DUPLANTIS DESIGN GROUP

Prepared for:

NLLD
North Lafourche Levee District

THIBODAUX, LAFOURCHE PARISH, LA

RIENZI / NORTH CANAL DRAINAGE AREA STUDY

Date Submitted: 10.26.2018

RIENZI / NORTH CANAL DRAINAGE AREA STUDY

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SECTION 1 – Introduction

The North Lafourche Levee District (NLLD) has hired Duplantis Design Group, PC (DDG) to investigate the existing Rienzi/North Canal Drainage Basin (Basin) to determine areas of deficiency that can be identified, studied, and subsequently addressed to improve the overall efficiency of the drainage systems within the Basin. A vicinity map of the overall Basin is included on Page 6.

This investigation will focus on all aspects of the Basin, including condition of the existing pump stations, open channel drainage conveyance systems, subsurface drainage systems, and drainage structures within the Basin.

In order to determine the areas of deficiency, DDG first gathered and studied elevation data across the Basin from the National Elevation Dataset (NED) produced by the US Geological Survey (USGS). The NED provides elevation data coverage of the continental United States, Alaska, Hawaii, and the island territories in a seamless format with a consistent projection, resolution, elevation units, and horizontal and vertical datums. The horizontal datum for NED is the North American Datum of 1983 (NAD 83), and the vertical datum is the North American Vertical Datum of 1988 (NAVD 88).

In addition to studying the NED elevation data, DDG met with representatives of the Lafourche Parish Government (LPG), the City of Thibodaux (COT), and Levert Land Company (Levert) to determine if there were any areas of concern to be investigated during this study.

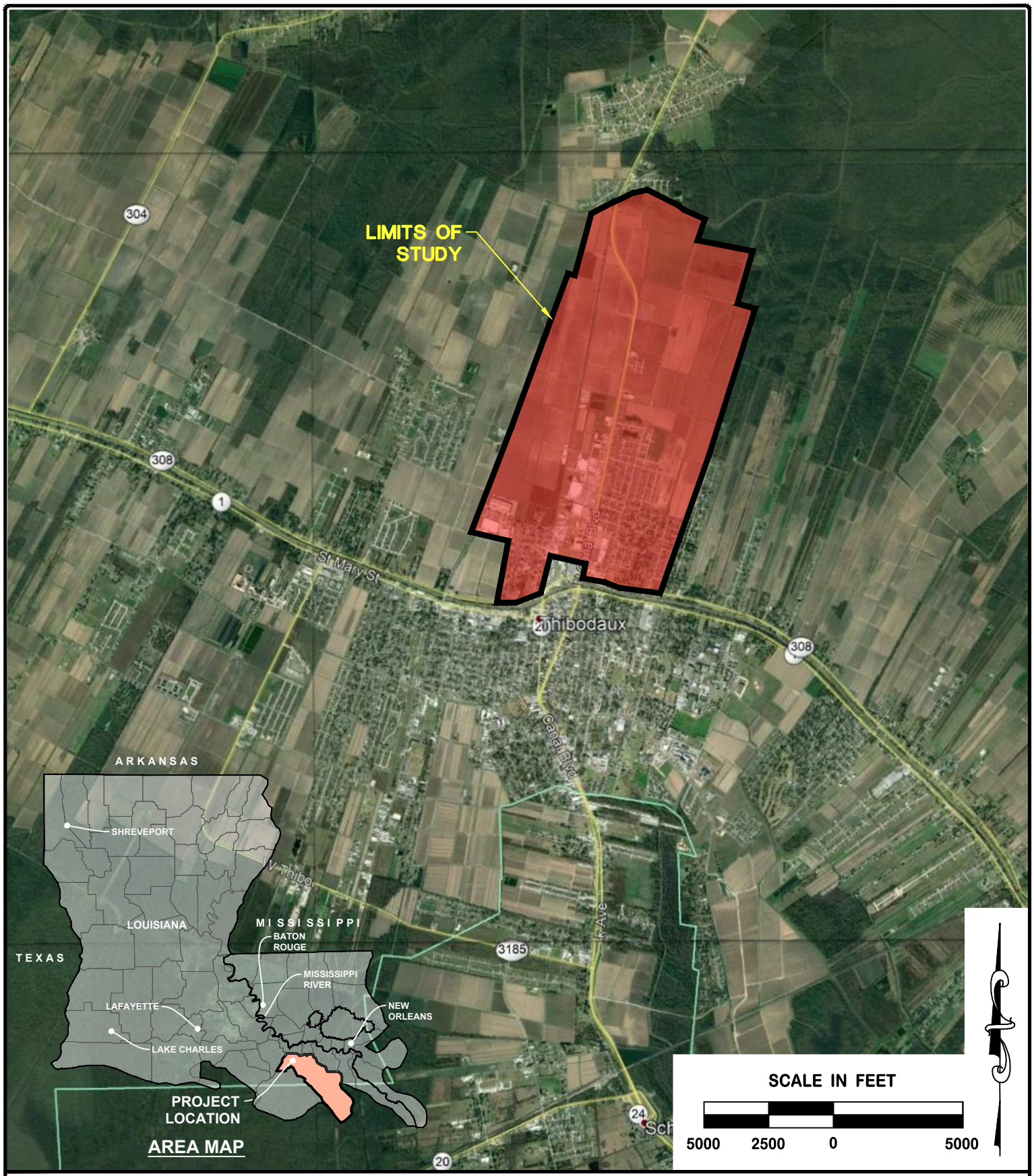
Based on review of the NED information, conversations with LPG, COT, and Levert, a preliminary list of areas of concern was produced and submitted to NLLD for review and approval. From this preliminary list, a scope of work was generated for topographic survey and field investigations needed to evaluate the areas of concern, and to subsequently determine proposed solutions. The preliminary list of areas of concern generated based on the preliminary review of the basin, is included in Appendix A of this report.

Using the information obtained from the topographic survey and field investigations, the areas of concern that were included in the preliminary list were evaluated in more detail, along with all of the open channel and sub-surface conveyance systems within the Basin. From this detailed evaluation, a prioritized list of recommended improvements with preliminary cost estimates was prepared. This list can be used by the COT, LPG, and the NLLD in the future when planning and budgeting for drainage improvements within the Basin.

Section 2 of this report evaluates and explains the existing conditions and general drainage patterns of the overall Basin, while Section 3 breaks down the overall Basin into its four main sub-basins and evaluates, in more detail, the existing conditions of each sub-basin, its associated open channel and subsurface conveyance systems, and capacities of the existing conveyance systems.

Section 4 of the report details the information obtained from the COT and Levert on the anticipated growth patterns within the Basin.

Section 5 of the report includes the prioritized list of recommended improvements with associated cost estimates.



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VICINITY MAP
RIENZI/NORTH CANAL DRAINAGE BASIN
THIBODAUX, LOUISIANA
LAFOURCHE PARISH

DATE: 9-5-18

J:\CAD\DWG\17-000\17-398\17-398 VICINITY MAP.dwg

SECTION 2 – Existing Conditions

The Rienzi/North Canal Drainage Basin includes approximately +/- 2500 acres of land at the northern tip of Lafourche Parish. The Basin is generally bounded to the west by Coulon Plantation Road and a ridge that extends north from Coulon Plantation Road towards the 80 Arpent Canal; Bayou Lafourche to the South; natural ridges and man-made berms to the east; and the Eighty Arpent Canal to the North. The Basin is comprised of a mixture of land uses, including commercial, residential, and cultivated areas, and generally drains north to the Eighty Arpent Canal, which is located at the northern limits of the Basin. The Basin is located mostly within the limits of the COT with the exception of the northernmost portion of the basin, which is located within the jurisdiction of the LPG.

The Drainage Area Map (Exhibit A) on the following page shows the limits of the Basin and this investigation, along with all major roadways, drainage laterals/features, and the COT municipal boundary.

According to a USDA Web Soil Survey, the Basin consists of both Hydrologic Group C and D soils. Approximately 63.5 percent of the basin consists of Group C soils and 36.5 percent of the Basin consists of Group D soils. The Group C soils within the basin consists of Cancienne silt loam and Cancienne silty clay loam. The Group D soils within the basin consist of Schriever clay. The UDSA Web Soil Survey describes Group C soils as having slow infiltration rates when thoroughly wet, and Group D soils as having very slow infiltration rates when thoroughly wet.

The ground elevations of the Basin ranges from a high elevation of approximately 18 near the south end of the Basin at LA Hwy 308 / Bayou Lafourche, to a low elevation of approximately 1 along the 80 Arpent Canal. Exhibit B represents the existing elevations within the Basin, as determined from the USGS NED. The NED elevations were used primarily to determine high/low points and slope patterns within the Basin. The topographic survey information was used for the more detailed capacity calculations that are included in Section 4 of the report.

A CD is provided in Appendix C, which includes an AutoCad Civil 3D 2019 file of the topographic survey information overlaid on an aerial backdrop of the Basin. The horizontal datum for provided topographic survey is NAD 83 – Louisiana South 1702, and the vertical datum is the North American Vertical Datum of NAVD 88 (Geoid 12b).

PRIVATELY OWNED PUMP STATION

CITY OF THIBODAUX PUMP STATION

CITY LIMITS

FORCED DRAINAGE AREA (PRIVATE PUMP)

LATERAL 103 (RIENZI CANAL)

LATERAL 102 (RIENZI CANAL)

LATERAL 105

LATERAL 104

LATERAL 102

LATERAL 101

SUB-LATERAL 105A

SUB-LATERAL 104B

SUB-LATERAL 104A

SUB-LATERAL 103E

SUB-LATERAL 103D

SUB-LATERAL 103B

SUB-LATERAL 103A

SUB-LATERAL 103C

SUB-LATERAL 102D

SUB-LATERAL 102C

SUB-LATERAL 102B

SUB-LATERAL 102

SUB-LATERAL 102A

SUB-LATERAL 101B

SUB-LATERAL 101A

ARLINGTON DRIVE

GLENWILD DR.

FORTY ARPENT ROAD

80 ARPENT CANAL

NORTH CANAL BLVD.

ROSEDOWN DRIVE

ST. PATRICK STREET

HIGHWAY 1

HIGHWAY 308

REGIONAL DETENTION POND

COULON PLANTATION ROAD

LEGEND

- DRAINAGE LATERAL
- DRAINAGE AREA BOUNDARY
- ROADWAYS
- CITY OF THIBODAUX MUNICIPAL BOUNDARY
- LEVEE/ BERM

DRAINAGE AREA MAP

SCALE IN FEET

1200 600 0 1200

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

DRAWN	MTB
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ISSUE DATE	10/3/2018
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SHEET	EXHIBIT A

J:\CAD\DWG\17-000\17-398\17-398 DRAINAGE AREA MAP.dwg

PRIVATELY OWNED PUMP STATION

CITY OF THIBODAUX PUMP STATION

FORCED DRAINAGE AREA (PRIVATE PUMP)

SUB-LATERAL 104B

SUB-LATERAL 104A

LATERAL 104

LATERAL 103 (RIENZI CANAL)

SUB-LATERAL 103E

LATERAL 105

SUB-LATERAL 104B

SUB-LATERAL 104A

LATERAL 104

SUB-LATERAL 103B

GLENWILD DR.

SUB-LATERAL 103A

LATERAL 103 (RIENZI CANAL)

SUB-LATERAL 105A

LATERAL 105

ARLINGTON DRIVE

NORTH CANAL BLVD.

SUB-LATERAL 102B

ROSEDOWN DRIVE

HIGHWAY 1

REGIONAL DETENTION POND

ST. PATRICK STREET

SUB-LATERAL 103C

SUB-LATERAL 102D

SUB-LATERAL 103D

SUB-LATERAL 103A

NORTH CANAL BLVD.

LATERAL 102

SUB-LATERAL 101B

SUB-LATERAL 102B

HIGHWAY 308

ST. PATRICK STREET

SUB-LATERAL 102

SUB-LATERAL 101A

SUB-LATERAL 102A

80 ARPENT CANAL

FORTY ARPENT ROAD

LATERAL 101

COULON PLANTATION ROAD

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL
- DRAINAGE AREA BOUNDARY
- ROADWAYS
- CITY OF THIBODAUX MUNICIPAL BOUNDARY
- LEVEE/ BERM

Elevations Table	
ELEVATION RANGE	COLOR
1.00–3.00	
3.00–4.00	
4.00–5.00	
5.00–6.00	
6.00–7.00	
7.00–9.00	
9.00–12.00	
12.00–18.00	

EXISTING ELEVATION MAP

SCALE IN FEET

1200 600 0 1200

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J:\CAD\DWG\17-000\17-398\17-398 ELEVATION MAP.dwg

SECTION 3 – Drainage Sub-Basins, Laterals, and Capacity Evaluations

The overall Rienzi/North Canal Drainage Basin is divided into 4 sub-basins, each with its own outfall location to the 80 Arpent Canal. Each of these sub-basins has a main drainage lateral that transports storm water to the 80 Arpent Canal. Exhibit C following this section shows the limits of the 4 sub-basins within the overall Basin, along with their respective main drainage laterals and outfall locations to the 80 Arpent Canal.

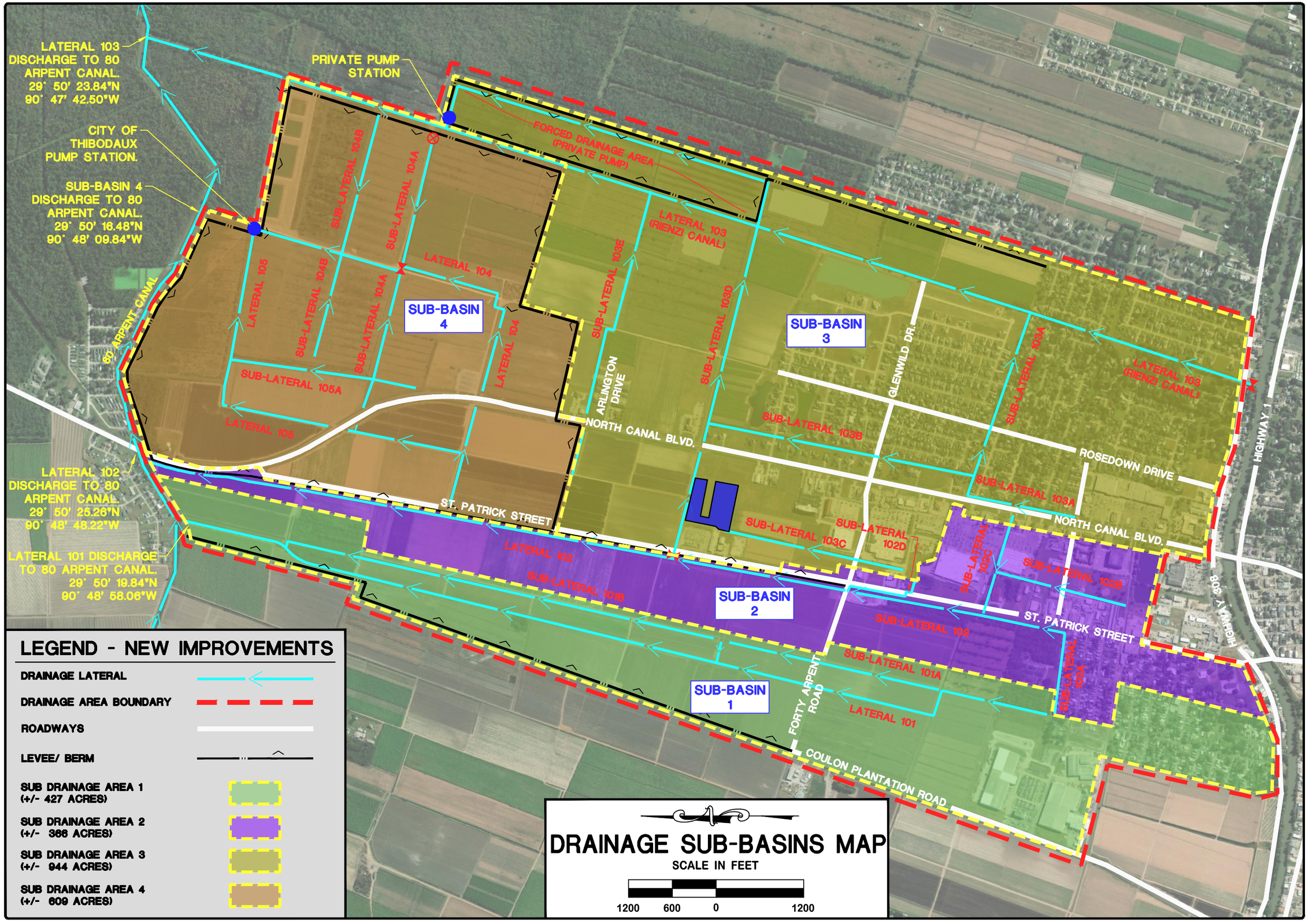
Each of the four sub-basins are further detailed in the following sections. Pictures documenting field conditions of the conveyance systems are included in the following sections along with maps depicting the details of the sub-basins, the location and direction of flow of the laterals and sub-laterals, the location, size, and inverts of the existing culverts, and other drainage features. Capacity calculations for the conveyance systems of each sub-basin are also included in the following sections.

The Hydraflow Express and Hydrograph Extension programs included in AutoCAD Civil 3D 2019 were utilized for the capacity and contributing area peak flow calculations. Parameters utilized in the calculations are included below:

- Existing open channel and culvert capacities were calculated using the Hydraflow Express Extension with the following parameters:
  - The software does not recognize negative invert elevations; as such, all culvert and ditch inverts were brought up to a baseline elevation of ten within the program.
  - Where multiple, parallel culverts were located within the laterals and sub-laterals, the average slope was used for the analysis.
  - The Hydraflow output reports for each open channel lateral/sub-lateral and culvert are included in Appendix B of the report.
- Contributing area peak flows were calculated using the Hydrograph Extension with the following parameters:
  - 25 year – 24 hour storm event
  - The LADOTD Hydraulic Manual runoff curve numbers were used to develop composite runoff curve numbers for the drainage areas
  - SCS (Soil Conservation Service), currently National Resource Conservation Service (NCRS), Lag method and Tabular Hydrograph method based on TR-20
  - SCS Type III rainfall distribution with a 5-minute interval
  - Shape factor of 284
  - Charts, graphs, coefficients and other hydraulic parameters taken from the Louisiana Department of Transportation (LADOTD) Hydraulic manual and TP 40 rainfall information.

- Time of Concentration (Tc) was determined by evaluating the time taken to convey stormwater from the most distant location in a particular drainage sub-basin to the culvert or open channel being reviewed. The Lag Method along with channel flow time using an average channel flow velocity of 2 ft/ second, was used to compute the Tc's for the drainage areas. The Lag method accounts for the basin slope, and the hydraulic length of the sub-basin area.

A table is included in the following sections for each sub-basin, which depicts the input and output parameters of the conveyance system capacity calculations. The calculated conveyance capacities of the open-channel and sub-surface sections were compared to the calculated 25 year peak flows, and the sections that were determined to be under-sized are indicated in the table.



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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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J:\CAD\DWG\17-000\17-398\17-398 DRAINAGE AREA MAP (Sub Drainage Areas).dwg

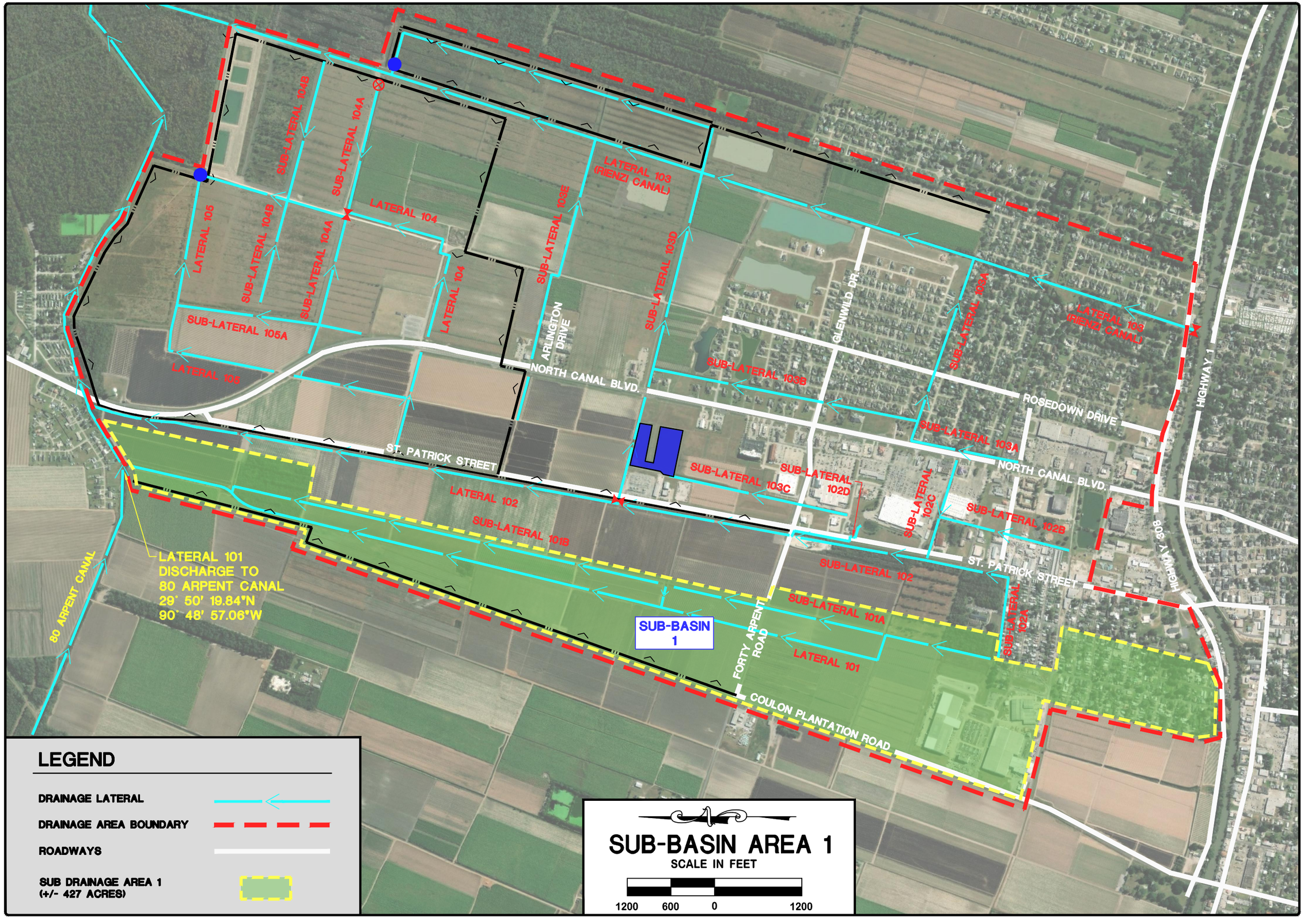
SECTION 3.1.A
Sub-Basin Area 1/Overview

Sub-Basin Area 1 consists of the area east of the Coulon Plantation Road and the area west of St. Patrick Street that is not included in Sub-Basin Area 2. This area is ± 427 acres and consists mostly of sugar cane fields with some areas of residential homes in North Thibodaux, as well as the industrial site of Cameco Industries, Inc.

This sub-basin includes one main drainage lateral, Lateral 101, and two sub-laterals, 101A and 101B. The sub-basin drains to the 80 Arpent Canal via gravity flow.

Exhibit D-1 on the next page shows the location of Sub-Basin Area 1 within the overall Basin, along with the main and sub-drainage laterals.

Section 3.1.B, following Exhibit D-1 includes a detailed description of Sub-Basin Area 1, with maps, pictures, and the conveyance system capacity tabulation.



LEGEND

- DRAINAGE LATERAL
- DRAINAGE AREA BOUNDARY
- ROADWAYS
- SUB DRAINAGE AREA 1 (+/- 427 ACRES)

SUB-BASIN AREA 1

SCALE IN FEET

1200 600 0 1200

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J:\CAD\DWG\17-000\17-398\17-398 DRAINAGE AREA MAP (Sub Drainage Areas)SB1.dwg

SECTION 3.1.B
Sub-Basin Area 1/ Existing Conditions & Capacity Calculation

Refer to Exhibits E-1.1 through E-1.3 on the following pages for detailed maps of the drainage laterals described and location of pictures provided in this section.

Lateral 101 is the main conveyance channel in this sub-basin which drains a majority of the sub-basin, inclusive of residential and industrial portions on the southern end of the sub-basin. Lateral 101 outfalls into the 80 Arpent Canal at approximately 29° 50' 19.84" N, 90° 48' 58.06" W. Lateral 101 is a sugar cane field ditch which appears to be accessible on both sides for maintenance purposes using existing sugar cane field headland roads. There are 7 culvert crossings in this lateral ranging from 18" diameter up to 84" diameter culverts. Lateral 101 is an excavated, open channel with dense weeds.

Picture 1A: Lateral 101 Looking north to culvert 101-1
(Reference E-1.1)

Picture 1B: Lateral 101 Looking south from station 8+00
(Reference E-1.1)

Picture 1C: Lateral 101 Looking south near station 15+00
(Reference E-1.1)

Picture 1D: Lateral 101 Looking north from station 35+00
(Reference E-1.1)

Picture 1E: Looking north at culvert 101-7
(Reference E-1.2)

Picture 1F: Lateral 101 Looking south from station 62+00
(Reference E-1.2)

Picture 1G: Looking north at culvert 101-8 (obstructed) at station 110+00 (8/30/2018)
(Reference E-1.3)

Sub-Lateral 101A is a conveyance ditch that drains a cultivated portion of Sub-Basin Area 1 and discharges into Lateral 101. Sub-lateral 101A is a sugar cane field ditch which appears to be accessible on the east side for maintenance purposes using an existing sugar cane field headland road. There are 4 culvert crossings in this sub-lateral ranging from 36" diameter up to 48" diameter. The ditch is an excavated, open channel, with dense weeds.

Picture 2A: Sub-Lateral 101A Looking north from station 216+00
(Reference E-1.1)

Sub-Lateral 101B is a conveyance ditch that drains a cultivated portion of Sub-basin Area 1 and discharges into Lateral 101. Sub-lateral 101B is a sugar cane field ditch which appears to be accessible on the west side of the ditch for maintenance purposes using the existing sugar cane headland road. The northern portion of the ditch appears to have heavier vegetation on the east and west sides of the ditch which may hinder maintenance access. There are 6 culvert crossings in this sub-lateral ranging from 18" diameter up to 60" diameter. The ditch is an excavated, open channel, with dense weeds.

Picture 3A: Sub-Lateral 101B looking south from station 10+00
(Reference E-1.2)

Picture 3B: Sub-Lateral 101B culvert crossing at station 11+50
(Reference E-1.2)

Picture 3C: Sub-Lateral 101B looking north from station 37+50
(Reference E-1.2)

OUTSIDE LIMITS OF STUDY AREA

COULON PLANTATION ROAD

CAMECO INDUSTRIES, INC.

CULVERT 101-1
18" CMP
24" CMP
INV IN- 5.05 (18")
INV IN- 4.93 (24")
INV OUT- 3.91 (18")
INV OUT- 3.97 (24")

CULVERT 101-2
48" CMP
INV IN- 2.18
INV OUT- 2.17

CULVERT 101-3
48" CMP
INV IN- 1.31
INV OUT- 1.25

CULVERT 101-4
48" CMP
INV IN- 1.82
INV OUT- 1.31

CULVERT 101-5
48" RCP
INV IN- 0.55
INV OUT- 0.86

CULVERT 101A-1
48" CMP
INV IN- 0.70
INV OUT- 0.86

CULVERT 101A-2
48" CMP
INV IN- 1.39
INV OUT- 1.14

CULVERT 101A-3
36" RCP
INV IN- 0.74
INV OUT- 0.84

LATERAL 101

SUB-LATERAL 101A

DITCH INV- 0.78

DITCH INV- 2.18

DITCH INV- 1.33

0+00 10+00 20+00 30+00 40+00

200+00 210+00 220+00

1A 1B 1C 1D 2A

COULON ROAD

NORTH 10TH ST.

FORTY ARPENT ROAD

MATCHLINE 'A'

SUB-BASIN AREA 2

ST. PATRICK STREET

WAL-MART

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.1.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 101, 101A AND 101B SUB-BASIN AREA 1

SCALE IN FEET

400 200 0 400

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FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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OUTSIDE LIMITS OF STUDY AREA

DITCH INV- 0.69

CULVERT 101-6
48" CMP
INV IN- -1.32
INV OUT- -0.70

CULVERT 101-7
54" STEEL
INV IN- -0.73
INV OUT- -0.67

40+00 50+00 60+00 70+00 80+00 90+00

233+71

LATERAL 101

LATERAL 101

SUB-LATERAL 101A

SUB-LATERAL 101B

1E 1F 3A 3B 3C

220+00 0+00 10+00 20+00 30+00 40+00

SUB-LATERAL 101A

CULVERT 101A-4
48" CMP
INV IN- 0.67
INV OUT- 0.67

DITCH INV- 1.90

CULVERT 101B-1
60" STEEL
INV IN- 0.19
INV OUT- -0.29

230+00

CULVERT 101B-2
24" CMP
INV IN- 1.83
INV OUT- 1.40

CULVERT 101B-3
24" CMP
INV IN- 0.94
INV OUT- 0.83

CULVERT 101B-4
30" CMP
INV IN- 0.11
INV OUT- 0.04

MATCHLINE 'A'

MATCHLINE 'B'

SUB-BASIN AREA 2

OE

ST. PATRICK STREET

ELECTRIC SUB-STATION

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.1.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 101, 101A AND 101B SUB-BASIN AREA 1

SCALE IN FEET

400 200 0 400

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OUTSIDE LIMITS OF
STUDY AREA

CULVERT 101-8
(OBSTRUCTED) 60" STEEL
INV IN- 0.11
INV OUT- -1.18

90+00
LATERAL 101
100+00
DITCH INV- -1.35
110+00
61+04
DITCH INV- -1.72
120+00
125+23
LATERAL 101 DISCHARGE
TO 80 ARPENT CANAL
29° 50' 19.84"
90° 48' 58.06"

40+00
50+00
SUB-LATERAL 101B
60+00
DITCH INV- 0.94
CULVERT 101B-5
18" PVC
INV IN- 0.23
INV OUT- -0.44
CULVERT 101B-6
18" PVC
INV IN- -0.38
INV OUT- 0.04

MATCHLINE "B"

80 ARPENT CANAL

SUB-BASIN AREA 2

OE
ST. PATRICK STREET

NORTH CANAL BLVD

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.1.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 101, 101A AND 101B SUB-BASIN AREA 1

SCALE IN FEET

400 200 0 400

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DDG

TABLE 1 : SUB-BASIN AREA 1 LATERAL AND SUB-LATERAL ANALYSIS

NLLD North Lafourche Levee District

			Open Channel Flow - Existing Capacity					Culvert Flow - Existing Capacity			Peak Flow Calculations - Based on Contributing Area		Comparison Analysis	
	Stations	Open Channel/ Culverts	Bottom Width (Ft.)	Side Slope (z:1)	Depth (Ft.)	Longitudinal Slope (%) (** use 0.05)	Mannings's Roughness (n)	Number and Type of Culvert	Mannings's Roughness (n)	Slope (%)	Contributing Area (Acres)	Composite Runoff Curve Number (CN)	Existing Culvert/ Open Channel Capacity (cfs)	25-Yr 24-Hr Peak Flow (cfs)
Lateral 101	0+00 to 0+30	Culvert 101-1						1-18" CMP; 1-24" CMP	0.024	1.44 1.07	131	85	**21***	**130**
	0+00 to 18+74	Open Channel	5	1.6	5	0.14	0.030				131	85	**235**	**157**
	6+34 to 7+95	Culvert 101-2						1-48" CMP	0.024	0.03	131	85	**77***	**130**
	18+74 to 19+57	Culvert 101-3						1-48" CMP	0.024	0.20	165	84	**77***	**157**
	19+57 to 34+53	Open Channel	5	1.5	5.5	**-0.01	0.030				212	84	**166***	**192**
	34+53 to 35+27	Culvert 101-4						1-48" CMP	0.024	-1.70	212	84	**60***	**192**
	35+27 to 36+16	Culvert 101-5						1-48" RCP	0.011	-0.69	212	84	**75***	**192**
	36+16 to 61+31	Open Channel	6	1.5	6.5	0.06	0.030				326	84	**297**	**280**
	48+67 to 49+39	Culvert 101-6						1-48" CMP	0.024	-2.07	248	84	**54***	**219**
	61+31 to 62+19	Culvert 101-7						1-54" Steel	0.024	-0.25	326	84	**98***	**280**
	62+19 to 109+76	Open Channel	10	2	6	**-0.02	0.030				326	84	**342**	**280**
	109+76 to 110+89	Culvert 101-8						1-60" Steel (Obstructed)	0.024	4.57	363	84	**140***	**280**
	110+89 to 125+23	Open Channel	10	2	6	0.21	0.030				428	83	**702**	**293**
Sub-Lateral 101A	200+00 to 216+54	Open Channel	7	1.9	5.5	**-0.08	0.030				19	83	**228**	**37**
	208+74 to 209+89	Culvert 101A-1						1-48" CMP	0.024	-0.54	11	83	**77**	**22**
	215+38 to 216+25	Culvert 101A-2						1-48" CMP	0.024	0.83	19	83	**77**	**37**
	216+25 to 217+31	Culvert 101A-3						1-36" RCP	0.011	-0.22	19	83	**39**	**37**
	216+54 to 233+71	Open Channel	7	2.2	4	**0.02	0.030				26	83	**126**	**45**
	229+58 to 230+51	Culvert 101A-4						1-48" CMP	0.024	0.00	26	83	**77**	**45**
Sub-Lateral 101B	0+00 to 0+30	Culvert 101B-1						1-60" Steel	0.024	1.92	6	83	**116**	**11**
	0+30 to 25+57	Open Channel	7	1.5	4	**-0.18	0.030				13	83	**104**	**21**
	11+50 to 11+80	Culvert 101B-2						1-24" CMP	0.024	1.45	6	83	**12**	**11**
	25+26 to 25+64	Culvert 101B-3						1-24" CMP	0.024	0.36	13	83	**12***	**21**
	25+57 to 49+73	Open Channel	7	1.5	4	**0.03	0.030				22	83	**104**	**31**
	37+30 to 37+60	Culvert 101B-4						1-30" CMP	0.024	0.35	18	83	**21***	**27**
	49+68 to 49+98	Culvert 101B-5						1-18" PVC	0.011	2.03	22	83	**7***	**31**
	49+73 to 61+00	Open Channel	7	1.5	4	**0.02	0.030				22	83	**104**	**31**
	59+84 to 60+07	Culvert 101B-6						1-18" PVC	0.011	-1.28	34	83	**3***	**42**

*** CULVERT/ OPEN CHANNEL UNDERSIZED TO HANDLE 25-YEAR 24-HOUR PEAK FLOW**

NOTE: REFERENCE E-1.1 THROUGH E-1.3 FOR LOCATIONS OF LATERALS, SUB-LATERALS, AND CULVERTS

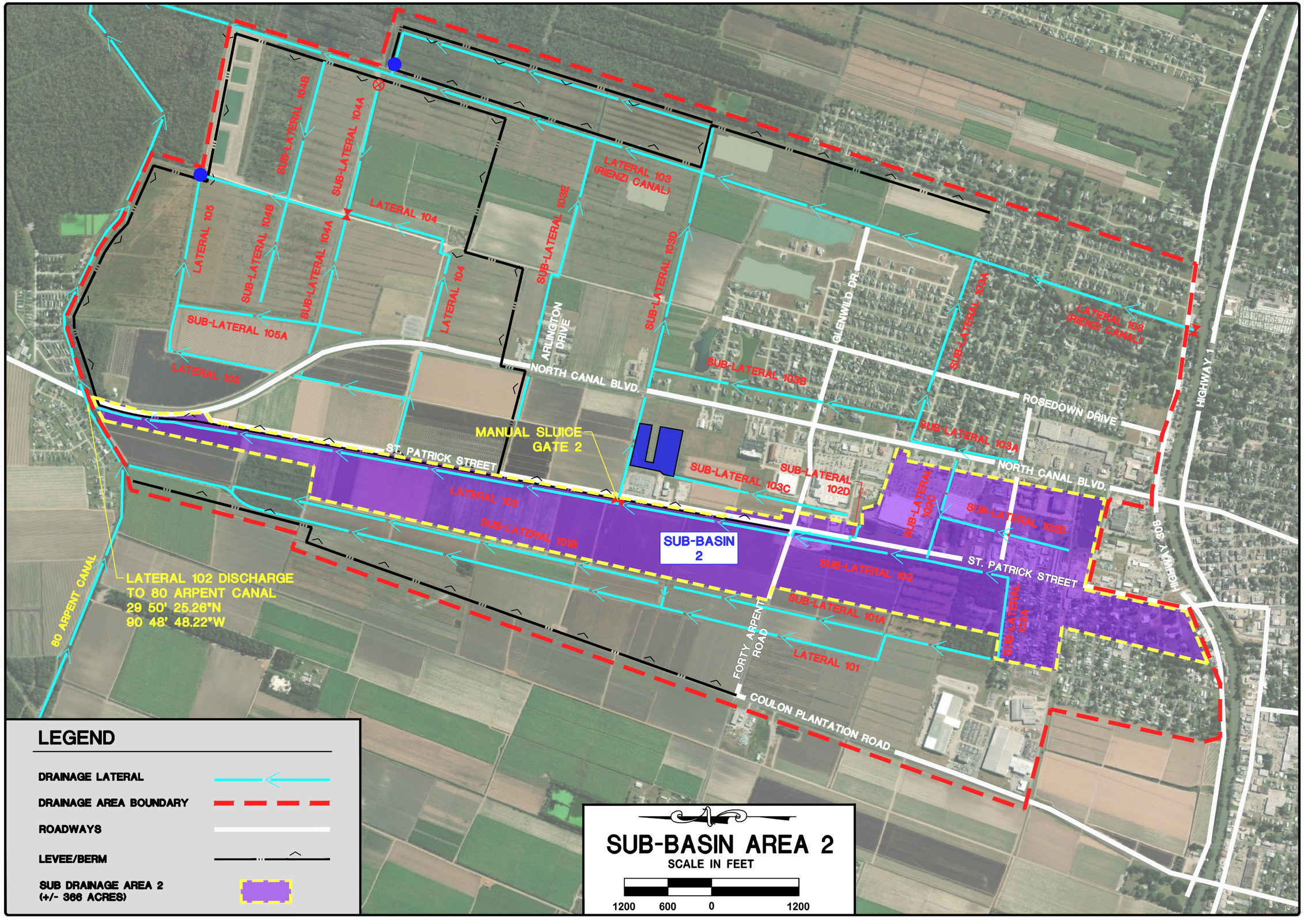
SECTION 3.2.A
Sub-Basin Area 2/Overview

Sub-Basin Area 2 consists of areas on both the east and west side of St. Patrick St. as well as a portion of the area west of North Canal Blvd. and east of St. Patrick St. This area is ± 366 acres and consists mostly of sugar cane fields with some areas of public and commercial developments (Thibodaux Civic Center, Big Lots, Wal-Mart, etc.) as well as a residential area at the southernmost portion of the sub basin.

This sub-basin includes one main drainage lateral, Lateral 102, and four sub-laterals, 102A, 102B, 102C, and 102D. The sub-basin drains to the 80 Arpent Canal via gravity flow.

Exhibit D-2 on the next page shows the location of Sub-basin Area 2 within the overall Basin along with the main and sub-drainage laterals.

Section 3.2.B following Exhibit D-2 includes a detailed description of Sub-Basin Area 2, with maps, pictures, and the conveyance system capacity tabulation.



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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

DRAWN	MTB
CHECKED	HRK
ISSUE DATE	10/3/2018
PROJECT NO.	17-398
SHEET	EXHIBIT D-2

J:\CAD\DWG\17-000\17-398\17-398 DRAINAGE AREA MAP (Sub Drainage Areas)SB2.dwg

SECTION 3.2.B
Sub-Basin Area 2/ Existing Conditions & Capacity Calculation

Refer to Exhibits E-2.1, E-2.2, E-2.3, and E-2.4 on the following pages for detailed maps of the drainage laterals described in this section.

Lateral 102 is the main conveyance channel in this sub-basin which drains a majority of the sub-basin inclusive of the southernmost residential and commercial areas, and outfalls into the 80 Arpent Canal at approximately 29° 50' 25.26" N, 90° 48' 48.22" W. Lateral 102 is accessible from the west side for maintenance purposes using existing sugar cane field headland roads. One section of the lateral near the 40 Arpent Road crossing is overgrown with trees on both sides and appears to be inaccessible to maintenance personnel. The east side of the ditch is bordered by a small berm that prevents stormwater from overtopping the ditch bank and inundating the adjacent forced drainage area (Sub-Basin Area 4). There is an existing overhead transmission line along the eastern bank of the ditch that makes maintenance from the eastern side difficult. There are 6 culvert crossings in this lateral ranging from 36" diameter up to double barrel 60" diameter. The ditch is an excavated, open channel, with dense weeds. There are several areas in this lateral where the channel is dammed off by sediment deposits from adjacent in-flowing cane field ditches. The dams are significant in some areas, hindering flow in the lateral.

Picture 3A Looking North at culvert 102-1
(Reference E-2.1)

Picture 3B Looking North at culverts 102-2 and 102-3
(Reference E-2.1)

Picture 3C: Lateral 102 looking North from station 7+00
(Reference E-2.1)

Picture 3D: Lateral 102 looking North from station 22+50 at the heavily vegetated ditch banks
(Reference E-2.1)

Picture 3E: Lateral 102 looking north from station 31+00 (9/26/2018 Rain Event)
(Reference E-2.1)

Picture 3F: Lateral 102 looking north from station 62+00 at sediment dams.
(Reference E-2.2)

Picture 3G: Lateral 102 sediment dam near station 55+00
(Reference E-2.2)

Picture 3H: Lateral 102 looking north from station 85+00 (9/26/2018 Rain Event)
(Reference E-2.2)

Picture 3I: Remains of emergency weir cut by the city of Thibodaux during past heavy rain event to drain the St. Patrick Street roadside ditch.
(Reference E-2.2)

Sub-Lateral 102A is an east west conveyance ditch that captures stormwater run-off from the residential areas in the southern part of Sub-Basin Area 2 and conveys it to Lateral 102. This sub-lateral is accessible from the north side for maintenance purposes. There is one 36" diameter culvert crossing in this lateral. The ditch is an excavated, open channel, with dense

Picture 4A: Sub-lateral 102A looking east from station 500+00
(Reference E-2.1)

Picture 4B: Looking east at culvert 102A-1
(Reference E-2.1)

Picture 4C: Sub-lateral 102A looking east from station 506+00
(Reference E-2.1)

Picture 4D: Sub-lateral 102A looking west from station 511+00
(Reference E-2.1)

Sub-Lateral 102B conveys storm water from the commercial areas along St. Patrick Street south of Rienzi Drive, the Civic Center, and Rienzi Drive to Sub-Lateral 102C. This sub-lateral is accessible on the east side for maintenance purposes. Accessibility for maintenance is limited behind Big Lots based on the overhead electrical infrastructure (see picture 5G and 5H below). This sub-lateral contains culvert crossings ranging in size from 36" diameter up to 42" diameter. Culvert 102B-2 is buried which also limits the capacity of the sub-lateral (See picture 5C below). The ditch behind Big Lots is an is an excavated, open channel with grass and some weeds.

Picture 5A: Sub-lateral 102B looking north at culverted section from station 310+00.
(Reference E-2.4)

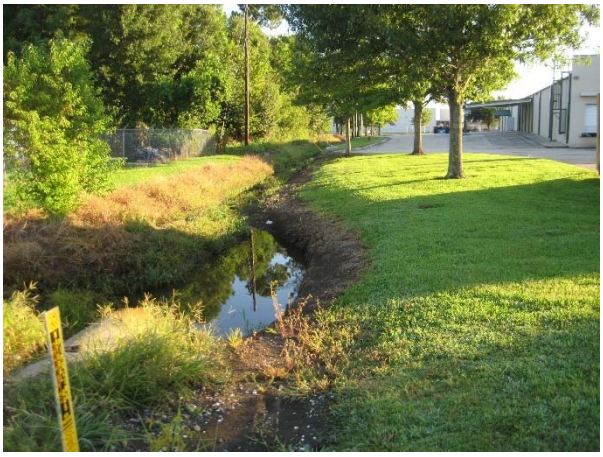
Picture 5B: Sub-lateral 102B looking north at culvert 102B-3
(Reference E-2.4)

Picture 5C: Sub-lateral 102B looking south from station 312+50 (James Riviere St.) at culvert 102B-2
(Reference E-2.4)

Picture 5D: Street Flooding on Rienzi Drive near Sub-Lateral 102B (9/26/2018 Rain Event)
(Reference E-2.4)

Picture 5E: Sub-lateral 102B looking south from station 312+50 (James Riviere St.) (9/26/2018 Rain Event)
(Reference E-2.4)

Picture 5F: Sub-lateral 102B looking north from station 312+70 (James Riviere St.) (9/26/2018 Rain Event)
(Reference E-2.4)



Picture 5G: Sub-lateral 102B looking north from station 312+70 (James Riviere St.)
(Reference E-2.4)

Picture 5H: Sub-lateral 102B looking north from station 315+00 (Limited Room for Widening)
(Reference E-2.4)

Sub-Lateral 102C captures storm water from the Big Lots Shopping Center parking lot and conveys it west to Lateral 102. This sub-lateral is accessible on the north side for maintenance purposes and contains culvert crossings ranging in size from 42" diameter up to 60" diameter. The ditch is an excavated channel, with dense weeds.

Picture 6A: Sub-Lateral 102C looking west from station 408+00 (Dry Conditions)
(Reference E-2.4)

Picture 6B: Sub-Lateral 102C looking west from station 408+00 (Flooded Conditions) (9/26/2018 Rain Event)
(Reference E-2.4)

Sub-Lateral 102D is the outfall ditch from the Wal-Mart detention pond that conveys stormwater to Lateral 102. This sub-lateral is accessible on the south side for maintenance purposes east of St. Patrick Street and on the west side of the sub-lateral as it flows to the west of St. Patrick Street. The sub-lateral runs under an existing overhead electrical line along St. Patrick Street. There are 2 culvert crossings in the sub-lateral, a 3' x 4' box culvert under St. Patrick Street and a 24" diameter reinforced concrete pipe that ties into Lateral 102. The culvert that discharges the Wal-Mart detention pond upstream of the sub-lateral is a 36" diameter Plastic pipe. The ditch leaving the detention pond has a lower invert than the downstream portions of the ditch. The downstream portions of the ditch remain dry during non-rain periods while the upstream portion from the Walmart Detention pond to St. Patrick Street always holds water. The ditch is an excavated channel, with short grass and few weeds.

Picture 7A: Looking southwest at Walmart detention pond from station 602+50
(Reference E-2.4)

Picture 7B: Looking west at culvert 102D-1
(Reference E-2.4)

Picture 7C: Sub-lateral 102D Looking north from station 605+00
(Reference E-2.4)

Picture 7D: Looking west at culvert 102D-2
(Reference E-2.4)

SUB-BASIN AREA 1

DITCH INV- 4.83

500+00

4A

SUB-LATERAL 102A

4B

CULVERT 102A-1
36" CMPA
INV IN- 4.43
INV OUT- 3.92

4C

510+00

4D

511+45

3A

0+00

CULVERT 102-1
36" CMP
INV IN- 3.90
INV OUT- 4.16

CULVERT 102-2
36" CMP
INV IN- 4.19
INV OUT- 3.97

3C

10+00

414+31

LATERAL 102

3D

20+00

HEAVILY VEGETATED
DITCH BANKS. DIFFICULT TO
ACCESS DITCH FOR MAINTENANCE.

DITCH INV- 1.81

CULVERT 102-4
54" CMPA
INV IN- 0.13
INV OUT- 0.26

FORTY ARPENT ROAD

611+33

30+00

3E

SEE INSET "2B"
ON SHEET E-2.4 FOR
PICTURE LOCATIONS
IN THIS AREA

40+00

MATCHLINE "A"

ST. PATRICK STREET

SUB-LATERAL 102D

609+00

610+00

36" RCP
INV IN- 3.02
INV OUT- 2.93
(COLLECTS STORMWATER
FROM SMALL AREA WEST
OF ST. PATRICK STREET)

SEE INSET "2A"
ON SHEET E-2.4 FOR
PICTURE LOCATIONS
IN THIS AREA

DITCH INV- 4.54

3B

JAMES RIVERE ST

CULVERT 102-3
36" RCPA
INV IN- 4.29
INV OUT- 3.97

CULVERT 102C-3
60" RCPA
INV IN- 2.35
INV OUT- 2.35

410+00

DITCH INV- 3.75

600+00

300+00

310+00

SUB-LATERAL 102B

DITCH IS SMALL WITH
LIMITED ROOM FOR
WIDENING.

WAL-MART

LOWES

ACADEMY

LATERAL 102D WEST OF
ST. PATRICK STREET IS
HIGHER THAN DETENTION
POND OUTFALL DITCH.

318+37

CULVERT IS BURIED
LIMITING CAPACITY.

BIG
LOTS

CULVERT 102C-2
42" CMP
INV IN- 3.42
INV OUT- 3.41

SUB-BASIN AREA 3

RIENZI DRIVE

SUB-LATERAL 102C

CULVERT 102C-1
42" CMP
INV IN- 3.24
INV OUT- 3.18

THIBODAUX
CIVIC CENTER

400+00

NORTH CANAL BLVD.

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.2.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 102 102A, 102B, 102C AND 102D SUB-BASIN AREA 2

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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SUB-BASIN AREA 1

MATCHLINE "A"

MATCHLINE "B"

DITCH INV- 0.38

MULTIPLE SEDIMENT DAMS OBSTRUCTING FLOW.

DITCH INV- 1.13

MULTIPLE SEDIMENT DAMS OBSTRUCTING FLOW.

EMERGENCY OVERFLOW WEIR CUT BY CITY OF THIBODAUX TO DRAIN ST. PATRICK STREET WESTERN ROADSIDE DITCH TO LATERAL 102.

40+00

50+00

60+00

70+00

80+00

LATERAL 102

3F

3G

3H

3I

OE

ST. PATRICK STREET

MANUAL SLUICE GATE 2

CULVERT 102-5
2-60" CMP
INV IN- -2.67
INV IN- -2.62
INV OUT- -2.81
INV OUT- -2.92

LA CONTRACTOR ENTERPRISE

ELECTRIC SUBSTATION

REGIONAL DETENTION POND

30

SUB-BASIN AREA 3

NORTH CANAL BLVD.

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.2.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 102, 102A, 102B, 102C AND 102D SUB-BASIN AREA 2

SCALE IN FEET

400 200 0 400

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SUB-BASIN AREA1

MATCHLINE "B"

MULTIPLE SEDIMENT DAMS OBSTRUCTING FLOW.

MULTIPLE SEDIMENT DAMS OBSTRUCTING FLOW.

DITCH INV- -0.12

DITCH INV- -2.19

90+00

100+00

110+00

120+00

128+91

LATERAL 102

80 ARPENT CANAL

OE

ST. PATRICK STREET

CULVERT 102-6
2-60" CMP
INV IN- -2.91
INV IN- -2.97
INV OUT- -2.92
INV OUT- -3.02

NORTH CANAL BLVD.

LATERAL 102 DISCHARGE TO
80 ARPENT CANAL.
29° 50' 25.26"N
90° 48' 48.22"W

SUB-BASIN AREA 3

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.2.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 102, 102A, 102B, 102C AND 102D SUB-BASIN AREA 2

SCALE IN FEET

400 200 0 400

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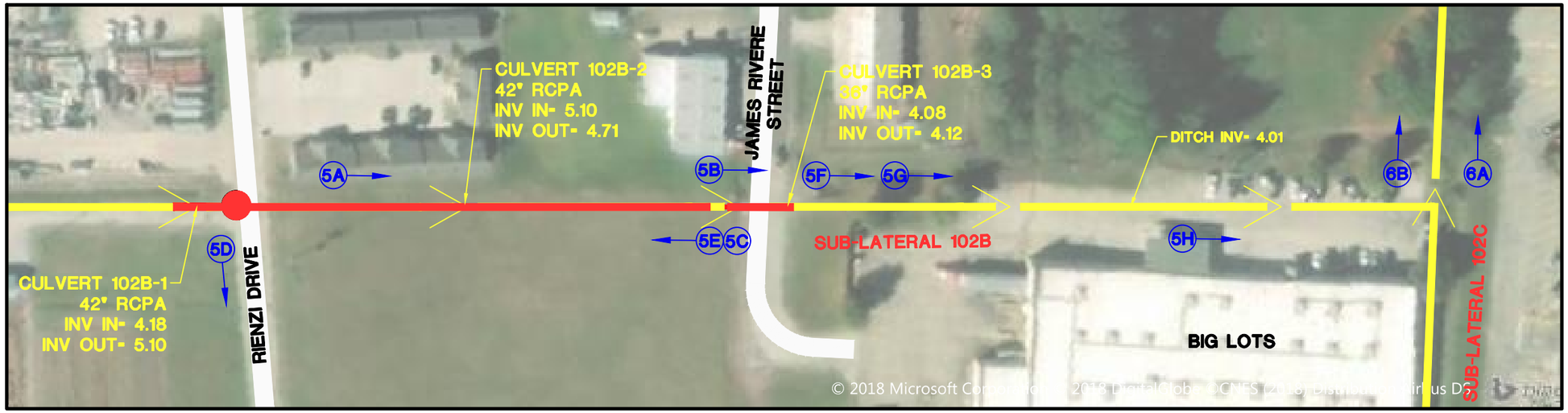
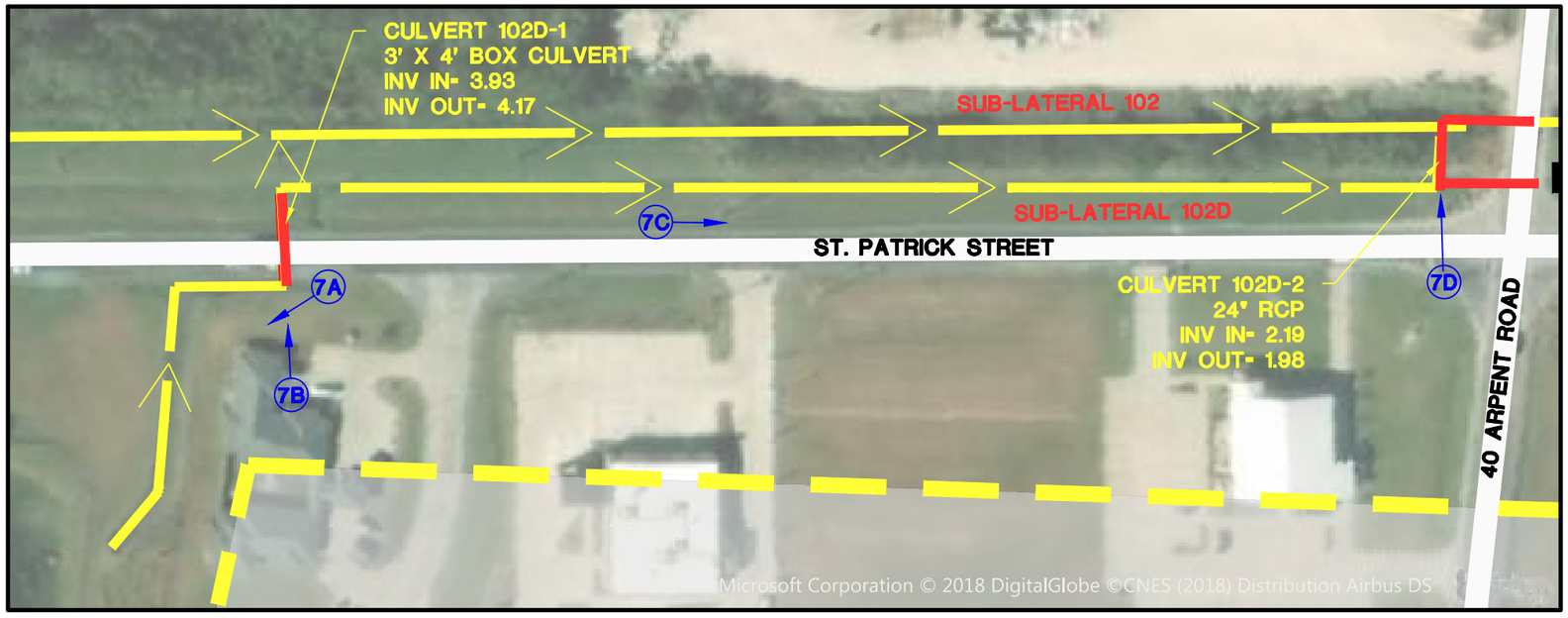


INSET 2A

SCALE: 1" = 100'



INSET 2B

SCALE: 1" = 100'

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.2.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 102, 102A, 102B, 102C AND 102D SUB-BASIN AREA 2 INSETS

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THIBODAUX, LOUISIANA

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TABLE 2: SUB-BASIN AREA 2 LATERAL AND SUB-LATERAL ANALYSIS

NLLD North Lafourche Levee District

			Open Channel Flow - Existing Capacity					Culvert Flow - Existing Capacity			Peak Flow Calculations - Based on Contributing Area		Comparison Analysis	
	Stations	Open Channel/ Culverts	Bottom Width (Ft.)	Side Slope (z:1)	Depth (Ft.)	Longitudinal Slope (%) (** use 0.05)	Mannings's Roughness (n)	Number and Type of Culvert	Mannings's Roughness (n)	Slope (%)	Contributing Area (Acres)	Composite Runoff Curve Number (CN)	Existing Culvert/ Open Channel Capacity (cfs)	25-Yr 24-Hr Peak Flow (cfs)
Lateral 102	0+00 to 11+09	Open Channel	2	2.5	3	0.09	0.025				51	80	43*	50
	0+37 to 1+02	Culvert 102-1						1-36" CMP	0.024	-0.72	51	80	29*	50
	5+09 to 5+60	Culvert 102-2						1-36" CMP	0.024	0.54	51	80	32*	50
	6+24 to 6+43	Culvert 102-3						1-36" RCPA	0.011	1.60	51	80	38*	50
	11+09 to 29+44	Open Channel	5	3	3.5	0.44	0.025				209	87	339	208
	29+80 to 30+32	Culvert 102-4						1-54" CMPA	0.024	-0.32	209	87	87*	208
	30+32 to 85+30	Open Channel	3	2.5	4.5	0.05	0.030				327	85	125*	279
	85+16 to 85+54	Culvert 102-5						2-60" CMP	0.024	0.68	327	85	225*	279
	85+96 to 105+57	Open Channel	8	1.5	5.5	**0.01	0.030				353	85	216*	423
	105+57 to 106+25	Culvert 102-6						2-60" CMP	0.024	0.05	353	85	225*	423
	106+24 to 126+89	Open Channel	9	1.5	6	**0.00	0.030				353	85	277*	423
Sub-Lateral 102A	500+00 to 505+84	Open Channel	4	2	4	0.08	0.030				12	80	114	24
	505+84 to 506+19	Culvert 102A-1						1-36" CMPA	0.024	0.82	12	80	32	24
	506+19 to 511+34	Open Channel	4	2	4	0.08	0.030				44	80	114	50
Sub-Lateral 102B	300+00 to 308+00	Open Channel	3	2	3.5	0.10	0.030				26	94	83	66
	308+00 to 312+76	Culvert 102B-1						1-42" RCPA	0.011	-0.84	26	94	40*	66
	308+76 to 312+55	Culvert 102B-2						1-42" RCPA	0.011	0.10	26	94	40*	66
	312+55 to 313+22	Culvert 102B-3						1-36" RCPA	0.011	0.98	36	94	35*	93
	313+22 to 318+35	Open Channel	4	1.5	2.5	0.12	0.030				40	94	43*	95
Sub-Lateral 102C	400+00 to 408+30	Open Channel	3	2	4	0.06	0.030				8	94	88	20
	401+80 to402+60	Culvert 102C-1						1-42" CMP	0.024	-0.04	8	94	20	20
	403+90 to 406+30	Culvert 102C-2						1-42" CMP	0.024	-0.04	8	94	20	20
	408+30 to 414+13	Open Channel	4	2	4	0.06	0.030				60	94	98	101
	413+01 to 414+14	Culvert 102C-3						1-60" RCPA	0.011	0.45	60	94	135	101
Sub-Lateral 102D	600+00 to 602+55	Open Channel	5	3	3	**0.00	0.030				27	83	67	57
	602+55 to 603+14	Culvert 102D-1						1-3' x 4' Box Culvert	0.011	-0.75	27	83	57	57
	603+14 to 609+00	Open Channel	4	3	2.5	**-0.09							41*	57
	609+00 to 610+95	Open Channel	4	3	2.5	0.34	0.030				33	83	106	65
	610+95 to 611+25	Culvert 102D-2						1-24" RCP	0.011	0.64	33	83	13*	65

*** CULVERT/ OPEN CHANNEL UNDERSIZED TO HANDLE 25-YEAR 24-HOUR PEAK FLOW**

NOTE: REFERENCE E-2.1 THROUGH E-2.4 FOR LOCATIONS OF LATERALS, SUB-LATERALS, AND CULVERTS

SECTION 3.3.A
Sub-Basin Area 3/Overview

Sub-Basin Area 3 consists of the portion of the drainage basin on the east side of Hwy 20 from Bayou Lafourche to the Thibodaux Volunteer Fire Station near Arlington Drive as well as a portion of the area between Hwy 20 and St. Patrick Street from Lowes to Arlington Drive. This area is ± 944 acres and consists mostly of residential and cultivated (Sugar Cane) property with smaller areas of commercial developments (Office Depot, Stage, Taco Bell, McDonalds, Pizza Hut, La Casa, Lowes, Academy Sports and outdoors, etc.). Sub-Basin Area 3 also contains a ±80 acre cultivated forced drainage area at the northeastern-most corner of the sub-basin. Levert owns and maintains a small tractor operated field pump at the northwest corner of this parcel of land, which pumps into the Rienzi Canal. DDG did not include a detailed analysis of this force drainage area as it is isolated from the rest of the sub-basin and has a minimal impact to the performance of the overall drainage basin. Also included in this sub-basin is a regional detention pond that accepts storm water from the commercial properties west of North Canal Blvd.

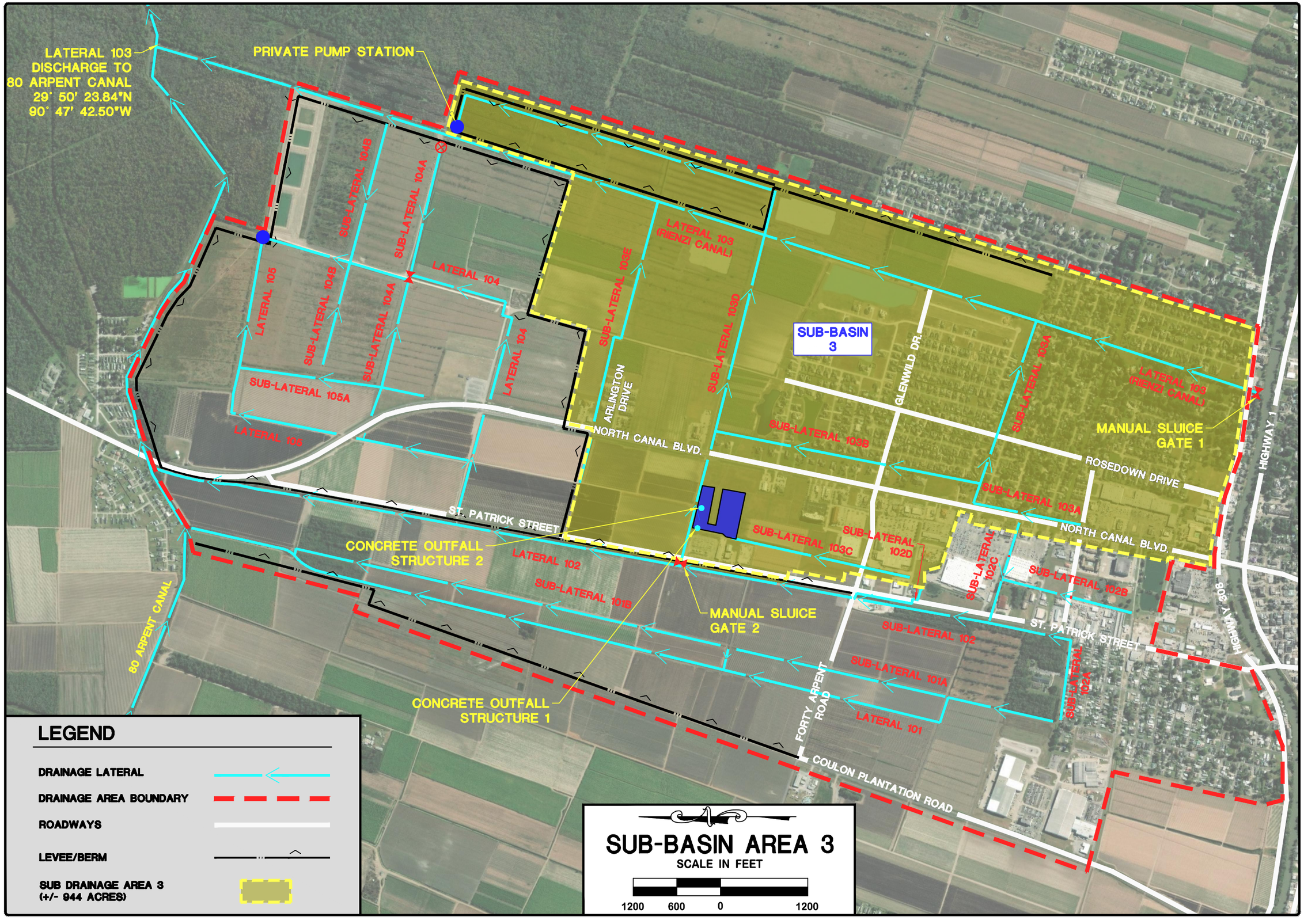
There are two manual operated sluice gates that are used to regulate flow into and out of the sub-basin. Manual sluice gate 1 is located at the tie in location of Lateral 103 (Rienzi Canal) and Bayou Lafourche. This manual sluice gate can be used to move water from the sub-basin into Bayou Lafourche as needed. Manual sluice gate 2 is located at the upstream end of sub-lateral 103D on the west side of St. Patrick Street and can move water from Sub-basin area 3 into Sub-basin area 2, and vice versa.

The +/- 8-acre regional detention pond is regulated by 2 concrete outfall structures as well as a number of 12" PVC emergency spill over culverts. Concrete outfall structure 1 is located in the north west corner of the detention pond and concrete outfall structure 2 is located on the north side of the pond, approximately 330' east of outfall structure 1. Both structures outfall to Sub-lateral 103D.

This sub-basin includes one main drainage lateral (Lateral 103 – Rienzi Canal), which drains to the 80 Arpent Canal via gravity flow, and five sub-laterals, 103A, 103B, 103C, 103D, and 103E.

Exhibit D-3 on the following page shows the location of Sub-Basin Area 3 within the overall Basin along with the main and sub-drainage laterals.

Section 3.3.B, following Exhibit D-3 includes a detailed description of Sub-Basin Area 3, with maps, pictures, and the conveyance system capacity tabulation.



LEGEND

- DRAINAGE LATERAL
- DRAINAGE AREA BOUNDARY
- ROADWAYS
- LEVEE/BERM
- SUB DRAINAGE AREA 3 (+/- 944 ACRES)

SUB-BASIN AREA 3

SCALE IN FEET

1200 600 0 1200

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

DRAWN	MTB
CHECKED	HRK
ISSUE DATE	10/3/2018
PROJECT NO.	17-398
SHEET	EXHIBIT D-3

J:\CAD\DWG\17-000\17-398\17-398 DRAINAGE AREA MAP (Sub Drainage Areas)SB3.dwg

SECTION 3.3.B
Sub-Basin Area 3/ Existing Conditions & Capacity Calculation

Refer to Exhibits E-3.1, E-3.2, E-3.3, E-3.4, and E-3.5 on the following pages for detailed maps of the drainage laterals and sub-laterals described in this section.

Lateral 103 (Rienzi Canal) is the main conveyance channel in this Sub-Basin which runs from Bayou Lafourche and outfalls into the 80 Arpent Canal at approximately 29° 50' 23.84" N, 90° 47' 42.50" W. Lateral 103 is accessible on the east side for maintenance purposes from Hwy 308 to Ashland Drive. The lateral is sub-surface from stations 31+86 to 41+99 and is accessible on the west side from Sub-Lateral 103A to the outfall location. In the northern portions of the lateral, from stations 109+00 to 149+00 the east and west sides of Lateral 103 are bordered by a berm that prevents water from spilling over into the adjacent forced drainage areas. There are 3 culvert crossings in Lateral 103, ranging from double barrel 48" diameter up to triple barrel 72" diameter culverts. The ditch is an excavated channel, with dense weeds.

Picture 8A: Manual Sluice gate #1 within Lateral 103 at Bayou Lafourche
(Reference E-3.1)

Picture 8B: Lateral 103 (Rienzi Canal) looking north from station 11+00
(Reference E-3.1)

Picture 8C: Looking north at culverts 103-2
(Reference E-3.1)

Picture 8D: Lateral 103 (Culverts 103-2 and 103-3) looking north from station 33+00.
(Reference E-3.1)

Picture 8E: Lateral 103 looking north from station 50+00
(Reference E-3.1)

Picture 8F: Lateral 103 looking north from station 70+00. Culverts 103-4 within Lateral 103.
(Reference E-3.2)

Picture 8G: Lateral 103 looking south from station 128+00. Private pump discharge pipe shown.
(Reference E-3.3)

Picture 8H: Lateral 103 looking north from station 128+00
(Reference E-3.3)

Sub-Lateral 103A runs adjacent, and to the east of North Canal Blvd, and captures storm water from the commercial developments in the area. This sub-lateral runs north along the east side of North Canal Blvd, past Melrose Drive then turns east to convey the water to Lateral 103 (Rienzi Canal). This sub-lateral is accessible on the west side for maintenance purposes for the stretch along North Canal Blvd, and on the north side of the sub-lateral on the east-west portion. The downstream portion of sub-lateral 103A near its tie-in location to lateral 103 is showing signs of bank stability issues. The side slope of the channel appears to be sloughing-in, limiting the conveyance capacity of the ditch, and eroding the yards of the adjacent residents. The ditch is an excavated channel with dense weeds.

Picture 9A: Looking south at culvert 103A-1
(Reference E-3.4)

Picture 9B: Looking north at culvert 103A-2
(Reference E-3.4)

Picture 9C: Sub-lateral 103A Looking east from station 214+00
(Reference E-3.4)

Picture 9D: Looking east at culvert 130A-4
(Reference E-3.4)

Picture 9E: Sub-lateral 103A Looking west from station 231+00
(Reference E-3.1)

Picture 9F: Looking east at culvert 130A-5
(Reference E-3.1)

Picture 9G: Sub-lateral 103A Looking east from station 231+00
(Reference E-3.1)

Picture 9H: Sub-lateral 103A Looking west from station 241+00
(Reference E-3.1)

Sub-Lateral 103B runs south to north within the Rienzi Subdivision and conveys storm water to Sub-lateral 103D. Sub-lateral 103B is accessible on both the east and west sides for maintenance purposes. There are two amenity ponds within Rienzi subdivision that discharge into the sub-lateral, and two concrete bridge crossings. Sub-lateral 103D is an excavated channel, with short grass and few weeds.

Picture 10A: Sub-lateral 103B looking north from station 300+50
(Reference E-3.4)

Picture 10B: Sub-lateral 103B looking south from station 314+50 @ Concrete Bridge Structure 1
(Reference E-3.4)

Picture 10C: Looking north at concrete bridge crossing 1
(Reference E-3.4)

Picture 10D: Sub-lateral 103B looking north from station 314+75
(Reference E-3.4)

Picture 10E: Looking north at concrete bridge crossing 2
(Reference E-3.4)

Picture 10F: Sub-lateral 103B looking north from station 328+00 on Concrete Bridge Structure 2.
(Reference E-3.4)

Sub-Lateral 103C runs south to north on the west side of Canal Blvd, conveying storm-water from Lowes, Academy Sports and Outdoors, the Hilton Inn, Kearney Street and Glenwild Drive to the regional detention pond. This sub-lateral is accessible on the east side for maintenance purposes. There are 2 culvert crossings in the sub-lateral, a 54" diameter reinforced concrete arch pipe and 48" diameter double-barrel corrugated metal pipes. The ditch is an excavated channel, with dense weeds.

Picture 11A: Sub-lateral 103C looking north from station 400+00 @ Westover Drive
(Reference E-3.4)

Picture 11B: looking north at culvert 103C-1 under Glenwild Drive
(Reference E-3.4)

Picture 11C: Sub-lateral 103C looking north from station 408+00. Academy Sports on right hand side.
(Reference E-3.4)

Picture 11D: Sub-lateral 103C looking south from station 415+00. Culvert 103C-2 in foreground.
(Reference E-3.4)

Picture 11E: looking north at culvert 103C-2
(Reference E-3.4)

Picture 11F: Sub-lateral 103C looking north from station 415+00. Culvert 103C-2 in foreground.
(Reference E-3.4)

Sub-Lateral 103D runs from west to east, starting on the west side of Canal Blvd at the regional detention pond, crossing Canal Blvd, and continuing to lateral 103 (The Rienzi Canal). There is a sluice gate (manual sluice gate 2) at the upstream end of the sub-lateral on the west side of St. Patrick St, that connects Sub-lateral 103D to Lateral 102 in Sub-Basin Area 2. This sluice gate normally remains closed, but can be opened if needed to move storm water out of Sub-Basin Area 3 into Sub-Basin Area 2. Levert's maintenance personnel operate this sluice gate when needed.

The regional detention pond discharges to sub-lateral 103D though 2 concrete outfall structures and a series of overflow culverts on the northern side of the pond. Concrete outfall structure 1 contains a 24" diameter opening at an invert of -0.75', and a rectangular weir opening (36" width x 10" height) at an invert of 2.18'. The discharge pipe from structure 1 is a 48" CMP. Concrete outfall structure 2 contains a 24" diameter opening at an invert of -1.49', and a rectangular weir opening (36" width x 10" height) at an invert of 1.31'. This structure also contains a catch basin area inlet at the top of the structure which is at an elevation of 2.51'. The discharge pipe from structure 2 is a 48" CMP.

Sub-lateral 103D is accessible on the north side for maintenance purposes. There are 4 culvert crossings in the sub-lateral ranging from 24" diameter up to 48" diameter double barrel culverts. The ditch is an excavated channel, with dense weeds.

Picture 12: Manual sluice gate 2 at the upstream end of lateral 103D, discharging into Lateral 102. (Reference E-3.4)

Picture 12A: Regional Detention Pond
(Reference E-3.4)

Picture 12B Concrete outfall structure 1 within regional detention pond.
(Reference E-3.4)

Picture 12C: Concrete outfall structure 1 discharge culvert into Sub-lateral 103D
(Reference E-3.4)

Picture 12D Concrete outfall structure 2 within regional detention pond.
(Reference E-3.4)

Picture 12E Looking east at culvert 103D-3
(Reference E-3.4)

Picture 12F: Sub-lateral 103D Looking east from 520+00.
(Reference E-3.4)

Sub-Lateral 103E runs west to east, conveying water from the northern cultivated areas of Sub-basin 3 on the west side of N Canal Blvd, east, to lateral 103 (The Rienzi Canal). To the west of N Canal Blvd, the sub-lateral is accessible on the north and south sides; however, accessibility is limited between N Canal Blvd and Rosedown Dr. There are 3 culvert crossings in the sub-lateral ranging from 30" diameter up to 48" diameter culverts at the Rosedown Dr and Swanson Dr crossings. The ditch is an excavated channel, with dense weeds.

