

Case File Report



Expires: 3/31/18

TECHNICAL MEMORANDUM

To: City of Scottsdale

From: HILGARTWILSON

Date: March 13th, 2017

RE: Great Hearts Academies – Scottsdale Preparatory Field Preliminary Drainage Analysis

Introduction and Background

This technical memorandum has been prepared in support of the Great Hearts Academies (GHA) proposed athletic field (the Project) located southwest of Trailside View and 91st Street, east of Pima Road and the 101 Highway, in the City of Scottsdale (the City). Refer to Figure 1 (Vicinity Map). Specifically, this memorandum discusses the regulatory framework in which the Project will be designed in accordance with as well as preliminary drainage considerations.

Future drainage reports will be prepared in accordance with the most current version of the City of Scottsdale (COS) Design Standards & Policies Manual (DSPM) and the Flood Control District of Maricopa County's (FCDMC) current versions of the Drainage Policies and Standards (DPSM), Drainage Design Manuals (DDM) for Maricopa County, - Hydrology and - Hydraulics.

Hydrologic Flow Determination

In July 2013, T.Y. Lin prepared the *Pinnacle Peak South Area Drainage Master Study Draft* (ADMS) (T.Y. Lin 2013) on behalf of the FCDMC that details the hydrologic and hydraulic conditions of a 45 square mile drainage area extending from Frank Lloyd Wright Boulevard to Dynamite Boulevard and from Scottsdale Road into the McDowell Mountains. The primary goal of the study was to characterize regional flows using the most up to date hydrologic study of the watershed referencing the most current land uses, rainfall data, detailed topography, and analysis. The hydrologic and hydraulic analysis for the study area was completed using FLO-2D, a volume conserving, two-dimensional flood routing modeling program best suited for simulating shallow, distributary flows within a watershed. The ADMS reported a worst case scenario flow of 488 cfs entering the northwest corner of the Project via box culverts beneath, as well as overtopping, Trailside View from the north. The ADMS also reported smaller flows for the 100-year, 6-hour and 24-hour events of 217cfs and 257cfs respectively. FLO-2D results from the ADMS are included as Attachment 1.

Site Location Relative to Known FEMA Flood Hazard Zones

The property is located within the Federal Emergency Management Agency's (FEMA) Special Flood Hazard Area (SFHA) Zone AO as delineated on the FEMA Flood Insurance Rate Maps (FIRMs) panel number O4013C1320L, revised October 16, 2013, which are presented on Figure 2 (FEMA Flood Map). The SFHA Zone associated with this Project is defined below.

Zone AO:

The flood insurance rate zone that corresponds to areas subject to inundation by 1-percent annual chance (100-year storm event) shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone.

As the entire Project is located in a FEMA SFHA AO Zone, lowest floor elevations of nonresidential structures shall be elevated to conform to Chapter 37, Article I. Floodplain Management - Special Flood Hazard Areas, Section 37-22 of the Scottsdale Revised Ordinance Code.

Hydraulic Analysis

The 100-year water surface extents of the watercourse through the site were determined in order to identify the anticipated flooding impacts to the proposed field. The preliminary hydraulic analyses for the Project was performed using Hydraflow with parameters referenced from obtained topographic data for the Project. The top widths specified in the Hydraflow results were used to delineate the washes approximate water surface extents. The supporting hydraulic calculations are included as Attachment 2 and the estimated watersurface extents shown on Figure 3 (Drainage Summary Exhibit). It can be seen that based on the current field and parking lot layout, the worst case scenario flows crossing Trailside View do not impact the Project.

Onsite Design Requirements

The proposed Project will comply with the City's required drainage standards as well as Maricopa County Planning and Development Design guidelines and regulations. In accordance with the approved regional drainage report entitled DC Ranch Planning Unit I Part 4 Drainage Plan Study and stormwater storage waiver for the site, onsite stormwater storage is not anticipated to be required.

References

T.Y. Lin, 2013. *Pinnacle Peak South Area Drainage Master Study (Draft)*. Phoenix, Arizona. July 2013.

Attachments

Figure 1: Vicinity Map

Figure 2: FEMA Flood Map

Figure 3: Drainage Summary Exhibit

Attachment 1: Pinnacle Peak South ADMS FLO-2D Results

Attachment 2: Hydraflow Calculations

HILGARTWILSON, LLC
2141 E Highland Avenue, Suite 250
Phoenix, Arizona 85016-4736
Phone: 602-490-0535

