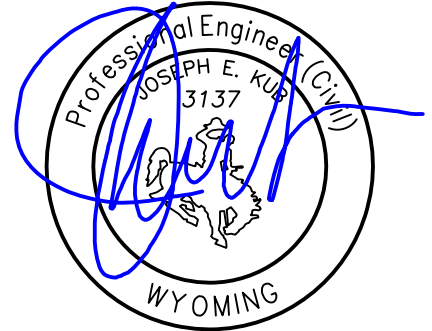# FLOODPLAIN ANALYSIS

Tract 11, Four Mile Ranchettes
Laramie County, Wyoming

For

John Laybourn

Historic Conditions

The site is located in a rural subdivision north of the City of Cheyenne and north of Four Mile Road. The site slopes gently from west to east and is vegetated by native grasses and weeds. The site is also traversed, from west to east, by the main channel of Child's Draw (Plot Plan – Figure 1). According to a WYDOT detailed hydrologic study of Child's Draw published in January of 2001, this site is located within Reach M3 at approximate river station 18618 as defined within the study. At this location the 100-yr storm flow is given as 872 cfs with a water surface elevation of 6136.84 (1929 NVGD Datum). The study utilized the City of Cheyenne 2 foot contour mapping dated 1984 and 1994 for elevation and location information.

Cross-sections of the channel using the same City contour mapping were developed and identified as A through I ranging from approximate river station 19100 downstream at 100 foot intervals to just east of the easterly property line of the tract in question as shown on Figure 2. A hydrologic analysis of each cross-section indicates 100-yr water surface elevations ranging from 6142.2 to 6135.9 from Section A to Section I, respectively, and using the WYDOT flow data. These cross-sections compare favorably with the WYDOT information and topographic information provided by Steil Surveying Services on Figure 1.

In addition to the main channel of Childs Draw a lesser drainage exists immediately to the north of Childs Draw near the driveway. This channel converges with the main channel just downstream of the east property line of Tract 11. Under high flow conditions it is expected that this sub-basin drainage way will be inundated by flows from the sub-basin and backwater from the main channel.

Current Conditions

Mr. Laybourn, the owner, has constructed a residence at the location shown on the Steil plot plan with a driveway from the cul-de-sac of Hidden Valley Trail to the dwelling. The driveway crosses Child's Draw at approximate river station 18500, which is just downstream of the WYDOT cross-section at river station 18618. A cross-section at 18500 (section G) indicates an historic 100-yr water surface elevation of 6136.5. There is a 24-inch culvert located at the intersection of the driveway and the historic main
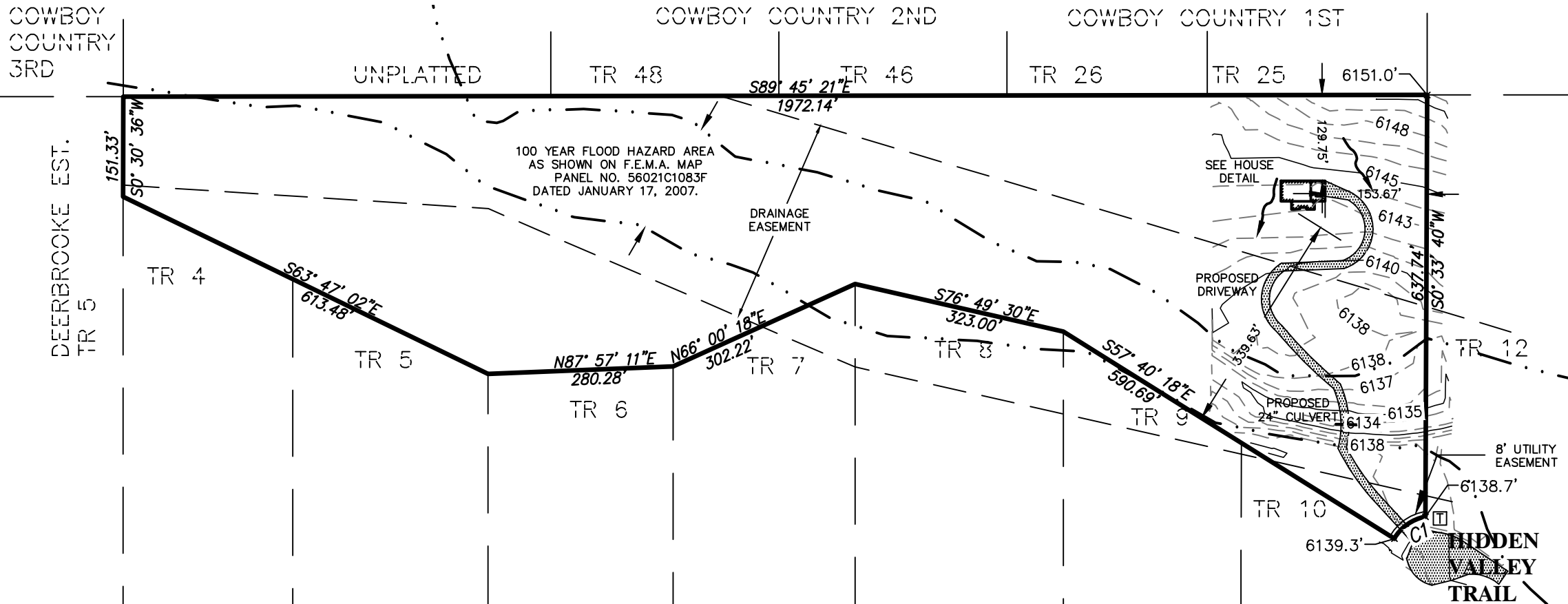
channel centerline that will convey a maximum flow of approximately 25 cfs as well as low flows generated by typical annual rain events.

Obviously, the driveway creates a dam across the main channel. This is an advantage and a detriment to the flood situation in the immediate vicinity. Short of a driveway that dips to and conforms to the existing channel cross-section, the only remaining options are a bridge structure and an overflow situation. Given the existing terrain and the cost of a bridge structure to accommodate the anticipated design flows and floating debris, the latter overflow possibility has been selected in light of the potential for overflow of the driveway. Figure 3 depicts the affect of the driveway on the flood conditions in the vicinity. The advantage of the driveway installation is the creation of a "detention" volume that, albeit somewhat minimal, compared to the potential design volume, is a positive result to the downstream flow conditions as well as the fact the floating debris will not measurably affect the flow conditions.

Given the potential for overflow of the driveway, the existing driveway profile was chosen to ensure the opportunity for overflow without adversely impacting either upstream or downstream historic flood conditions. Analysis of the channel hydraulics given the existing driveway profile and culvert suggests that the maximum depth of flow over the roadway will be approximately 1.4 feet at a flow rate of 850 cfs. However, once the flow passes over the roadway the water surface elevation recedes rapidly to the historic floodplain while still within the subject property downstream of the roadway.