Picture 13A: Sub-lateral 103E looking west from North Canal Blvd. at station 608+00.
(Reference E-3.5)

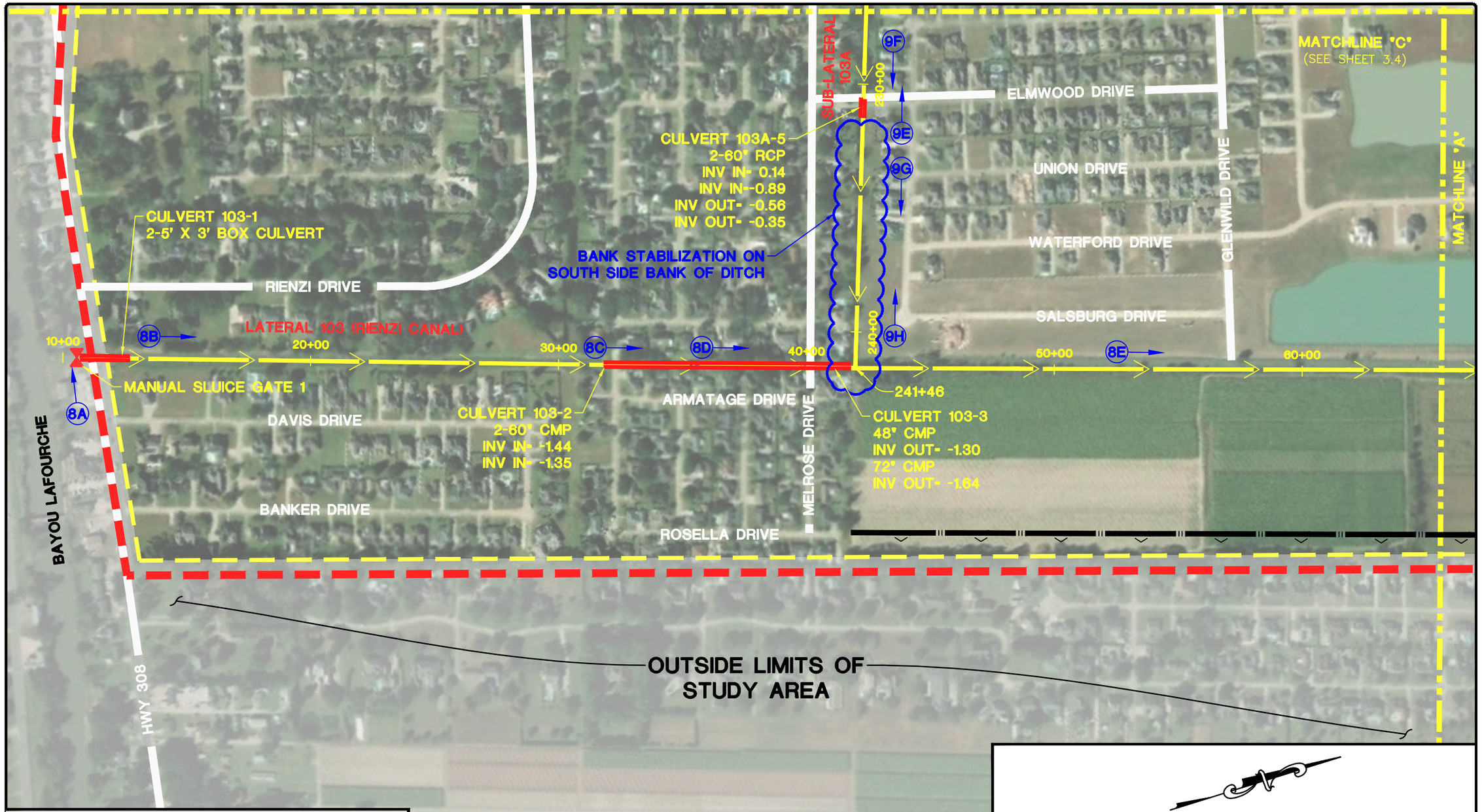
Picture 13B: looking east at culvert 103E-1. North Canal Blvd. in the background.
(Reference E-3.5)

Picture 13C: Sub-lateral 103E looking east from North Canal Blvd at station 608+75.
(Reference E-3.5)

Picture 13D: Sub-lateral 103E looking west from station 618+00.
(Reference E-3.5)

Picture 13E: Looking east at culvert 103E-2. Swanson Drive in Background.
(Reference E-3.5)

Picture 13F: Sub-lateral 103E looking east from Swanson Drive at station 618+25.
(Reference E-3.5)



LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.3.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 103 (RIENZI CANAL), 103A, 103B, 103C, 103D AND 103E SUB-BASIN AREA 3

SCALE IN FEET

400 200 0 400

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FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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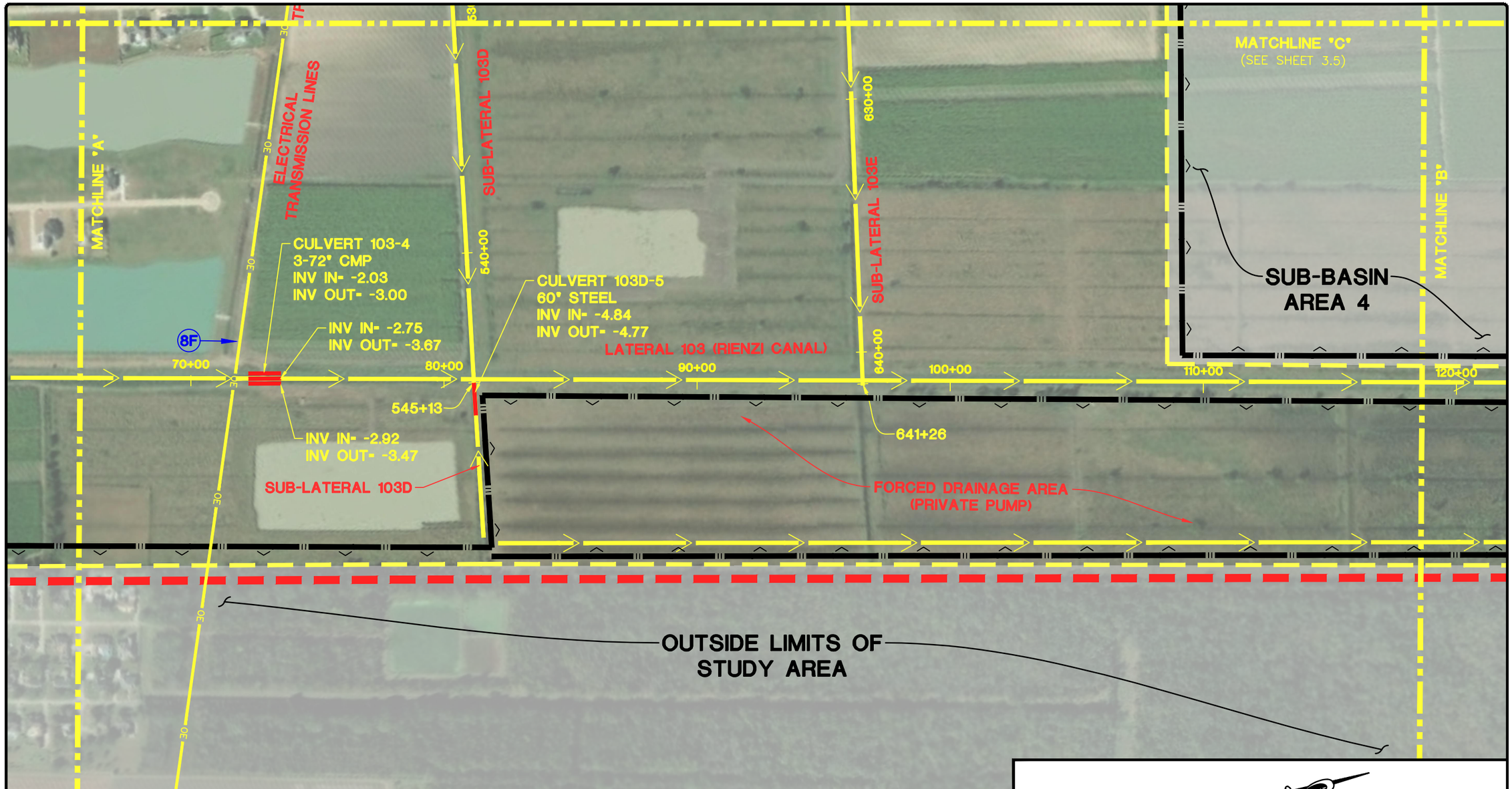

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.3.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 103 (RIENZI CANAL), 103A, 103B, 103C, 103D AND 103E SUB-BASIN AREA 3

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SUB-BASIN
AREA 4

MATCHLINE "B"

SUB-LATERAL 104A

SUB-LATERAL 104B

CITY OF THIBODAUX
SEWER TREATMENT PONDS

80 ARPENT CANAL

CULVERT 104A-3
24" PVC
(BLOCKED)

LATERAL 103 (RIENZI CANAL)

120+00 8G 8H 130+00 140+00 150+00 160+00 168+82

TRACTOR POWERED
PUMP (PRIVATE PUMP)

LATERAL 103
DISCHARGE TO 80
ARPENT CANAL.
29° 50' 23.84"N
90° 47' 42.50"W

OUTSIDE LIMITS OF
STUDY AREA

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.3.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 103 (RIENZI CANAL), 103A, 103B, 103C, 103D AND 103E SUB-BASIN AREA 3

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THIBODAUX, LOUISIANA

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SUB-BASIN AREA 2

CULVERT 103C-1
54" RCPA
INV IN- 2.30
INV OUT- 2.09

CULVERT 103C-2
2-48" CMP
INV IN- 1.42
INV IN- 1.28
INV OUT- 1.07
INV OUT- 1.05

MANUAL SLUICE GATE 2

CULVERT 103D-1
1-48" CMP
INV IN- -1.68
INV OUT- -1.58

ST. PATRICK STREET

WAL-MART

LOWES

ACADEMY

SUB-LATERAL 103C

CONCRETE OUTFALL STRUCTURE 1

CULVERT 103D-2
1-42" CMP
INV IN- -0.01
INV OUT- -0.33

REGIONAL DETENTION POND

CONCRETE OUTFALL STRUCTURE 2

HAMPTON INN

BIG LOTS

CULVERT 103A-2
30" CMP
INV IN- 4.13
INV OUT- 4.03

CULVERT 103A-3
54" CMP
INV IN- 2.81
INV OUT- 2.66

CULVERT 103D-3
1-42" CMPA
INV IN- -0.89
INV OUT- -0.99

SUB-LATERAL 103D

DITCH INV- -2.22

WESTOVER DRIVE

GLENWILD DRIVE

KARNEY STREET

N. CANAL BLVD.

54" CMPA
INV IN- 1.18
INV OUT- 1.36

SUB-LATERAL 103A

CULVERT 103A-1
30" PVC
INV IN- 4.85
INV OUT- 4.45

CONCRETE BRIDGE CROSSING 1

CONCRETE BRIDGE CROSSING 2

SUB-LATERAL 103B

DITCH INV- -0.95

CULVERT 103A-4
1-48" CMP
1-48" RCP
INV IN- 1.09
INV IN- 0.78
INV OUT- 0.94
INV OUT- 0.86

CULVERT 103D-4
2-60" RCP
INV IN- -1.64
INV IN- -1.41
INV OUT- -1.82
INV OUT- -1.61

RIENZI DRIVE

MELROSE DRIVE

ST. DELPHINE DRIVE

ROSEDOWN DRIVE

MATCHLINE "D" (SEE SHEET 3.5)

MATCHLINE "C" (SEE SHEET 3.1)

SUB-LATERAL 103A

BANK STABILIZATION ON SOUTH SIDE BANK OF DITCH

ELMWOOD DRIVE

CULVERT 103A-5
2-60" RCP
INV IN- 0.14
INV IN- -0.56
INV OUT- -0.69
INV OUT- -0.35

UNION DRIVE

400+00 410+00 420+00 424+99 500+00 510+00 520+00 537+20 210+00 200+00 300+00 310+00 320+00 330+00 220+00 230+00

11A 11B 11C 11D 11E 11F 12 12A 12B 12C 12D 12E 12F 9A 9B 9C 9D 10A 10B 10C 10D 10E 10F

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.3.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 103 (RIENZI CANAL), 103A, 103B, 103C, 103D AND 103E SUB-BASIN AREA 3

SCALE IN FEET

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SUB-BASIN AREA 2

ST. PATRICK STREET

MANUAL SLUICE GATE 2

48" CMP
INV IN= -0.75
INV OUT= -1.11

500+00

CULVERT 103D-1
48" CMP
INV IN= -1.68
INV OUT= -1.58

MATCHLINE "D"
(SEE SHEET 3.4)

410+00

420+00

424+99

SUB-LATERAL 103C

REGIONAL DETENTION POND

30

SUB-LATERAL 103D

CULVERT 103D-2
42" CMP
INV IN= -0.01
INV OUT= -0.33

CONCRETE OUTFALL STRUCTURE 1

CONCRETE OUTFALL STRUCTURE 2

510+00

600+00

SUB-BASIN AREA 4

CULVERT 103E-1
30" CMP
INV IN= 0.00
INV OUT= -0.27

CULVERT 103D-3
48" CMPA
INV IN= -0.69
INV OUT= -0.99

N. CANAL BLVD.

13A

13B

13C

13D

13E

13F

ARLINGTON DRIVE

610+00

SWANSON DRIVE

CONCRETE BRIDGE 2

CONCRETE BRIDGE 1

310+00

320+00

330+00

337+20

SUB-LATERAL 103B

ELECTRICAL TRANSMISSION LINES

520+00

CULVERT 103E-2
48" RCP
INV IN= 0.99
INV OUT= 1.26

CULVERT 103D-4
2-60" RCP
INV IN= -1.64
INV IN= -1.41
INV OUT= -1.82
INV OUT= -1.61

CULVERT 103E-3
48" RCP
INV IN= -0.25
INV OUT= -0.37

620+00

SUB-LATERAL 103E

ROSEDOWN DRIVE

GLENWILD DRIVE

MATCHLINE "C"
(SEE SHEET 3.2)

530+00

SUB-LATERAL 103D

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.3.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 103 (RIENZI CANAL), 103A, 103B, 103C, 103D AND 103E SUB-BASIN AREA 3

SCALE IN FEET

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RIENZI / N. CANAL DRAINAGE BASIN

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THIBODAUX, LOUISIANA

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TABLE 3: SUB-BASIN AREA 3 LATERAL AND SUB-LATERAL ANALYSIS

NLLD North Lafourche Levee District

			Open Channel Flow - Existing Capacity					Culvert Flow - Existing Capacity			Peak Flow Calculations - Based on Contributing Area		Comparison Analysis	
	Stations	Open Channel/ Culverts	Bottom Width (Ft.)	Side Slope (z:1)	Depth (Ft.)	Longitudinal Slope (%) (** use 0.05)	Mannings's Roughness (n)	Number and Type of Culvert	Mannings's Roughness (n)	Slope (%)	Contributing Area (Acres)	Composite Runoff Curve Number (CN)	Existing Culvert/ Open Channel Capacity (cfs)	25-Yr 24-Hr Peak Flow (cfs)
Lateral 103	10+00 to 11+91	Culvert 103-1						2 - 5' Wide x 3' Deep Box Culverts	0.011	0.00	-	-	**200**	**-**
	11+91 to 31+86	Open Channel	10	2.5	11	**0.01	0.030				126	79	**1,206**	**128**
	31+86 to 32+78	Culvert 103-2						2-60" CMP	0.024	0.01	126	79	**128**	**128**
	32+78 to 41+99	Culvert 103-3						1-48" CMP; 1-72" CMP	0.024	0.01	126	79	**140**	**128**
	41+99 to 72+60	Open Channel	20	2.5	10	0.10	0.030				432	81	**2,353**	**402**
	72+60 to 73+04	Culvert 103-4						3-72" CMP	0.024	2.70	432	81	**549**	**402**
	73+04 to 127+53	Open Channel	20	2.5	10	0.10	0.030				962	83	**2,353**	**834**
	127+53 to 168+82	Open Channel	19	2.5	7.5	0.13	0.030				1,015	83	**1,433**	**858**
Sub-Lateral 103A	200+00 to 214+94	OpenChannel	5	4	3	0.35	0.025				21	94	**257**	**31**
	201+16 to 202+14	Culvert 103A-1						1-30" PVC	0.011	0.20	21	94	**32**	**31**
	204+27 to 204+85	Culvert 103A-2						1-30" CMP	0.024	0.16	21	94	**31**	**31**
	210+55 to 211+19	Culvert 103A-3						1-54" CMP	0.024	0.25	21	94	**86**	**31**
	214+94 to 224+52	OpenChannel	10	2	5	0.1	0.030				103	83	**332**	**129**
	224+52 to 225+08	Culvert 103A-4						1-48" CMP; 1-48" RCP	0.024; 0.011	0.08	103	83	**130**	**129**
	225+08 to 230+61	Open Channel	10	2	5	0.22	0.030				122	82	**493**	**145**
	230+61 to 231+57	Culvert 103A-5						2-60" RCP	0.011	0.36	122	82	**241**	**145**
	231+57 to 241+19	Open Channel	12	1.5	6	0.1	0.030				132	82	**476**	**157**
Sub-Lateral 103B	300+00 to 313+90	Open Channel	12	2.5	5.5	0.05	0.030				18	79	**355**	**64**
	313+90 to 337+16	Open Channel	12	2.5	5.5	0.05	0.030				54	79	**355**	**108**
Sub-Lateral 103C	400+00 to 406+24	Open Channel	10	3	4	0.13	0.030				29	94	**394**	**51**
	406+24 to 407+23	Culvert 103C-1						1-54" RCPA	0.011	0.43	29	94	**104**	**51**
	407+23 to 415+76	Open Channel	10	3	4	0.13	0.030				56	94	**394**	**99**
	415+76 to 417+03	Culvert 103C-2						2-48" CMP	0.024	0.67	56	94	**129**	**99**
	417+03 to 424+64	Open Channel	20	4	5	0.5	0.030				87	90	**2,104**	**142**
Sub-Lateral 103D	500+00 to 500+30	Culvert 103D-1						1-48" CMP	0.024	3.18	87	83	**65**	**0**
	500+30 to 513+38	Open Channel	5	1.5	3.5	**-0.09	0.030				153	83	**64***	**90**
	503+86 to 504+19	Culvert 103D-2						1-42" CMP	0.024	1.60	129	83	**47***	**76**
	513+38 to 514+84	Culvert 103D-3						1-48" CMPA	0.024	0.30	153	83	**99**	**90**
	514+84 to 525+85	Open Channel	10	2	5.5	0.06	0.030				166	83	**313**	**98**
	525+85 to 526+86	Culvert 103D-4						2-60" RCP	0.011	0.51	166	83	**256**	**98**
	526+86 to 545+13	Open Channel	10	2	5.5	0.06	0.030				166	83	**313**	**98**
	545+13 to 545+33	Culvert 103D-5						1- 60" Steel	0.024	0.68	26	83	**113**	**102**
Sub-Lateral 103E	600+00 to 606+56	Open Channel	4	2.5	2.5	0.85	0.030				25	83	**151**	**21**
	606+56 to 608+50	Culvert 103E-1						1-30" CMP	0.024	0.30	25	83	**22**	**21**
	608+50 to 613+40	Open Channel	3	2	2.5	**-0.22	0.030				38	83	**28***	**36**
	613+40 to 614+08	Culvert 103E-2						1-48" RCP	0.011	-0.35	38	83	**77**	**36**
	614+08 to 621+58	Open Channel	3	2	2.5	0.21	0.030				71	83	**57***	**65**
	621+58 to 622+17	Culvert 103E-3						1-48" RCP	0.011	0.37	71	83	**77**	**65**
	622+17 to 641+09	Open Channel	6	2	2.5	**0.00	0.030				212	83	**141**	**184**

*** CULVERT/ OPEN CHANNEL UNDERSIZED TO HANDLE 25-YEAR 24-HOUR PEAK FLOW**

NOTE: REFERENCE E-3.1 THROUGH E-3.5 FOR LOCATIONS OF LATERALS, SUB-LATERALS, AND CULVERTS

SECTION 3.4.A
Sub-Basin Area 4/Overview

Sub-Basin Area 4 consists of ± 609 acres of cultivated land located in the northern most and lowest portion of the Basin between St. Patrick St. and the Rienzi Canal.

This sub-basin is surrounded on all sides by man-made berms and headland roads, which act as levees, ranging from +2' to +6' in elevation. The sub-basin gravity flows to a COT maintained pump station that is located at the northern end of the sub-basin. This pump station consists of two electric pumps, one 20" diameter and one 18" diameter. Both pumps are located in the open, with no shelter from the elements or back-up power supply in the event of a power outage. The two pumps discharge into the 80 Arpent Canal at approximately 29° 50' 16.48" N, 90° 48' 09.84" W.

Prior to the construction of the City of Thibodaux Sewer Ponds within Sub-Basin Area 4, there was an additional diesel pump at Sub-Lateral 104 B where it meets the Rienzi Canal. This pump was taken out of commission when the sewer ponds were dug and was not replaced.

Sub-Basin Area 4 contains one manual sluice gate (Manual Sluice Gate 3), located within Lateral 104, and one blocked culvert located at the upstream end of sub-lateral 104A. Sluice gate 3 is operated by Levert's maintenance personnel and is used to regulate the flow of water from the upstream portions of the sub-basin down to the pump station. If the flow of water from the higher portions of the sub-basin is not regulated by sluice gate 3, the lower areas of the sub-basin near the curve in N Canal Blvd, become inundated due to a lack of pumping capacity.

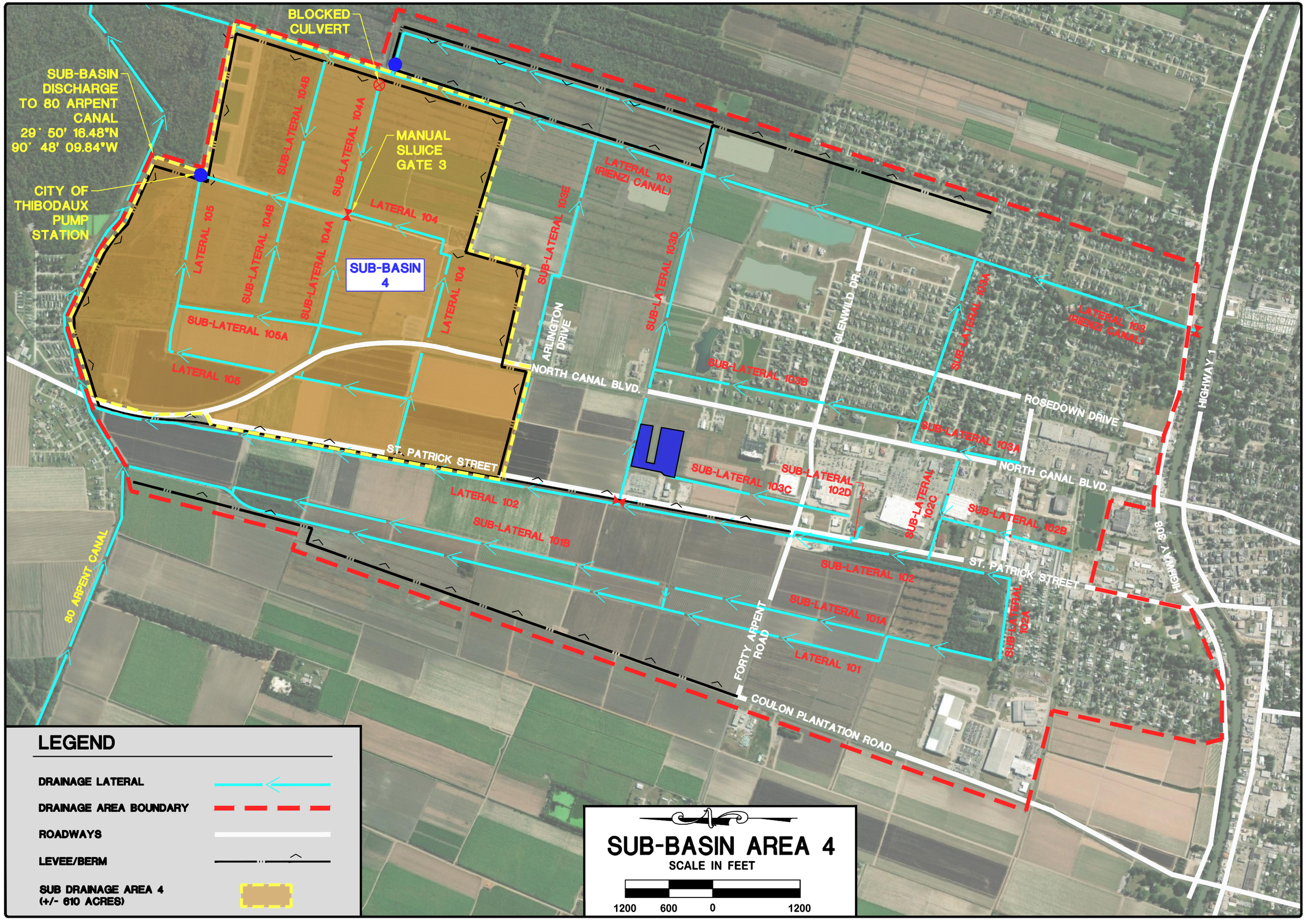
The blocked culvert at the eastern end of sub-lateral 104A, is intended to prevent water from lateral 103 (The Rienzi Canal) from entering Sub-Basin Area 4 during significant rain events, when the water level in the Rienzi Canal stages up. This culvert was previously blocked with a flap gate; however, the gate was damaged at some point in the past and was subsequently removed and replaced with a piece of plywood. The plywood is removed periodically by the landowner's maintenance personnel if the pumps need to be run or if water levels

in Sub-Basin Area 4 are higher than water levels in the Rienzi Canal. It should be noted that per discussions with Levert's maintenance personnel, water levels within the Rienzi Canal are rarely lower than the levels within Sub-Basin Area 4.

This sub-basin includes two main drainage laterals (Laterals 104 and 105) and three sub-laterals, 104A, 104B, and 105A.

Exhibit D-4 on the next page, shows the location of Sub-Basin Area 4 within the overall Basin along with the main and sub-drainage laterals.

Section 3.4.B following Exhibit D-4 includes a detailed description of Sub-Basin Area 4, with maps, pictures, and the conveyance system capacity tabulation.



LEGEND

- DRAINAGE LATERAL
- DRAINAGE AREA BOUNDARY
- ROADWAYS
- LEVEE/BERM
- SUB DRAINAGE AREA 4 (+/- 610 ACRES)

SUB-BASIN AREA 4

SCALE IN FEET

1200 600 0 1200

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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SHEET	EXHIBIT D-4

J:\CAD\DWG\17-000\17-398\17-398 DRAINAGE AREA MAP (Sub Drainage Areas)SB4.dwg

SECTION 3.4.B
Sub-Basin Area 4/ Existing Conditions & Capacity Calculation

Refer to Exhibits E-4.1 and E-4.2 and on the following page for a detailed map of the drainage laterals described in this section.

Lateral 104 is 1 of 2 main conveyance channels that carry storm water to the COT pump station. Lateral 104 captures storm water from the cultivated areas east and west of North Canal Blvd, as well as Eric Andolsek Park, and conveys it east to Rosedown Drive and then north to the COT pump station. The upstream, east-west portion of the lateral is accessible to maintenance personnel on the north side of the lateral while the downstream, north-south portion is accessible on the west side up to Sub-Lateral 104A and the east side up to the city pump station. There are 9 culvert crossings in this lateral ranging from 24" up to 84" diameter culverts. The ditch is an excavated channel, with dense weeds.

Picture 14A: Lateral 104 looking west from North Canal Blvd.
(Reference E-4.1)

Picture 14B: Looking east at culvert 104-2. North Canal Blvd. in the background of picture.
(Reference E-4.1)

Picture 14C: Lateral 104 looking east from North Canal Blvd. Andolsek Park in left background of picture.
(Reference E-4.1)

Picture 14D: Looking east at culvert 104-3
(Reference E-4.1)

Picture 14E: Looking north at culvert 104-4
(Reference E-4.1)

Picture 14F: Looking east at manual sluice gate 3 on east end of culvert 104+6.
(Reference E-4.1)

Picture 14G: Lateral 104 looking south from station 64+50.
(Reference E-4.1)

Sub-Lateral 104A conveys water from the cultivated areas east and west of lateral 104 into lateral 104. The upstream portion of sub-lateral 104A adjacent to the Rienzi canal contains a 24" PVC culvert that is currently blocked by Levert with a piece of plywood, as detailed in Section 3.4.A above, to keep water from lateral 103 (Rienzi Canal) from backing up into the sub-basin. Manual sluice gate 3 is also located in sub-lateral 104A. It is mounted on the the upstream end of a 30" corrugated metal pipe. The sluice gate is normally maintained at approximately 20% open. Levert maintenance personnel have determined through trial and error that this scenario works the best with the current pumping capacity.

There are 3 culvert crossings in this sub-lateral: a 48" diameter RCP under North Canal Blvd., a 36" CMP under the headland road just west of North Canal Blvd., and the 24" PVC culvert from the Rienzi Canal that is blocked. The sub-lateral is accessible to maintenance personnel on the north side via an existing cane field/ gravel headland road. The ditch is an excavated channel, with dense weeds.

Picture 15A: Looking east at culvert 104A-1. North Canal Blvd. in background.
(Reference E-4.1)

Picture 15B: Looking east at culvert 104A-2
(Reference E-4.1)

Picture 15C: Sub-lateral 104A looking west from station 223+00.
(Reference E-4.1)

Picture 15D: Sub-lateral 104A looking east from 223+00. Manual sluice gate 3 on east end of culvert 104+6 shown.
(Reference E-4.1)

Picture 15E: Sub-lateral 104A looking west from station 242+00. Blocked culvert shown. Rienzi Canal in foreground.
(Reference E-4.2)

Sub-Lateral 104B conveys water from the cultivated area east and west of lateral 104 into lateral 104. The sub-lateral is accessible to maintenance personnel on the north side via an existing cane field headland road. The ditch is an excavated channel, with dense weeds.

Picture 16A: Sub-lateral 104B looking east from station 14+50
(Reference E-4.1)

Picture 16B: Sub-lateral 104B looking west from station 14+50
(Reference E-4.1)

Lateral 105 is the 2nd of 2 main conveyance channels that carry storm water to the COT pump station. Lateral 105 captures storm water from the cultivated areas east and west of North Canal Blvd and conveys it north and then east to the COT pump station. The upstream, north-south portion of the lateral is accessible to maintenance personnel on the west side of the lateral while the downstream, east-west portion does not have an existing headland road adjacent to the lateral, but is accessible through the Levert pastures. There are 3 culvert crossings in this lateral ranging from 24" up to 36" diameter culverts. Culvert 105-2 is approximately 80% obstructed with silt which is significantly limiting the conveyance capacity of this lateral. The ditch is an excavated channel, with dense weeds.

Picture 17A: Lateral 105 looking south from station 117+00.
(Reference E-4.1)

Picture 17B: Looking north at culvert 105-1. North Canal Blvd. in background.
(Reference E-4.1)

Picture 17C: Looking south at culvert 105-2 (Buried). North Canal Blvd. in background.
(Reference E-4.1)

Picture 17D: Lateral 105 looking north from station 118+00.
(Reference E-4.1)

Picture 17E: Lateral 105 and city pump station looking west from station 158+00. Lateral 104 entering picture from left side.
(Reference E-4.1)

Picture 17F: Looking north at discharge canal from city pump station to 80 Arpent Canal.
(Reference E-4.1)

Sub-Lateral 105A is a conveyance channel that conveys water from the cultivated areas north of North Canal Blvd. to Lateral 105. The sub- lateral is accessible to maintenance personnel on the west side of the sub-lateral. There are 2 culvert crossings in this lateral, a 30" RCPA that crosses N Canal Blvd and a 54" RCP that crosses the headland road a few feet downstream of the N Canal Blvd crossing. The ditch is an excavated channel, with dense weeds.

Picture 18A: Looking east at culvert 105A-2.
(Reference E-4.1)

Picture 18B: Sub-lateral 105A looking north from station 402+00.
(Reference E-4.1)

Picture 18C: Sub-lateral 105A looking north from station 409+00.
(Reference E-4.1)

SUB-BASIN AREA 2

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.4.B FOR PICTURES) — A

ST. PATRICK STREET

NORTH CANAL BLVD.

36" CMP IS 80% BURIED.

DITCH INV- 2.95

CULVERT 104-1
18" PVC
INV IN- 0.96
INV OUT- 0.54

DITCH INV- 1.35

CULVERT 104-2
24" RCP
INV IN- -1.11
INV OUT- -1.20

CULVERT 104-3
24" PVC
INV IN- -0.25
INV OUT- -0.24

DITCH INV- -0.12

CULVERT 104-4
36" RCP
INV IN- -0.11
INV OUT- -0.57

CULVERT 104-5
24" STEEL
INV IN- -0.66
INV OUT- -0.70

CULVERT 104A-1
48" RCP
INV IN- -1.93
INV OUT- -1.80

CULVERT 104A-2
36" CMP
INV IN- -1.81
INV OUT- -1.86

CULVERT 105A-1
30" RCPA
INV IN- -2.34
INV OUT- -2.40

CULVERT 105A-2
54" RCP
INV IN- -4.01
INV OUT- -4.35

CULVERT 105-1
36" RCP
INV IN- -1.84
INV OUT- -1.84

CULVERT 105-2
36" CMP
INV IN- 1.04
INV OUT- -0.46

DITCH INV- 1.68

CULVERT 105-3
24" STEEL
INV IN- -0.57
INV OUT- -2.24

DITCH INV- -4.27

DITCH INV- -4.57

CULVERT 104-6
30" CMP
INV IN- 0.47
INV OUT- -2.84

CULVERT 104-7
36" STEEL
INV IN- -3.12
INV OUT- -3.12

CULVERT 104-8
84" STEEL
INV IN- -5.16
INV OUT- -5.04

CULVERT 104-9
54" STEEL
INV IN- -4.14
INV OUT- -4.75

CULVERT 104B-1
30" CMP
INV IN- -3.88
INV OUT- -3.88

SUB-LATERAL RECENTLY EXCAVATED TO BETTER DRAIN ERIC ANDOLSEK PARK.

ERIC ANDOLSEK PARK

CITY OF THIBODAUX SEWER TREATMENT PLANT

CITY PUMP STATION

MANUAL SLUICE GATE #3 MOUNTED ON 30" CMP

MATCHLINE

OUTSIDE LIMITS OF STUDY AREA

80 ARPENT CANAL

LATERAL 104 — LATERAL 104A — LATERAL 104B — SUB-LATERAL 104A — SUB-LATERAL 104B — LATERAL 105 — SUB-LATERAL 105A

LATERALS/SUB-LATERALS 104, 104A, 104B 105 AND 105A (FORCED DRAINAGE AREA) SUB-BASIN AREA 4

SCALE IN FEET
400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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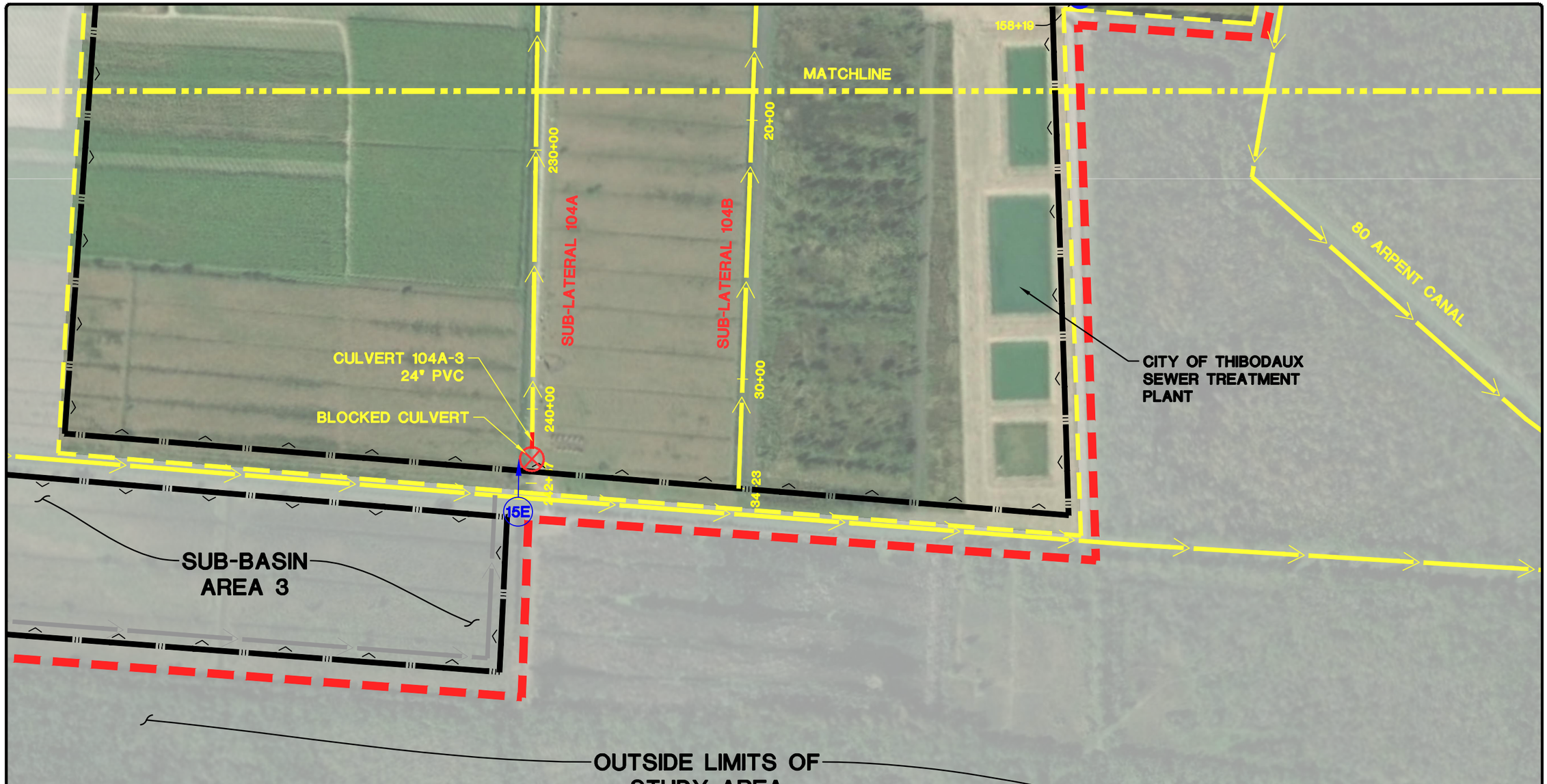

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- PICTURE REFERENCE POINT (SEE SECTION 3.4.B FOR PICTURES) — A

LATERALS/SUB-LATERALS 104, 104A, 104B, 105 AND 105A (FORCED DRAINAGE AREA) SUB-BASIN AREA 4

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TABLE 4: SUB-BASIN AREA 4 LATERAL AND SUB-LATERAL ANALYSIS

NLLD North Lafourche Levee District

			Open Channel Flow - Existing Capacity					Culvert Flow - Existing Capacity			Peak Flow Calculations - Based on Contributing Area		Comparison Analysis	
	Stations	Open Channel/ Culverts	Bottom Width (Ft.)	Side Slope (z:1)	Depth (Ft.)	Longitudinal Slope (%) (** use 0.05)	Mannings's Roughness (n)	Number and Type of Culvert	Mannings's Roughness (n)	Slope (%)	Contributing Area (Acres)	Composite Runoff Curve Number (CN)	Existing Culvert/ Open Channel Capacity (cfs)	25-Yr 24-Hr Peak Flow (cfs)
Lateral 104	0+00 to 13+47	Open Channel	4	2.5	2.5	0.35	0.030				56	83	97	61
	6+32 to 7+18	Culvert 104-1						1-18" PVC	0.011	0.00	31	83	7*	34
	13+47 to 15+10	Culvert 104-2						1-24" RCP	0.011	-0.31	56	83	24	61
	15+10 to 29+46	Open Channel	4	2.5	2.5	**-0.04	0.030				188	83	37*	198
	19+98 to 20+49	Culvert 104-3						1-24" PVC	0.011	-0.03	103	83	14*	108
	27+02 to 27+87	Culvert 104-4						1-36" RCP	0.011	0.79	188	83	38*	200
	29+46 to 30+44	Culvert 104-5						1-24" Steel	0.024	-0.13	188	83	14*	200
	30+44 to 44+16	Open Channel	5	2	3.5	**-0.08	0.030				227	83	75*	225
	43+80 to 44+16	Culvert 104-6						1-30" CMP w/ Sluice Gate	0.024	6.20	188	83	21*	200
	44+16 to 44+62	Culvert 104-7						1-36" Steel	0.024	0.10	227	83	32*	225
	44+62 to 52+46	Open Channel	10	1.5	6	0.24	0.030				319	83	651	307
	52+46 to 52+80	Culvert 104-8						1-84" Steel	0.024	-0.41	319	83	262*	307
	52+80 to 64+70	Open Channel	10	1.5	6	**-0.05	0.030				380	83	297*	346
	59+03 to 59+31	Culvert 104-9						1-54" Steel	0.024	3.05	319	83	89*	307
Sub-Lateral 104A	201+29 to 202+44	Culvert 104A-1						1-48" RCP	0.011	-0.07	21	83	78	29
	202+44 to 203+53	Culvert 104A-2						1-36" CMP	0.024	0.17	21	83	31	29
	203+53 to 222+80	Open Channel	7	1.5	5.5	0.07	0.030				60	83	235	75
Lateral 105	100+00 to 116+53	Open Channel	4	2	2	0.17	0.030				42	83	38*	46
	116+53 to 117+86	Culvert 105-1						1-36" RCP	0.011	0.00	42	83	65	46
	117+86 to 118+28	Culvert 105-2						1-36" CMP	0.024	4.95	42	83	32*	46
	118+28 to 133+59	Open Channel	7	1.1	3	**0.00	0.030				63	83	53*	66
	133+59 to 134+80	Culvert 105-3						1-24" Steel	0.024	4.73	63	83	12*	66
	134+80 to 157+80	OpenChannel	8	1.5	6.5	0.23	0.030				170	83	652	164
Sub-Lateral 105A	400+04 to 401+41	Culvert 105A-1						1-30" RCPA	0.011	0.05	21	83	49	41
	401+41 to 401+87	Culvert 105A-2						1-54" RCP	0.011	1.31	21	83	104	41
	401+87 to 427+75	Open Channel	7	1.5	5.5	0.07	0.030				57	83	235	94

* CULVERT/ OPEN CHANNEL UNDERSIZED TO HANDLE 25-YEAR 24-HOUR PEAK FLOW

NOTE: REFERENCE E-4.1 AND E-4.2 FOR LOCATIONS OF LATERALS, SUB-LATERALS, AND CULVERTS

SECTION 4
Future Development

Upon review of the undeveloped areas within the drainage basin and discussing future plans with the landowners and the city, the following areas will likely see development within the next 10 years (Refer to Exhibit F on the following page for a map showing these locations):

A. *Commercial and Residential Developments along Canal Blvd:* The City of Thibodaux has recently extended utilities along Canal Blvd. in anticipation of future development. Planned developments at this time include a +/- 20-acre church site, (2) +/- 45-acre commercial sites, and a +/- 34-acre school site. Sub-laterals 103D, 103E and Laterals 104 and 105 will be the main drainage outfalls for these developments. These ditches will need to be properly maintained and potentially widening to accommodate this future development.

B. *Northern Expansion of the Rienzi Subdivision*

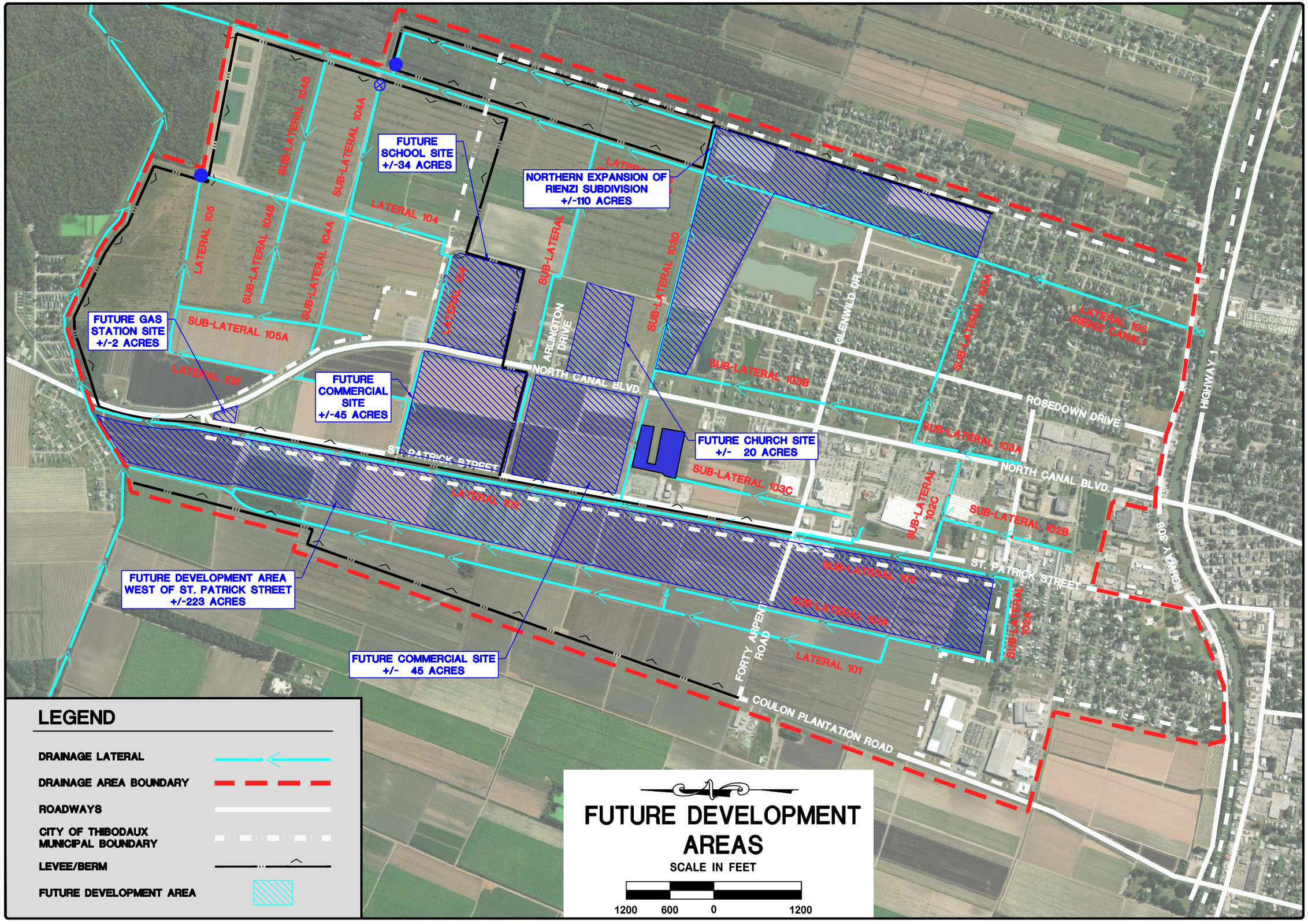
Future phases of the Rienzi Subdivision are planned north of the existing subdivision. Existing elevations in these areas are lower than previous phases, therefore, a larger volume of fill material will be required to bring the subdivision to elevations consistent with previous phases. Lateral 103 (the Rienzi Canal) drains this area. If development continues north, the Rienzi Canal may need to be improved. Furthermore, consideration may need to be given to mitigating flood plain volume losses caused by added fill.

C. *Future Development Area west of St. Patrick Street*

The area west of St. Patrick Street in the northern portions of the drainage basin are naturally higher areas that can accommodate development. If this area is developed, it should drain north into the 80 Arpent Canal via Laterals 101 and 102.

D. *Future Gas Station at Hwy 20 St. Patrick Street Intersection*

The area south of the Hwy 20 - St. Patrick Street Intersection is being evaluated for a potential location for a gas station. This area would likely drain southeast to lateral 105 which flows to the COT pump station.



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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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SHEET	EXHIBIT F

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SECTION 5
Recommended Improvements with Engineer's Cost Estimate

Based on the existing conditions and capacity calculations included in the sections above, there are many required improvements that are evident. These improvements include items such as cleaning out existing culverts and drainage channels, culvert replacements, channel improvements, replacement of existing drainage structures, and increased pumping capacity. The required improvements have been lumped together into several projects based generally on the location of the improvements within the Basin, preliminary cost estimates have been prepared for each project, and the projects have been prioritized based on the severity of the need for the improvements, cost, and anticipated benefits. The proposed projects are listed below by order of the sub-basins that they are included in. The prioritized list of the projects is included in Section 6.

Rienzi - Sub-Basin Area 1 Improvements:

Lateral 101 Culvert Replacements and Ditch Widening to Help Alleviate Flooding in North Thibodaux

Lateral 101 is a sugar cane field ditch that is currently maintained by the farmers of the surrounding property, the Hebert Brothers.

There are several culverts in lateral 101 that are undersized as shown in the capacity calculations (reference Table 1 in section 3.1.B) and there is very little longitudinal slope to the lateral. Replacing undersized culverts and establishing a positive longitudinal slope within the lateral should help to alleviate street flooding issues experienced in the residential areas in north Thibodaux (North 1st St. – North 13th St.).

Recommended channel improvements include excavating a uniform ditch section (5' Bottom Width; 1V:3H Side slopes; 0.05% longitudinal slope) from station 19+57 to station 34+53.

Culvert replacement improvements to this lateral include replacing culverts 101-1 and 101-2 with double barrel 48" culverts, replacing culverts 101-3, 101-4, and 101-5 with double barrel 54" culverts, and replacing culverts 101-6, 101-7, and 101-8 with double barrel 60" culverts.

Refer to the following page for a preliminary cost estimate for the above referenced improvements and Exhibits E-6A.1 through E6A.3 for maps showing the proposed improvements.

Rienzi - Sub-Basin Area 1 Improvements Preliminary Project Budget:

Lateral 101 Culvert Replacements and Ditch Widening to Help Alleviate Flooding in North Thibodaux

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$20,000.00	$20,000.00
Earthwork – Excavate Ditch and Place Material On-Site	LF	1,500	$8.00	$12,000.00
48" RCP/ CMP(UF)	LF	272	$135.00	$36,720.00
54" RCP/ CMP(UF)	LF	280	$220.00	$61,600.00
60" RCP/ CMP(UF)	LF	180	$260.00	$46,800.00
Remove Asphalt Roadway and Base	SY	50	$20.00	$1,000.00
Asphalt Roadway (40 Arpent Road)	TON	15	$125.00	$1,875.00
Roadway Base (Class II) (12" Thick)	SY	50	$55.00	$2,750.00
Aggregate Surfacing (Cane Field Headland)	SY	150	$85.00	$12,750.00
Construction Subtotal				**$195,495.00**
Design + Survey Fees (15%)				$29,324.25
Materials Testing (2.5%)				$4,887.38
Contingencies (25%)				$48,873.75
Estimated Project Budget				**$278,580.38**

OUTSIDE LIMITS OF STUDY AREA

COULON PLANTATION ROAD

CAMECO INDUSTRIES, INC.

DITCH WIDENING AREA
STA 19+57 TO 34+53

CULVERT 101-5
EXISTING: 48" RCP
PROPOSED: (2)-54" RCP/CMPUF

CULVERT 101-3
EXISTING: 48" CMP
PROPOSED: (2)-54" RCP/CMPUF

CULVERT 101-4
EXISTING: 48" CMP
PROPOSED: (2)-54" RCP/CMPUF

CULVERT 101-2
EXISTING: (1)-36" CMP
PROPOSED: (2)-48" RCP/CMPUF

CULVERT 101-1
EXISTING: (1)-18" CMP AND
(1)-24" CMP
PROPOSED: (2)-48" RCP/CMPUF

20+00

LATERAL 101

30+00

40+00

LATERAL 101

0+00

10+00

LATERAL 101

COULON ROAD

NORTH 10TH ST.

SUB-BASIN AREA 2

FORTY ARPENT ROAD

MATCHLINE "A"

ST. PATRICK STREET

WAL-MART

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 1 IMPROVEMENTS: LATERAL 101 CULVERT REPLACEMENTS AND DITCH WIDENING TO HELP ALLEVIATE FLOODING IN NORTH THIBODAUX

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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ISSUE DATE	10/3/2018
PROJECT NO.	17-398
SHEET	E-5.1

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OUTSIDE LIMITS OF
STUDY AREA

CULVERT 101-6
EXISTING: 48" CMP
PROPOSED: (2)-60" RCP/CMPUF

CULVERT 101-7
EXISTING: 54" STEEL
PROPOSED: (2)-60" RCP/CMPUF

40+00
LATERAL 101
50+00
60+00
LATERAL 101
70+00
80+00
90+00

MATCHLINE 'A'

MATCHLINE 'B'

SUB-BASIN AREA 2

ST. PATRICK STREET

ELECTRIC
SUB-STATION

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 1 IMPROVEMENTS: LATERAL 101 CULVERT REPLACEMENTS AND DITCH WIDENING TO HELP ALLEVIATE FLOODING IN NORTH THIBODAUX

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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PROJECT NO.	17-398
SHEET	E-5.2

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OUTSIDE LIMITS OF STUDY AREA

CULVERT 101-8
EXISTING: 60" STEEL (OBSTRUCTED)
PROPOSED: (2)-60" RCP/CMPUF

90+00
100+00
110+00
120+00
125+23
LATERAL 101

80 ARPENT CANAL

MATCHLINE "B"

SUB-BASIN AREA 2

OE
ST. PATRICK STREET

NORTH CANAL BLVD

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 1 IMPROVEMENTS: LATERAL 101 CULVERT REPLACEMENTS AND DITCH WIDENING TO HELP ALLEVIATE FLOODING IN NORTH THIBODAUX

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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Rienzi - Sub-Basin Area 2 Improvements:

Lateral 102 Culvert Replacement, Ditch Widening, and Continued Monitoring

Lateral 102 drains a large area of commercial and residential property in the southwest portion of the drainage basin. As mentioned previously, the roadways in this area become inundated during heavy rain events.

It was determined during field investigations that Lateral 102 is significantly silted in at several locations where cane field culverts flow into the lateral from the west. Clearing the lateral of these blockages would drop the standing water level of the lateral upstream of the improvements, and provide better conveyance capabilities. Furthermore, the section of Lateral 102, south of the St. Patrick St/Forty Arpent Rd Intersection, is currently overgrown and inaccessible to parish maintenance personnel. Access is further inhibited by the proximity of the concrete mixing facility and the overhead electrical lines at this intersection. This area should be cleared of all trees and canal blockages to improve the conveyance capability of the lateral and so that city employees can better maintain and monitor this area for drainage obstructions. Maintenance personnel should also include monitoring of this lateral at all cane field culverts for siltation in their normal maintenance routine, and clear the lateral of blockages as they occur.

Recommended channel improvements include excavating uniform sections as follows; 3' Bottom Width / 1V:3H Side slopes / 0.05% longitudinal slope from station 0+00 to station 11+09; 5' Bottom Width / 1V:3H Side slopes / 0.10% longitudinal slope from station 30+32 to station 85+30; 12' Bottom Width / 1V:3H Side slopes / 0.10% longitudinal slope from station 85+96 to station 126+89.

Recommended culvert improvements include replacing culverts 102-1, 102-2, and 102-3 with 1-48" culvert at a 0.05% slope, adding one 54" culvert at a 0.10% slope to culvert 102-4, and adding 2 additional 60" CMP's at a 0.10 % to culverts 102-5 and 102-6.

Refer to the following page for a preliminary cost estimate for the above referenced improvements and Exhibits E-6B.1 through E6B.3 for maps showing the proposed improvements.

Rienzi - Sub-Basin Area 2 Improvements Preliminary Project Budget:

Lateral 102 Culvert Replacement, Ditch Widening, and Continued Monitoring

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$20,000.00	$20,000.00
Tree Clearing	Acre	0.2	$10,000.00	$2,000.00
Earthwork – Excavate Ditch and Place Material On-Site	LF	11,000	$12.00	$132,000.00
48" RCP/ CMP(UF)	LF	115	$135.00	$15,525.00
54" RCP/ CMP(UF)	LF	50	$220.00	$11,000.00
60" RCP/ CMP(UF)	LF	160	$260.00	$41,600.00
Remove Asphalt Roadway and Base	SY	50	$20.00	$1,000.00
Asphalt Roadway (40 Arpent Road)	TON	15	$125.00	$1,875.00
Roadway Base (Class II) (12" Thick)	SY	50	$55.00	$2,750.00
Aggregate Surfacing (Cane Field Headland)	SY	200	$85.00	$17,000.00
Construction Subtotal				**$244,750.00**
Design + Survey Fees (15%)				$36,712.50
Materials Testing (2.5%)				$6,118.75
Contingencies (25%)				$61,187.50
Estimated Project Budget				**$348,768.75**

SUB-BASIN AREA 1

CULVERT 102-2
EXISTING: 36" CMP
PROPOSED: 48" RCP/CMPUF

CULVERT 102-3
EXISTING: 36" RCPA
PROPOSED: 48" RCP/CMPUF

RECOMMENDED DITCH
WIDENING AREA 1
STA 0+00 TO 11+09

CULVERT 102-4
EXISTING: 54" CMPA
PROPOSED: 1-54" CMPA
1-54" RCP/CMPUF

0+00
10+00
20+00
30+00
LATERAL 102
0+00

FORTY ARPENT ROAD

MATCHLINE "A"

ST. PATRICK STREET

CULVERT 102-1
EXISTING: 36" CMP
PROPOSED: 48" RCP/CMPUF

RIENZI DRIVE

JAMES RIVERE ST.

RECOMMENDED DITCH
WIDENING AREA 2
STA 30+32 TO 85+30

WAL-MART

LOWES

ACADEMY

BIG LOTS

SUB-BASIN AREA 3

THIBODAUX CIVIC CENTER

NORTH CANAL BLVD.

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 2 IMPROVEMENTS: LATERAL 102 CULVERT REPLACEMENT, DITCH WIDENING AND CONTINUED MONITORING

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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PROJECT NO.	17-398
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SUB-BASIN AREA 1

MATCHLINE "A"

MATCHLINE "B"

RECOMMENDED DITCH
WIDENING AREA 2
STA 30+32 TO 85+30

CULVERT 102-5
EXISTING: (2)-60" CMP
PROPOSED: (4)-60" CMP

50+00

60+00

70+00

80+00

LATERAL 102

ST. PATRICK STREET

LA CONTRACTOR
ENTERPRISE

MANUAL SLUICE GATE 2

ELECTRIC SUBSTATION

REGIONAL
DETENTION
POND

30

30

SUB-BASIN AREA 3

NORTH CANAL BLVD.

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 2 IMPROVEMENTS: LATERAL 102 CULVERT REPLACEMENT, DITCH WIDENING AND CONTINUED MONITORING

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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SUB-BASIN AREA1

MATCHLINE "B"

RECOMMENDED DITCH
WIDENING AREA 3
STA 85+96 TO 126+89

80 ARPENT CANAL

90+00

100+00

LATERAL 102

110+00

120+00

128+91

ST. PATRICK STREET

CULVERT 102-6
EXISTING: (2)-60" CMP
PROPOSED: (4)-60" CMP

NORTH CANAL BLVD.

SUB-BASIN AREA 3

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 2 IMPROVEMENTS: LATERAL 102 CULVERT REPLACEMENT, DITCH WIDENING AND CONTINUED MONITORING

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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Rienzi - Sub-Basin Area 2 Improvements:

Sub-Lateral 102B Culvert Improvements

Sub-Lateral 102B drains Rienzi drive as well as the adjacent commercial properties. The capacity of the existing 42" RCPA culverts in Lateral 102B is not adequate to handle the peak flows from the contributing drainage area. During significant rain events, Rienzi Drive and the empty lot between Rienzi Drive and James Riviere St become inundated. In addition, culvert 102B-2 is partially buried, further limiting conveyance capabilities of the sub-lateral.

Recommended culvert improvements include adding a second 42" RCPA to culverts 102B-1, 102B-2, and 102B-3.

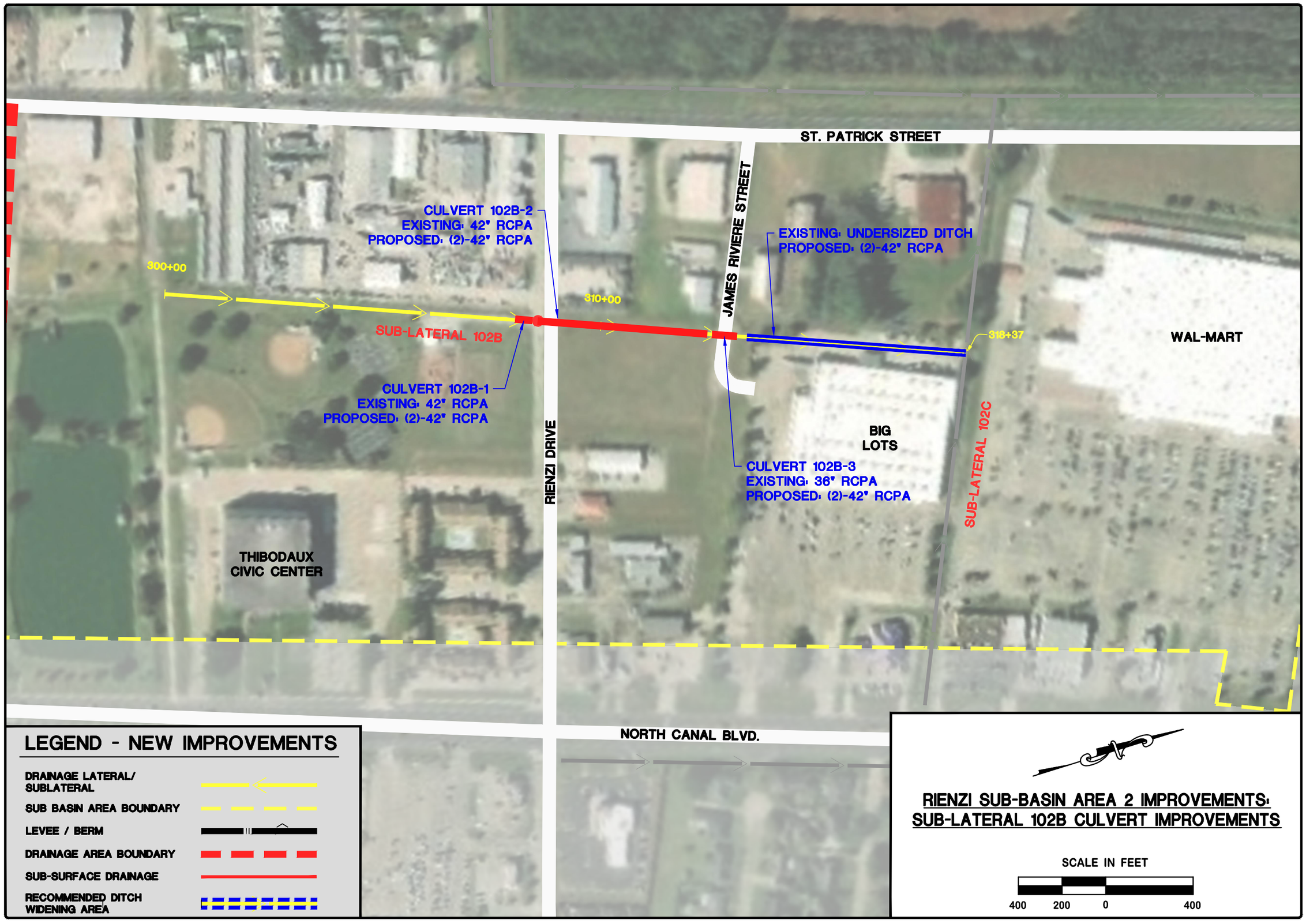
In addition, since there is limited room for long term maintenance and channel improvements behind Big Lots, double barrel 42" RCPA culverts are recommended to replace the undersized channel from station 313+22 to 318+35.

Refer to the following page for a preliminary cost estimate for the above referenced improvements and Exhibit E-6C for a map showing the proposed improvements.

Rienzi - Sub-Basin Area 2 Improvements Preliminary Project Budget:

Sub-Lateral 102B Culvert Cleaning & Culvert Additions

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$15,000.00	$15,000.00
42" RCPA/ CMPA(UF)	LF	1050	$130.00	$136,500.00
Catch Basins / Junction Boxes	EA	5	$10,000.00	$50,000.00
Remove Concrete Roadway and Base	SY	120	$20.00	$2,400.00
Concrete Roadway (Rienzi Drive, James Riviere St.)	SY	120	$60.00	$7,200.00
Roadway Base (Class II) (12" Thick)	SY	120	$55.00	$6,600.00
Construction Subtotal				**$217,700.00**
Design + Survey Fees (15%)				$32,655.00
Materials Testing (2.5%)				$5,442.50
Contingencies (25%)				$54,425.00
Estimated Project Budget				**$310,222.50**



LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 2 IMPROVEMENTS: SUB-LATERAL 102B CULVERT IMPROVEMENTS

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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PROJECT NO.	17-398
SHEET	E-5.7

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Rienzi - Sub-Basin Area 2 Improvements:

Sub-Lateral 102D Culvert Replacement and Ditch Widening

Sub-Lateral 102D is the outfall ditch for the Wal-Mart Detention Pond. This Sub-lateral conveys water north to the St. Patrick Street / Forty Arpent Road Intersection. Proposed improvements to this sub-lateral include channel widening and culvert replacements.

Recommended channel improvements include excavating a uniform section, 4' Bottom Width / 1V:3H Side slopes / 0.2% longitudinal slope from station 603+14 to 609+00.

Recommended culvert improvements include removing culvert 102D-2 (24" cmp) and replacing it with a 48" culvert.

An alternate option would be to continue Sub-Lateral 102D west to tie into Lateral 102. This alternate tie in location would eliminate the need for the channel improvements, the replacement of culvert 102D-2, and would provide additional connectivity between sub-lateral 102D and Lateral 102.

Refer to the following page for a preliminary cost estimate for the above referenced improvements, and Exhibit E-6D for a map showing the proposed improvements.

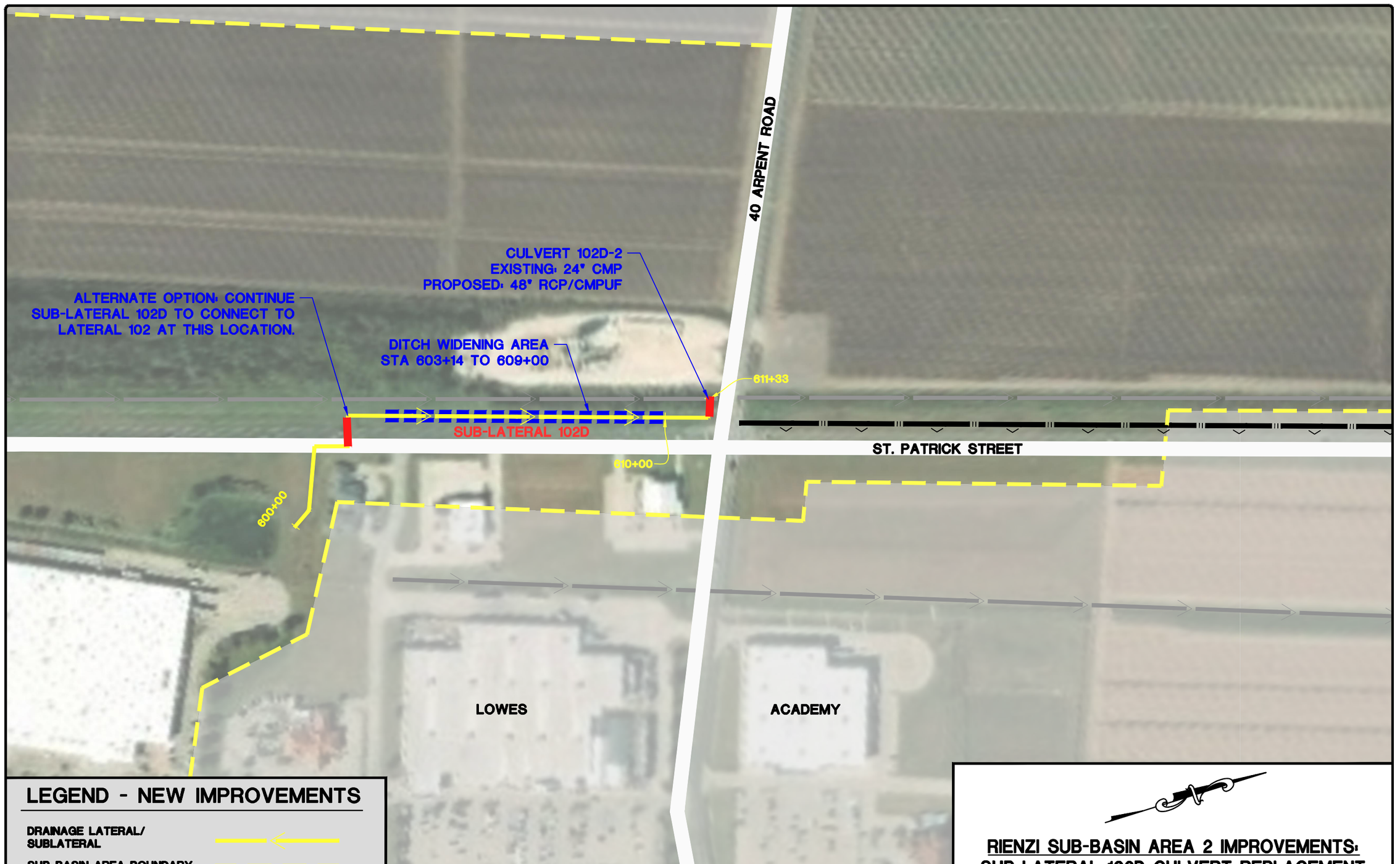
Rienzi - Sub-Basin Area 2 Improvements Preliminary Project Budget:

Sub-lateral 102D Culvert Replacement & Ditch Widening

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$7,500.00	$7,500.00
Earthwork – Excavate Ditch and Place Material On-Site	LF	586	$5.00	$2,930.00
48" RCP/ CMP(UF)	LF	30	$135.00	$4,050.00
Construction Subtotal				**$14,480.00**
Design + Survey Fees (15%)				$2,172.00
Materials Testing (2.5%)				$362.00
Contingencies (25%)				$3,620.00
Estimated Project Budget				**$20,634.00**

Estimated Project Budget (Alternate Option)

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$2,500.00	$2,500.00
Earthwork – Excavate Ditch and Place Material On-Site	CY, NS	100	$5.00	$5,000.00
Construction Subtotal				**$7,500.00**



LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 2 IMPROVEMENTS: SUB-LATERAL 102D CULVERT REPLACEMENT AND DITCH WIDENING

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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Rienzi - Sub-Basin Area 3 Improvements:

Sub-Lateral 103A Sub-Surface Drainage Improvements

Sub-Lateral 103A is Exhibiting bank stability issues that are destabilizing adjacent residential lots. Proposed improvements within this sub-lateral include installing culverts to replace sections of the sub-lateral that are currently exhibiting stability issues.

Recommended culvert improvements for channel stability issues include installing double barrel 60" culverts in sub-lateral 103-A from North Canal Blvd to the Rienzi Canal (Lateral 103).

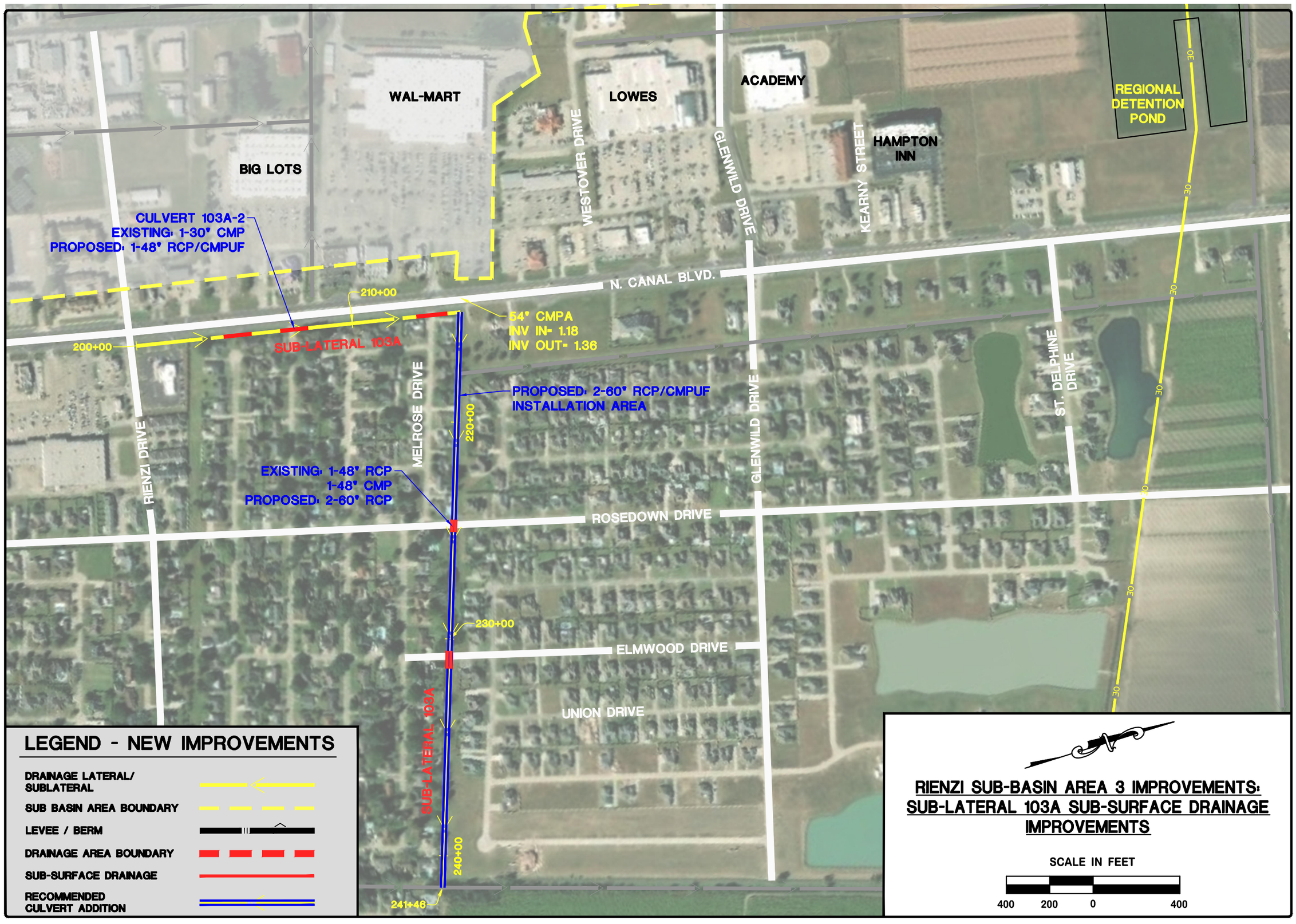
Culvert 103A-2 (30" cmp) is undersized to handle the peak flow of the contributing area and should be replaced with a 48" culvert.

Refer to the following page for a preliminary cost estimate for the above referenced improvements and Exhibit E-6E for a map showing the proposed improvements.

Rienzi - Sub-Basin Area 3 Improvements Preliminary Project Budget:

Sub-lateral 103A Subsurface Drainage Improvements

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$50,000.00	$50,000.00
48" RCP/ CMP(UF)	LF	90	$135.00	$12,150.00
60" RCP/ CMP(UF)	LF	5234	$260.00	$1,360,840.00
Catch Basin Junction	EA	3	$20,000.00	$60,000.00
Remove Concrete Roadway and Base	SY	150	$20.00	$3,000.00
Concrete Roadway (Belmont, Rosedown Dr., and Elmwood Dr.)	SY	150	$125.00	$18,750.00
Roadway Base (Class II) (12" Thick)	SY	150	$55.00	$8,250.00
Construction Subtotal				**$1,512,990.00**
Design + Survey Fees (15%)				$226,948.50
Materials Testing (2.5%)				$37,824.75
Contingencies (25%)				$378,247.50
Estimated Project Budget				**$2,156,010.75**



LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED CULVERT ADDITION

RIENZI SUB-BASIN AREA 3 IMPROVEMENTS: SUB-LATERAL 103A SUB-SURFACE DRAINAGE IMPROVEMENTS

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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Rienzi - Sub-Basin Area 3 Improvements:

St. Patrick Street Roadside Ditch Re-Grading and Cross Culvert Installation

The roadside ditch along the west side of St. Patrick St does not currently have an outlet. During rain events, the water in the roadside ditch has to stage up and overtop St Patrick St to get to the roadside ditch on the east side of St Patrick St and sub-lateral 103D or lateral 104. During a heavy rain event in 2017 the roadside ditch overtopped St Patrick St, prompting the COT to cut the earthen berm between the St Patrick St roadside ditch and lateral 102, to alleviate the flooding over St Patrick St. This is not a viable long-term solution, since the property to the west of St Patrick St is higher than the property in Sub-Basin areas 3 and 4, and runoff from Sub-Basin Area 2 would inundate Sub-Basin Areas 3 and 4 through the berm opening.

Recommended improvements include re-grading the roadside ditch to low points that line up with Sub-Lateral 103D and Lateral 104. There is currently an existing catch basin and 48" diameter cross drain culvert under St Patrick St that can be utilized to convey water to sub-lateral 103D. A new 24" cross drain pipe should be installed under St. Patrick Street to tie into Lateral 104.

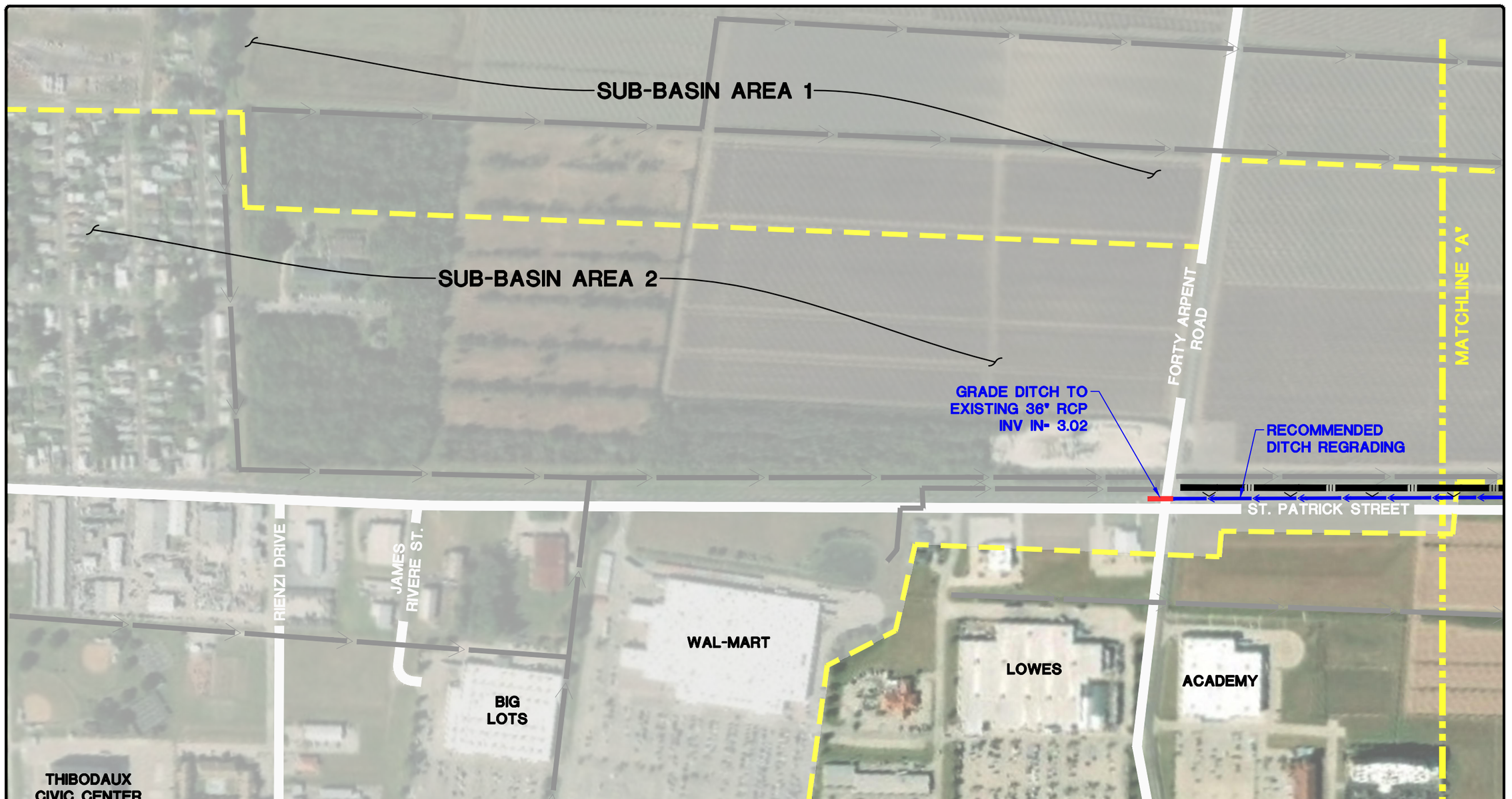
The existing cut-through in the berm that was excavated by the COT should be backfilled, and a high-point created in the St Patrick St roadside ditch to prevent water from backing into Sub-Basin Area 4 from the 80 Arpent Canal during high-tide events.

Refer to the following page for a preliminary cost estimate for the above referenced improvements and Exhibits E-6F.1 through E-6F.3 for maps showing the proposed improvements.

Rienzi - Sub-Basin Area 3 Improvements Preliminary Project Budget:

St. Patrick Street Roadside Ditch Re-Grading and Cross Culvert Installation
Estimated Project Budget

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$20,000.00	$20,000.00
Regrading Existing Roadside Ditch	LF	8000	$10.00	$80,000.00
Repair Existing Berm Cut-Through	LS	1	$2,500.00	$2,500.00
Fill Existing Hwy 20 Roadside Ditch near 80 Arpent Canal	LS	1	$5,000.00	$5,000.00
24" RCP/ CMP(UF)	LF	60	$80.00	$4,800.00
Remove Asphalt Roadway and Base	SY	50	$20.00	$1,000.00
Asphalt Roadway (St. Patrick St.)	Ton	15	$125.00	$1,875.00
Roadway Base (Class II)(12" Thick)	SY	50	$55.00	$2,750.00
Construction Subtotal				**$117,925.00**
Design + Survey Fees (15%)				$17,688.75
Materials Testing (2.5%)				$2,948.13
Contingencies (25%)				$29,481.25
Estimated Project Budget				**$168,043.13**



LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH REGRADING
- RECOMMENDED CULVERT ADDITION

RIENZI SUB-BASIN AREA 3 IMPROVEMENTS:
ST. PATRICK STREET ROADSIDE DITCH
RE-GRADING AND CROSS CULVERT INSTALLATION

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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SUB-BASIN AREA 1

SUB-BASIN AREA 2

MATCHLINE "A"

MATCHLINE "B"

MANUAL SLUICE GATE 2

RECOMMENDED DITCH REGRADING

EXISTING EMERGENCY CUT THROUGH OF BERM.

ST. PATRICK STREET

UTILIZE EXISTING CATCH BASIN AND 48" CMP TO DRAIN ST. PATRICK STREET WESTERN ROAD SIDE DITCH.

PROPOSED: 24" RCP CULVERT UNDER ST. PATRICK STREET

LA CONTRACTOR ENTERPRISE

ELECTRIC SUBSTATION

REGIONAL DETENTION POND

SUB-LATERAL 103D

LATERAL 104

NORTH CANAL BLVD.