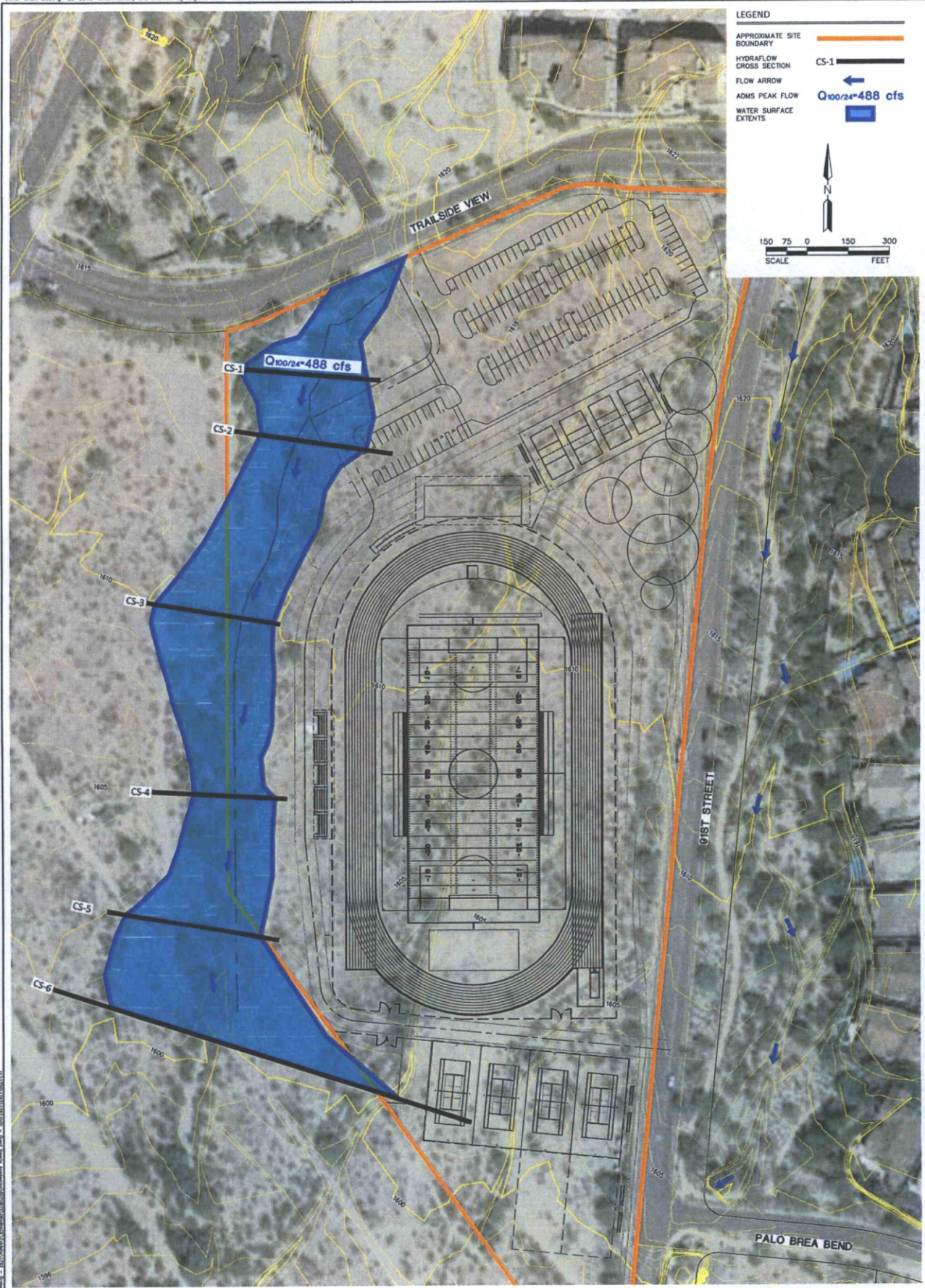


PROJ.NO.: 1792
 DATE: MAR 2017
 SCALE: 1" = 600'
 DRAWN BY: SL
 CHECKED BY: AT

GREAT HEARTS ACADEMIES
 SCOTTSDALE PREPATORY FIELD
 SCOTTSDALE, ARIZONA

FIG. 1: VICINITY MAP


HILGARTWILSON
 2141 E. HIGHLAND AVE., STE. 250
 PHOENIX, AZ 85016
 P: 602.490.0535 / F: 602.368.2436



HILGARTWILSON
 PROJ. NO.: 1792
 DATE: MAR. 2017
 SCALE: 1" = 50'
 DRAWN: BB
 DESIGNED: HW
 APPROVED: AT

GREAT HEARTS ACADEMIES
 SCOTTSDALE PREPARATORY FIELD
 SCOTTSDALE, ARIZONA
FIG. 3: PRELIMINARY DRAINAGE SUMMARY EXHIBIT

HILGARTWILSON
 ENGINEER | PLAN | SURVEY | MANAGE
 2141 E. HIGHLAND AVE., STE. 250 | P. 602.490.0035 / F. 602.368.2436
 PHOENIX, AZ 85016
 www.hilgartwilson.com