Conclusion

The basic conclusion is that the presence of the driveway as it currently exists across the channel does not change the historic 100-year floodplain beyond the property lines of the subject property either upstream or downstream of the roadway crossing.
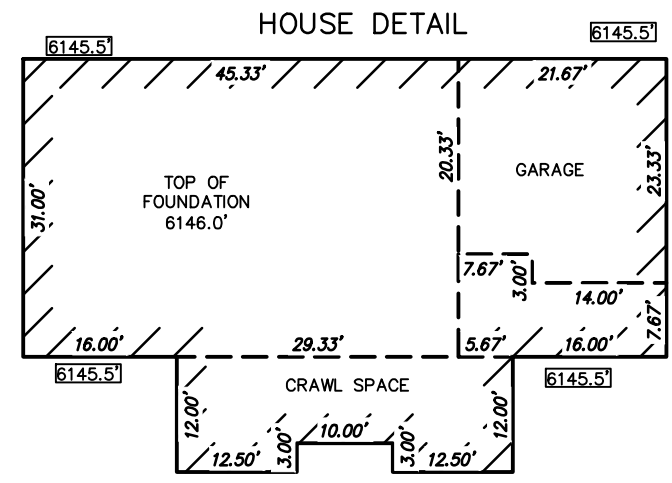
FIGURE 1

PLOT PLAN
FOR
TRACT 11,
FOUR MILE RANCHETTES,
LARAMIE COUNTY, WYOMING.
Date prepared: 10-09-14
Date of survey: 10-03-14

100 YEAR FLOOD HAZARD AREA
AS SHOWN ON F.E.M.A. MAP
PANEL NO. 56021C1083F
DATED JANUARY 17, 2007.

CURVE TABLE

CURVE #	DELTA	RADIUS	CHORD BEARING	CHORD LENGTH	ARC LENGTH
C1	48° 21' 18"	70.00'	N55° 05' 16"E	57.34'	59.08'

HOUSE DETAIL
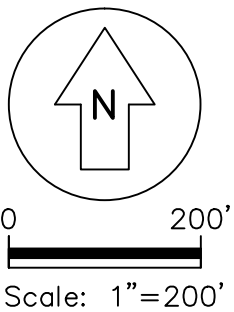
TBM = NE CORNER TRACT 11

ASSUMED ELEV. = 6151.0'
NOT ZONED
TRACT = 17.42 ACRES

∿→ Drainage arrow
00.0 Existing elevation
[00.0] Proposed elevation

Scale: 1"=200'
0   200'

N

STEIL SURVEYING SERVICES, LLC
REGISTERED LAND SURVEYORS
1102 W. 19th ST. CHEYENNE, WY. 82001 (307)634-7273
756 GILCHRIST ST. WHEATLAND, WY. 82201 (307)322-9789

REVISED: 11-4-14
2014DWG\14335\PP TRACT 11 FOUR MILE RANCHETTES.DWG

TRACT 11
FOURMILE RANCHETTES
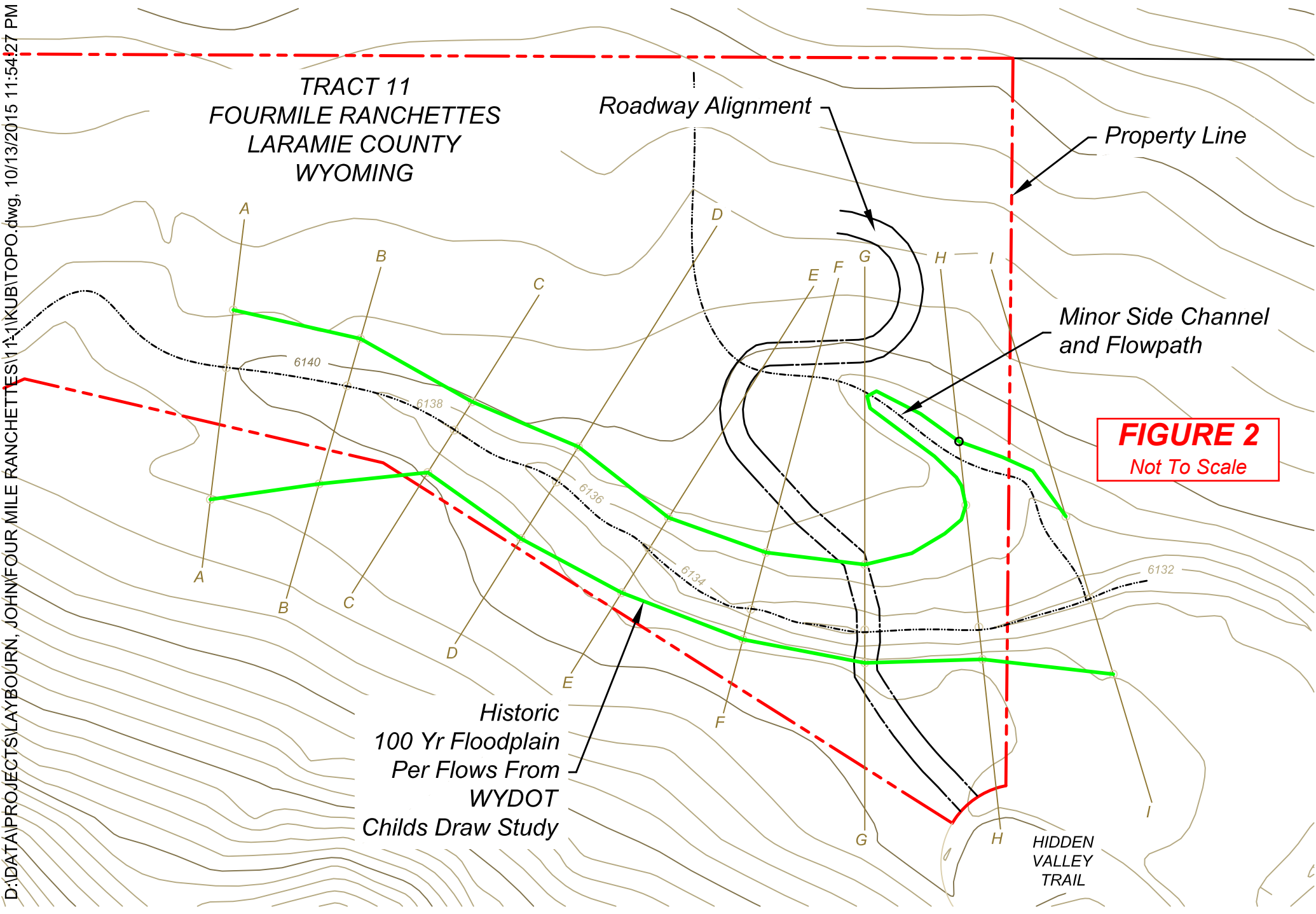LARAMIE COUNTY
WYOMING

Roadway Alignment

Property Line

Minor Side Channel
and Flowpath

FIGURE 2
Not To Scale

Historic
100 Yr Floodplain
Per Flows From
WYDOT
Childs Draw Study

HIDDEN
VALLEY
TRAIL

6140
6138
6136
6134
6132

D:\DATA\PROJECTS\LAYBOURN, JOHN\FOUR MILE RANCHETTES\11\11KUB\TOPO.dwg, 10/13/2015 11:54:27 PM

Channel Report

LAYBOURN X-SEC A

User-defined

Invert Elev (ft)	= 40.00
Slope (%)	= 1.00
N-Value	= 0.035

Calculations

Compute by:	Known Q
Known Q (cfs)	= 872.00

Highlighted

Depth (ft)	= 2.20
Q (cfs)	= 872.00
Area (sqft)	= 191.98
Velocity (ft/s)	= 4.54
Wetted Perim (ft)	= 170.87
Crit Depth, Yc (ft)	= 1.98
Top Width (ft)	= 170.80
EGL (ft)	= 2.52

(Sta, El, n)-(Sta, El, n)...
(0.00, 46.00)-(91.00, 44.00, 0.035)-(153.00, 42.00, 0.035)-(200.00, 40.00, 0.035)-(312.00, 42.00, 0.035)-(368.00, 44.00, 0.035)-(406.00, 46.00, 0.035)