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH REGRADING
- RECOMMENDED CULVERT ADDITION

RIENZI SUB-BASIN AREA 3 IMPROVEMENTS:
ST. PATRICK STREET ROADSIDE DITCH
RE-GRADING AND CROSS CULVERT INSTALLATION

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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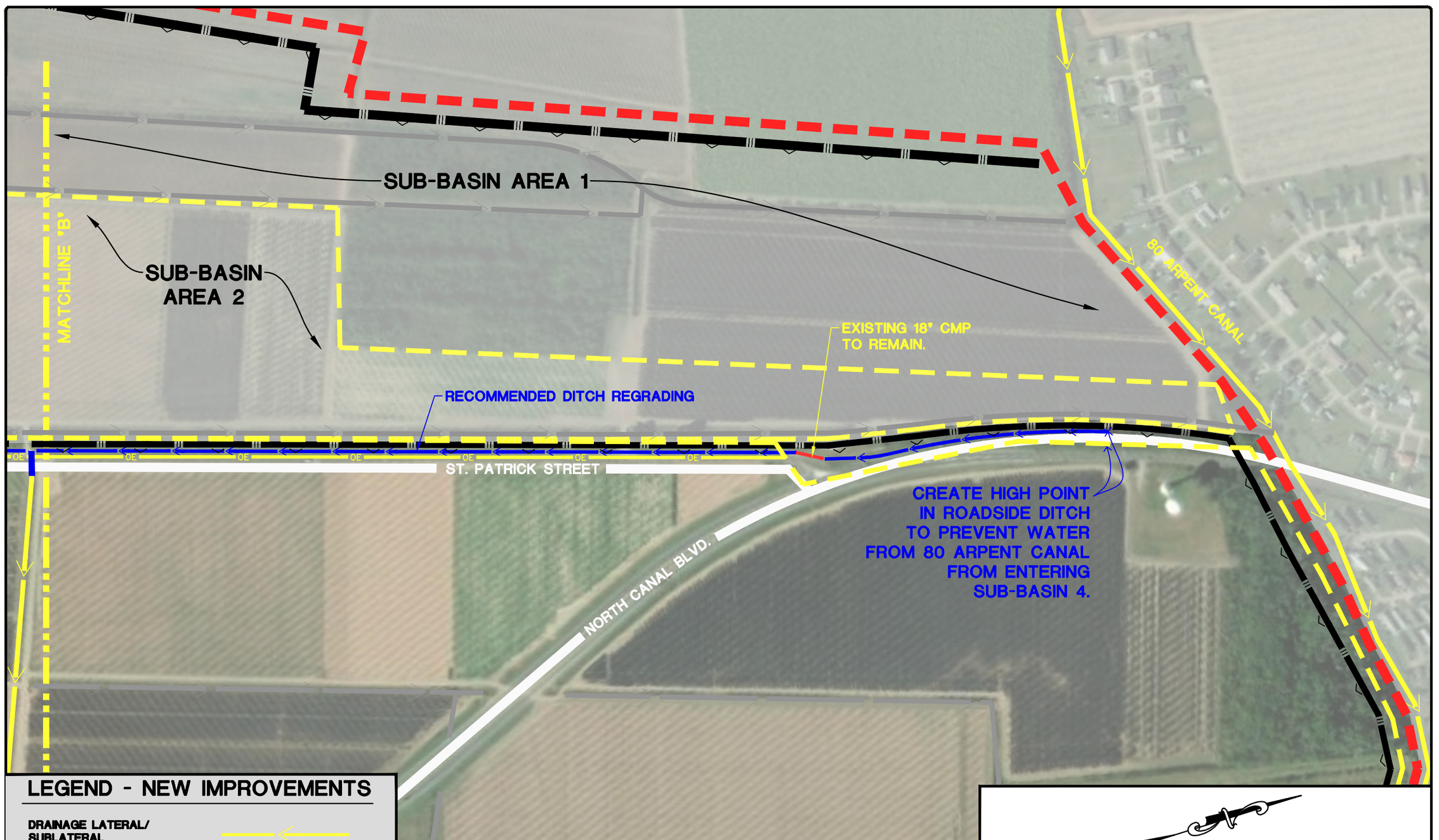

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH REGRADING
- RECOMMENDED CULVERT ADDITION

RIENZI SUB-BASIN AREA 3 IMPROVEMENTS:
ST. PATRICK STREET ROADSIDE DITCH
RE-GRADING AND CROSS CULVERT INSTALLATION

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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PROJECT NO.	17-398
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Rienzi - Sub-Basin Area 3 Improvements:

Sub-lateral 103D and 103E Culvert Replacements and Ditch Widening

Sub-lateral 103D conveys stormwater flowing from the regional detention pond and the surrounding sugar cane fields to the east side of N Canal Blvd, and into the Rienzi Canal. Over time, from station 500+30 to 513+38, the channel has silted in, raising the standing water level of the regional detention pond, thus reducing its detention capacity.

Recommended channel improvements in sub-lateral 103D include excavating a uniform section (8' Bottom Width; 1V:3H Side slopes; 0.08% longitudinal slope) from station 500+00 to station 513+38, and establishing the invert of the channel to match culvert 103D-3 under N Canal Blvd. This would provide an additional +/- 0.50' of freeboard, or approximately 6,196 CY of storage, to the regional detention pond.

Based on capacity calculations, sub-lateral 103E does not currently have the capacity to carry the contributing peak area flow. Recommended channel improvements in this channel include excavating a uniform section (3' Bottom Width; 1V:3H Side slopes; 0.05% longitudinal slope) from station 608+50 to station 613+40 and then from station 614+08 to 621+58 to a uniform section of 5' Bottom Width, 1V:3H Side slopes, and 0.05% longitudinal slope.

Culvert improvements include replacing culverts 103D-2 with 1-60" culvert to provide the required capacity.

The invert of culvert 103E-2 is approximately 1.53' higher than the next upstream culvert (103E-1), limiting the conveyance capacity of the channel. Culvert 103E-2 should be either removed and re-laid or replaced with a new 48" culvert (depending on the condition of the existing culvert), at an invert elevation consistent with the upstream and downstream culverts.

Refer to the following page for a preliminary cost estimate for the above referenced improvements and Exhibit E-6G for a map showing the proposed improvements.

Rienzi - Sub-Basin Area 3 Improvements Preliminary Project Budget:

Sub-laterals 103D and 103 E Channel and Culvert Improvements

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$20,000.00	$20,000.00
Earthwork – Excavate Ditch and Place Material On-Site	LF	2,600	$8.00	$20,800.00
Relaying Culvert	LF	90	$25.00	$2,250.00
48" RCP/ CMP(UF)	LF	135	$260.00	$35,100.00
Remove Concrete Roadway and Base	SY	50	$20.00	$1,000.00
Concrete Roadway (Swanson Drive)	SY	50	$60.00	$3,000.00
Roadway Base (Class II) (12" Thick)	SY	50	$55.00	$2,750.00
Construction Subtotal				**$84,900.00**
Design + Survey Fees (15%)				$12,735.00
Materials Testing (2.5%)				$2,122.50
Contingencies (25%)				$21,225.00
Estimated Project Budget				**$120,982.50**

SUB-BASIN AREA 2

ST. PATRICK STREET

SLUICE GATE 2

500+00

CULVERT 103D-2
EXISTING: 42" CMP
PROPOSED: 48" RCP/CMPUF

REGIONAL DETENTION POND

30

DITCH WIDENING AREA
STA 500+30 TO 513+38

510+00

600+00

SUB-LATERAL 103E

SUB-BASIN AREA 4

OE

N. CANAL BLVD.

ARLINGTON DRIVE

610+00

DITCH WIDENING AREA
STA 608+50 TO 613+40

CULVERT 103E-2
RE-LAY 48" CMP TO ENSURE POSITIVE DRAINAGE.

LATERAL 104

SWANSON DRIVE

SUB-LATERAL 103D

620+00

DITCH WIDENING AREA 2
STA 614+08 TO 621+58

GLENWILD DRIVE

ELECTRICAL TRANSMISSION LINES

ROSEDOWN DRIVE

530+00

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 3 IMPROVEMENTS: SUB-LATERAL 103D AND 103E CULVERT REPLACEMENTS AND DITCH WIDENING

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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Rienzi - Sub-Basin Area 4 Pumping Capacity Improvements:

Pump Capacity, Drainage Structure, Channel, and Culvert Improvements

Sub-Basin Area 4 is a forced drainage area that is currently served by two electric pumps, one 18" and one 20". As discussed in section 3.4.A of the report, Levert land's maintenance representative currently has to regulate the upstream flow of water by way of manual sluice gate 3 in Lateral 104, to keep the lower lying areas of Sub-Basin Area 4 from becoming inundated with water, because the existing pumping capacity is not adequate.

An additional 20" pump would provide adequate capacity for the sub-basin and would eliminate the need to regulate stormwater through manual sluice gate 3. Since the two existing pumps are electric, it is recommended that the new 20" pump be diesel operated so that all pumping capacity is not lost in the event of a power outage.

The existing make-shift plywood blocking on culvert 104A-3 should be replaced with a new sluice gate to, provide reliable backflow protection from Lateral 103 (Rienzi Canal).

Recommended channel improvements within lateral 104 include excavating uniform sections as follows: 8' Bottom Width / 1V:3H Side slopes / 0.10% longitudinal slope from station 15+10 to station 29+46; 10' Bottom Width / 1V:3H Side slopes / 0.10% longitudinal slope from station 30+44 to station 44+16; and 10' Bottom Width / 1V:3H Side slopes / 0.10% longitudinal slope from station 52+80 to station 64+70.

Recommended culvert improvements due to inadequate capacity include replacing culvert 104-3 with a 54" culvert, culverts 104-4, 104-5, 104-6, and 104-7 with double barrel 54" culverts, and culverts 104-8 and 104-9 with double barrel 60" culverts.

The addition of a new 36" culvert upstream of culvert 104-2 is recommended to better distribute the flow across N Canal Blvd between Laterals 104 and 105.

Refer to the following page for a preliminary cost estimate for the above referenced improvements and Exhibits E-6H.1 through E6H.2 for maps showing the proposed improvements.

Rienzi - Sub-Basin Area 4 Pumping Capacity Improvements Preliminary Project Budget:

Pump Capacity, Drainage Structure, Channel, and Culvert Improvements

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$30,000.00	$30,000.00
Additional 20" Diesel Pump	LS	1	$200,000.00	$200,000.00
Earthwork – Excavate Ditch and Place Material On-Site	LF	4,000	$13.00	$52,000.00
36" RCP/ CMP(UF)	LF	30	$110.00	$3,300.00
48" RCP/ CMP(UF)	LF	150	$135.00	$20,250.00
54" RCP/ CMP(UF)	LF	430	$220.00	$94,600.00
60" RCP/ CMP(UF)	LF	200	$260.00	$52,000.00
Remove Asphalt Roadway and Base (Canal Blvd)	SY	270	$20.00	$5,400.00
Asphalt Roadway (Canal Blvd)	TON	100	$125.00	$12,500.00
Roadway Base (Class II) (12" Thick)	SY	270	$55.00	$14,850.00
24" Slide Gate	EA	1	$10,000.00	$10,000.00
Traffic Control Devices	LS	1	$10,000.00	$10,000.00
Aggregate Surfacing (Cane Field Headland)	SY	100	$85.00	$8,500.00
Construction Subtotal				**$513,400.00**
Design + Survey Fees (15%)				$77,010.00
Materials Testing (2.5%)				$12,835.00
Contingencies (25%)				$128,350.00
Estimated Project Budget				**$731,595.00**

SUB-BASIN AREA 2

ST. PATRICK STREET

NORTH CANAL BLVD.

OE

0+00

LATERAL 104

10+00

RECOMMENDED CULVERT
1-36" RCP/CMPUF

CULVERT 105-2
EXISTING: 31" CMP
PROPOSED: 48" RCP/CMPUF
NOTE: CULVERT 105-2
REPLACEMENT INCLUDED IN
PROJECT J.

ERIC
ANDOLSEK
PARK

DITCH WIDENING
AREA 1
STA 15+10
TO 29+46

20+00

CULVERT 104-3
EXISTING: 24" RCP
PROPOSED: 54" RCP/CMPUF

CULVERT 104-4
EXISTING: 36" RCP
PROPOSED: 2-54" RCP/CMPUF

CULVERT 104-5
EXISTING: 36" CMP
PROPOSED: 2-54" RCP/CMPUF

LATERAL 104

30+00

40+00

DITCH WIDENING
AREA 2
STA 30+44
TO 44+16

SUB-LATERAL 104A

50+00

CULVERT 104-6
EXISTING: 30" CMP
PROPOSED: 2-54"
RCP/CMPUF

CULVERT 104-7
EXISTING: 36" CMP
PROPOSED: 2-54"
RCP/CMPUF

DITCH
WIDENING
AREA 3

MATCHLINE

CULVERT 104-8
EXISTING: 84" CMP
PROPOSED: 2-60" RCP/CMPUF

DITCH WIDENING
AREA 3
STA 52+80
TO 64+70

60+00

65+62

LATERAL 104

CULVERT 104-9
EXISTING: 54" CMP
PROPOSED: 2-60"
RCP/CMPUF

80 ARPENT CANAL

CITY PUMP STATION
EXISTING: 18" AND 20"
ELECTRIC PUMPS
PROPOSED: ADDITIONAL
20" DIESEL PUMP

OUTSIDE LIMITS OF
STUDY AREA

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 4 PUMPING CAPACITY IMPROVEMENTS: PUMP CAPACITY, DRAINAGE STRUCTURE, CHANNEL, AND CULVERT IMPROVEMENTS

SCALE IN FEET

400 200 0 400

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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MATCHLINE

REPLACE PLYWOOD BLOCKING WITH NEW SLUICE GATE 4

CULVERT 104A-3
1-24" PVC

80 ARPENT CANAL

CITY OF THIBODAUX SEWER TREATMENT PLANT

SUB-BASIN AREA 3

OUTSIDE LIMITS OF STUDY AREA

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 4 PUMPING CAPACITY IMPROVEMENTS: PUMP CAPACITY, DRAINAGE STRUCTURE, CHANNEL, AND CULVERT IMPROVEMENTS

SCALE IN FEET

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Rienzi - Sub-Basin Area 4 Expansion and Improvements:

Force Drainage Area Expansion and Associated Upgrades

Sub-Basin Area 4 currently consists of approximately 609 acres which drains to the existing COT maintained pumps. Sub-lateral 103E, located south of Sub-Basin Area 4, drains approximately 212 acres of Sub-Basin Area 3 to the Rienzi Canal. During heavy rain events, the Rienzi Canal (Lateral 103), stages up and begins to back-flow through sub-lateral 103E into Sub-Basin Area 3, and subsequently makes its way to Sub-Basin Area 4, which pumps are already under capacity. Incorporating the 212-acre sub-lateral 103E drainage area into Sub-Basin Area 4 by adding a sluice gate and culvert at the downstream end of sub-lateral 103E where it ties into the Rienzi canal at station 641+26, would prevent the Rienzi canal from backing up through sub-lateral 103E during heavy rain events. The added drainage area to Sub-Basin Area 4 would require additional pumping capacity beyond the added 20" pump included in the Sub-Basin Area 4 improvement project. The added drainage area would also require work to the existing berms/ levees and a means for emergency overflow from the gravity drainage area to the forced drainage area.

In lieu of the added 20" pump, a 30" diesel pump would be recommended.

In order to convey runoff from the added area, the portion of sub-lateral 103E to the east of N Canal Blvd would need to be re-graded to drain west to Rosedown Dr, and then a new lateral would need to be excavated along the east side of Rosedown Dr to tie into Lateral 104. The new lateral should have a minimum 5' wide bottom, with 1V:3H Side slopes, 0.10% longitudinal slope.

Lateral 104 should be improved to provide a minimum 13' wide bottom width, with 1V:3H side slopes, and a 0.10% longitudinal slope from station 30+44 to the pumps at station 64+70.

Recommended culvert improvements include replacing 104-6, 104-7, 104-8 and 104-9 with triple barrel 72" culverts. These culvert improvements would be in lieu of those recommended in the Sub-Basin Area 4 improvements.

Refer to the following page for a preliminary cost estimate for the above referenced improvements and Exhibits E-6I for a map showing the proposed improvements.

Rienzi - Sub-Basin Area 4 Expansion and Improvements Preliminary Project Budget:

Force Drainage Area Expansion and Associated Upgrades

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$30,000.00	$30,000.00
Additional 30" Diesel Pump	LS	1	$300,000.00	$300,000.00
Earthwork – Excavate New Ditch and Place Material On-Site	LF	3,500	$13.00	$45,500.00
Earthwork – Widen Existing Ditch and Place Material On-Site	LF	3,450	$13.00	$44,850.00
Earthwork - Upgrades to Levees	LS	1	$50,000.00	$50,000.00
72" RCP/ CMP(UF)	LF	600	$310.00	$186,000.00
Sluice Gates for Emergency Overflow	EA	2	$20,000.00	$40,000.00
24" Sluice Gate and Culvert	EA	1	$10,000.00	$10,000.00
Construction Subtotal				**$706,350.00**
Design + Survey Fees (15%)				$105,952.50
Materials Testing (2.5%)				$17,658.75
Contingencies (25%)				$176,587.50
Estimated Project Budget				**$1,006,548.75**

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH
- FORCED DRAINAGE EXPANSION AREA
- RECOMMENDED DITCH WIDENING AREA

RIENZI SUB-BASIN AREA 4 EXPANSION AND IMPROVEMENTS: FORCE DRAINAGE AREA EXPANSION AND ASSOCIATED UPGRADES

SCALE IN FEET

800 400 0 800

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RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

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Rienzi - Sub-Basin Area 4 / Lateral 105 Improvements:

Lateral 105 Culvert Replacements and Ditch Widening

Lateral 105 conveys stormwater from west of N Canal Blvd, east to the COT pump station. There are culverts and channel sections within the lateral that are undersized, filled with sediment, and/or not properly sloped. Recommended improvements include ditch widening and culvert replacements within this lateral.

Channel improvements recommended within lateral 105 include excavating a uniform section from station 100+00 to 116+53 with a minimum 5' Bottom Width, 1V:3H Side slopes, and a 0.10% longitudinal slope. From station 118+28 to 133+59, and minimum section of 7' Bottom Width, 1V:3H Side slopes, and a 0.10% longitudinal slope is recommended.

Culvert improvements include replacing culverts 105-2 and 105-3 with 48" culverts.

Refer to the following page for a preliminary cost estimate for the above referenced improvements and Exhibits E-6 for a map showing the proposed improvements.

Note that culvert 105-2 is approximately 80% silted in. It is recommended that this culvert be cleaned out as soon as possible through the COT normal maintenance program.

Rienzi - Sub-Basin Area 4 / Lateral 105 Improvements Preliminary Project Budget:

Lateral 105 Culvert Replacements and Ditch Widening

Description	Unit	Quantity	Unit Price	Total
Mobilization/ Construction Layout	LS	1	$20,000.00	$20,000.00
Earthwork – Excavate Ditch and Place Material On-Site	LF	3,184	$8.00	$25,472.00
48" RCP/ CMP(UF)	LF	350	$135.00	$47,250.00
Remove Asphalt Roadway and Base	SY	100	$20.00	$2,000.00
Asphalt Roadway (North Canal Blvd.)	TON	30	$125.00	$3,750.00
Roadway Base (Class II) (12" Thick)	SY	100	$55.00	$5,500.00
Aggregate Surfacing (Cane Field Headland)	SY	100	$85.00	$8,500.00
Construction Subtotal				**$103,972.00**
Design + Survey Fees (15%)				$15,595.80
Materials Testing (2.5%)				$2,599.30
Contingencies (25%)				$25,993.00
Estimated Project Budget				**$148,160.10**

SUB-BASIN AREA 2

ST. PATRICK STREET

NORTH CANAL BLVD.

CULVERT 105-2
EXISTING: 36" CMP
PROPOSED: 48" RCP/CMPUF

DITCH WIDENING
AREA 1
STA 100+00
TO 116+53

DITCH WIDENING
AREA 2
STA 118+28 TO 133+59

CULVERT 105-3
EXISTING: 24" STEEL
PROPOSED: 48" RCP/CMPUF

100+00

110+00

120+00

LATERAL 105

130+00

140+00

SUB-LATERAL 105A

SUB-LATERAL 105

160+00

ERIC
ANDOLSEK
PARK

SUB-LATERAL 104A

SUB-LATERAL 104A

CITY PUMP
STATION

80' ARPENT CANAL

OUTSIDE LIMITS OF
STUDY AREA

LEGEND - NEW IMPROVEMENTS

- DRAINAGE LATERAL/ SUBLATERAL
- SUB BASIN AREA BOUNDARY
- LEVEE / BERM
- DRAINAGE AREA BOUNDARY
- SUB-SURFACE DRAINAGE
- RECOMMENDED DITCH WIDENING AREA

**RIENZI SUB-BASIN AREA 4 IMPROVEMENTS:
LATERAL 105 CULVERT REPLACEMENT AND
DITCH WIDENING**

SCALE IN FEET

400 200 0 400

DUPLANTIS DESIGN GROUP, PC
314 E. Bayou Road Thibodaux, LA 70301
Phone: 985.447.0090 \\ Fax: 985.447.7009
THIBODAUX \ COVINGTON
HOUSTON \ BATON ROUGE \ HOUMA
WWW.DDGPC.COM

RIENZI / N. CANAL DRAINAGE BASIN

FOR: NORTH LAFOURCHE LEVEE DISTRICT
THIBODAUX, LOUISIANA

DRAWN	MTB
CHECKED	HRK
ISSUE DATE	10/3/2018
PROJECT NO.	17-398
SHEET	E-5.17

J:\CAD\DWG\17-000\17-398\RECOMMENDED IMPROVEMENT PLANS\17-398 RECOMMENDED IMPROVEMENTS PROJECT J.dwg

SECTION 6
Project Priority & Cost Summary

All of the proposed projects detailed in Section 5 above have been evaluated based on the estimate cost and anticipated benefit that would be seen from the improvements, so that the projects could be prioritized. The table below includes the prioritized project list. This list can be used by the COT, LPG, and NLLD in future planning and budgeting for improvements within the Rienzi / N Canal Drainage Basin.

Priority	Project Name / Description	Estimated Budget
1	Removal of Obstruction at Culvert 101-8	$1,500.00
2	Cleaning Silt from Culvert 102B-2	$3,500.00
3	Cleaning Silt from Culvert 105-2	$2,000.00
4	Rienzi Sub-Basin Area 2 Improvements: Lateral 102 Culvert Replacement, Ditch Widening, and Continued Monitoring	$348,768.75
5	Rienzi Sub-Basin Area 2 Improvements: Sub-Lateral 102B Culvert Improvements	$310,222.50
6	Rienzi Sub-Basin Area 1 Improvements: Lateral 101 Culvert Replacements and Ditch Widening to Help Alleviate Flooding in North Thibodaux	$278,580.38
7	Rienzi Sub-Basin Area 3 Improvements: Sub-Lateral 103A Sub-Surface Drainage Improvements	$2,156,010.75
8	Rienzi Sub-Basin Area 3 Improvements: St Patrick St Roadside Ditch Re-Grading and Cross Culvert Installation	$168,043.13
9	Rienzi Sub-Basin Area 3 Improvements: Sub-Lateral 103D and 103E Culvert Replacements and Ditch Widening	$120,982.50
10	Rienzi Sub-Basin Area 4 / Lateral 105 Improvements: Lateral 105 Culvert Replacements and Ditch Widening	$148,160.10
11	Rienzi Sub-Basin Area 2 Improvements: Sub-Lateral 102D Culvert Replacement and Ditch Widening	$20,634.00
12	Rienzi Sub-Basin Area 4 Pumping Capacity Improvements: Pump Capacity, Drainage Structure, Channel, and Culvert Improvements	$731,595.00
13	Rienzi Sub-Basin Area 4 Expansion and Improvements: Force Drainage Area Expansion and Associated Upgrades	$1,006,548.75

Appendix A – Preliminary List of Areas of Concern

Upon review of the elevation data and meetings with LPG, COT, and Levert Land, the following areas were determined to warrant additional investigation:

A. ***Canal Blvd at Andolsek Park:*** During heavy rain events, the roadside ditches along the east and west sides of Canal Blvd become inundated and the outside travel lanes of Canal Blvd are periodically topped by the rising water. This area appears to drain to the east, but there does not appear to be a definitive path for the water to ultimately get to the Eighty Arpent Canal. As part of the scope of work for phase 2, DDG proposes to trace the existing path of the stormwater from the area of concern to the Eighty Arpent canal. This will require topographic survey information of the ditches and culverts downstream of the area of concern.

B. ***St. Patrick at Levert Rd:*** During Hurricane Harvey, the drainage ditch along the West side of St Patrick Rd became inundated and the road was topped by the rising water. The COT excavated an emergency outlet to the west to relieve the rising flood waters. DDG proposes to trace the existing path of the stormwater from the area of concern to the Eighty Arpent Canal, which will require topographic survey information of the ditches and culverts downstream of the area of concern.

C. ***Existing Regional Detention ponds:*** During our meeting with the COT, concern was raised that the existing regional detention pond is overgrown and likely not providing the originally designed storage volume. DDG proposes to obtain a current survey of the existing pond to determine if there is adequate storage volume.

D. ***Northern Reach of Twelve Cedars:*** The COT indicated that the roads in the back (northernmost) section of Twelve Cedars periodically flood. DDG proposes to trace the existing path of the stormwater from the area of concern to the Eighty Arpent Canal, which will require topographic survey information of the ditches and culverts downstream of the area of concern.

E. ***Walmart Drainage Ditch:*** Levert Land indicated that the existing drainage ditch to the south of the Walmart parking lot becomes inundated and floods the existing driveway during normal rain events. DDG proposes to trace the existing path of the stormwater from the area of concern to the 80 Arpent Canal, which will require topographic survey information of the ditches and culverts downstream of the area of concern.

F. ***Existing Pump Stations:*** There are three existing pump stations that are located along the northern end of the Basin. Two of these pump stations are operated by the City of Thibodaux and the third is operated by Levert Land. The COT indicated that one of the two City operated pumps was taken out of service when construction of the new sewer treatment plant commenced. DDG proposes to gather information on these three pump stations (size of pumps, operational parameters, etc.) to evaluate and determine if increasing the existing pump capacity is a possible solution to some of the issues indicated above.

G. ***Drainage Basin Boundary Investigation:*** DDG will also conduct field investigations and gather topographic survey information to confirm the boundaries of the drainage basin and the configuration / elevations of major drainage lateral outlets into the 80 Arpent Canal.

H. ***General Mapping of the Existing Drainage System:*** As requested by NLLD, DDG can also survey and map the existing drainage system within the Basin for future reference.

Appendix B – Hydraflow Express Output for Existing Capacities

Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101 Sta 0+00 to 0+30 Pipe 1

Invert Elev Dn (ft)	=	13.91
Pipe Length (ft)	=	79.00
Slope (%)	=	1.44
Invert Elev Up (ft)	=	15.05
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

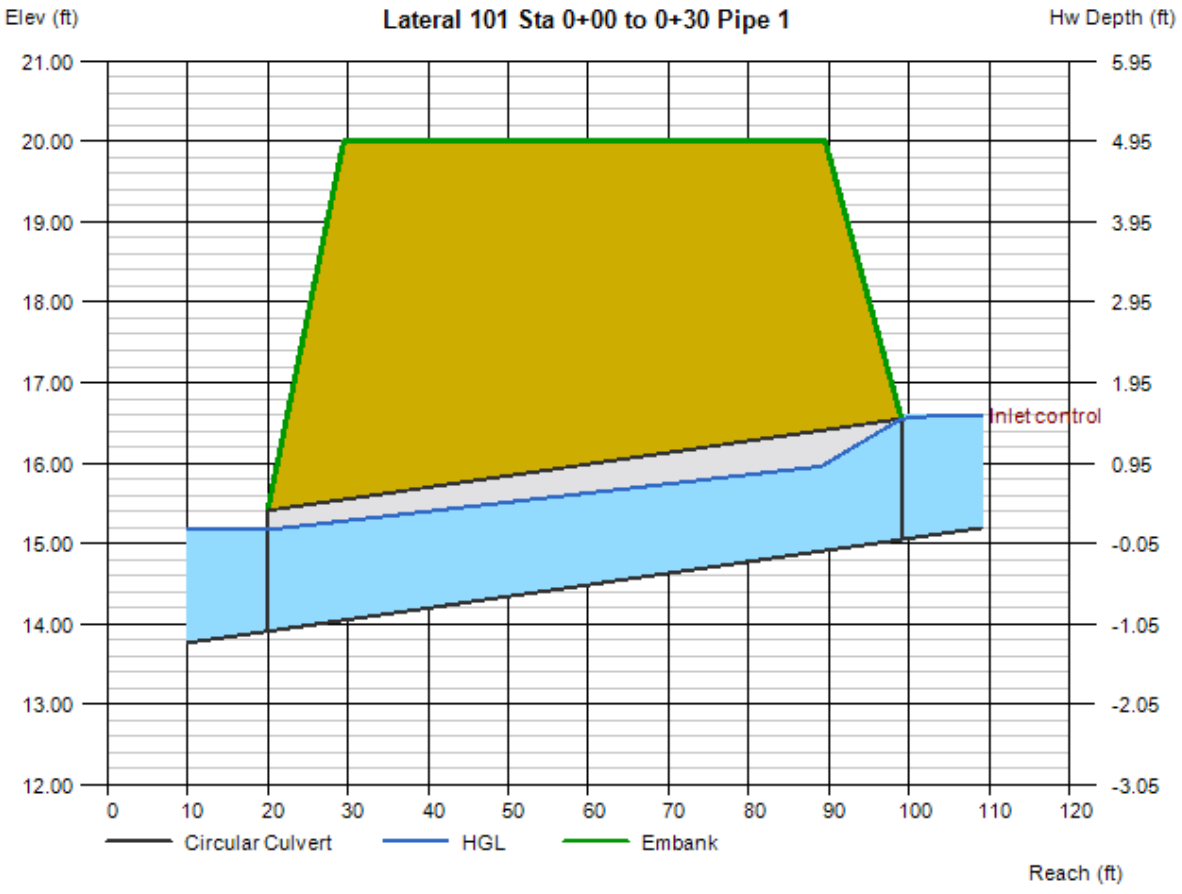
Top Elevation (ft)	=	20.00
Top Width (ft)	=	60.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	7.00
Qpipe (cfs)	=	7.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.41
Veloc Up (ft/s)	=	5.45
HGL Dn (ft)	=	15.17
HGL Up (ft)	=	16.07
Hw Elev (ft)	=	16.59
Hw/D (ft)	=	1.03
Flow Regime	=	Inlet Control



Culvert Report

Lateral 101 Sta 0+00 to 0+30 Pipe 2

Invert Elev Dn (ft)	=	13.97
Pipe Length (ft)	=	79.00
Slope (%)	=	1.09
Invert Elev Up (ft)	=	14.83
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

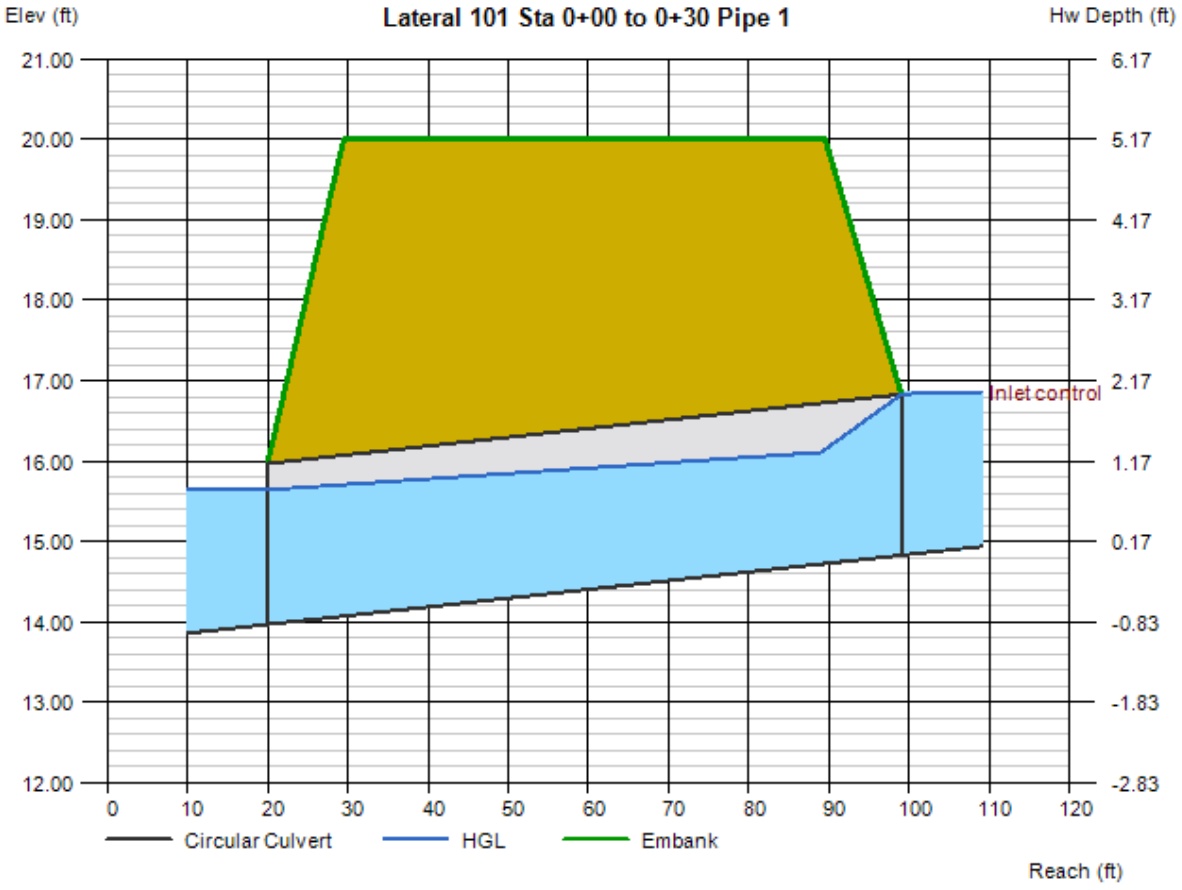
Top Elevation (ft)	=	20.00
Top Width (ft)	=	60.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	14.00
Qpipe (cfs)	=	14.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.99
Veloc Up (ft/s)	=	6.22
HGL Dn (ft)	=	15.64
HGL Up (ft)	=	16.18
Hw Elev (ft)	=	16.86
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Lateral 101 Sta 0+00 to 18+74

Trapezoidal

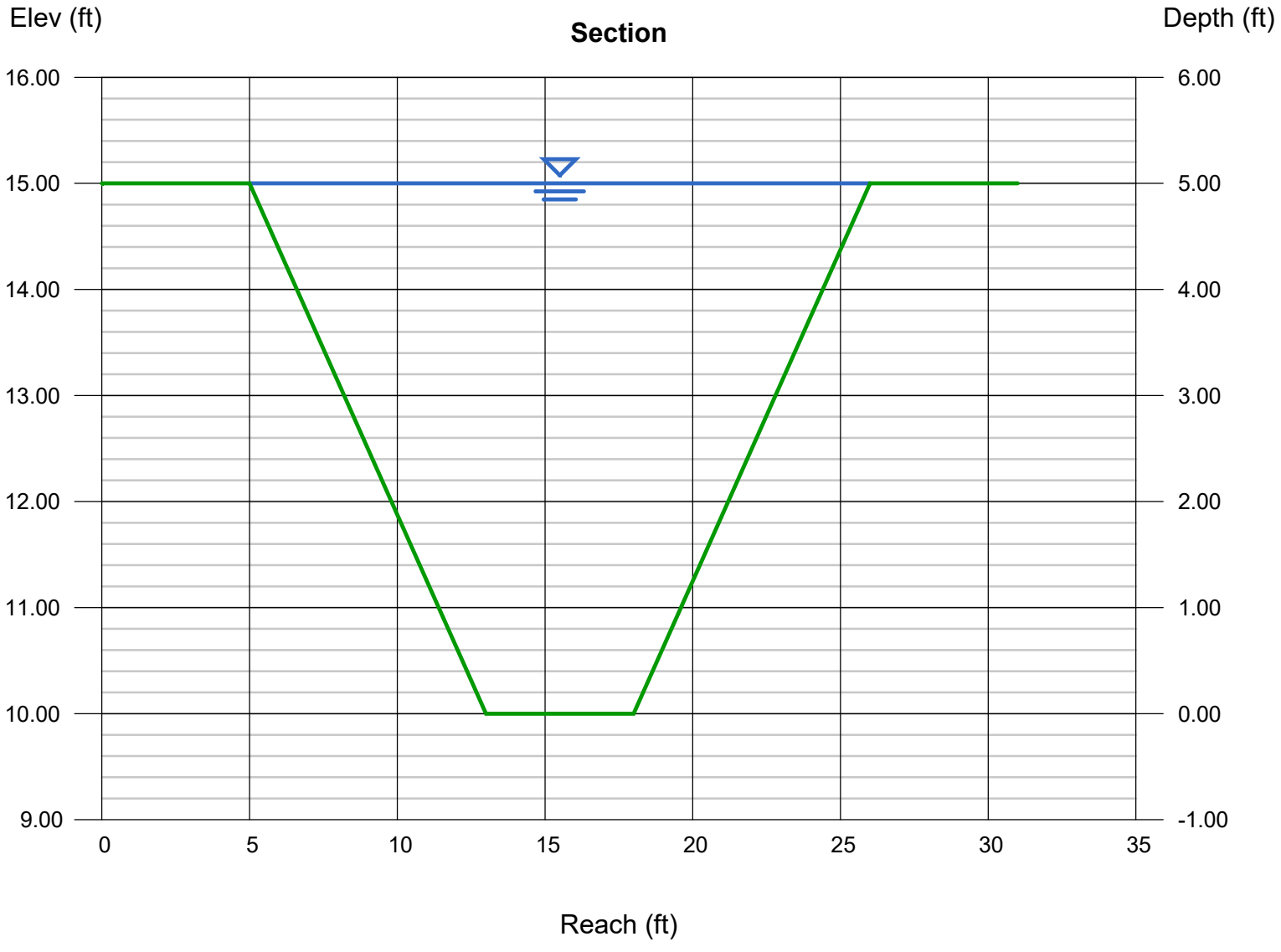
Bottom Width (ft)	= 5.00
Side Slopes (z:1)	= 1.60, 1.60
Total Depth (ft)	= 5.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.14
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.00

Highlighted

Depth (ft)	= 5.00
Q (cfs)	= 235.01
Area (sqft)	= 65.00
Velocity (ft/s)	= 3.62
Wetted Perim (ft)	= 23.87
Crit Depth, Yc (ft)	= 2.99
Top Width (ft)	= 21.00
EGL (ft)	= 5.20



Culvert Report

Lateral 101 Sta 6+34

Invert Elev Dn (ft)	=	12.17
Pipe Length (ft)	=	30.00
Slope (%)	=	0.03
Invert Elev Up (ft)	=	12.18
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

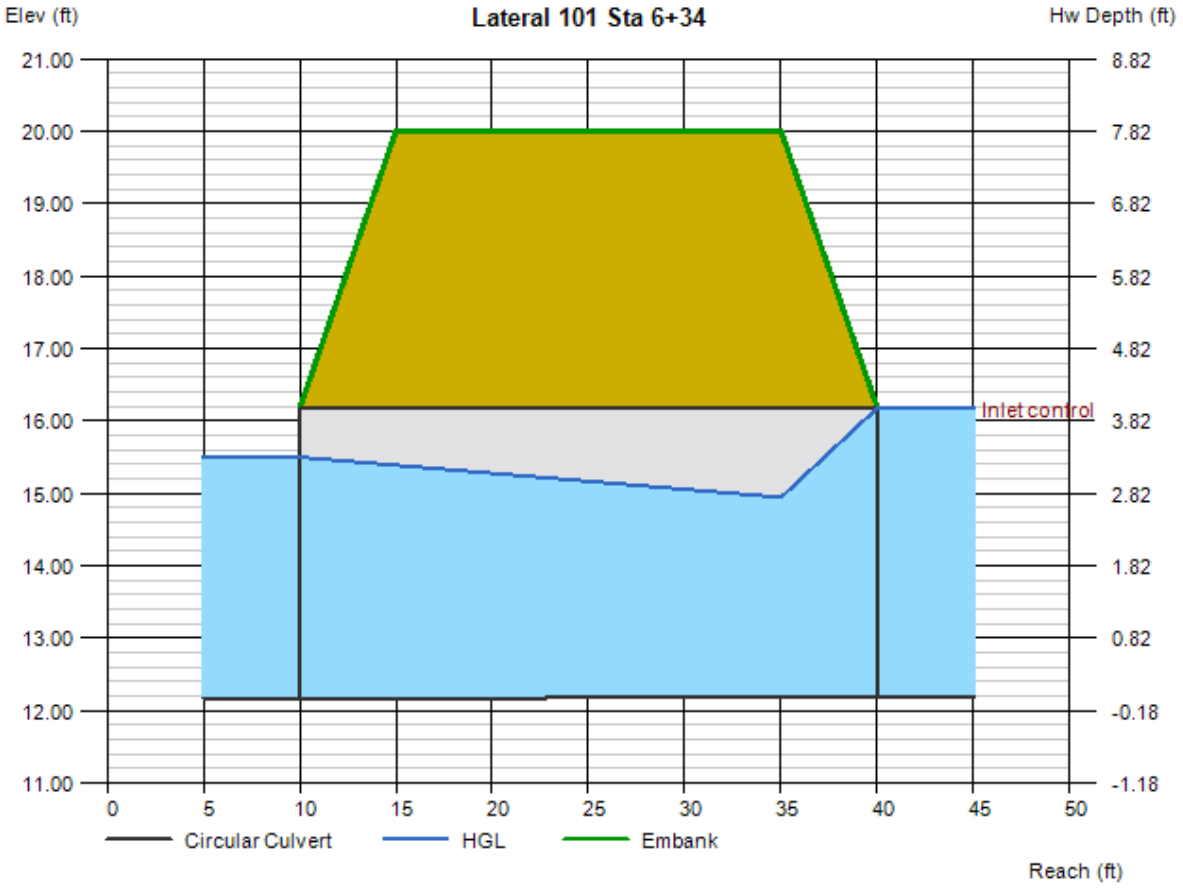
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	77.00
Qpipe (cfs)	=	77.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.89
Veloc Up (ft/s)	=	8.70
HGL Dn (ft)	=	15.50
HGL Up (ft)	=	14.83
Hw Elev (ft)	=	16.18
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101 Sta 18+74

Invert Elev Dn (ft)	=	11.31
Pipe Length (ft)	=	30.00
Slope (%)	=	-0.20
Invert Elev Up (ft)	=	11.25
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

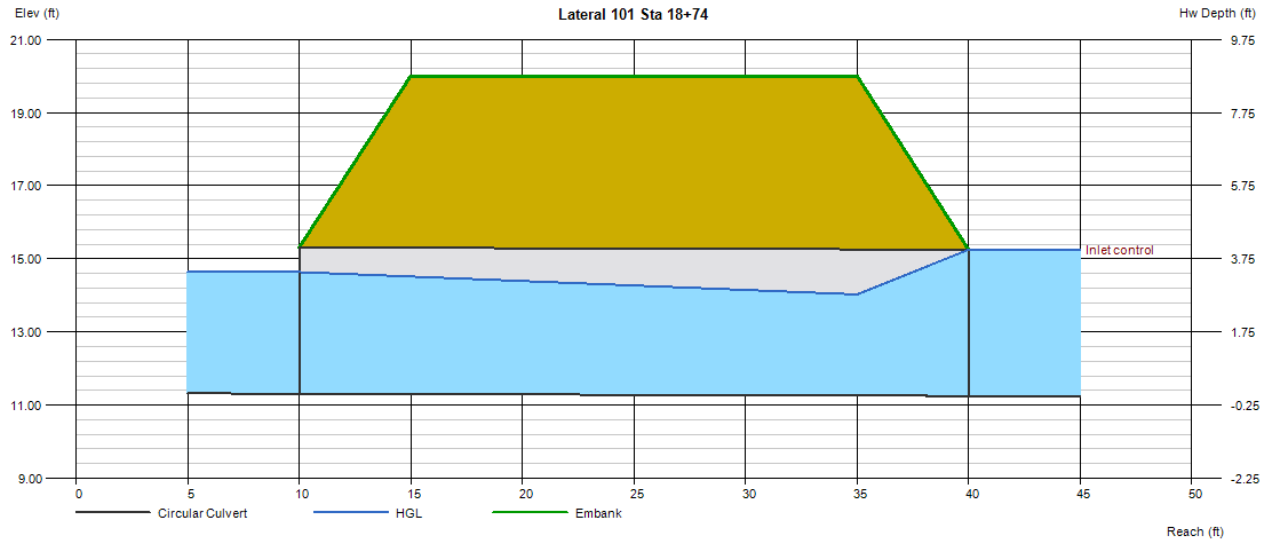
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	77.00
Qpipe (cfs)	=	77.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.89
Veloc Up (ft/s)	=	8.70
HGL Dn (ft)	=	14.64
HGL Up (ft)	=	13.90
Hw Elev (ft)	=	15.25
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101 Sta 19+57 to 34+35

Trapezoidal

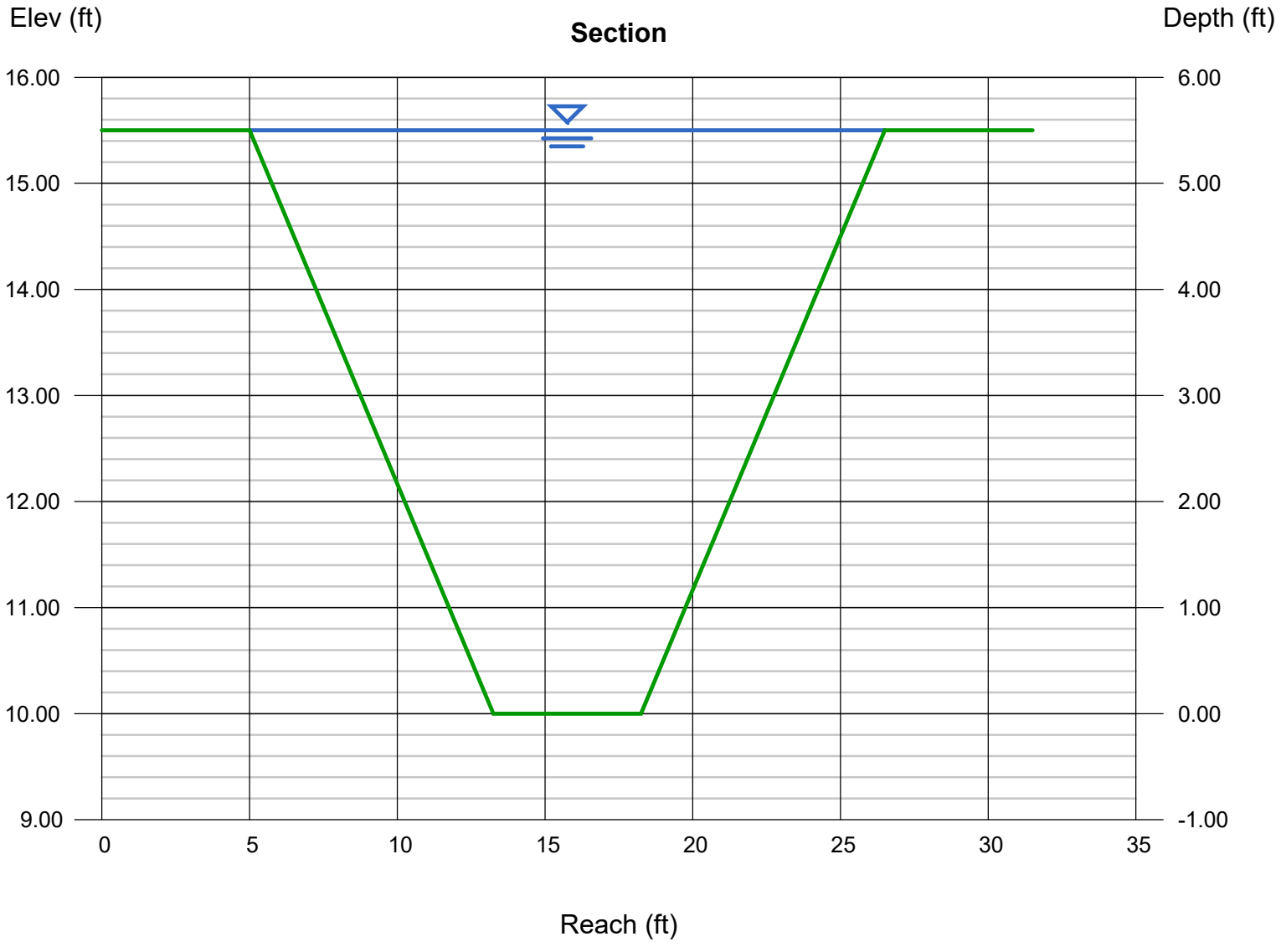
Bottom Width (ft)	= 5.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 5.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.50

Highlighted

Depth (ft)	= 5.50
Q (cfs)	= 165.52
Area (sqft)	= 72.88
Velocity (ft/s)	= 2.27
Wetted Perim (ft)	= 24.83
Crit Depth, Yc (ft)	= 2.52
Top Width (ft)	= 21.50
EGL (ft)	= 5.58



Culvert Report

Lateral 101 Sta 34 53

Invert Elev Dn (ft)	=	11.82
Pipe Length (ft)	=	30.00
Slope (%)	=	-1.70
Invert Elev Up (ft)	=	11.31
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

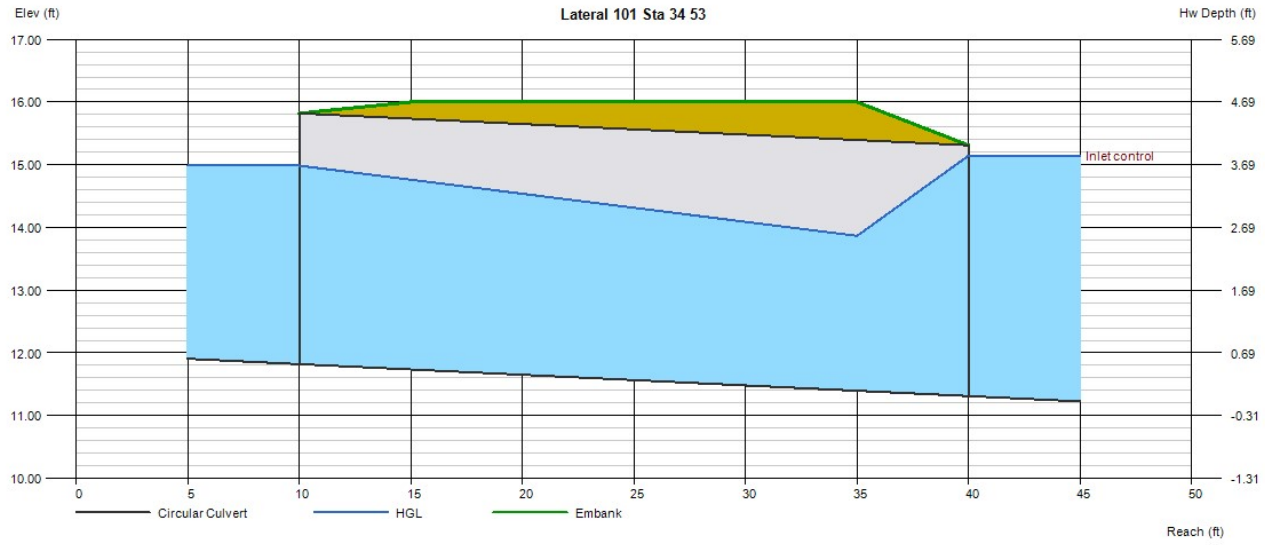
Top Elevation (ft)	=	16.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	10.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	60.00
Qpipe (cfs)	=	60.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.62
Veloc Up (ft/s)	=	7.89
HGL Dn (ft)	=	14.99
HGL Up (ft)	=	13.64
Hw Elev (ft)	=	15.15
Hw/D (ft)	=	0.96
Flow Regime	=	Inlet Control



Culvert Report

Lateral 101 Sta 35 27

Invert Elev Dn (ft)	=	10.86
Pipe Length (ft)	=	45.00
Slope (%)	=	-0.69
Invert Elev Up (ft)	=	10.55
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

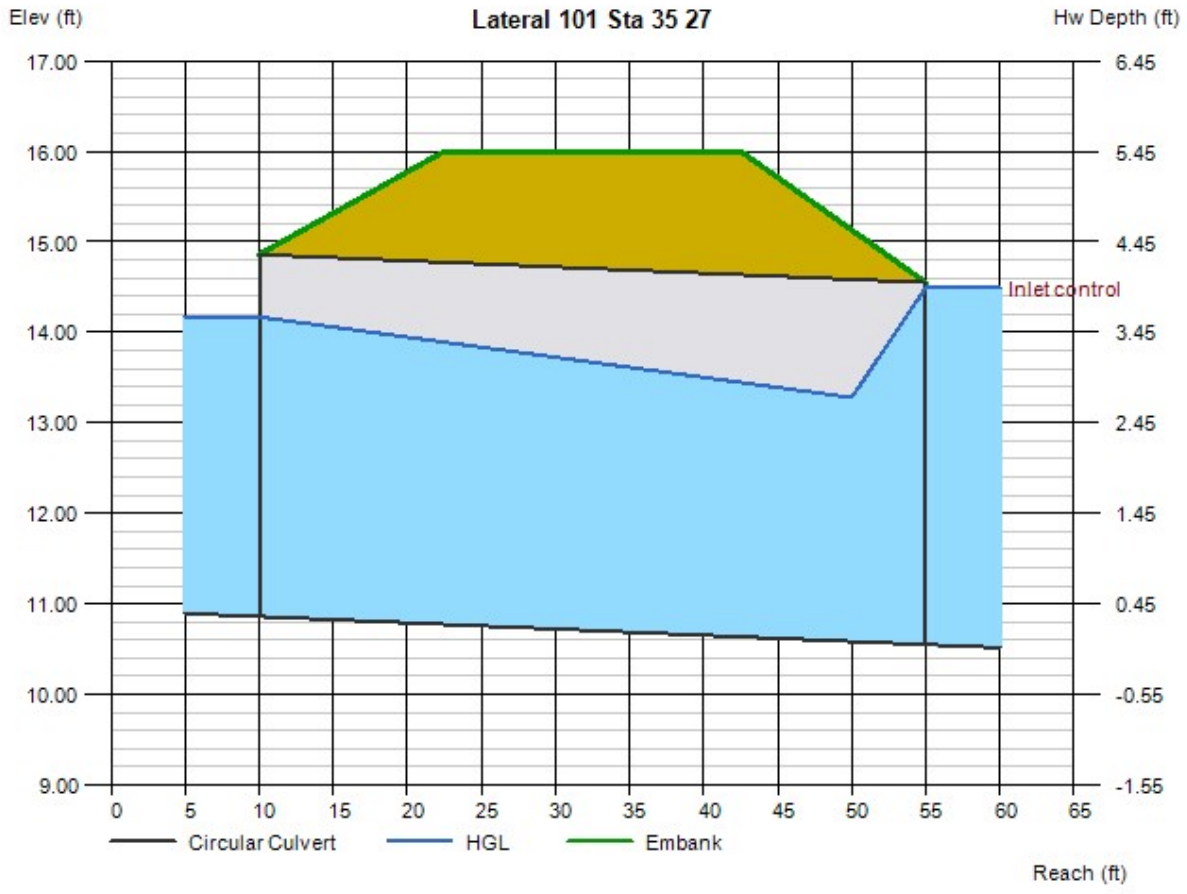
Top Elevation (ft)	=	16.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	10.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	75.00
Qpipe (cfs)	=	75.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.75
Veloc Up (ft/s)	=	8.60
HGL Dn (ft)	=	14.17
HGL Up (ft)	=	13.17
Hw Elev (ft)	=	14.49
Hw/D (ft)	=	0.99
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101 Sta 36+16 to 61+31

Trapezoidal

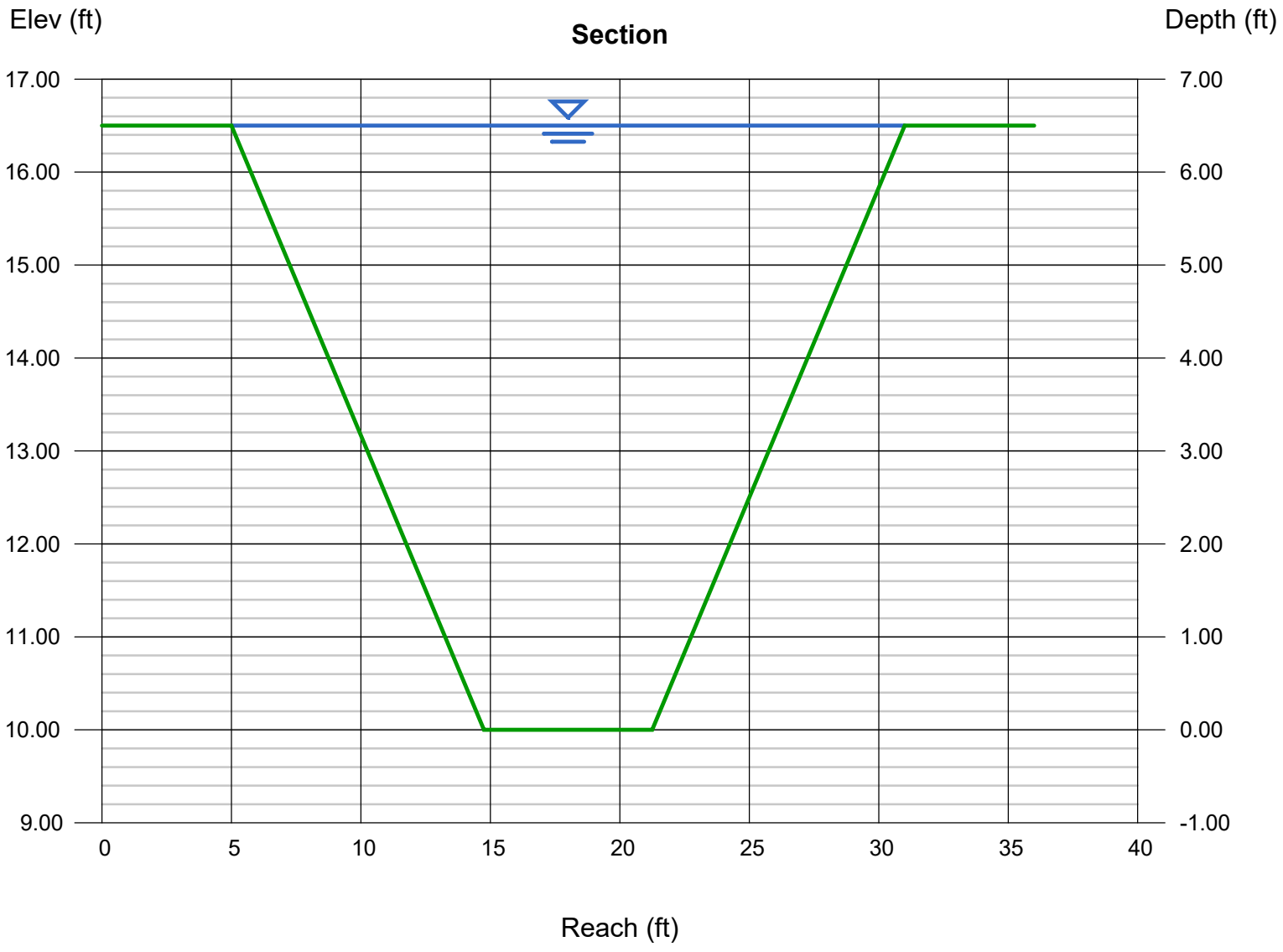
Bottom Width (ft)	= 6.50
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 6.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.06
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 6.50

Highlighted

Depth (ft)	= 6.50
Q (cfs)	= 297.15
Area (sqft)	= 105.63
Velocity (ft/s)	= 2.81
Wetted Perim (ft)	= 29.94
Crit Depth, Yc (ft)	= 3.15
Top Width (ft)	= 26.00
EGL (ft)	= 6.62



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101 Sta 48+67

Invert Elev Dn (ft)	=	9.30
Pipe Length (ft)	=	30.00
Slope (%)	=	-2.07
Invert Elev Up (ft)	=	8.68
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

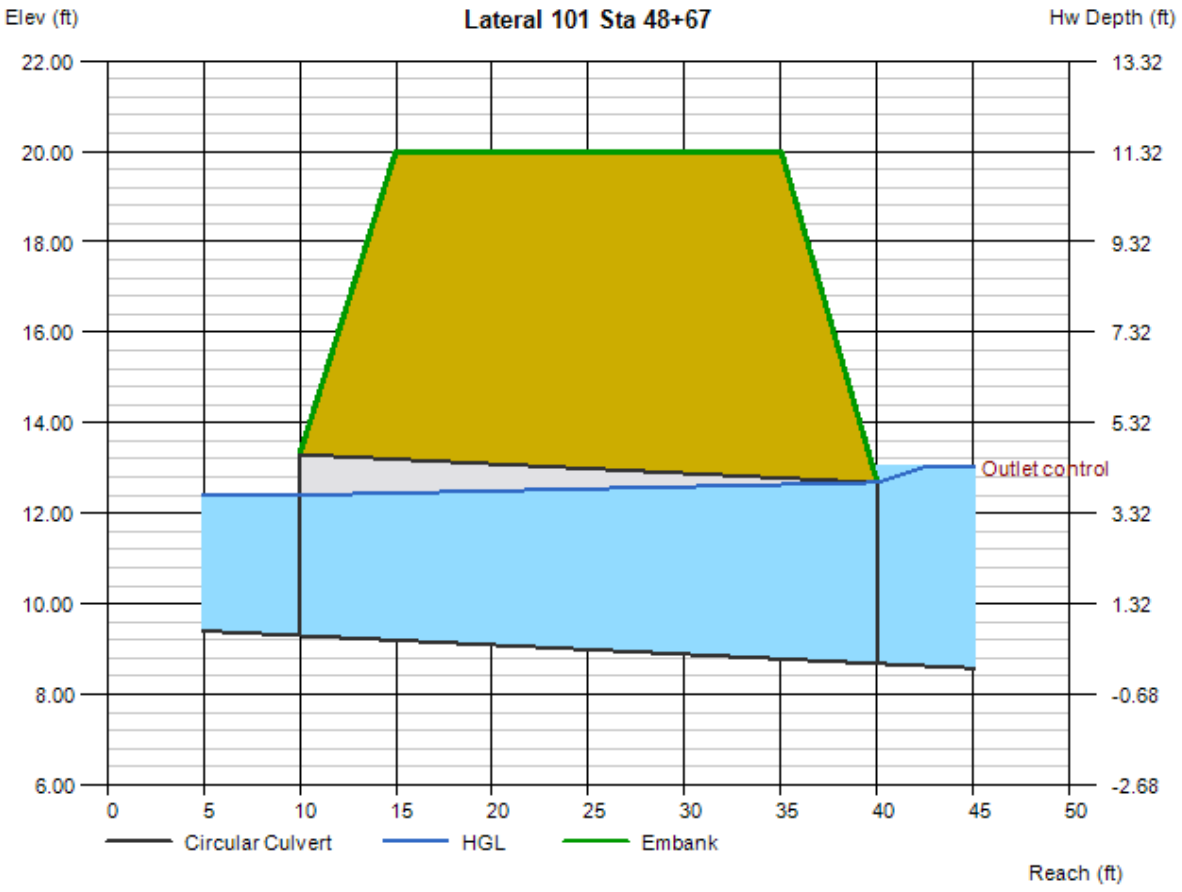
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	54.00
Qpipe (cfs)	=	54.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.16
Veloc Up (ft/s)	=	4.30
HGL Dn (ft)	=	12.40
HGL Up (ft)	=	12.68
Hw Elev (ft)	=	13.03
Hw/D (ft)	=	1.09
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101 Sta 61+31

Invert Elev Dn (ft)	=	9.33
Pipe Length (ft)	=	25.00
Slope (%)	=	-0.24
Invert Elev Up (ft)	=	9.27
Rise (in)	=	54.0
Shape	=	Circular
Span (in)	=	54.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

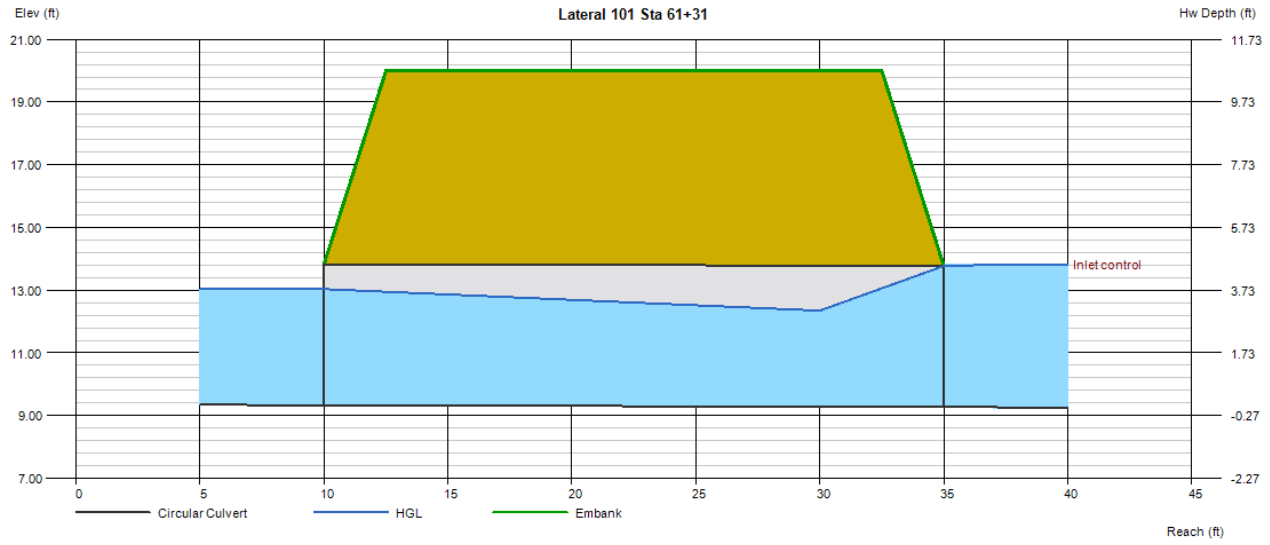
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	98.00
Qpipe (cfs)	=	98.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.00
Veloc Up (ft/s)	=	9.02
HGL Dn (ft)	=	13.03
HGL Up (ft)	=	12.18
Hw Elev (ft)	=	13.82
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101 Sta 62+19 to 109+76

Trapezoidal

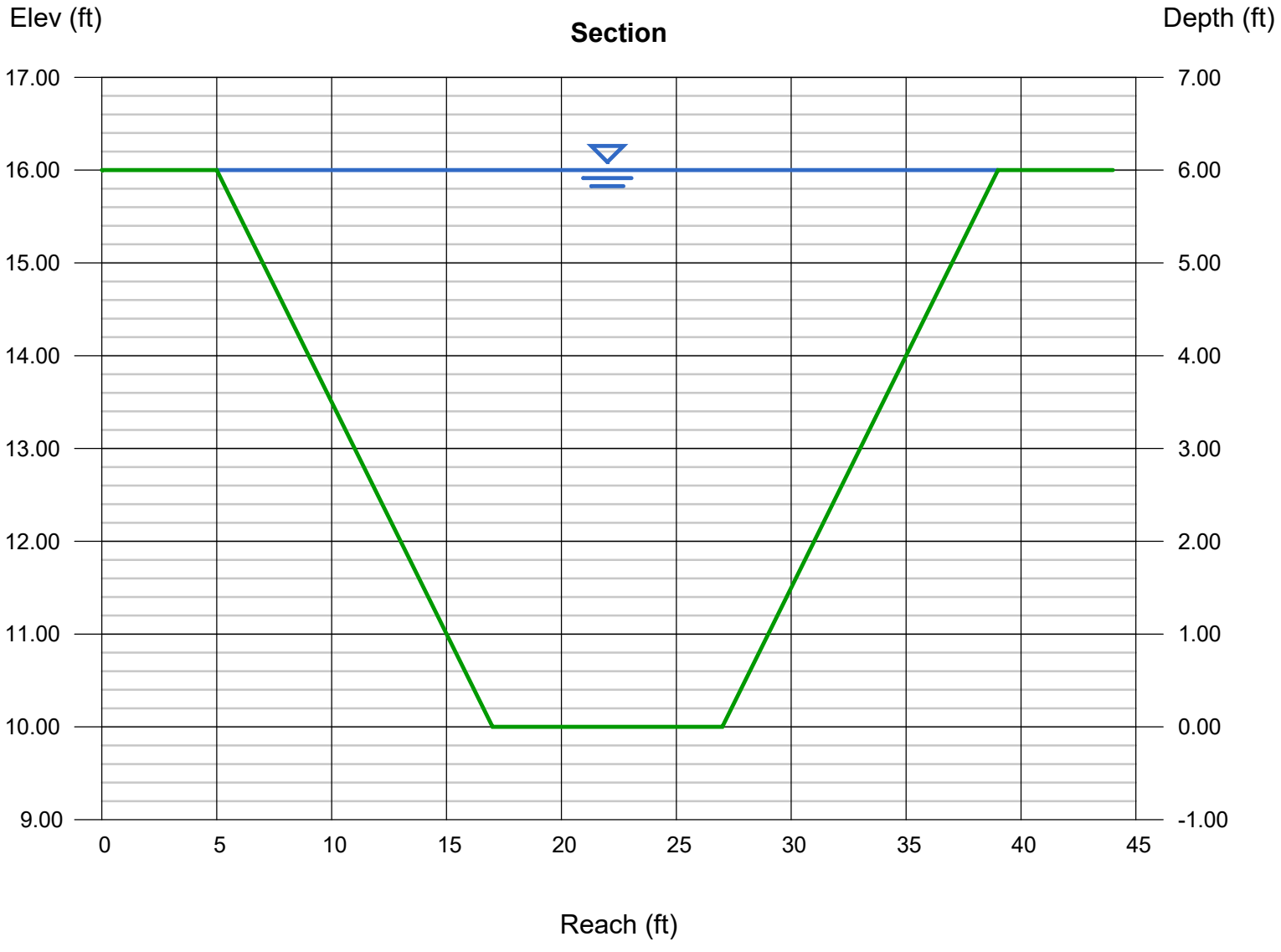
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 6.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 6.00

Highlighted

Depth (ft)	= 6.00
Q (cfs)	= 342.53
Area (sqft)	= 132.00
Velocity (ft/s)	= 2.59
Wetted Perim (ft)	= 36.83
Crit Depth, Yc (ft)	= 2.75
Top Width (ft)	= 34.00
EGL (ft)	= 6.10



Culvert Report

Lateral 101 Sta 109+76

Invert Elev Dn (ft)	=	8.82
Pipe Length (ft)	=	28.00
Slope (%)	=	4.61
Invert Elev Up (ft)	=	10.11
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

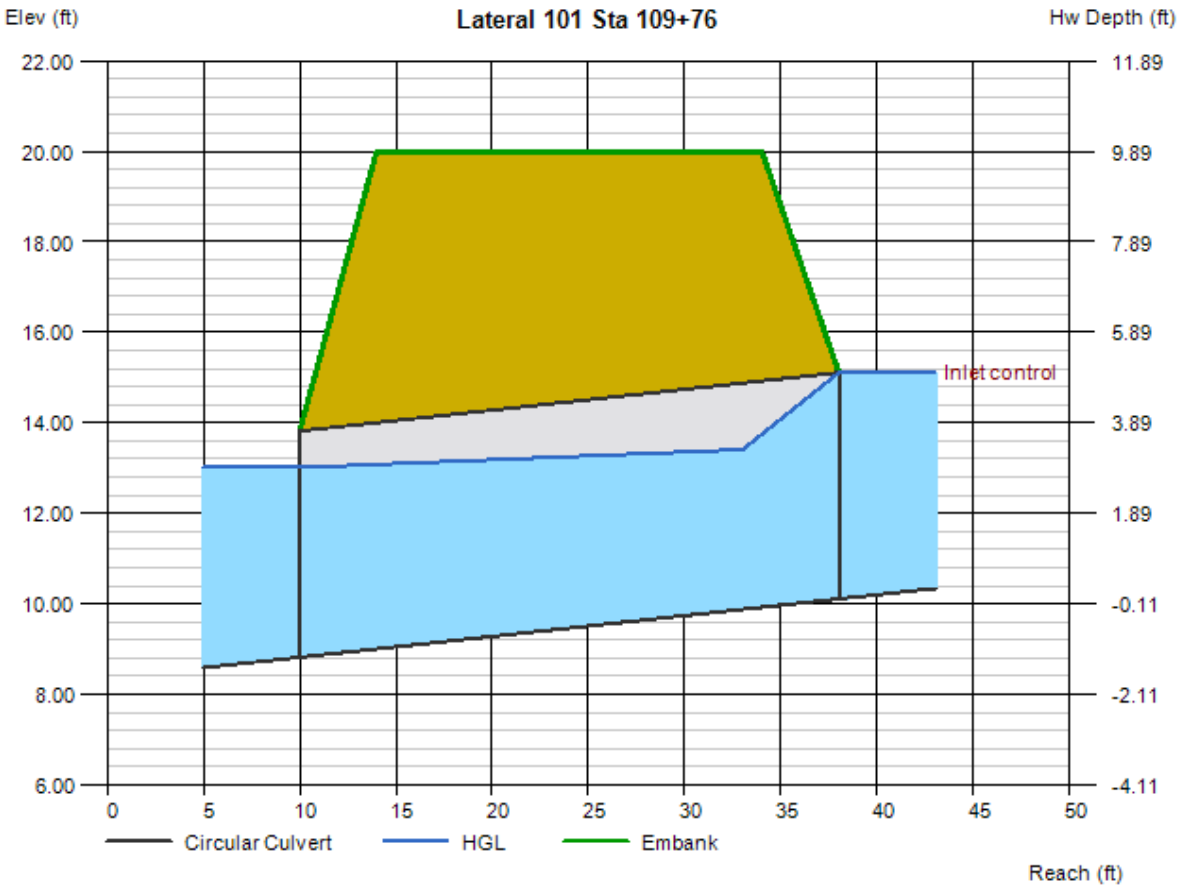
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	150.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	140.00
Qpipe (cfs)	=	140.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.96
Veloc Up (ft/s)	=	9.89
HGL Dn (ft)	=	13.01
HGL Up (ft)	=	13.50
Hw Elev (ft)	=	15.13
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

Lateral 101 Sta 110+89 to 125+23

Trapezoidal

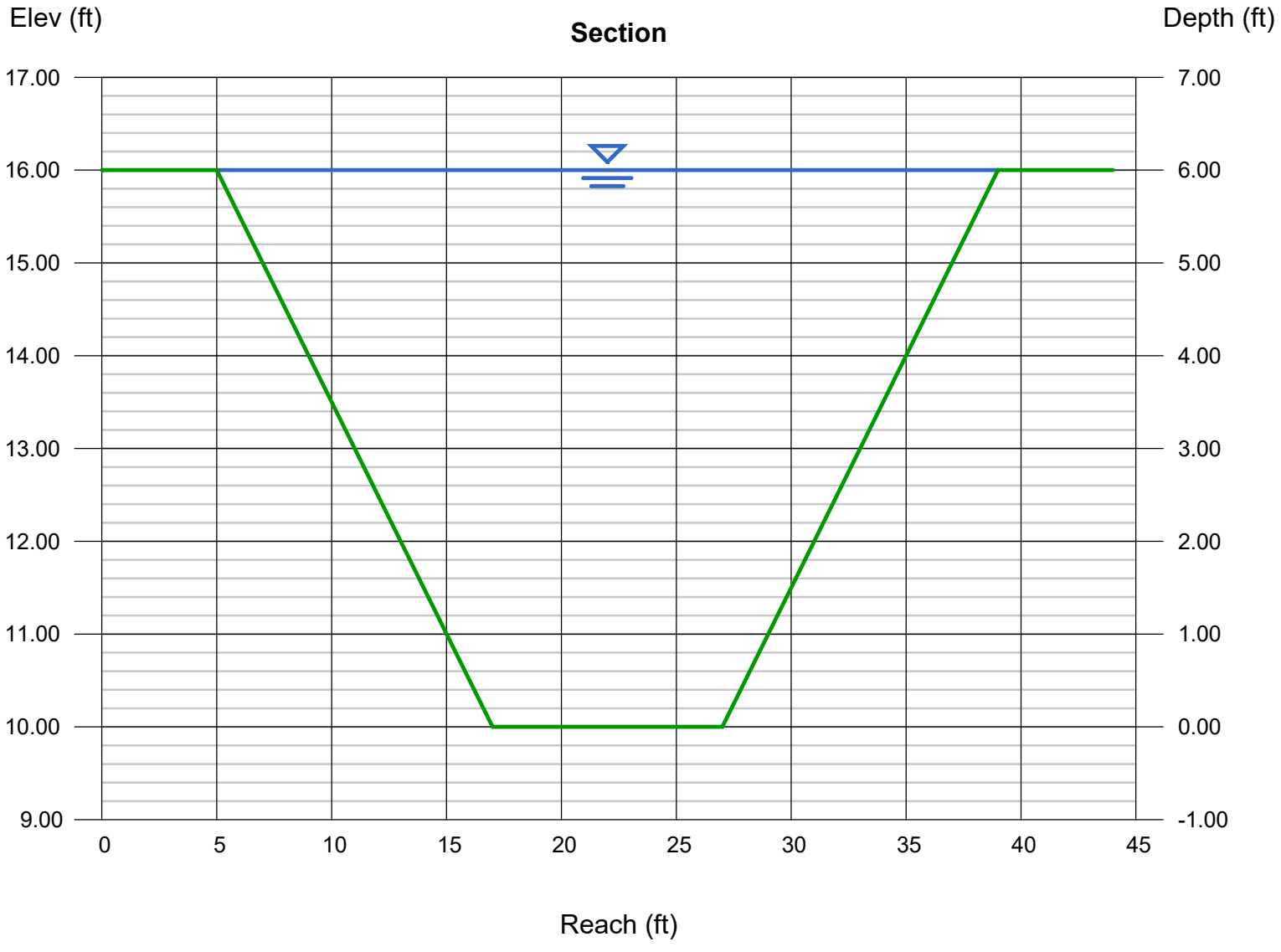
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 6.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.21
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 6.00

Highlighted

Depth (ft)	= 6.00
Q (cfs)	= 701.98
Area (sqft)	= 132.00
Velocity (ft/s)	= 5.32
Wetted Perim (ft)	= 36.83
Crit Depth, Yc (ft)	= 4.08
Top Width (ft)	= 34.00
EGL (ft)	= 6.44



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101A Sta 1200+00 to 216+54

Trapezoidal

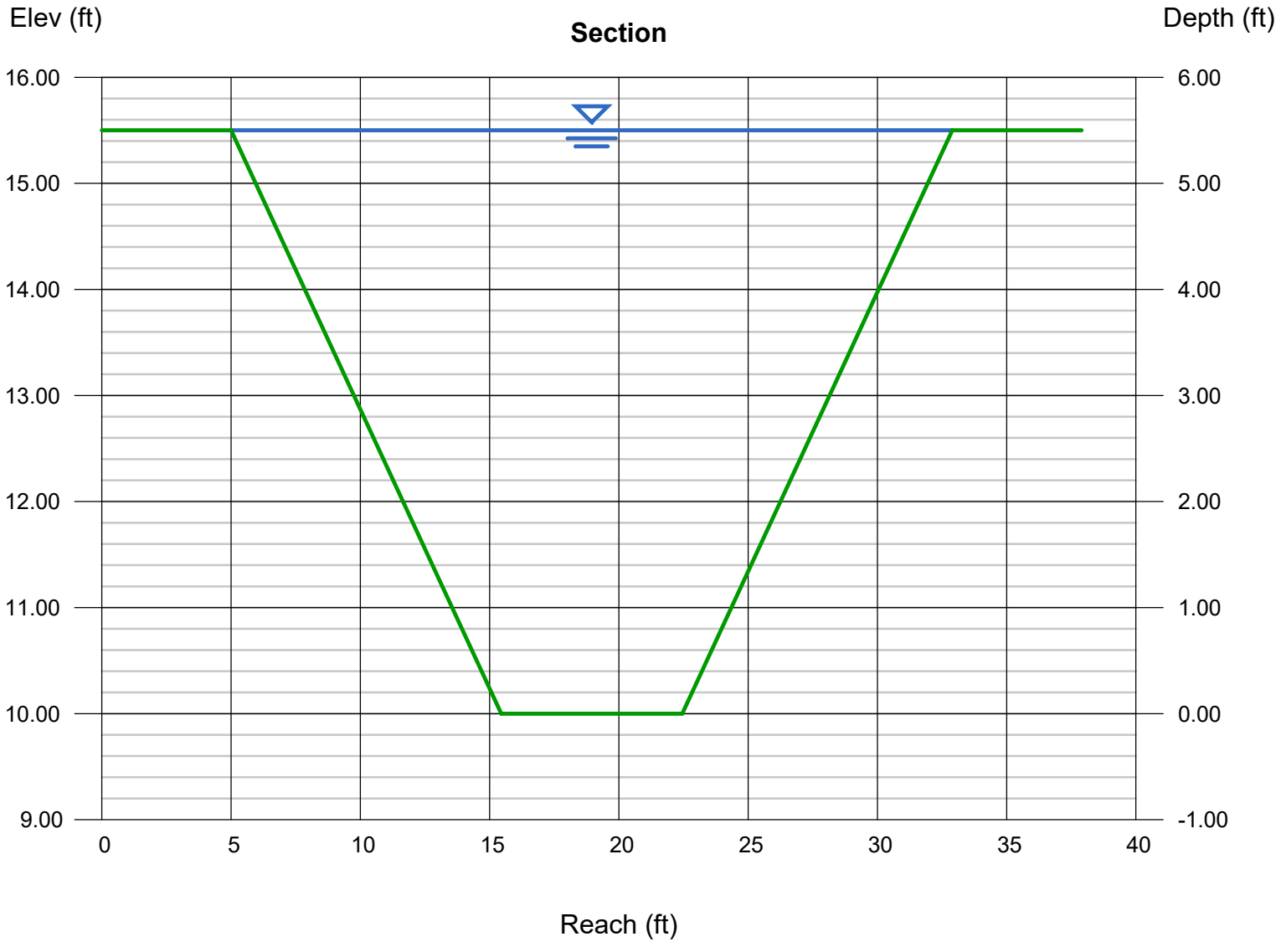
Bottom Width (ft)	= 7.00
Side Slopes (z:1)	= 1.90, 1.90
Total Depth (ft)	= 5.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.50