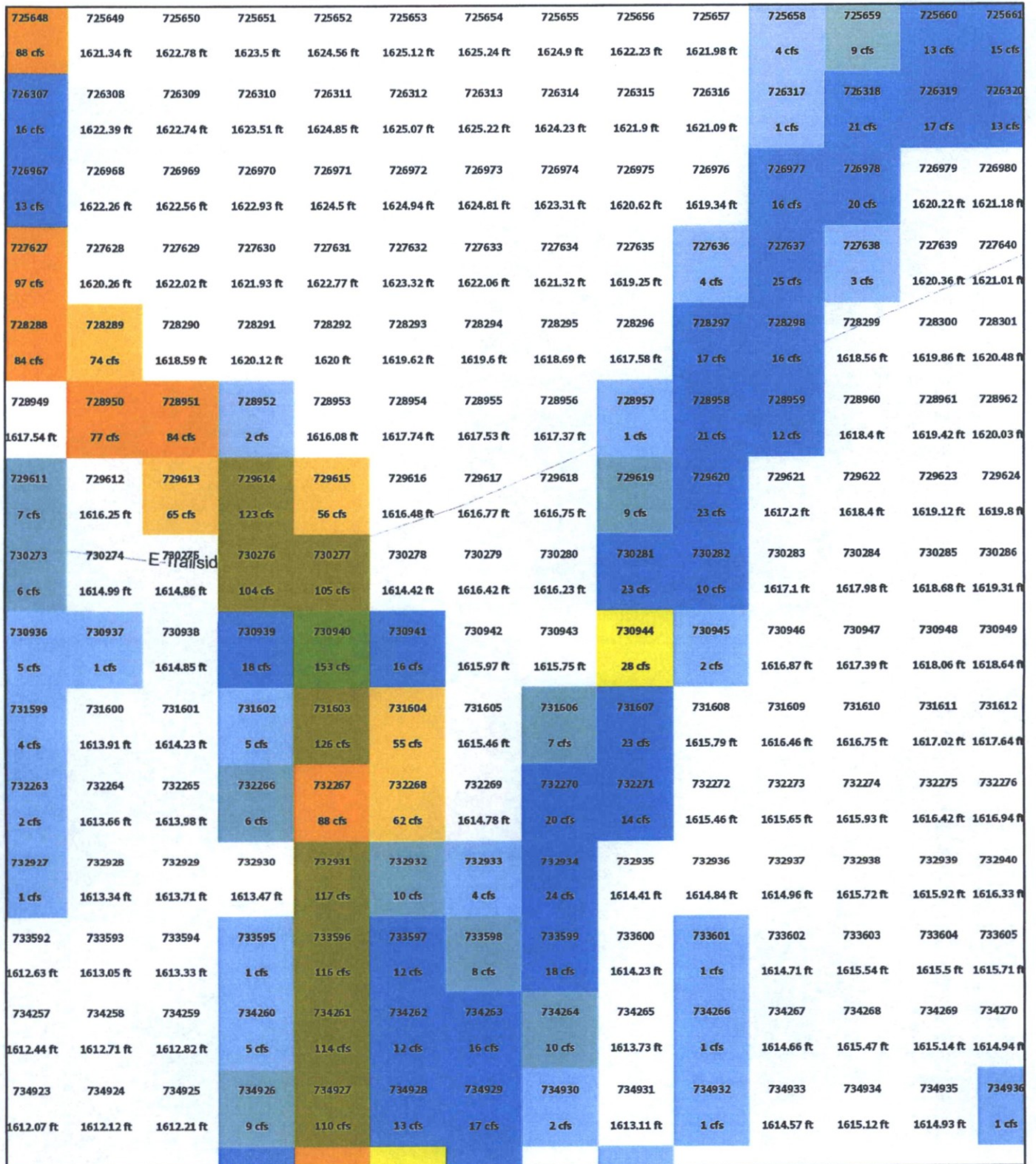
REV.	DESCRIPTION



**ATTACHMENT 1
PINNACLE PEAK SOUTH ADMS FLO-2D RESULTS**

Flo2D Viewer

Model: 2D_PinnaclePeakSouth/100YR6HR_P



1:774

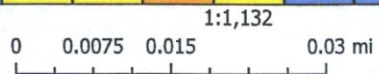


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Flo2D Viewer

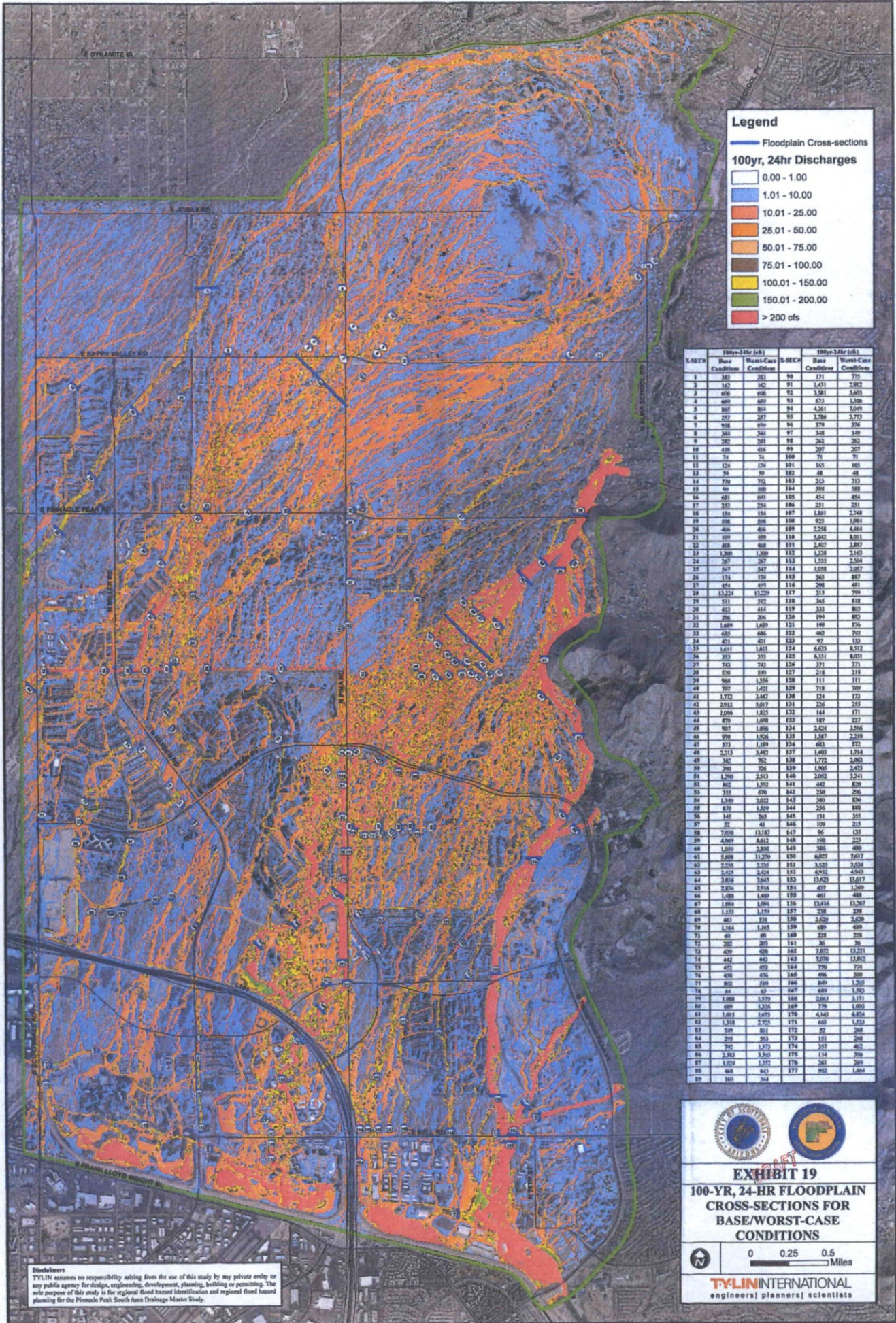
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725643	725644	725645	725646	725647	725648	725649	725650	725651	725652	725653	725654	725655	725656	725657	725658	725659	725660	725661	725662	725663	725664	725665	725666	725667	725668	725669
2 cfs	2 cfs	2 cfs	3 cfs	66 cfs	101 cfs	1621.34 ft	1622.77 ft	1623.5 ft	1624.56 ft	1625.12 ft	1625.23 ft	1624.89 ft	1622.23 ft	1621.98 ft	4 cfs	11 cfs	19 cfs	17 cfs	24 cfs	25 cfs	14 cfs	10 cfs	25 cfs	38 cfs	47 cfs	22 cfs
726302	726303	726304	726305	726306	726307	726308	726309	726310	726311	726312	726313	726314	726315	726316	726317	726318	726319	726320	726321	726322	726323	726324	726325	726326	726327	726328
2 cfs	2 cfs	2 cfs	3 cfs	13.4 cfs	23 cfs	1622.39 ft	1622.73 ft	1623.51 ft	1624.85 ft	1625.07 ft	1625.22 ft	1624.23 ft	1621.89 ft	1621.08 ft	4 cfs	24 cfs	19 cfs	15 cfs	6 cfs	2 cfs	5 cfs	10 cfs	26 cfs	49 cfs	48 cfs	27 cfs
726962	726963	726964	726965	726966	726967	726968	726969	726970	726971	726972	726973	726974	726975	726976	726977	726978	726979	726980	726981	726982	726983	726984	726985	726986	726987	726988
2 cfs	1 cfs	1 cfs	1619.07 ft	135 cfs	11 cfs	1622.26 ft	1622.55 ft	1622.93 ft	1624.5 ft	1624.94 ft	1624.8 ft	1623.31 ft	1620.62 ft	1619.37 ft	20 cfs	23 cfs	1 cfs	1621.8 ft	1621.67 ft	1621.8 ft	6 cfs	10 cfs	29 cfs	59 cfs	52 cfs	22 cfs
727622	727623	727624	727625	727626	727627	727628	727629	727630	727631	727632	727633	727634	727635	727636	727637	727638	727639	727640	727641	727642	727643	727644	727645	727646	727647	727648
1616.12 ft	1617.08 ft	1 cfs	1618.79 ft	83 cfs	112 cfs	1620.26 ft	1622.02 ft	1621.92 ft	1622.77 ft	1623.32 ft	1622.06 ft	1621.32 ft	1619.24 ft	6 cfs	30 cfs	4 cfs	1620.36 ft	1621.01 ft	1621.22 ft	1620.91 ft	6 cfs	16 cfs	35 cfs	62 cfs	47 cfs	12 cfs
728283	728284	728285	728286	728287	728288	728289	728290	728291	728292	728293	728294	728295	728296	728297	728298	728299	728300	728301	728302	728303	728304	728305	728306	728307	728308	728309