Channel Report

Friday, Aug 7 2015
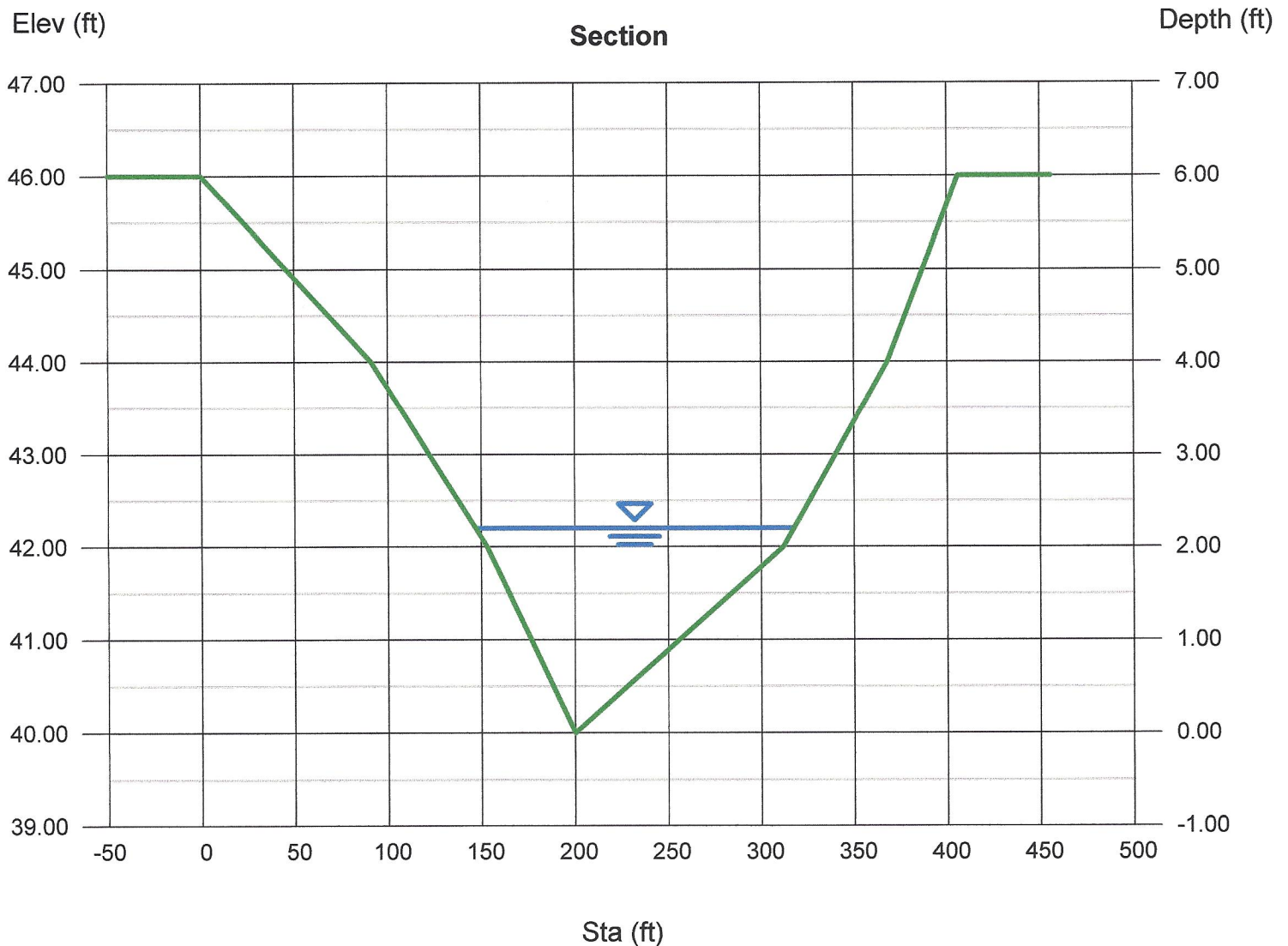
LAYBOURN X-SEC B

User-defined

Invert Elev (ft)	=	38.50
Slope (%)	=	1.30
N-Value	=	0.035

Calculations

Compute by:		Known Q
Known Q (cfs)	=	872.00

Highlighted

Depth (ft)	=	2.72
Q (cfs)	=	872.00
Area (sqft)	=	164.76
Velocity (ft/s)	=	5.29
Wetted Perim (ft)	=	143.15
Crit Depth, Yc (ft)	=	2.60
Top Width (ft)	=	143.01
EGL (ft)	=	3.16

(Sta, El, n)-(Sta, El, n)...

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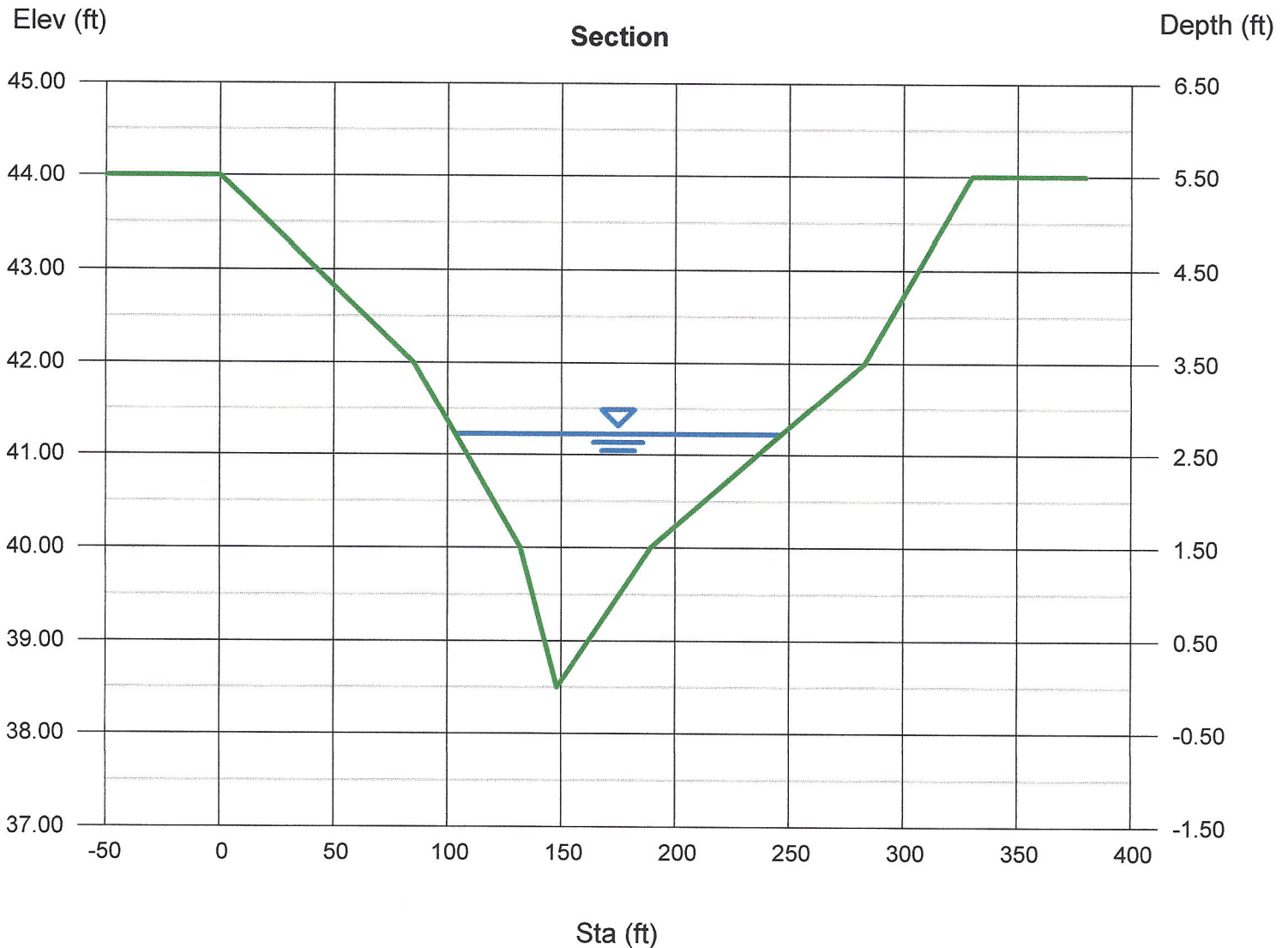
Channel Report

LAYBOURN X-SEC C

User-defined

Invert Elev (ft)	=	36.00
Slope (%)	=	1.30
N-Value	=	0.035

Highlighted

Depth (ft)	=	3.46
Q (cfs)	=	872.00
Area (sqft)	=	124.64
Velocity (ft/s)	=	7.00
Wetted Perim (ft)	=	71.55
Crit Depth, Yc (ft)	=	3.37
Top Width (ft)	=	71.20
EGL (ft)	=	4.22

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	872.00

(Sta, El, n)-(Sta, El, n)...