Highlighted

Depth (ft)	= 5.50
Q (cfs)	= 227.77
Area (sqft)	= 95.98
Velocity (ft/s)	= 2.37
Wetted Perim (ft)	= 30.62
Crit Depth, Yc (ft)	= 2.54
Top Width (ft)	= 27.90
EGL (ft)	= 5.59



Culvert Report

SubLateral 101A Sta 208+74

Invert Elev Dn (ft)	=	10.86
Pipe Length (ft)	=	30.00
Slope (%)	=	-0.53
Invert Elev Up (ft)	=	10.70
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

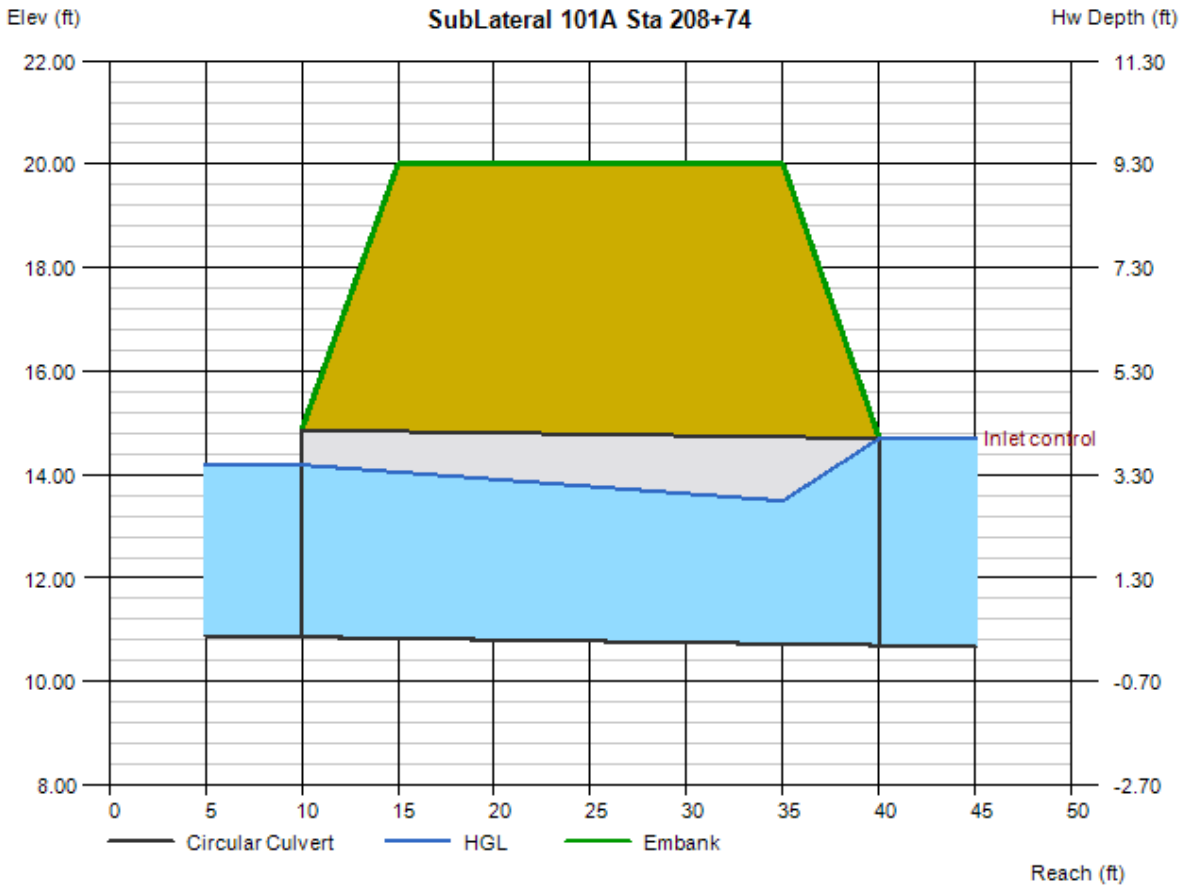
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	150.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	77.00
Qpipe (cfs)	=	77.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.89
Veloc Up (ft/s)	=	8.70
HGL Dn (ft)	=	14.19
HGL Up (ft)	=	13.35
Hw Elev (ft)	=	14.71
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

SubLateral 101A Sta 215+38

Invert Elev Dn (ft)	=	11.14
Pipe Length (ft)	=	30.00
Slope (%)	=	0.83
Invert Elev Up (ft)	=	11.39
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

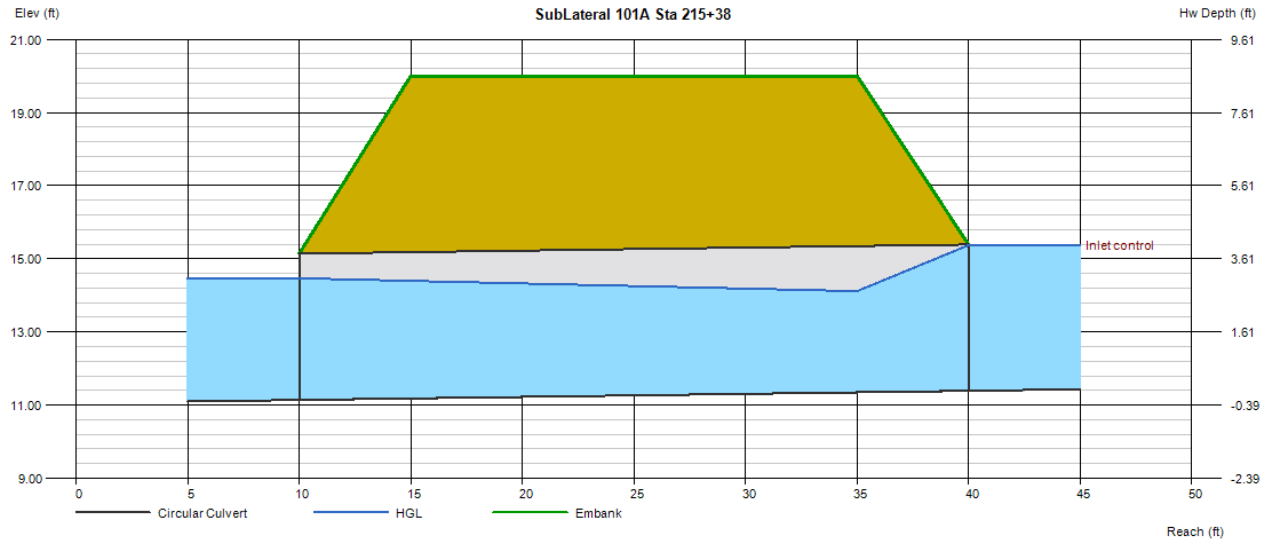
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	150.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	77.00
Qpipe (cfs)	=	77.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.89
Veloc Up (ft/s)	=	8.70
HGL Dn (ft)	=	14.47
HGL Up (ft)	=	14.04
Hw Elev (ft)	=	15.37
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Culvert Report

SubLateral 101A Sta 216+25

Invert Elev Dn (ft)	=	10.84
Pipe Length (ft)	=	45.00
Slope (%)	=	-0.22
Invert Elev Up (ft)	=	10.74
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

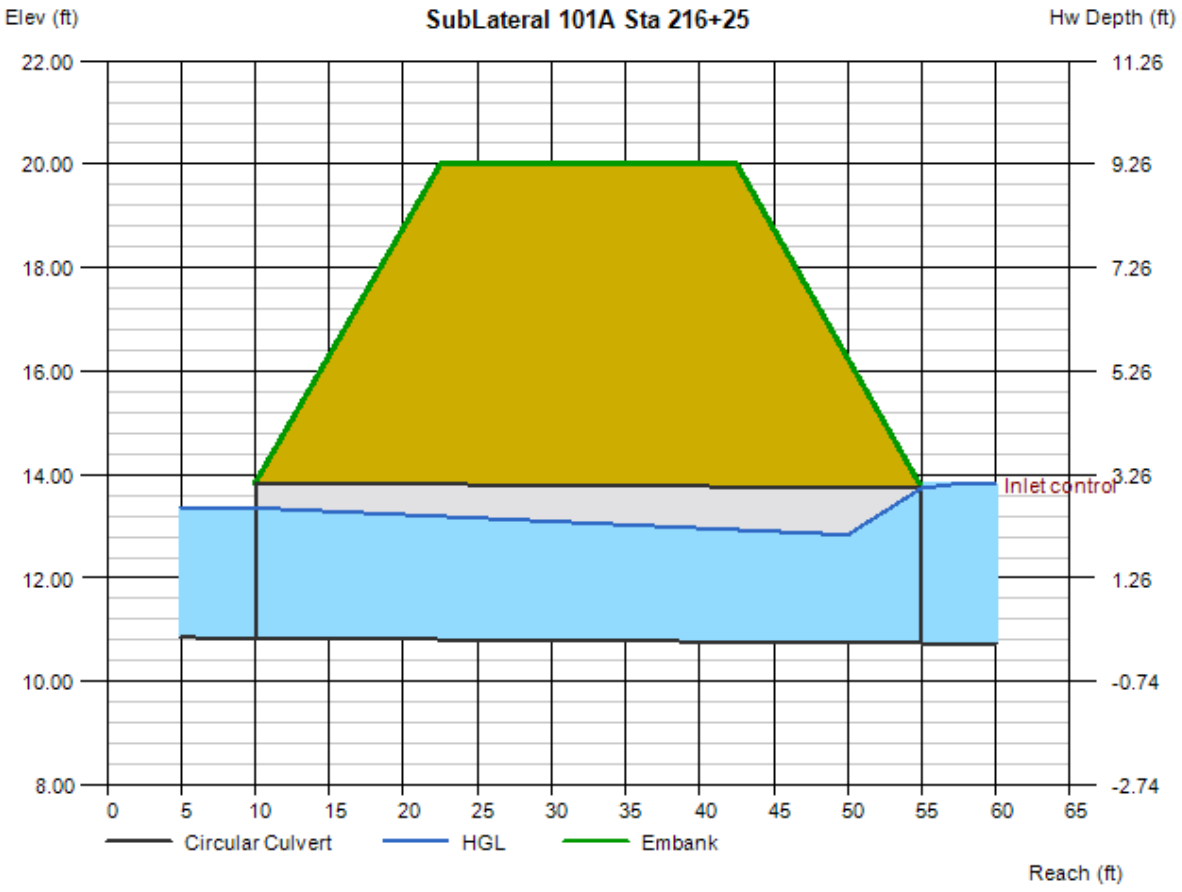
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	20.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	39.00
Qpipe (cfs)	=	39.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.16
Veloc Up (ft/s)	=	7.66
HGL Dn (ft)	=	13.36
HGL Up (ft)	=	12.77
Hw Elev (ft)	=	13.82
Hw/D (ft)	=	1.03
Flow Regime	=	Inlet Control



Channel Report

Lateral 101A Sta 216+54 to 233+71

Trapezoidal

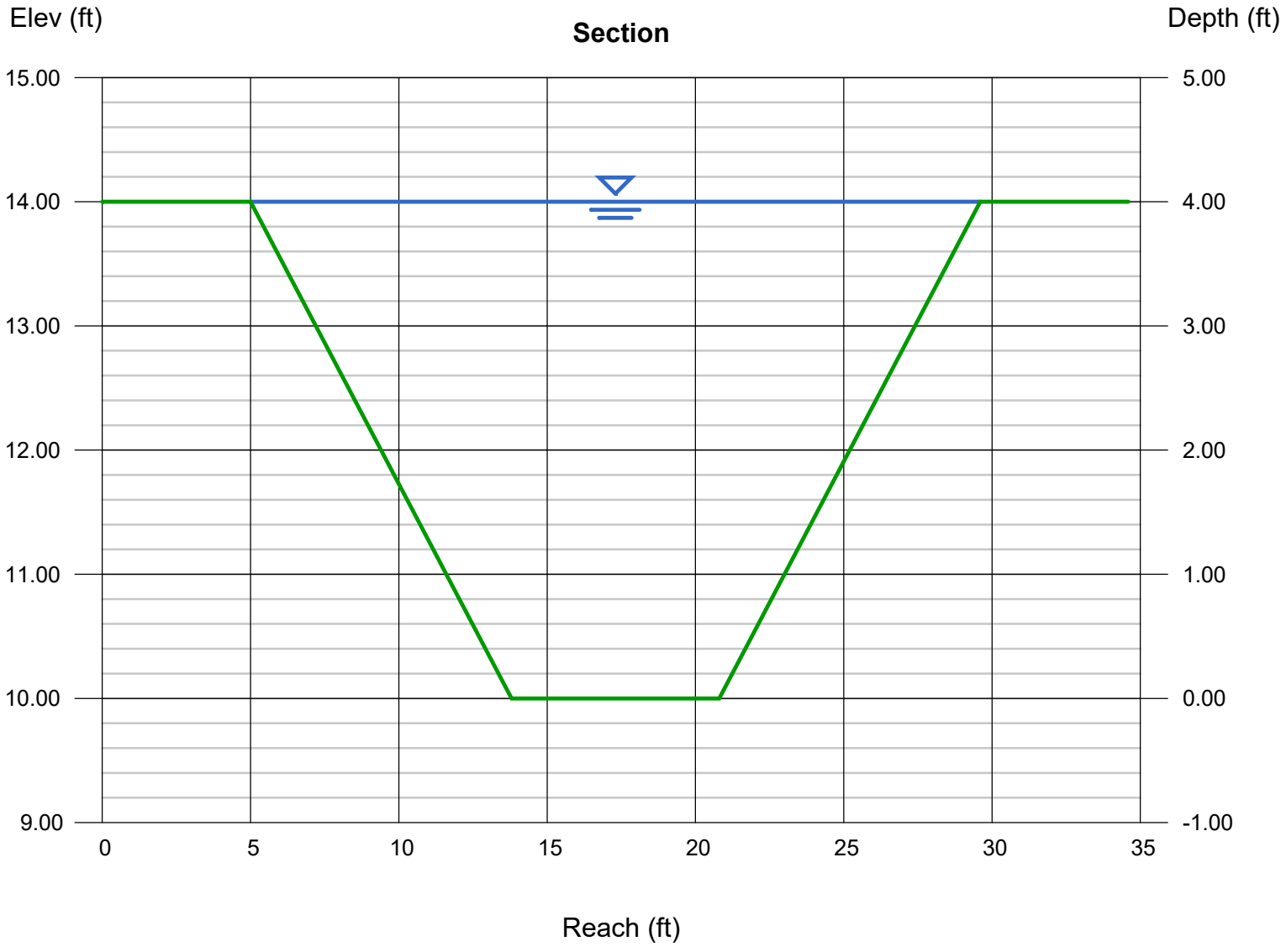
Bottom Width (ft)	= 7.00
Side Slopes (z:1)	= 2.20, 2.20
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 125.52
Area (sqft)	= 63.20
Velocity (ft/s)	= 1.99
Wetted Perim (ft)	= 26.33
Crit Depth, Yc (ft)	= 1.78
Top Width (ft)	= 24.60
EGL (ft)	= 4.06



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

SubLateral 101A Sta 229+58

Invert Elev Dn (ft)	=	9.33
Pipe Length (ft)	=	30.00
Slope (%)	=	0.00
Invert Elev Up (ft)	=	9.33
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

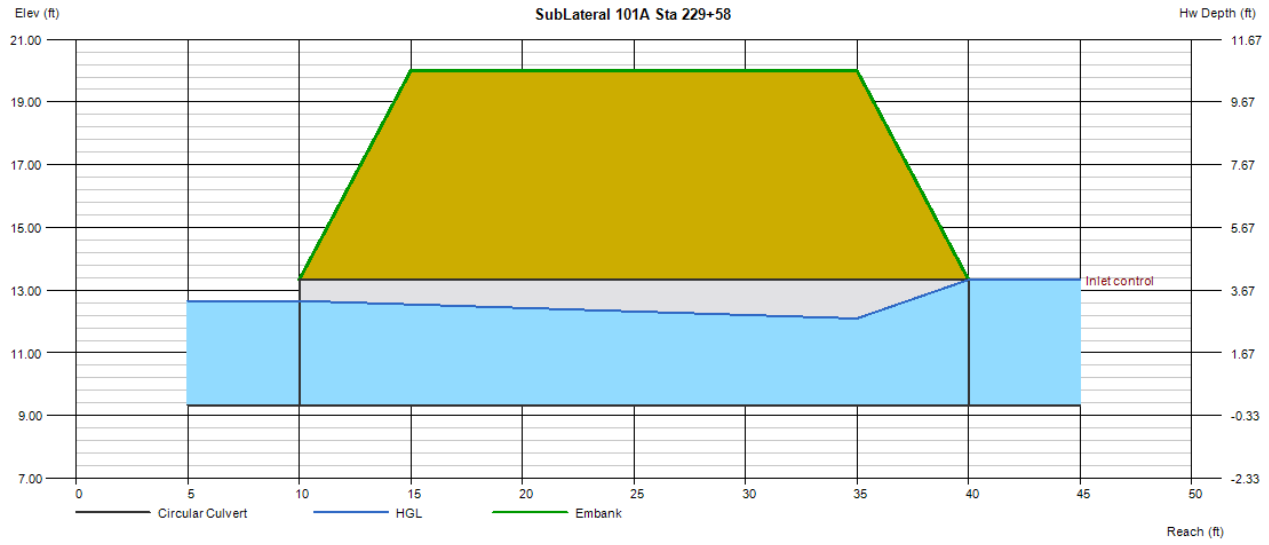
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	77.00
Qpipe (cfs)	=	77.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.89
Veloc Up (ft/s)	=	8.70
HGL Dn (ft)	=	12.66
HGL Up (ft)	=	11.98
Hw Elev (ft)	=	13.33
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Culvert Report

SubLateral 102B Sta 0+00

Invert Elev Dn (ft)	=	9.71
Pipe Length (ft)	=	25.00
Slope (%)	=	1.92
Invert Elev Up (ft)	=	10.19
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

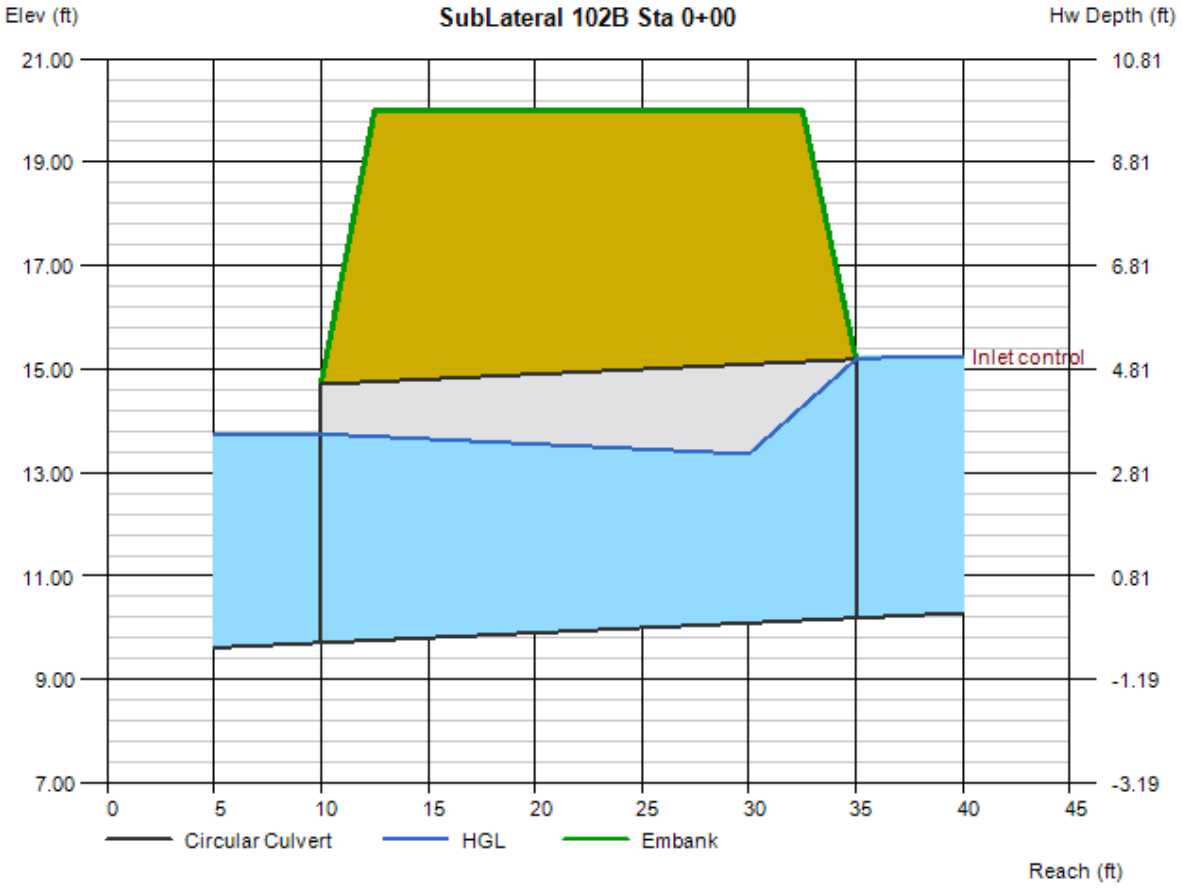
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	100.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	116.00
Qpipe (cfs)	=	116.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.83
Veloc Up (ft/s)	=	9.17
HGL Dn (ft)	=	13.75
HGL Up (ft)	=	13.26
Hw Elev (ft)	=	15.25
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101B Sta 0+00 to 25+57

Trapezoidal

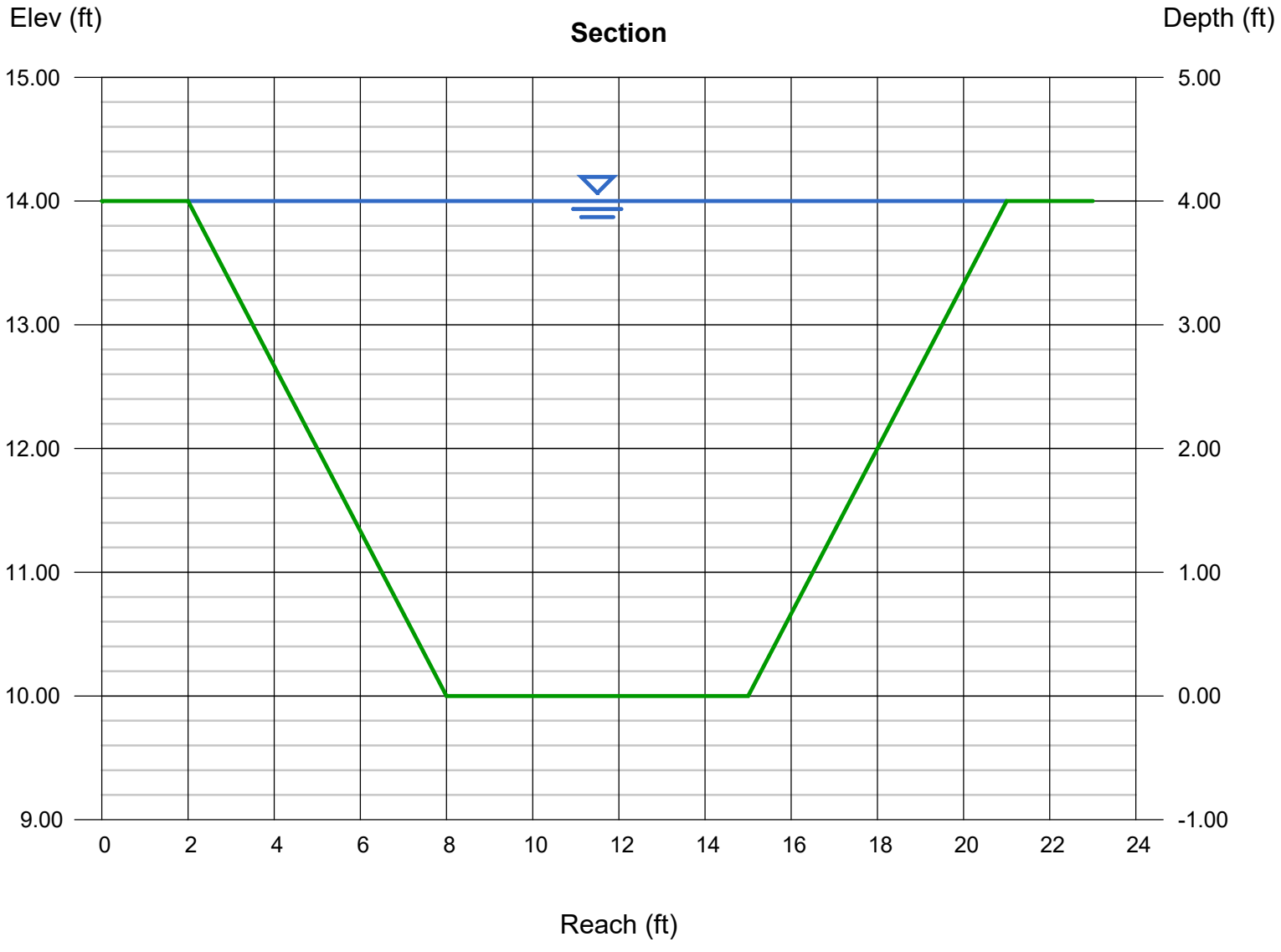
Bottom Width (ft)	= 7.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 104.06
Area (sqft)	= 52.00
Velocity (ft/s)	= 2.00
Wetted Perim (ft)	= 21.42
Crit Depth, Yc (ft)	= 1.68
Top Width (ft)	= 19.00
EGL (ft)	= 4.06



Culvert Report

SubLateral 101B Sta 11+50

Invert Elev Dn (ft)	=	11.40
Pipe Length (ft)	=	30.00
Slope (%)	=	1.43
Invert Elev Up (ft)	=	11.83
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

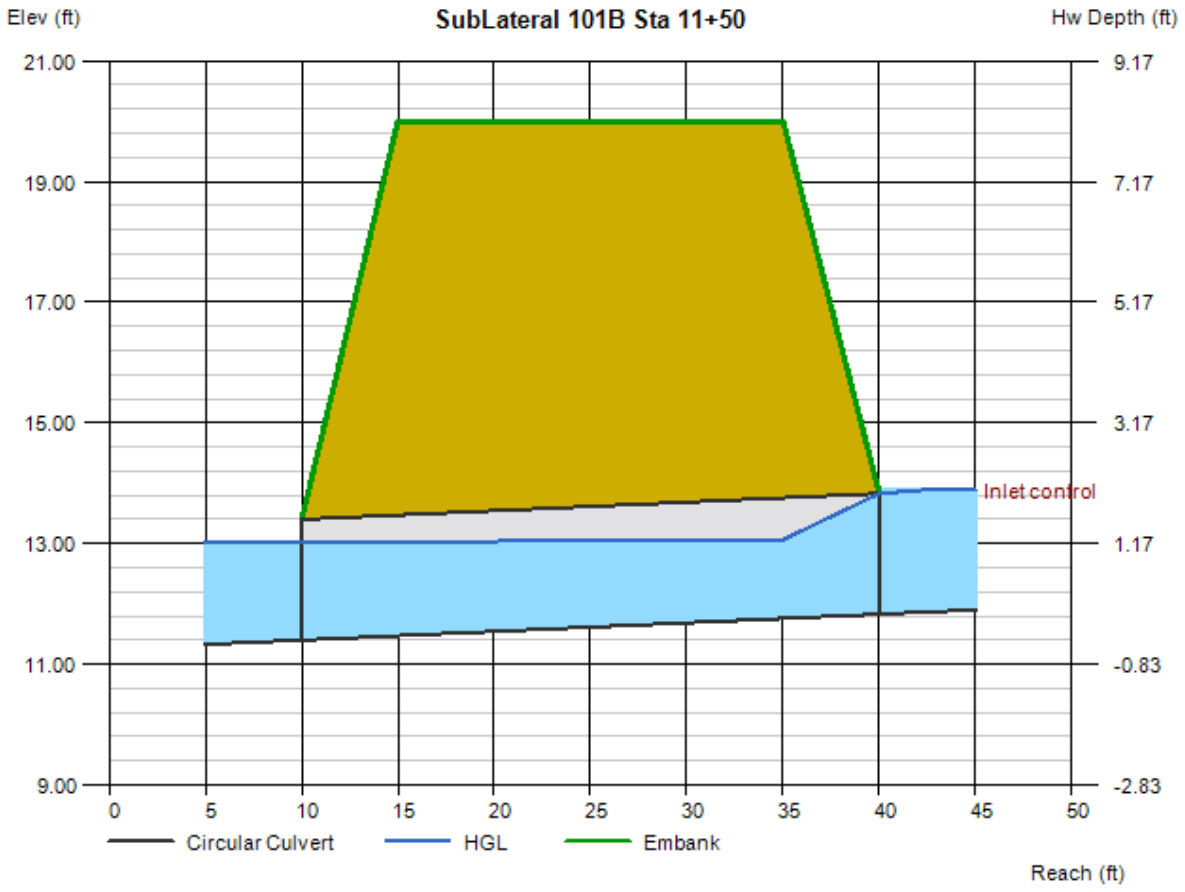
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	12.00
Qpipe (cfs)	=	12.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.40
Veloc Up (ft/s)	=	5.85
HGL Dn (ft)	=	13.02
HGL Up (ft)	=	13.07
Hw Elev (ft)	=	13.89
Hw/D (ft)	=	1.03
Flow Regime	=	Inlet Control



Culvert Report

SubLateral 101B Sta 25+26

Invert Elev Dn (ft)	=	10.83
Pipe Length (ft)	=	30.00
Slope (%)	=	0.37
Invert Elev Up (ft)	=	10.94
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

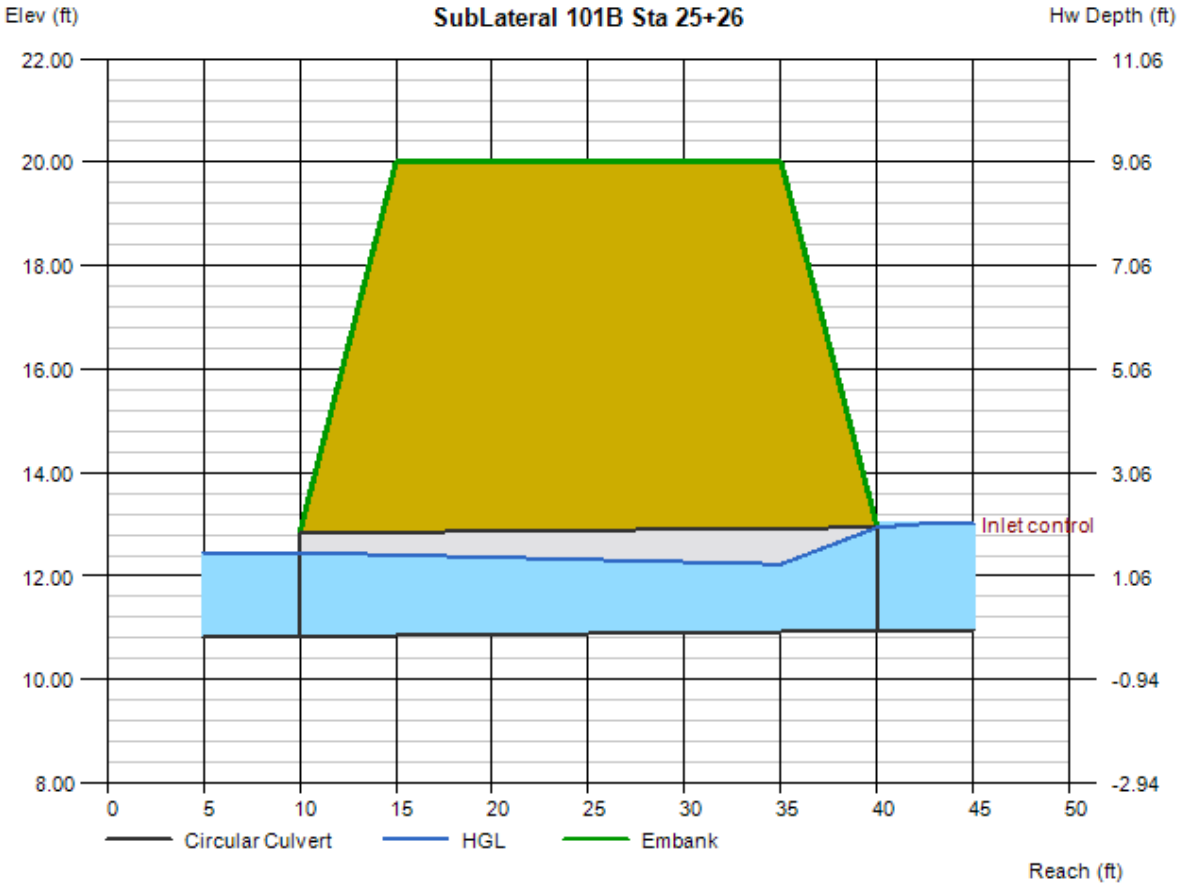
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	12.00
Qpipe (cfs)	=	12.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.40
Veloc Up (ft/s)	=	5.85
HGL Dn (ft)	=	12.45
HGL Up (ft)	=	12.18
Hw Elev (ft)	=	13.01
Hw/D (ft)	=	1.04
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101B Sta 25+57 to 49+73

Trapezoidal

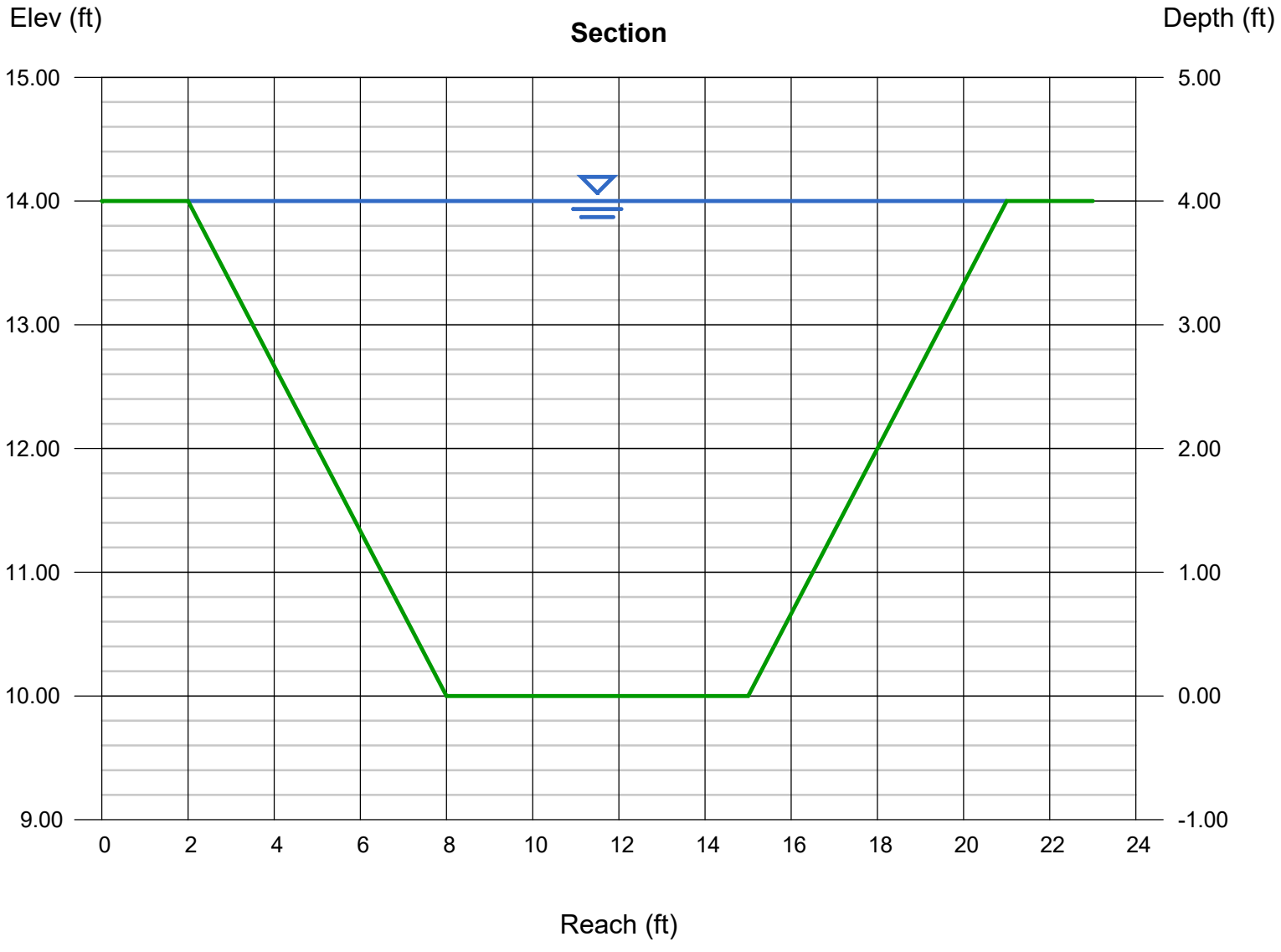
Bottom Width (ft)	= 7.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 104.06
Area (sqft)	= 52.00
Velocity (ft/s)	= 2.00
Wetted Perim (ft)	= 21.42
Crit Depth, Yc (ft)	= 1.68
Top Width (ft)	= 19.00
EGL (ft)	= 4.06



Culvert Report

SubLateral 101B Sta 37+30

Invert Elev Dn (ft)	=	10.04
Pipe Length (ft)	=	20.00
Slope (%)	=	0.35
Invert Elev Up (ft)	=	10.11
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

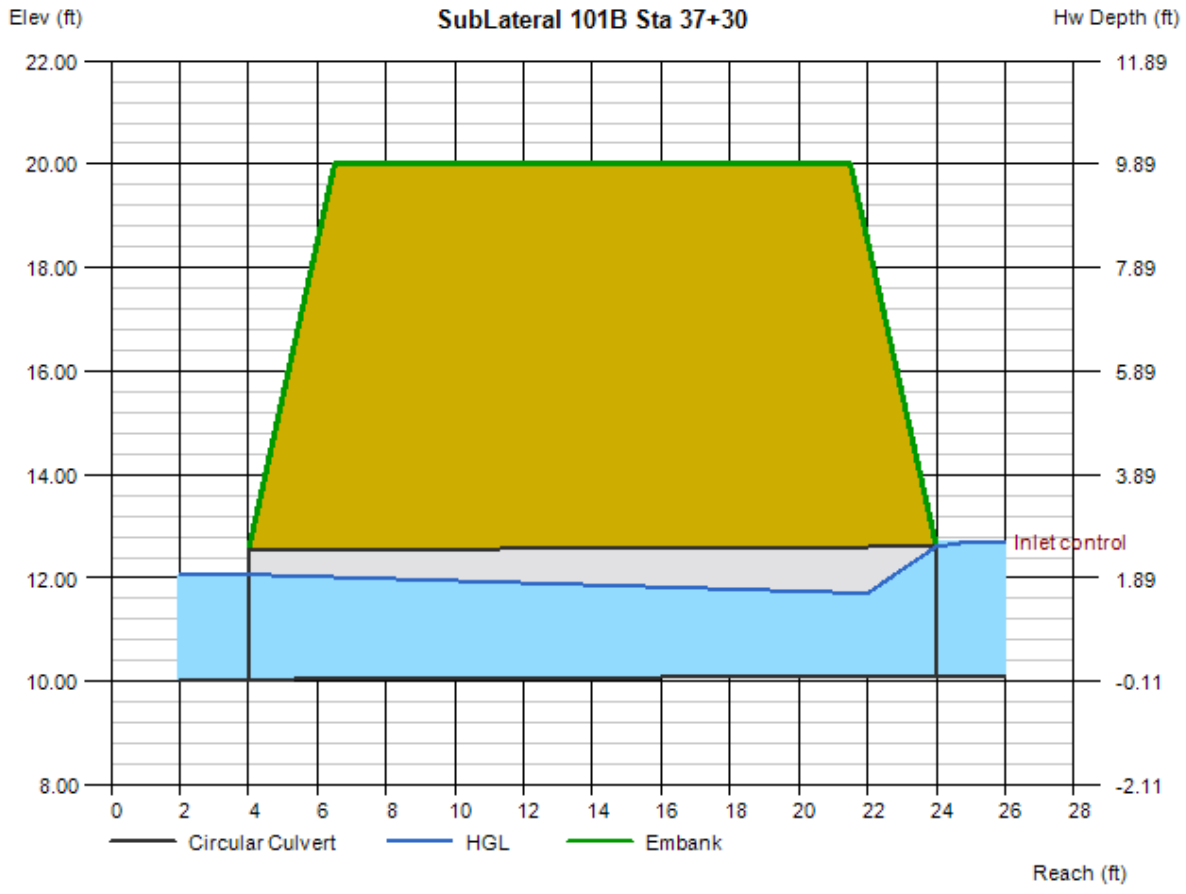
Top Elevation (ft)	=	20.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	21.00
Qpipe (cfs)	=	21.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.92
Veloc Up (ft/s)	=	6.54
HGL Dn (ft)	=	12.07
HGL Up (ft)	=	11.67
Hw Elev (ft)	=	12.70
Hw/D (ft)	=	1.04
Flow Regime	=	Inlet Control



Culvert Report

SubLateral 101B Sta 49+68

Invert Elev Dn (ft)	=	9.56
Pipe Length (ft)	=	33.00
Slope (%)	=	2.03
Invert Elev Up (ft)	=	10.23
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

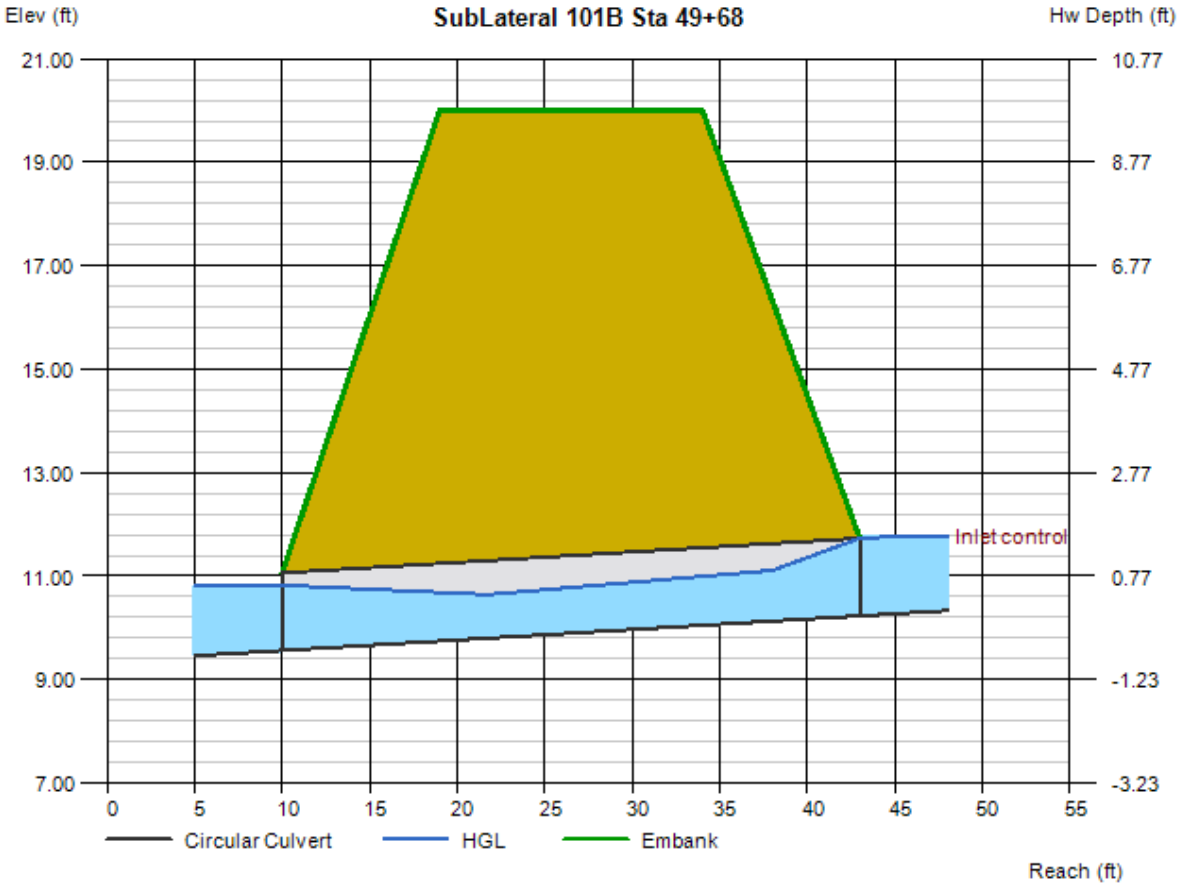
Top Elevation (ft)	=	20.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	7.00
Qpipe (cfs)	=	7.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.41
Veloc Up (ft/s)	=	5.45
HGL Dn (ft)	=	10.82
HGL Up (ft)	=	11.25
Hw Elev (ft)	=	11.77
Hw/D (ft)	=	1.03
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 101B Sta 49+73 to 61+00

Trapezoidal

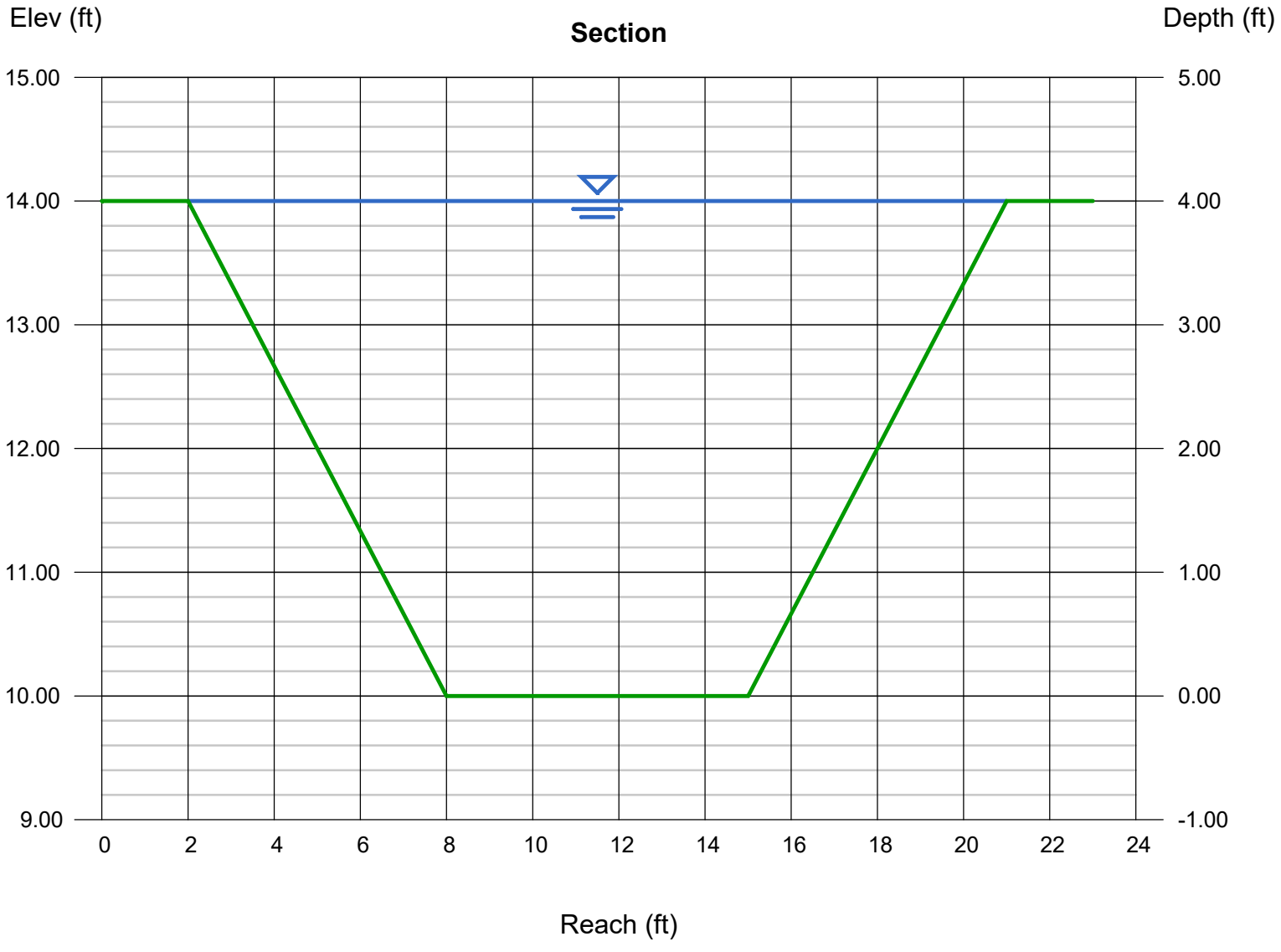
Bottom Width (ft)	= 7.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 104.06
Area (sqft)	= 52.00
Velocity (ft/s)	= 2.00
Wetted Perim (ft)	= 21.42
Crit Depth, Yc (ft)	= 1.68
Top Width (ft)	= 19.00
EGL (ft)	= 4.06



Culvert Report

SubLateral 101B Sta 59+84

Invert Elev Dn (ft)	=	10.04
Pipe Length (ft)	=	33.00
Slope (%)	=	-1.27
Invert Elev Up (ft)	=	9.62
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

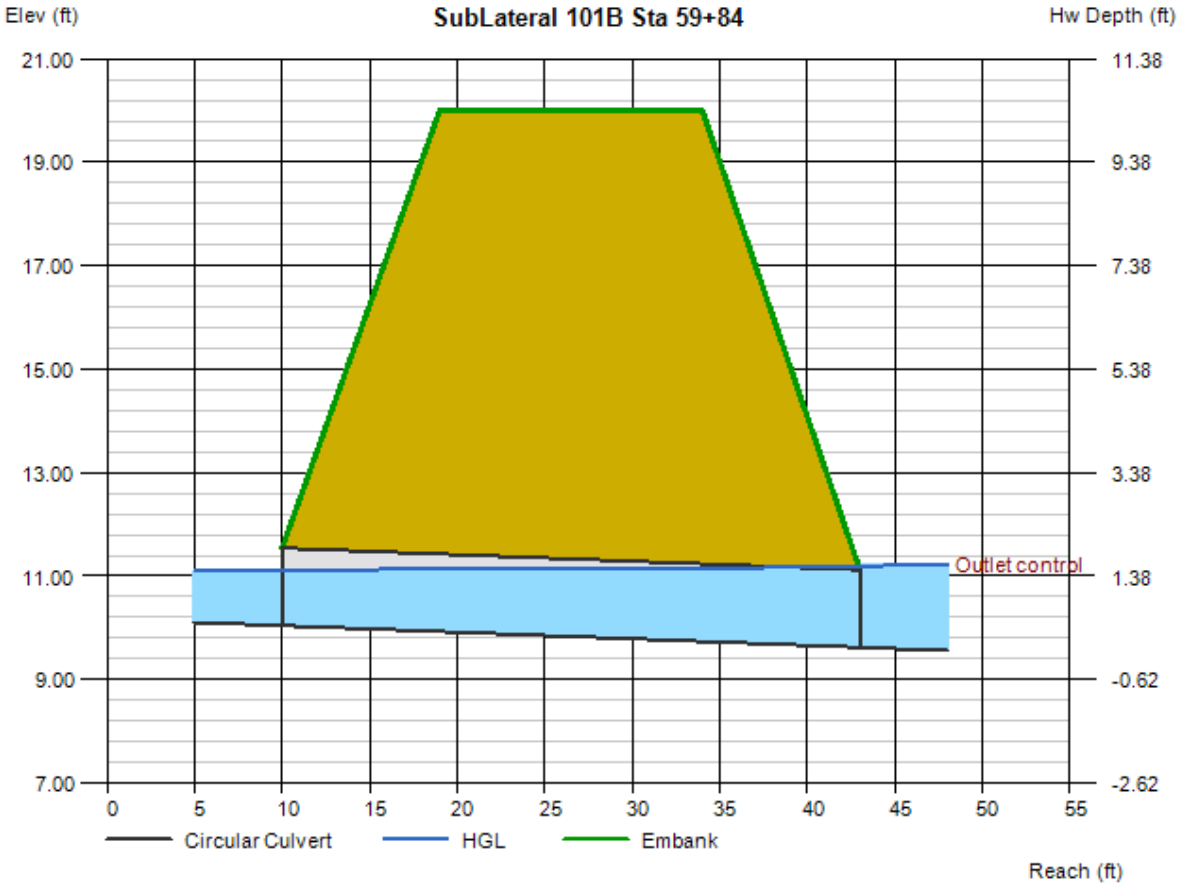
Top Elevation (ft)	=	20.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	3.00
Qpipe (cfs)	=	3.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.20
Veloc Up (ft/s)	=	1.70
HGL Dn (ft)	=	11.12
HGL Up (ft)	=	11.17
Hw Elev (ft)	=	11.23
Hw/D (ft)	=	1.07
Flow Regime	=	Outlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 102 Sta 0+00 to 11+09

Trapezoidal

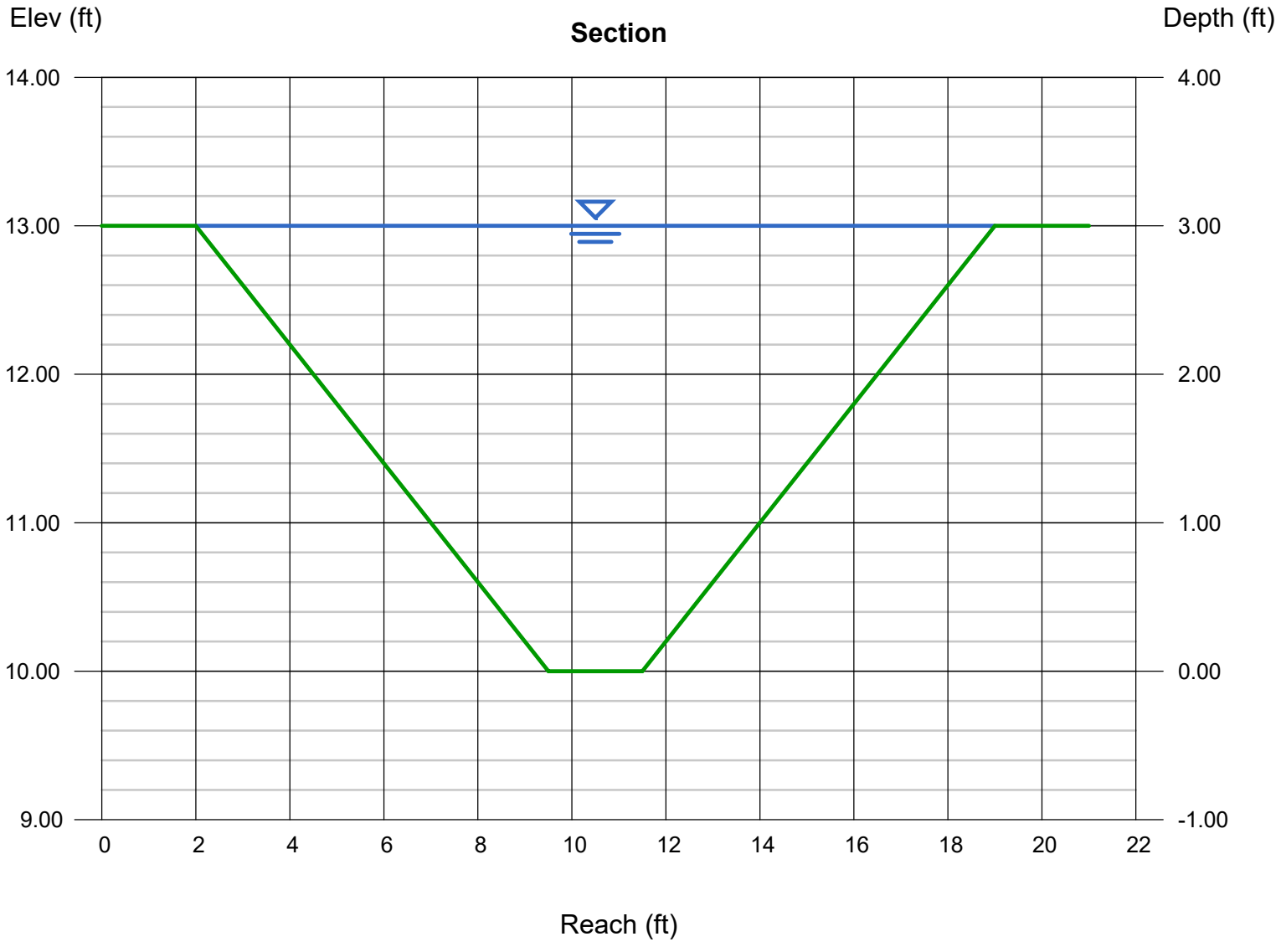
Bottom Width (ft)	= 2.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.00

Highlighted

Depth (ft)	= 3.00
Q (cfs)	= 42.64
Area (sqft)	= 28.50
Velocity (ft/s)	= 1.50
Wetted Perim (ft)	= 18.16
Crit Depth, Yc (ft)	= 1.44
Top Width (ft)	= 17.00
EGL (ft)	= 3.03



Culvert Report

Lateral 102 Sta 0+37

Invert Elev Dn (ft)	=	14.16
Pipe Length (ft)	=	36.00
Slope (%)	=	-0.72
Invert Elev Up (ft)	=	13.90
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

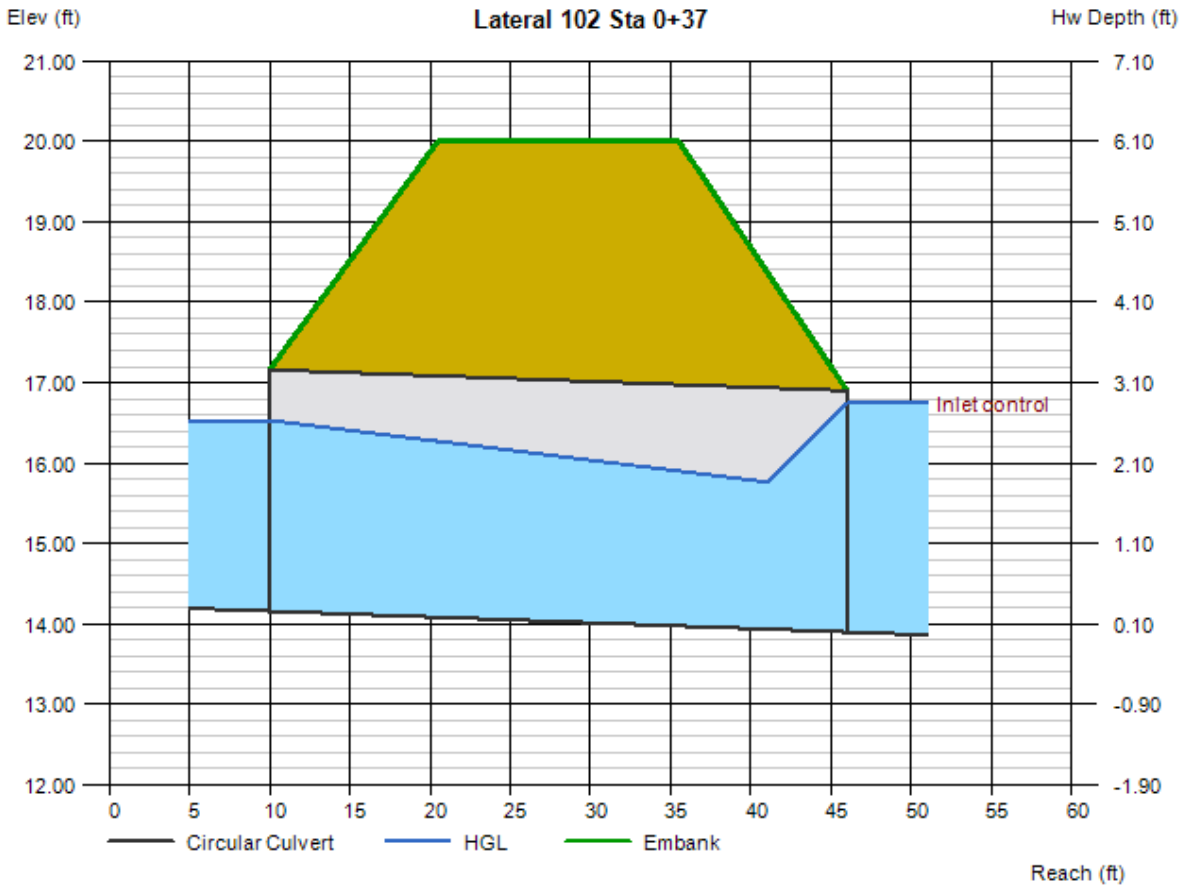
Top Elevation (ft)	=	20.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	29.00
Qpipe (cfs)	=	29.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.84
Veloc Up (ft/s)	=	6.81
HGL Dn (ft)	=	16.53
HGL Up (ft)	=	15.64
Hw Elev (ft)	=	16.75
Hw/D (ft)	=	0.95
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 102 Sta 5+09

Invert Elev Dn (ft)	=	13.97
Pipe Length (ft)	=	41.00
Slope (%)	=	0.54
Invert Elev Up (ft)	=	14.19
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

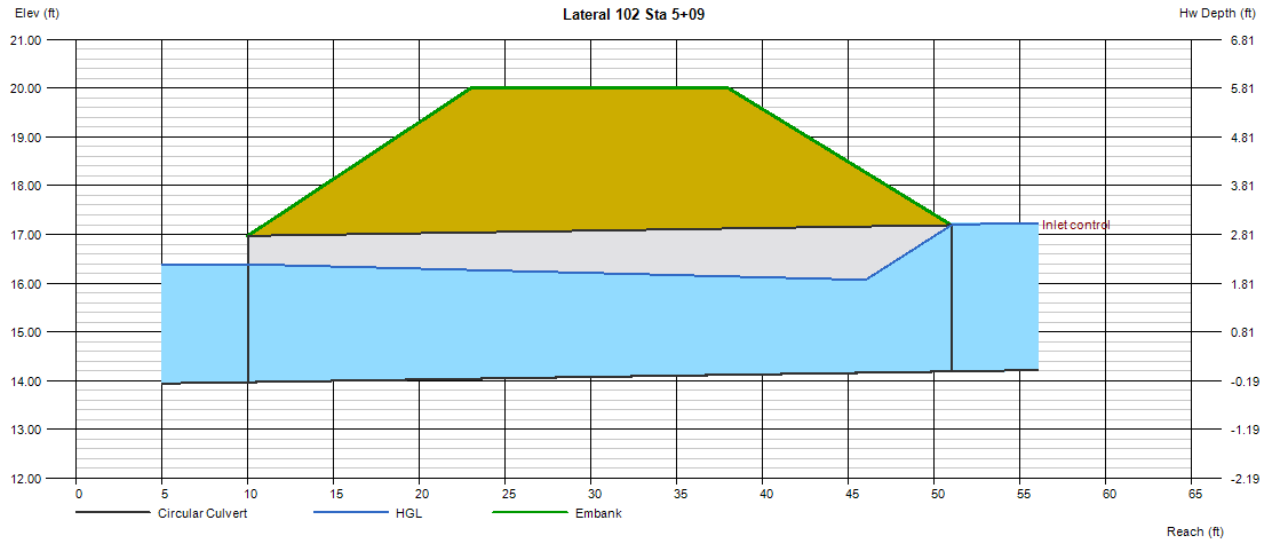
Top Elevation (ft)	=	20.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	32.00
Qpipe (cfs)	=	32.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.24
Veloc Up (ft/s)	=	7.07
HGL Dn (ft)	=	16.39
HGL Up (ft)	=	16.02
Hw Elev (ft)	=	17.22
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Culvert Report

Lateral 102 Sta 6+24

Invert Elev Dn (ft)	=	13.97
Pipe Length (ft)	=	20.00
Slope (%)	=	1.60
Invert Elev Up (ft)	=	14.29
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

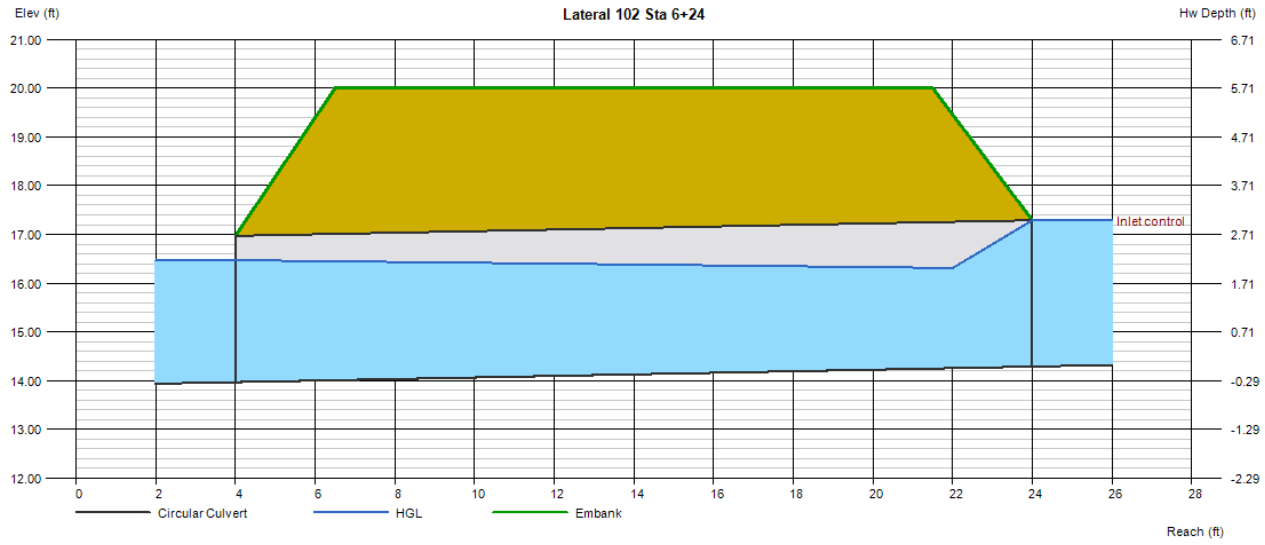
Top Elevation (ft)	=	20.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	38.00
Qpipe (cfs)	=	38.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.03
Veloc Up (ft/s)	=	7.57
HGL Dn (ft)	=	16.47
HGL Up (ft)	=	16.29
Hw Elev (ft)	=	17.29
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 102 Sta 11+09 to 29+44

Trapezoidal

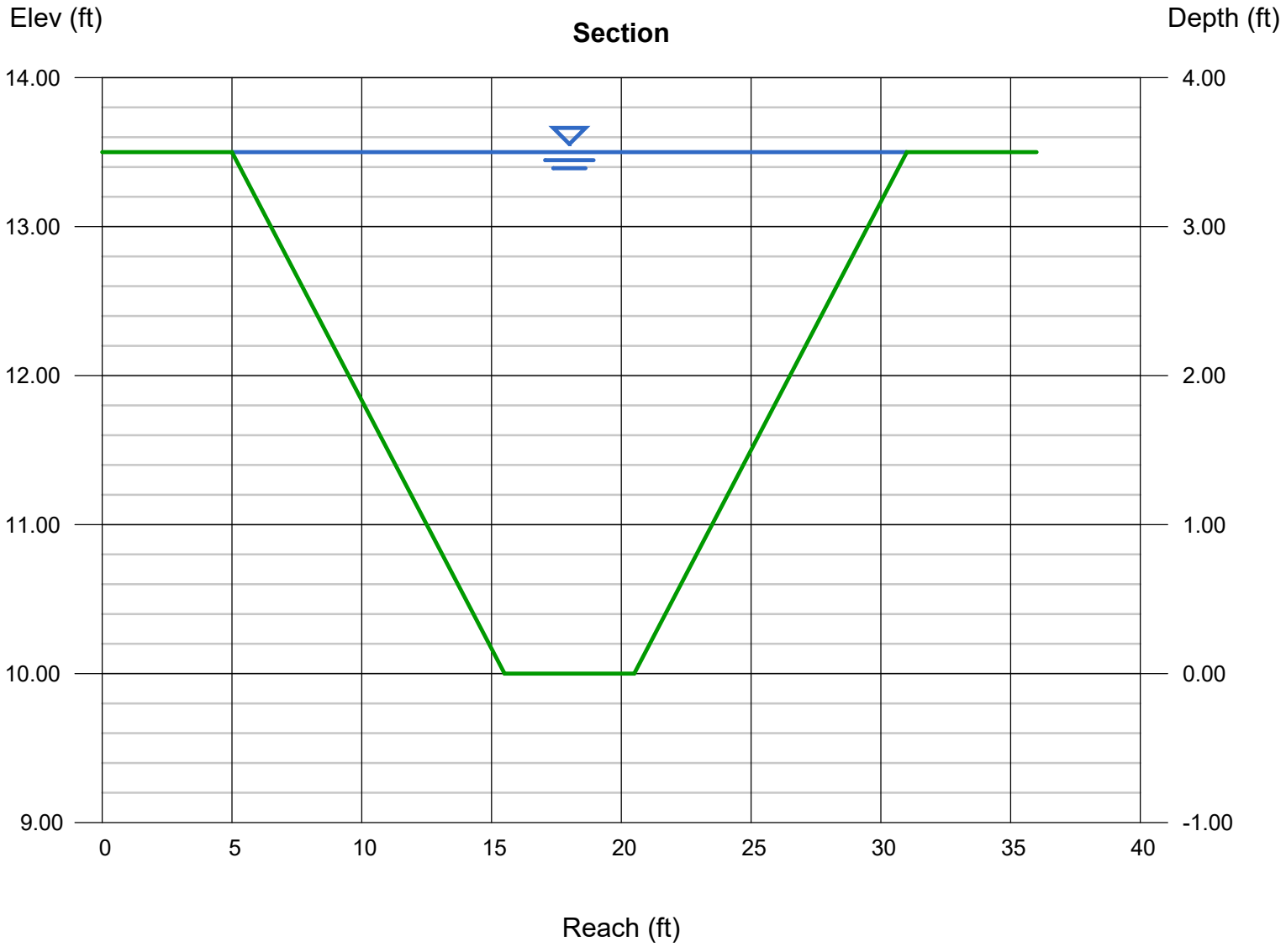
Bottom Width (ft)	= 5.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.44
N-Value	= 0.025

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.50

Highlighted

Depth (ft)	= 3.50
Q (cfs)	= 339.53
Area (sqft)	= 54.25
Velocity (ft/s)	= 6.26
Wetted Perim (ft)	= 27.14
Crit Depth, Yc (ft)	= 3.08
Top Width (ft)	= 26.00
EGL (ft)	= 4.11



Culvert Report

Lateral 102 Sta 29+80

Invert Elev Dn (ft)	=	10.26
Pipe Length (ft)	=	41.00
Slope (%)	=	-0.32
Invert Elev Up (ft)	=	10.13
Rise (in)	=	54.0
Shape	=	Circular
Span (in)	=	54.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

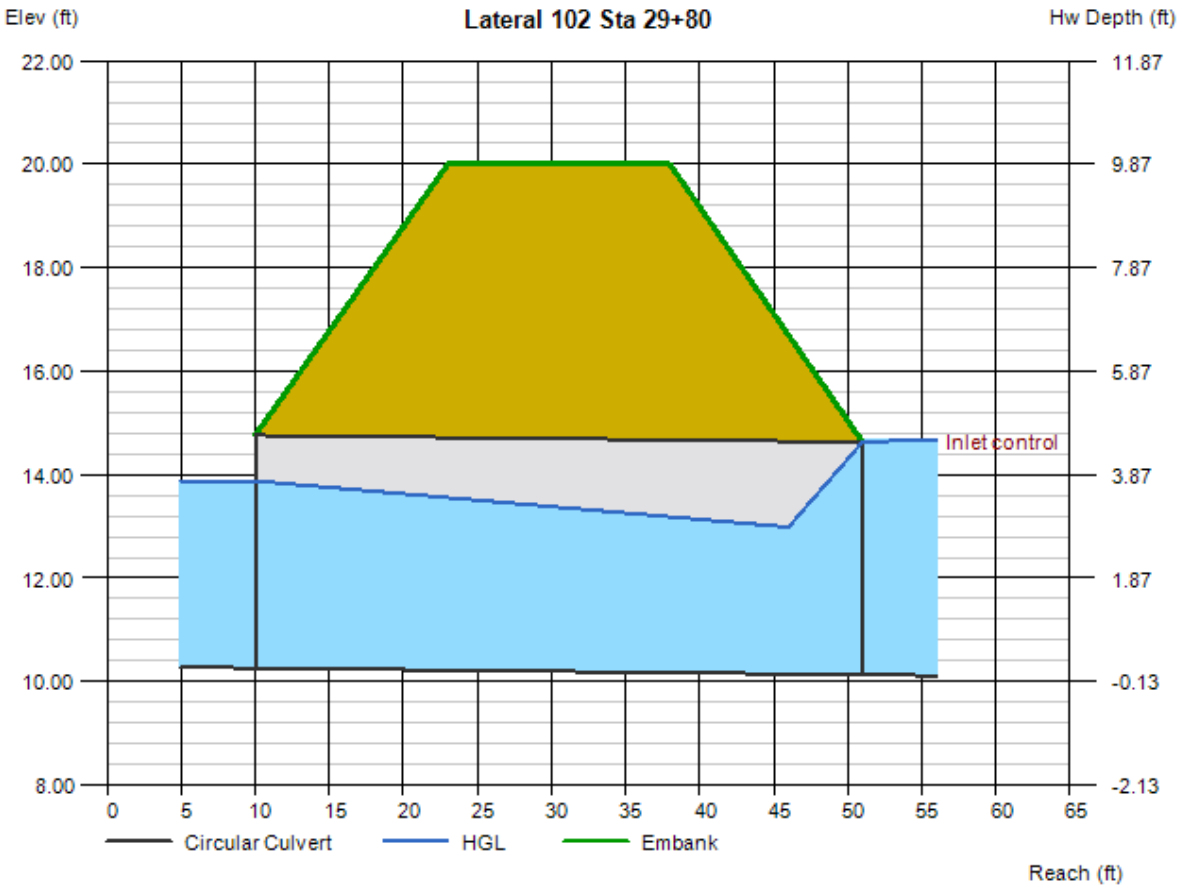
Top Elevation (ft)	=	20.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	150.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	87.00
Qpipe (cfs)	=	87.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.35
Veloc Up (ft/s)	=	8.61
HGL Dn (ft)	=	13.88
HGL Up (ft)	=	12.86
Hw Elev (ft)	=	14.66
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 102 Sta 30+32 to 85+30

Trapezoidal

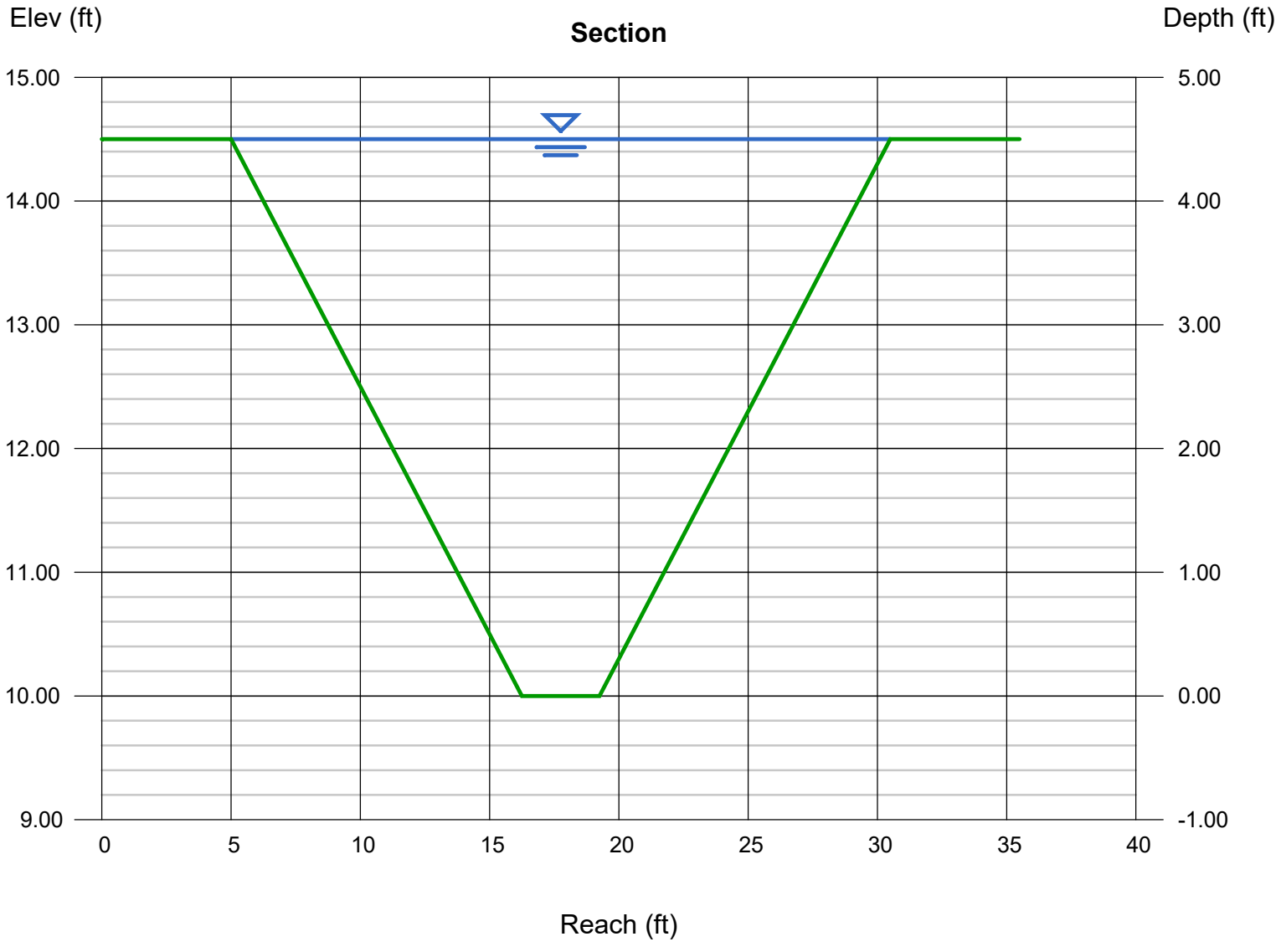
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 4.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.50

Highlighted

Depth (ft)	= 4.50
Q (cfs)	= 125.74
Area (sqft)	= 64.13
Velocity (ft/s)	= 1.96
Wetted Perim (ft)	= 27.23
Crit Depth, Yc (ft)	= 2.23
Top Width (ft)	= 25.50
EGL (ft)	= 4.56



Culvert Report

Lateral 102 Sta 85 16

Invert Elev Dn (ft)	=	7.10
Pipe Length (ft)	=	38.00
Slope (%)	=	0.68
Invert Elev Up (ft)	=	7.36
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	2
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