1615.58 ft	1 cfs	2 cfs	4 cfs	1618.52 ft	97 cfs	86 cfs	1618.59 ft	1620.12 ft	1620 ft	1619.62 ft	1619.59 ft	1618.69 ft	1617.59 ft	22 cfs	20 cfs	1618.58 ft	1619.86 ft	1620.48 ft	1620.56 ft	1620.13 ft	9 cfs	24 cfs	45 cfs	56 cfs	36 cfs	9 cfs
728944	728945	728946	728947	728948	728949	728950	728951	728952	728953	728954	728955	728956	728957	728958	728959	728960	728961	728962	728963	728964	728965	728966	728967	728968	728969	728970
1615.08 ft	2 cfs	2 cfs	1 cfs	1617.17 ft	1617.54 ft	90 cfs	98 cfs	4 cfs	1616.08 ft	1617.74 ft	1617.52 ft	1617.37 ft	2 cfs	27 cfs	14 cfs	1618.4 ft	1619.41 ft	1620.03 ft	1620.03 ft	2 cfs	17 cfs	34 cfs	43 cfs	50 cfs	27 cfs	11 cfs
729606	729607	729608	729609	729610	729611	729612	729613	729614	729615	729616	729617	729618	729619	729620	729621	729622	729623	729624	729625	729626	729627	729628	729629	729630	729631	729632
1 cfs	3 cfs	1 cfs	1615.86 ft	1 cfs	8 cfs	1616.25 ft	77 cfs	139 cfs	51 cfs	1616.48 ft	1616.77 ft	1616.75 ft	13 cfs	27 cfs	1617.2 ft	1618.4 ft	1619.11 ft	1619.8 ft	1619.77 ft	4 cfs	23 cfs	36 cfs	41 cfs	47 cfs	20 cfs	11 cfs
730268	730269	730270	730271	730272	730273	730274	730275	730276	730277	730278	730279	730280	730281	730282	730283	730284	730285	730286	730287	730288	730289	730290	730291	730292	730293	730294
1614.21 ft	3 cfs	1614.77 ft	1615.05 ft	3 cfs	6 cfs	1614.99 ft	1614.87 ft	119 cfs	129 cfs	1614.42 ft	1616.42 ft	1616.26 ft	29 cfs	11 cfs	1617.1 ft	1617.97 ft	1618.68 ft	1619.31 ft	1619.32 ft	5 cfs	23 cfs	41 cfs	45 cfs	45 cfs	17 cfs	14 cfs
730931	730932	730933	730934	730935	730936	730937	730938	730939	730940	730941	730942	730943	730944	730945	730946	730947	730948	730949	730950	730951	730952	730953	730954	730955	730956	730957
2 cfs	3 cfs	1614.39 ft	1614.37 ft	3 cfs	5 cfs	1 cfs	1614.85 ft	13 cfs	177 cfs	18 cfs	1615.97 ft	2 cfs	33 cfs	4 cfs	1616.86 ft	1617.38 ft	1618.06 ft	1618.64 ft	1618.83 ft	2 cfs	24 cfs	40 cfs	52 cfs	44 cfs	21 cfs	16 cfs
731594	731595	731596	731597	731598	731599	731600	731601	731602	731603	731604	731605	731606	731607	731608	731609	731610	731611	731612	731613	731614	731615	731616	731617	731618	731619	731620
