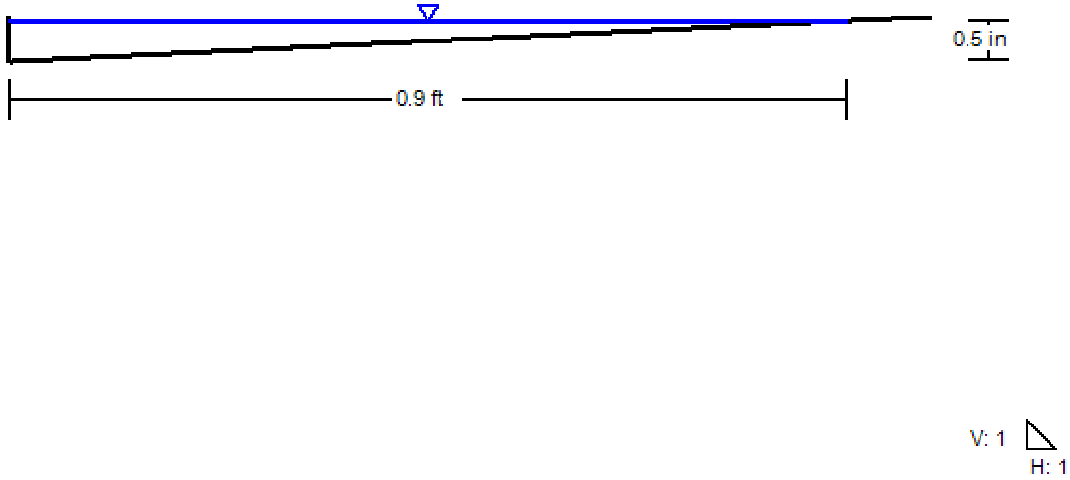
Input Data	
Discharge	0.28 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.048 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees

Results	
Spread	0.9 ft
Depth	0.5 in
Gutter Depression	0.0 in
Total Depression	0.0 in

Cross Section for Sump 1 (COS)

Project Description	
Solve For	Spread

Input Data	
Discharge	0.28 cfs
Spread	0.9 ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.048 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees



Worksheet for Sump 2 (COS)

Project Description	
Solve For	Spread

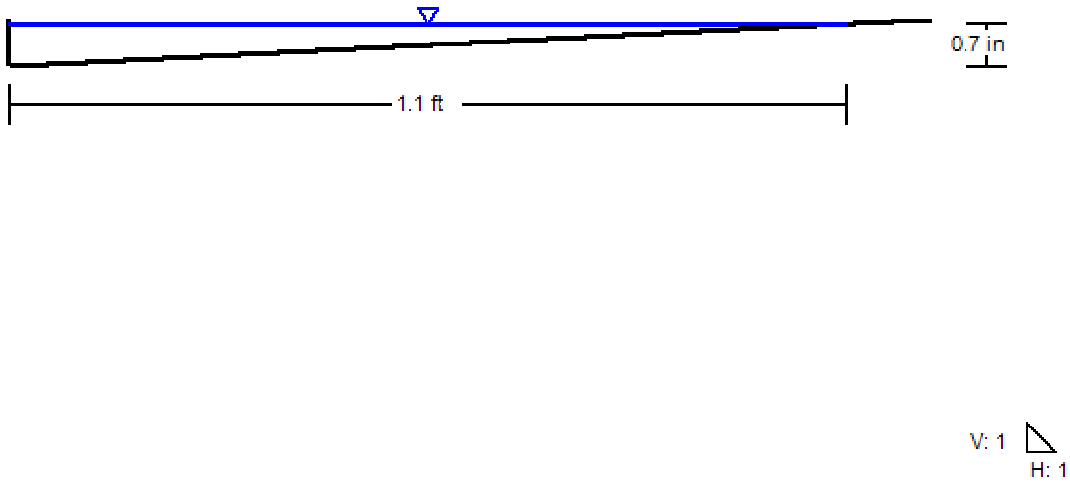
Input Data	
Discharge	0.38 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.050 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees

Results	
Spread	1.1 ft
Depth	0.7 in
Gutter Depression	0.0 in
Total Depression	0.0 in

Cross Section for Sump 2 (COS)

Project Description	
Solve For	Spread

Input Data	
Discharge	0.38 cfs
Spread	1.1 ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.050 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees



Worksheet for Sump 3 (COS)

Project Description	
Solve For	Spread

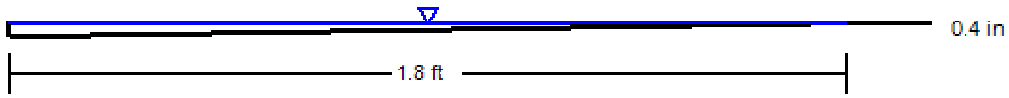
Input Data	
Discharge	0.15 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.016 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees

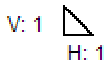
Results	
Spread	1.8 ft
Depth	0.4 in
Gutter Depression	0.0 in
Total Depression	0.0 in

Cross Section for Sump 3 (COS)

Project Description	
Solve For	Spread

Input Data	
Discharge	0.15 cfs
Spread	1.8 ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.016 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees





Worksheet for Sump 4 (COS)

Project Description	
Solve For	Spread

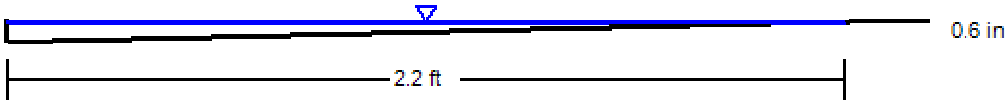
Input Data	
Discharge	0.37 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.024 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees

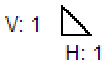
Results	
Spread	2.2 ft
Depth	0.6 in
Gutter Depression	0.0 in
Total Depression	0.0 in

Cross Section for Sump 4 (COS)

Project Description	
Solve For	Spread

Input Data	
Discharge	0.37 cfs
Spread	2.2 ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.024 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees





Worksheet for Sump 5 (COS)

Project Description	
Solve For	Spread

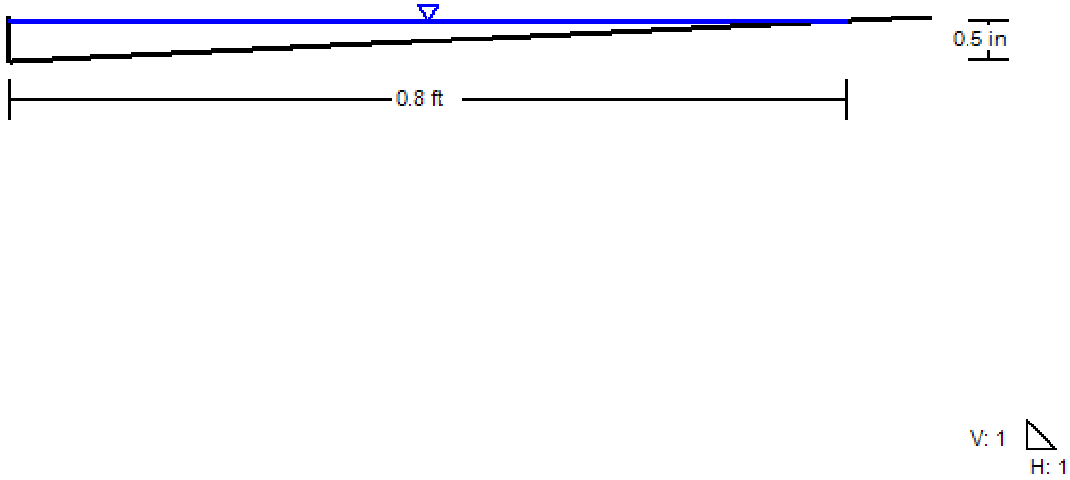
Input Data	
Discharge	0.24 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.048 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees

Results	
Spread	0.8 ft
Depth	0.5 in
Gutter Depression	0.0 in
Total Depression	0.0 in

Cross Section for Sump 5 (COS)

Project Description	
Solve For	Spread

Input Data	
Discharge	0.24 cfs
Spread	0.8 ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.048 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees



Worksheet for Sump 6 (COS)

Project Description	
Solve For	Spread

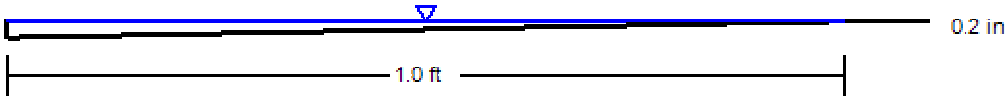
Input Data	
Discharge	0.08 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.019 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees

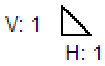
Results	
Spread	1.0 ft
Depth	0.2 in
Gutter Depression	0.0 in
Total Depression	0.0 in

Cross Section for Sump 6 (COS)

Project Description	
Solve For	Spread

Input Data	
Discharge	0.08 cfs
Spread	1.0 ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.019 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees





Worksheet for Sump 7 (COS)

Project Description	
Solve For	Spread

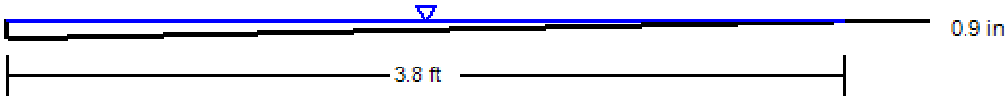
Input Data	
Discharge	0.64 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.020 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees

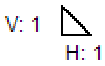
Results	
Spread	3.8 ft
Depth	0.9 in
Gutter Depression	0.0 in
Total Depression	0.0 in

Cross Section for Sump 7 (COS)

Project Description	
Solve For	Spread

Input Data	
Discharge	0.64 cfs
Spread	3.8 ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.020 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees





Worksheet for Sump 8 (COS)

Project Description	
Solve For	Spread

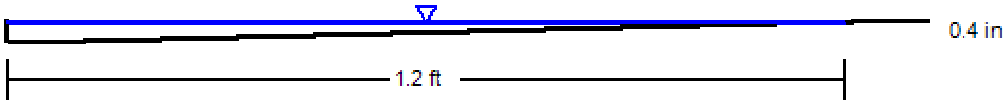
Input Data	
Discharge	0.16 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.025 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees

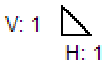
Results	
Spread	1.2 ft
Depth	0.4 in
Gutter Depression	0.0 in
Total Depression	0.0 in

Cross Section for Sump 8 (COS)

Project Description	
Solve For	Spread

Input Data	
Discharge	0.16 cfs
Spread	1.2 ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.025 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees





Worksheet for Sump 9 (COS)

Project Description	
Solve For	Spread

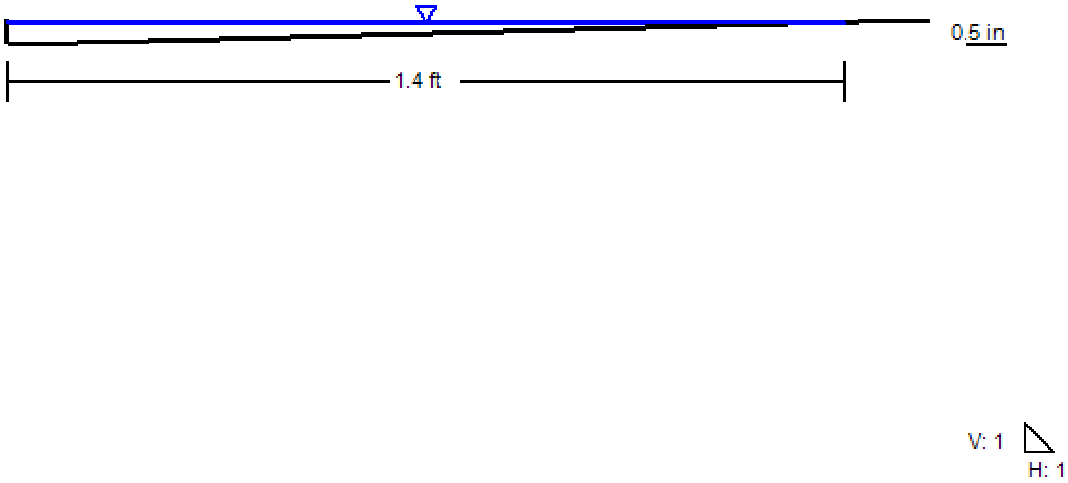
Input Data	
Discharge	0.22 cfs
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.027 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees

Results	
Spread	1.4 ft
Depth	0.5 in
Gutter Depression	0.0 in
Total Depression	0.0 in

Cross Section for Sump 9 (COS)

Project Description	
Solve For	Spread

Input Data	
Discharge	0.22 cfs
Spread	1.4 ft
Gutter Width	0.00 ft
Gutter Cross Slope	0.000 ft/ft
Road Cross Slope	0.027 ft/ft
Curb Opening Length	10.0 ft
Opening Height	1.0 ft
Curb Throat Type	Horizontal
Local Depression	0.0 in
Local Depression Width	0.0 in
Throat Incline Angle	90.00 degrees



APPENDIX E.6
CURB SPREAD ANALYSIS

MacArthur Curb Spread Calculation

Project: MacArthur Blvd **Date:** 11/28/2023 **Designer:** AGB **Reviewed:** WRB

Road	Station	Drainage Area (ac)	C	Intensity (in/hr)	Upstream Q10 (cfs)	Q10 (cfs)	Longitudinal Slope	Road Cross Slope	Roughness Coeff.	Allowable Spread (ft)	Computed Spread (ft)	Efficiency %	Bypass (cfs)	Note
MacArthur Blvd	232+08 LT	0.72	0.38	7.07	0	1.93	0.40%	2.00%	0.015	13.00	10.50	0%	10.50	
MacArthur Blvd	243+32 LT	4.55	0.42	4.88	0.00	9.33	2.10%	2.40%	0.015	13.00	12.50	0%	9.33	

Worksheet for Curb Spread 232+08

Project Description	
Solve For	Spread

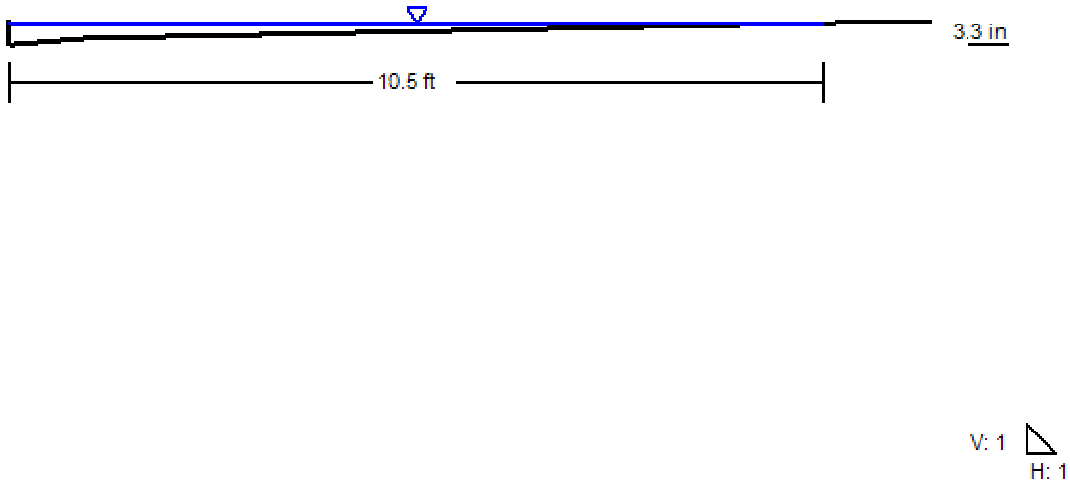
Input Data	
Channel Slope	0.004 ft/ft
Discharge	1.94 cfs
Gutter Width	1.0 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Roughness Coefficient	0.015

Results	
Spread	10.5 ft
Flow Area	1.1 ft^2
Depth	3.3 in
Gutter Depression	0.8 in
Velocity	1.72 ft/s

Cross Section for Curb Spread 232+08

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.004 ft/ft
Discharge	1.94 cfs
Gutter Width	1.0 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.020 ft/ft
Spread	10.5 ft
Roughness Coefficient	0.015



Worksheet for Curb Spread 243+35

Project Description	
Solve For	Spread

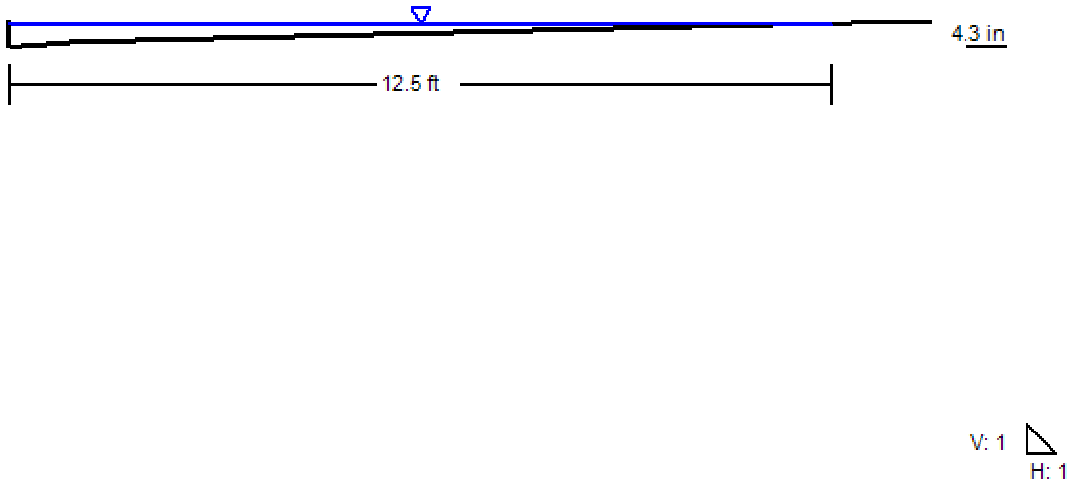
Input Data	
Channel Slope	0.021 ft/ft
Discharge	9.33 cfs
Gutter Width	1.0 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.024 ft/ft
Roughness Coefficient	0.015

Results	
Spread	12.5 ft
Flow Area	1.9 ft^2
Depth	4.3 in
Gutter Depression	0.7 in
Velocity	4.92 ft/s

Cross Section for Curb Spread 243+35

Project Description	
Solve For	Spread

Input Data	
Channel Slope	0.021 ft/ft
Discharge	9.33 cfs
Gutter Width	1.0 ft
Gutter Cross Slope	0.083 ft/ft
Road Cross Slope	0.024 ft/ft
Spread	12.5 ft
Roughness Coefficient	0.015



APPENDIX F
CULVERT COMPUTATIONS

APPENDIX F.1
CULVERT DESIGN

Post-Development Rational Flow Calculation for Existing Drainage Structures

Project: MacArthur Blvd | Project number: 18-04565-003 | Designed by: ALB | Date: 6/27/2024 | Checked by: WRB | Date: 6/27/2024

Roadway classification: Arterial

From MCDOT c-value chart

	Imp	turf	woods
A	0.9	0.12	0.15
B	0.9	0.16	0.2
C	0.9	0.19	0.23
D	0.9	0.24	0.3

From table 3-3

C Factor	T_c (min)
>0.80	5
0.65-0.79	7
0.4-0.64	10
<0.39	15

from table 3-7

Tc (min)	I_{10} (in/hr)	I_{25} (in/hr)
5	7.07	8.05
7	6.52	7.49
10	5.85	6.77
15	5	5.84

Structure	Station	Total Area (ac)	A-Imp (ac)	A-turf (ac)	A-Woods (ac)	B-Imp (ac)	B-turf (ac)	B-Woods (ac)	C-Imp (ac)	C-turf (ac)	C-Woods (ac)	D-Imp (ac)	D-turf (ac)	D-Woods (ac)	Weighted C	T_c (min)	I_{10} (in/hr)	Q_{10} (cfs)	I_{25} (in/hr)	Q_{25} (cfs)
Culvert 1	166+65	1.10	0.00	0.00	0.00	0.07	0.00	0.30	0.01	0.00	0.72	0.00	0.00	0.00	0.27	15	5.00	1.49	5.84	1.74
Culvert 2	169+00	0.65	0.00	0.00	0.00	0.07	0.00	0.21	0.00	0.00	0.37	0.00	0.00	0.00	0.29	15	5.00	0.95	5.84	1.11
Culvert 3	170+50	2.78	0.00	0.00	0.00	0.31	0.05	1.05	0.00	0.00	1.37	0.00	0.00	0.00	0.29	15	5.00	4.06	5.84	4.74
Culvert 4	181+00	6.04	0.00	0.00	0.00	0.35	0.31	0.67	1.22	0.03	3.35	0.02	0.00	0.09	0.40	10	5.85	14.14	6.77	16.37
Culvert 5	189+00	1.12	0.00	0.00	0.00	0.00	0.07	0.45	0.00	0.00	0.00	0.14	0.00	0.46	0.33	15	5.00	1.83	5.84	2.13
Culvert 6	195+00	3.03	0.00	0.00	0.00	0.00	0.13	0.85	0.00	0.00	0.00	0.31	0.00	1.74	0.33	15	5.00	4.96	5.84	5.79
Culvert 7	208+50	5.67	0.00	0.00	0.00	0.62	0.02	2.59	0.00	0.00	0.00	0.00	0.00	2.44	0.32	15	5.00	9.06	5.84	10.58
Culvert 8	211+00	4.70	0.00	0.00	0.00	0.48	0.39	2.33	0.00	0.00	0.00	0.00	0.00	1.50	0.30	15	5.00	7.05	5.84	8.24
Culvert 9	220+50	1.57	0.00	0.00	0.00	0.07	0.00	0.19	0.09	0.00	0.08	0.09	0.00	1.05	0.38	15	5.00	2.98	5.84	3.48
Culvert 10	237+00	1.17	0.00	0.00	0.00	0.05	0.00	0.48	0.05	0.00	0.01	0.14	0.00	0.44	0.38	15	5.00	2.23	5.84	2.61
Culvert 11	228+12	2.28	0.00	0.00	0.00	0.04	0.00	0.50	0.00	0.00	0.93	0.00	0.00	0.81	0.26	15	5.00	2.96	5.84	3.46
Culvert 12	247+00	0.44	0.00	0.00	0.00	0.17	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.47	10.00	5.85	1.21	6.77	1.40

APPENDIX F.2
CULVERT COMPUTATIONS

HY-8 Culvert Analysis Report

CULVERT 1 AT STA 166+65

Table 1 - Culvert Summary Table: Culvert 1 at STA 166+65

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	148.53	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.17 cfs	0.17 cfs	148.76	0.23	0.0*	1-S2n	0.17	0.17	0.17	0.05	1.99	2.42
0.35 cfs	0.35 cfs	148.86	0.33	0.0*	1-S2n	0.24	0.24	0.24	0.08	2.44	2.99
0.52 cfs	0.52 cfs	148.94	0.41	0.009	1-S2n	0.29	0.30	0.29	0.10	2.74	3.37
0.70 cfs	0.70 cfs	149.00	0.47	0.071	1-S2n	0.34	0.35	0.34	0.11	2.97	3.66
0.87 cfs	0.87 cfs	149.07	0.54	0.133	1-S2n	0.38	0.39	0.38	0.13	3.16	3.89
1.04 cfs	1.04 cfs	149.13	0.60	0.195	1-S2n	0.42	0.43	0.42	0.14	3.32	4.09
1.22 cfs	1.22 cfs	149.19	0.66	0.258	1-S2n	0.46	0.47	0.46	0.15	3.45	4.27
1.39 cfs	1.39 cfs	149.24	0.71	0.324	1-S2n	0.50	0.50	0.50	0.16	3.57	4.42
1.49 cfs	1.49 cfs	149.29	0.74	0.764	2-M2c	0.52	0.52	0.52	0.17	3.63	4.51
1.74 cfs	1.74 cfs	149.36	0.80	0.834	2-M2c	0.57	0.56	0.56	0.18	3.84	4.70

Note: 10-year storm design flow = 1.49cfs.