(0.00, 44.00)-(81.00, 42.00, 0.035)-(145.00, 40.00, 0.035)-(160.00, 38.00, 0.035)-(177.00, 36.00, 0.035)-(202.00, 38.00, 0.035)-(227.00, 40.00, 0.035)
-(329.00, 42.00, 0.035)-(367.00, 44.00, 0.035)

Channel Report

Friday, Aug 7 2015
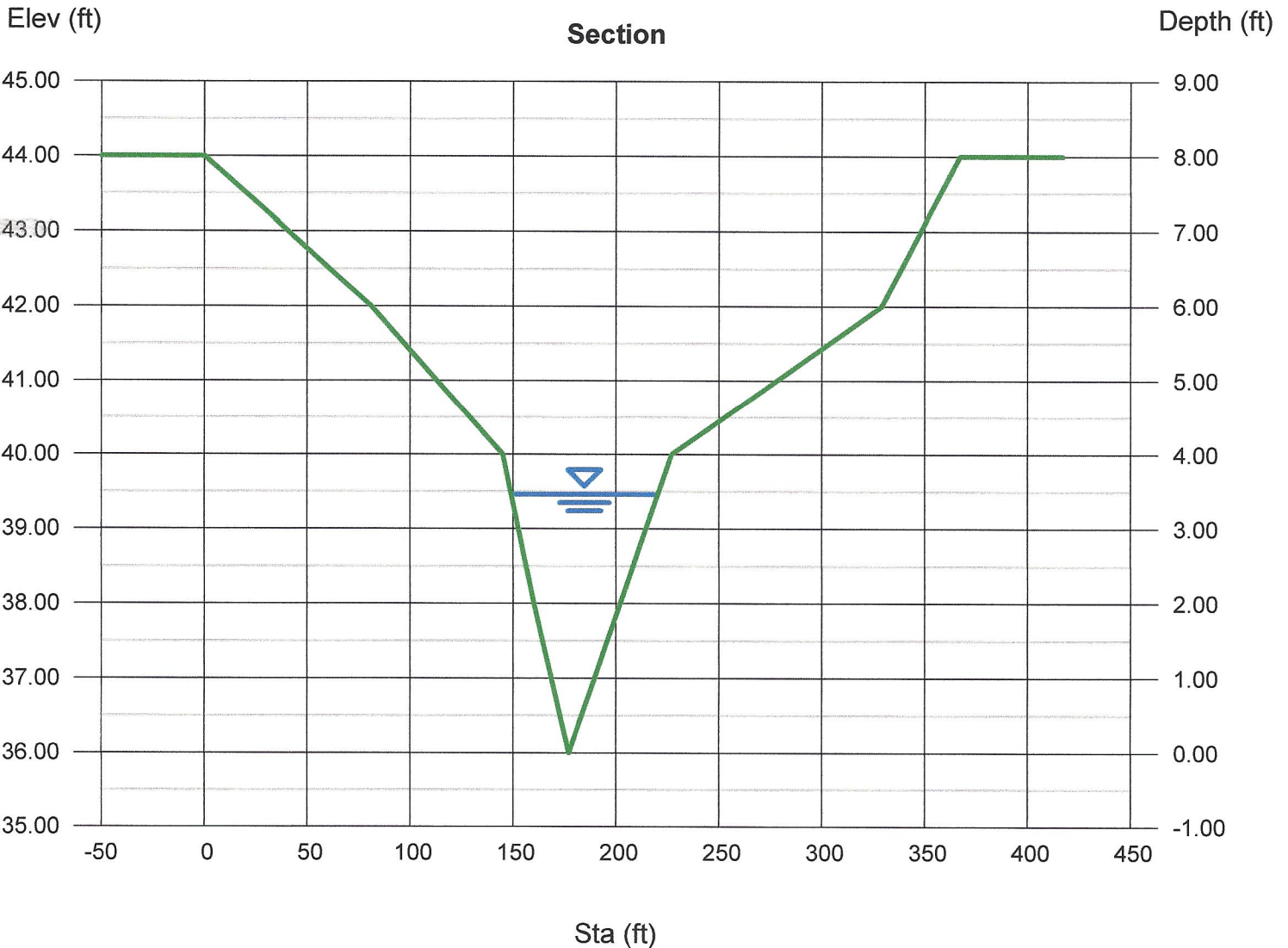
LAYBOURN X-SEC D

User-defined

Invert Elev (ft)	=	35.70
Slope (%)	=	1.30
N-Value	=	0.035

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	872.00

Highlighted

Depth (ft)	=	2.83
Q (cfs)	=	872.00
Area (sqft)	=	142.80
Velocity (ft/s)	=	6.11
Wetted Perim (ft)	=	100.36
Crit Depth, Yc (ft)	=	2.70
Top Width (ft)	=	100.15
EGL (ft)	=	3.41

(Sta, El, n)-(Sta, El, n)...
(0.00, 42.00)-(89.00, 40.00, 0.035)-(122.00, 38.00, 0.035)-(139.00, 36.00, 0.035)-(150.00, 35.70, 0.035)-(162.00, 36.00, 0.035)-(193.00, 38.00, 0.035)
-(270.00, 40.00, 0.035)-(307.00, 42.00, 0.035)
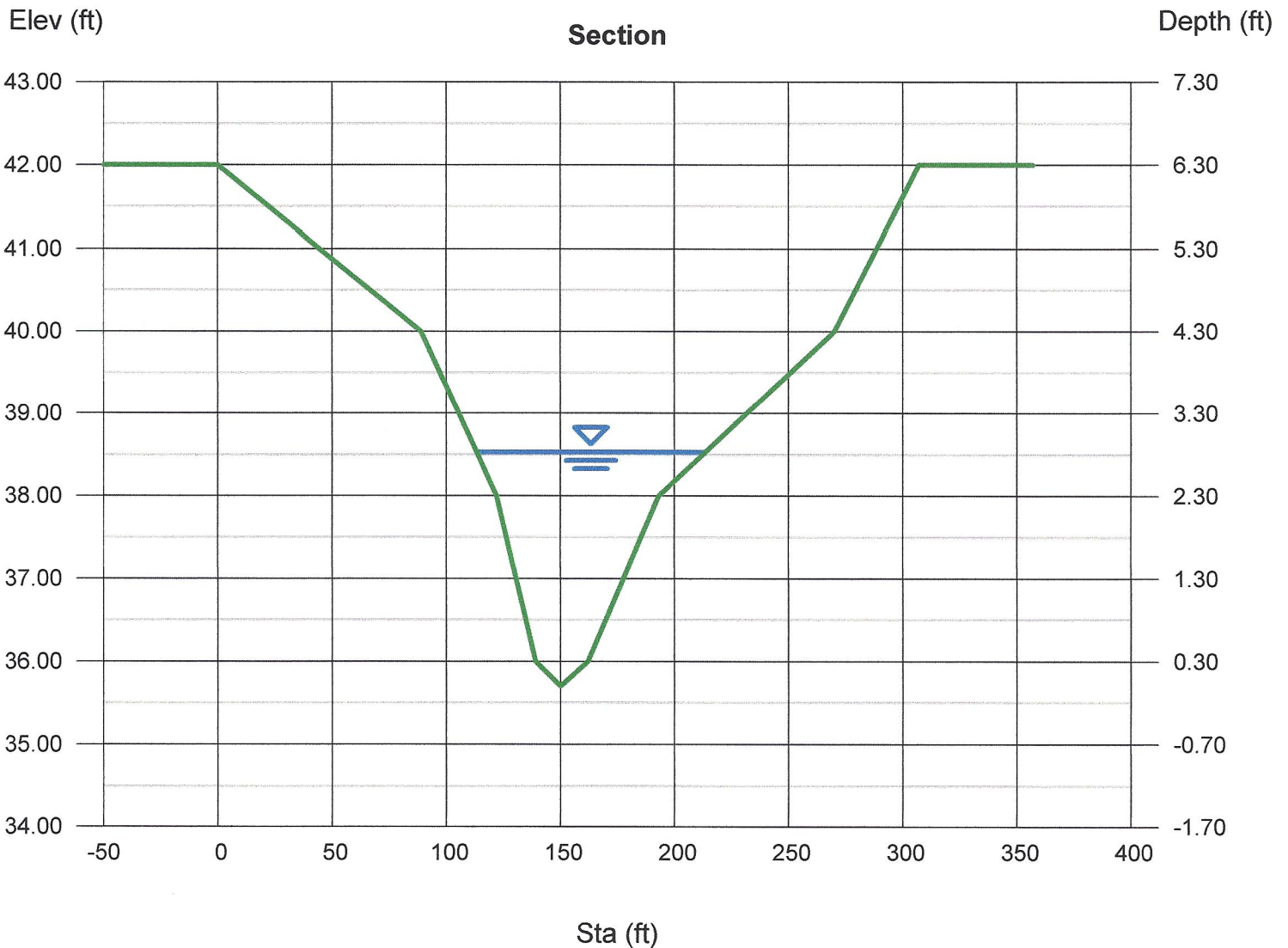
Channel Report