4 cfs	1613.32 ft	1613.71 ft	1613.68 ft	4 cfs	5 cfs	1613.91 ft	1614.23 ft	8 cfs	143 cfs	69 cfs	1615.47 ft	9 cfs	28 cfs	1615.8 ft	1616.46 ft	1616.74 ft	1617.02 ft	1617.63 ft	1618.12 ft	1 cfs	17 cfs	37 cfs	73 cfs	39 cfs	21 cfs	21 cfs
732258	732259	732260	732261	732262	732263	732264	732265	732266	732267	732268	732269	732270	732271	732272	732273	732274	732275	732276	732277	732278	732279	732280	732281	732282	732283	732284
2 cfs	1612.83 ft	1612.9 ft	2 cfs	5 cfs	4 cfs	1613.66 ft	1613.98 ft	8 cfs	97 cfs	80 cfs	1614.79 ft	25 cfs	17 cfs	1615.46 ft	1615.65 ft	1615.92 ft	1616.41 ft	1616.94 ft	1617.51 ft	1617.76 ft	13 cfs	39 cfs	72 cfs	43 cfs	26 cfs	26 cfs
732922	732923	732924	732925	732926	732927	732928	732929	732930	732931	732932	732933	732934	732935	732936	732937	732938	732939	732940	732941	732942	732943	732944	732945	732946	732947	732948
2 cfs	1612.11 ft	1 cfs	2 cfs	5 cfs	1 cfs	1613.34 ft	1613.71 ft	1613.48 ft	136 cfs	14 cfs	6 cfs	28 cfs	3 cfs	1614.83 ft	1614.95 ft	1615.72 ft	1615.92 ft	1616.32 ft	1616.81 ft	1617.04 ft	12 cfs	58 cfs	55 cfs	44 cfs	35 cfs	10 cfs
733587	733588	733589	733590	733591	733592	733593	733594	733595	733596	733597	733598	733599	733600	733601	733602	733603	733604	733605	733606	733607	733608	733609	733610	733611	733612	733613
1 cfs	1611.78 ft	3 cfs	6 cfs	2 cfs	1612.64 ft	1613.06 ft	1613.33 ft	3 cfs	132 cfs	16 cfs	12 cfs	22 cfs	1614.24 ft	1614.31 ft	1614.7 ft	1615.54 ft	1615.49 ft	1615.71 ft	1615.94 ft	1616.05 ft	20 cfs	62 cfs	52 cfs	59 cfs	32 cfs	11 cfs
734252	734253	734254	734255	734256	734257	734258	734259	734260	734261	734262	734263	734264	734265	734266	734267	734268	734269	734270	734271	734272	734273	734274	734275	734276	734277	734278
1611.17 ft	1611.15 ft	6 cfs	3 cfs	1611.97 ft	1612.45 ft	1612.72 ft	1612.83 ft	8 cfs	128 cfs	16 cfs	20 cfs	13 cfs	1613.73 ft	1 cfs	1614.05 ft	1615.47 ft	1615.13 ft	1614.94 ft	1615.01 ft	2 cfs	44 cfs	46 cfs	80 cfs	40 cfs	10 cfs	8 cfs
734918	734919	734920	734921	734922	734923	734924	734925	734926	734927	734928	734929	734930	734931	734932	734933	734934	734935	734936	734937	734938	734939	734940	734941	734942	734943	734944
1610.67 ft	4 cfs	6 cfs	1 cfs	1611.93 ft	1612.08 ft	1612.13 ft	1612.22 ft	13 cfs	124 cfs	17 cfs	21 cfs	4 cfs	1613.11 ft	1 cfs	1614.57 ft	1615.12 ft	1614.93 ft	1614.37 ft	4 cfs	9 cfs	55 cfs	68 cfs	66 cfs	21 cfs	10 cfs	5 cfs