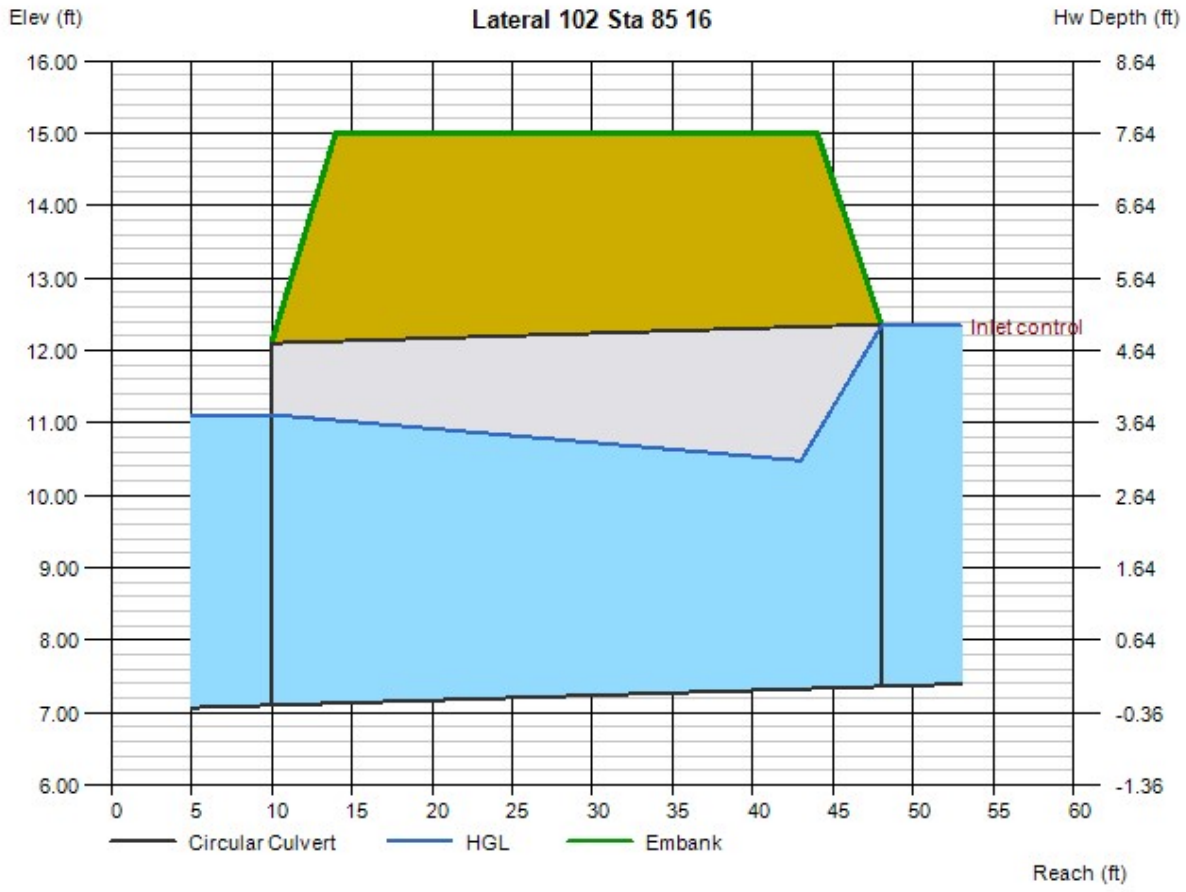
Top Elevation (ft)	=	15.00
Top Width (ft)	=	30.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	10.00
Qmax (cfs)	=	300.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	225.00
Qpipe (cfs)	=	225.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.66
Veloc Up (ft/s)	=	9.06
HGL Dn (ft)	=	11.11
HGL Up (ft)	=	10.38
Hw Elev (ft)	=	12.34
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 102 Sta 85+96 to 105+57

Trapezoidal

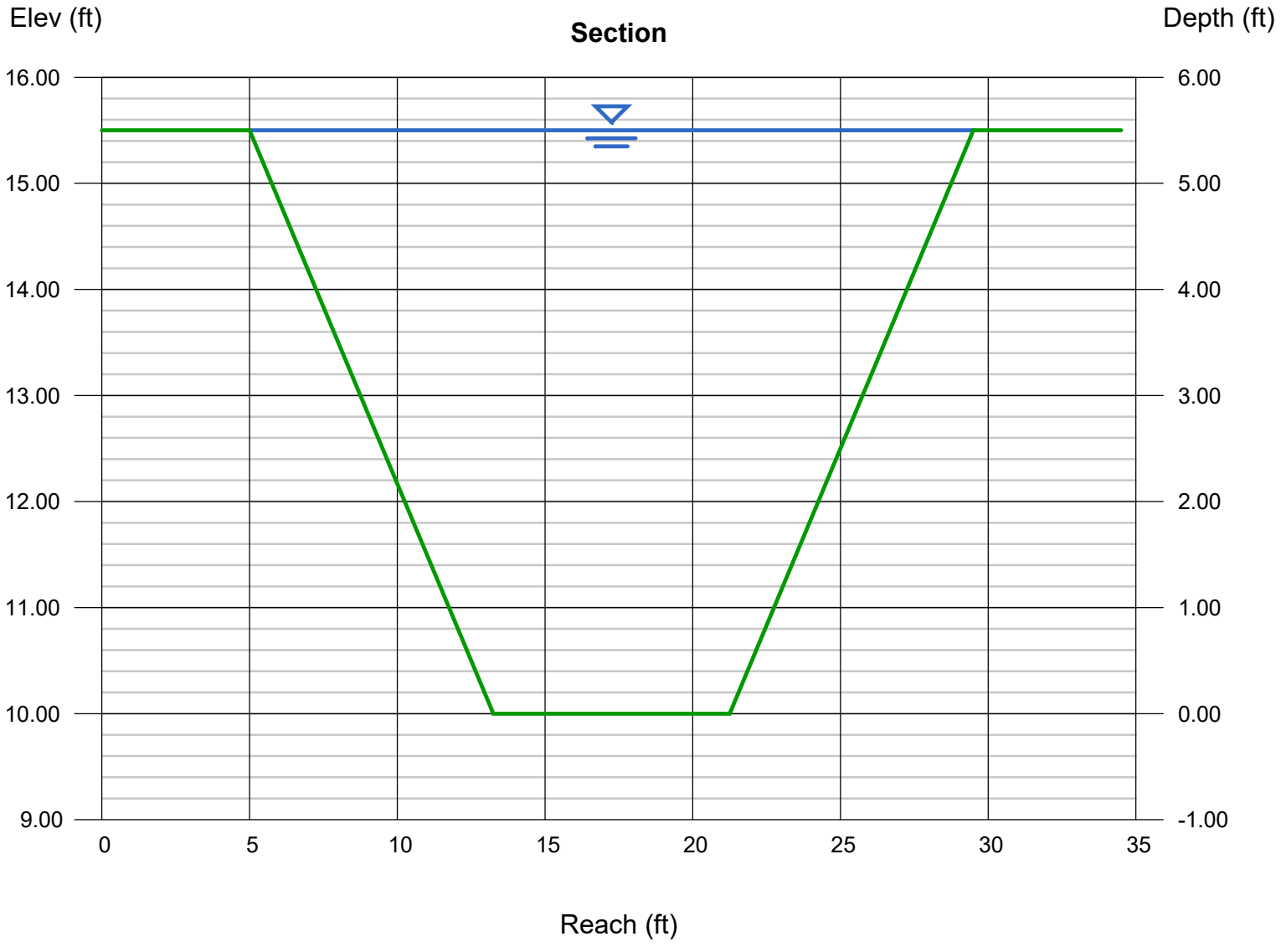
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 5.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.50

Highlighted

Depth (ft)	= 5.50
Q (cfs)	= 215.56
Area (sqft)	= 89.38
Velocity (ft/s)	= 2.41
Wetted Perim (ft)	= 27.83
Crit Depth, Yc (ft)	= 2.42
Top Width (ft)	= 24.50
EGL (ft)	= 5.59



Culvert Report

Lateral 102 Sta 105 57

Invert Elev Dn (ft)	=	7.04
Pipe Length (ft)	=	40.00
Slope (%)	=	0.05
Invert Elev Up (ft)	=	7.06
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	2
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

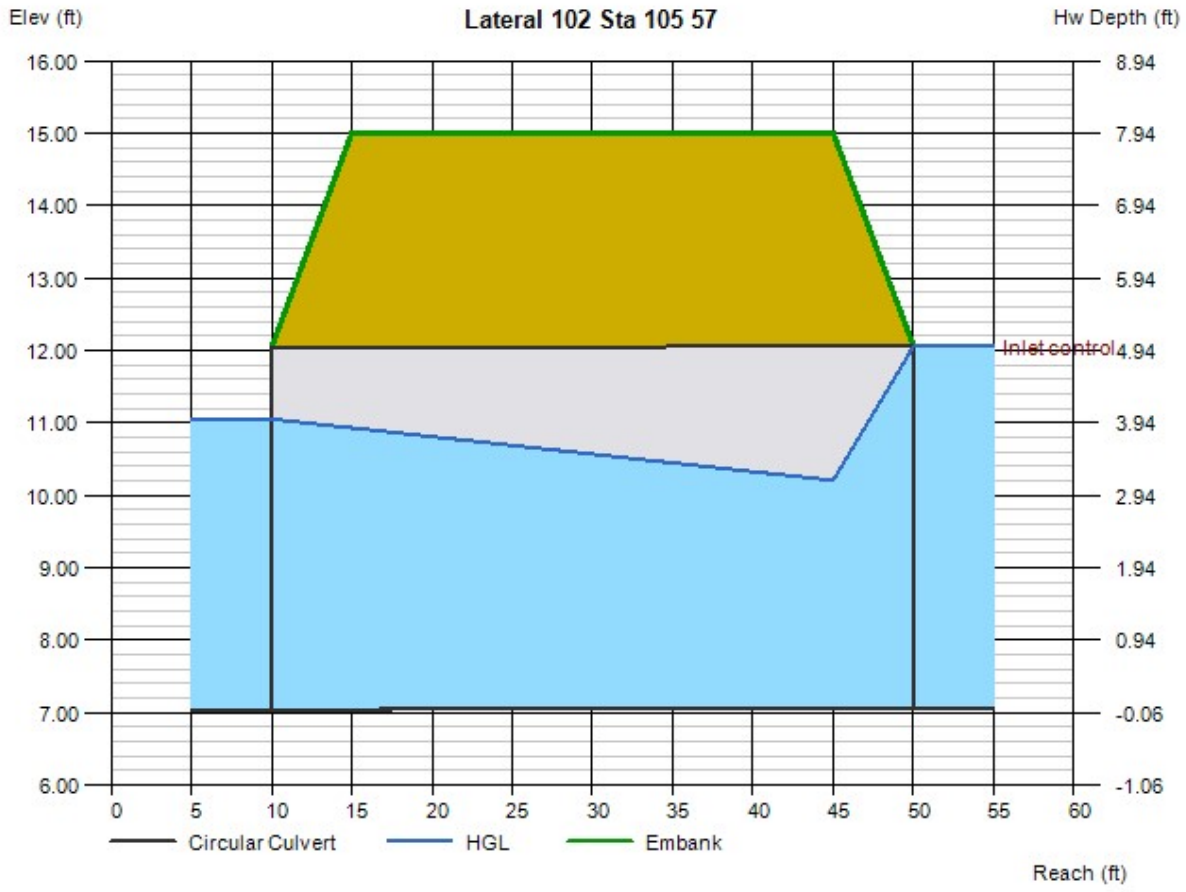
Top Elevation (ft)	=	15.00
Top Width (ft)	=	30.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	10.00
Qmax (cfs)	=	300.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	225.00
Qpipe (cfs)	=	225.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.66
Veloc Up (ft/s)	=	9.06
HGL Dn (ft)	=	11.05
HGL Up (ft)	=	10.08
Hw Elev (ft)	=	12.06
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 102 Sta 106+24 to 126+89

Trapezoidal

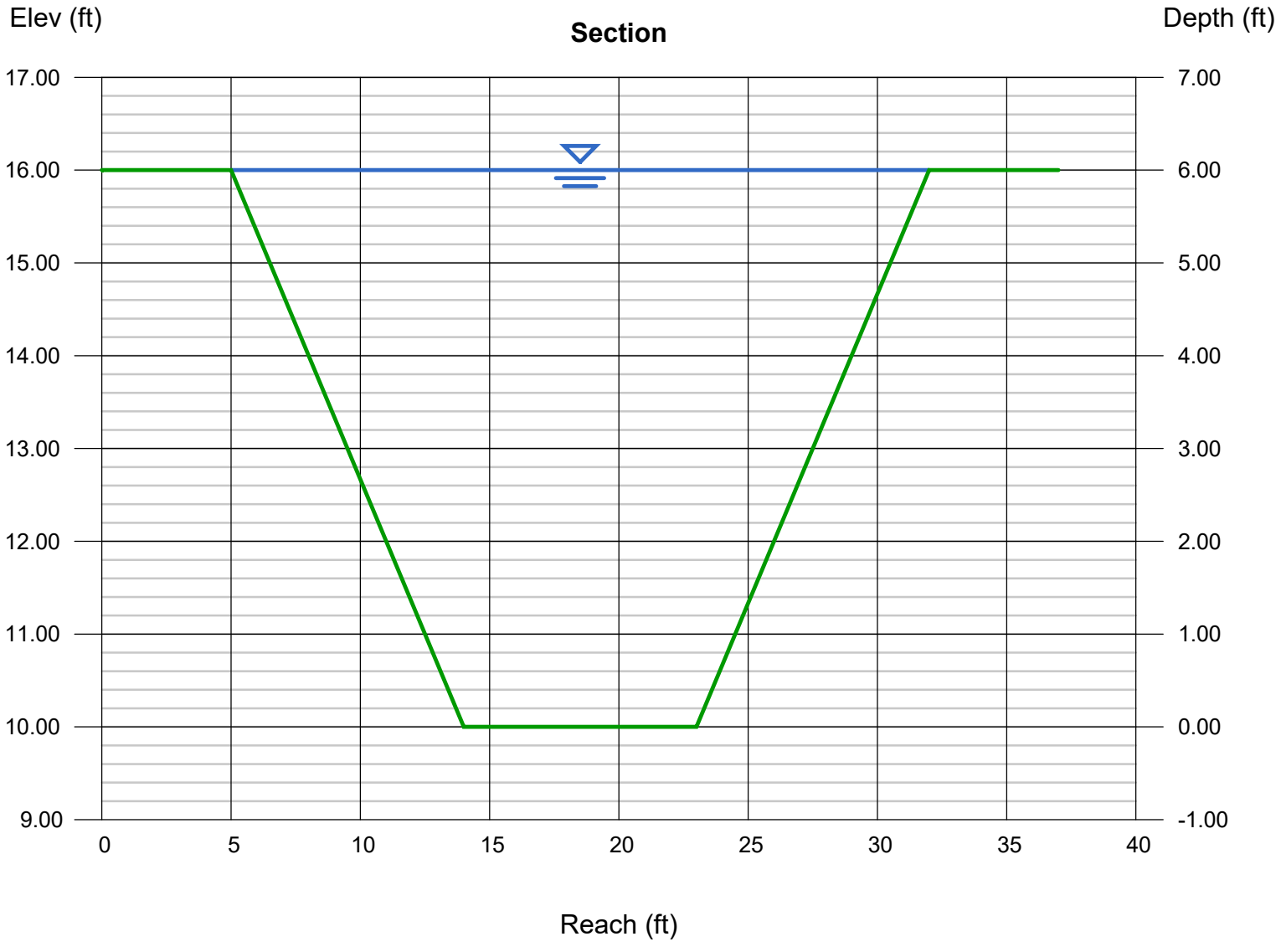
Bottom Width (ft)	= 9.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 6.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 6.00

Highlighted

Depth (ft)	= 6.00
Q (cfs)	= 277.21
Area (sqft)	= 108.00
Velocity (ft/s)	= 2.57
Wetted Perim (ft)	= 30.63
Crit Depth, Yc (ft)	= 2.65
Top Width (ft)	= 27.00
EGL (ft)	= 6.10



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

SubLateral 102A Sta 500+00 to 505+84

Trapezoidal

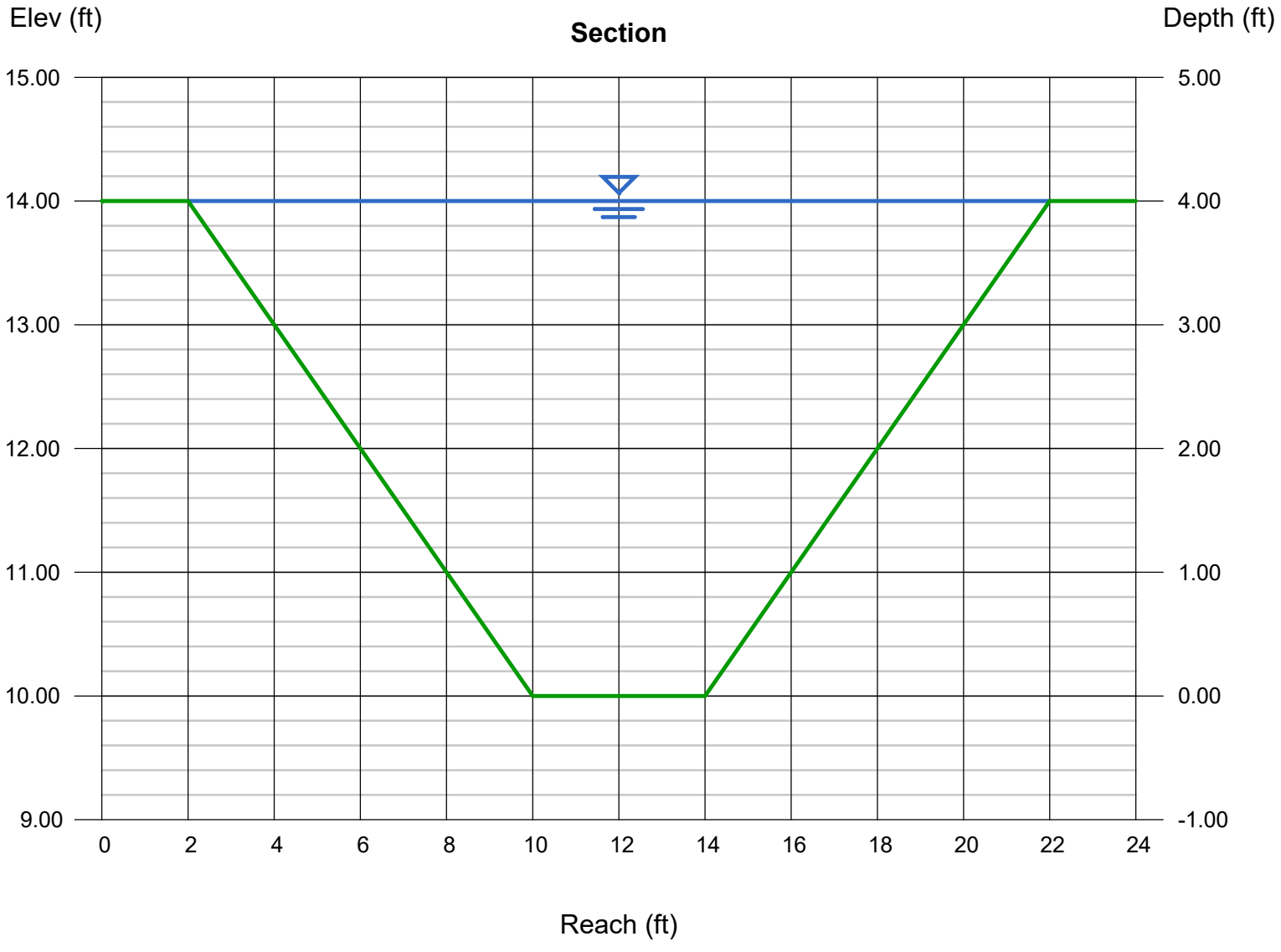
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.08
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 113.54
Area (sqft)	= 48.00
Velocity (ft/s)	= 2.37
Wetted Perim (ft)	= 21.89
Crit Depth, Yc (ft)	= 2.09
Top Width (ft)	= 20.00
EGL (ft)	= 4.09



Culvert Report

SubLateral 102A Sta 505+84

Invert Elev Dn (ft)	=	13.92
Pipe Length (ft)	=	62.00
Slope (%)	=	0.82
Invert Elev Up (ft)	=	14.43
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

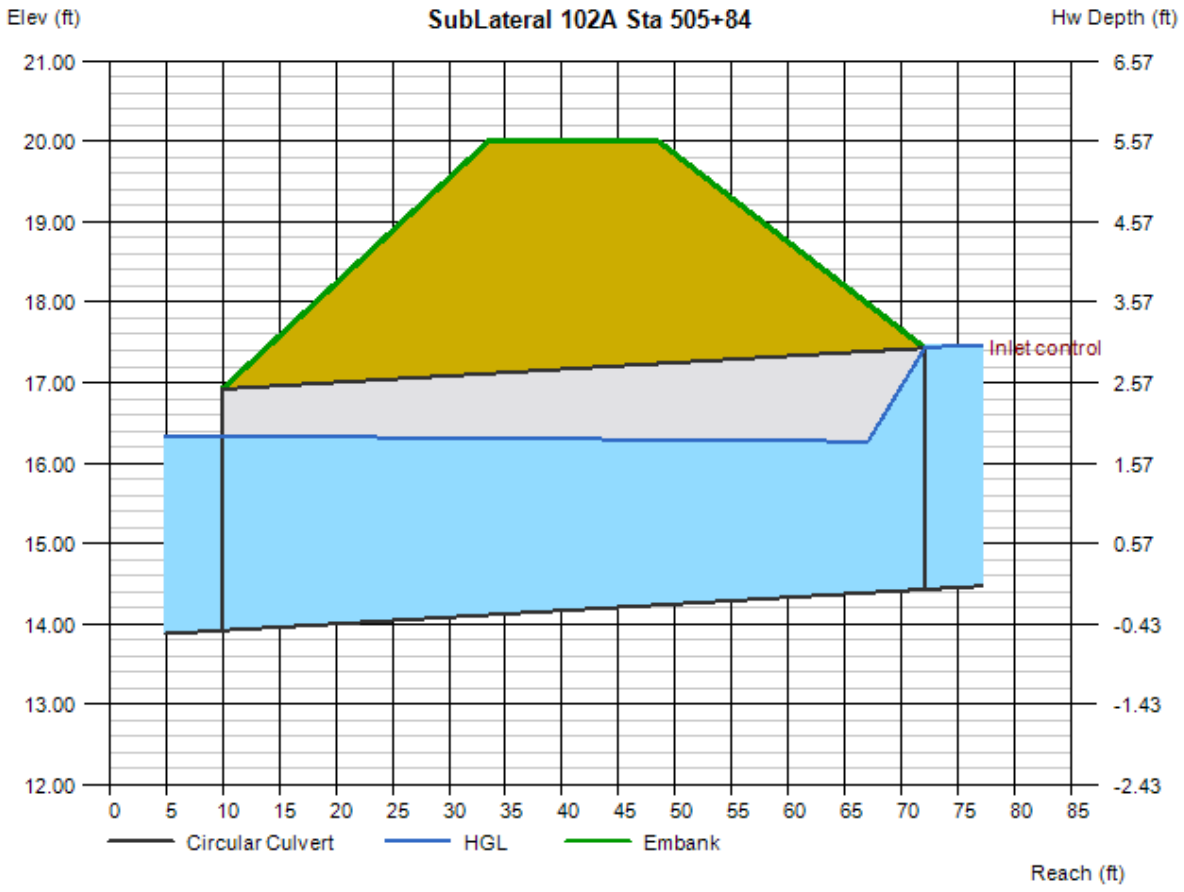
Top Elevation (ft)	=	20.00
Top Width (ft)	=	15.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	32.00
Qpipe (cfs)	=	32.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.24
Veloc Up (ft/s)	=	7.07
HGL Dn (ft)	=	16.34
HGL Up (ft)	=	16.26
Hw Elev (ft)	=	17.46
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

SubLateral 102A Sta 506+19 to 511+34

Trapezoidal

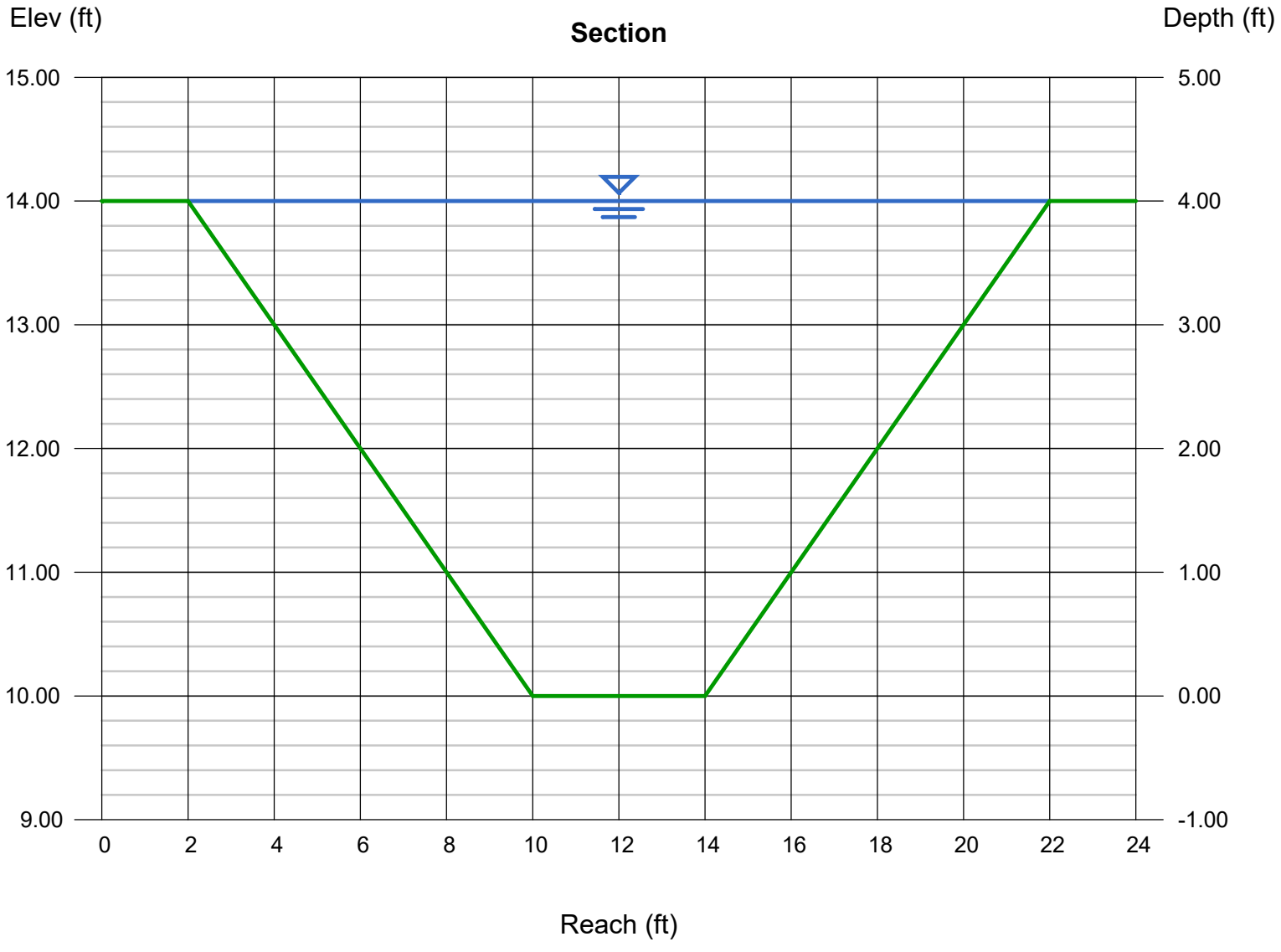
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.08
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 113.54
Area (sqft)	= 48.00
Velocity (ft/s)	= 2.37
Wetted Perim (ft)	= 21.89
Crit Depth, Yc (ft)	= 2.09
Top Width (ft)	= 20.00
EGL (ft)	= 4.09



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Oct 16 2018

Lateral 102B 300+00 to 308+00

Trapezoidal

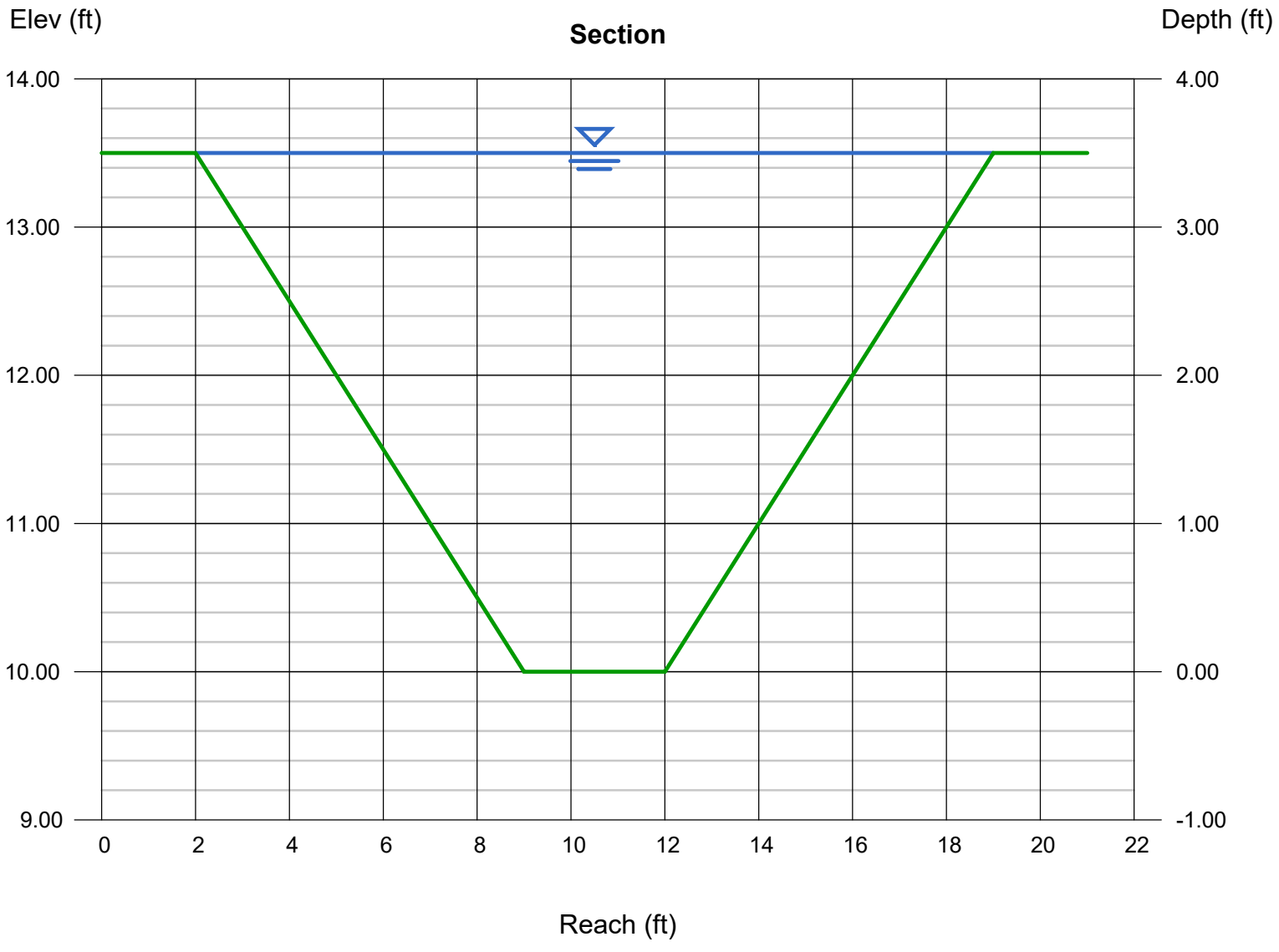
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 3.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.10
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.50

Highlighted

Depth (ft)	= 3.50
Q (cfs)	= 83.42
Area (sqft)	= 35.00
Velocity (ft/s)	= 2.38
Wetted Perim (ft)	= 18.65
Crit Depth, Yc (ft)	= 1.93
Top Width (ft)	= 17.00
EGL (ft)	= 3.59



Culvert Report

Sublateral 102B station 308+00

Invert Elev Dn (ft)	=	15.10
Pipe Length (ft)	=	50.00
Slope (%)	=	-0.84
Invert Elev Up (ft)	=	14.68
Rise (in)	=	42.0
Shape	=	Circular
Span (in)	=	42.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

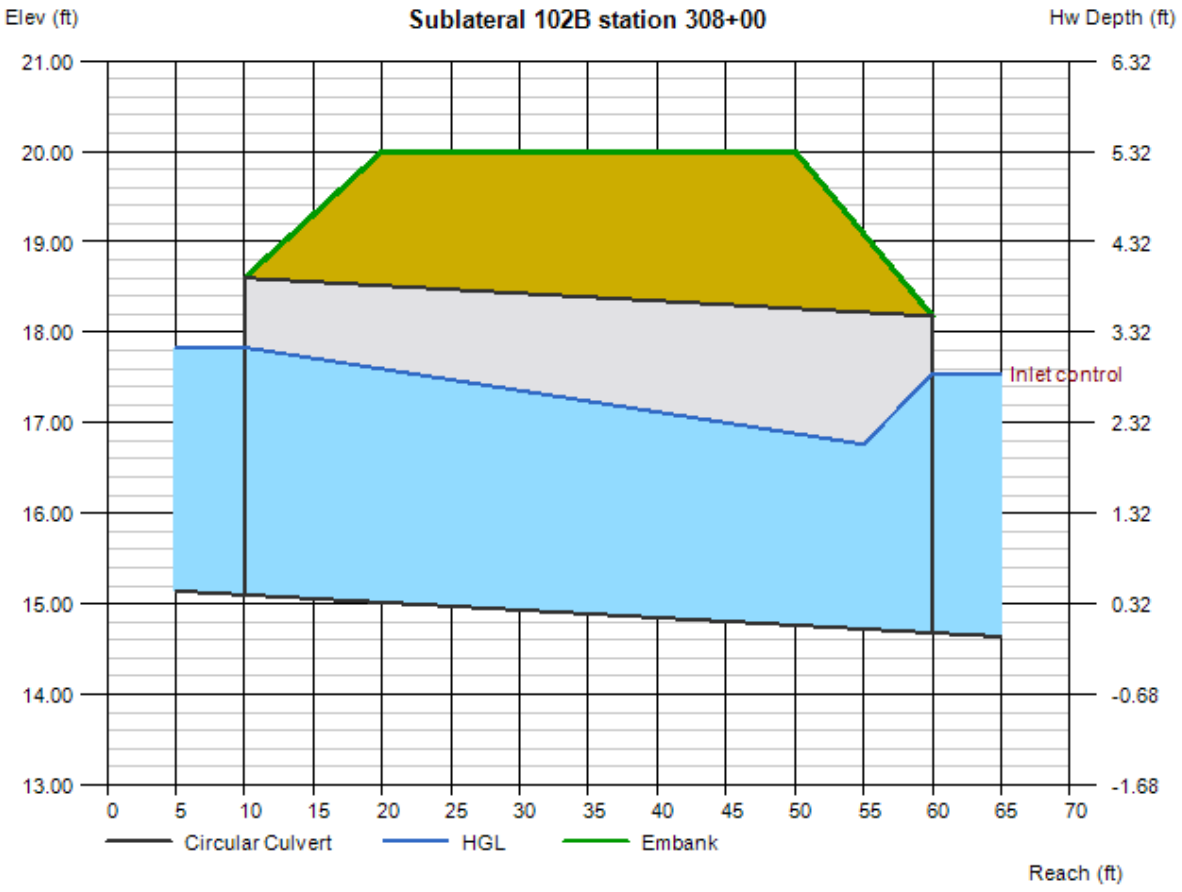
Top Elevation (ft)	=	20.00
Top Width (ft)	=	30.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	40.00
Qpipe (cfs)	=	40.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.96
Veloc Up (ft/s)	=	7.19
HGL Dn (ft)	=	17.83
HGL Up (ft)	=	16.65
Hw Elev (ft)	=	17.54
Hw/D (ft)	=	0.82
Flow Regime	=	Inlet Control



Culvert Report

Sublateral 102 B Station 308+76

Invert Elev Dn (ft)	=	14.71
Pipe Length (ft)	=	391.00
Slope (%)	=	0.10
Invert Elev Up (ft)	=	15.10
Rise (in)	=	31.0
Shape	=	Arch
Span (in)	=	62.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Arch Corrugated Metal
Culvert Entrance	=	Thin wall projecting (A)
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0496, 0.57, 0.9

Embankment

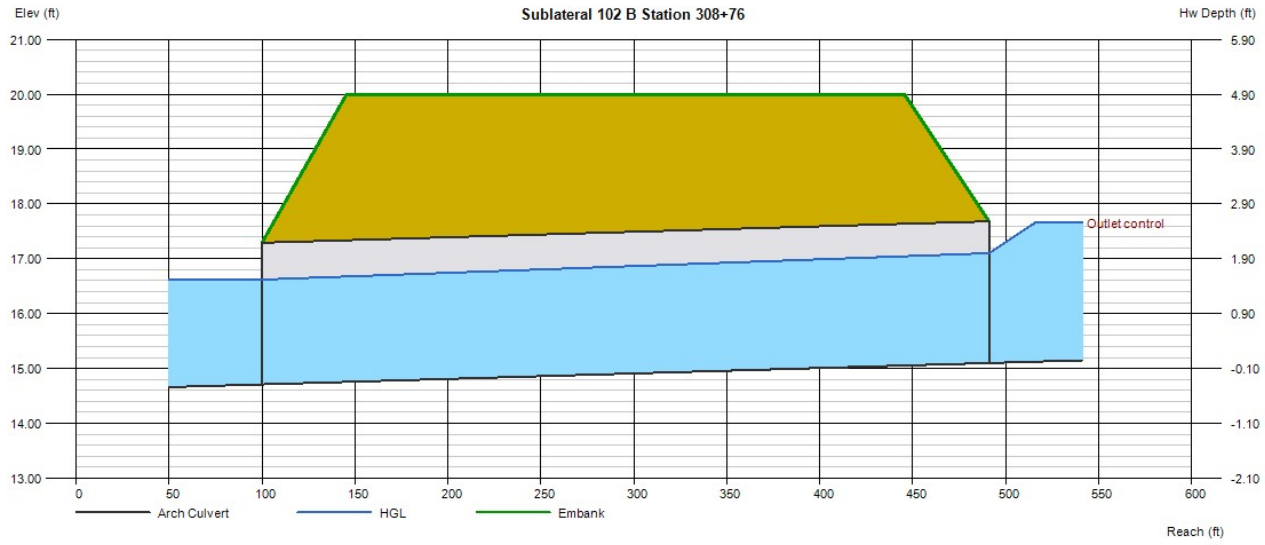
Top Elevation (ft)	=	20.00
Top Width (ft)	=	300.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	40.00
Qpipe (cfs)	=	40.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.51
Veloc Up (ft/s)	=	4.35
HGL Dn (ft)	=	16.62
HGL Up (ft)	=	17.10
Hw Elev (ft)	=	17.66
Hw/D (ft)	=	0.99
Flow Regime	=	Outlet Control



Culvert Report

Sublateral 102 B Station 312+55

Invert Elev Dn (ft)	=	14.12
Pipe Length (ft)	=	57.00
Slope (%)	=	0.98
Invert Elev Up (ft)	=	14.68
Rise (in)	=	27.0
Shape	=	Arch
Span (in)	=	54.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Arch Corrugated Metal
Culvert Entrance	=	Thin wall projecting (A)
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0496, 0.57, 0.9

Embankment

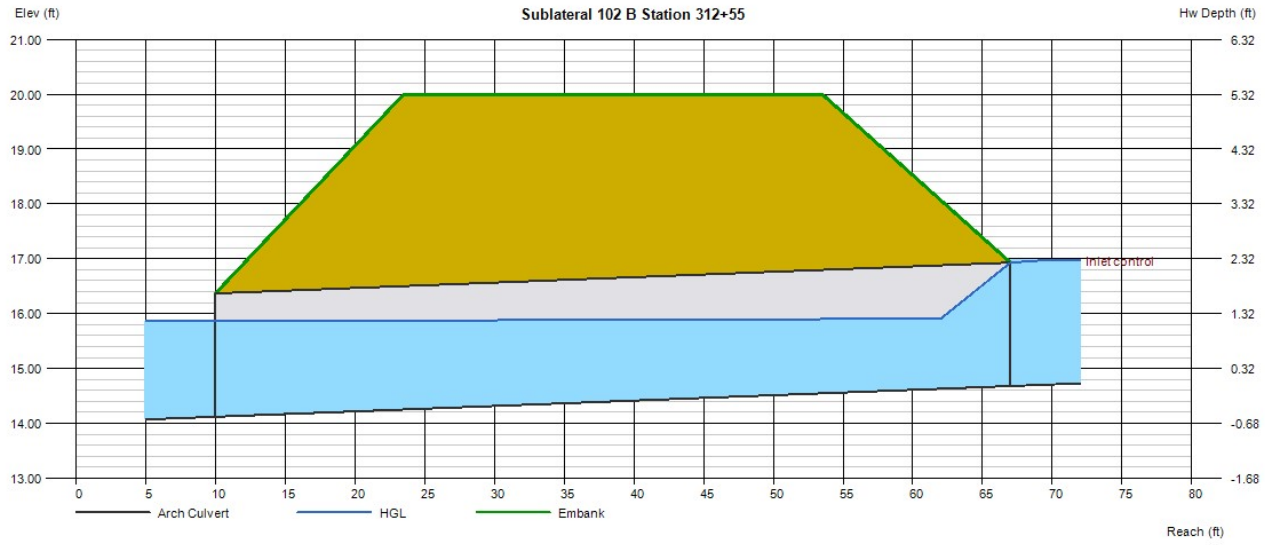
Top Elevation (ft)	=	20.00
Top Width (ft)	=	30.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	35.00
Qpipe (cfs)	=	35.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.03
Veloc Up (ft/s)	=	6.66
HGL Dn (ft)	=	15.86
HGL Up (ft)	=	15.91
Hw Elev (ft)	=	16.98
Hw/D (ft)	=	1.02
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

SubLateral 102B Sta 313+22 to 318+35

Trapezoidal

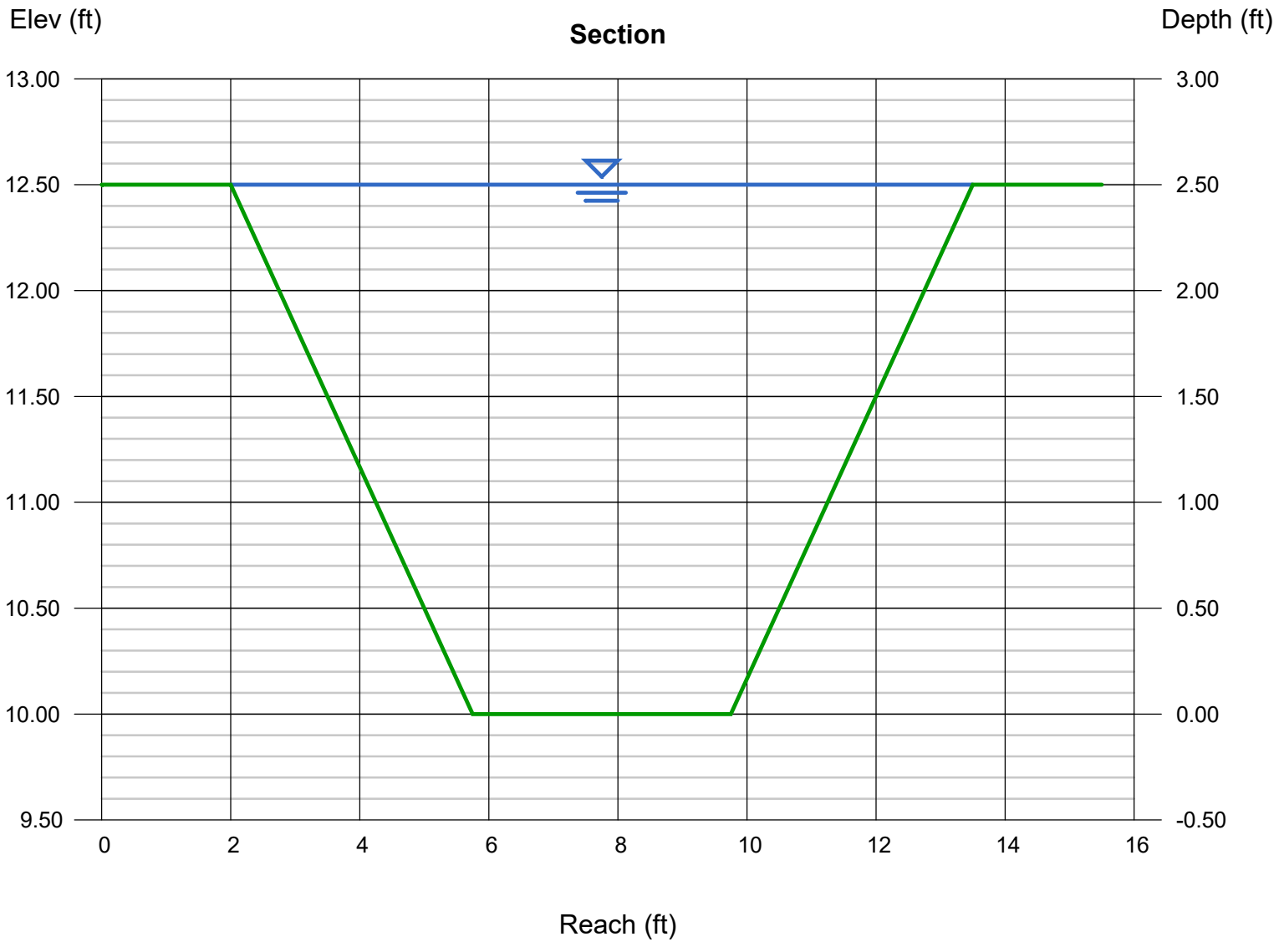
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.12
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.50

Highlighted

Depth (ft)	= 2.50
Q (cfs)	= 43.35
Area (sqft)	= 19.38
Velocity (ft/s)	= 2.24
Wetted Perim (ft)	= 13.01
Crit Depth, Yc (ft)	= 1.30
Top Width (ft)	= 11.50
EGL (ft)	= 2.58



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

SubLateral 102C Sta 400+00 to 408+30

Trapezoidal

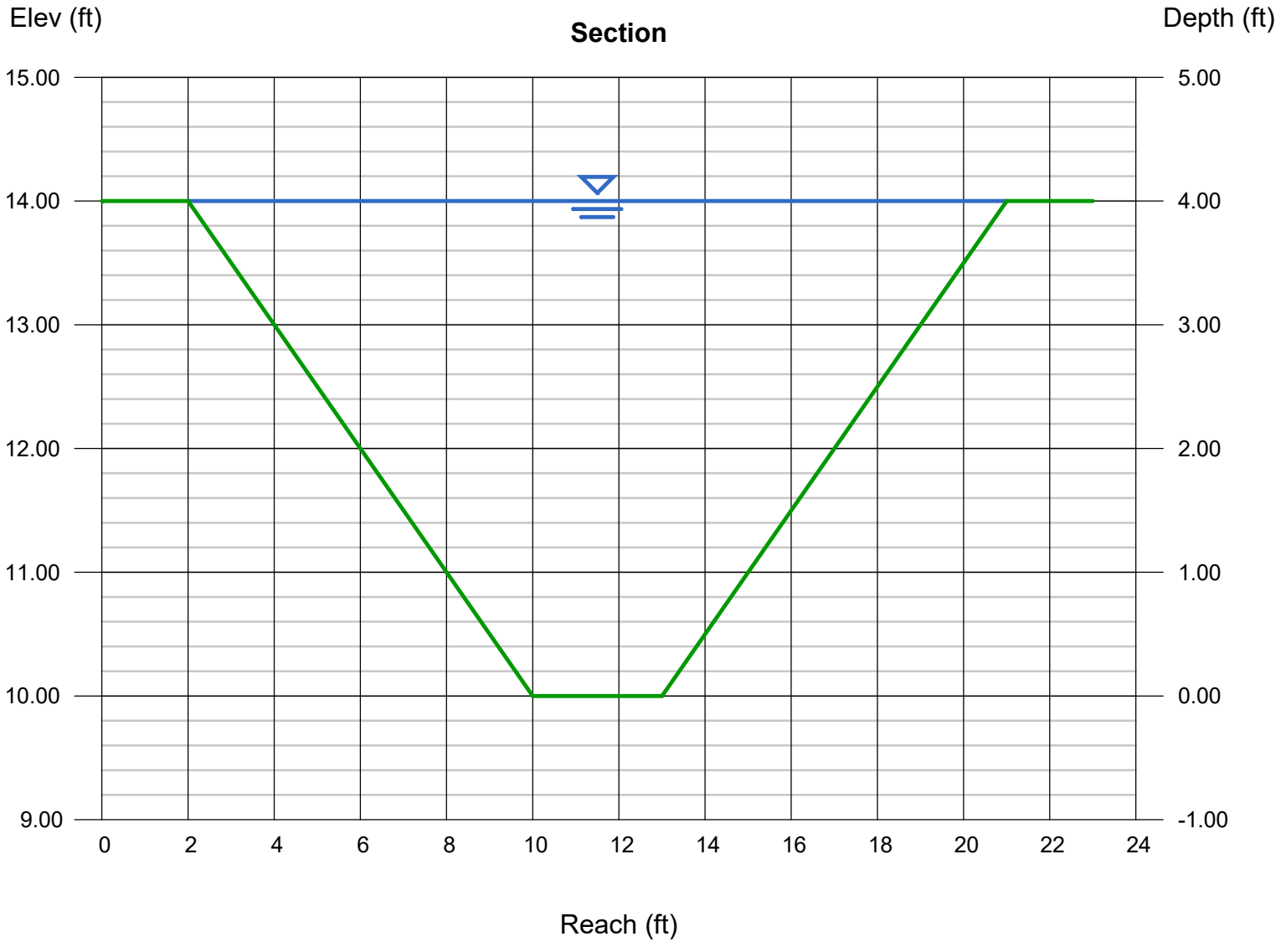
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.06
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 87.75
Area (sqft)	= 44.00
Velocity (ft/s)	= 1.99
Wetted Perim (ft)	= 20.89
Crit Depth, Yc (ft)	= 1.98
Top Width (ft)	= 19.00
EGL (ft)	= 4.06



Culvert Report

Sublateral 102 C Station 401+86

Invert Elev Dn (ft)	=	13.42
Pipe Length (ft)	=	438.00
Slope (%)	=	-0.04
Invert Elev Up (ft)	=	13.24
Rise (in)	=	42.0
Shape	=	Circular
Span (in)	=	42.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Headwall
Coeff. K,M,c,Y,k	=	0.0078, 2, 0.0379, 0.69, 0.5

Embankment

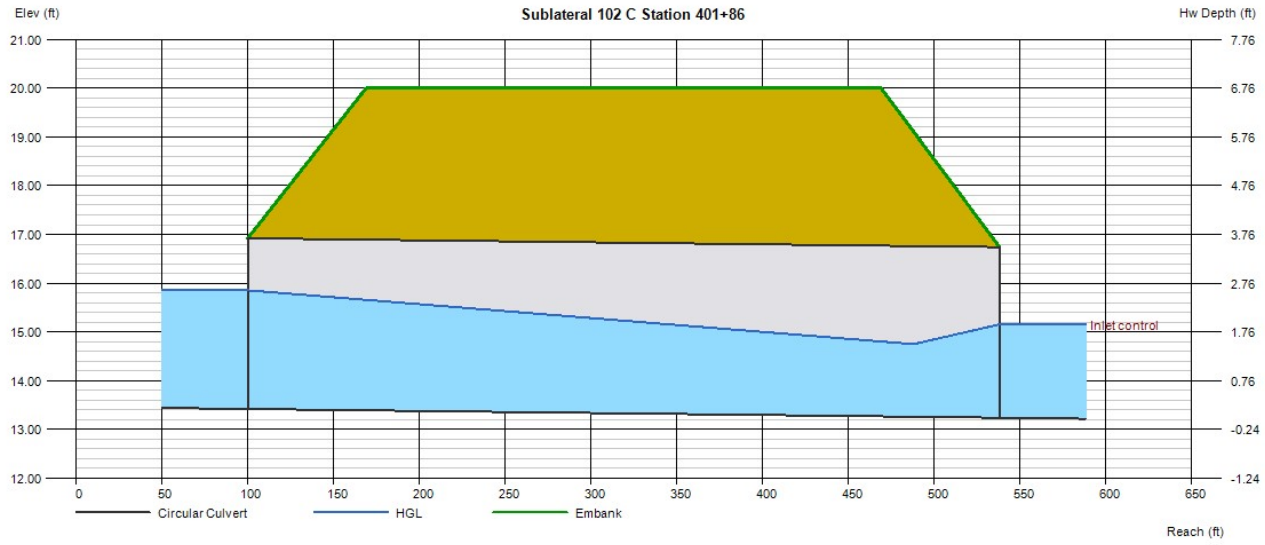
Top Elevation (ft)	=	20.00
Top Width (ft)	=	300.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	20.00
Qpipe (cfs)	=	20.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.80
Veloc Up (ft/s)	=	5.74
HGL Dn (ft)	=	15.85
HGL Up (ft)	=	14.61
Hw Elev (ft)	=	15.15
Hw/D (ft)	=	0.55
Flow Regime	=	Inlet Control



Culvert Report

Sublateral 102C Station 403+90

Invert Elev Dn (ft)	=	13.42
Pipe Length (ft)	=	245.00
Slope (%)	=	0.00
Invert Elev Up (ft)	=	13.41
Rise (in)	=	42.0
Shape	=	Circular
Span (in)	=	42.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

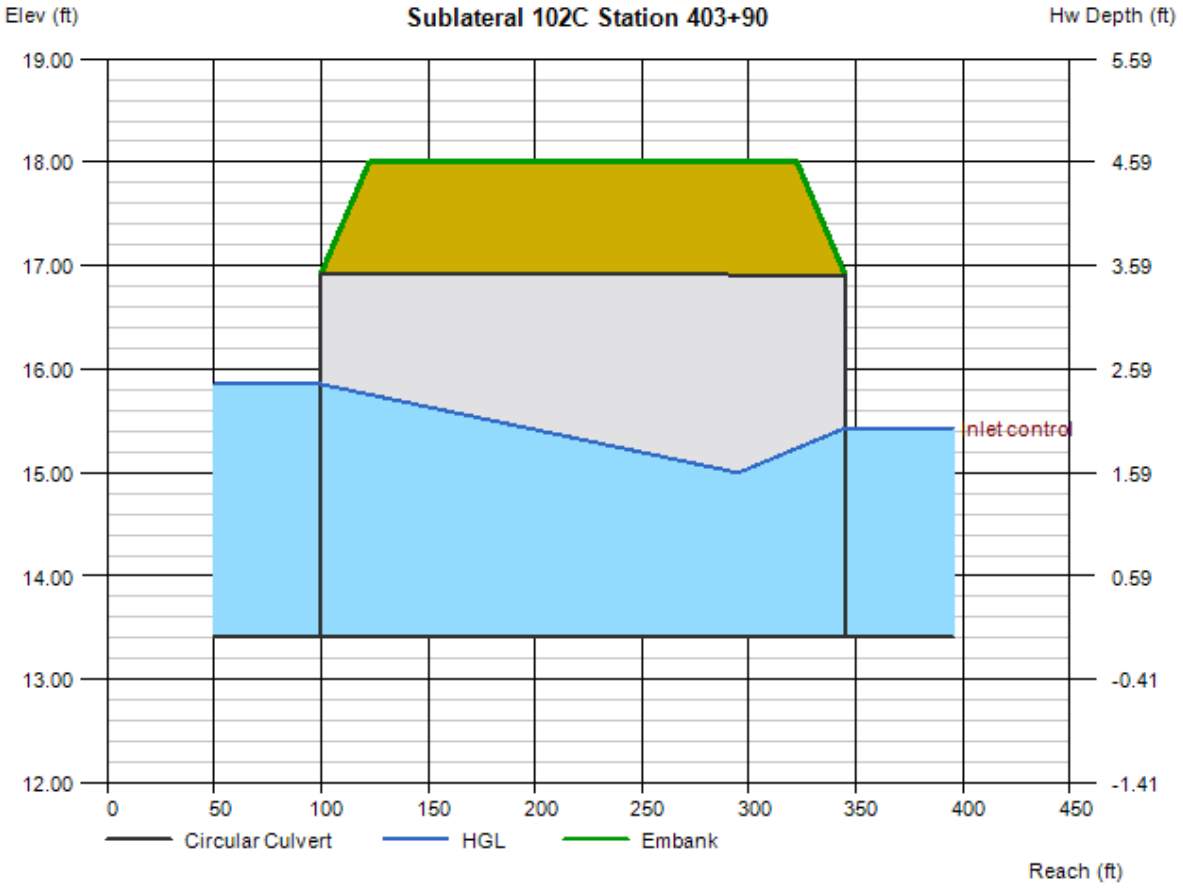
Top Elevation (ft)	=	18.00
Top Width (ft)	=	200.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	20.00
Qpipe (cfs)	=	20.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.80
Veloc Up (ft/s)	=	5.74
HGL Dn (ft)	=	15.85
HGL Up (ft)	=	14.78
Hw Elev (ft)	=	15.43
Hw/D (ft)	=	0.58
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

SubLateral 102C Sta 408+30 to 414+13

Trapezoidal

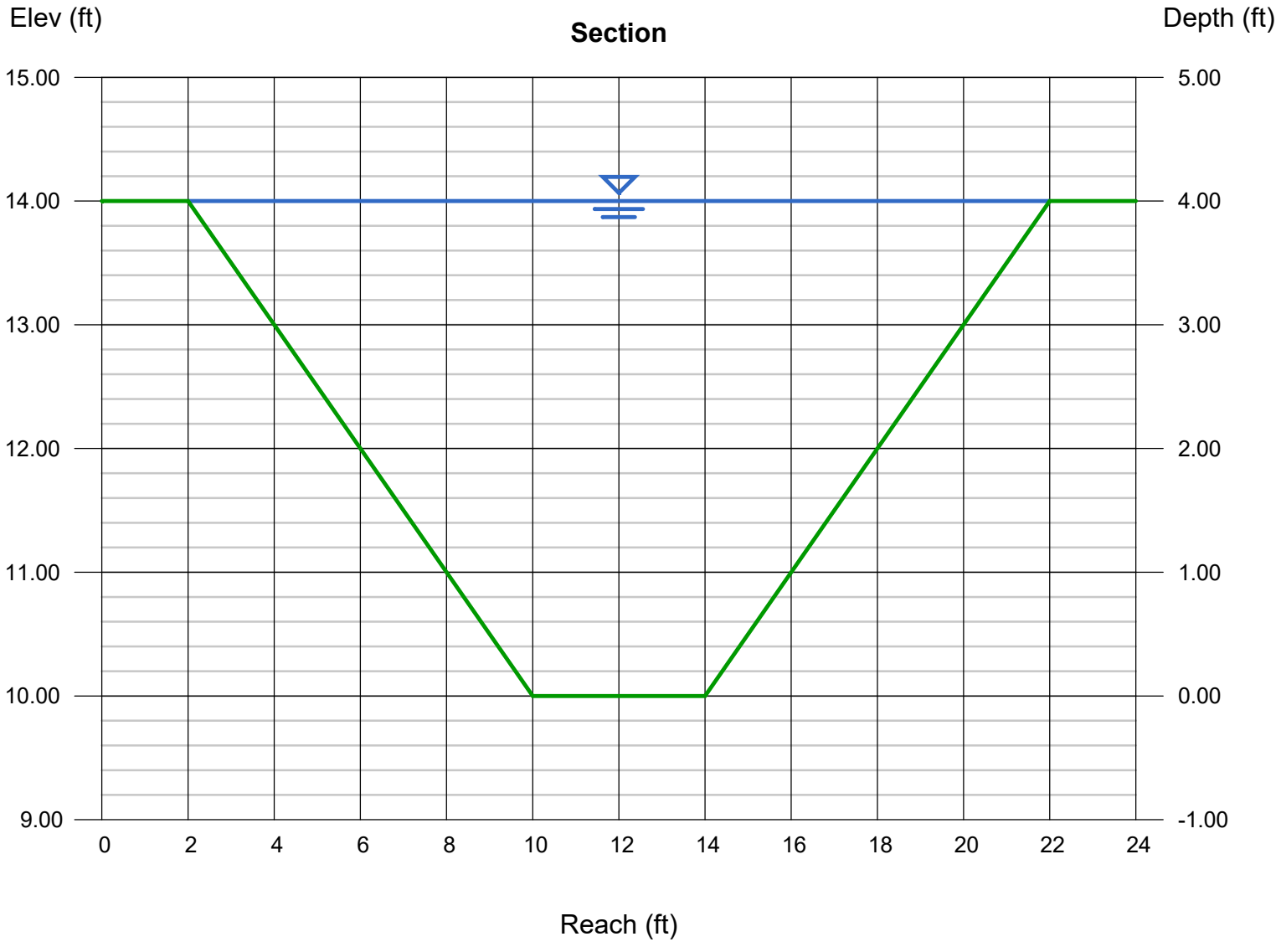
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.06
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 98.33
Area (sqft)	= 48.00
Velocity (ft/s)	= 2.05
Wetted Perim (ft)	= 21.89
Crit Depth, Yc (ft)	= 1.94
Top Width (ft)	= 20.00
EGL (ft)	= 4.07



Culvert Report

Sublateral 102 C Station 413+01

Invert Elev Dn (ft)	=	12.35
Pipe Length (ft)	=	49.00
Slope (%)	=	0.45
Invert Elev Up (ft)	=	12.57
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

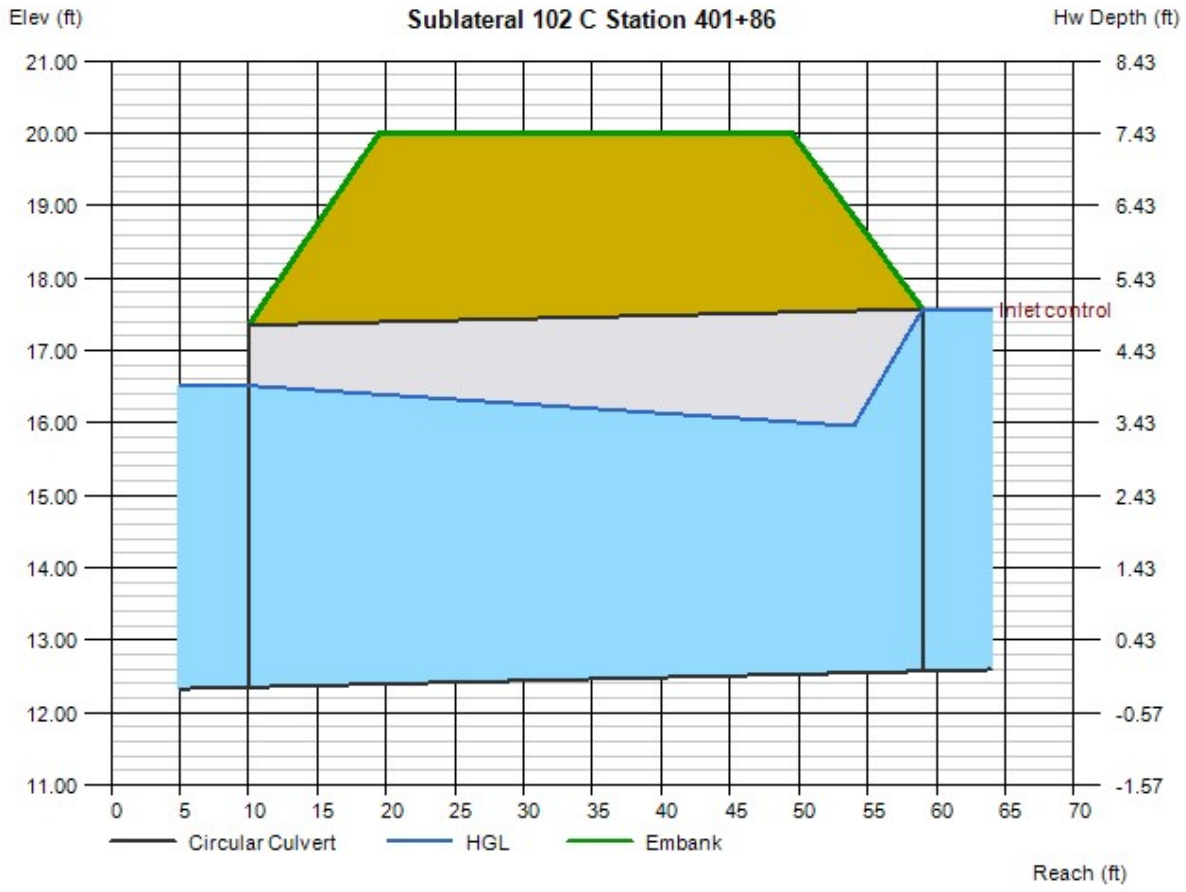
Top Elevation (ft)	=	20.00
Top Width (ft)	=	30.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	5.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	135.00
Qpipe (cfs)	=	135.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.73
Veloc Up (ft/s)	=	9.74
HGL Dn (ft)	=	16.51
HGL Up (ft)	=	15.89
Hw Elev (ft)	=	17.57
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Culvert Report

Sublateral 102D Station 602+55

Invert Elev Dn (ft)	=	14.17
Pipe Length (ft)	=	32.00
Slope (%)	=	-0.75
Invert Elev Up (ft)	=	13.93
Rise (in)	=	36.0
Shape	=	Box
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Flared Wingwalls
Culvert Entrance	=	30D to 75D wingwall flares
Coeff. K,M,c,Y,k	=	0.026, 1, 0.0347, 0.81, 0.4

Embankment

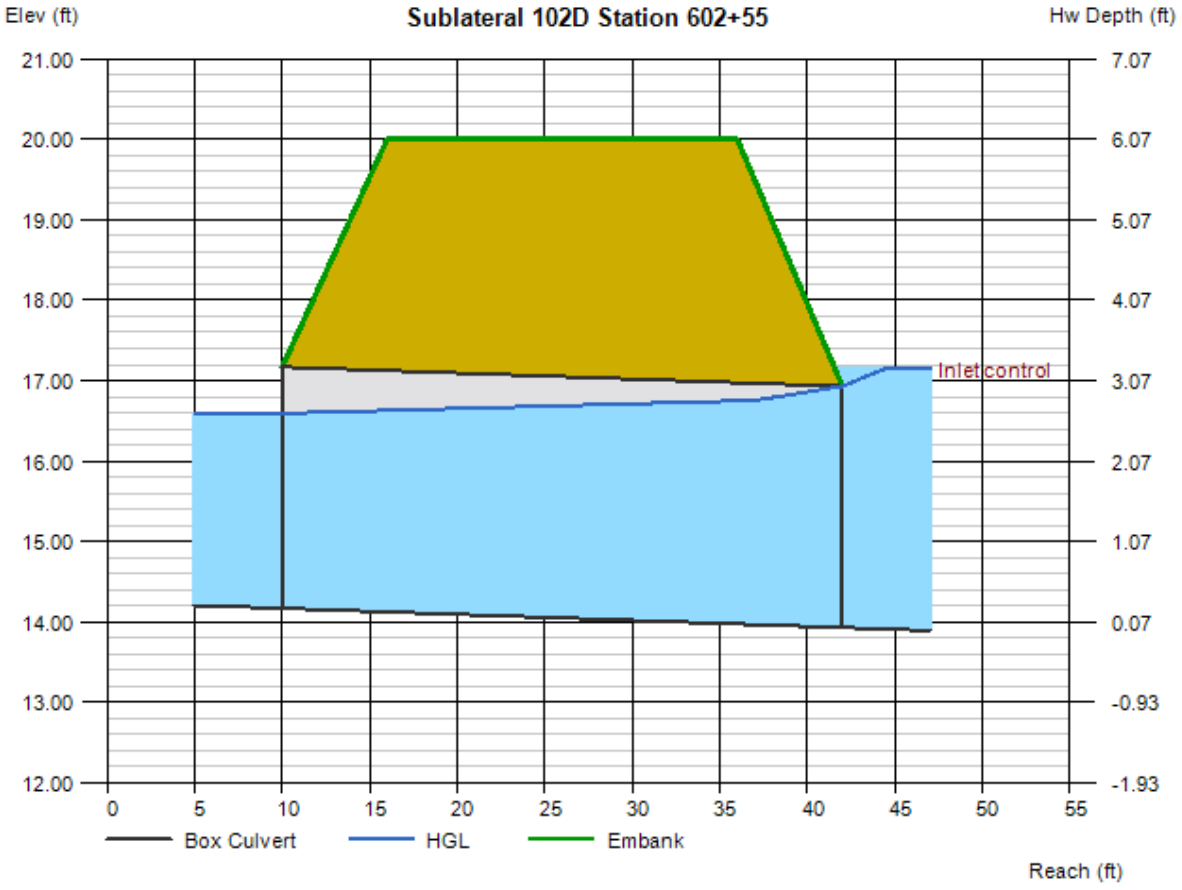
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	57.00
Qpipe (cfs)	=	57.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.88
Veloc Up (ft/s)	=	4.99
HGL Dn (ft)	=	16.59
HGL Up (ft)	=	16.78
Hw Elev (ft)	=	17.15
Hw/D (ft)	=	1.07
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 26 2018

Sub-Lateral 603+14 to 609+00

Trapezoidal

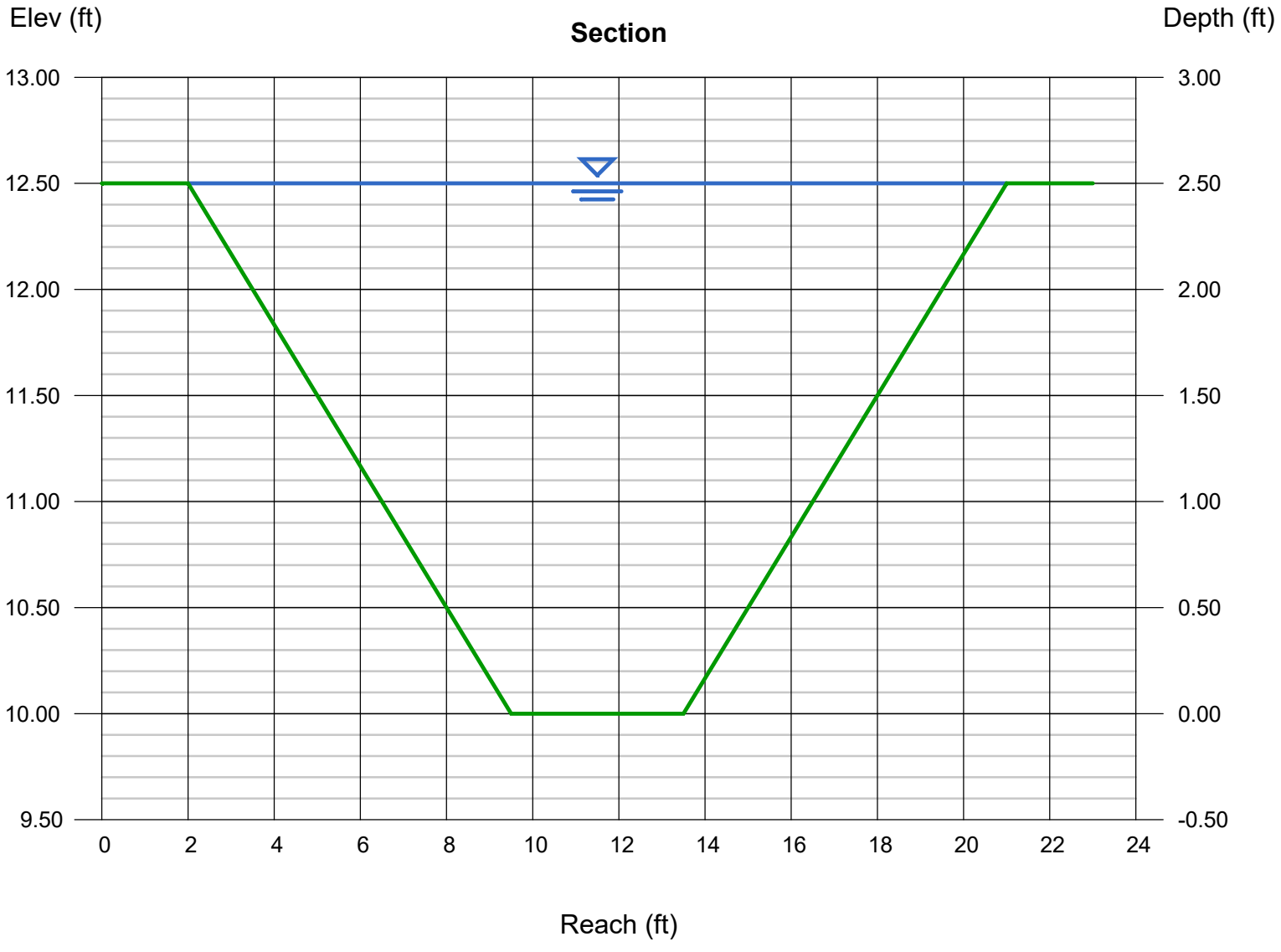
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.50

Highlighted

Depth (ft)	= 2.50
Q (cfs)	= 40.82
Area (sqft)	= 28.75
Velocity (ft/s)	= 1.42
Wetted Perim (ft)	= 19.81
Crit Depth, Yc (ft)	= 1.12
Top Width (ft)	= 19.00
EGL (ft)	= 2.53



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 26 2018

Sub-Lateral 102D 609+00 TO 610+95

Trapezoidal

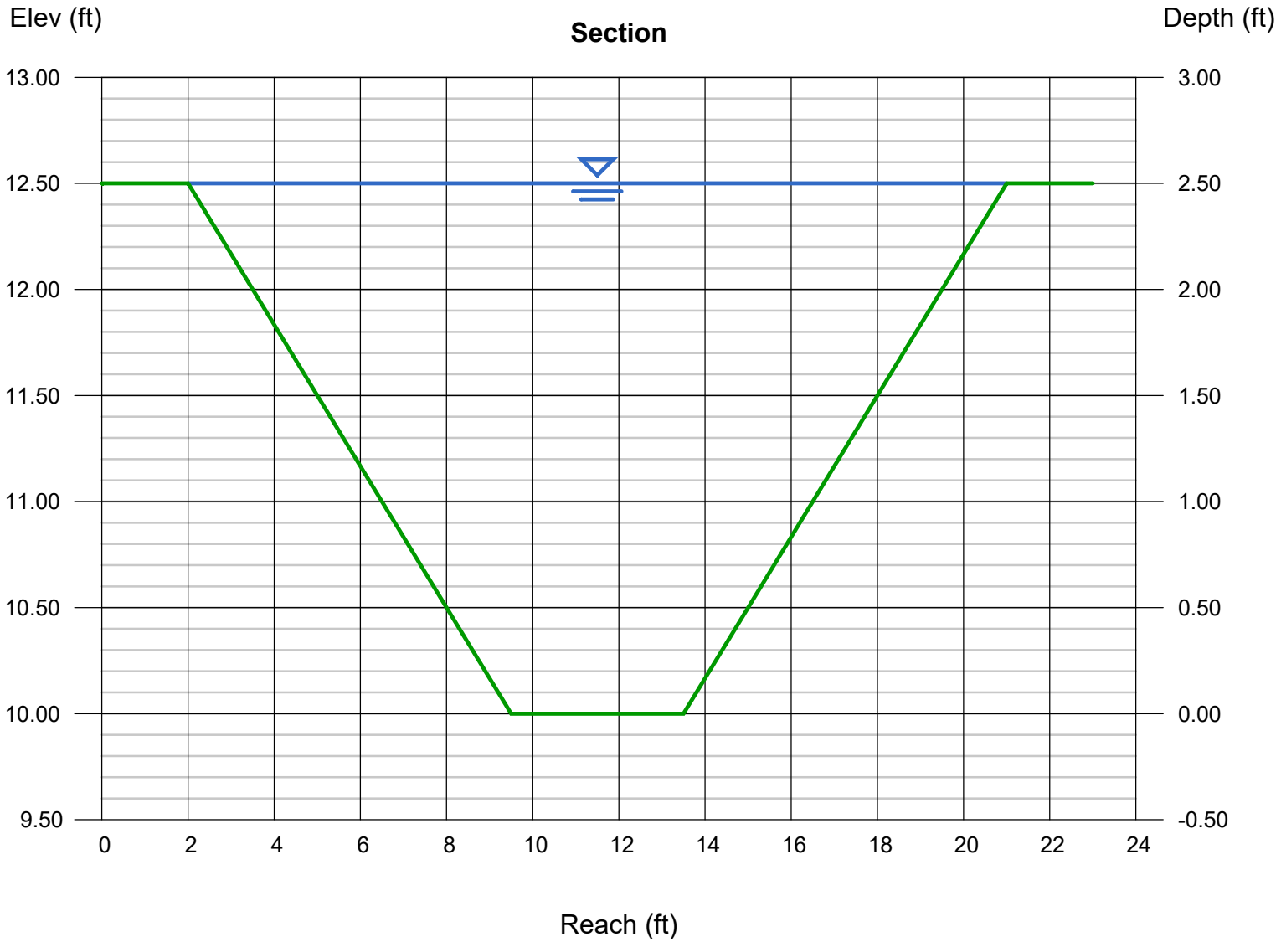
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.34
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.50

Highlighted

Depth (ft)	= 2.50
Q (cfs)	= 106.45
Area (sqft)	= 28.75
Velocity (ft/s)	= 3.70
Wetted Perim (ft)	= 19.81
Crit Depth, Yc (ft)	= 1.84
Top Width (ft)	= 19.00
EGL (ft)	= 2.71



Culvert Report

Sublateral 102D Station 610+95

Invert Elev Dn (ft)	=	11.98
Pipe Length (ft)	=	33.00
Slope (%)	=	0.64
Invert Elev Up (ft)	=	12.19
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

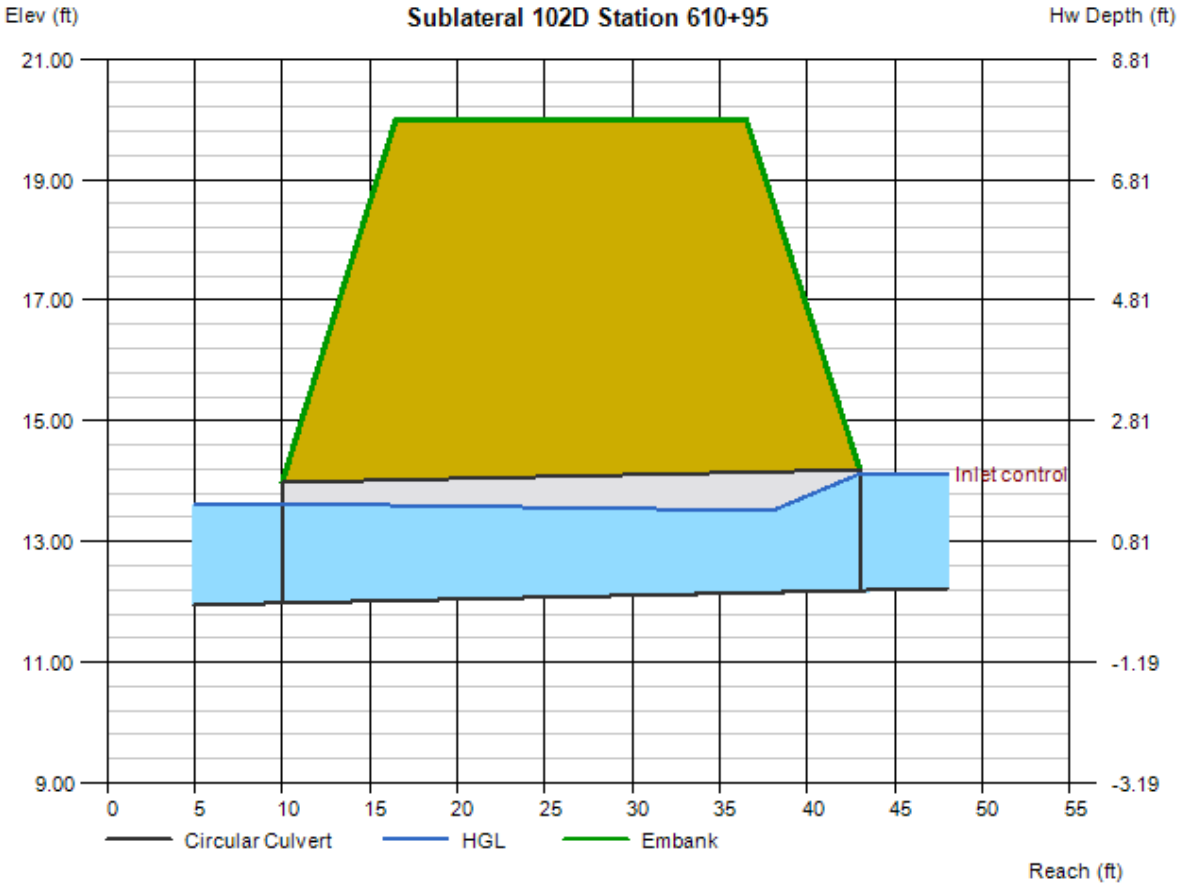
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	13.00
Qpipe (cfs)	=	13.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.69
Veloc Up (ft/s)	=	6.01
HGL Dn (ft)	=	13.63
HGL Up (ft)	=	13.49
Hw Elev (ft)	=	14.12
Hw/D (ft)	=	0.97
Flow Regime	=	Inlet Control



Culvert Report

Lateral 103 Station 10+00

Invert Elev Dn (ft)	=	8.18
Pipe Length (ft)	=	100.00
Slope (%)	=	0.00
Invert Elev Up (ft)	=	8.18
Rise (in)	=	36.0
Shape	=	Box
Span (in)	=	60.0
No. Barrels	=	2
n-Value	=	0.011
Culvert Type	=	90D Headwall, Chamfered or Beveled Inlet Edges
Culvert Entrance	=	90D headwall w/3/4-in chamfers
Coeff. K,M,c,Y,k	=	0.515, 0.667, 0.0375, 0.79, 0.2