LAYBOURN X-SEC E

User-defined

Invert Elev (ft)	=	33.90
Slope (%)	=	1.00
N-Value	=	0.035

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	872.00

Highlighted

Depth (ft)	=	3.50
Q (cfs)	=	872.00
Area (sqft)	=	144.02
Velocity (ft/s)	=	6.05
Wetted Perim (ft)	=	84.41
Crit Depth, Yc (ft)	=	3.23
Top Width (ft)	=	84.10
EGL (ft)	=	4.07

(Sta, El, n)-(Sta, El, n)...
(0.00, 40.00)-(168.00, 38.00, 0.035)-(186.00, 36.00, 0.035)-(205.00, 34.00, 0.035)-(207.00, 33.90, 0.035)-(210.00, 34.00, 0.035)-(233.00, 36.00, 0.035)
-(268.00, 38.00, 0.035)-(316.00, 40.00, 0.035)
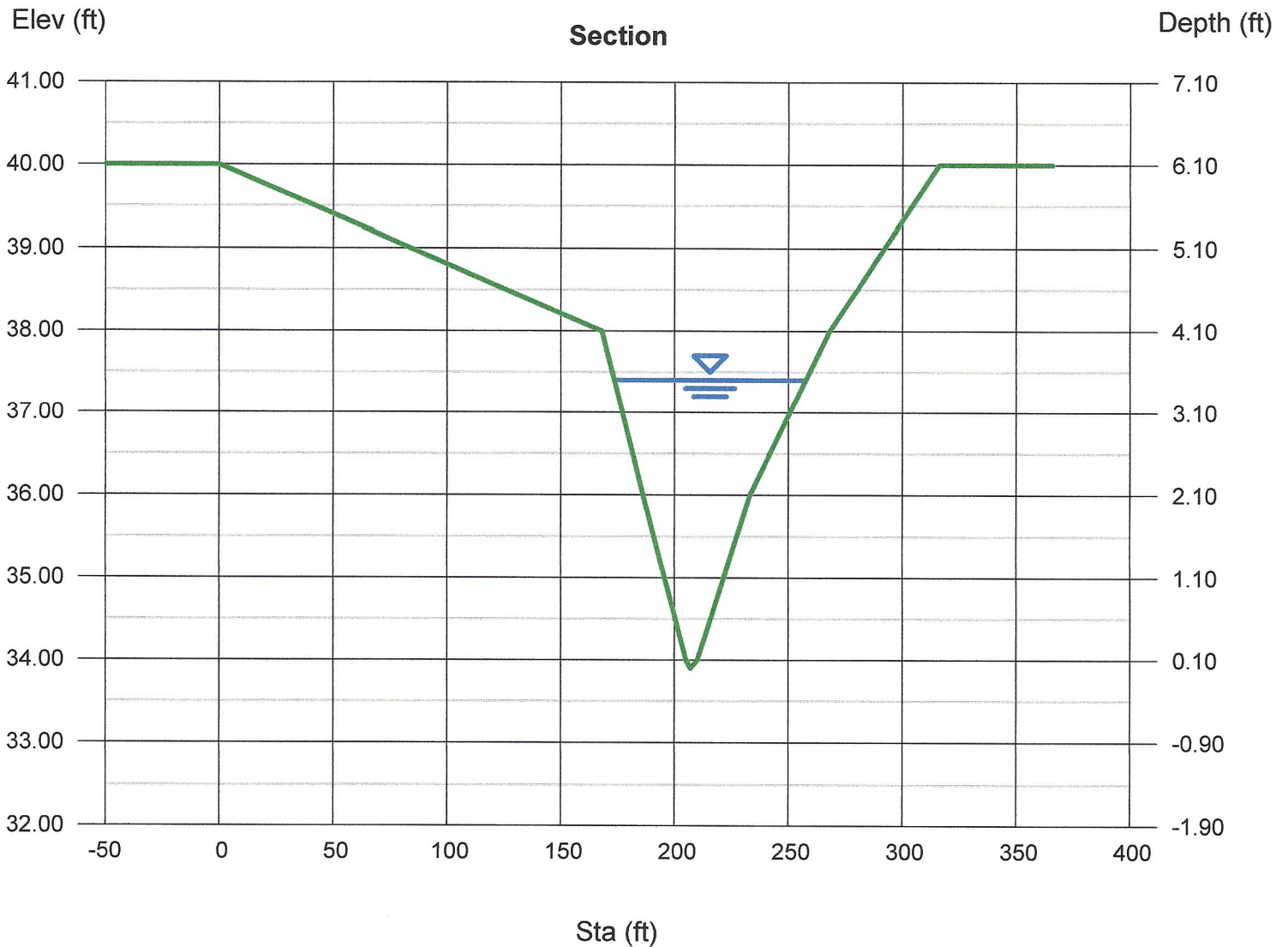
Channel Report

LAYBOURN X-SEC F

User-defined

Invert Elev (ft)	=	32.80
Slope (%)	=	1.00
N-Value	=	0.035

Highlighted

Depth (ft)	=	4.03
Q (cfs)	=	872.00
Area (sqft)	=	142.30
Velocity (ft/s)	=	6.13
Wetted Perim (ft)	=	81.40
Crit Depth, Yc (ft)	=	3.76
Top Width (ft)	=	80.92
EGL (ft)	=	4.61

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	872.00

(Sta, El, n)-(Sta, El, n)...