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PINNACLE PEAK SOUTH ADMS



Legend

Floodplain Cross-sections

100yr, 24hr Discharges

- 0.00 - 1.00
- 1.01 - 10.00
- 10.01 - 25.00
- 25.01 - 50.00
- 50.01 - 75.00
- 75.01 - 100.00
- 100.01 - 150.00
- 150.01 - 200.00
- > 200 cfs

X-SECTION	100yr-24hr (cb)		100yr-24hr (cb)	
	Base Conditions	Worst-Case Conditions	Base Conditions	Worst-Case Conditions
1	351	351	99	775
2	167	162	91	2,612
3	606	606	92	3,581
4	609	609	93	453
5	847	864	94	4,261
6	257	257	95	3,786
7	938	939	96	379
8	241	241	97	348
9	282	281	98	262
10	416	416	99	207
11	78	78	100	71
12	128	128	101	165
13	90	90	102	48
14	770	771	103	213
15	89	889	104	285
16	481	489	105	454
17	253	254	106	211
18	154	154	107	1,881
19	208	208	108	972
20	408	408	109	2,258
21	109	109	110	5,042
22	468	468	111	3,807
23	1,309	1,309	112	1,628
24	207	207	113	1,451
25	617	617	114	1,058
26	174	174	115	265
27	474	474	116	268
28	13,224	13,229	117	315
29	511	512	118	365
30	413	414	119	333
31	286	286	120	1,999
32	1,489	1,489	121	199
33	684	686	122	463
34	421	421	123	97
35	1,611	1,611	124	6,633
36	353	353	125	6,331
37	743	743	126	371
38	570	570	127	218
39	568	1,456	128	111
40	907	1,421	129	718
41	1,772	3,447	130	124
42	2,915	5,617	131	274
43	1,096	1,825	132	148
44	870	1,698	133	187
45	907	1,896	134	2,424
46	990	1,826	135	1,487
47	973	1,889	136	483
48	3,215	3,483	137	1,403
49	342	762	138	1,772
50	702	706	139	1,800
51	1,700	2,513	140	2,022
52	862	1,592	141	442
53	312	670	142	240
54	1,249	2,023	143	389
55	870	1,529	144	256
56	149	365	145	131
57	25	41	146	109
58	7,059	13,182	147	96
59	4,609	8,612	148	100
60	1,650	2,808	149	786
61	2,608	11,270	150	4,627
62	2,215	2,215	151	3,420
63	2,423	2,424	152	4,932
64	2,816	2,843	153	13,623
65	2,826	2,816	154	423
66	1,028	1,400	155	461
67	1,094	1,094	156	13,416
68	1,123	1,179	157	238
69	483	511	158	2,420
70	1,164	1,165	159	689
71	60	60	160	223
72	290	291	161	36
73	429	428	162	7,872
74	442	443	163	3,070
75	452	463	164	770
76	438	436	165	406
77	803	538	166	649
78	64	63	167	689
79	1,868	1,879	168	2,663
80	489	1,216	169	779
81	1,015	1,675	170	4,143
82	1,318	2,325	171	665
83	349	361	172	268
84	292	363	173	361
85	902	1,373	174	337
86	2,363	3,363	175	114
87	1,078	1,122	176	261
88	463	613	177	902
89	160	304		1,484

Disclaimer
 TYLIN assumes no responsibility arising from the use of this study by any private entity or any public agency for design, engineering, development, planning, building or permitting. The sole purpose of this study is for regional flood hazard identification and regional flood hazard planning for the Pinnacle Peak South Area Drainage Master Study.