Embankment

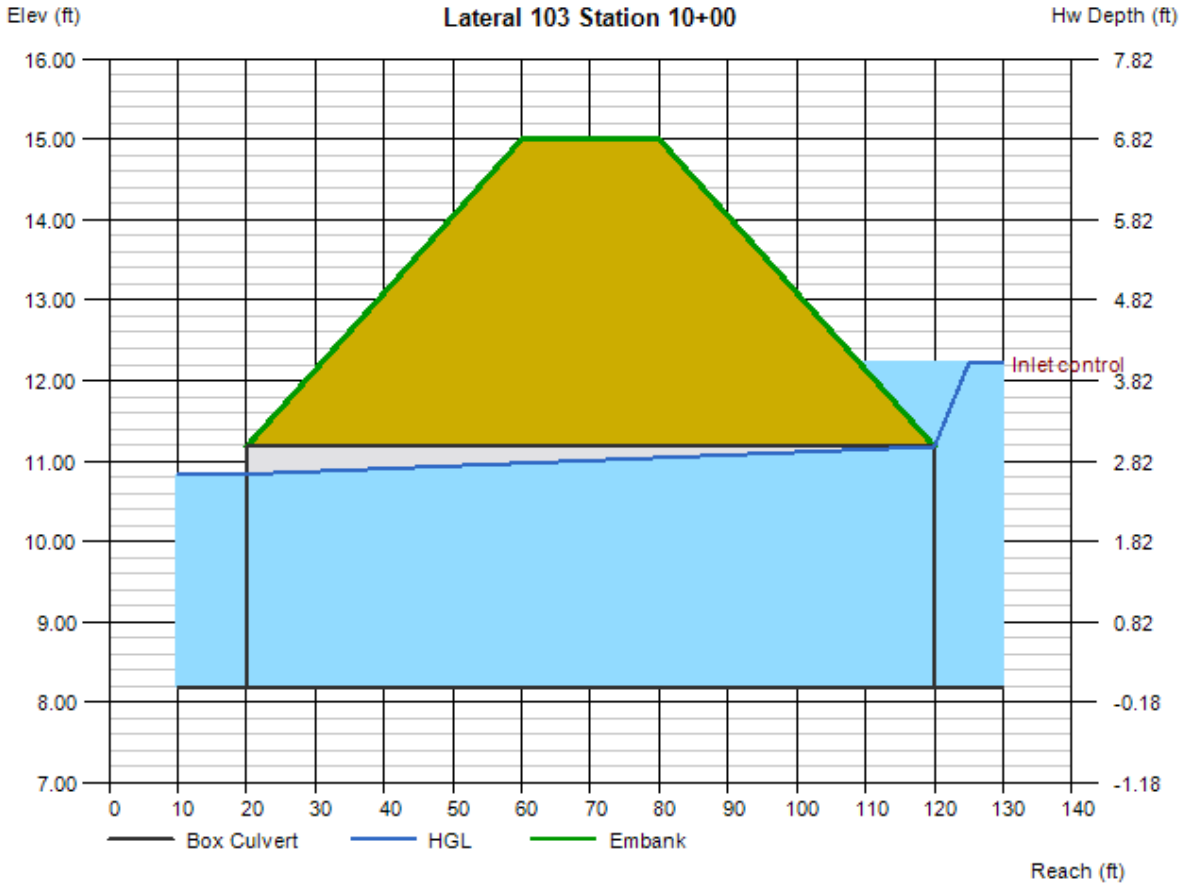
Top Elevation (ft)	=	15.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	200.00
Qmax (cfs)	=	300.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	200.00
Qpipe (cfs)	=	200.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.53
Veloc Up (ft/s)	=	6.67
HGL Dn (ft)	=	10.84
HGL Up (ft)	=	11.18
Hw Elev (ft)	=	12.22
Hw/D (ft)	=	1.35
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 103 Sta 11+91 to 31+86

Trapezoidal

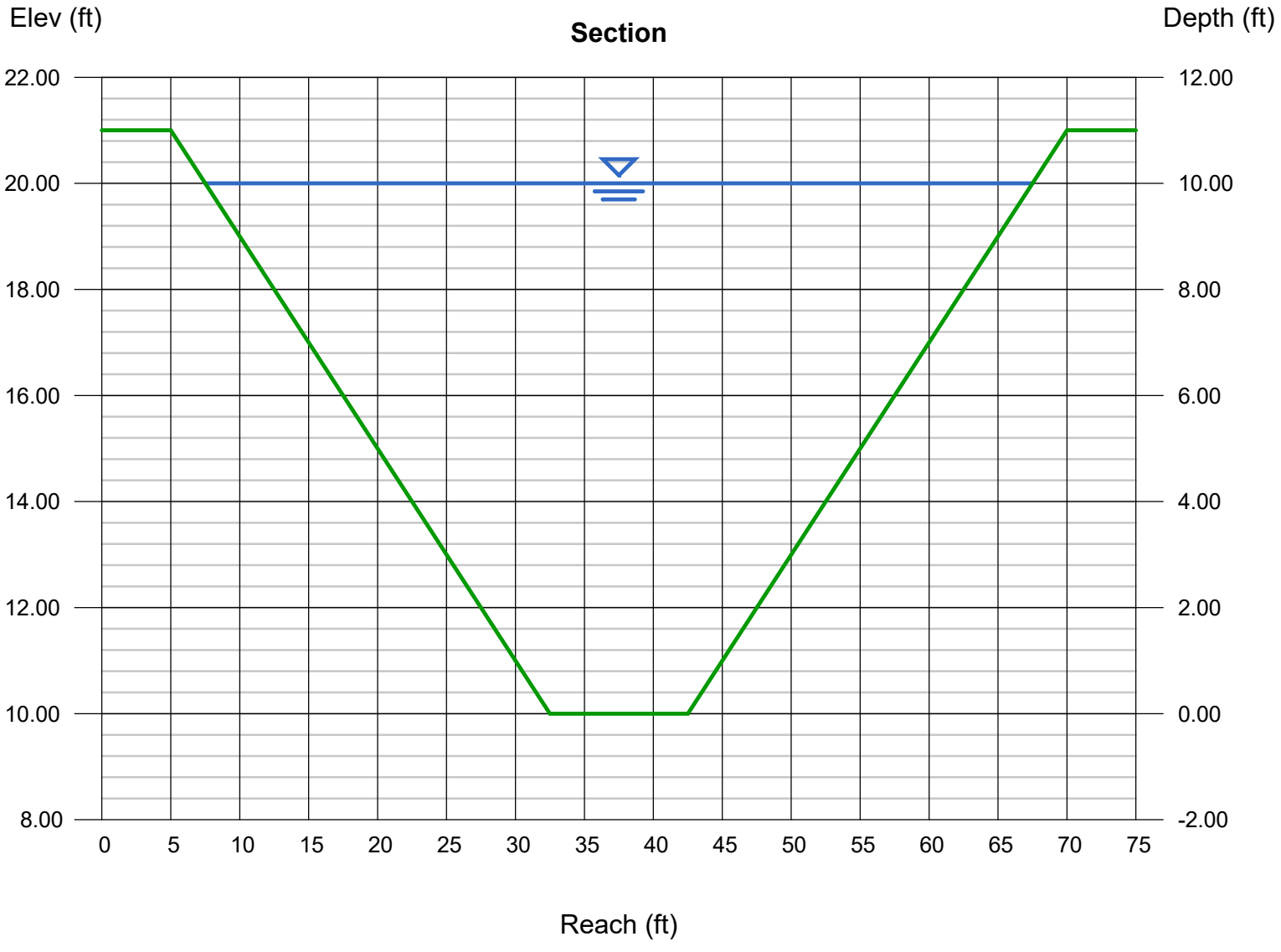
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 11.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 10.00

Highlighted

Depth (ft)	= 10.00
Q (cfs)	= 1,206
Area (sqft)	= 350.00
Velocity (ft/s)	= 3.45
Wetted Perim (ft)	= 63.85
Crit Depth, Yc (ft)	= 5.14
Top Width (ft)	= 60.00
EGL (ft)	= 10.18



Culvert Report

Culvert 103-2

Invert Elev Dn (ft)	=	8.51
Pipe Length (ft)	=	976.00
Slope (%)	=	0.01
Invert Elev Up (ft)	=	8.61
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	2
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

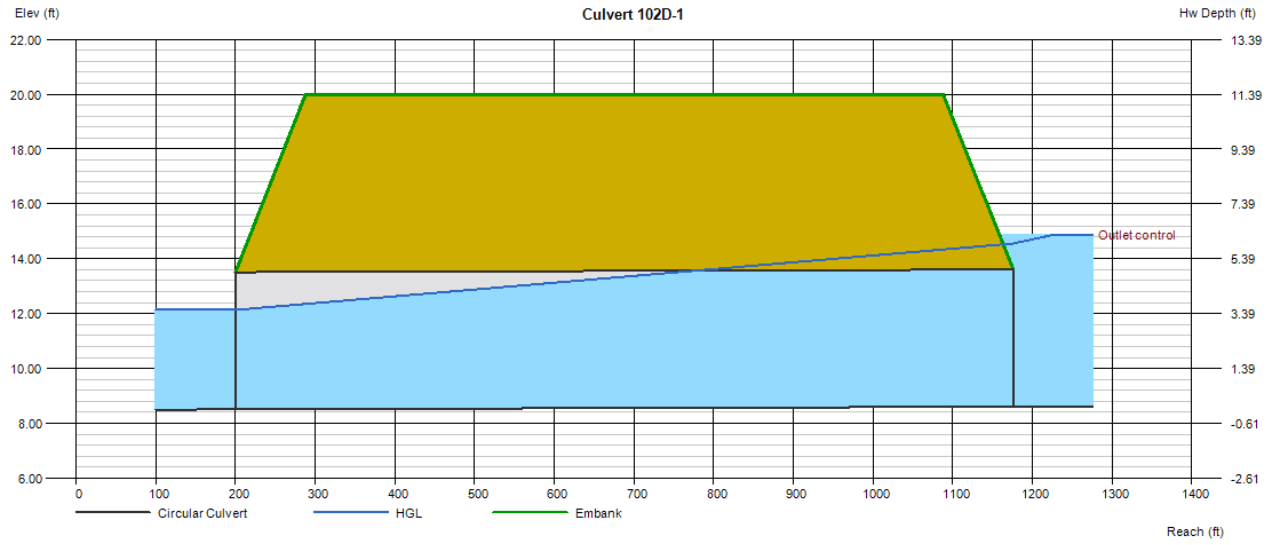
Top Elevation (ft)	=	20.00
Top Width (ft)	=	800.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	100.00
Qmax (cfs)	=	150.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	128.00
Qpipe (cfs)	=	128.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.20
Veloc Up (ft/s)	=	3.26
HGL Dn (ft)	=	12.14
HGL Up (ft)	=	14.56
Hw Elev (ft)	=	14.87
Hw/D (ft)	=	1.25
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Tuesday, Oct 16 2018

Culvert 103-3

Invert Elev Dn (ft)	=	8.51
Pipe Length (ft)	=	976.00
Slope (%)	=	0.01
Invert Elev Up (ft)	=	8.61
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

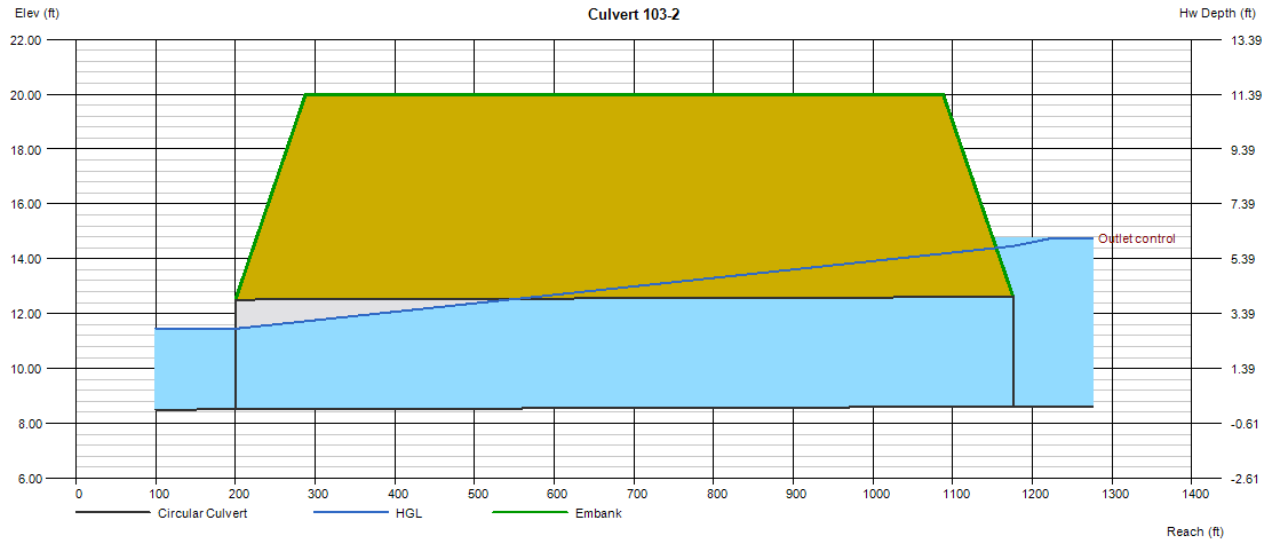
Top Elevation (ft)	=	20.00
Top Width (ft)	=	800.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	40.00
Qpipe (cfs)	=	40.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.04
Veloc Up (ft/s)	=	3.18
HGL Dn (ft)	=	11.45
HGL Up (ft)	=	14.46
Hw Elev (ft)	=	14.76
Hw/D (ft)	=	1.54
Flow Regime	=	Outlet Control



Culvert Report

Culvert 103-3 culvert 2

Invert Elev Dn (ft)	=	8.51
Pipe Length (ft)	=	976.00
Slope (%)	=	0.01
Invert Elev Up (ft)	=	8.61
Rise (in)	=	72.0
Shape	=	Circular
Span (in)	=	72.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

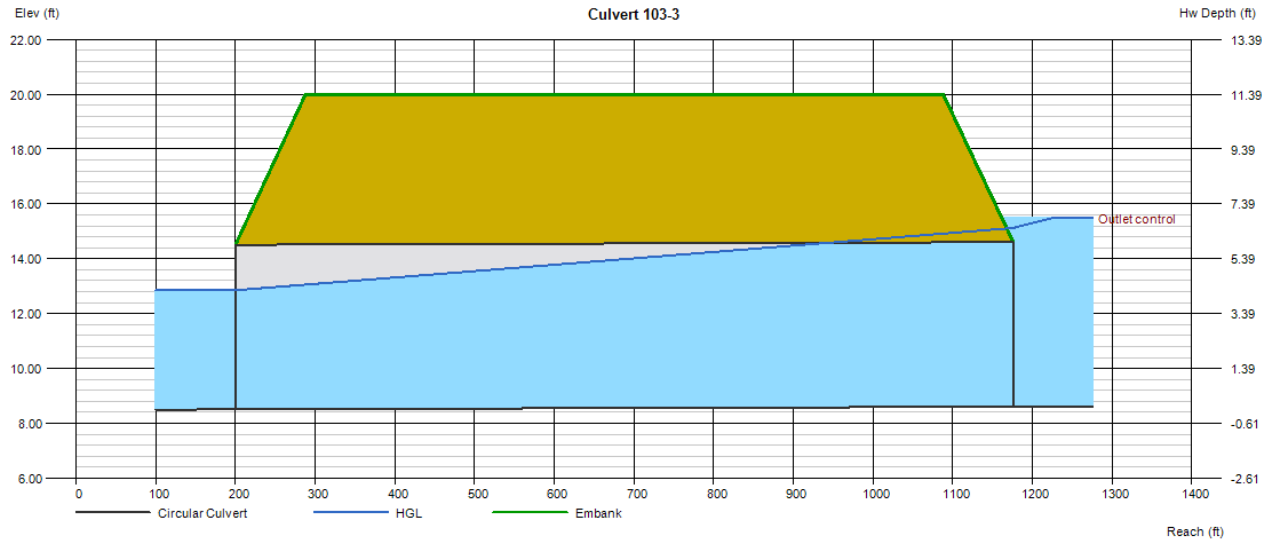
Top Elevation (ft)	=	20.00
Top Width (ft)	=	800.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	100.00
Qpipe (cfs)	=	100.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.56
Veloc Up (ft/s)	=	3.54
HGL Dn (ft)	=	12.85
HGL Up (ft)	=	15.12
Hw Elev (ft)	=	15.49
Hw/D (ft)	=	1.15
Flow Regime	=	Outlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 103 Sta 41+99 to 72+60

Trapezoidal

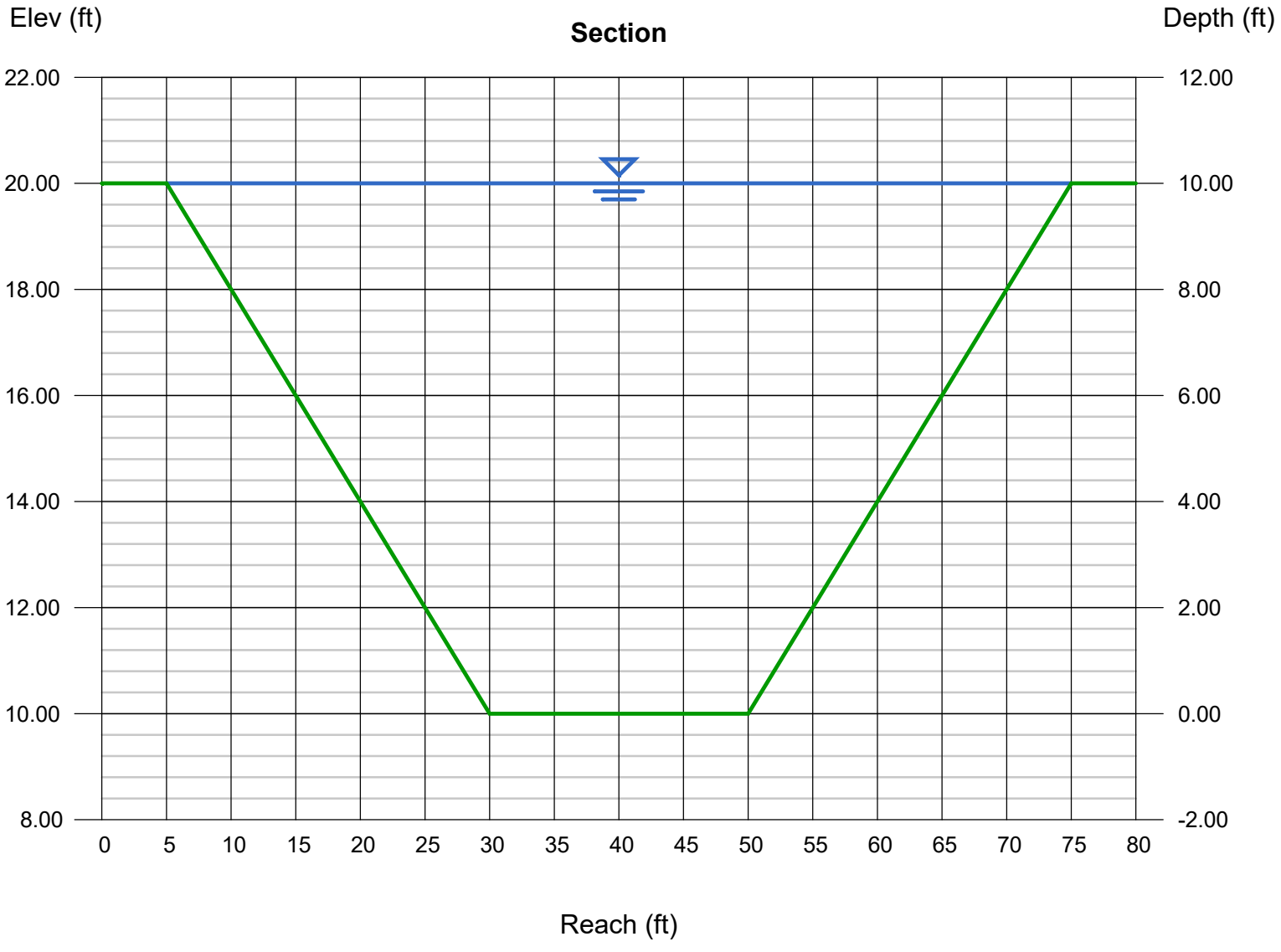
Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 10.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.10
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 10.00

Highlighted

Depth (ft)	= 10.00
Q (cfs)	= 2,353
Area (sqft)	= 450.00
Velocity (ft/s)	= 5.23
Wetted Perim (ft)	= 73.85
Crit Depth, Yc (ft)	= 5.89
Top Width (ft)	= 70.00
EGL (ft)	= 10.43



Culvert Report

Lateral 103 Station 72+60

Invert Elev Dn (ft)	=	6.62
Pipe Length (ft)	=	30.00
Slope (%)	=	2.70
Invert Elev Up (ft)	=	7.43
Rise (in)	=	72.0
Shape	=	Circular
Span (in)	=	72.0
No. Barrels	=	3
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

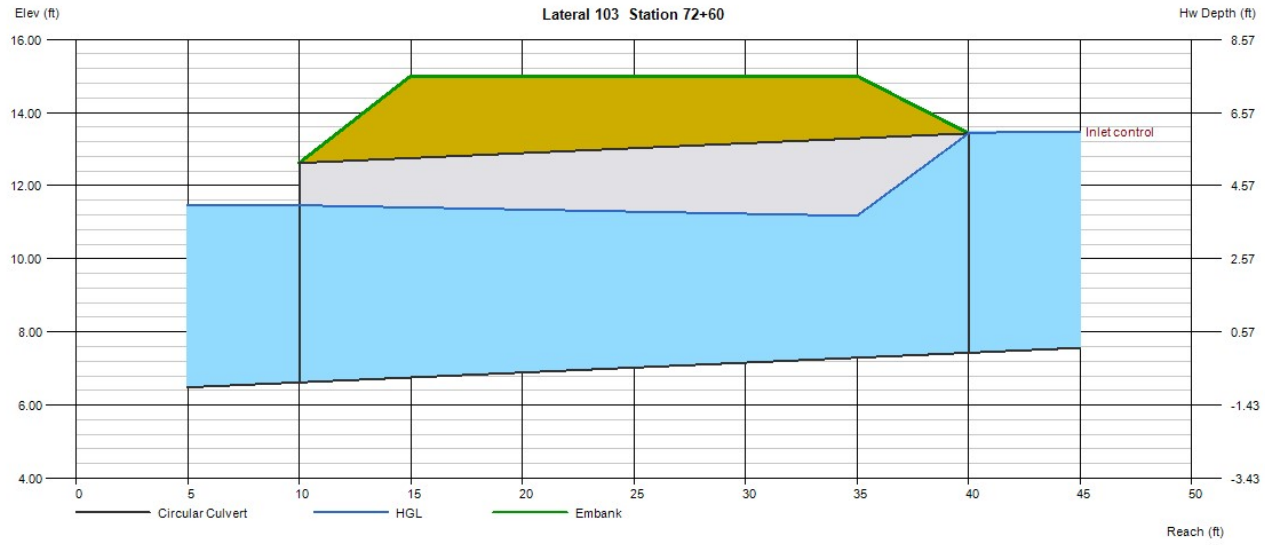
Top Elevation (ft)	=	15.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	500.00
Qmax (cfs)	=	550.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	549.00
Qpipe (cfs)	=	549.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.48
Veloc Up (ft/s)	=	10.04
HGL Dn (ft)	=	11.46
HGL Up (ft)	=	11.12
Hw Elev (ft)	=	13.48
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Wednesday, Oct 3 2018

Lateral 103 Sta 73+04 to 127+53

Trapezoidal

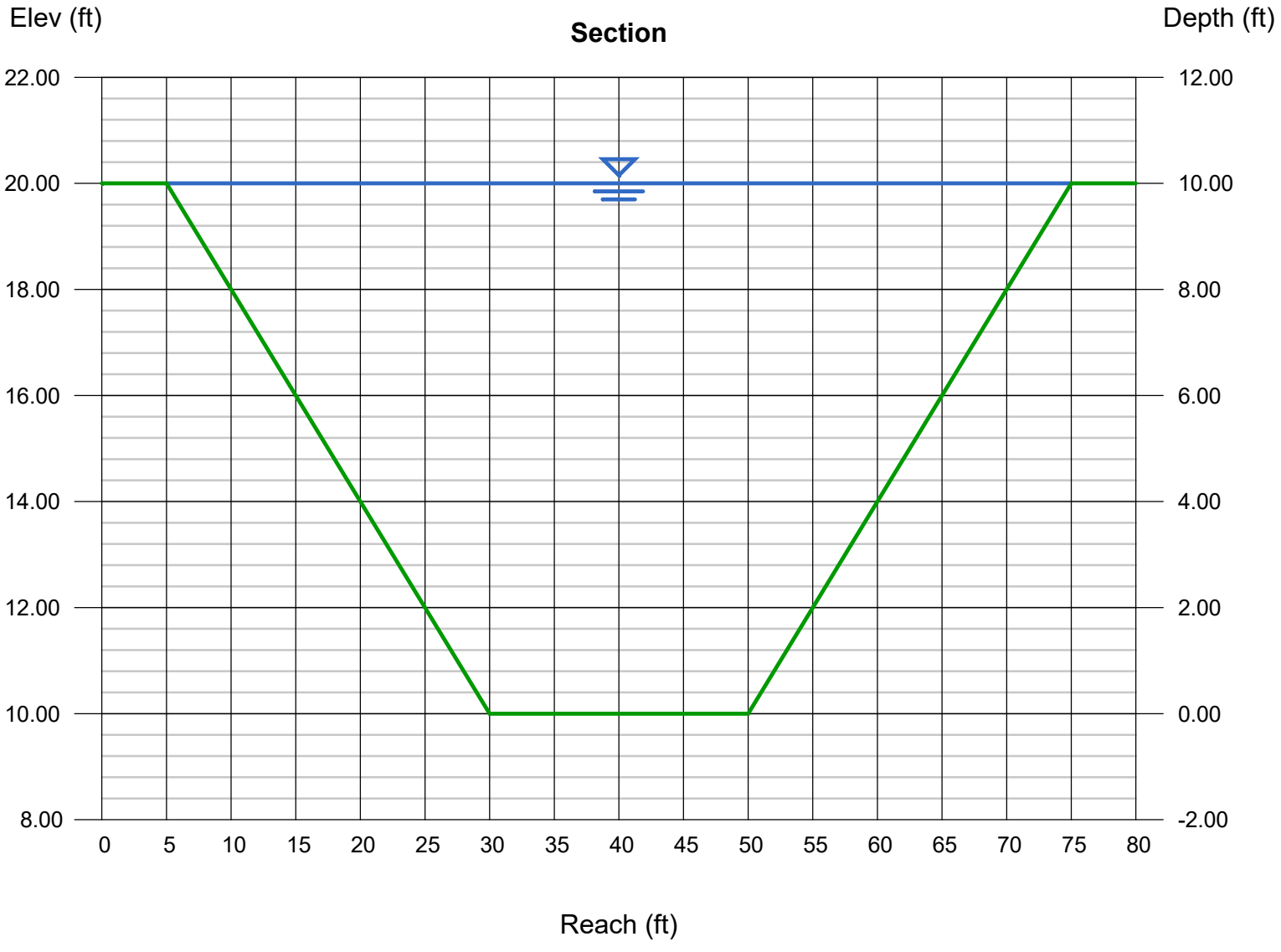
Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 10.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.10
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 10.00

Highlighted

Depth (ft)	= 10.00
Q (cfs)	= 2,353
Area (sqft)	= 450.00
Velocity (ft/s)	= 5.23
Wetted Perim (ft)	= 73.85
Crit Depth, Yc (ft)	= 5.89
Top Width (ft)	= 70.00
EGL (ft)	= 10.43



Channel Report

Lateral 103 Sta 127+53 to 168+82

Trapezoidal

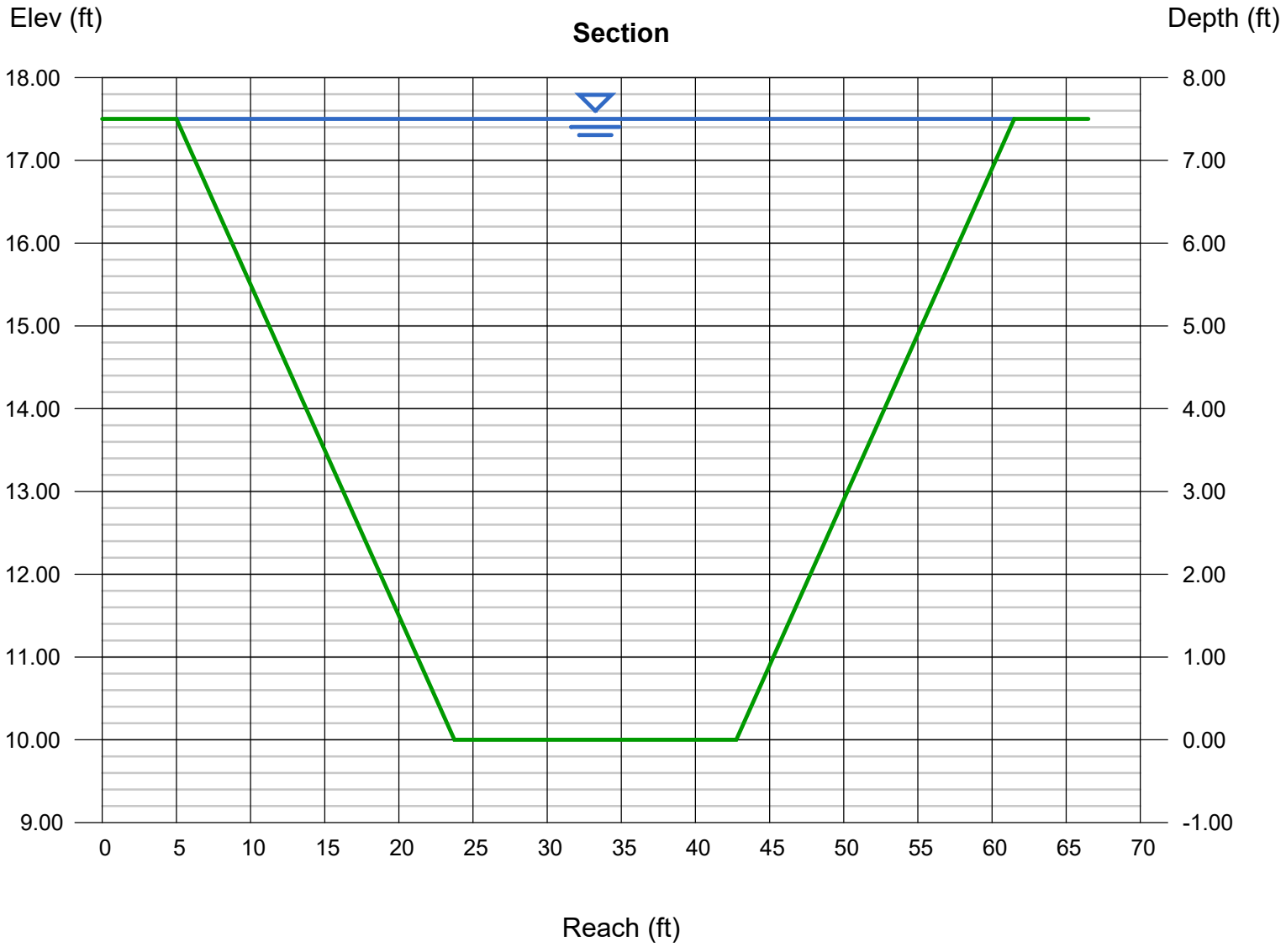
Bottom Width (ft)	= 19.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 7.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.13
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 7.50

Highlighted

Depth (ft)	= 7.50
Q (cfs)	= 1,433
Area (sqft)	= 283.13
Velocity (ft/s)	= 5.06
Wetted Perim (ft)	= 59.39
Crit Depth, Yc (ft)	= 4.57
Top Width (ft)	= 56.50
EGL (ft)	= 7.90



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 3A Station 200+00 to 214+94

Trapezoidal

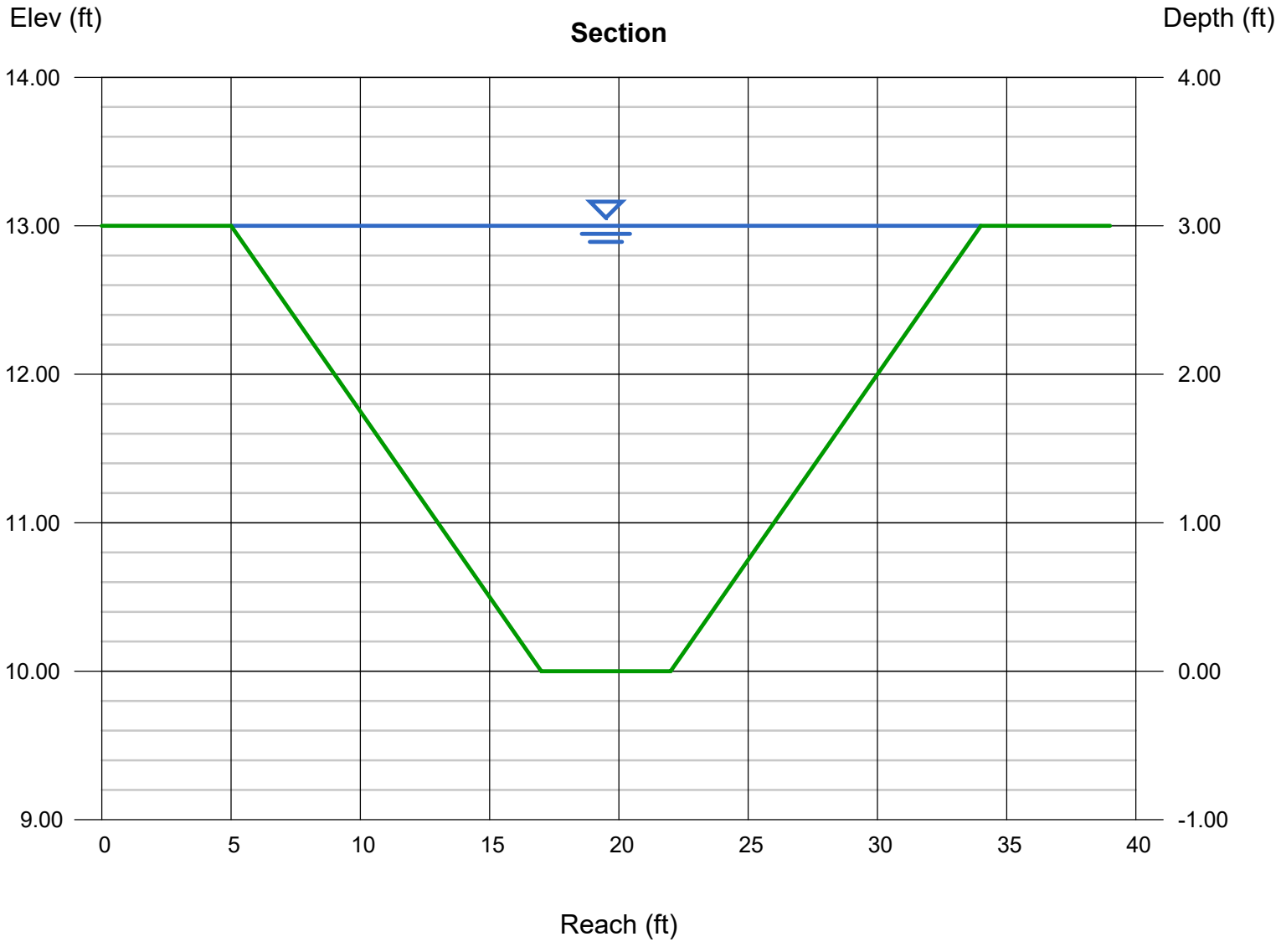
Bottom Width (ft)	= 5.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.35
N-Value	= 0.025

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.00

Highlighted

Depth (ft)	= 3.00
Q (cfs)	= 257.00
Area (sqft)	= 51.00
Velocity (ft/s)	= 5.04
Wetted Perim (ft)	= 29.74
Crit Depth, Yc (ft)	= 2.49
Top Width (ft)	= 29.00
EGL (ft)	= 3.39



Culvert Report

Culvert 103A-1

Invert Elev Dn (ft)	=	14.48
Pipe Length (ft)	=	181.00
Slope (%)	=	0.20
Invert Elev Up (ft)	=	14.85
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

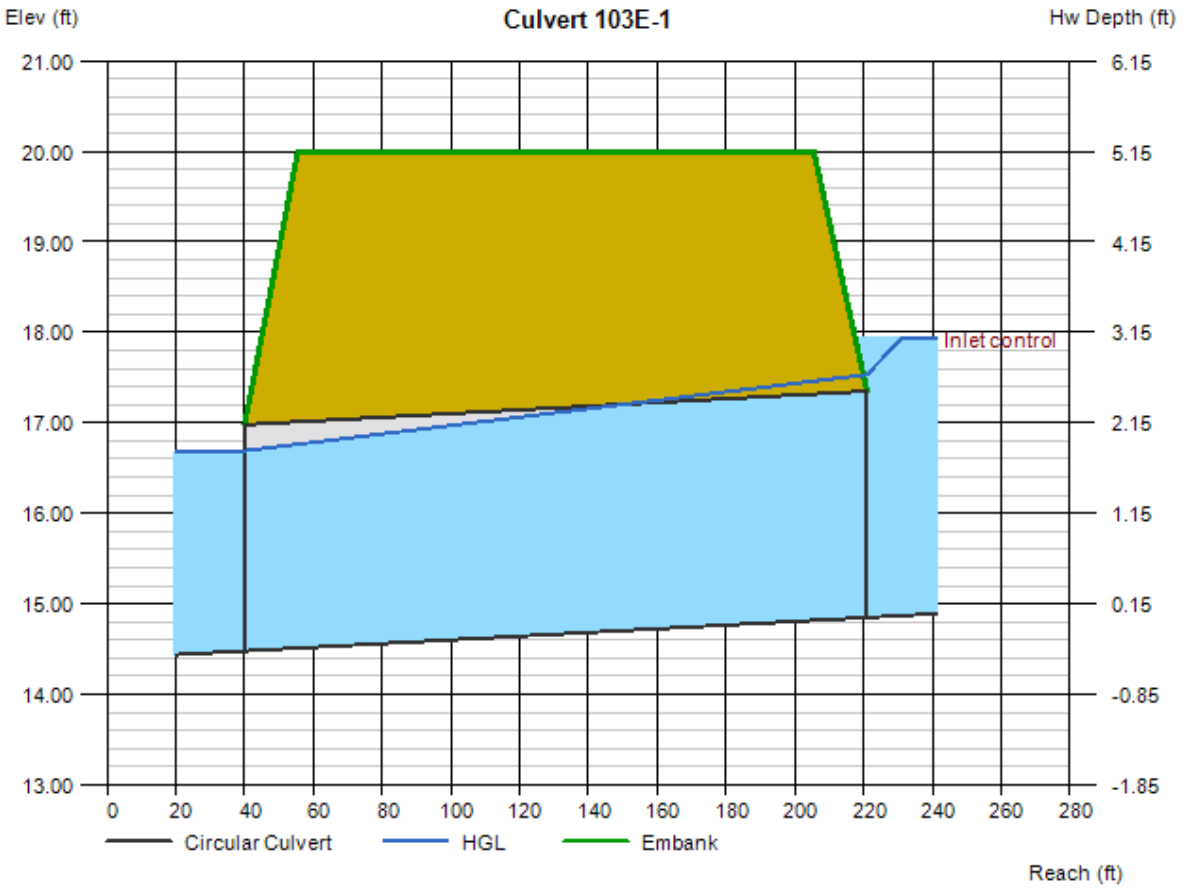
Top Elevation (ft)	=	20.00
Top Width (ft)	=	150.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	32.00
Qpipe (cfs)	=	32.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.96
Veloc Up (ft/s)	=	6.52
HGL Dn (ft)	=	16.69
HGL Up (ft)	=	17.53
Hw Elev (ft)	=	17.93
Hw/D (ft)	=	1.23
Flow Regime	=	Inlet Control



Culvert Report

Culvert 103A-2

Invert Elev Dn (ft)	=	14.03
Pipe Length (ft)	=	60.00
Slope (%)	=	0.17
Invert Elev Up (ft)	=	14.13
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Headwall
Coeff. K,M,c,Y,k	=	0.0078, 2, 0.0379, 0.69, 0.5

Embankment

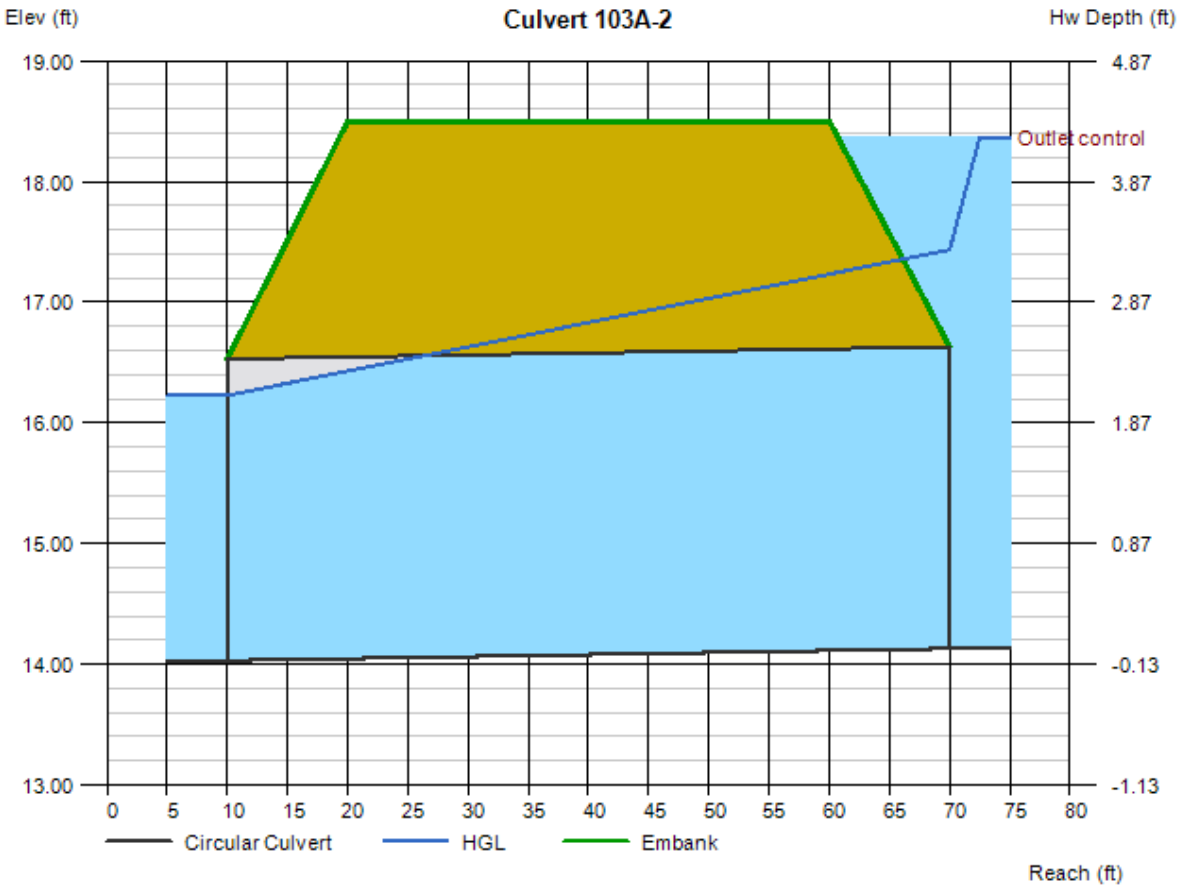
Top Elevation (ft)	=	18.50
Top Width (ft)	=	40.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	31.00
Qpipe (cfs)	=	31.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.78
Veloc Up (ft/s)	=	6.32
HGL Dn (ft)	=	16.23
HGL Up (ft)	=	17.43
Hw Elev (ft)	=	18.36
Hw/D (ft)	=	1.69
Flow Regime	=	Outlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Thursday, Sep 20 2018

Sublateral 103a Station 210+55

Invert Elev Dn (ft)	=	12.66
Pipe Length (ft)	=	61.00
Slope (%)	=	0.25
Invert Elev Up (ft)	=	12.81
Rise (in)	=	54.0
Shape	=	Circular
Span (in)	=	54.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

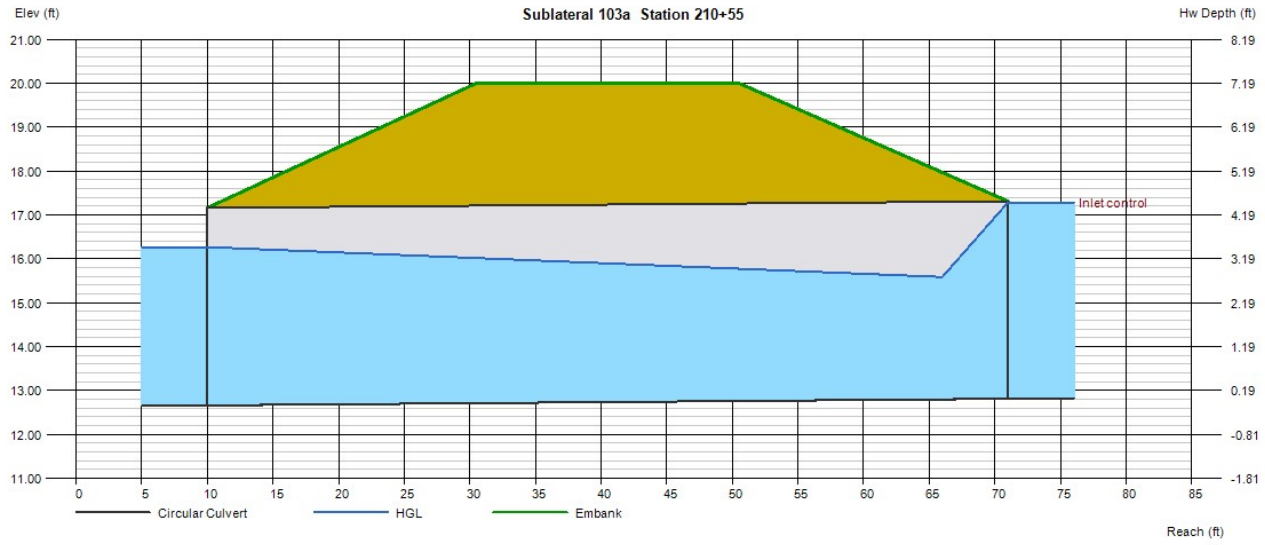
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	10.00
Qmax (cfs)	=	90.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	86.00
Qpipe (cfs)	=	86.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.29
Veloc Up (ft/s)	=	8.57
HGL Dn (ft)	=	16.27
HGL Up (ft)	=	15.53
Hw Elev (ft)	=	17.29
Hw/D (ft)	=	0.99
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 3A Station 214+94 to 224+52

Trapezoidal

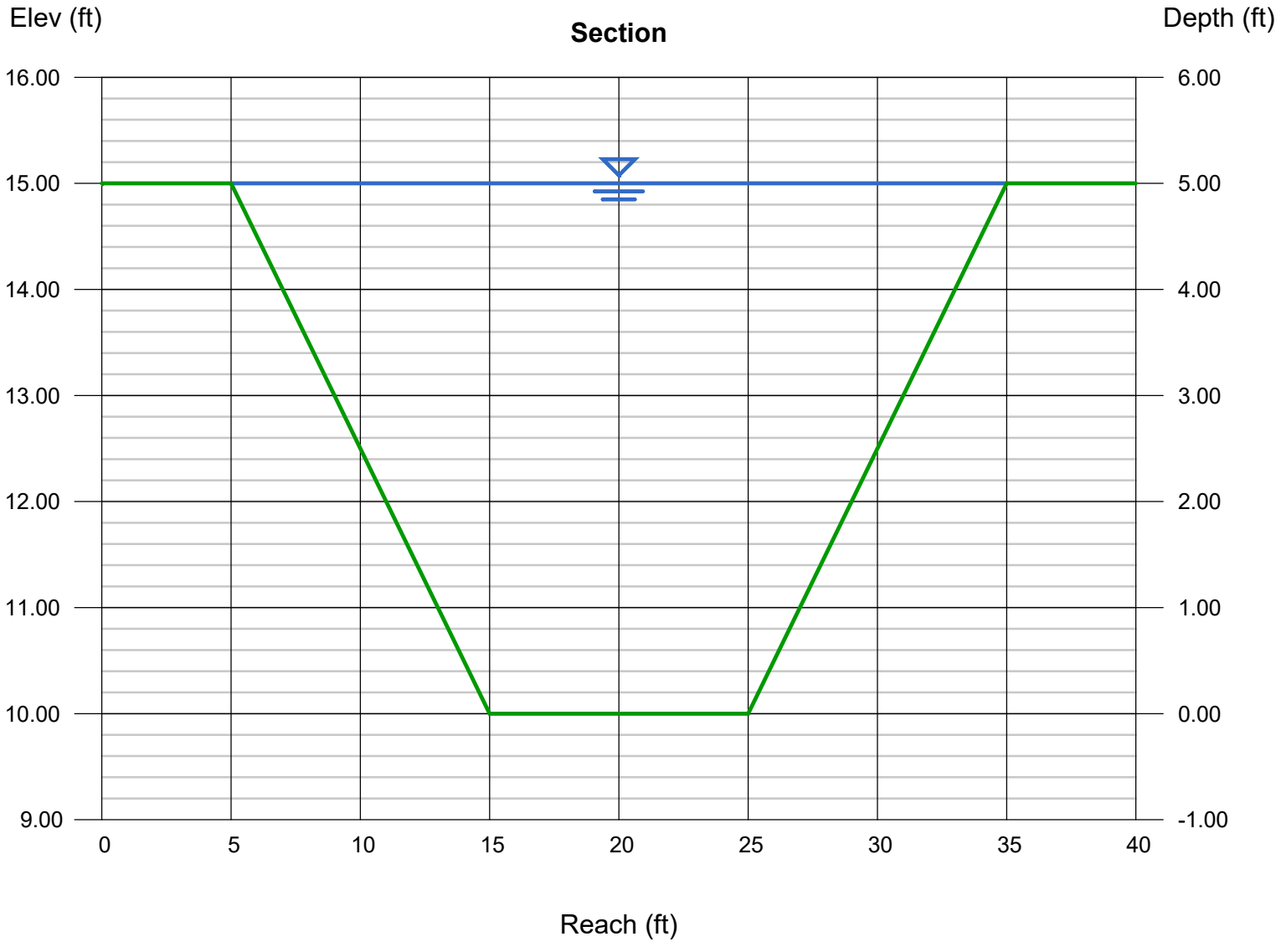
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 5.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.10
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.00

Highlighted

Depth (ft)	= 5.00
Q (cfs)	= 332.44
Area (sqft)	= 100.00
Velocity (ft/s)	= 3.32
Wetted Perim (ft)	= 32.36
Crit Depth, Yc (ft)	= 2.70
Top Width (ft)	= 30.00
EGL (ft)	= 5.17



Culvert Report

Sublateral 103a Station 224+52

Invert Elev Dn (ft)	=	10.90
Pipe Length (ft)	=	53.00
Slope (%)	=	0.08
Invert Elev Up (ft)	=	10.94
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	2
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

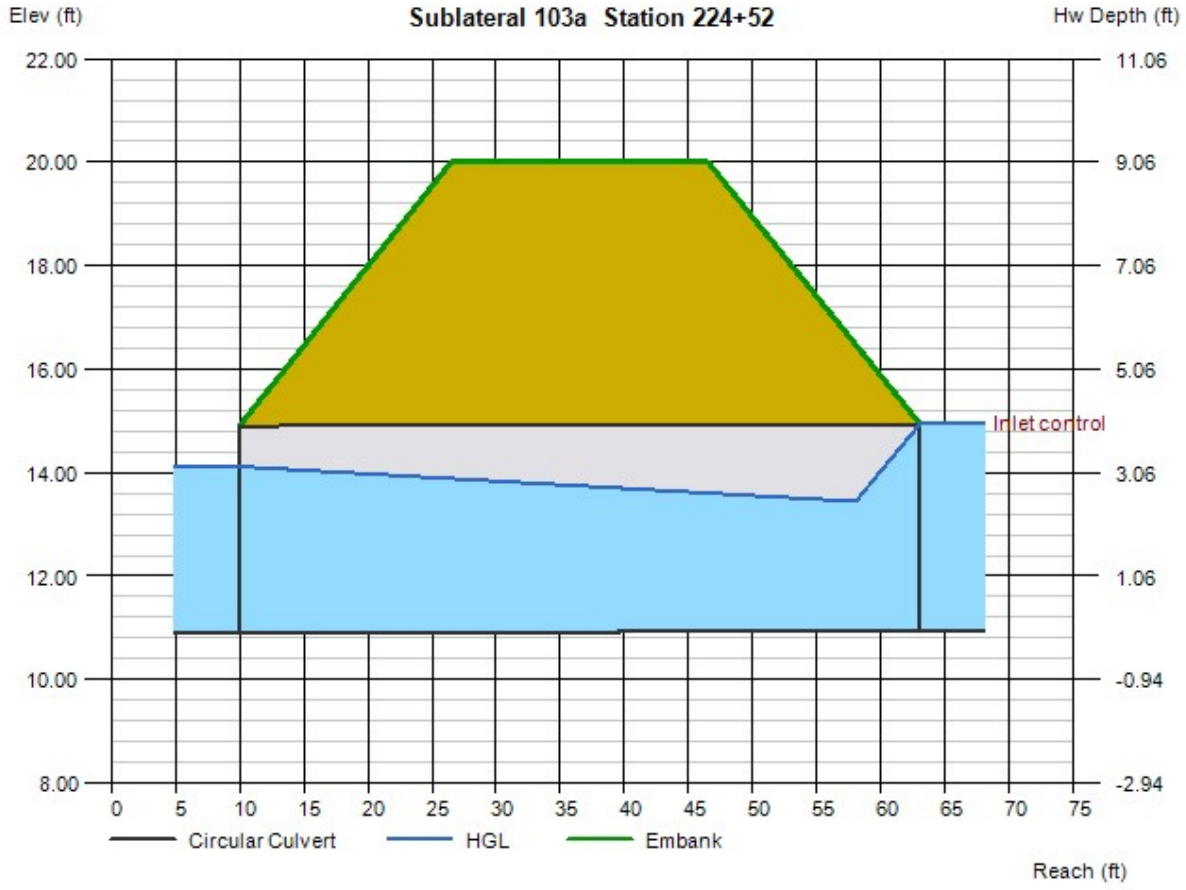
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	100.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	130.00
Qpipe (cfs)	=	130.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.00
Veloc Up (ft/s)	=	8.13
HGL Dn (ft)	=	14.12
HGL Up (ft)	=	13.37
Hw Elev (ft)	=	14.96
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 3A Station 225+08 to 230+61

Trapezoidal

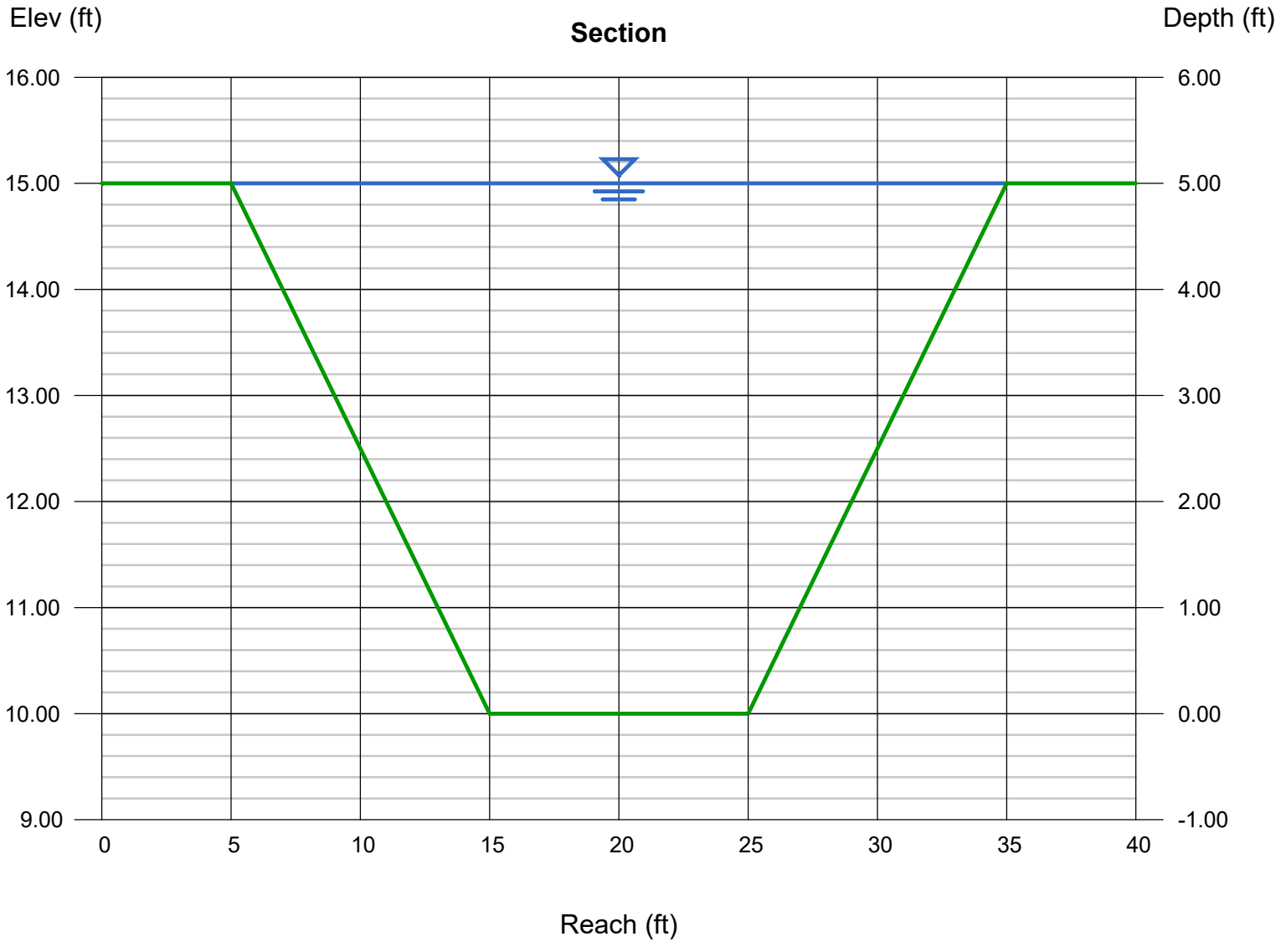
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 5.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.22
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.00

Highlighted

Depth (ft)	= 5.00
Q (cfs)	= 493.09
Area (sqft)	= 100.00
Velocity (ft/s)	= 4.93
Wetted Perim (ft)	= 32.36
Crit Depth, Yc (ft)	= 3.36
Top Width (ft)	= 30.00
EGL (ft)	= 5.38



Culvert Report

Sublateral 103a Station 230+61

Invert Elev Dn (ft)	=	9.53
Pipe Length (ft)	=	73.00
Slope (%)	=	0.36
Invert Elev Up (ft)	=	9.79
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	2
n-Value	=	0.011
Culvert Type	=	Elliptical Inlet Face (C)
Culvert Entrance	=	Tapered inlet-beveled edges (C)
Coeff. K,M,c,Y,k	=	0.536, 0.622, 0.0368, 0.83, 0.2

Embankment

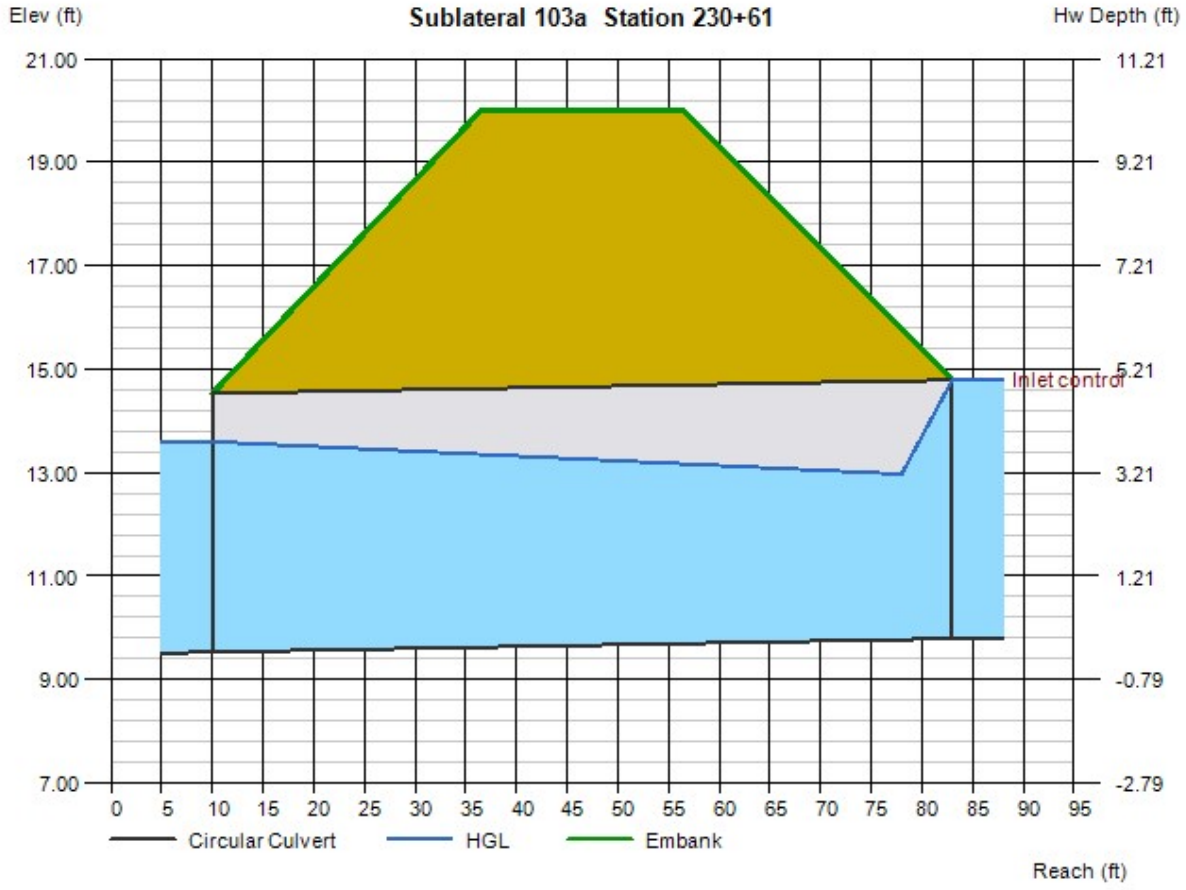
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	200.00
Qmax (cfs)	=	300.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	241.00
Qpipe (cfs)	=	241.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.04
Veloc Up (ft/s)	=	9.30
HGL Dn (ft)	=	13.60
HGL Up (ft)	=	12.92
Hw Elev (ft)	=	14.81
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 3A Station 231+57 to 241+19

Trapezoidal

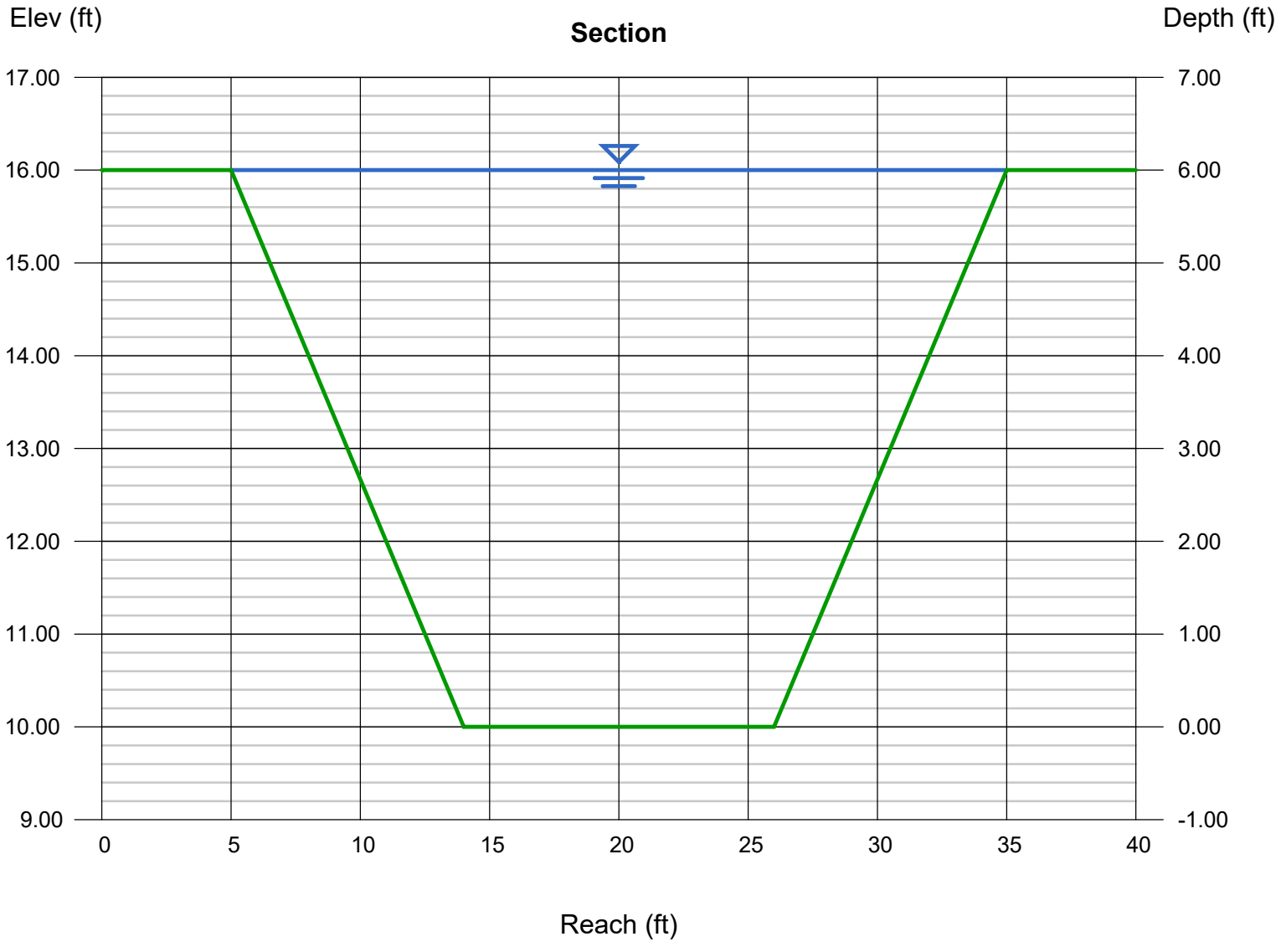
Bottom Width (ft)	= 12.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 6.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.10
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 6.00

Highlighted

Depth (ft)	= 6.00
Q (cfs)	= 476.28
Area (sqft)	= 126.00
Velocity (ft/s)	= 3.78
Wetted Perim (ft)	= 33.63
Crit Depth, Yc (ft)	= 3.19
Top Width (ft)	= 30.00
EGL (ft)	= 6.22



Channel Report

SubLateral 3B Station 300+00 to 313+90

Trapezoidal

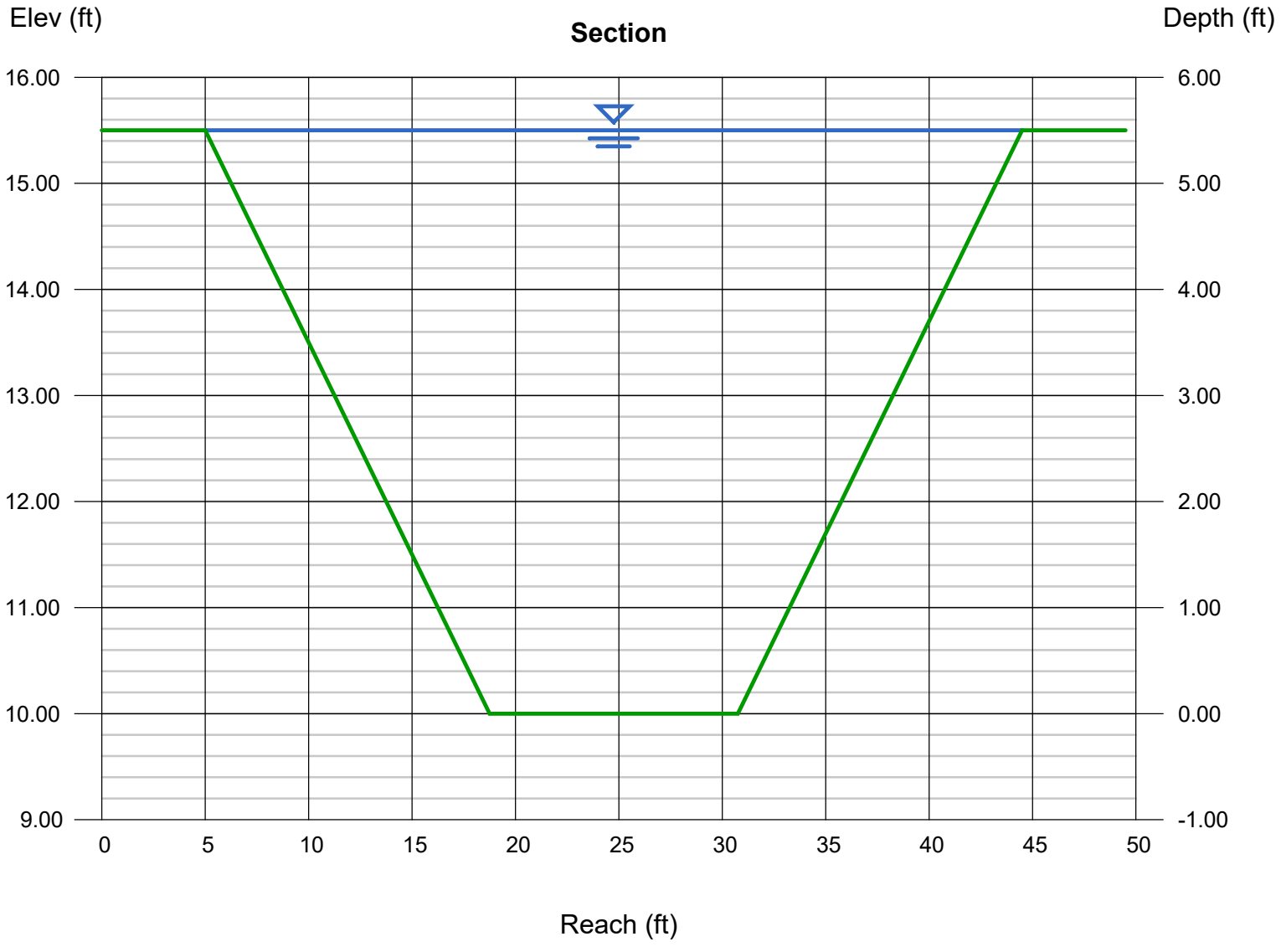
Bottom Width (ft)	= 12.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 5.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.50

Highlighted

Depth (ft)	= 5.50
Q (cfs)	= 355.03
Area (sqft)	= 141.63
Velocity (ft/s)	= 2.51
Wetted Perim (ft)	= 41.62
Crit Depth, Yc (ft)	= 2.51
Top Width (ft)	= 39.50
EGL (ft)	= 5.60



Channel Report

Station 400+00 to 406+24 ; 407+23 to 415+76

Trapezoidal

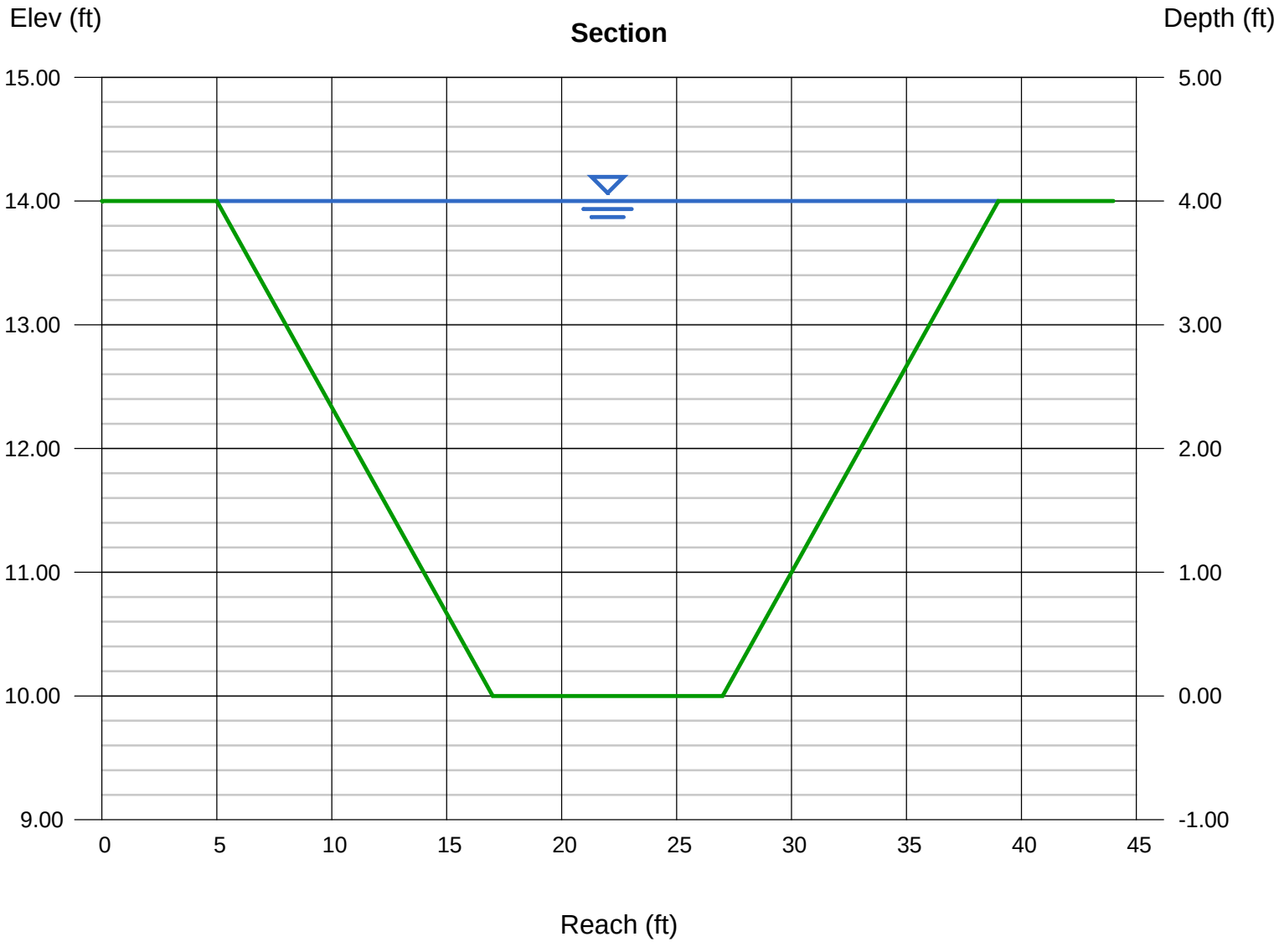
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 4.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.13
N-Value	= 0.022

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.00

Highlighted

Depth (ft)	= 4.00
Q (cfs)	= 394.16
Area (sqft)	= 88.00
Velocity (ft/s)	= 4.48
Wetted Perim (ft)	= 35.30
Crit Depth, Yc (ft)	= 2.76
Top Width (ft)	= 34.00
EGL (ft)	= 4.31



Culvert Report

Sublateral 103C Station 406+24

Invert Elev Dn (ft)	=	12.09
Pipe Length (ft)	=	49.00
Slope (%)	=	0.43
Invert Elev Up (ft)	=	12.30
Rise (in)	=	54.0
Shape	=	Circular
Span (in)	=	54.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

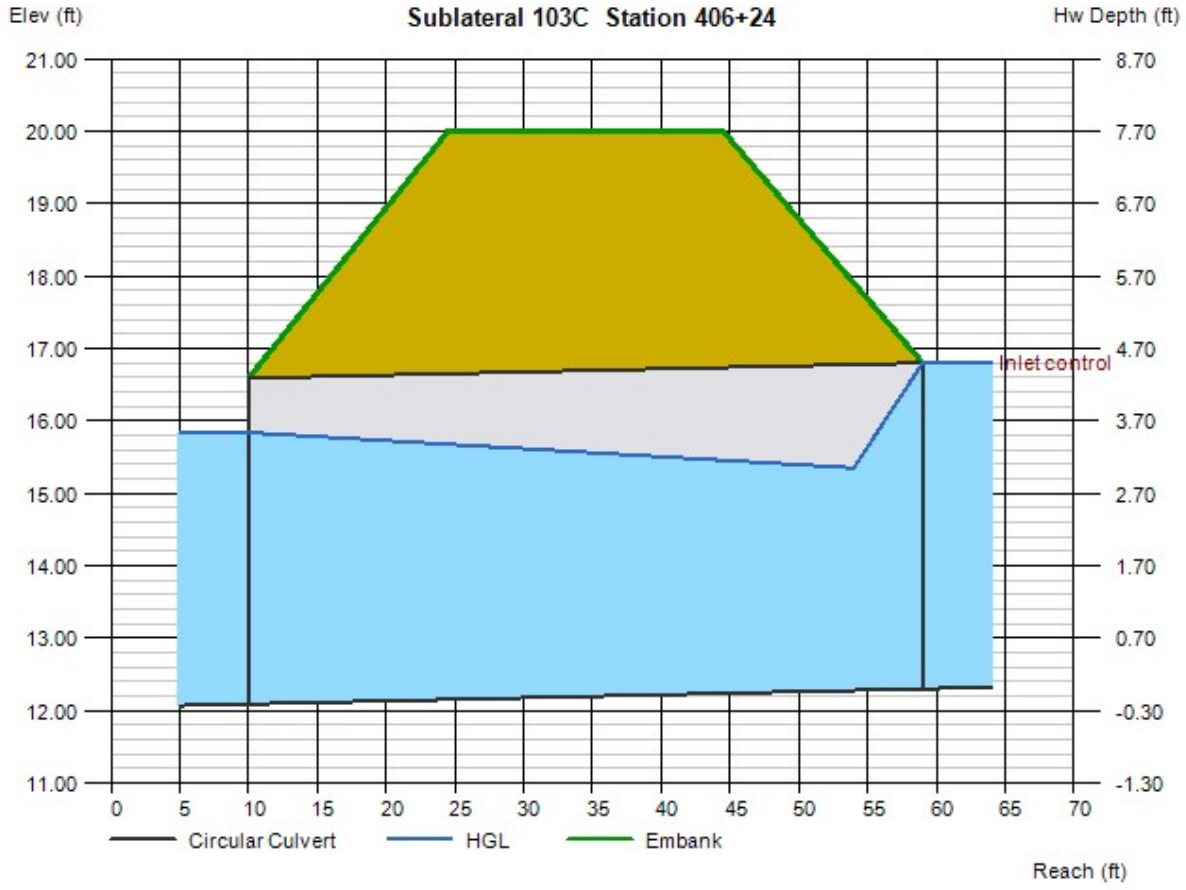
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	150.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	104.00
Qpipe (cfs)	=	104.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.35
Veloc Up (ft/s)	=	9.25
HGL Dn (ft)	=	15.84
HGL Up (ft)	=	15.30
Hw Elev (ft)	=	16.81
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Culvert Report

Sublateral 103C Station 415+76

Invert Elev Dn (ft)	=	11.06
Pipe Length (ft)	=	40.00
Slope (%)	=	0.67
Invert Elev Up (ft)	=	11.33
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	2
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