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 148.53 ft,

Outlet Elevation (invert): 148.22 ft

Culvert Length: 58.60 ft,

Culvert Slope: 0.0053

Site Data - Culvert 1 at STA 166+65

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

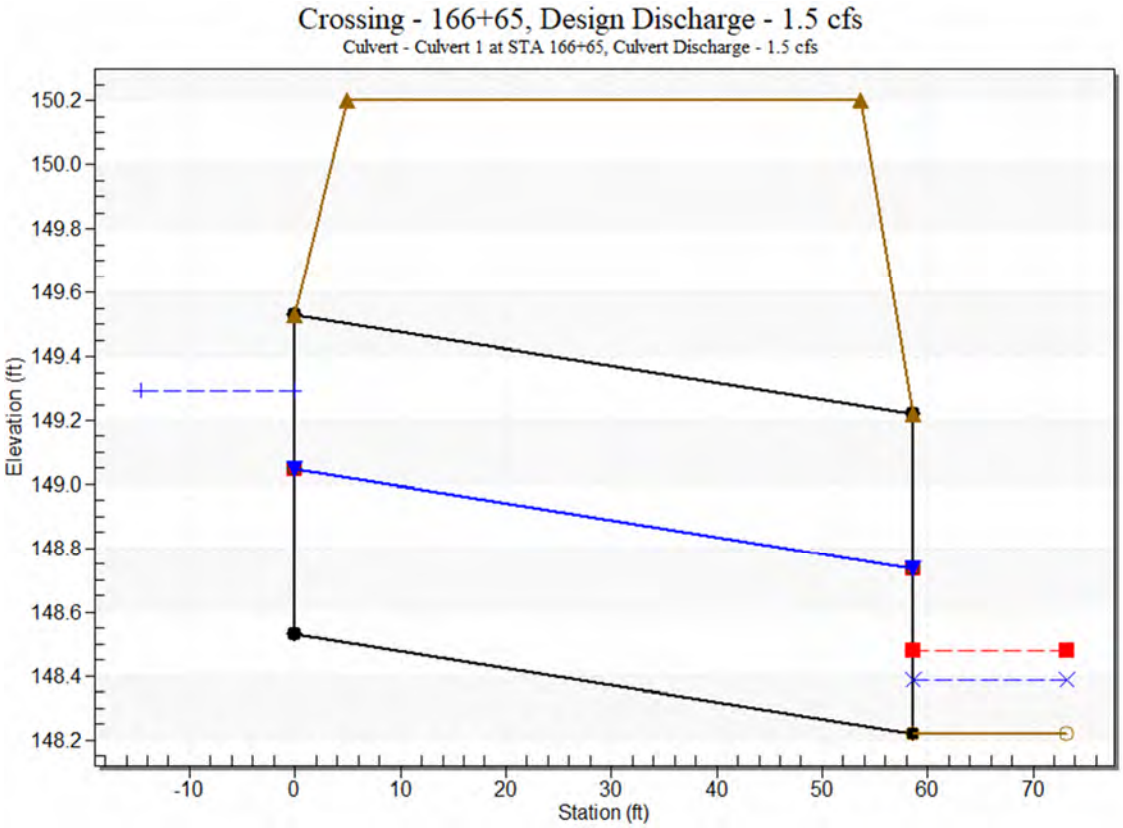
Inlet Elevation: 148.53 ft

Outlet Station: 58.60 ft

Outlet Elevation: 148.22 ft

Number of Barrels: 1

Water Surface Profile Plot for Culvert: Culvert 1 at STA 166+65



Culvert Data Summary - Culvert 1 at STA 166+65

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: None

Tailwater Data for Crossing: 166+65

Table 2 - Downstream Channel Rating Curve (Crossing: 166+65)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	148.22	0.00	0.00	0.00	0.00
0.17	148.27	0.05	2.42	0.86	2.05
0.35	148.30	0.08	2.99	1.25	2.16
0.52	148.32	0.10	3.37	1.54	2.22
0.70	148.33	0.11	3.66	1.79	2.27
0.87	148.35	0.13	3.89	2.00	2.30
1.04	148.36	0.14	4.09	2.20	2.33
1.22	148.37	0.15	4.27	2.37	2.36
1.39	148.38	0.16	4.42	2.53	2.38
1.49	148.39	0.17	4.51	2.62	2.39
1.74	148.40	0.18	4.70	2.82	2.41

Tailwater Channel Data - 166+65

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 1.00 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.2530

Channel Manning's n: 0.0380

Channel Invert Elevation: 148.22 ft

Roadway Data for Crossing: 166+65

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.20 ft

Crest Elevation: 150.20 ft

Roadway Surface: Paved

Roadway Top Width: 48.60 ft

CULVERT 2 AT STA 169+00

Table 3 - Culvert Summary Table: Culvert 2 at STA 169+00

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	148.48	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.11 cfs	0.11 cfs	148.65	0.16	0.174	1-S1t	0.12	0.12	0.25	0.25	0.54	0.61
0.22 cfs	0.22 cfs	148.73	0.20	0.251	1-S1t	0.16	0.17	0.32	0.32	0.75	0.72
0.33 cfs	0.33 cfs	148.79	0.25	0.311	1-S1t	0.20	0.20	0.37	0.37	0.92	0.80
0.44 cfs	0.44 cfs	148.84	0.29	0.362	1-S1t	0.22	0.24	0.41	0.41	1.06	0.86
0.56 cfs	0.56 cfs	148.89	0.33	0.407	1-S1t	0.25	0.26	0.45	0.45	1.19	0.91
0.67 cfs	0.67 cfs	148.93	0.36	0.448	1-S1t	0.27	0.29	0.48	0.48	1.30	0.95
0.78 cfs	0.78 cfs	148.97	0.39	0.485	1-S1t	0.30	0.31	0.51	0.51	1.41	0.99
0.89 cfs	0.89 cfs	149.00	0.42	0.521	1-S1t	0.32	0.34	0.54	0.54	1.51	1.02
0.95 cfs	0.95 cfs	149.02	0.43	0.540	1-S1t	0.33	0.35	0.55	0.55	1.56	1.04
1.11 cfs	1.11 cfs	149.07	0.47	0.586	1-S1t	0.35	0.38	0.58	0.58	1.70	1.08

Note: 10-year storm design flow = 0.95 cfs.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 148.48 ft,

Outlet Elevation (invert): 148.37 ft

Culvert Length: 20.45 ft,

Culvert Slope: 0.0054

Site Data - Culvert 2 at STA 169+00

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

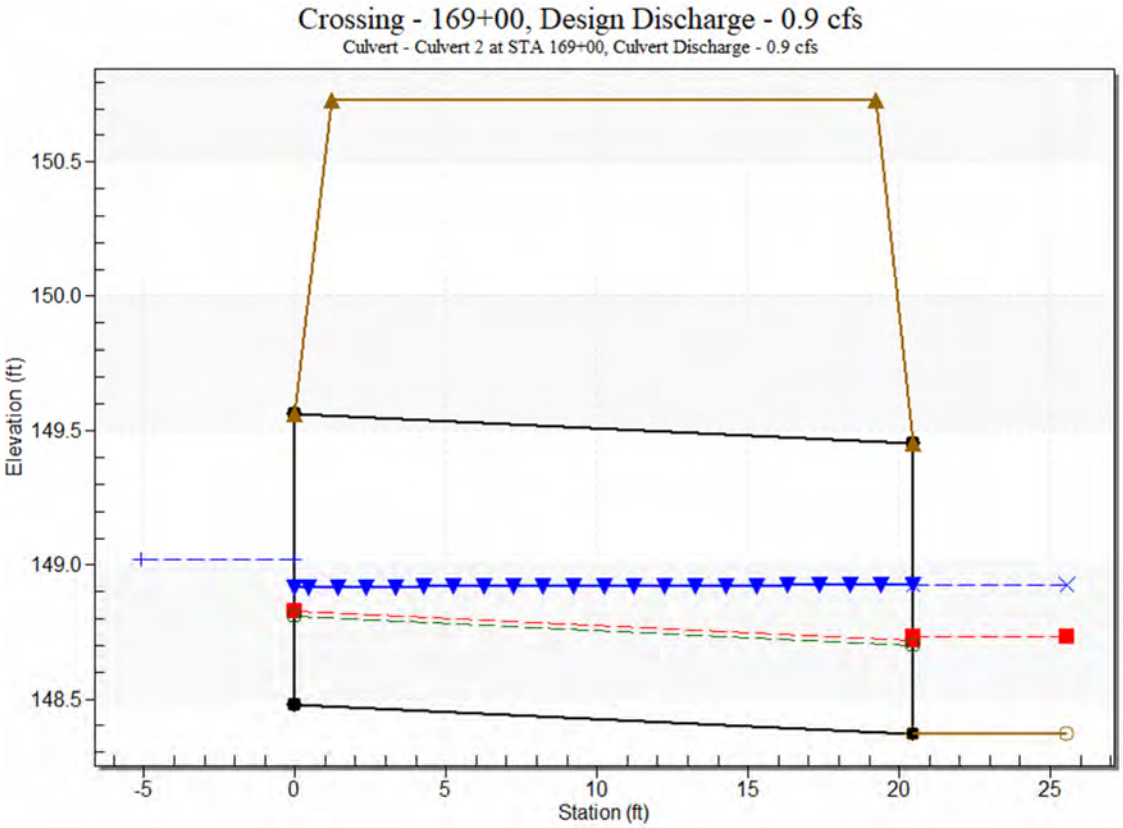
Inlet Elevation: 148.48 ft

Outlet Station: 20.45 ft

Outlet Elevation: 148.37 ft

Number of Barrels: 1

Water Surface Profile Plot for Culvert: Culvert 2 at STA 169+00



Culvert Data Summary - Culvert 2 at STA 169+00

Barrel Shape: User Defined

Barrel Span: 1.42 ft

Barrel Rise: 1.08 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0120 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: 169+00

Table 4 - Downstream Channel Rating Curve (Crossing: 169+00)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	148.37	0.00	0.00	0.00	0.00
0.11	148.62	0.25	0.61	0.07	0.31
0.22	148.69	0.32	0.72	0.09	0.32
0.33	148.74	0.37	0.80	0.11	0.33
0.44	148.78	0.41	0.86	0.12	0.33
0.56	148.82	0.45	0.91	0.13	0.34
0.67	148.85	0.48	0.95	0.14	0.34
0.78	148.88	0.51	0.99	0.15	0.35
0.89	148.91	0.54	1.02	0.16	0.35
0.95	148.92	0.55	1.04	0.16	0.35
1.11	148.95	0.58	1.08	0.17	0.35

Tailwater Channel Data - 169+00

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0047

Channel Manning's n: 0.0400

Channel Invert Elevation: 148.37 ft

Roadway Data for Crossing: 169+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.73 ft

Crest Elevation: 150.73 ft

Roadway Surface: Paved

Roadway Top Width: 18.00 ft

CULVERT 3 AT STA 170+50

Table 5 - Culvert Summary Table: Culvert 3 at STA 170+50

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	147.87	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.47 cfs	0.47 cfs	148.18	0.31	0.267	1-S2n	0.23	0.24	0.23	0.41	2.50	0.93
0.95 cfs	0.95 cfs	148.45	0.45	0.583	1-S1t	0.33	0.35	0.53	0.53	1.63	1.11
1.42 cfs	1.42 cfs	148.60	0.57	0.730	1-S1t	0.41	0.43	0.62	0.62	2.02	1.23
1.90 cfs	1.90 cfs	148.73	0.71	0.858	1-S1t	0.48	0.50	0.69	0.69	2.37	1.32
2.37 cfs	2.37 cfs	148.84	0.85	0.968	1-S1t	0.54	0.56	0.75	0.75	2.70	1.40
2.84 cfs	2.84 cfs	148.95	0.97	1.077	1-S1t	0.60	0.62	0.80	0.80	3.01	1.46
3.32 cfs	3.32 cfs	149.05	1.10	1.183	1-S1t	0.66	0.67	0.85	0.85	3.31	1.52
3.79 cfs	3.79 cfs	149.15	1.22	1.285	7-M1t	0.73	0.72	0.90	0.90	3.61	1.57
4.06 cfs	4.06 cfs	149.21	1.30	1.342	7-M1t	0.76	0.75	0.92	0.92	3.78	1.60
4.74 cfs	4.74 cfs	149.36	1.48	1.495	7-M1t	0.87	0.81	0.97	0.97	4.21	1.66

Note: 10-year storm design flow = 4.06 cfs.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 147.87 ft,