EXHIBIT 19
100-YR, 24-HR FLOODPLAIN
CROSS-SECTIONS FOR
BASE/WORST-CASE
CONDITIONS

0 0.25 0.5 Miles

TYLIN INTERNATIONAL
 engineers | planners | scientists



**ATTACHMENT 2
HYDRAFLOW CALCULATIONS**

Channel Report

CS-1

User-defined

Invert Elev (ft) = 1614.00
 Slope (%) = 1.75
 N-Value = 0.032

Calculations

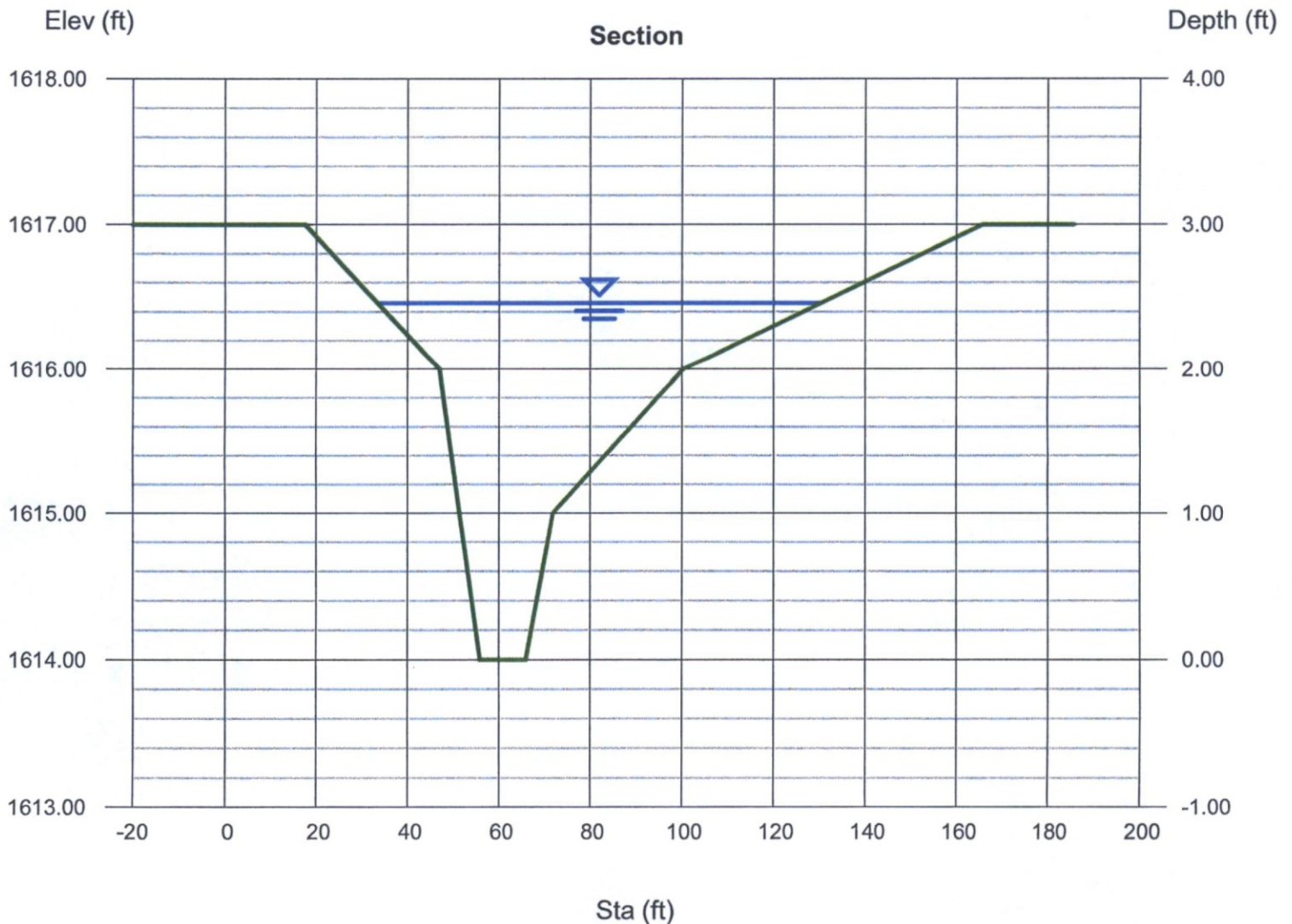
Compute by: Known Q
 Known Q (cfs) = 488.00

Highlighted

Depth (ft) = 2.46
 Q (cfs) = 488.00
 Area (sqft) = 86.59
 Velocity (ft/s) = 5.64
 Wetted Perim (ft) = 97.24
 Crit Depth, Yc (ft) = 2.51
 Top Width (ft) = 96.90
 EGL (ft) = 2.95