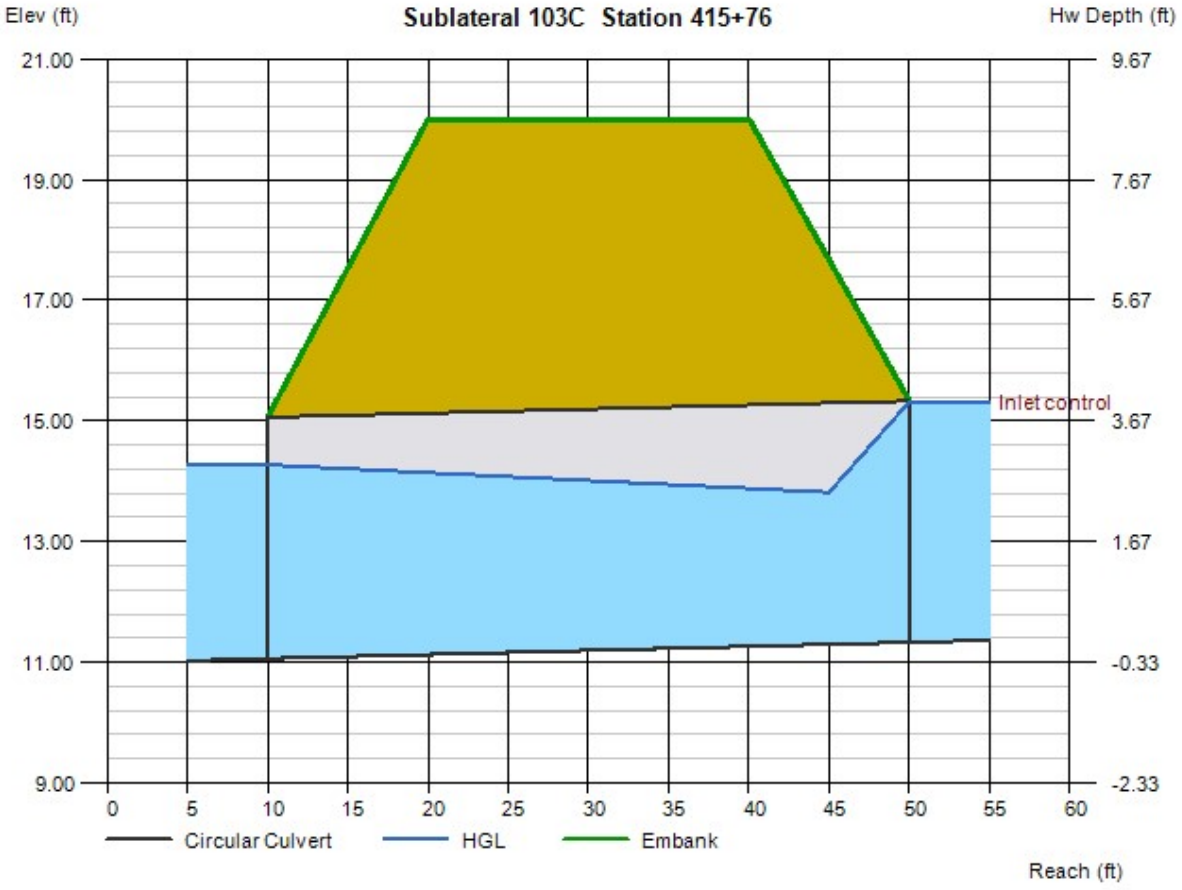
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	150.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	129.00
Qpipe (cfs)	=	129.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.97
Veloc Up (ft/s)	=	8.11
HGL Dn (ft)	=	14.27
HGL Up (ft)	=	13.75
Hw Elev (ft)	=	15.32
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

Station 417+03 to 424+64

Trapezoidal

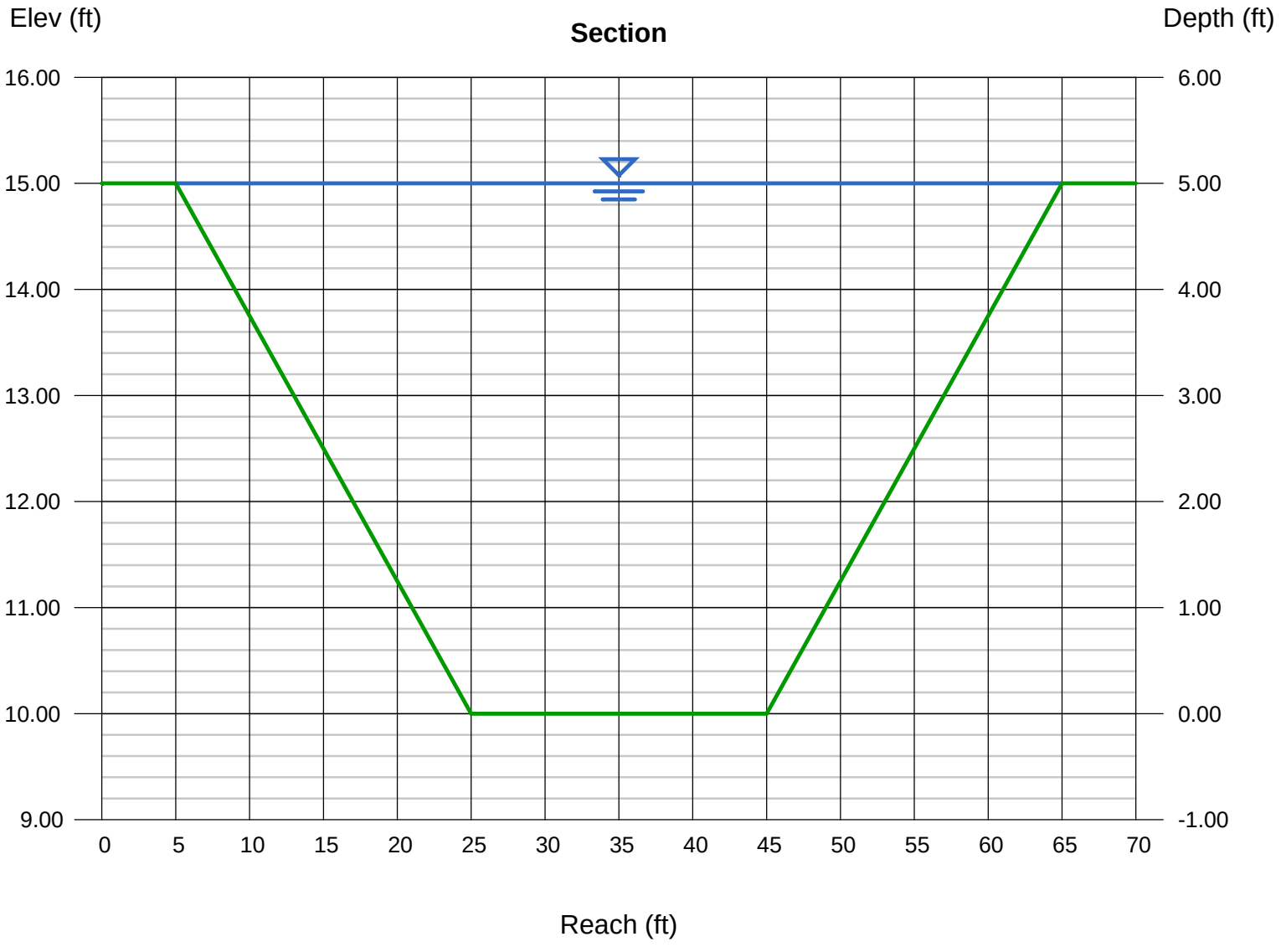
Bottom Width (ft)	= 20.00
Side Slopes (z:1)	= 4.00, 4.00
Total Depth (ft)	= 5.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.50
N-Value	= 0.022

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.00

Highlighted

Depth (ft)	= 5.00
Q (cfs)	= 2,104
Area (sqft)	= 200.00
Velocity (ft/s)	= 10.52
Wetted Perim (ft)	= 61.23
Crit Depth, Yc (ft)	= 5.00
Top Width (ft)	= 60.00
EGL (ft)	= 6.72



Culvert Report

SubLateral 103D Station 500+00

Invert Elev Dn (ft)	=	8.42
Pipe Length (ft)	=	56.00
Slope (%)	=	3.18
Invert Elev Up (ft)	=	10.20
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

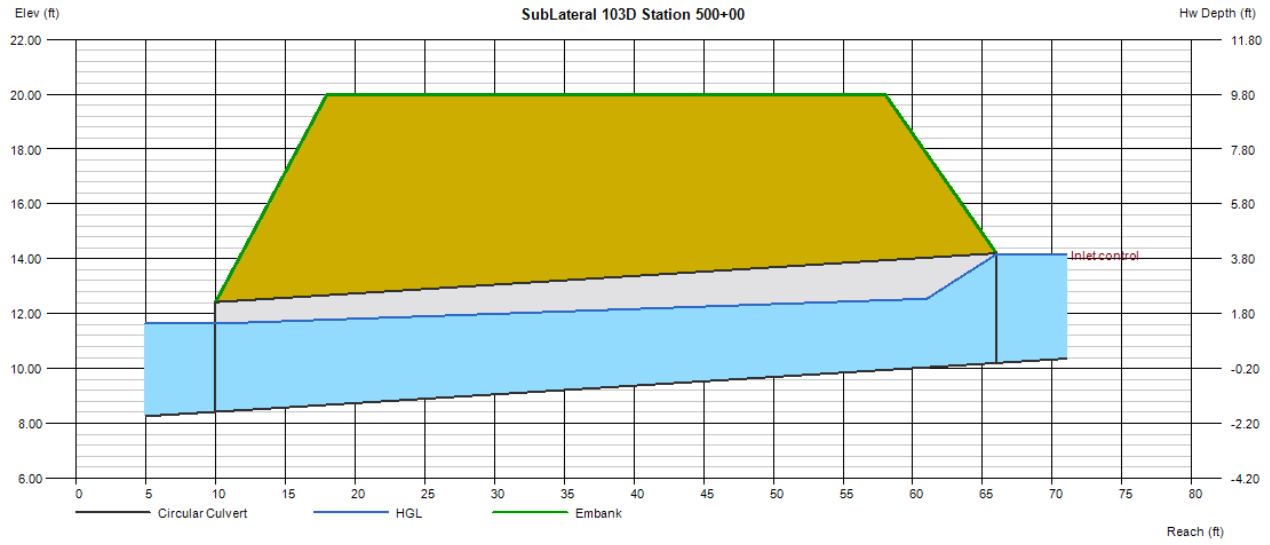
Top Elevation (ft)	=	20.00
Top Width (ft)	=	40.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	65.00
Qpipe (cfs)	=	65.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.00
Veloc Up (ft/s)	=	8.13
HGL Dn (ft)	=	11.64
HGL Up (ft)	=	12.63
Hw Elev (ft)	=	14.16
Hw/D (ft)	=	0.99
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 103D Station 500+00 to 513+38

Trapezoidal

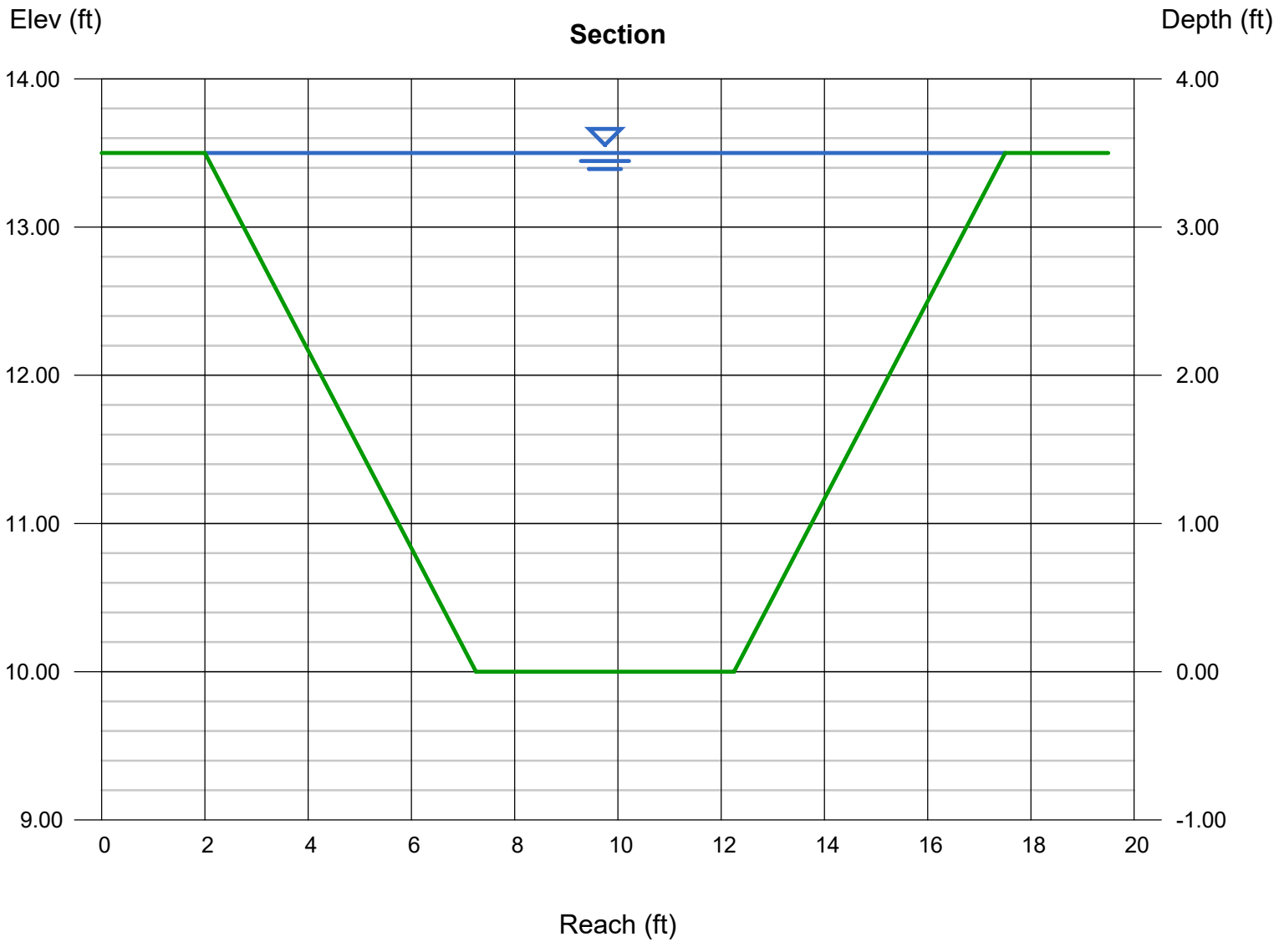
Bottom Width (ft)	= 5.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 3.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.50

Highlighted

Depth (ft)	= 3.50
Q (cfs)	= 63.85
Area (sqft)	= 35.88
Velocity (ft/s)	= 1.78
Wetted Perim (ft)	= 17.62
Crit Depth, Yc (ft)	= 1.48
Top Width (ft)	= 15.50
EGL (ft)	= 3.55



Culvert Report

SubLateral 103D Station 503+86

Invert Elev Dn (ft)	=	9.67
Pipe Length (ft)	=	20.00
Slope (%)	=	1.60
Invert Elev Up (ft)	=	9.99
Rise (in)	=	42.0
Shape	=	Circular
Span (in)	=	42.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

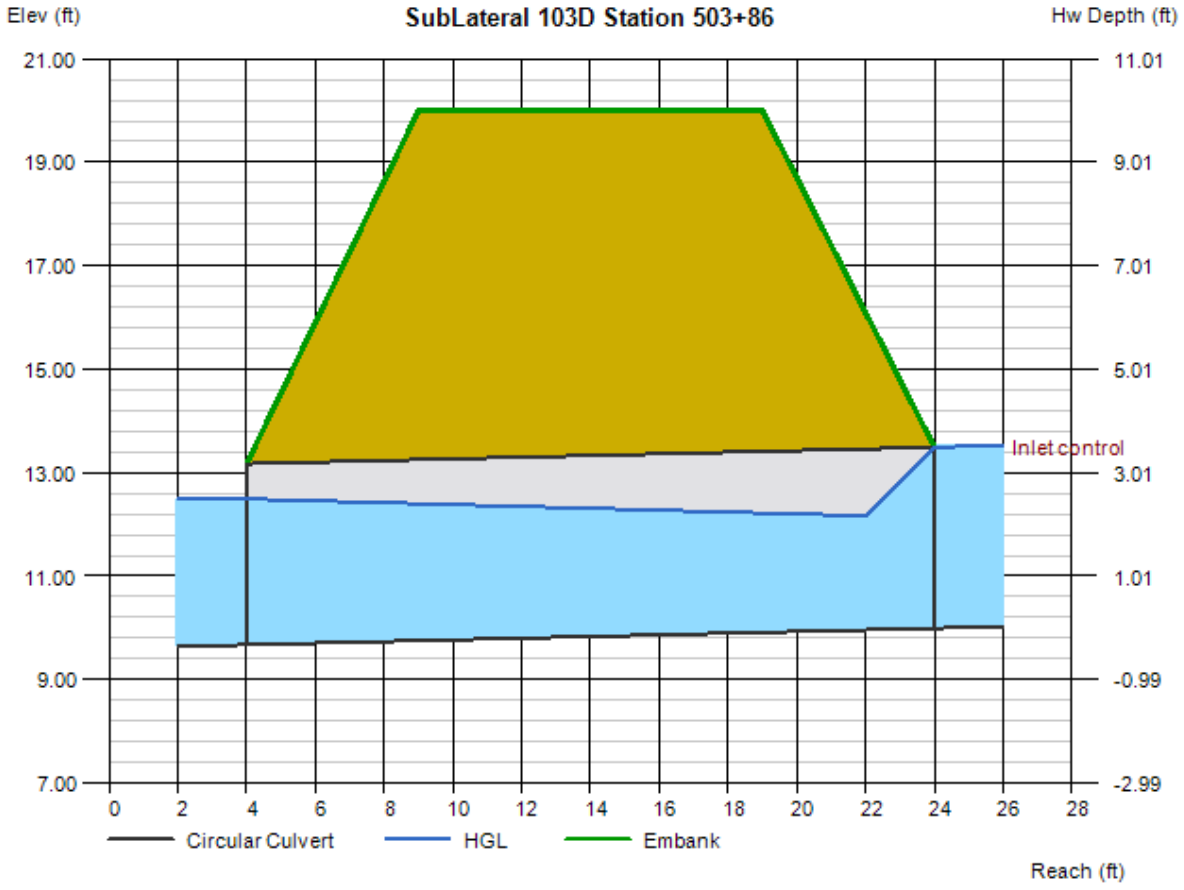
Top Elevation (ft)	=	20.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	47.00
Qpipe (cfs)	=	47.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.66
Veloc Up (ft/s)	=	7.63
HGL Dn (ft)	=	12.49
HGL Up (ft)	=	12.13
Hw Elev (ft)	=	13.51
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Culvert Report

Culvert 103D-3

Invert Elev Dn (ft)	=	9.01
Pipe Length (ft)	=	88.00
Slope (%)	=	0.34
Invert Elev Up (ft)	=	9.31
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Headwall
Coeff. K,M,c,Y,k	=	0.0078, 2, 0.0379, 0.69, 0.5

Embankment

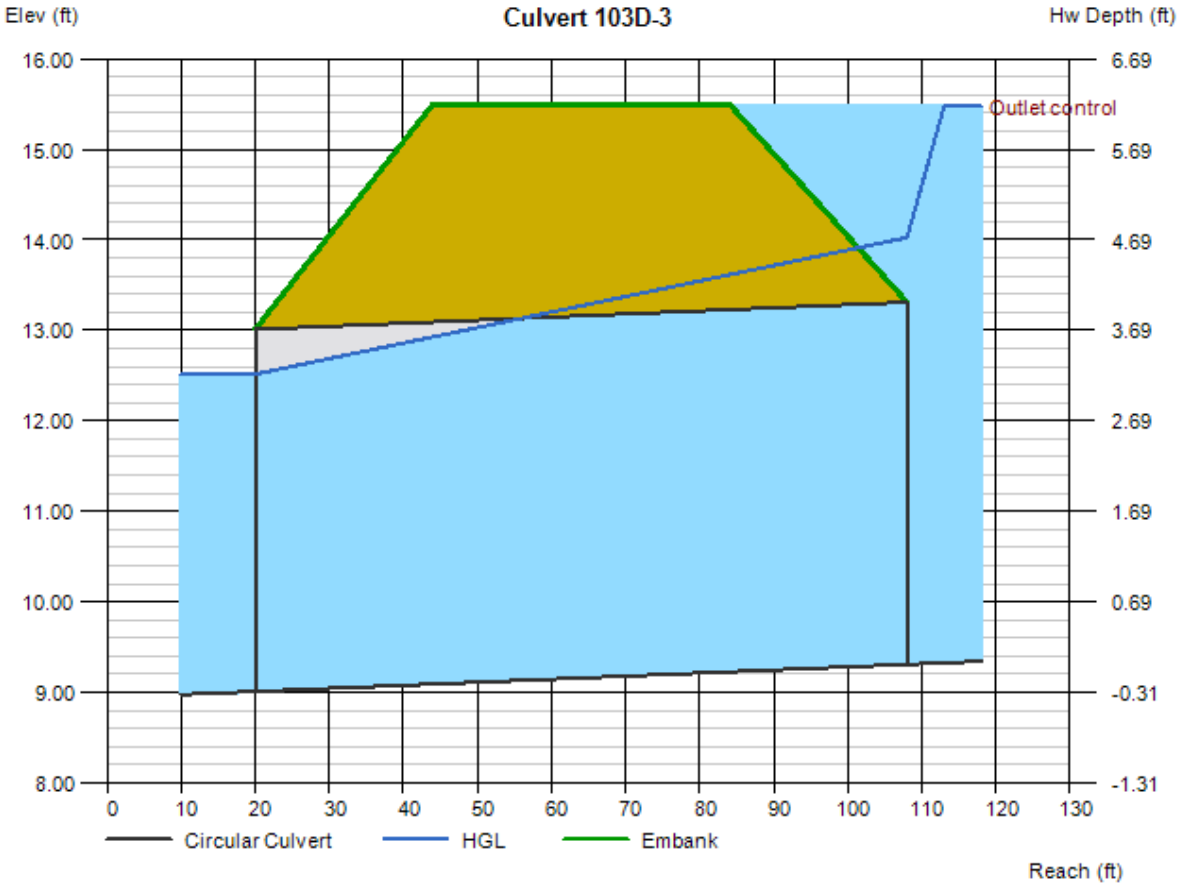
Top Elevation (ft)	=	15.50
Top Width (ft)	=	40.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	99.00
Qpipe (cfs)	=	99.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	8.48
Veloc Up (ft/s)	=	7.88
HGL Dn (ft)	=	12.52
HGL Up (ft)	=	14.03
Hw Elev (ft)	=	15.47
Hw/D (ft)	=	1.54
Flow Regime	=	Outlet Control



Channel Report

SubLateral 103D Station 514+84 to 525+85

Trapezoidal

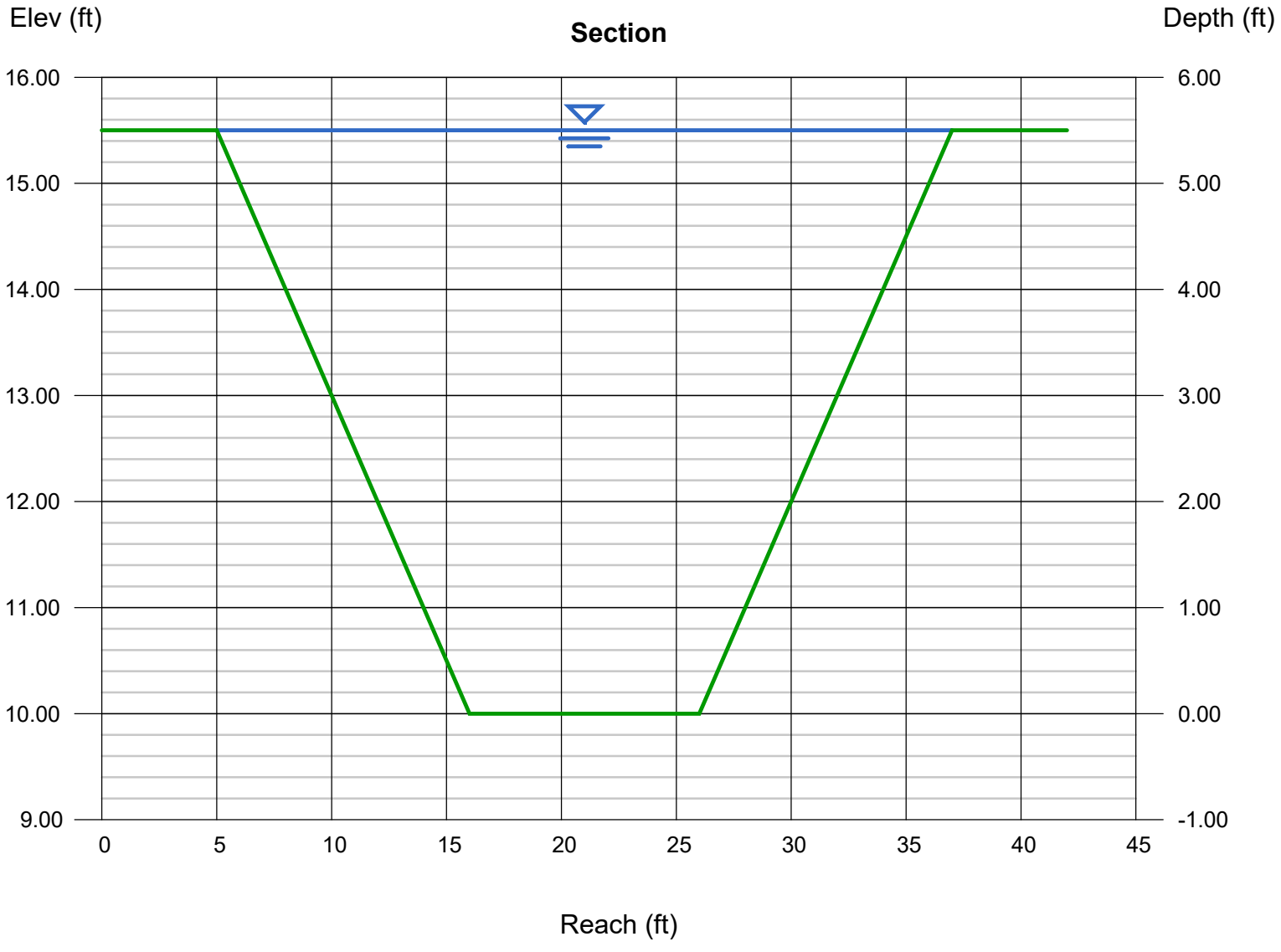
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 5.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.06
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.50

Highlighted

Depth (ft)	= 5.50
Q (cfs)	= 313.16
Area (sqft)	= 115.50
Velocity (ft/s)	= 2.71
Wetted Perim (ft)	= 34.60
Crit Depth, Yc (ft)	= 2.61
Top Width (ft)	= 32.00
EGL (ft)	= 5.61



Culvert Report

SubLateral 103D Station 252+85

Invert Elev Dn (ft)	=	8.29
Pipe Length (ft)	=	37.00
Slope (%)	=	0.51
Invert Elev Up (ft)	=	8.48
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	2
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

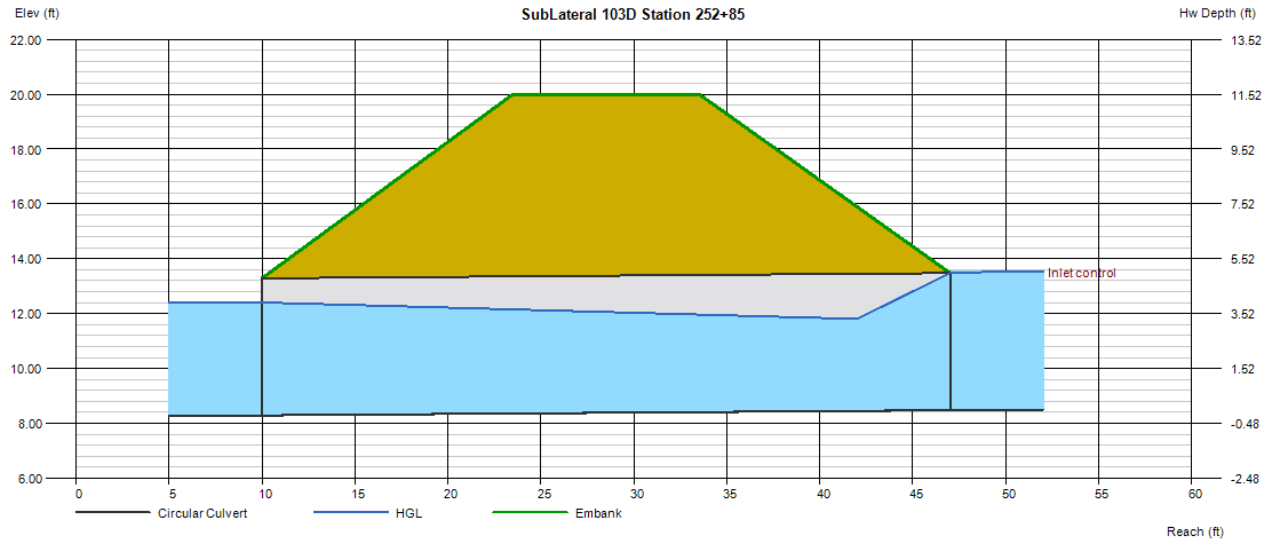
Top Elevation (ft)	=	20.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	200.00
Qmax (cfs)	=	300.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	256.00
Qpipe (cfs)	=	256.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.40
Veloc Up (ft/s)	=	9.53
HGL Dn (ft)	=	12.41
HGL Up (ft)	=	11.71
Hw Elev (ft)	=	13.53
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 103D Station 526+86 to 545+13

Trapezoidal

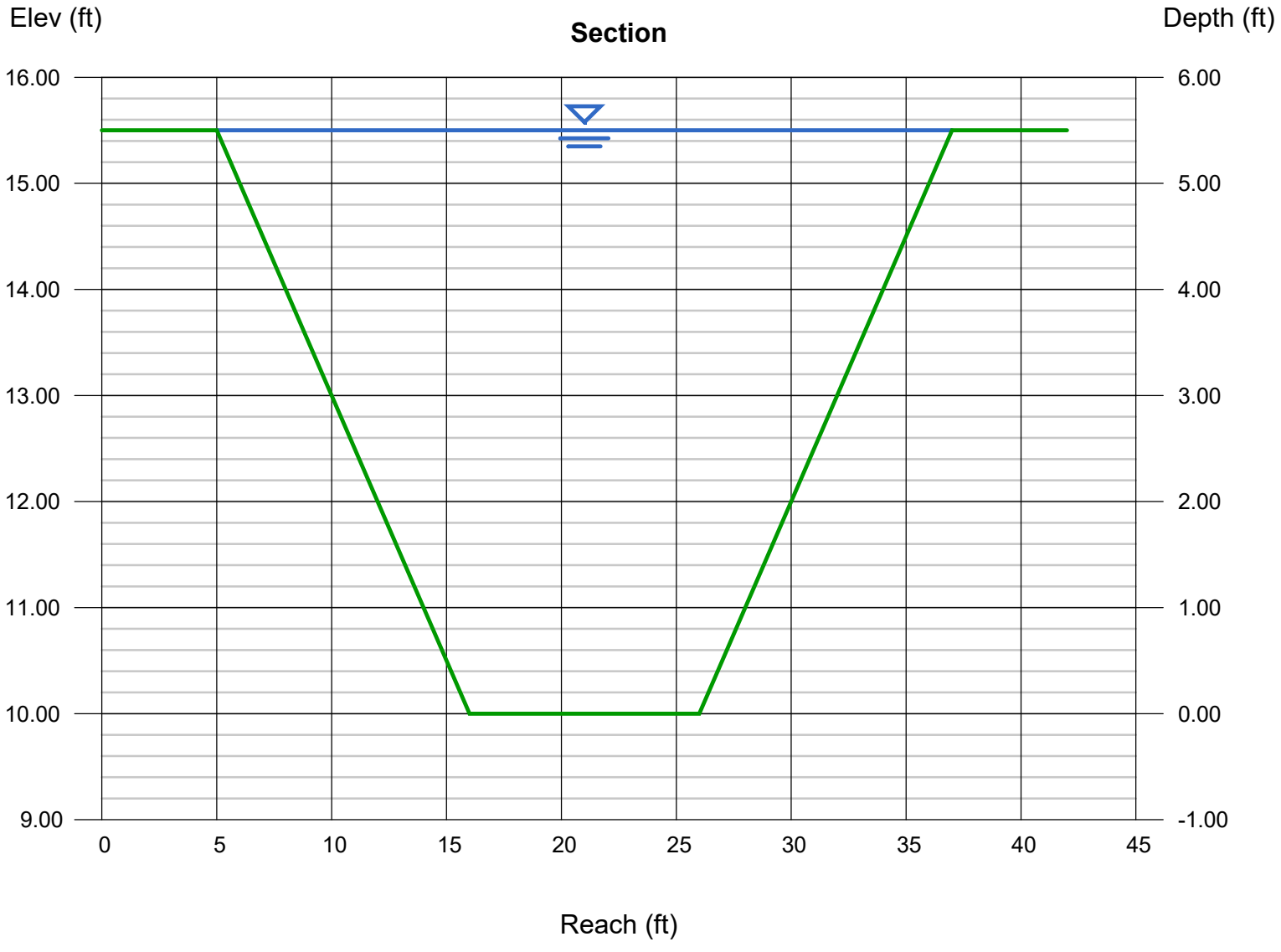
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 5.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.06
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.50

Highlighted

Depth (ft)	= 5.50
Q (cfs)	= 313.16
Area (sqft)	= 115.50
Velocity (ft/s)	= 2.71
Wetted Perim (ft)	= 34.60
Crit Depth, Yc (ft)	= 2.61
Top Width (ft)	= 32.00
EGL (ft)	= 5.61



Culvert Report

Culvert 103D-5

Invert Elev Dn (ft)	=	5.23
Pipe Length (ft)	=	20.00
Slope (%)	=	0.65
Invert Elev Up (ft)	=	5.36
Rise (in)	=	60.0
Shape	=	Circular
Span (in)	=	60.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

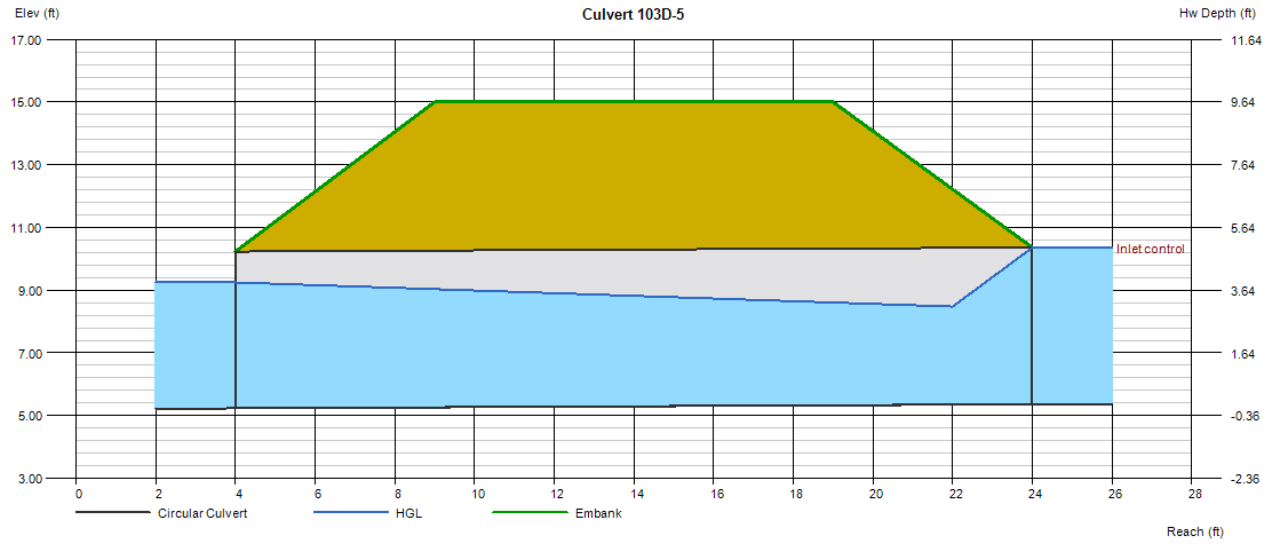
Top Elevation (ft)	=	15.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	100.00
Qmax (cfs)	=	200.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	113.00
Qpipe (cfs)	=	113.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.69
Veloc Up (ft/s)	=	9.07
HGL Dn (ft)	=	9.25
HGL Up (ft)	=	8.39
Hw Elev (ft)	=	10.36
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 103E Station 600+00 to 606+56

Trapezoidal

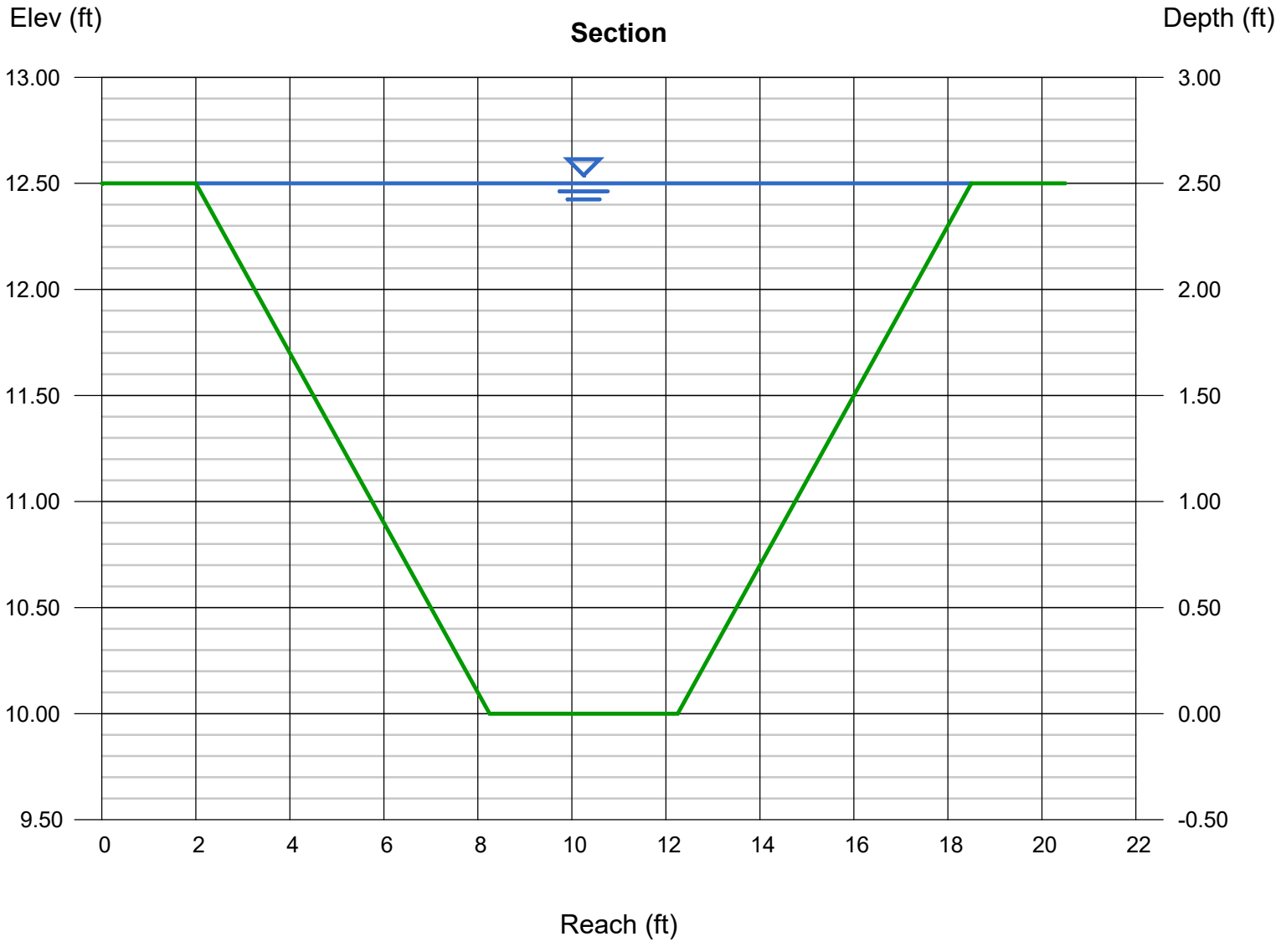
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.85
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.50

Highlighted

Depth (ft)	= 2.50
Q (cfs)	= 151.13
Area (sqft)	= 25.63
Velocity (ft/s)	= 5.90
Wetted Perim (ft)	= 17.46
Crit Depth, Yc (ft)	= 2.29
Top Width (ft)	= 16.50
EGL (ft)	= 3.04



Culvert Report

Culvert 103E-1

Invert Elev Dn (ft)	=	9.73
Pipe Length (ft)	=	90.00
Slope (%)	=	0.30
Invert Elev Up (ft)	=	10.00
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

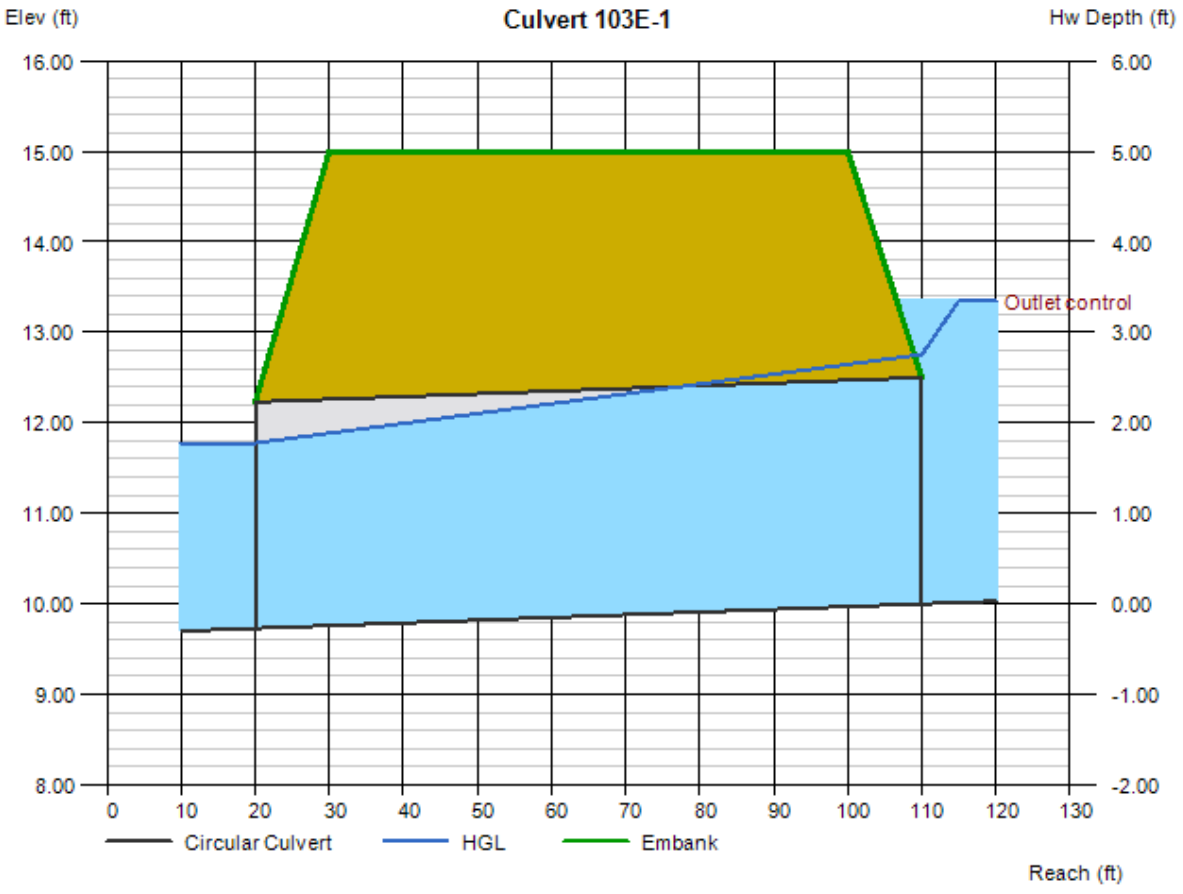
Top Elevation (ft)	=	15.00
Top Width (ft)	=	70.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	22.00
Qpipe (cfs)	=	22.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.11
Veloc Up (ft/s)	=	4.48
HGL Dn (ft)	=	11.78
HGL Up (ft)	=	12.75
Hw Elev (ft)	=	13.35
Hw/D (ft)	=	1.34
Flow Regime	=	Outlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 103E Station 608+50 to 613+40

Trapezoidal

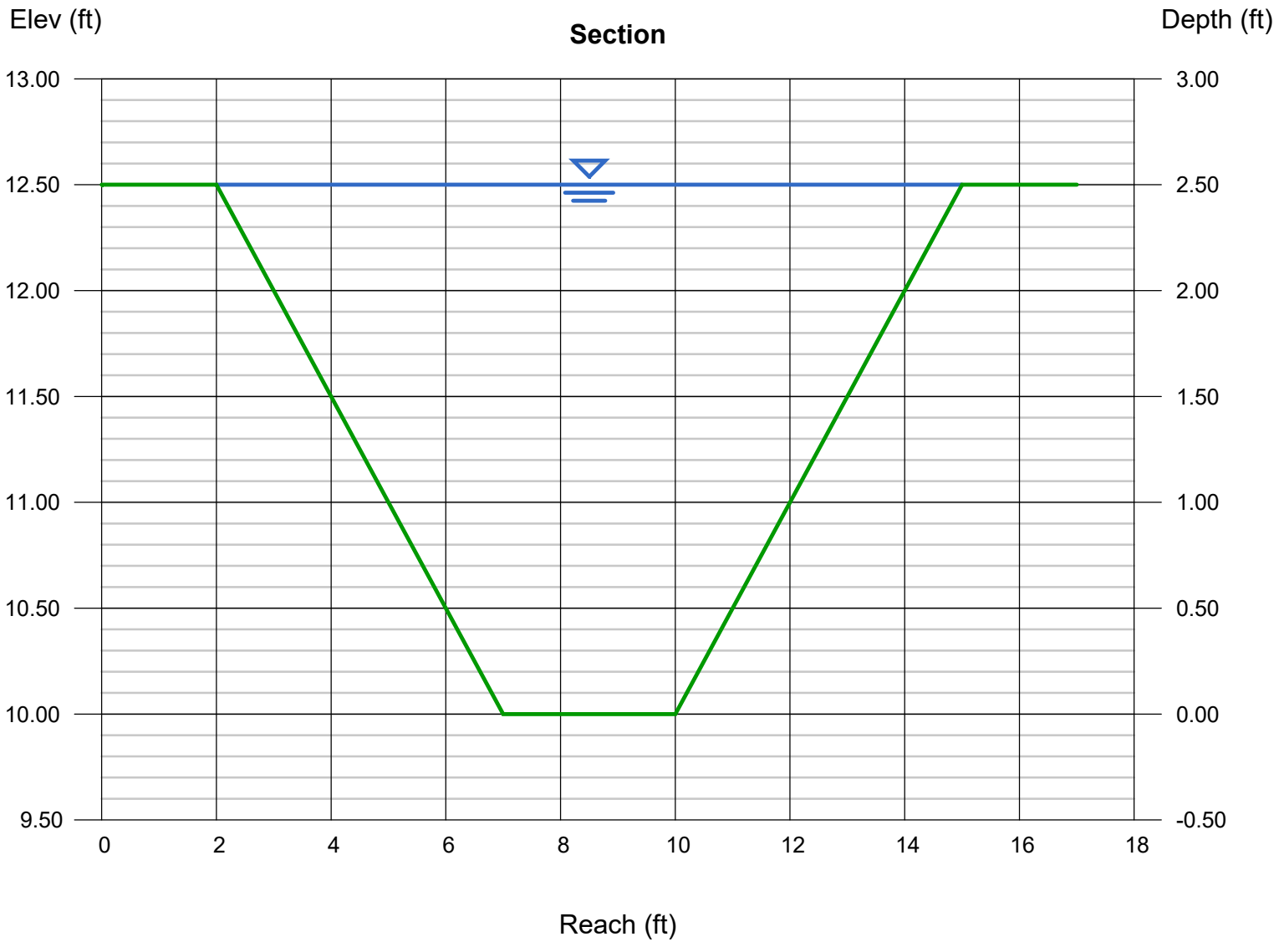
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.50

Highlighted

Depth (ft)	= 2.50
Q (cfs)	= 27.86
Area (sqft)	= 20.00
Velocity (ft/s)	= 1.39
Wetted Perim (ft)	= 14.18
Crit Depth, Yc (ft)	= 1.09
Top Width (ft)	= 13.00
EGL (ft)	= 2.53



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 103E Station 613+40

Invert Elev Dn (ft)	=	11.26
Pipe Length (ft)	=	77.00
Slope (%)	=	-0.35
Invert Elev Up (ft)	=	10.99
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

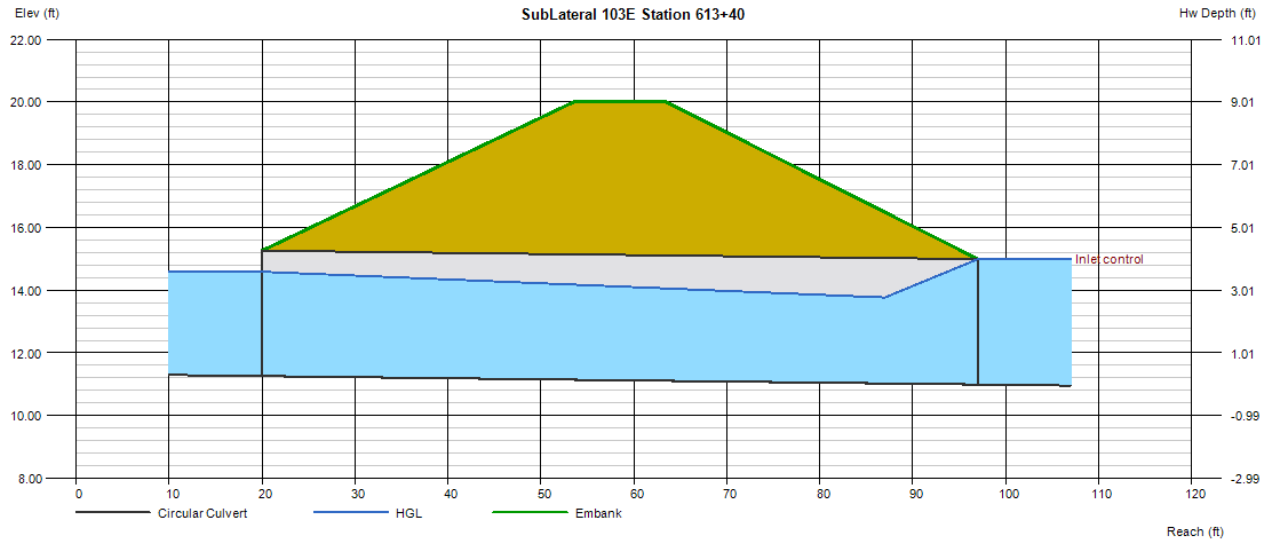
Top Elevation (ft)	=	20.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	77.00
Qpipe (cfs)	=	77.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.89
Veloc Up (ft/s)	=	8.70
HGL Dn (ft)	=	14.59
HGL Up (ft)	=	13.64
Hw Elev (ft)	=	15.00
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

SubLateral 103E Station 614+08 to 621+58

Trapezoidal

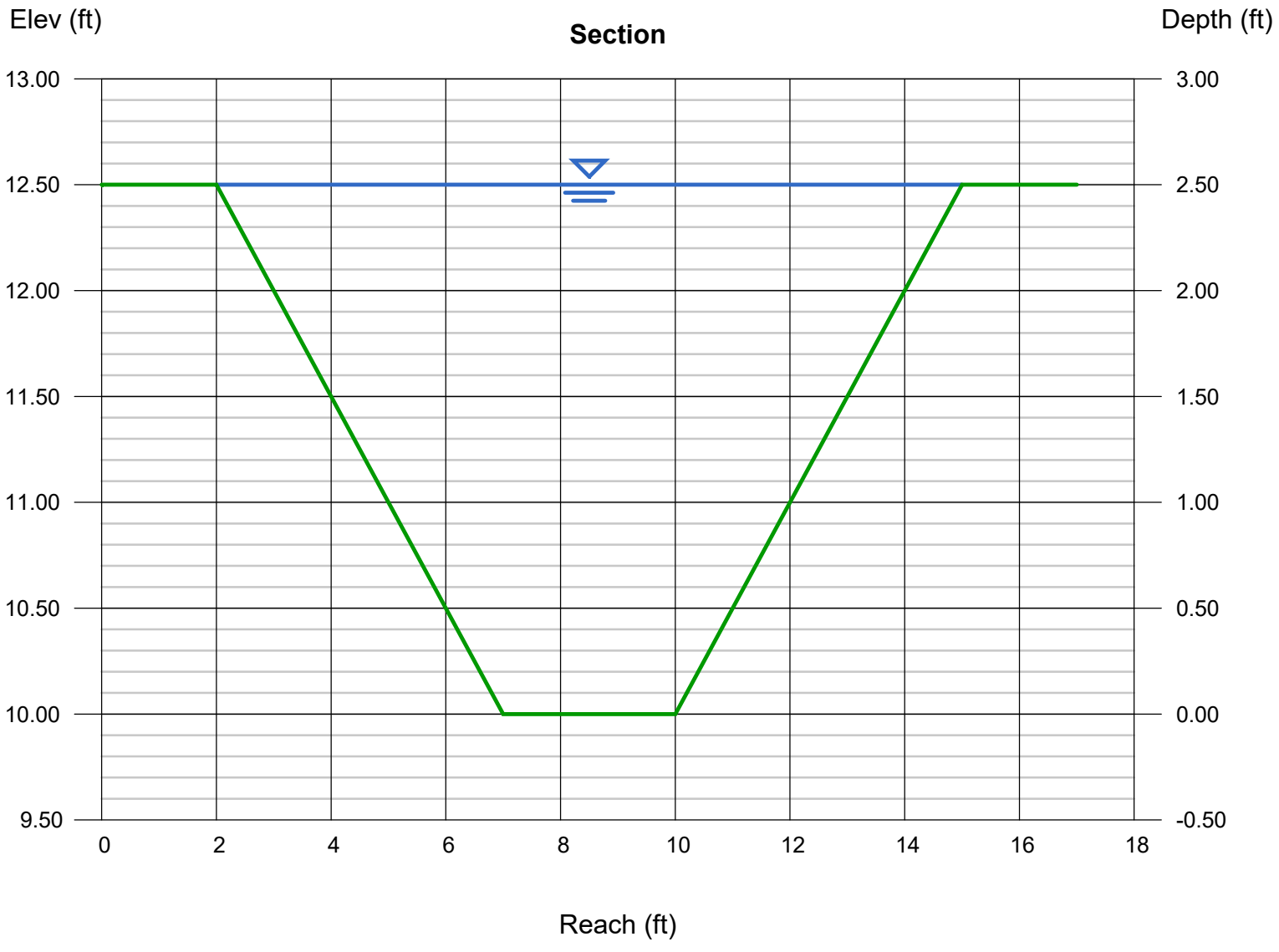
Bottom Width (ft)	= 3.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.21
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.50

Highlighted

Depth (ft)	= 2.50
Q (cfs)	= 57.10
Area (sqft)	= 20.00
Velocity (ft/s)	= 2.86
Wetted Perim (ft)	= 14.18
Crit Depth, Yc (ft)	= 1.60
Top Width (ft)	= 13.00
EGL (ft)	= 2.63



Culvert Report

Sublateral 103E Station 621+58

Invert Elev Dn (ft)	=	9.63
Pipe Length (ft)	=	38.00
Slope (%)	=	0.37
Invert Elev Up (ft)	=	9.77
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

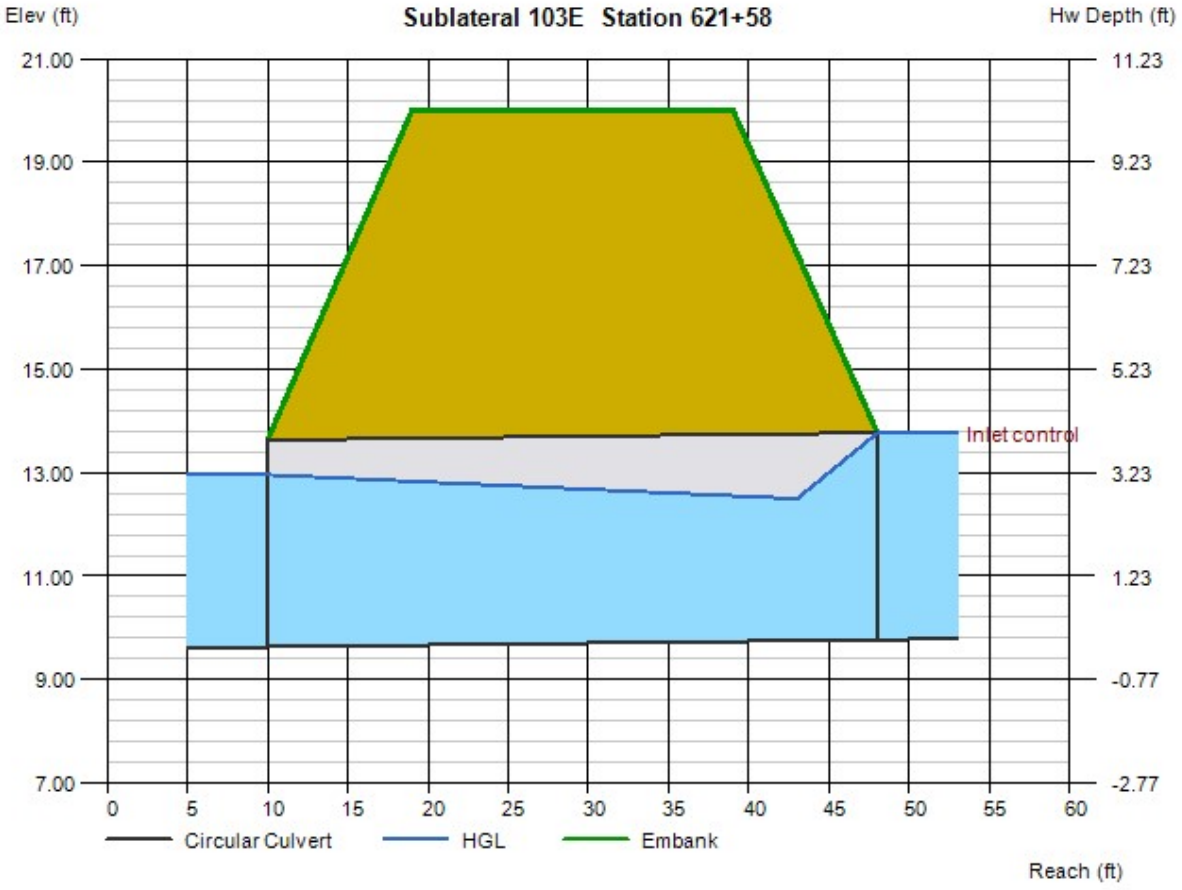
Top Elevation (ft)	=	20.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	150.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	77.00
Qpipe (cfs)	=	77.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.89
Veloc Up (ft/s)	=	8.70
HGL Dn (ft)	=	12.96
HGL Up (ft)	=	12.42
Hw Elev (ft)	=	13.76
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

SubLateral 103E Station 622+17 to 641+09

Trapezoidal

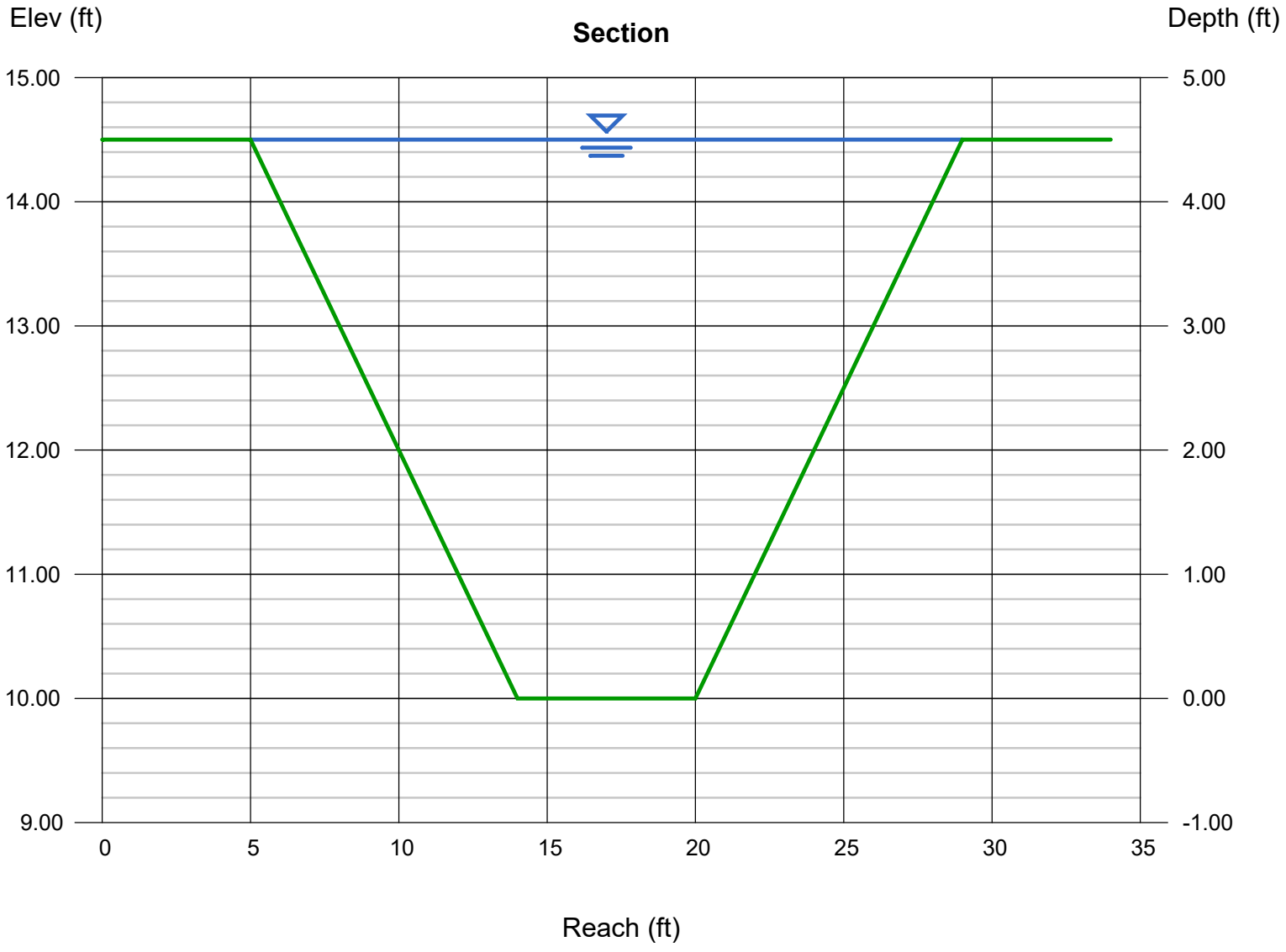
Bottom Width (ft)	= 6.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 4.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 4.50

Highlighted

Depth (ft)	= 4.50
Q (cfs)	= 140.82
Area (sqft)	= 67.50
Velocity (ft/s)	= 2.09
Wetted Perim (ft)	= 26.12
Crit Depth, Yc (ft)	= 2.05
Top Width (ft)	= 24.00
EGL (ft)	= 4.57



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

Lateral 104 Station 0+00 to 13+47

Trapezoidal

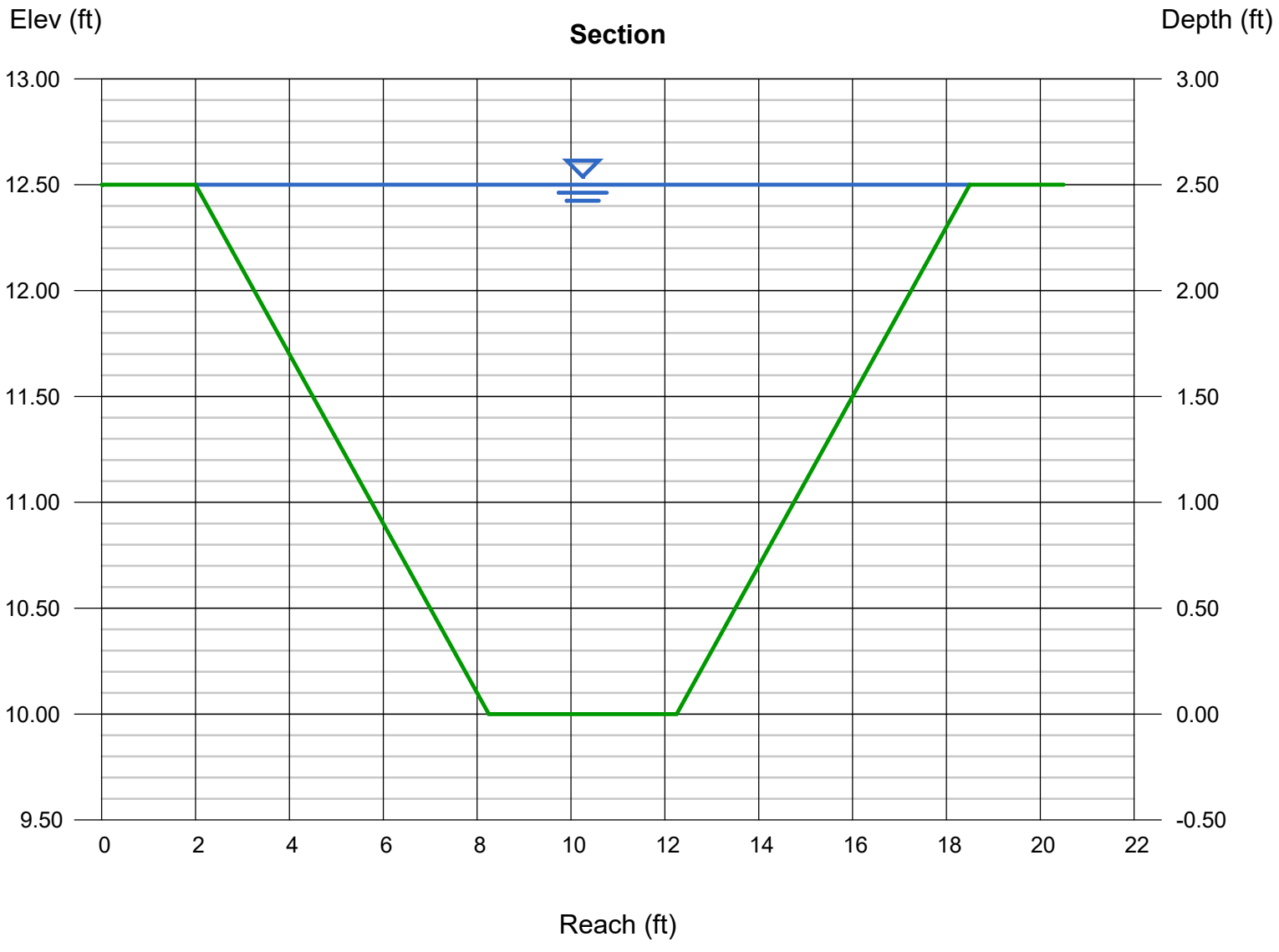
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.35
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.50

Highlighted

Depth (ft)	= 2.50
Q (cfs)	= 96.98
Area (sqft)	= 25.63
Velocity (ft/s)	= 3.78
Wetted Perim (ft)	= 17.46
Crit Depth, Yc (ft)	= 1.83
Top Width (ft)	= 16.50
EGL (ft)	= 2.72



Culvert Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

Lateral 104 Station 6+23

Invert Elev Dn (ft)	=	10.56
Pipe Length (ft)	=	30.00
Slope (%)	=	0.00
Invert Elev Up (ft)	=	10.56
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

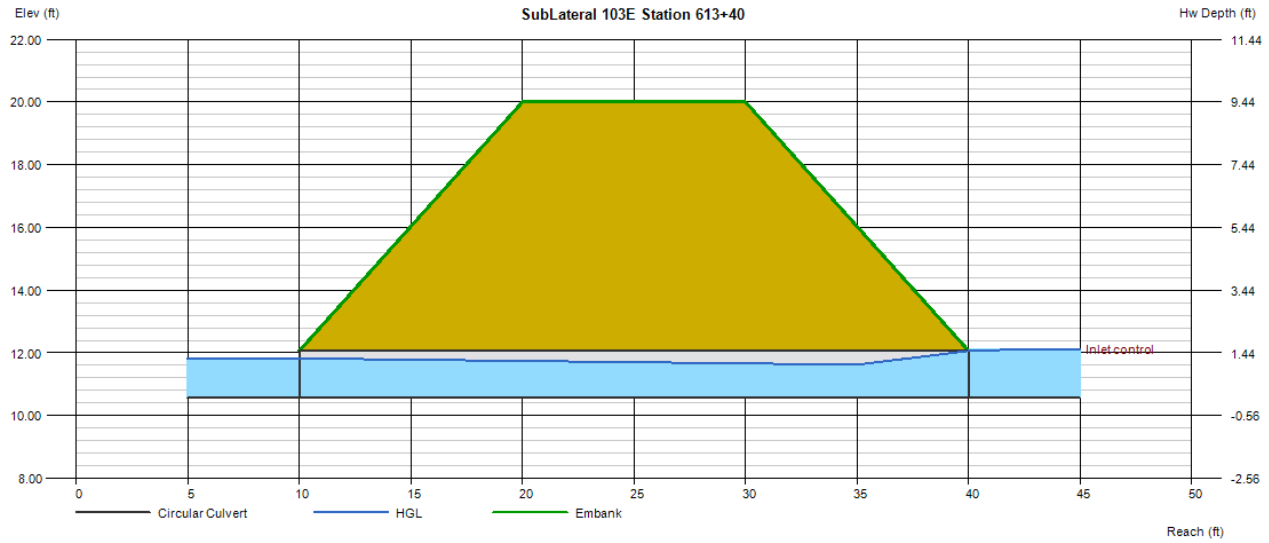
Top Elevation (ft)	=	20.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	7.00
Qpipe (cfs)	=	7.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.41
Veloc Up (ft/s)	=	5.45
HGL Dn (ft)	=	11.82
HGL Up (ft)	=	11.58
Hw Elev (ft)	=	12.12
Hw/D (ft)	=	1.04
Flow Regime	=	Inlet Control



Culvert Report

Lateral 104 Station 13+47

Invert Elev Dn (ft)	=	8.80
Pipe Length (ft)	=	132.00
Slope (%)	=	-0.31
Invert Elev Up (ft)	=	8.39
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Square edge w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0098, 2, 0.0398, 0.67, 0.5

Embankment

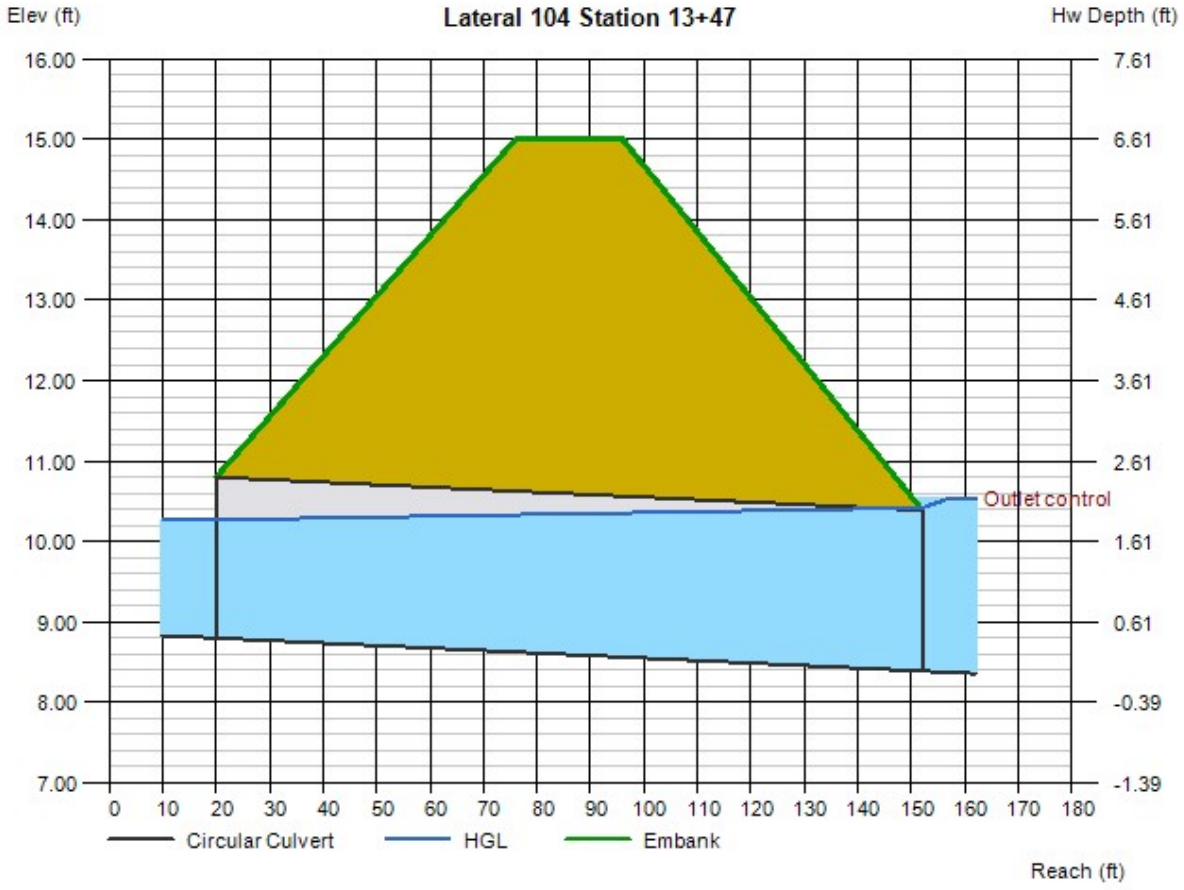
Top Elevation (ft)	=	15.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	7.00
Qpipe (cfs)	=	7.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.83
Veloc Up (ft/s)	=	2.23
HGL Dn (ft)	=	10.27
HGL Up (ft)	=	10.42
Hw Elev (ft)	=	10.53
Hw/D (ft)	=	1.07
Flow Regime	=	Outlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

Lateral 104 Station 15+10 to 29+46

Trapezoidal

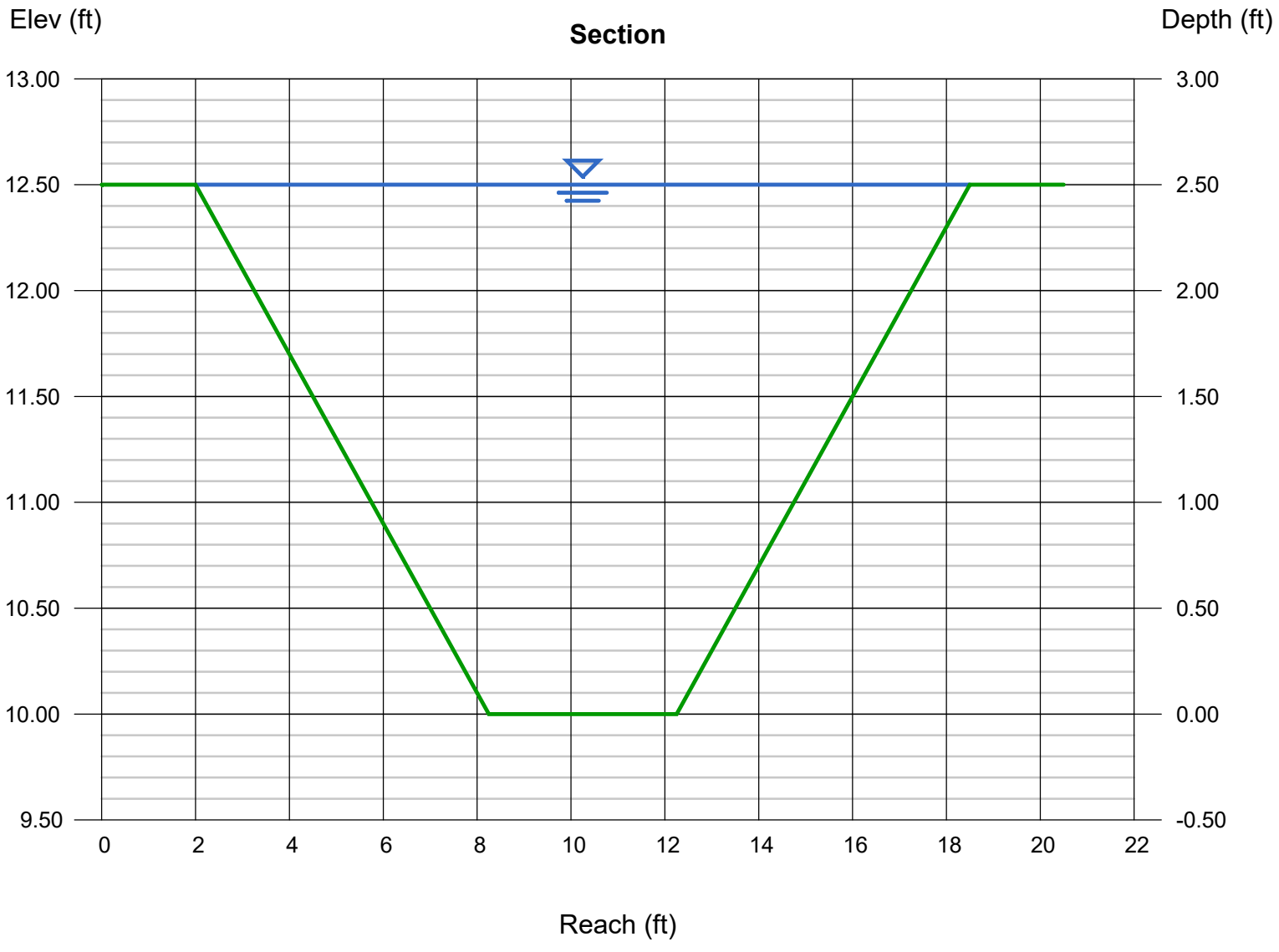
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 2.50, 2.50
Total Depth (ft)	= 2.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.50

Highlighted

Depth (ft)	= 2.50
Q (cfs)	= 36.66
Area (sqft)	= 25.63
Velocity (ft/s)	= 1.43
Wetted Perim (ft)	= 17.46
Crit Depth, Yc (ft)	= 1.10
Top Width (ft)	= 16.50
EGL (ft)	= 2.53



Culvert Report

Lateral 104 Station 19+98

Invert Elev Dn (ft)	=	9.76
Pipe Length (ft)	=	20.00
Slope (%)	=	-0.05
Invert Elev Up (ft)	=	9.75
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

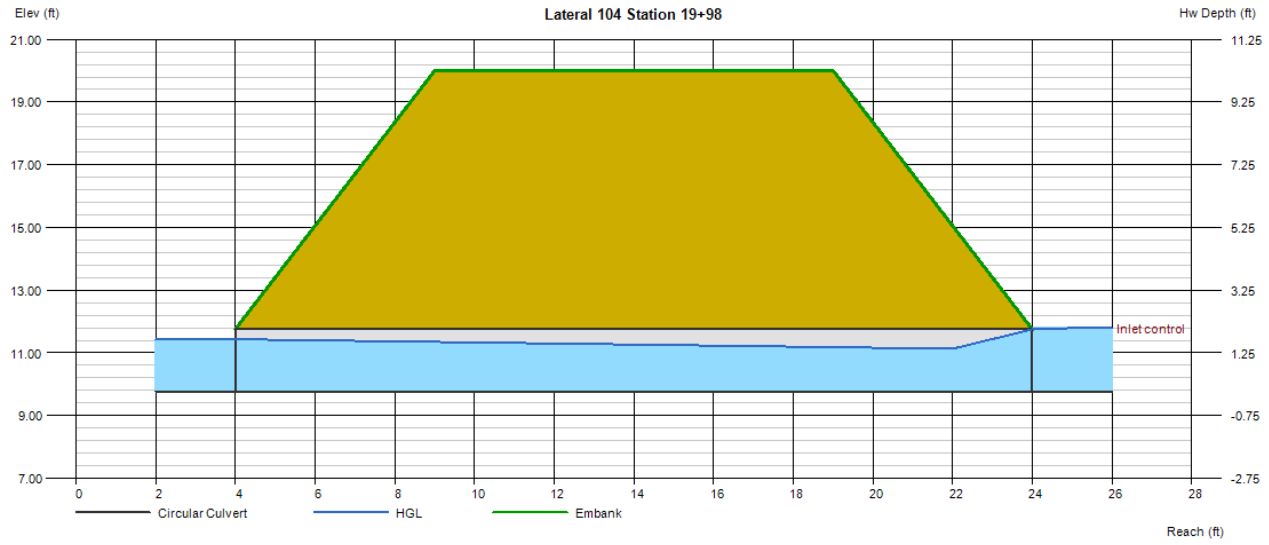
Top Elevation (ft)	=	20.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	14.00
Qpipe (cfs)	=	14.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.99
Veloc Up (ft/s)	=	6.22
HGL Dn (ft)	=	11.43
HGL Up (ft)	=	11.10
Hw Elev (ft)	=	11.79
Hw/D (ft)	=	1.02
Flow Regime	=	Inlet Control