Outlet Elevation (invert): 147.72 ft

Culvert Length: 29.10 ft,

Culvert Slope: 0.0052

Site Data - Culvert 3 at STA 170+50

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

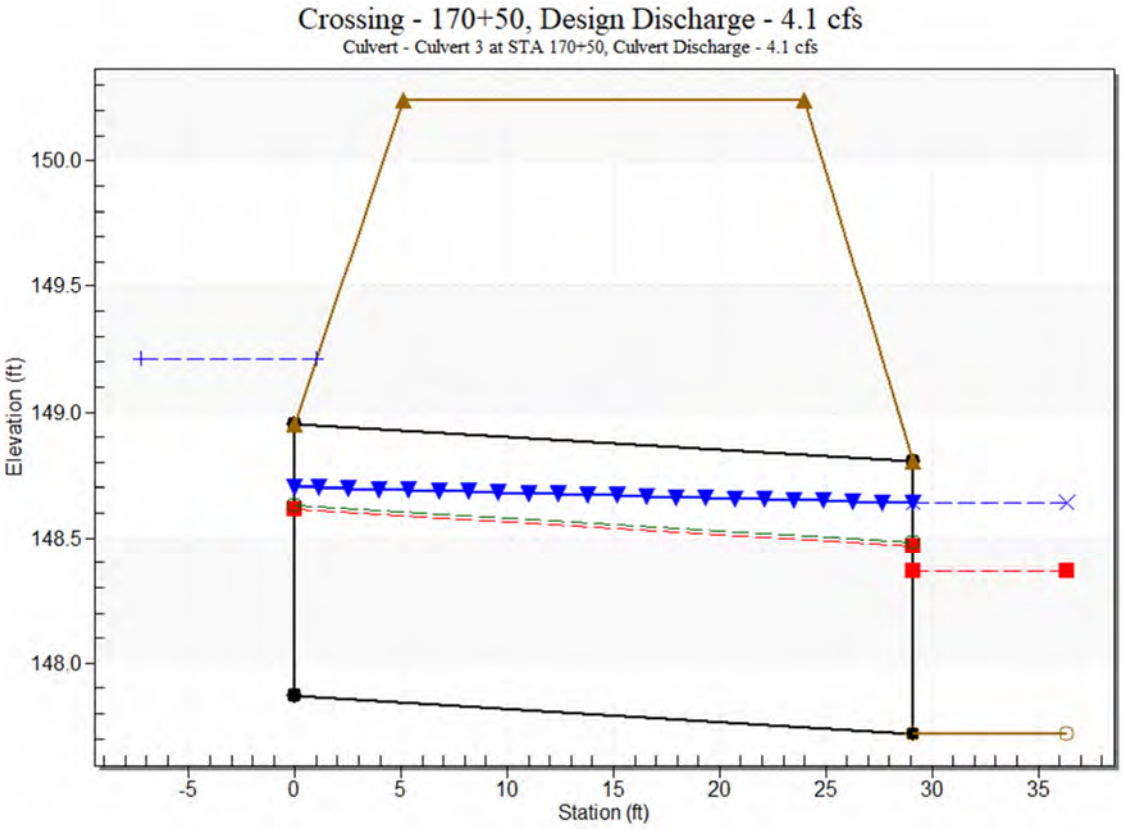
Inlet Elevation: 147.87 ft

Outlet Station: 29.10 ft

Outlet Elevation: 147.72 ft

Number of Barrels: 1

Water Surface Profile Plot for Culvert: Culvert 3 at STA 170+50



Culvert Data Summary - Culvert 3 at STA 170+50

Barrel Shape: User Defined

Barrel Span: 1.42 ft

Barrel Rise: 1.08 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0120 (bottom)

Culvert Type: Straight

Inlet Configuration: Thin Edge Projecting

Inlet Depression: None

Tailwater Data for Crossing: 170+50

Table 6 - Downstream Channel Rating Curve (Crossing: 170+50)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	147.72	0.00	0.00	0.00	0.00
0.47	148.13	0.41	0.93	0.14	0.36
0.95	148.25	0.53	1.11	0.19	0.38
1.42	148.34	0.62	1.23	0.22	0.39
1.90	148.41	0.69	1.32	0.24	0.40
2.37	148.47	0.75	1.40	0.26	0.40
2.84	148.52	0.80	1.46	0.28	0.41
3.32	148.57	0.85	1.52	0.30	0.41
3.79	148.62	0.90	1.57	0.31	0.41
4.06	148.64	0.92	1.60	0.32	0.42
4.74	148.69	0.97	1.66	0.34	0.42

Tailwater Channel Data - 170+50

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0056

Channel Manning's n: 0.0400

Channel Invert Elevation: 147.72 ft

Roadway Data for Crossing: 170+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.24 ft

Crest Elevation: 150.24 ft

Roadway Surface: Paved

Roadway Top Width: 18.82 ft

CULVERT 4 AT STA 181+00

Table 7 - Culvert Summary Table: Culver 4 at STA 181+00

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	148.34	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
1.64 cfs	1.64 cfs	148.73	0.39	0.0*	1-S2n	0.28	0.29	0.28	0.15	2.67	2.70
3.27 cfs	3.27 cfs	148.90	0.56	0.121	1-S2n	0.40	0.41	0.40	0.23	3.26	3.34
4.91 cfs	4.91 cfs	149.04	0.70	0.255	1-S2n	0.49	0.51	0.49	0.28	3.64	3.76
6.55 cfs	6.55 cfs	149.17	0.83	0.390	1-S2n	0.58	0.59	0.58	0.32	3.93	4.08
8.19 cfs	8.19 cfs	149.28	0.94	0.530	1-S2n	0.66	0.66	0.66	0.36	4.15	4.35
9.82 cfs	9.82 cfs	149.43	1.05	1.089	2-M2c	0.74	0.73	0.73	0.40	4.41	4.57
11.46 cfs	11.46 cfs	149.53	1.15	1.194	2-M2c	0.82	0.79	0.79	0.43	4.67	4.77
13.10 cfs	13.10 cfs	149.64	1.25	1.298	7-M2c	0.91	0.85	0.85	0.46	4.94	4.95
14.14 cfs	14.14 cfs	149.71	1.32	1.366	7-M2c	0.97	0.88	0.88	0.48	5.10	5.05
16.37 cfs	16.37 cfs	149.87	1.48	1.526	7-M2c	1.25	0.95	0.95	0.51	5.47	5.26

Note: 10-year storm design flow = 14.14 cfs.

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 148.34 ft,

Outlet Elevation (invert): 148.02 ft

Culvert Length: 63.30 ft,

Culvert Slope: 0.0051

Site Data - Culvert 4 at STA 181+00

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

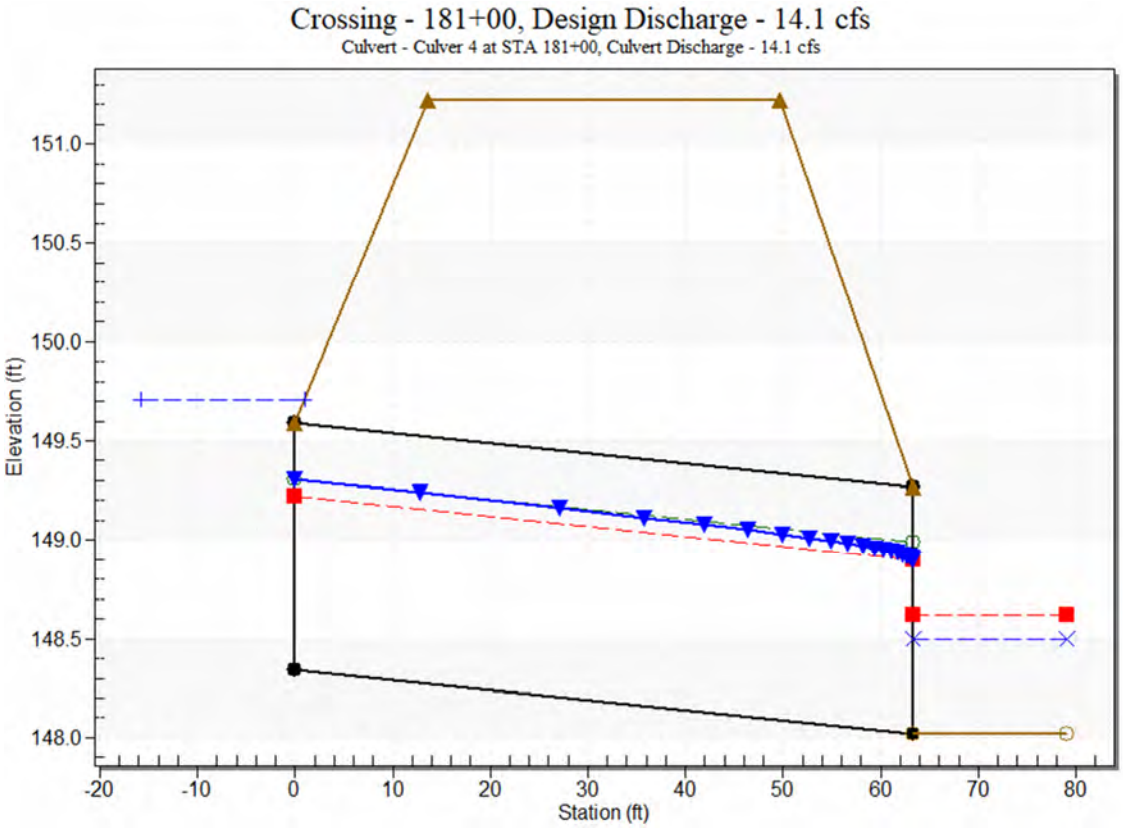
Inlet Elevation: 148.34 ft

Outlet Station: 63.30 ft

Outlet Elevation: 148.02 ft

Number of Barrels: 3

Water Surface Profile Plot for Culvert: Culvert 4 at STA 181+00



Culvert Data Summary - Culvert 4 at STA 181+00

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: None

Tailwater Data for Crossing: 181+00

Table 8 - Downstream Channel Rating Curve (Crossing: 181+00)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	148.02	0.00	0.00	0.00	0.00
1.64	148.17	0.15	2.70	0.74	1.35
3.27	148.25	0.23	3.34	1.08	1.42
4.91	148.30	0.28	3.76	1.34	1.46
6.55	148.34	0.32	4.08	1.56	1.49
8.19	148.38	0.36	4.35	1.75	1.52
9.82	148.42	0.40	4.57	1.91	1.53
11.46	148.45	0.43	4.77	2.07	1.55
13.10	148.48	0.46	4.95	2.21	1.56
14.14	148.50	0.48	5.05	2.29	1.57
16.37	148.53	0.51	5.26	2.46	1.59

Tailwater Channel Data - 181+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 3.00 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.0770

Channel Manning's n: 0.0380

Channel Invert Elevation: 148.02 ft

Roadway Data for Crossing: 181+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 151.00 ft

Crest Elevation: 151.22 ft

Roadway Surface: Paved

Roadway Top Width: 36.00 ft

CULVERT 5 AT STA 189+00

Table 9 - Culvert Summary Table: Culvert 5 at STA 189+00

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	147.69	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.21 cfs	0.21 cfs	147.93	0.24	0.112	1-S2n	0.18	0.18	0.18	0.36	2.02	0.82
0.43 cfs	0.43 cfs	148.03	0.34	0.222	1-S2n	0.25	0.25	0.25	0.47	2.48	0.97
0.64 cfs	0.64 cfs	148.12	0.43	0.305	1-S2n	0.30	0.31	0.30	0.54	2.79	1.08
0.85 cfs	0.85 cfs	148.19	0.50	0.375	1-JS1t	0.35	0.36	0.61	0.61	1.44	1.16
1.06 cfs	1.06 cfs	148.25	0.56	0.438	1-S2n	0.39	0.41	0.39	0.66	3.22	1.22
1.28 cfs	1.28 cfs	148.31	0.62	0.498	1-JS1t	0.43	0.45	0.71	0.71	1.79	1.28
1.49 cfs	1.49 cfs	148.37	0.68	0.555	1-JS1t	0.47	0.48	0.75	0.75	1.95	1.33
1.70 cfs	1.70 cfs	148.50	0.74	0.811	1-S1t	0.50	0.52	0.79	0.79	2.10	1.38
1.83 cfs	1.83 cfs	148.53	0.77	0.840	1-S1t	0.52	0.54	0.81	0.81	2.18	1.40
2.13 cfs	2.13 cfs	148.60	0.85	0.909	1-S1t	0.57	0.58	0.86	0.86	2.38	1.46