(0.00, 40.00)-(167.00, 38.00, 0.035)-(199.00, 36.00, 0.035)-(232.00, 34.00, 0.035)-(239.00, 32.80, 0.035)-(246.00, 34.00, 0.035)-(260.00, 36.00, 0.035)
-(276.00, 38.00, 0.035)-(322.00, 40.00, 0.035)
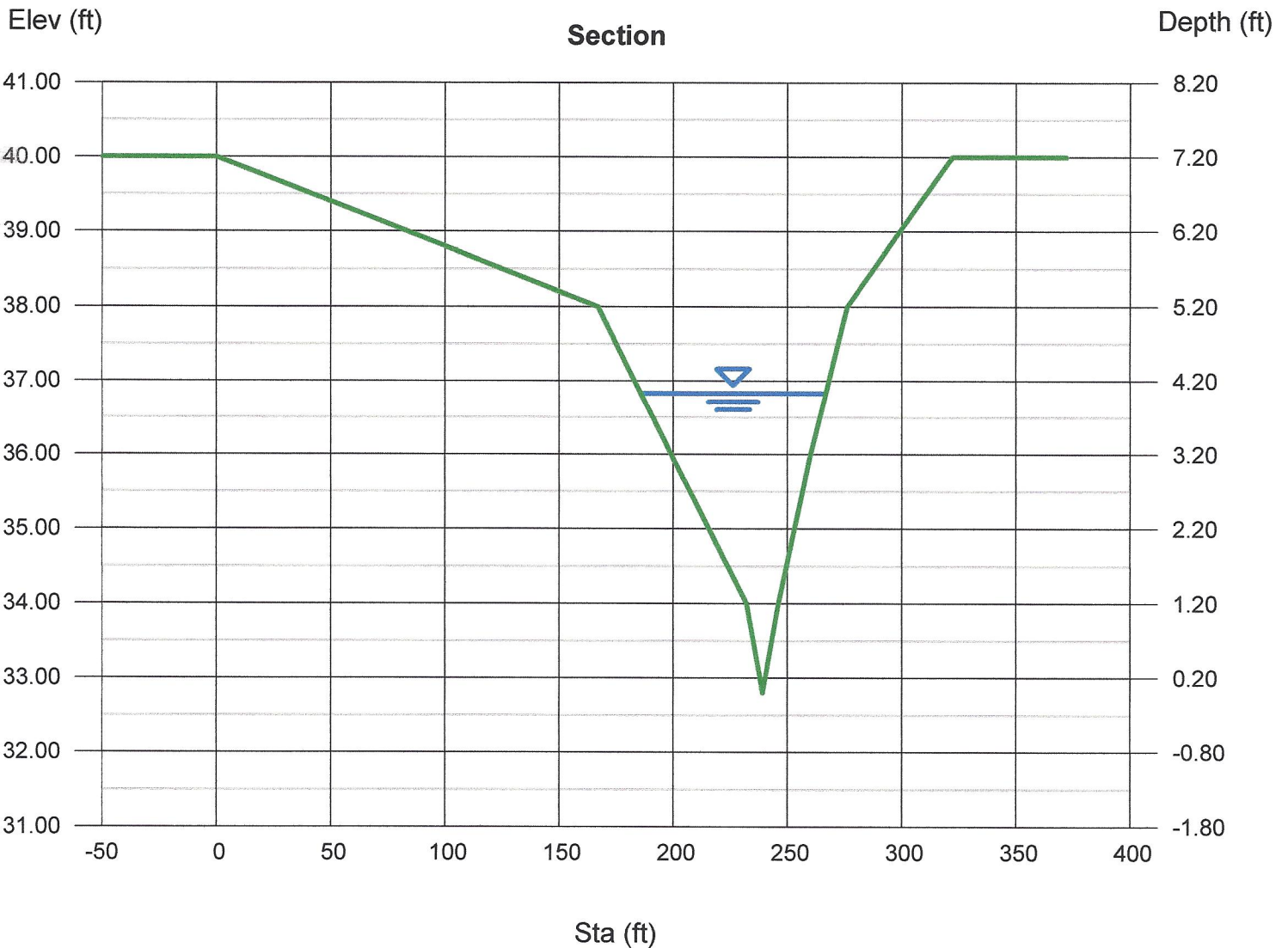
Channel Report

LAYBOURN X-SEC G

User-defined

Invert Elev (ft)	=	32.00
Slope (%)	=	0.70
N-Value	=	0.035

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	872.00

Highlighted

Depth (ft)	=	4.47
Q (cfs)	=	872.00
Area (sqft)	=	162.80
Velocity (ft/s)	=	5.36
Wetted Perim (ft)	=	87.89
Crit Depth, Yc (ft)	=	3.79
Top Width (ft)	=	87.33
EGL (ft)	=	4.92

(Sta, El, n)-(Sta, El, n)...

(0.00, 40.00)-(26.00, 38.00, 0.035)-(43.00, 37.80, 0.035)-(65.00, 38.00, 0.035)-(101.00, 38.50, 0.035)-(134.00, 38.00, 0.035)-(208.00, 36.00, 0.035)-(232.00, 34.00, 0.035)-(248.00, 32.00, 0.035)-(263.00, 34.00, 0.035)-(273.00, 36.00, 0.035)-(294.00, 38.00, 0.035)-(405.00, 40.00, 0.035)
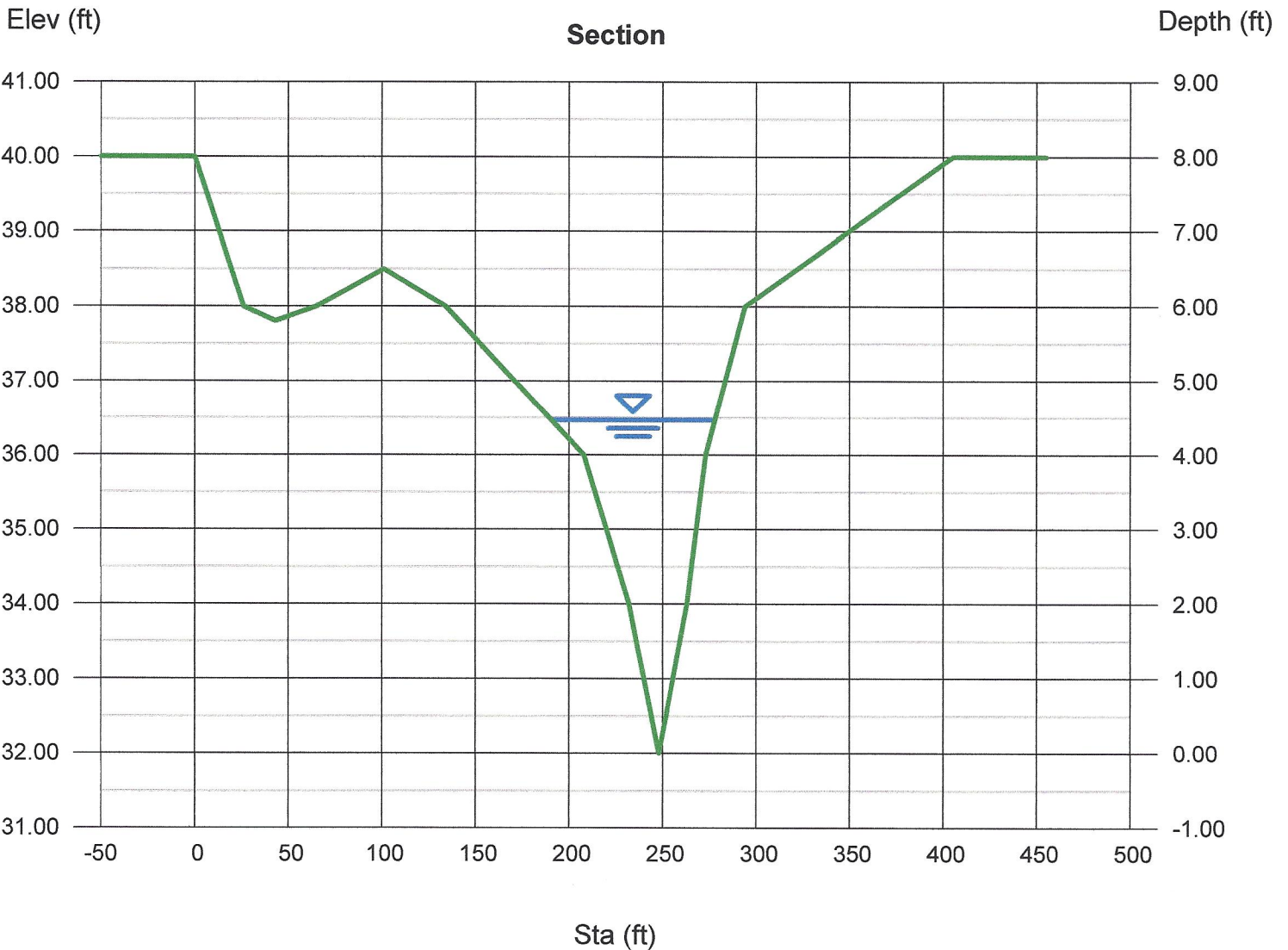
Channel Report

LAYBOURN X-SEC H

User-defined

Invert Elev (ft)	=	32.10
Slope (%)	=	0.50
N-Value	=	0.035

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	872.00

Highlighted

Depth (ft)	=	4.68
Q (cfs)	=	872.00
Area (sqft)	=	207.64
Velocity (ft/s)	=	4.20
Wetted Perim (ft)	=	124.98
Crit Depth, Yc (ft)	=	3.81
Top Width (ft)	=	124.41
EGL (ft)	=	4.95

(Sta, El, n)-(Sta, El, n)...