Culvert Report

Lateral 104 Station 27+02

Invert Elev Dn (ft)	=	9.43
Pipe Length (ft)	=	58.00
Slope (%)	=	0.79
Invert Elev Up (ft)	=	9.89
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

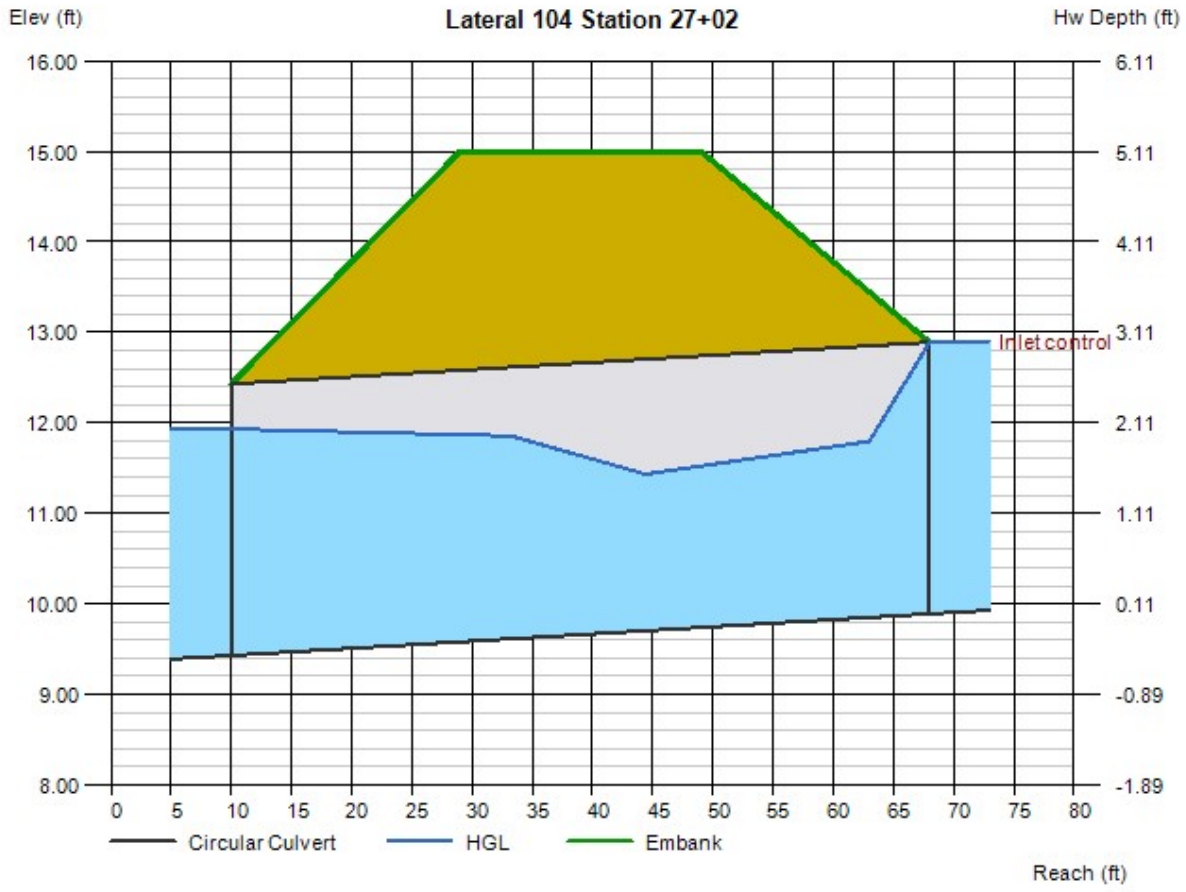
Top Elevation (ft)	=	15.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	38.00
Qpipe (cfs)	=	38.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.03
Veloc Up (ft/s)	=	7.57
HGL Dn (ft)	=	11.93
HGL Up (ft)	=	11.89
Hw Elev (ft)	=	12.90
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Culvert Report

Lateral 104 Station 29+46

Invert Elev Dn (ft)	=	9.34
Pipe Length (ft)	=	31.00
Slope (%)	=	-0.13
Invert Elev Up (ft)	=	9.30
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

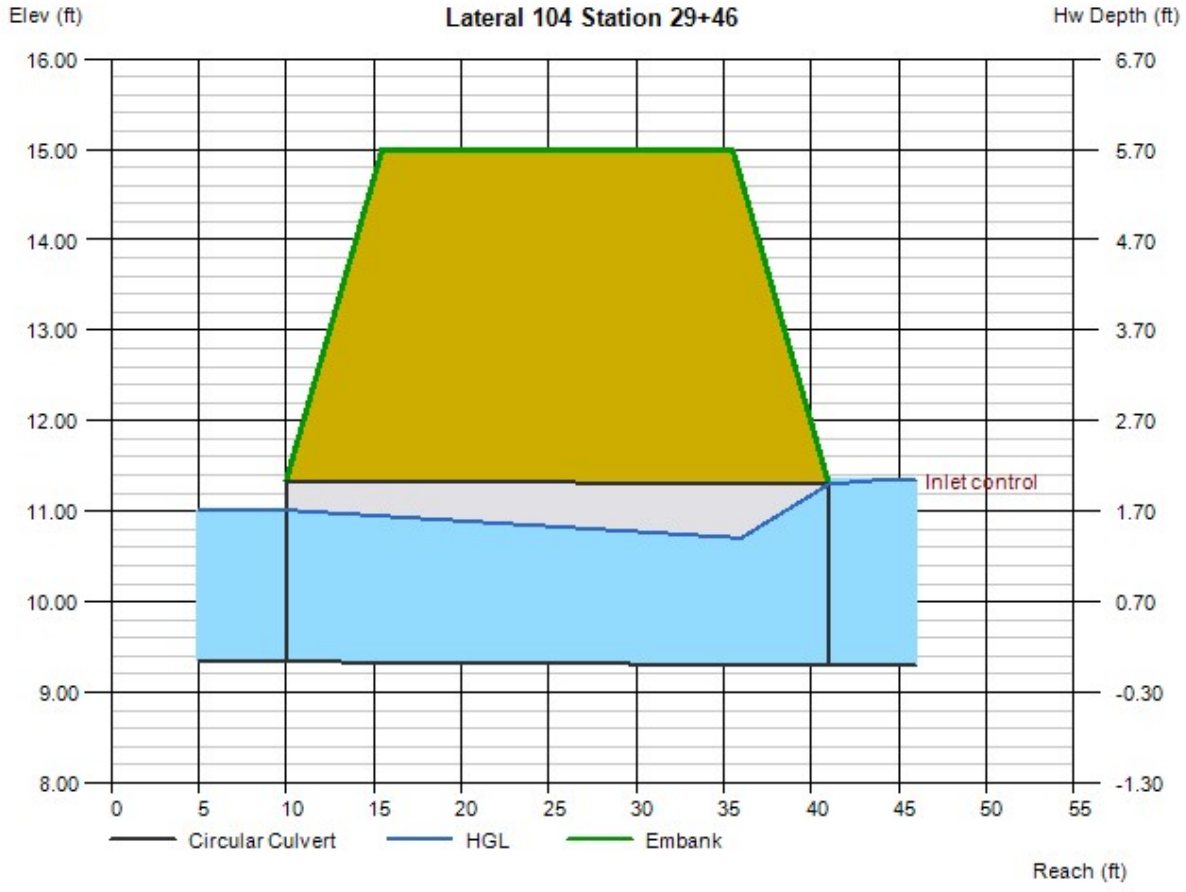
Top Elevation (ft)	=	15.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	14.00
Qpipe (cfs)	=	14.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.99
Veloc Up (ft/s)	=	6.22
HGL Dn (ft)	=	11.01
HGL Up (ft)	=	10.65
Hw Elev (ft)	=	11.34
Hw/D (ft)	=	1.02
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

Lateral 104 Station 30+44 to 44+16

Trapezoidal

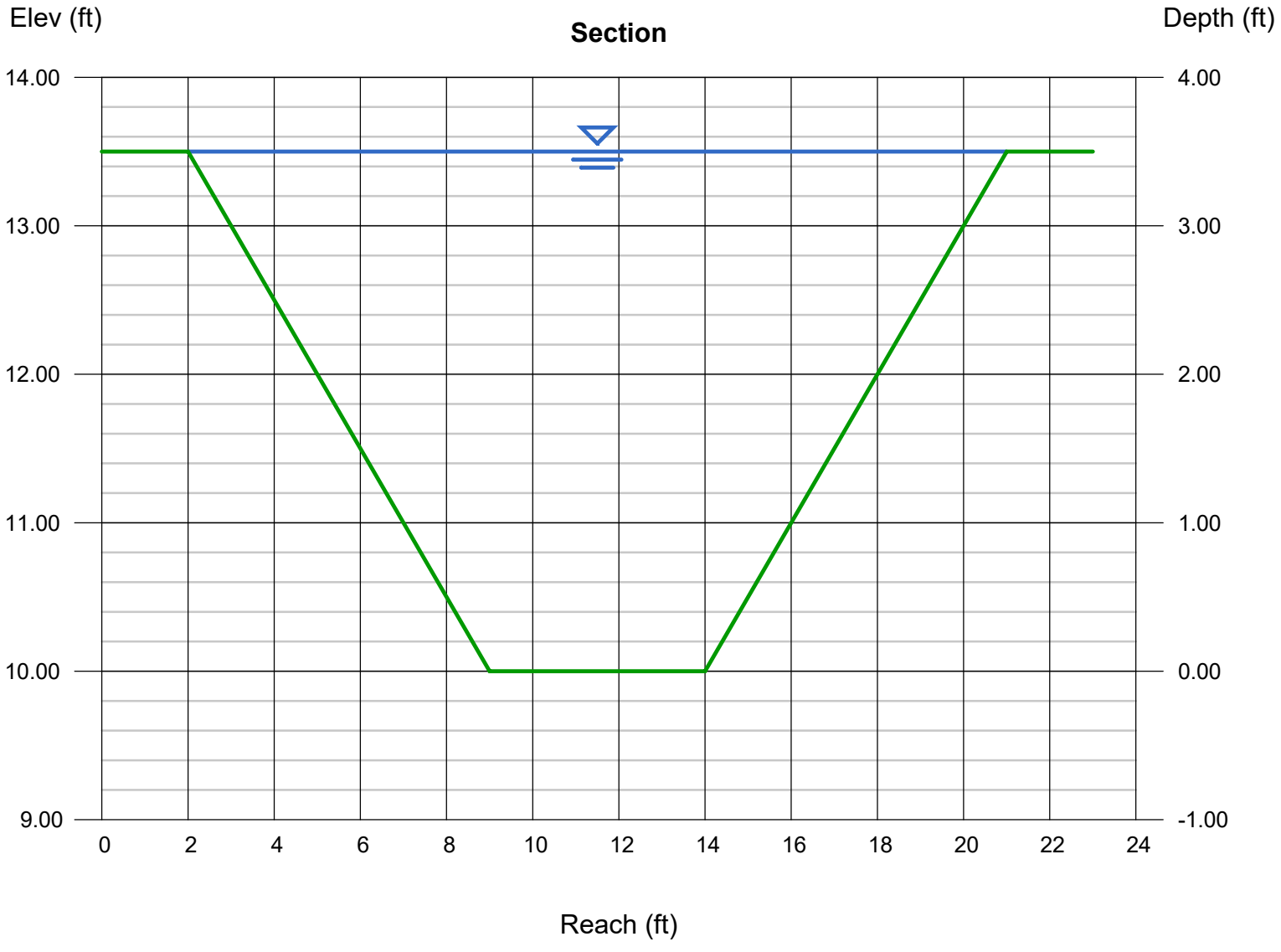
Bottom Width (ft)	= 5.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 3.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.50

Highlighted

Depth (ft)	= 3.50
Q (cfs)	= 74.69
Area (sqft)	= 42.00
Velocity (ft/s)	= 1.78
Wetted Perim (ft)	= 20.65
Crit Depth, Yc (ft)	= 1.55
Top Width (ft)	= 19.00
EGL (ft)	= 3.55



Culvert Report

Lateral 104 Station 43+80

Invert Elev Dn (ft)	=	7.16
Pipe Length (ft)	=	53.00
Slope (%)	=	6.25
Invert Elev Up (ft)	=	10.47
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

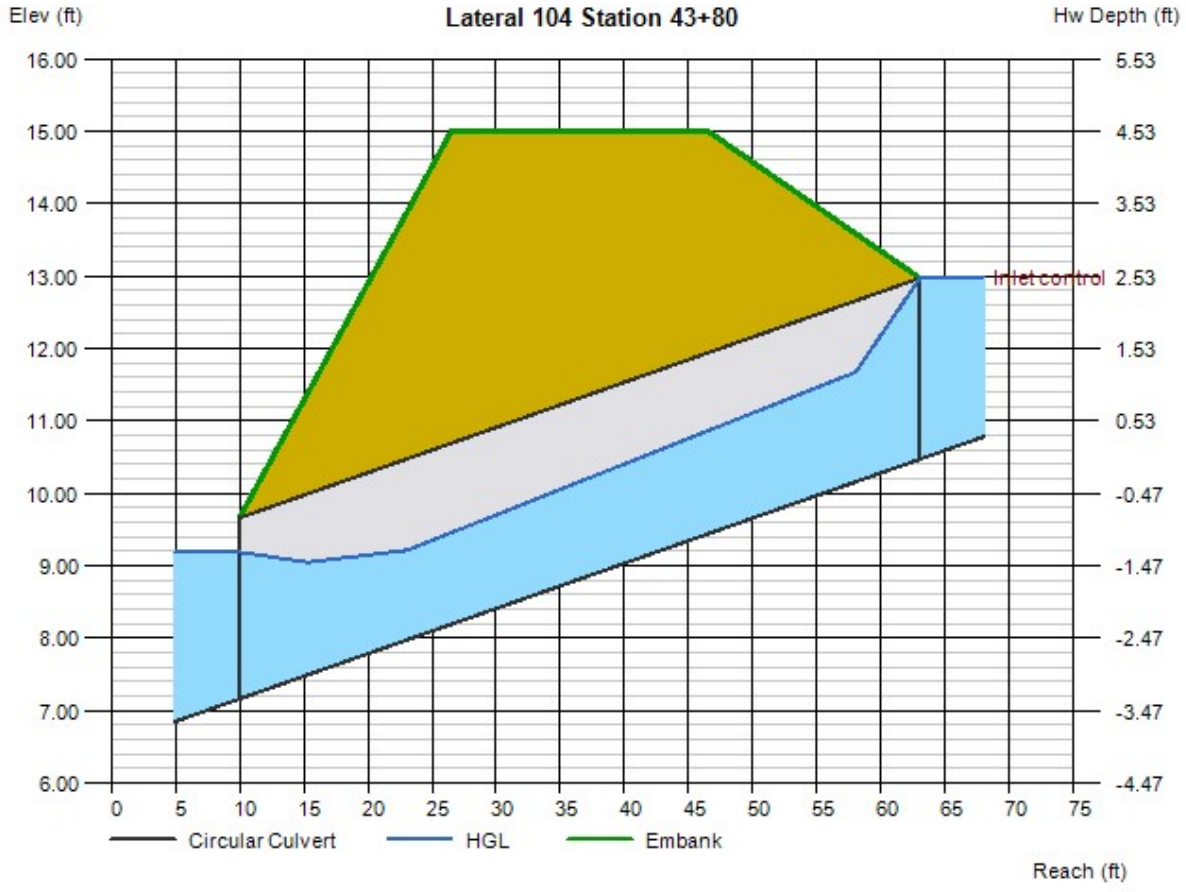
Top Elevation (ft)	=	15.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	21.00
Qpipe (cfs)	=	21.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.92
Veloc Up (ft/s)	=	6.54
HGL Dn (ft)	=	9.19
HGL Up (ft)	=	12.03
Hw Elev (ft)	=	12.99
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Culvert Report

Lateral 104 Station 44+16

Invert Elev Dn (ft)	=	6.88
Pipe Length (ft)	=	35.00
Slope (%)	=	0.00
Invert Elev Up (ft)	=	6.88
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

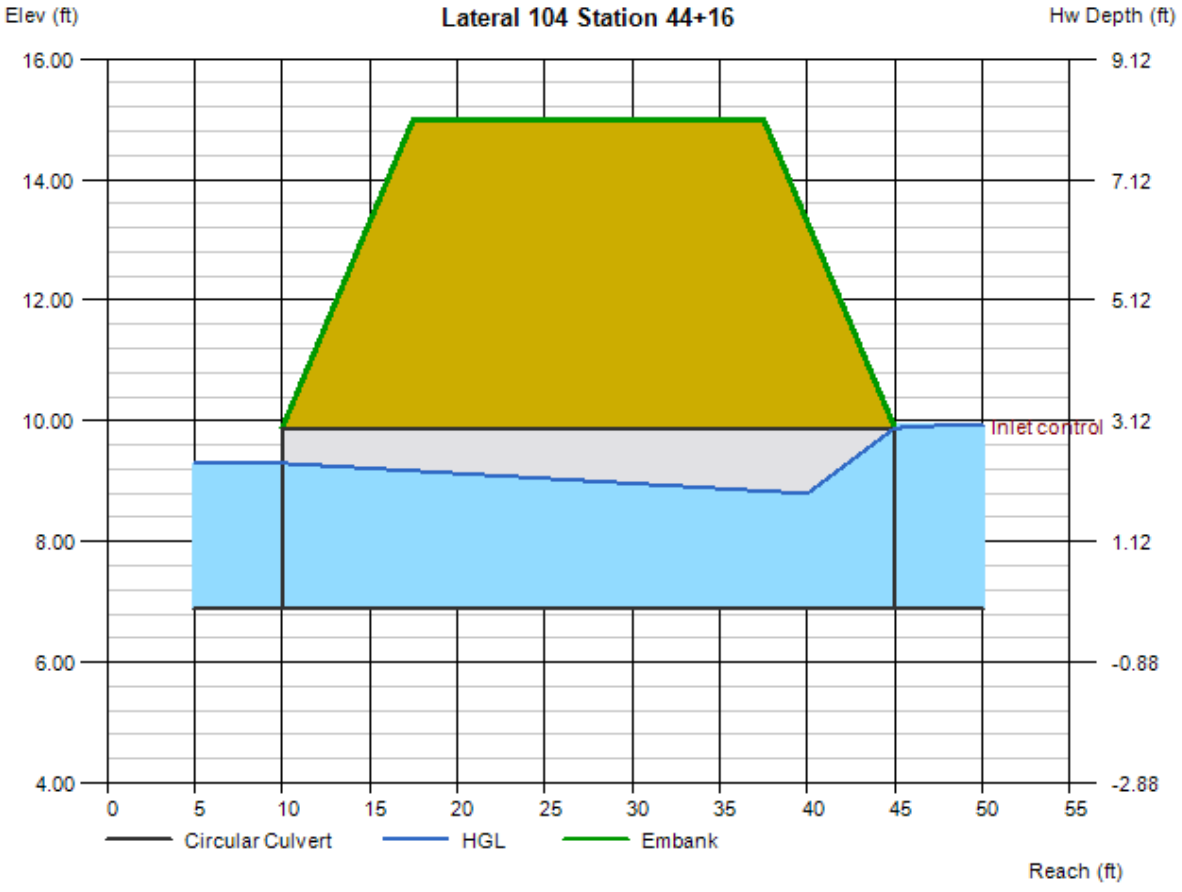
Top Elevation (ft)	=	15.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	50.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	32.00
Qpipe (cfs)	=	32.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.24
Veloc Up (ft/s)	=	7.07
HGL Dn (ft)	=	9.30
HGL Up (ft)	=	8.71
Hw Elev (ft)	=	9.92
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Lateral 104 Station 44+62 to 52+46

Trapezoidal

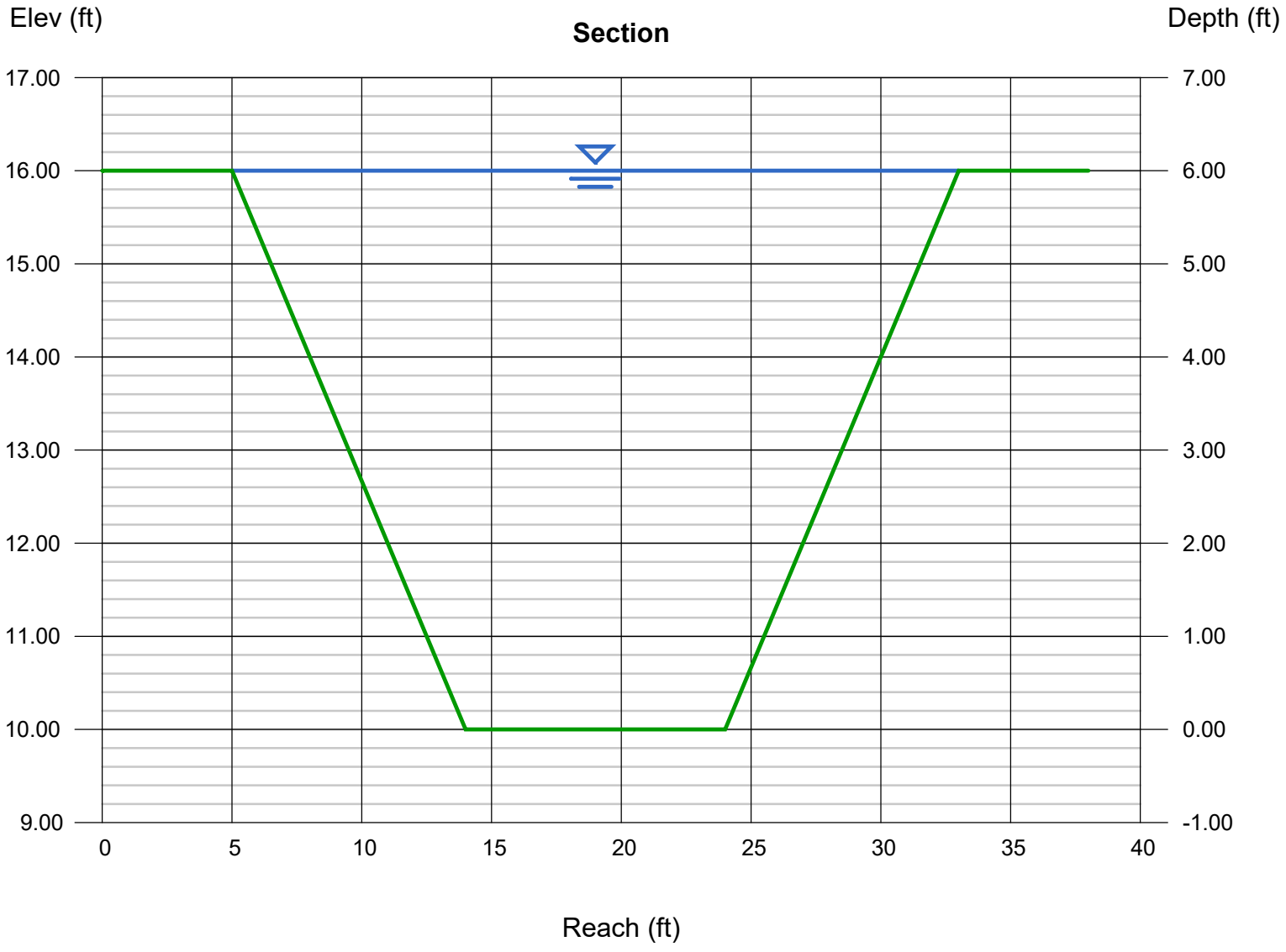
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 6.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.24
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 6.00

Highlighted

Depth (ft)	= 6.00
Q (cfs)	= 650.53
Area (sqft)	= 114.00
Velocity (ft/s)	= 5.71
Wetted Perim (ft)	= 31.63
Crit Depth, Yc (ft)	= 4.12
Top Width (ft)	= 28.00
EGL (ft)	= 6.51



Culvert Report

Lateral 104 Station 52+464.

Invert Elev Dn (ft)	=	4.96
Pipe Length (ft)	=	29.00
Slope (%)	=	-0.41
Invert Elev Up (ft)	=	4.84
Rise (in)	=	84.0
Shape	=	Circular
Span (in)	=	84.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

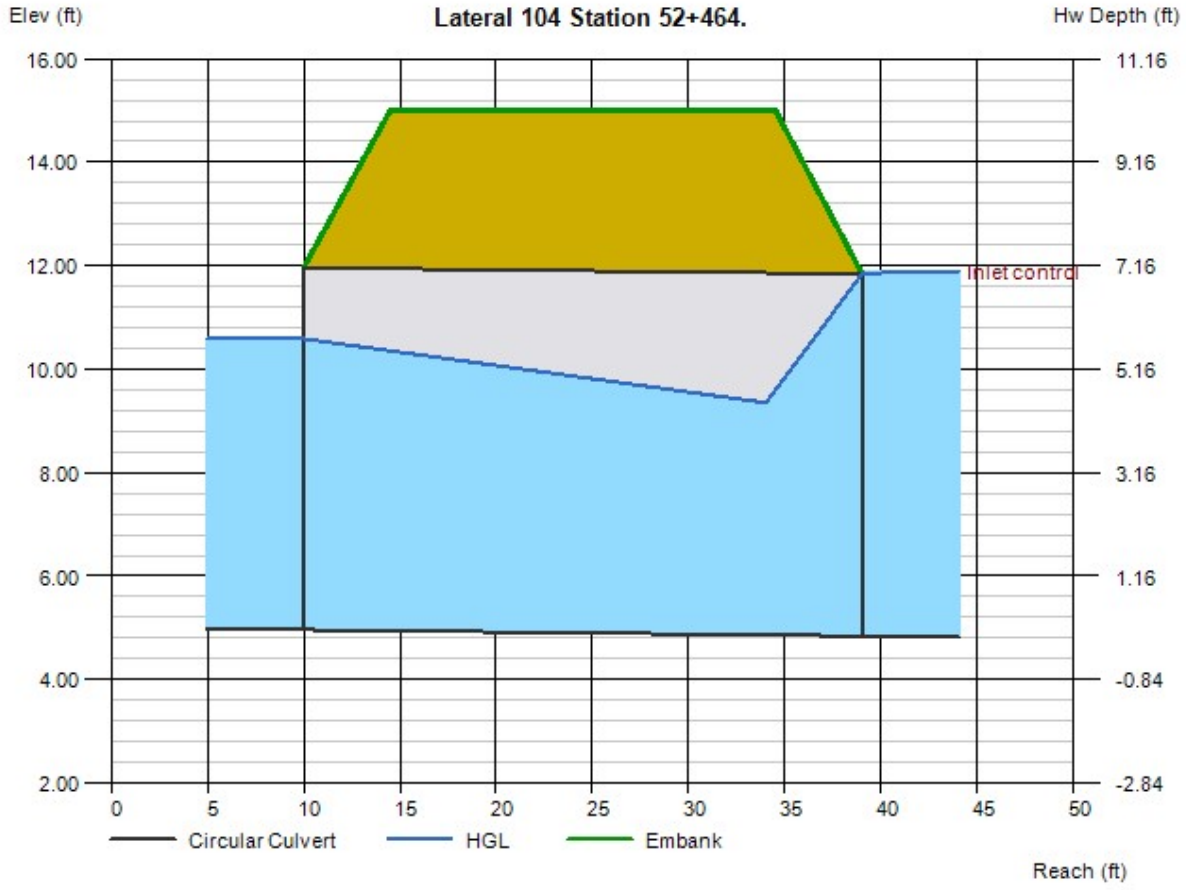
Top Elevation (ft)	=	15.00
Top Width (ft)	=	20.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	200.00
Qmax (cfs)	=	300.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	263.00
Qpipe (cfs)	=	263.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.93
Veloc Up (ft/s)	=	10.75
HGL Dn (ft)	=	10.59
HGL Up (ft)	=	9.09
Hw Elev (ft)	=	11.89
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Lateral 104 Station 52+46 to 64+70

Trapezoidal

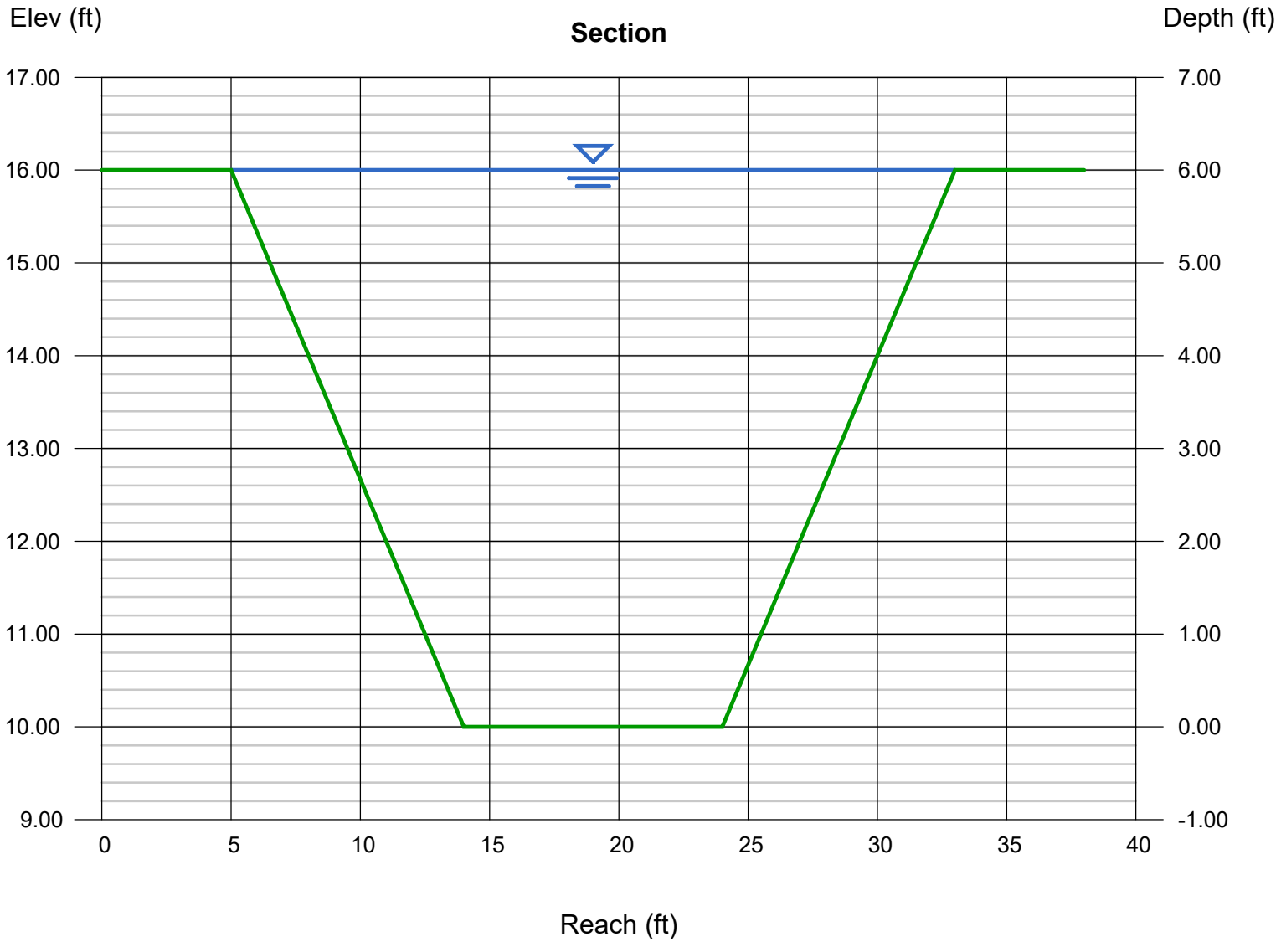
Bottom Width (ft)	= 10.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 6.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 6.00

Highlighted

Depth (ft)	= 6.00
Q (cfs)	= 296.92
Area (sqft)	= 114.00
Velocity (ft/s)	= 2.60
Wetted Perim (ft)	= 31.63
Crit Depth, Yc (ft)	= 2.63
Top Width (ft)	= 28.00
EGL (ft)	= 6.11



Culvert Report

Lateral 104 Station 59+03

Invert Elev Dn (ft)	=	5.25
Pipe Length (ft)	=	20.00
Slope (%)	=	3.05
Invert Elev Up (ft)	=	5.86
Rise (in)	=	54.0
Shape	=	Circular
Span (in)	=	54.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

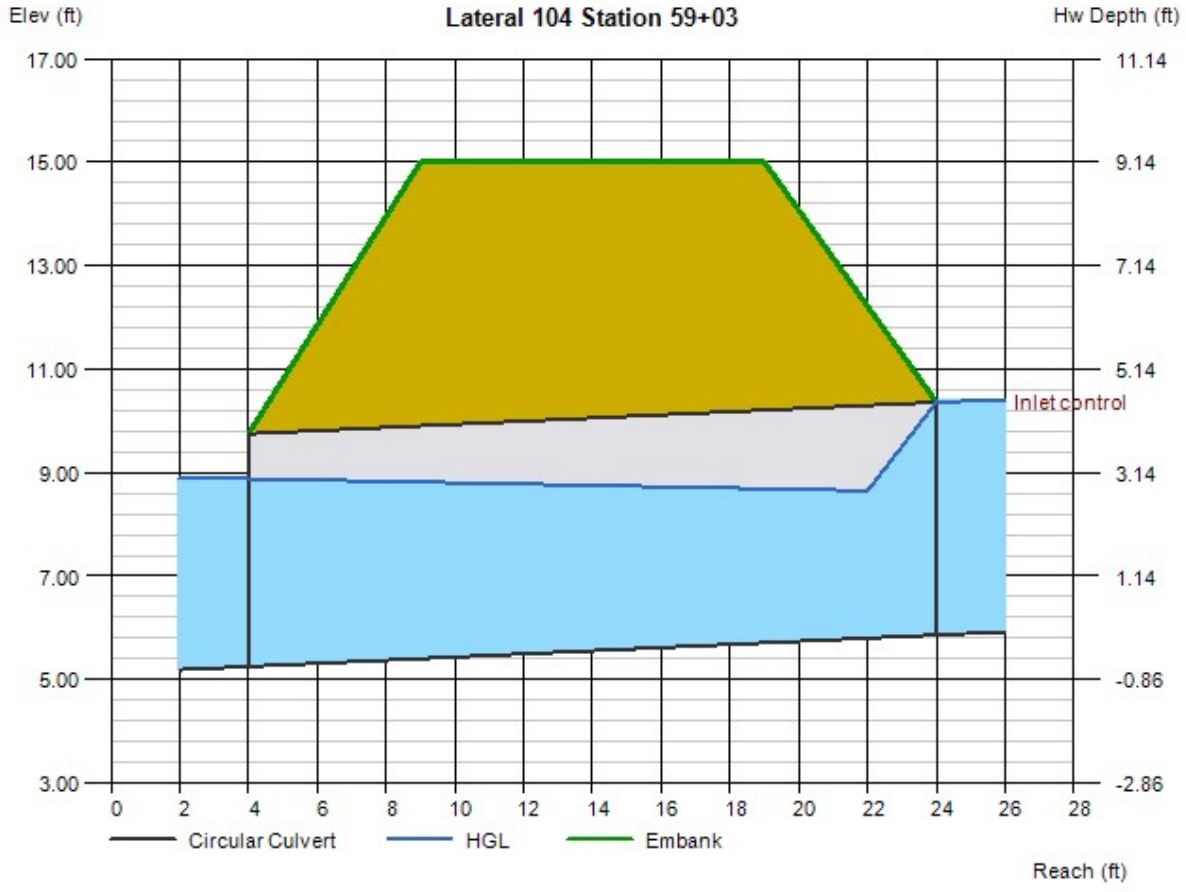
Top Elevation (ft)	=	15.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	89.00
Qpipe (cfs)	=	89.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.47
Veloc Up (ft/s)	=	8.69
HGL Dn (ft)	=	8.88
HGL Up (ft)	=	8.62
Hw Elev (ft)	=	10.38
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Culvert Report

Sub Lateral 104A Station 201

Invert Elev Dn (ft)	=	8.20
Pipe Length (ft)	=	181.00
Slope (%)	=	-0.07
Invert Elev Up (ft)	=	8.07
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

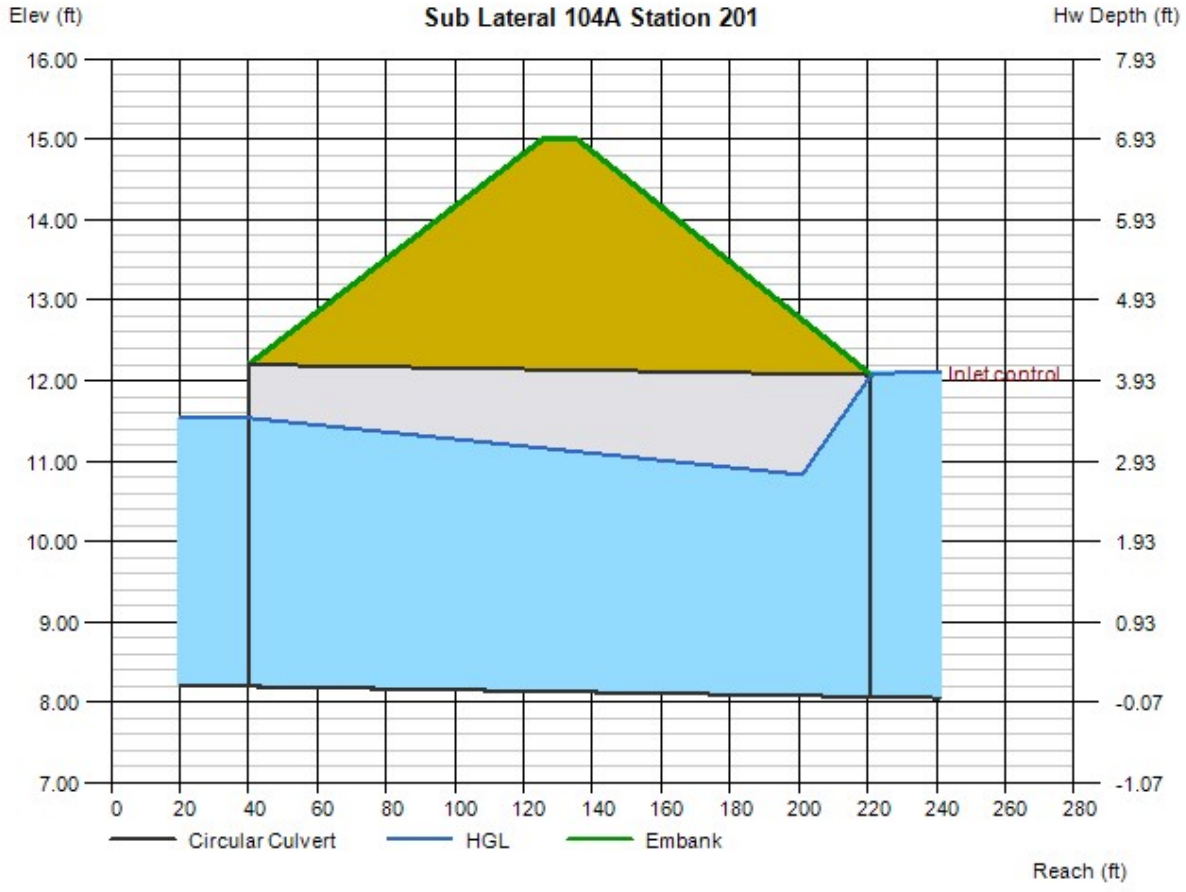
Top Elevation (ft)	=	15.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	30.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	78.00
Qpipe (cfs)	=	78.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.97
Veloc Up (ft/s)	=	8.74
HGL Dn (ft)	=	11.54
HGL Up (ft)	=	10.74
Hw Elev (ft)	=	12.11
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Culvert Report

Sub Lateral 104A Station 202+40

Invert Elev Dn (ft)	=	8.14
Pipe Length (ft)	=	30.00
Slope (%)	=	0.17
Invert Elev Up (ft)	=	8.19
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

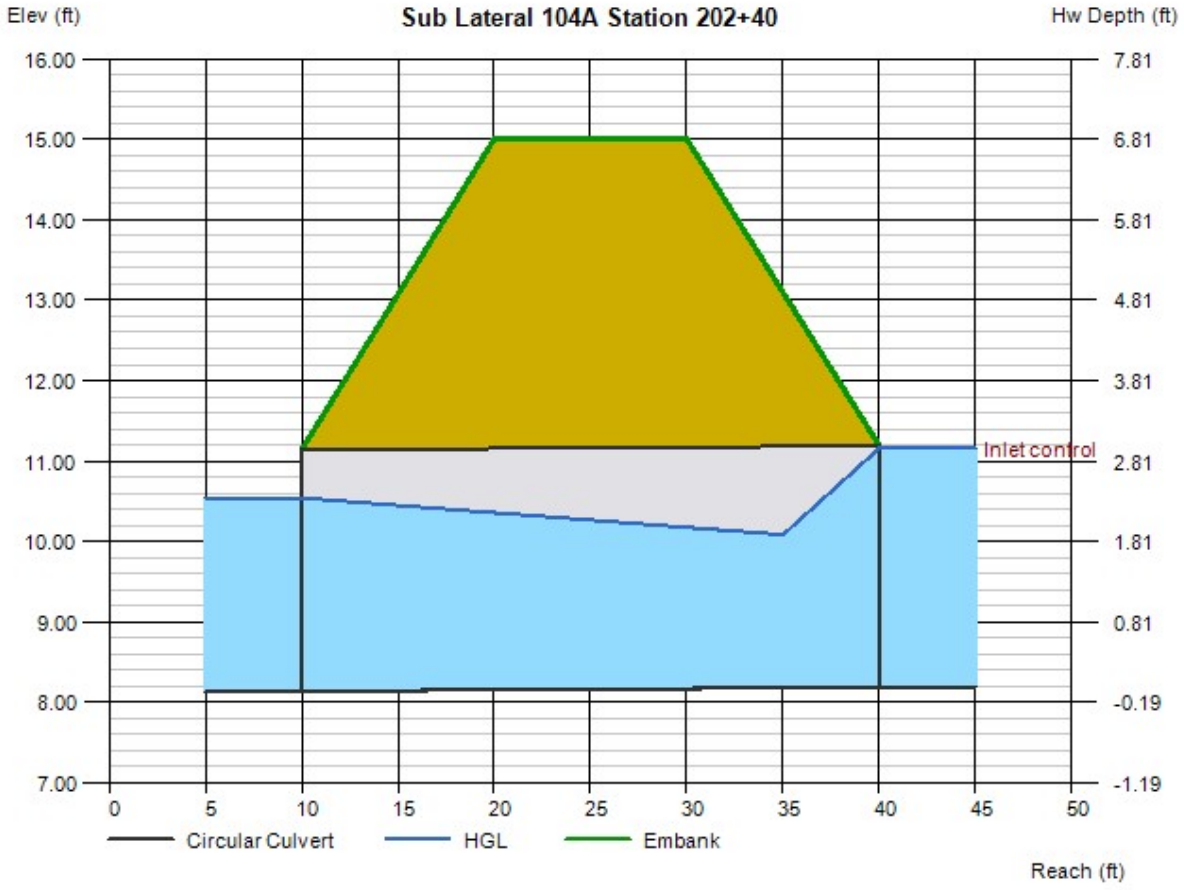
Top Elevation (ft)	=	15.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	30.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	31.00
Qpipe (cfs)	=	31.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.11
Veloc Up (ft/s)	=	6.98
HGL Dn (ft)	=	10.54
HGL Up (ft)	=	9.99
Hw Elev (ft)	=	11.16
Hw/D (ft)	=	0.99
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 104A Station 203+53 to 222+80

Trapezoidal

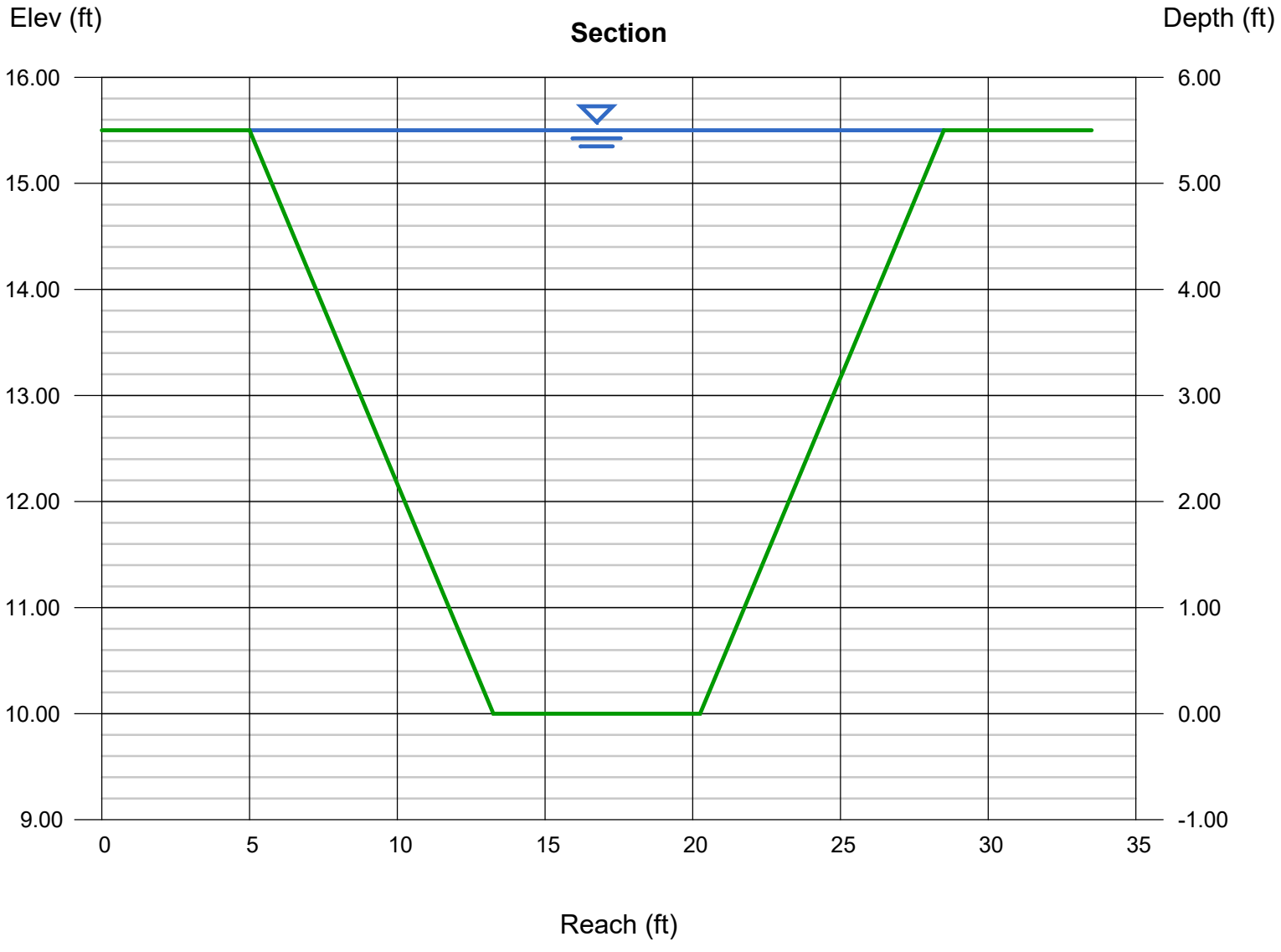
Bottom Width (ft)	= 7.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 5.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.07
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.50

Highlighted

Depth (ft)	= 5.50
Q (cfs)	= 235.10
Area (sqft)	= 83.88
Velocity (ft/s)	= 2.80
Wetted Perim (ft)	= 26.83
Crit Depth, Yc (ft)	= 2.69
Top Width (ft)	= 23.50
EGL (ft)	= 5.62



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

Lateral 105 Station 100+00 to 116+53

Trapezoidal

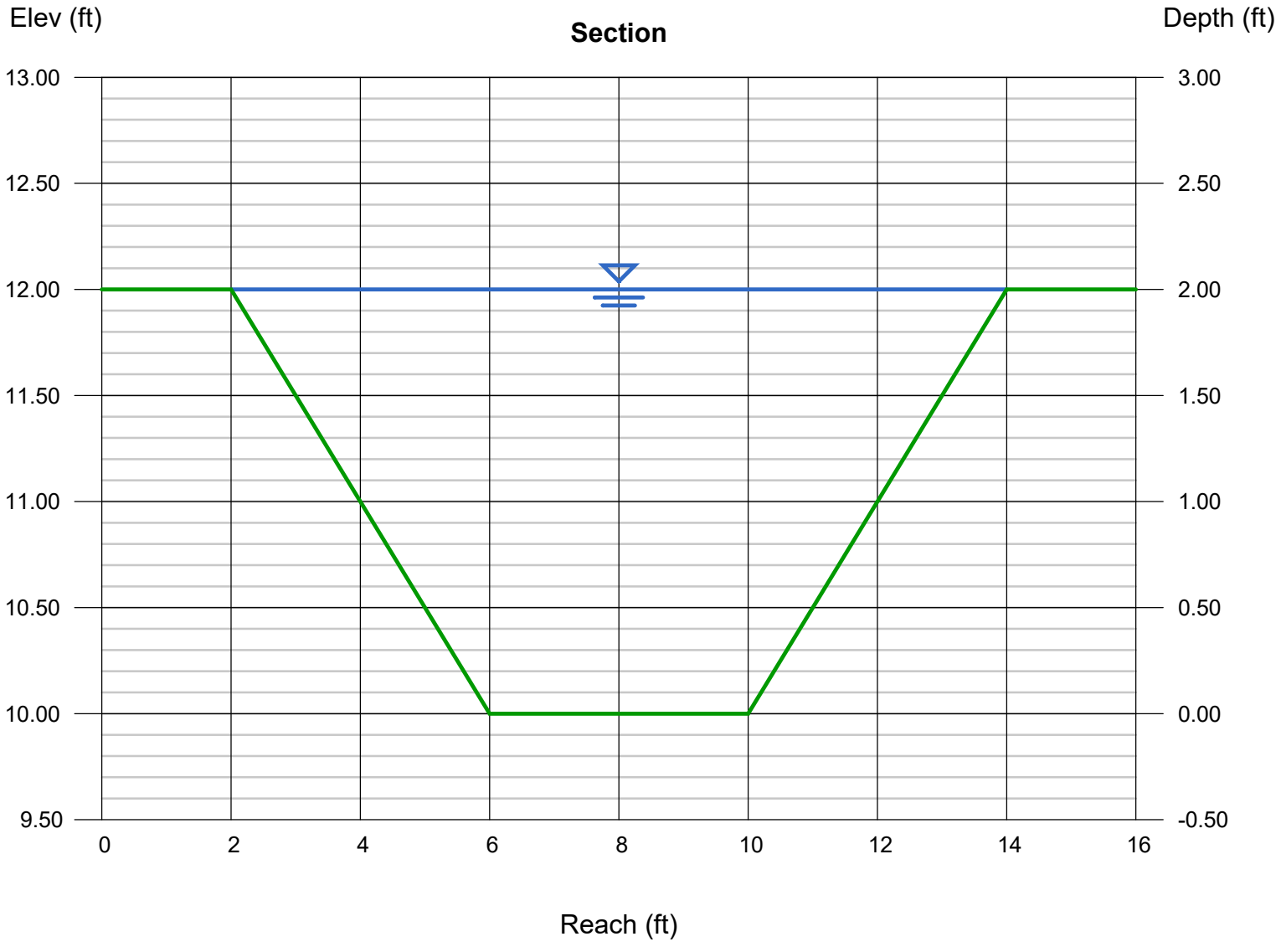
Bottom Width (ft)	= 4.00
Side Slopes (z:1)	= 2.00, 2.00
Total Depth (ft)	= 2.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.17
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 2.00

Highlighted

Depth (ft)	= 2.00
Q (cfs)	= 37.64
Area (sqft)	= 16.00
Velocity (ft/s)	= 2.35
Wetted Perim (ft)	= 12.94
Crit Depth, Yc (ft)	= 1.15
Top Width (ft)	= 12.00
EGL (ft)	= 2.09



Culvert Report

Culvert 105-1

Invert Elev Dn (ft)	=	8.16
Pipe Length (ft)	=	195.00
Slope (%)	=	0.00
Invert Elev Up (ft)	=	8.16
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

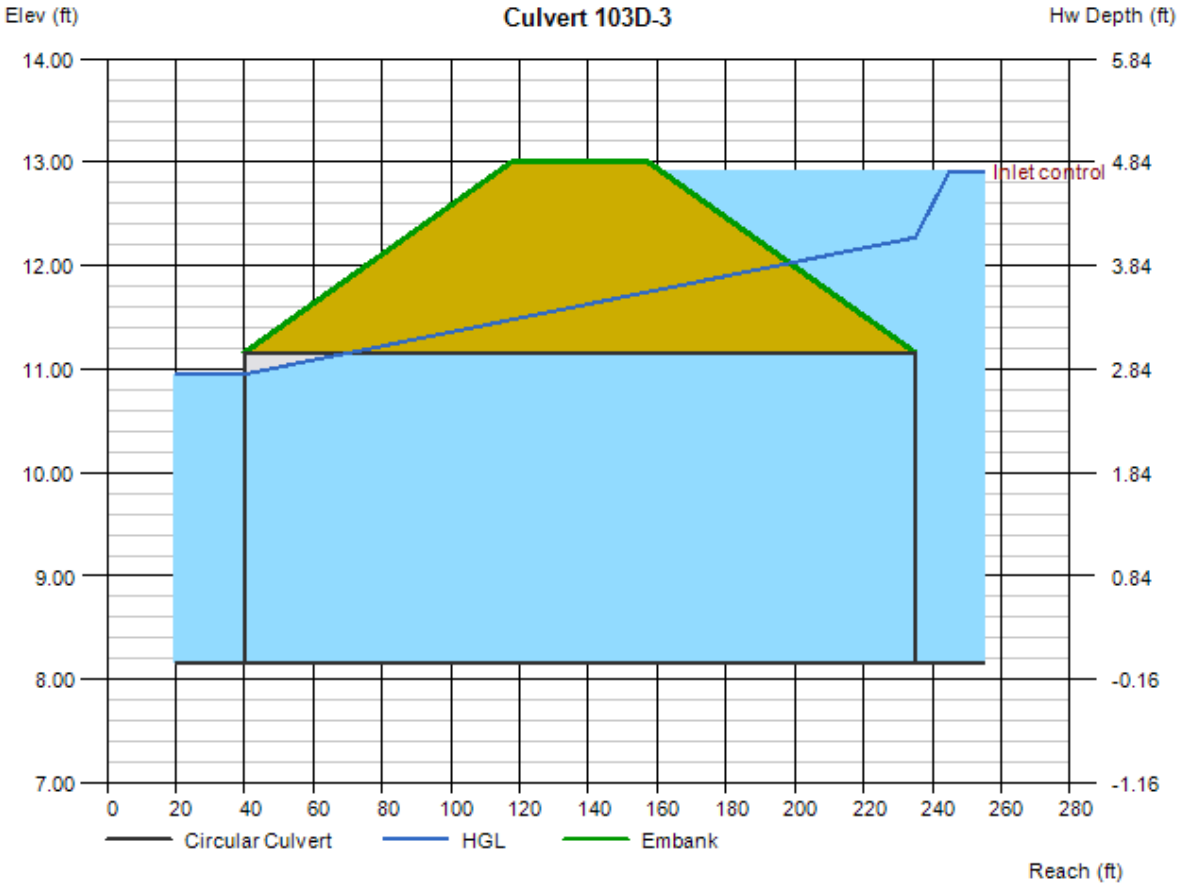
Top Elevation (ft)	=	13.00
Top Width (ft)	=	40.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	65.00
Qpipe (cfs)	=	65.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	9.48
Veloc Up (ft/s)	=	9.20
HGL Dn (ft)	=	10.95
HGL Up (ft)	=	12.27
Hw Elev (ft)	=	12.91
Hw/D (ft)	=	1.58
Flow Regime	=	Inlet Control



Culvert Report

Lateral 105 station 117

Invert Elev Dn (ft)	=	9.54
Pipe Length (ft)	=	30.00
Slope (%)	=	5.00
Invert Elev Up (ft)	=	11.04
Rise (in)	=	36.0
Shape	=	Circular
Span (in)	=	36.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

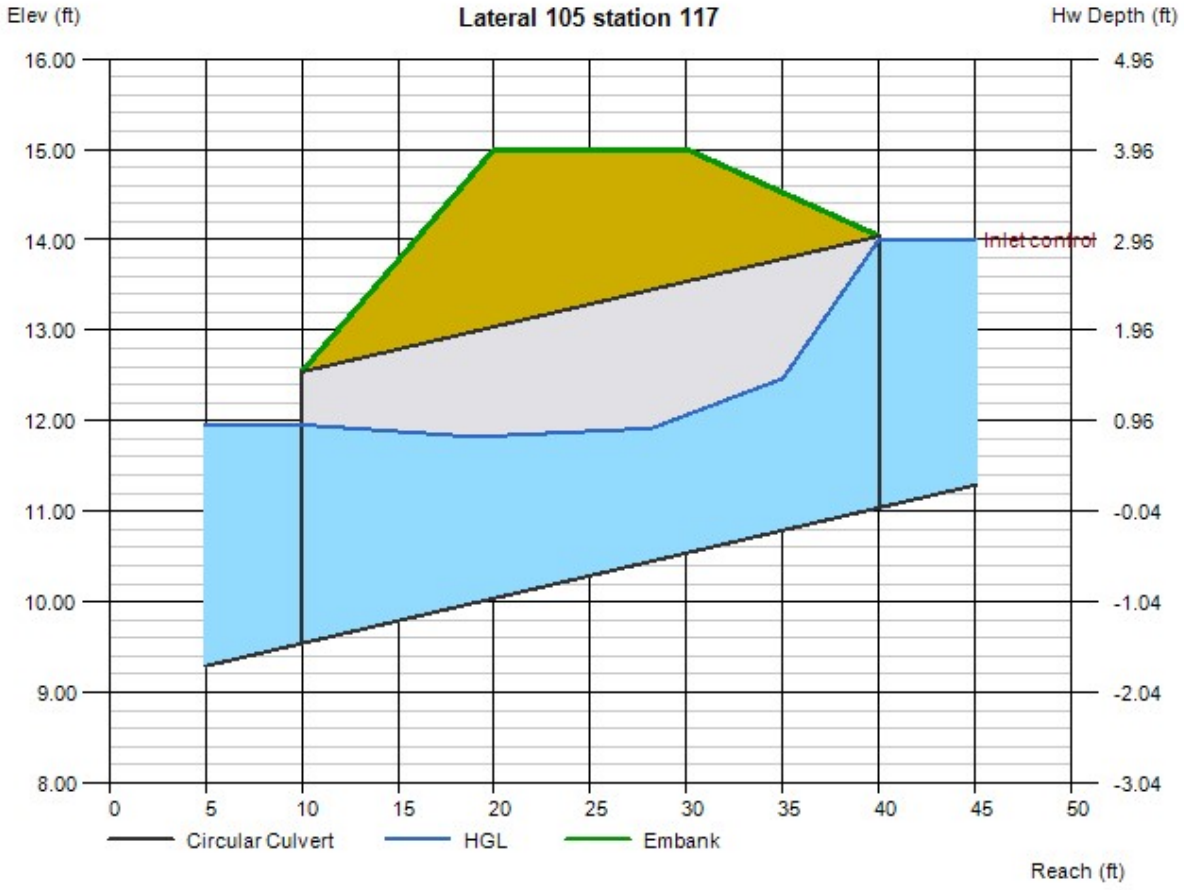
Top Elevation (ft)	=	15.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	30.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	32.00
Qpipe (cfs)	=	32.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.24
Veloc Up (ft/s)	=	7.07
HGL Dn (ft)	=	11.96
HGL Up (ft)	=	12.87
Hw Elev (ft)	=	14.01
Hw/D (ft)	=	0.99
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

Lateral 105 Station 118+28 to 133+59

Trapezoidal

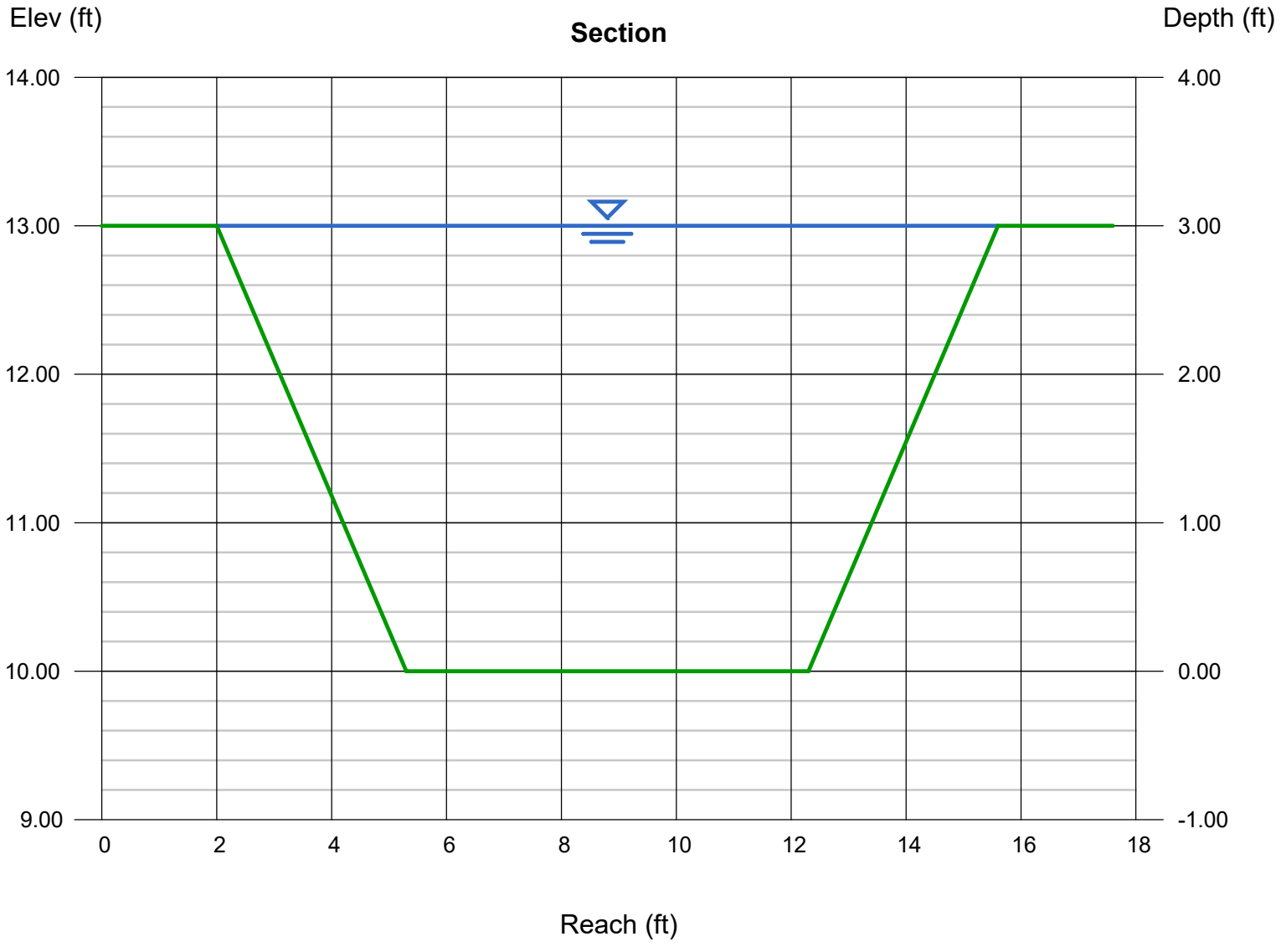
Bottom Width (ft)	= 7.00
Side Slopes (z:1)	= 1.10, 1.10
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 10.00
Slope (%)	= 0.05
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 3.00

Highlighted

Depth (ft)	= 3.00
Q (cfs)	= 53.27
Area (sqft)	= 30.90
Velocity (ft/s)	= 1.72
Wetted Perim (ft)	= 15.92
Crit Depth, Yc (ft)	= 1.15
Top Width (ft)	= 13.60
EGL (ft)	= 3.05



Culvert Report

Lateral 105 station 133

Invert Elev Dn (ft)	=	7.76
Pipe Length (ft)	=	35.00
Slope (%)	=	4.77
Invert Elev Up (ft)	=	9.43
Rise (in)	=	24.0
Shape	=	Circular
Span (in)	=	24.0
No. Barrels	=	1
n-Value	=	0.024
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

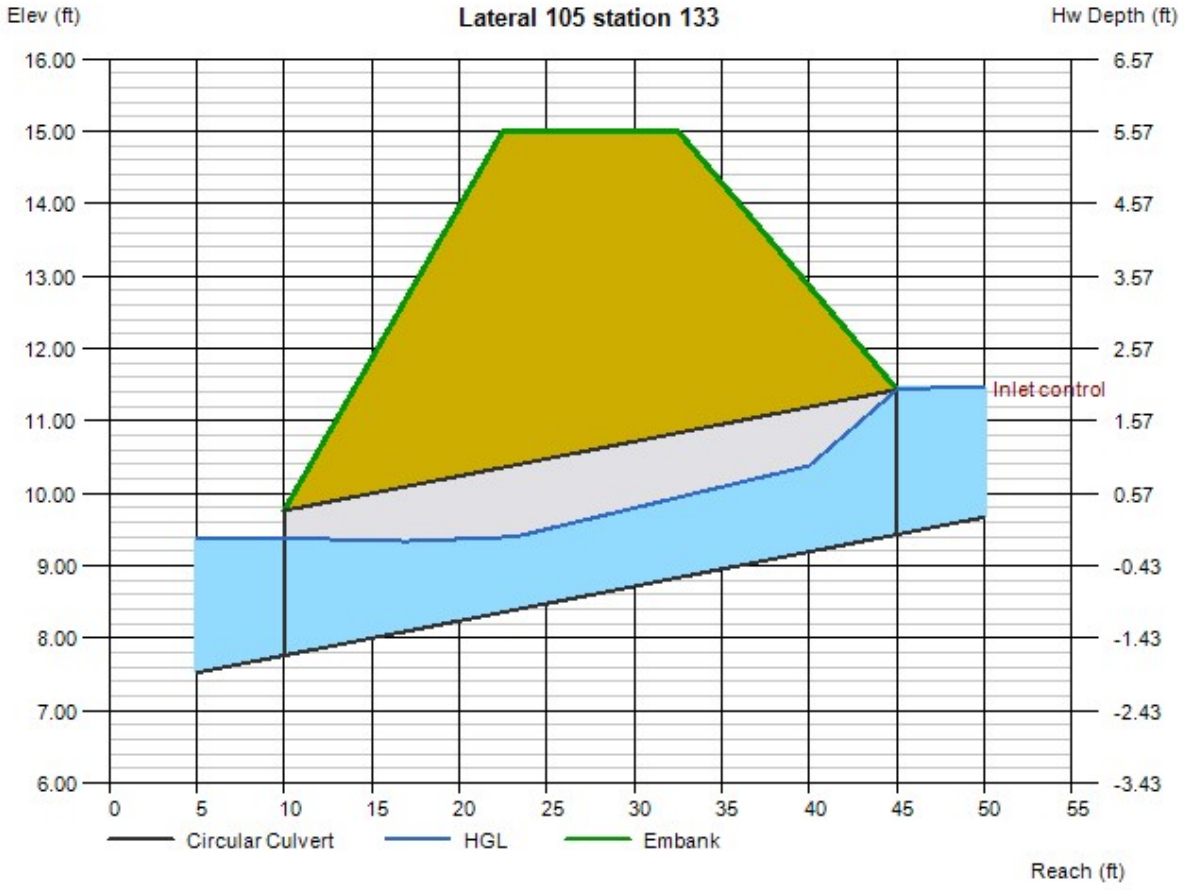
Top Elevation (ft)	=	15.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	0.00
Qmax (cfs)	=	30.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	12.00
Qpipe (cfs)	=	12.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.40
Veloc Up (ft/s)	=	5.85
HGL Dn (ft)	=	9.38
HGL Up (ft)	=	10.67
Hw Elev (ft)	=	11.46
Hw/D (ft)	=	1.01
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

Lateral 105 Station 134+02 to 157+80

Trapezoidal

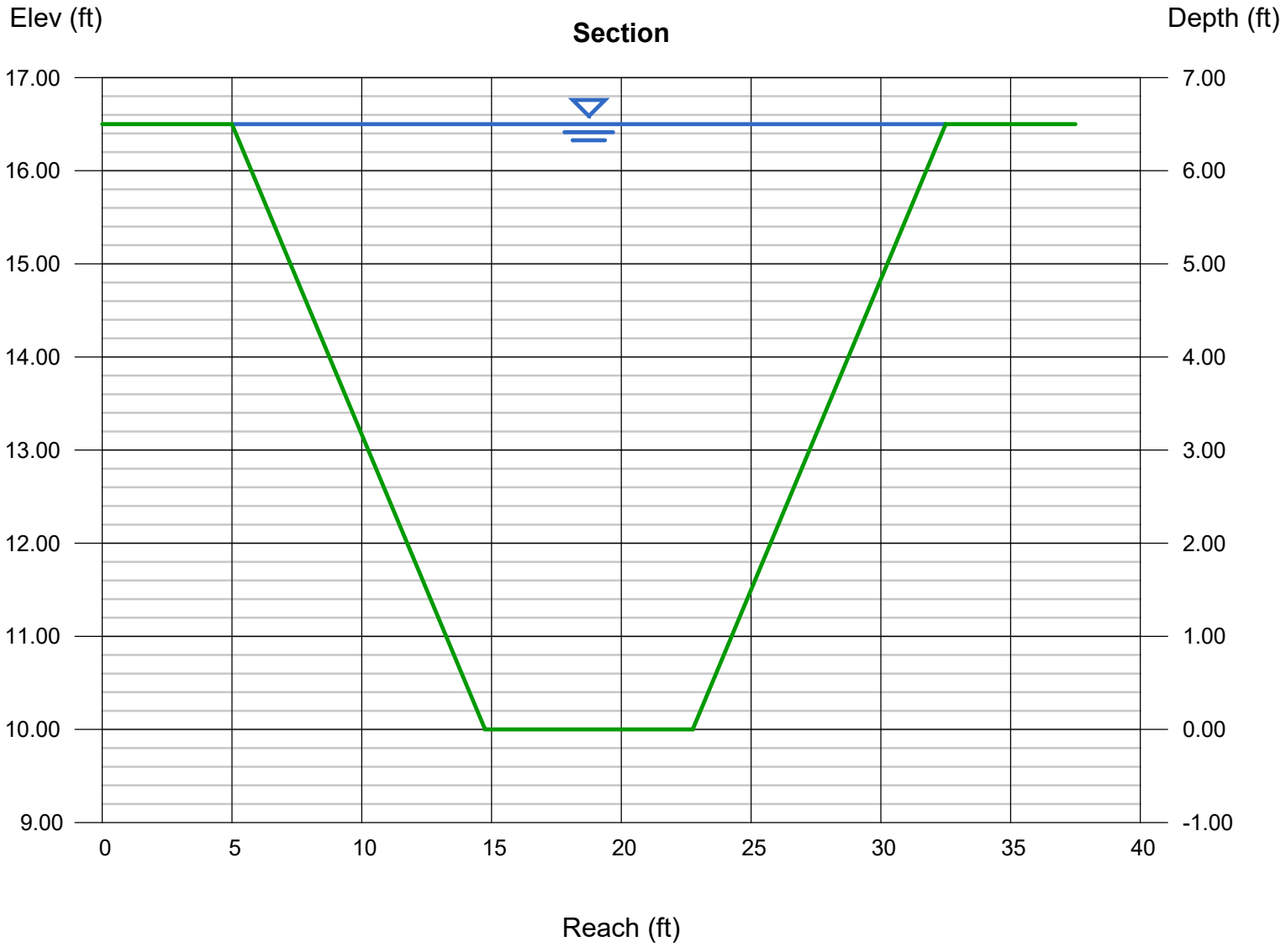
Bottom Width (ft)	= 8.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 6.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.23
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 6.50

Highlighted

Depth (ft)	= 6.50
Q (cfs)	= 652.40
Area (sqft)	= 115.38
Velocity (ft/s)	= 5.65
Wetted Perim (ft)	= 31.44
Crit Depth, Yc (ft)	= 4.47
Top Width (ft)	= 27.50
EGL (ft)	= 7.00



Culvert Report

Culvert 105A-1

Invert Elev Dn (ft)	=	7.60
Pipe Length (ft)	=	115.00
Slope (%)	=	0.05
Invert Elev Up (ft)	=	7.66
Rise (in)	=	30.0
Shape	=	Circular
Span (in)	=	30.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

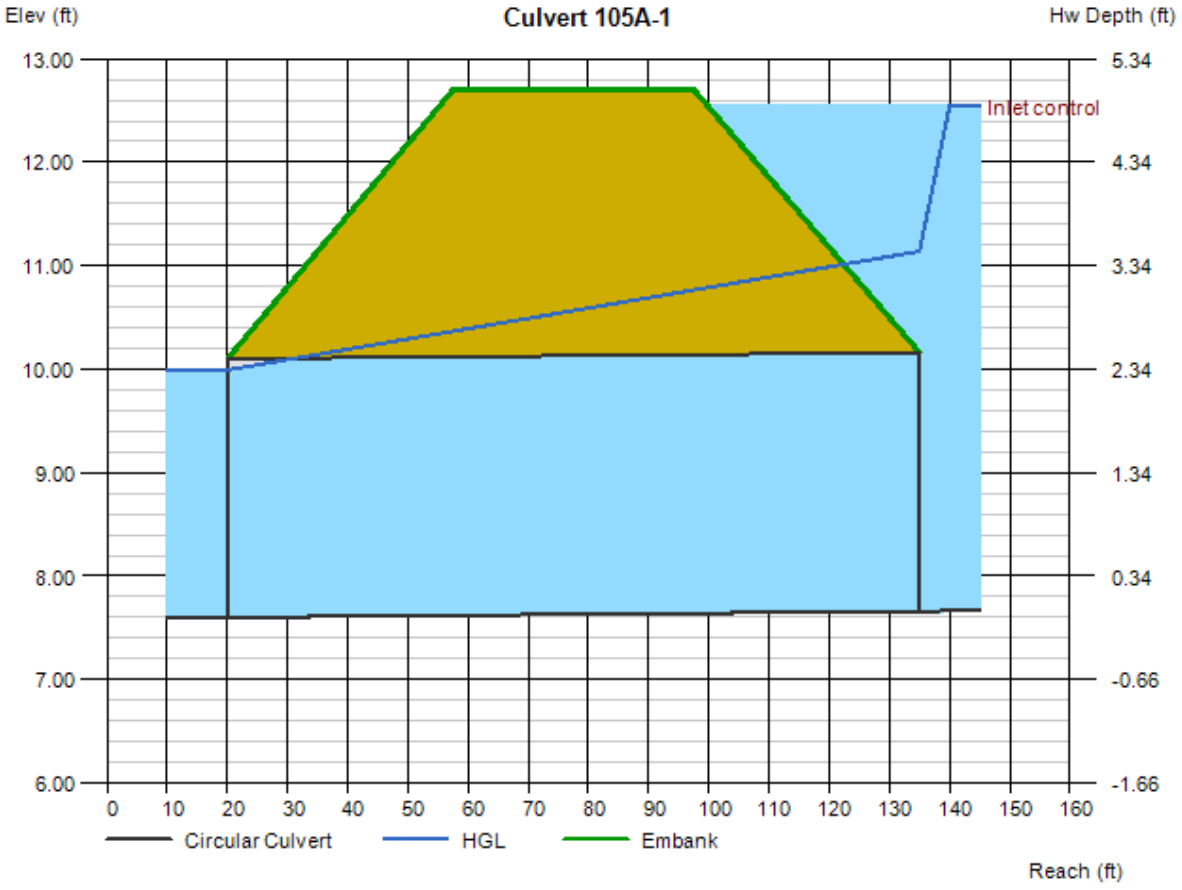
Top Elevation (ft)	=	12.70
Top Width (ft)	=	40.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	1.00
Qmax (cfs)	=	100.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	49.00
Qpipe (cfs)	=	49.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	10.13
Veloc Up (ft/s)	=	9.98
HGL Dn (ft)	=	9.99
HGL Up (ft)	=	11.14
Hw Elev (ft)	=	12.54
Hw/D (ft)	=	1.95
Flow Regime	=	Inlet Control



Culvert Report

subLateral 105a station 401

Invert Elev Dn (ft)	=	5.65
Pipe Length (ft)	=	26.00
Slope (%)	=	1.31
Invert Elev Up (ft)	=	5.99
Rise (in)	=	54.0
Shape	=	Circular
Span (in)	=	54.0
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

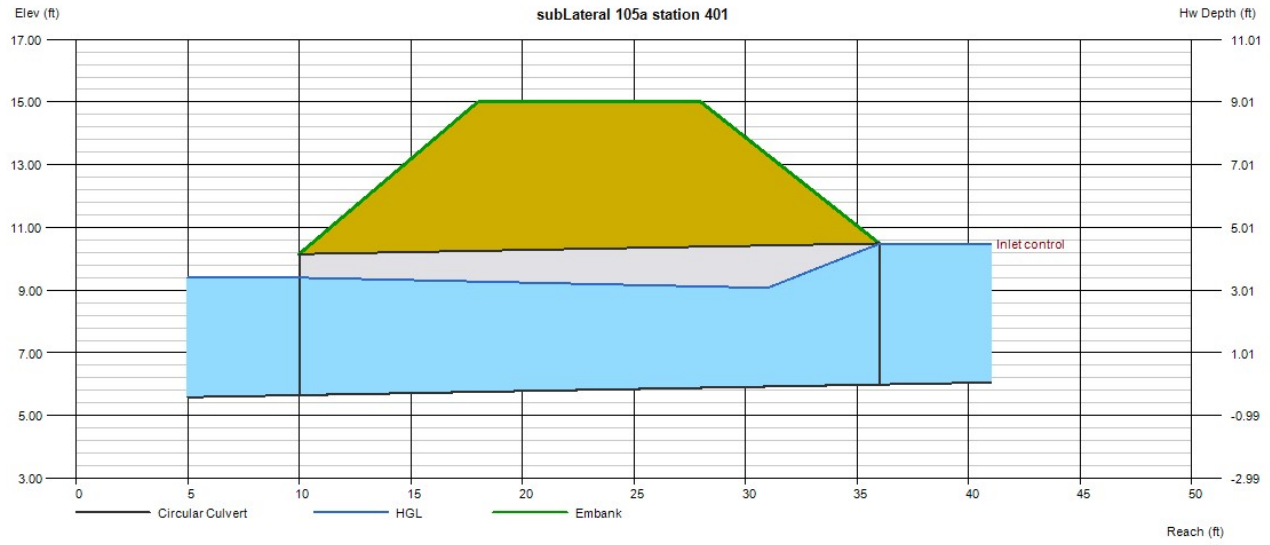
Top Elevation (ft)	=	15.00
Top Width (ft)	=	10.00
Crest Width (ft)	=	50.00

Calculations

Qmin (cfs)	=	50.00
Qmax (cfs)	=	150.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	104.00
Qpipe (cfs)	=	104.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.35
Veloc Up (ft/s)	=	9.21
HGL Dn (ft)	=	9.40
HGL Up (ft)	=	9.00
Hw Elev (ft)	=	10.48
Hw/D (ft)	=	1.00
Flow Regime	=	Inlet Control



Channel Report

Hydraflow Express Extension for Autodesk® AutoCAD® Civil 3D® by Autodesk, Inc. Friday, Oct 5 2018

SubLateral 105A Station 401+87 to 527+62

Trapezoidal

Bottom Width (ft)	= 7.00
Side Slopes (z:1)	= 1.50, 1.50
Total Depth (ft)	= 5.50
Invert Elev (ft)	= 10.00
Slope (%)	= 0.07
N-Value	= 0.030

Calculations

Compute by:	Known Depth
Known Depth (ft)	= 5.50

Highlighted

Depth (ft)	= 5.50
Q (cfs)	= 235.10
Area (sqft)	= 83.88
Velocity (ft/s)	= 2.80
Wetted Perim (ft)	= 26.83
Crit Depth, Yc (ft)	= 2.69
Top Width (ft)	= 23.50
EGL (ft)	= 5.62