Note: 10-year storm design flow = 1.83 cfs.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 147.69 ft,

Outlet Elevation (invert): 147.44 ft

Culvert Length: 49.80 ft,

Culvert Slope: 0.0050

Site Data - Culvert 5 at STA 189+00

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

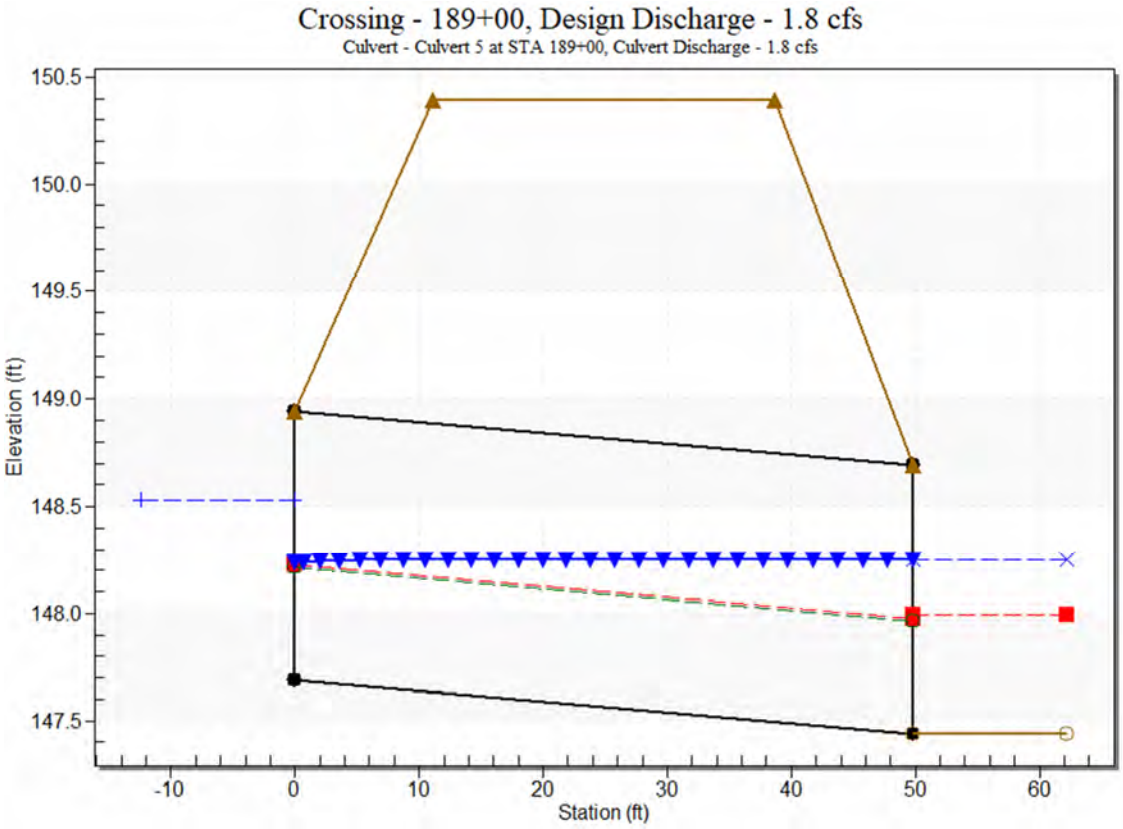
Inlet Elevation: 147.69 ft

Outlet Station: 49.80 ft

Outlet Elevation: 147.44 ft

Number of Barrels: 1

Water Surface Profile Plot for Culvert: Culvert 5 at STA 189+00



Culvert Data Summary - Culvert 5 at STA 189+00

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: 189+00

Table 10 - Downstream Channel Rating Curve (Crossing: 189+00)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	147.44	0.00	0.00	0.00	0.00
0.21	147.80	0.36	0.82	0.11	0.34
0.43	147.91	0.47	0.97	0.15	0.36
0.64	147.98	0.54	1.08	0.17	0.36
0.85	148.05	0.61	1.16	0.19	0.37
1.06	148.10	0.66	1.22	0.21	0.38
1.28	148.15	0.71	1.28	0.22	0.38
1.49	148.19	0.75	1.33	0.23	0.38
1.70	148.23	0.79	1.38	0.25	0.39
1.83	148.25	0.81	1.40	0.25	0.39
2.13	148.30	0.86	1.46	0.27	0.39

Tailwater Channel Data - 189+00

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.0050

Channel Manning's n: 0.0380

Channel Invert Elevation: 147.44 ft

Roadway Data for Crossing: 189+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 20.00 ft

Crest Elevation: 150.39 ft

Roadway Surface: Paved

Roadway Top Width: 27.60 ft

CULVERT 6 AT STA 195+00

Table 11 - Culvert Summary Table: Culvert 6 at STA 195+00

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	147.81	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.58 cfs	0.58 cfs	148.11	0.30	0.0*	1-S2n	0.22	0.22	0.22	0.11	2.27	4.33
1.16 cfs	1.16 cfs	148.24	0.43	0.0*	1-S2n	0.31	0.32	0.31	0.16	2.77	5.18
1.74 cfs	1.74 cfs	148.36	0.55	0.104	1-S2n	0.39	0.39	0.39	0.19	3.10	5.76
2.32 cfs	2.32 cfs	148.47	0.66	0.216	1-S2n	0.45	0.45	0.45	0.21	3.35	6.19
2.89 cfs	2.89 cfs	148.62	0.75	0.809	2-M2c	0.52	0.51	0.51	0.23	3.60	6.55
3.47 cfs	3.47 cfs	148.71	0.84	0.896	2-M2c	0.58	0.56	0.56	0.25	3.83	6.86
4.05 cfs	4.05 cfs	148.79	0.93	0.980	2-M2c	0.64	0.61	0.61	0.27	4.06	7.14
4.63 cfs	4.63 cfs	148.87	1.02	1.062	7-M2c	0.70	0.65	0.65	0.28	4.28	7.38
4.96 cfs	4.96 cfs	148.92	1.07	1.109	7-M2c	0.74	0.67	0.67	0.29	4.40	7.51
5.79 cfs	5.79 cfs	149.05	1.21	1.237	7-M2c	0.88	0.73	0.73	0.31	4.72	7.81

Note: 10-year storm design flow = 4.96 cfs.

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 147.81 ft,

Outlet Elevation (invert): 147.46 ft

Culvert Length: 69.30 ft,

Culvert Slope: 0.0051

Site Data - Culvert 6 at STA 195+00

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

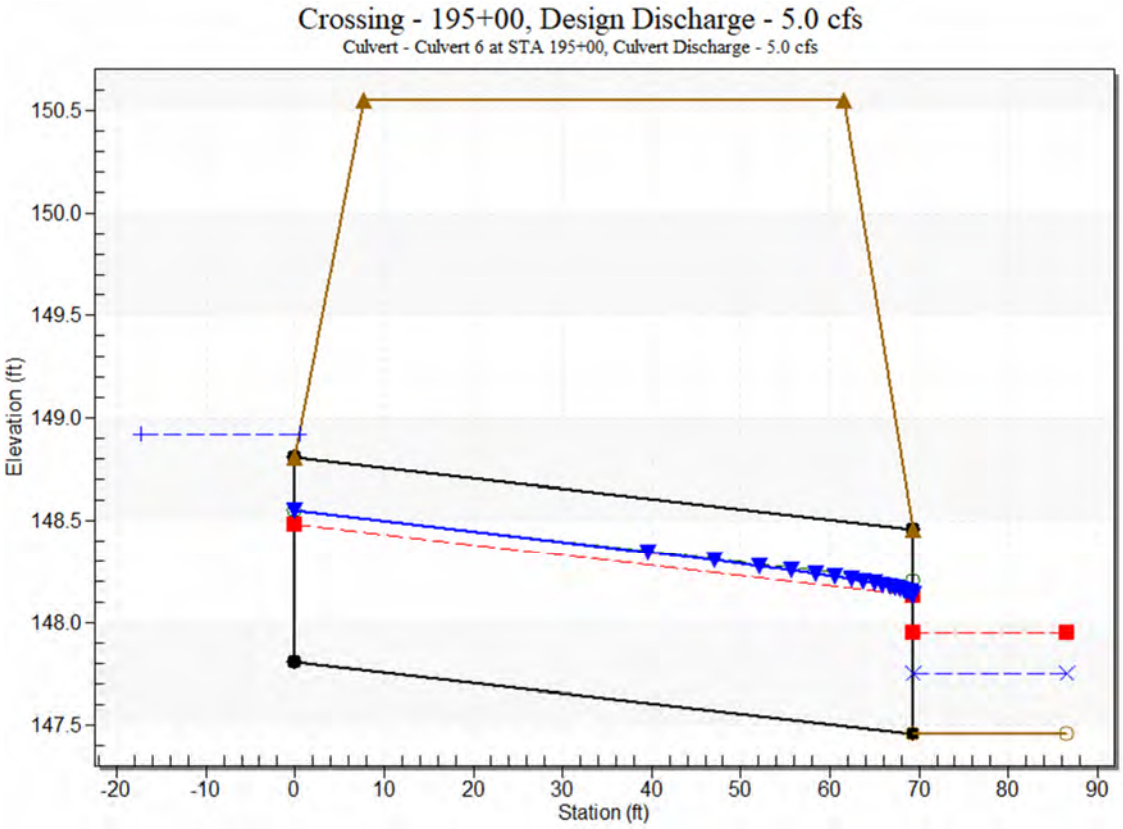
Inlet Elevation: 147.81 ft

Outlet Station: 69.30 ft

Outlet Elevation: 147.46 ft

Number of Barrels: 2

Water Surface Profile Plot for Culvert: Culvert 6 at STA 195+00



Culvert Data Summary - Culvert 6 at STA 195+00

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: 195+00

Table 12 - Downstream Channel Rating Curve (Crossing: 195+00)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	147.46	0.00	0.00	0.00	0.00
0.58	147.57	0.11	4.33	2.94	2.85
1.16	147.62	0.16	5.18	4.04	2.98
1.74	147.65	0.19	5.76	4.84	3.05
2.32	147.67	0.21	6.19	5.49	3.11
2.89	147.69	0.23	6.55	6.04	3.15
3.47	147.71	0.25	6.86	6.53	3.19
4.05	147.73	0.27	7.14	6.98	3.22
4.63	147.74	0.28	7.38	7.38	3.25
4.96	147.75	0.29	7.51	7.60	3.26
5.79	147.77	0.31	7.81	8.11	3.29

Tailwater Channel Data - 195+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 0.50 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.4160

Channel Manning's n: 0.0380

Channel Invert Elevation: 147.46 ft

Roadway Data for Crossing: 195+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.00 ft

Crest Elevation: 150.55 ft

Roadway Surface: Paved

Roadway Top Width: 54.00 ft

CULVERT 7 AT STA 208+50

Table 13 - Culvert Summary Table: Culvert 7 at STA 208+50

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	147.79	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
1.06 cfs	1.06 cfs	148.12	0.33	0.0*	1-S2n	0.21	0.24	0.21	0.14	2.99	5.70
2.12 cfs	2.12 cfs	148.27	0.48	0.0*	1-S2n	0.29	0.35	0.29	0.19	3.66	6.81
3.17 cfs	3.17 cfs	148.39	0.60	0.0*	1-S2n	0.36	0.43	0.36	0.23	4.10	7.56
4.23 cfs	4.23 cfs	148.50	0.71	0.074	1-S2n	0.43	0.50	0.43	0.26	4.43	8.13
5.29 cfs	5.29 cfs	148.60	0.81	0.215	1-S2n	0.48	0.56	0.48	0.28	4.69	8.60
6.35 cfs	6.35 cfs	148.69	0.90	0.369	1-S2n	0.54	0.62	0.54	0.30	4.88	9.01
7.41 cfs	7.41 cfs	148.78	0.99	0.535	1-S2n	0.59	0.67	0.59	0.32	5.07	9.36
8.46 cfs	8.46 cfs	148.88	1.09	0.715	5-S2n	0.65	0.72	0.65	0.34	5.23	9.68
9.06 cfs	9.06 cfs	148.94	1.15	0.822	5-S2n	0.68	0.74	0.68	0.35	5.30	9.85
10.58 cfs	10.58 cfs	149.10	1.31	1.213	5-S2n	0.77	0.80	0.77	0.38	5.41	10.25

Note: 10-year storm design flow = 9.06 cfs.