(0.00, 40.00)-(32.00, 38.00, 0.035)-(63.00, 37.00, 0.035)-(107.00, 37.20, 0.035)-(167.00, 36.00, 0.035)-(209.00, 34.00, 0.035)-(222.00, 32.10, 0.035)
-(235.00, 34.00, 0.035)-(245.00, 36.00, 0.035)-(264.00, 38.00, 0.035)-(316.00, 38.20, 0.035)-(363.00, 37.70, 0.035)-(382.00, 38.00, 0.035)-(391.00, 40.00, 0.03
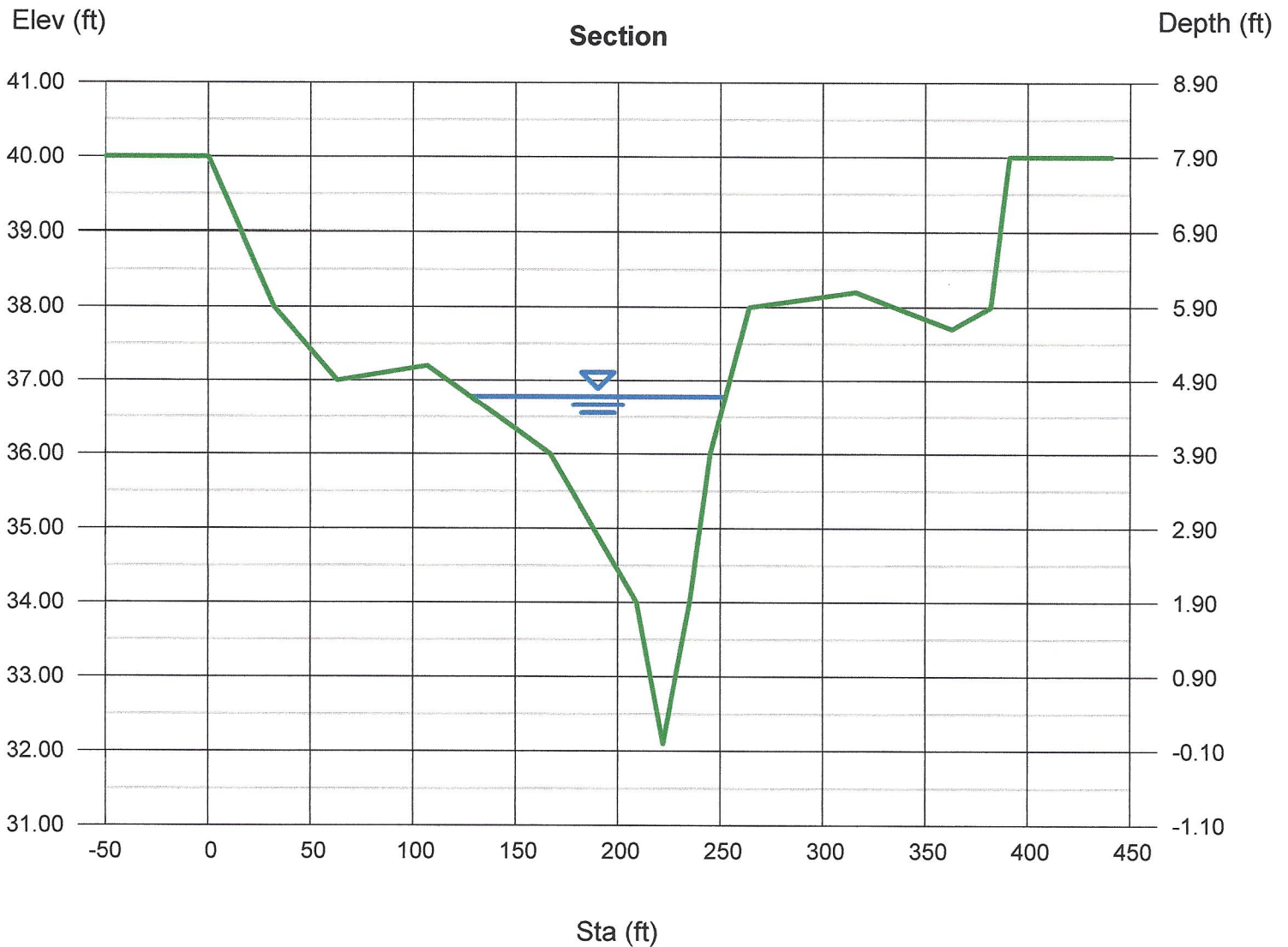
Channel Report

LAYBOURN X-SEC I

User-defined

Invert Elev (ft)	=	32.00
Slope (%)	=	0.50
N-Value	=	0.035

Calculations

Compute by:		Known Q
Known Q (cfs)	=	872.00

Highlighted

Depth (ft)	=	3.88
Q (cfs)	=	872.00
Area (sqft)	=	221.16
Velocity (ft/s)	=	3.94
Wetted Perim (ft)	=	145.59
Crit Depth, Yc (ft)	=	3.22
Top Width (ft)	=	145.28
EGL (ft)	=	4.12

(Sta, El, n)-(Sta, El, n)...