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 147.79 ft,

Outlet Elevation (invert): 147.22 ft

Culvert Length: 61.00 ft,

Culvert Slope: 0.0093

Site Data - Culvert 7 at STA 208+50

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

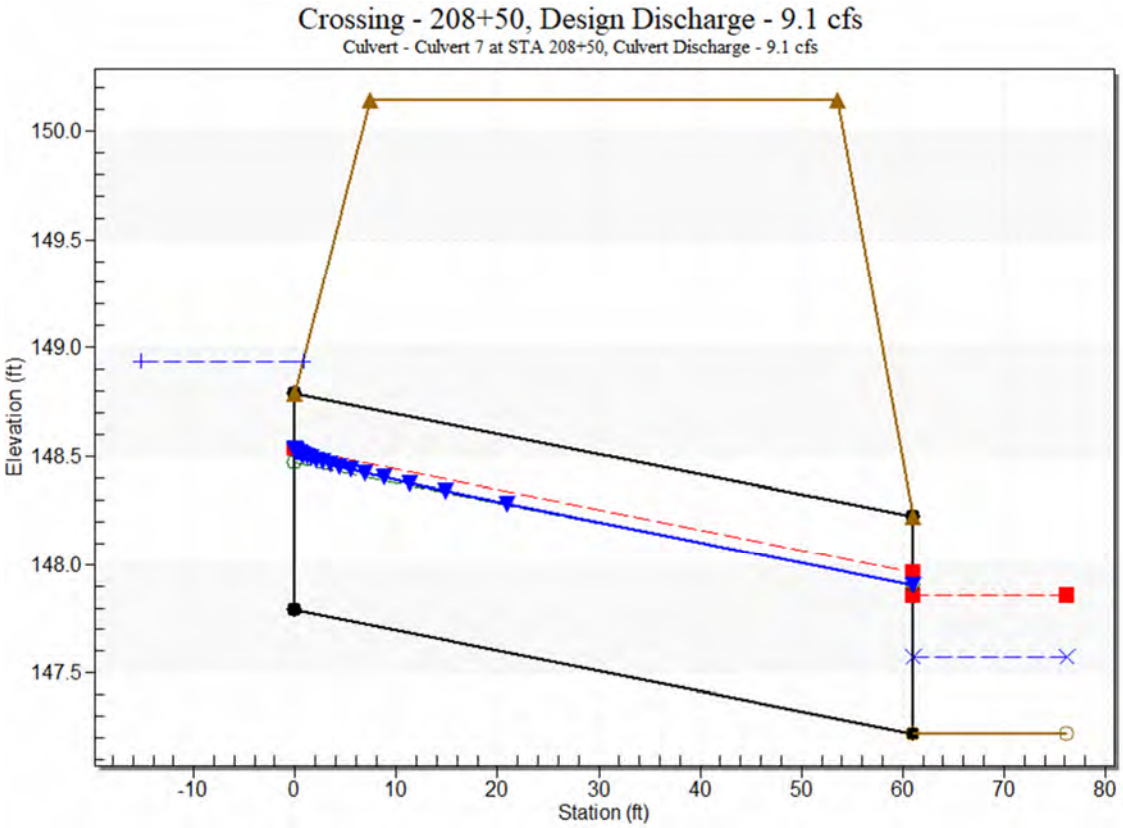
Inlet Elevation: 147.79 ft

Outlet Station: 61.00 ft

Outlet Elevation: 147.22 ft

Number of Barrels: 3

Water Surface Profile Plot for Culvert: Culvert 7 at STA 208+50



Culvert Data Summary - Culvert 7 at STA 208+50

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: None

Tailwater Data for Crossing: 208+50

Table 14 - Downstream Channel Rating Curve (Crossing: 208+50)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	147.22	0.00	0.00	0.00	0.00
1.06	147.36	0.14	5.70	4.96	3.44
2.12	147.41	0.19	6.81	6.77	3.59
3.17	147.45	0.23	7.56	8.07	3.68
4.23	147.48	0.26	8.13	9.13	3.75
5.29	147.50	0.28	8.60	10.04	3.80
6.35	147.52	0.30	9.01	10.83	3.85
7.41	147.54	0.32	9.36	11.56	3.88
8.46	147.56	0.34	9.68	12.22	3.92
9.06	147.57	0.35	9.85	12.57	3.93
10.58	147.60	0.38	10.25	13.39	3.98

Tailwater Channel Data - 208+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 0.50 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.5720

Channel Manning's n: 0.0380

Channel Invert Elevation: 147.22 ft

Roadway Data for Crossing: 208+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 150.00 ft

Crest Elevation: 150.14 ft

Roadway Surface: Paved

Roadway Top Width: 46.20 ft

CULVERT 8 AT STA 211+00

Table 15 - Culvert Summary Table: Culvert 8 at STA 211+00

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	147.48	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.82 cfs	0.82 cfs	147.77	0.29	0.0*	1-S2n	0.21	0.22	0.21	0.12	2.25	5.80
1.65 cfs	1.65 cfs	147.90	0.42	0.067	1-S2n	0.30	0.31	0.30	0.16	2.75	6.94
2.47 cfs	2.47 cfs	148.00	0.52	0.163	1-S2n	0.37	0.38	0.37	0.19	3.07	7.70
3.30 cfs	3.30 cfs	148.10	0.62	0.258	1-S2n	0.44	0.44	0.44	0.22	3.32	8.28
4.12 cfs	4.12 cfs	148.21	0.70	0.728	2-M2c	0.50	0.50	0.50	0.24	3.54	8.77
4.94 cfs	4.94 cfs	148.29	0.78	0.808	2-M2c	0.56	0.55	0.55	0.26	3.76	9.18
5.77 cfs	5.77 cfs	148.36	0.85	0.884	2-M2c	0.61	0.59	0.59	0.28	3.98	9.54
6.59 cfs	6.59 cfs	148.44	0.92	0.958	2-M2c	0.67	0.63	0.63	0.29	4.19	9.87
7.05 cfs	7.05 cfs	148.48	0.96	0.999	2-M2c	0.71	0.66	0.66	0.30	4.30	10.04
8.24 cfs	8.24 cfs	148.59	1.07	1.111	7-M2c	0.81	0.71	0.71	0.32	4.60	10.44

Note: 10-year storm design flow = 7.05 cfs.

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 147.48 ft,

Outlet Elevation (invert): 147.22 ft

Culvert Length: 50.80 ft,

Culvert Slope: 0.0051

Site Data - Culvert 8 at STA 211+00

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

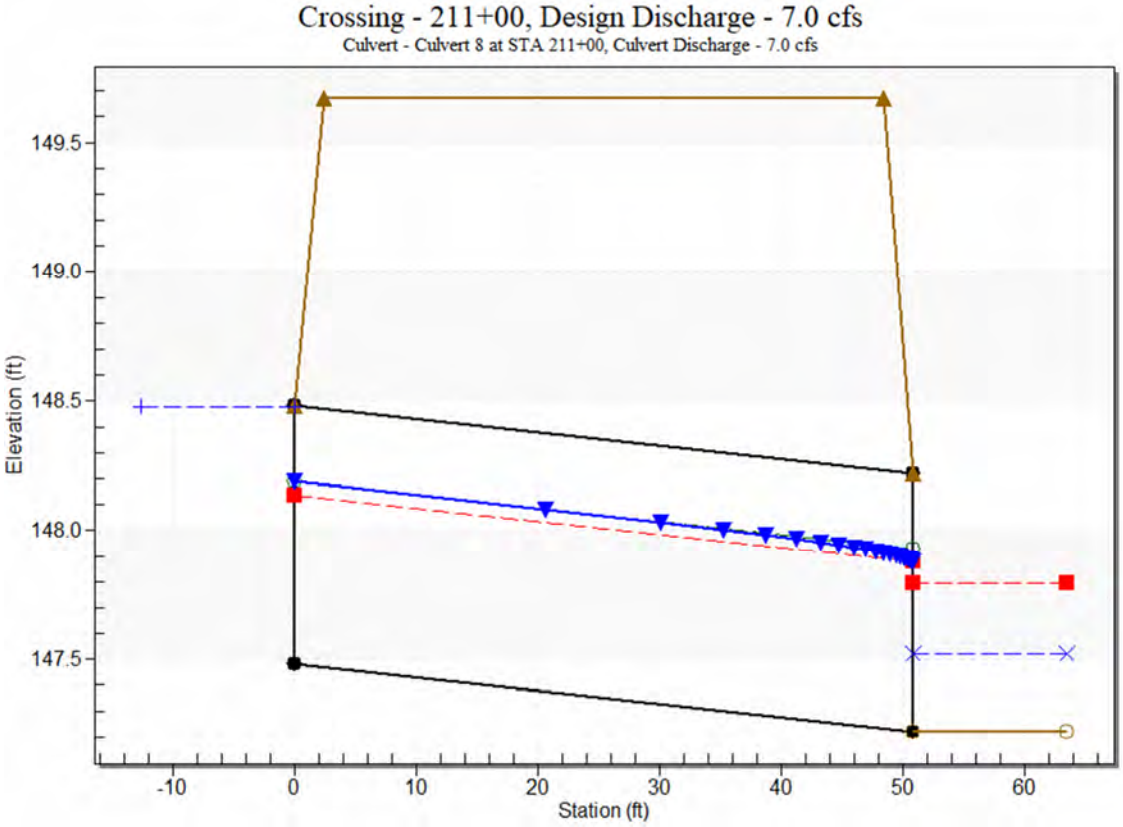
Inlet Elevation: 147.48 ft

Outlet Station: 50.80 ft

Outlet Elevation: 147.22 ft

Number of Barrels: 3

Water Surface Profile Plot for Culvert: Culvert 8 at STA 211+00



Culvert Data Summary - Culvert 8 at STA 211+00

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved End in Headwall

Inlet Depression: None

Tailwater Data for Crossing: 211+00

Table 16 - Downstream Channel Rating Curve (Crossing: 211+00)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	147.22	0.00	0.00	0.00	0.00
0.82	147.34	0.12	5.80	5.24	3.75
1.65	147.38	0.16	6.94	7.19	3.92
2.47	147.41	0.19	7.70	8.60	4.02
3.30	147.44	0.22	8.28	9.75	4.09
4.12	147.46	0.24	8.77	10.74	4.15
4.94	147.48	0.26	9.18	11.60	4.20
5.77	147.50	0.28	9.54	12.39	4.24
6.59	147.51	0.29	9.87	13.11	4.27
7.05	147.52	0.30	10.04	13.48	4.29
8.24	147.54	0.32	10.44	14.39	4.34

Tailwater Channel Data - 211+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 0.50 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.7130

Channel Manning's n: 0.0380

Channel Invert Elevation: 147.22 ft

Roadway Data for Crossing: 211+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 149.67 ft

Roadway Surface: Paved

Roadway Top Width: 46.00 ft

CULVERT 9 AT STA 220+50

Table 17 - Culvert Summary Table: Culvert 9 at STA 220+50

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	147.80	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.35 cfs	0.35 cfs	148.07	0.27	0.0*	1-S2n	0.09	0.23	0.09	0.11	8.38	2.51
0.70 cfs	0.70 cfs	148.19	0.39	0.0*	1-S2n	0.13	0.33	0.13	0.15	10.30	3.02
1.04 cfs	1.04 cfs	148.28	0.48	0.0*	1-S2n	0.16	0.40	0.16	0.18	11.63	3.36
1.39 cfs	1.39 cfs	148.36	0.56	0.0*	1-S2n	0.18	0.47	0.18	0.21	12.70	3.61
1.74 cfs	1.74 cfs	148.43	0.63	0.0*	1-S2n	0.20	0.52	0.20	0.23	13.56	3.83
2.09 cfs	2.09 cfs	148.52	0.72	0.0*	1-S2n	0.22	0.58	0.22	0.25	14.29	4.01
2.44 cfs	2.44 cfs	148.60	0.80	0.0*	1-S2n	0.24	0.62	0.24	0.26	14.97	4.17
2.78 cfs	2.78 cfs	148.68	0.88	0.0*	1-S2n	0.25	0.67	0.25	0.28	15.55	4.31
2.98 cfs	2.98 cfs	148.72	0.92	0.0*	1-S2n	0.26	0.69	0.26	0.29	15.87	4.39
3.48 cfs	3.48 cfs	148.83	1.03	0.0*	1-S2n	0.28	0.75	0.28	0.31	16.60	4.57

Note: 10-year storm design flow = 2.98 cfs.

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 147.80 ft,

Outlet Elevation (invert): 135.35 ft

Culvert Length: 66.18 ft,

Culvert Slope: 0.1915

Site Data - Culvert 9 at STA 220+50

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

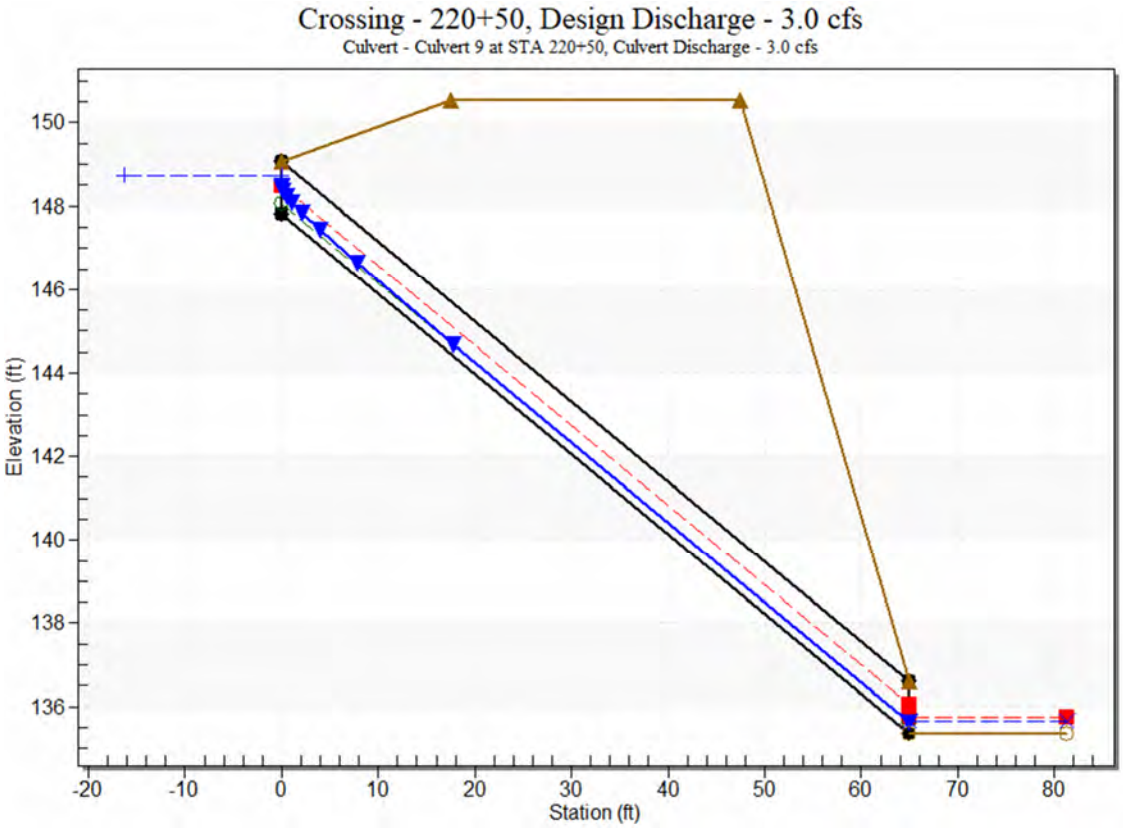
Inlet Elevation: 147.80 ft

Outlet Station: 65.00 ft

Outlet Elevation: 135.35 ft

Number of Barrels: 1

Water Surface Profile Plot for Culvert: Culvert 9 at STA 220+50



Culvert Data Summary - Culvert 9 at STA 220+50

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

Tailwater Data for Crossing: 220+50

Table 18 - Downstream Channel Rating Curve (Crossing: 220+50)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	135.35	0.00	0.00	0.00	0.00
0.35	135.46	0.11	2.51	0.95	1.65
0.70	135.50	0.15	3.02	1.31	1.73
1.04	135.53	0.18	3.36	1.58	1.78
1.39	135.56	0.21	3.61	1.80	1.81
1.74	135.58	0.23	3.83	1.99	1.83
2.09	135.60	0.25	4.01	2.16	1.86
2.44	135.61	0.26	4.17	2.31	1.87
2.78	135.63	0.28	4.31	2.44	1.89
2.98	135.64	0.29	4.39	2.52	1.90
3.48	135.66	0.31	4.57	2.69	1.92

Tailwater Channel Data - 220+50

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 0.63 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.1400

Channel Manning's n: 0.0380

Channel Invert Elevation: 135.35 ft

Roadway Data for Crossing: 220+50

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 150.53 ft

Roadway Surface: Paved

Roadway Top Width: 30.00 ft

CULVERT 10 AT STA 237+00

Table 19 - Culvert Summary Table: Culvert 10 at STA 237+00

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	147.48	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.26 cfs	0.26 cfs	147.75	0.27	0.0*	1-S2n	0.16	0.20	0.16	0.07	2.76	3.30
0.52 cfs	0.52 cfs	147.86	0.38	0.0*	1-S2n	0.23	0.28	0.23	0.10	3.39	3.99
0.78 cfs	0.78 cfs	147.95	0.47	0.0*	1-S2n	0.28	0.35	0.28	0.13	3.81	4.45
1.04 cfs	1.04 cfs	148.03	0.55	0.0*	1-S2n	0.32	0.40	0.32	0.14	4.14	4.81
1.31 cfs	1.31 cfs	148.10	0.62	0.0*	1-S2n	0.36	0.45	0.36	0.16	4.40	5.09
1.57 cfs	1.57 cfs	148.18	0.70	0.0*	1-S2n	0.40	0.50	0.40	0.17	4.65	5.34
1.83 cfs	1.83 cfs	148.25	0.77	0.047	1-S2n	0.43	0.54	0.43	0.19	4.85	5.56
2.09 cfs	2.09 cfs	148.31	0.83	0.114	1-S2n	0.46	0.58	0.46	0.20	5.03	5.76
2.23 cfs	2.23 cfs	148.35	0.87	0.150	1-S2n	0.48	0.60	0.48	0.20	5.12	5.85
2.61 cfs	2.61 cfs	148.43	0.95	0.251	1-S2n	0.52	0.65	0.52	0.22	5.35	6.09

Note: 10-year storm design flow = 2.23 cfs.

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 147.48 ft,

Outlet Elevation (invert): 146.90 ft

Culvert Length: 56.50 ft,

Culvert Slope: 0.0103

Site Data - Culvert 10 at STA 237+00

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

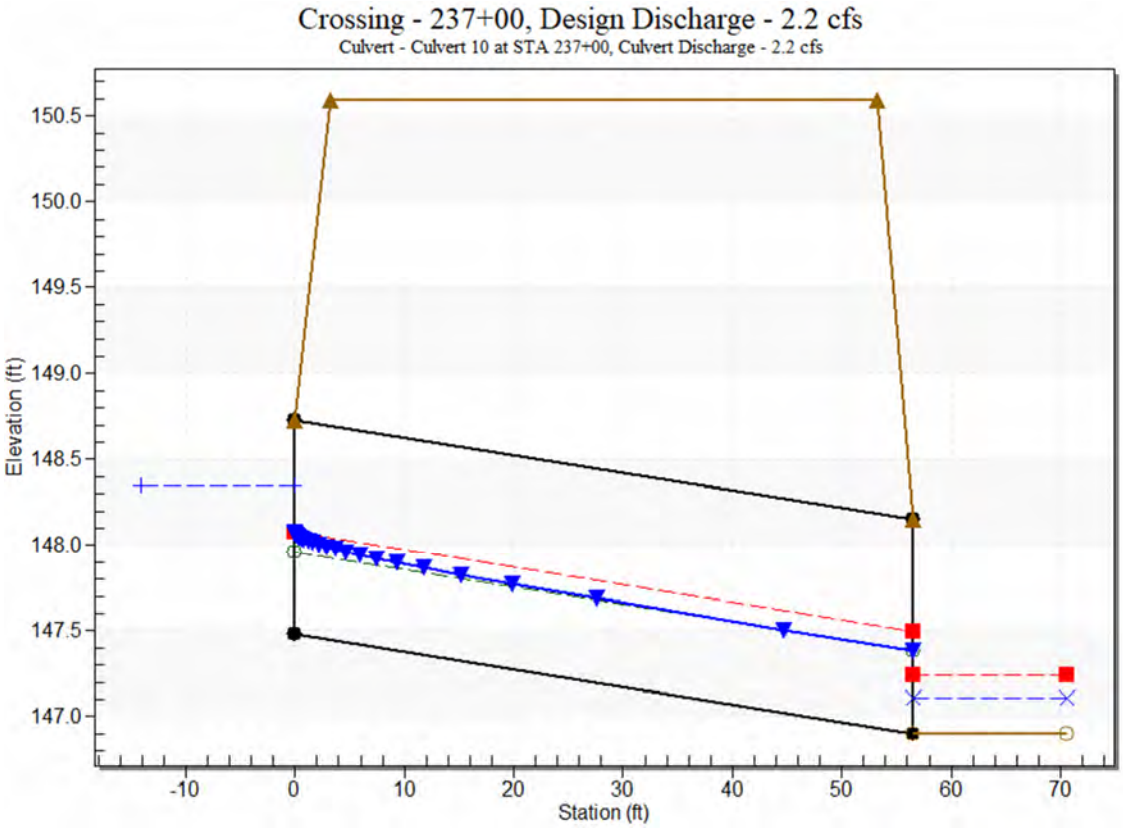
Inlet Elevation: 147.48 ft

Outlet Station: 56.50 ft

Outlet Elevation: 146.90 ft

Number of Barrels: 1

Water Surface Profile Plot for Culvert: Culvert 10 at STA 237+00



Culvert Data Summary - Culvert 10 at STA 237+00

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: 237+00

Table 20 - Downstream Channel Rating Curve (Crossing: 237+00)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	146.90	0.00	0.00	0.00	0.00
0.26	146.97	0.07	3.30	1.70	2.55
0.52	147.00	0.10	3.99	2.40	2.67
0.78	147.03	0.13	4.45	2.92	2.74
1.04	147.04	0.14	4.81	3.34	2.80
1.31	147.06	0.16	5.09	3.71	2.84
1.57	147.07	0.17	5.34	4.03	2.87
1.83	147.09	0.19	5.56	4.33	2.90
2.09	147.10	0.20	5.76	4.59	2.92
2.23	147.10	0.20	5.85	4.73	2.93
2.61	147.12	0.22	6.09	5.08	2.96

Tailwater Channel Data - 237+00

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 0.63 ft

Side Slope (H:V): 6.00 (_:1)

Channel Slope: 0.3700

Channel Manning's n: 0.0380

Channel Invert Elevation: 146.90 ft

Roadway Data for Crossing: 237+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 150.59 ft

Roadway Surface: Paved

Roadway Top Width: 50.00 ft

CULVERT 11 AT STA 226+12

Table 21 - Culvert Summary Table: Culvert 11 at STA 226+12

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	148.23	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.35 cfs	0.35 cfs	148.54	0.31	0.0*	1-S2n	0.16	0.23	0.16	0.22	3.88	3.47
0.69 cfs	0.69 cfs	148.67	0.44	0.0*	1-S2n	0.22	0.33	0.22	0.29	4.77	4.13
1.04 cfs	1.04 cfs	148.77	0.54	0.0*	1-S2n	0.27	0.40	0.27	0.34	5.28	4.57
1.38 cfs	1.38 cfs	148.87	0.64	0.0*	1-S2n	0.31	0.46	0.31	0.38	5.84	4.91
1.73 cfs	1.73 cfs	148.96	0.73	0.0*	1-S2n	0.35	0.52	0.35	0.41	6.22	5.19
2.08 cfs	2.08 cfs	149.05	0.82	0.0*	1-S2n	0.38	0.57	0.38	0.44	6.55	5.43
2.42 cfs	2.42 cfs	149.14	0.91	0.0*	1-S2n	0.41	0.62	0.41	0.46	6.84	5.64
2.77 cfs	2.77 cfs	149.21	0.98	0.0*	1-S2n	0.44	0.67	0.44	0.49	7.10	5.84
2.96 cfs	2.96 cfs	149.26	1.03	0.0*	1-S2n	0.46	0.69	0.47	0.50	7.10	5.93
3.46 cfs	3.46 cfs	149.36	1.13	0.0*	1-S2n	0.50	0.75	0.51	0.53	7.39	6.17

Note: 10-year storm design flow = 2.96 cfs.