(0.00, 40.00)-(43.00, 38.00, 0.035)-(85.00, 36.00, 0.035)-(143.00, 34.00, 0.035)-(161.00, 32.00, 0.035)-(165.00, 32.00, 0.035)-(168.00, 32.00, 0.035)
-(183.00, 34.00, 0.035)-(237.00, 36.00, 0.035)-(316.00, 36.50, 0.035)
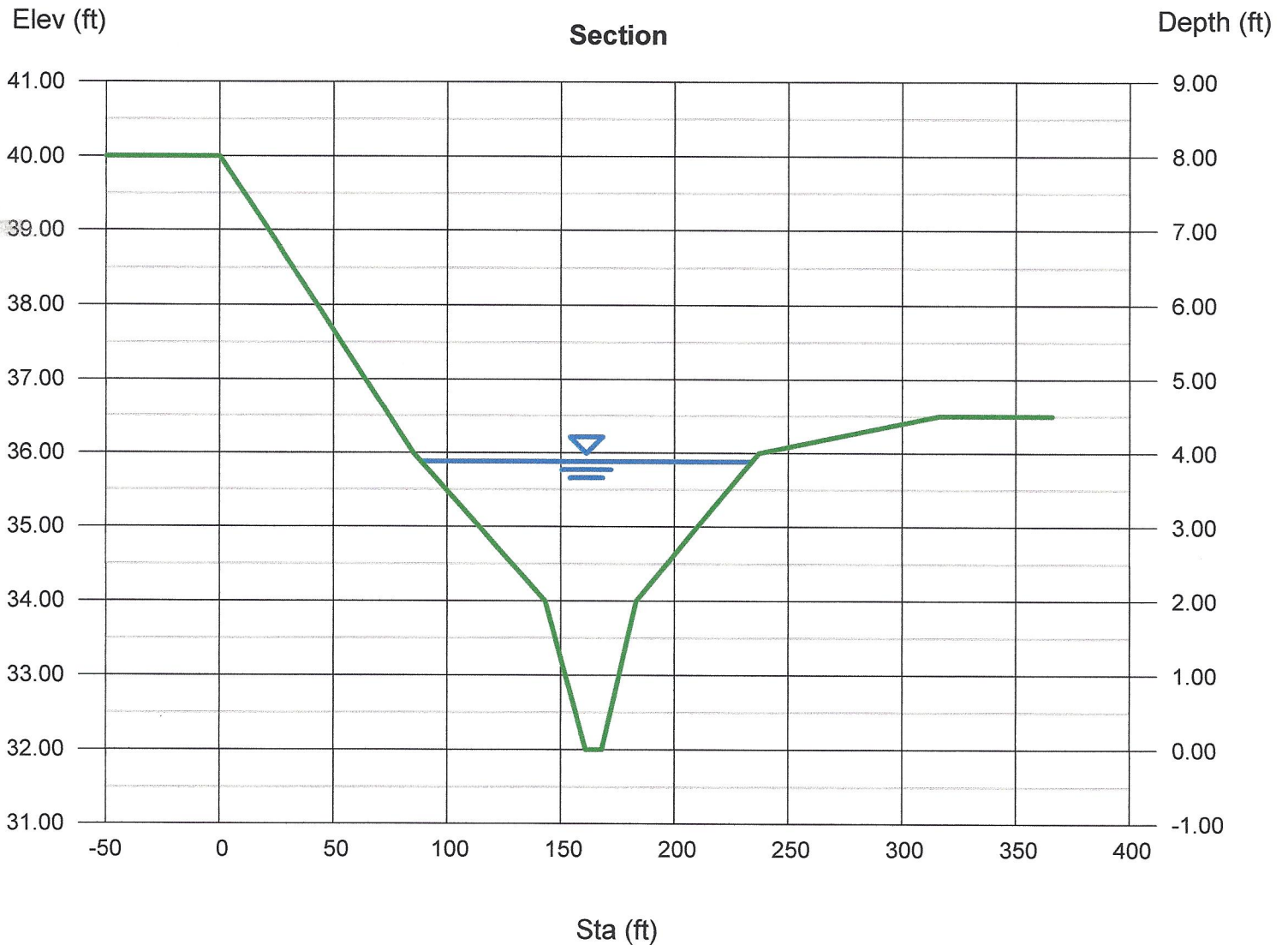
TRACT 11
FOURMILE RANCHETTES
LARAMIE COUNTY
WYOMING

Property Line

Historic 100 Yr
Floodplain Per
WYDOT Study
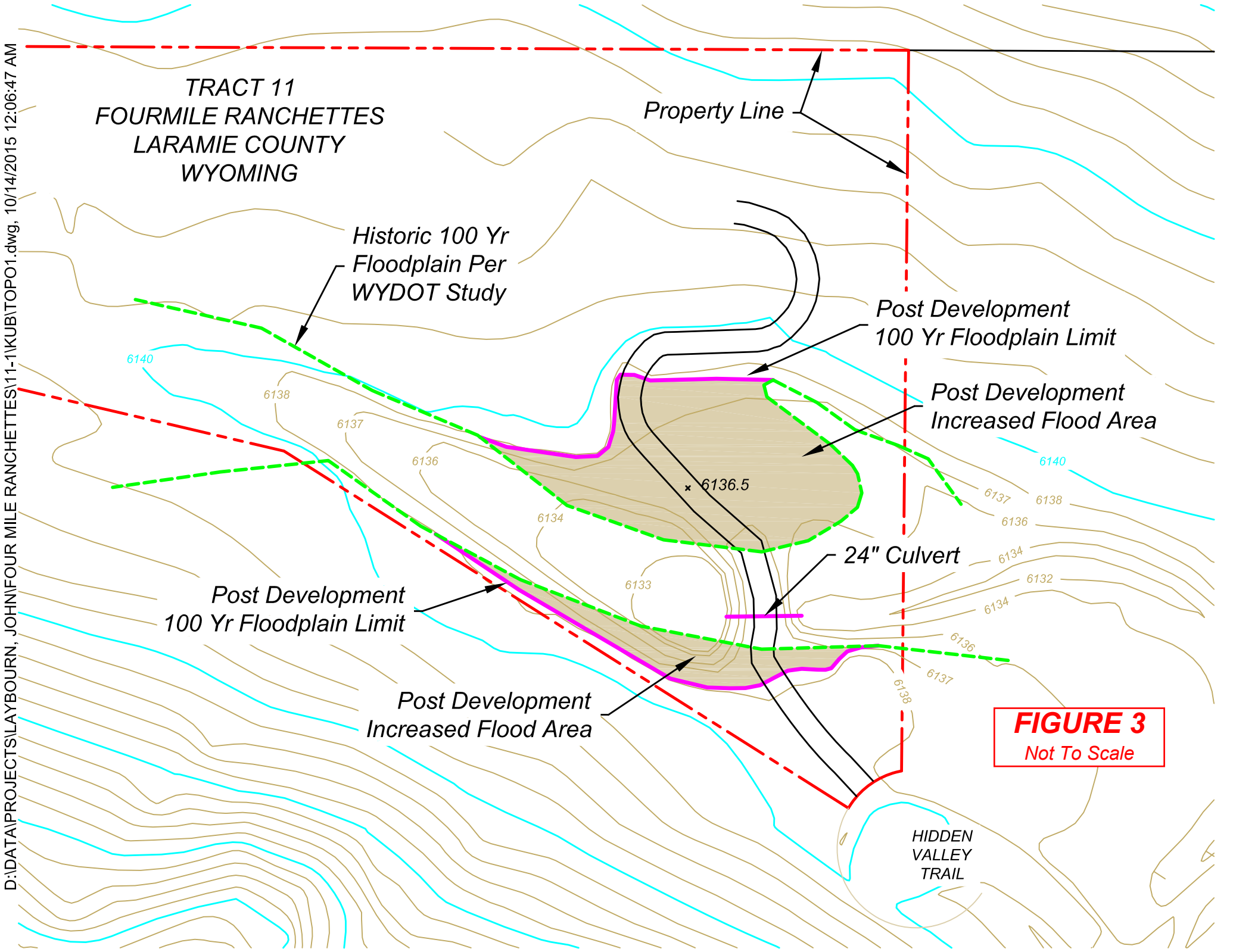
Post Development
100 Yr Floodplain Limit

Post Development
Increased Flood Area

24" Culvert

6136.5

Post Development
100 Yr Floodplain Limit

Post Development
Increased Flood Area

HIDDEN
VALLEY
TRAIL

FIGURE 3
Not To Scale

D:\DATA\PROJECTS\LAYBOURN, JOHN\FOUR MILE RANCHETTES\11-1\KUB\TOPO1.dwg, 10/14/2015 12:06:47 AM

Channel Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2009 by Autodesk, Inc.

Roadway Profile - Laybourn

User-defined

Invert Elev (ft)	=	36.50
Slope (%)	=	1.00
N-Value	=	0.030

Calculations

Compute by:	Known Q	
Known Q (cfs)	=	850.00

Highlighted

Depth (ft)	=	1.38
Q (cfs)	=	850.00
Area (sqft)	=	213.01
Velocity (ft/s)	=	3.99
Wetted Perim (ft)	=	294.37
Crit Depth, Yc (ft)	=	1.28
Top Width (ft)	=	294.36
EGL (ft)	=	1.63

(Sta, El, n)-(Sta, El, n)...

(0.00, 38.00)-(65.00, 37.00, 0.030)-(126.00, 36.50, 0.030)-(186.00, 37.00, 0.030)-(450.00, 39.00, 0.030)