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 148.23 ft,

Outlet Elevation (invert): 146.86 ft

Culvert Length: 64.01 ft,

Culvert Slope: 0.0214

Site Data - Culvert 11 at STA 226+12

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

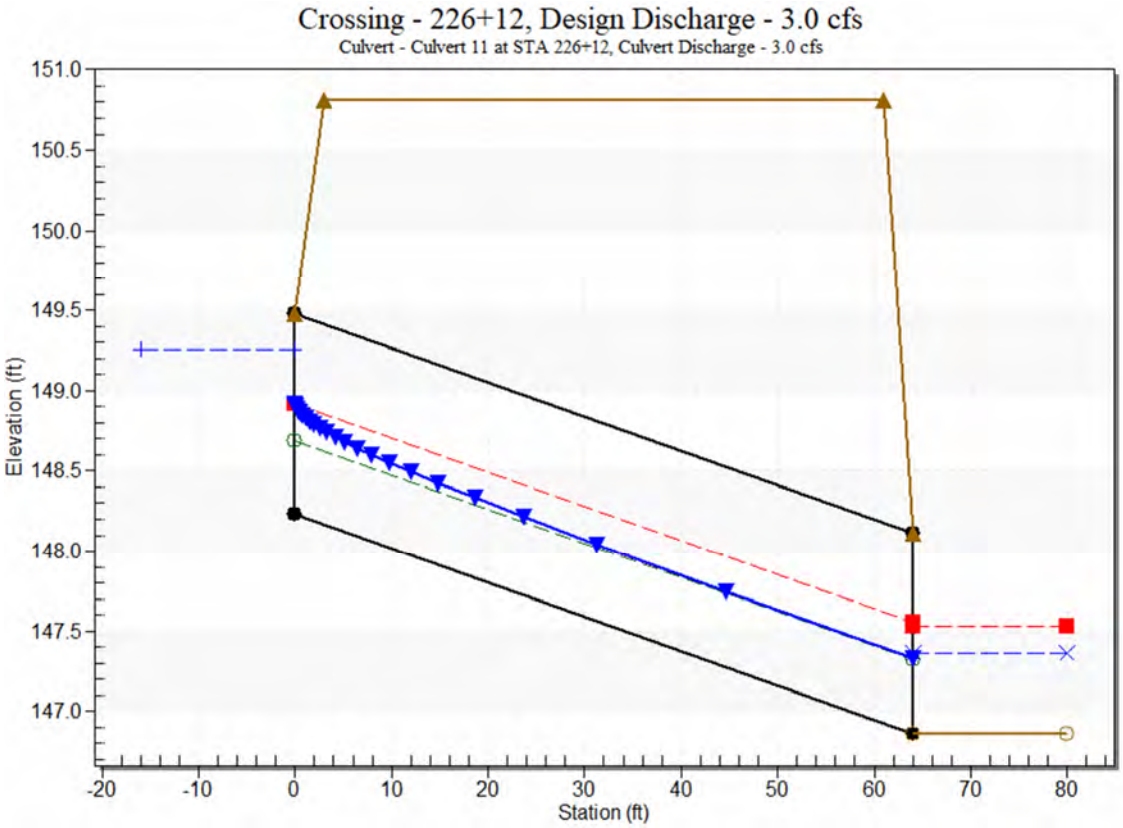
Inlet Elevation: 148.23 ft

Outlet Station: 64.00 ft

Outlet Elevation: 146.86 ft

Number of Barrels: 1

Water Surface Profile Plot for Culvert: Culvert 11 at STA 226+12



Culvert Data Summary - Culvert 11 at STA 226+12

Barrel Shape: Circular

Barrel Diameter: 1.25 ft

Barrel Material:

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: 226+12

Table 22 - Downstream Channel Rating Curve (Crossing: 226+12)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	146.86	0.00	0.00	0.00	0.00
0.35	147.08	0.22	3.47	2.37	1.83
0.69	147.15	0.29	4.13	3.07	1.91
1.04	147.20	0.34	4.57	3.58	1.96
1.38	147.24	0.38	4.91	3.98	2.00
1.73	147.27	0.41	5.19	4.33	2.02
2.08	147.30	0.44	5.43	4.64	2.05
2.42	147.32	0.46	5.64	4.91	2.07
2.77	147.35	0.49	5.84	5.17	2.08
2.96	147.36	0.50	5.93	5.30	2.09
3.46	147.39	0.53	6.17	5.62	2.11

Tailwater Channel Data - 226+12

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 2.00 (_:1)

Channel Slope: 0.1700

Channel Manning's n: 0.0380

Channel Invert Elevation: 146.86 ft

Roadway Data for Crossing: 226+12

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 58.00 ft

Crest Elevation: 150.81 ft

Roadway Surface: Paved

Roadway Top Width: 58.00 ft

CULVERT 12 AT STA 247+00

Table 23 - Culvert Summary Table: Culvert 12 at STA 247+00

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00 cfs	0.00 cfs	151.21	0.00	0.000	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
0.14 cfs	0.14 cfs	151.41	0.20	0.0*	1-JS1t	0.10	0.15	0.35	0.35	0.57	0.38
0.28 cfs	0.28 cfs	151.50	0.29	0.071	1-JS1t	0.15	0.22	0.46	0.46	0.80	0.45
0.42 cfs	0.42 cfs	151.57	0.36	0.151	1-JS1t	0.18	0.27	0.53	0.53	0.99	0.49
0.56 cfs	0.56 cfs	151.63	0.42	0.218	1-JS1t	0.21	0.31	0.59	0.59	1.15	0.53
0.70 cfs	0.70 cfs	151.68	0.47	0.278	1-JS1t	0.23	0.35	0.64	0.64	1.31	0.56
0.84 cfs	0.84 cfs	151.74	0.53	0.335	1-JS1t	0.25	0.38	0.69	0.69	1.45	0.59
0.98 cfs	0.98 cfs	151.79	0.58	0.388	1-JS1t	0.27	0.42	0.73	0.73	1.59	0.61
1.12 cfs	1.12 cfs	151.84	0.63	0.440	1-JS1t	0.29	0.45	0.77	0.77	1.73	0.63
1.21 cfs	1.21 cfs	151.87	0.66	0.473	1-JS1t	0.30	0.46	0.79	0.79	1.81	0.64
1.40 cfs	1.40 cfs	151.94	0.73	0.541	1-JS1t	0.33	0.50	0.84	0.84	2.00	0.67

Note: 10-year storm design flow = 1.21 cfs.

* Full Flow Headwater elevation is below inlet invert.

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 151.21 ft,

Outlet Elevation (invert): 150.82 ft

Culvert Length: 16.00 ft,

Culvert Slope: 0.0244

Site Data - Culvert 12 at STA 247+00

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

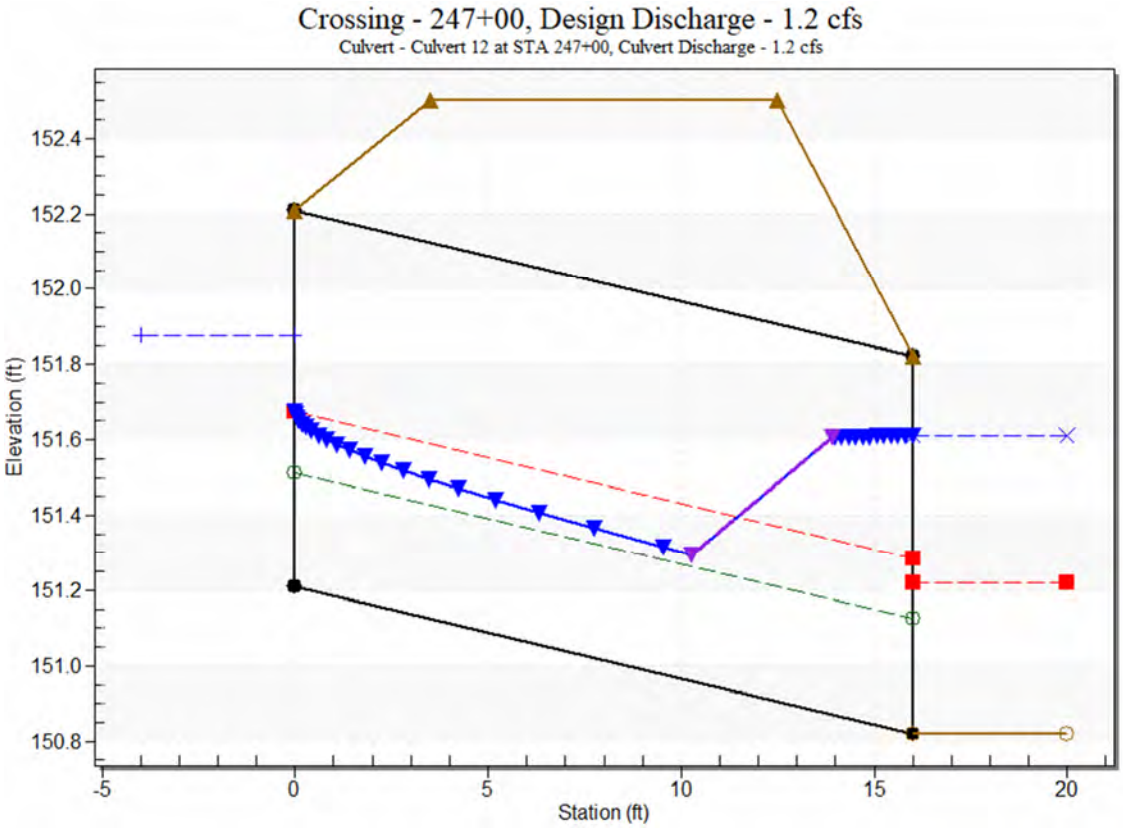
Inlet Elevation: 151.21 ft

Outlet Station: 16.00 ft

Outlet Elevation: 150.82 ft

Number of Barrels: 1

Water Surface Profile Plot for Culvert: Culvert 12 at STA 247+00



Culvert Data Summary - Culvert 12 at STA 247+00

Barrel Shape: Circular

Barrel Diameter: 1.00 ft

Barrel Material:

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall (Ke=0.5)

Inlet Depression: None

Tailwater Data for Crossing: 247+00

Table 24 - Downstream Channel Rating Curve (Crossing: 247+00)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
0.00	150.82	0.00	0.00	0.00	0.00
0.14	151.17	0.35	0.38	0.02	0.16
0.28	151.28	0.46	0.45	0.03	0.16
0.42	151.35	0.53	0.49	0.03	0.17
0.56	151.41	0.59	0.53	0.04	0.17
0.70	151.46	0.64	0.56	0.04	0.17
0.84	151.51	0.69	0.59	0.04	0.18
0.98	151.55	0.73	0.61	0.05	0.18
1.12	151.59	0.77	0.63	0.05	0.18
1.21	151.61	0.79	0.64	0.05	0.18
1.40	151.66	0.84	0.67	0.05	0.18

Tailwater Channel Data - 247+00

Tailwater Channel Option: Triangular Channel

Side Slope (H:V): 3.00 (_:1)

Channel Slope: 0.0010

Channel Manning's n: 0.0380

Channel Invert Elevation: 150.82 ft

Roadway Data for Crossing: 247+00

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 9.00 ft

Crest Elevation: 152.50 ft

Roadway Surface: Gravel

Roadway Top Width: 9.00 ft