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

(0.00, 1617.00)-(17.60, 1617.00, 0.032)-(47.00, 1616.00, 0.032)-(51.40, 1615.00, 0.032)-(55.90, 1614.00, 0.032)-(65.90, 1614.00, 0.032)-(71.80, 1615.00, 0.032)-(100.30, 1616.00, 0.032)-(165.70, 1617.00, 0.032)



Channel Report

CS-2

User-defined

Invert Elev (ft) = 1611.00
 Slope (%) = 1.13
 N-Value = 0.032

Calculations

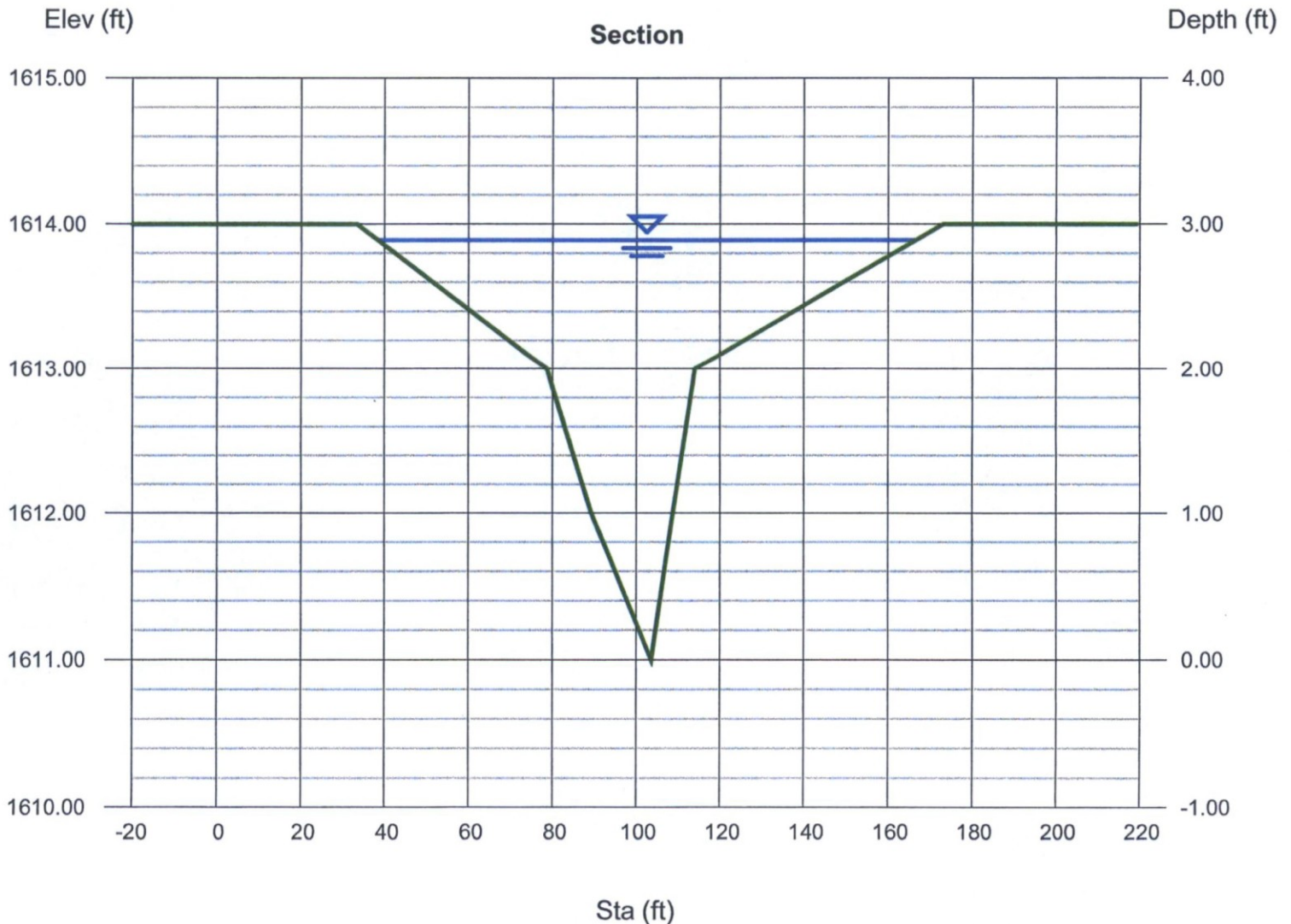
Compute by: Known Q
 Known Q (cfs) = 488.00

Highlighted

Depth (ft) = 2.89
 Q (cfs) = 488.00
 Area (sqft) = 109.68
 Velocity (ft/s) = 4.45
 Wetted Perim (ft) = 128.42
 Crit Depth, Yc (ft) = 2.77
 Top Width (ft) = 128.13
 EGL (ft) = 3.20

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

(0.00, 1614.00)-(33.40, 1614.00, 0.032)-(78.70, 1613.00, 0.032)-(89.40, 1612.00, 0.032)-(103.60, 1611.00, 0.032)-(108.70, 1612.00, 0.032)-(114.00, 1613.00, 0.032)
 -(173.00, 1614.00, 0.032)-(199.30, 1614.00, 0.032)



Channel Report

CS-3

User-defined

Invert Elev (ft) = 1608.00
 Slope (%) = 2.33
 N-Value = 0.032

Calculations

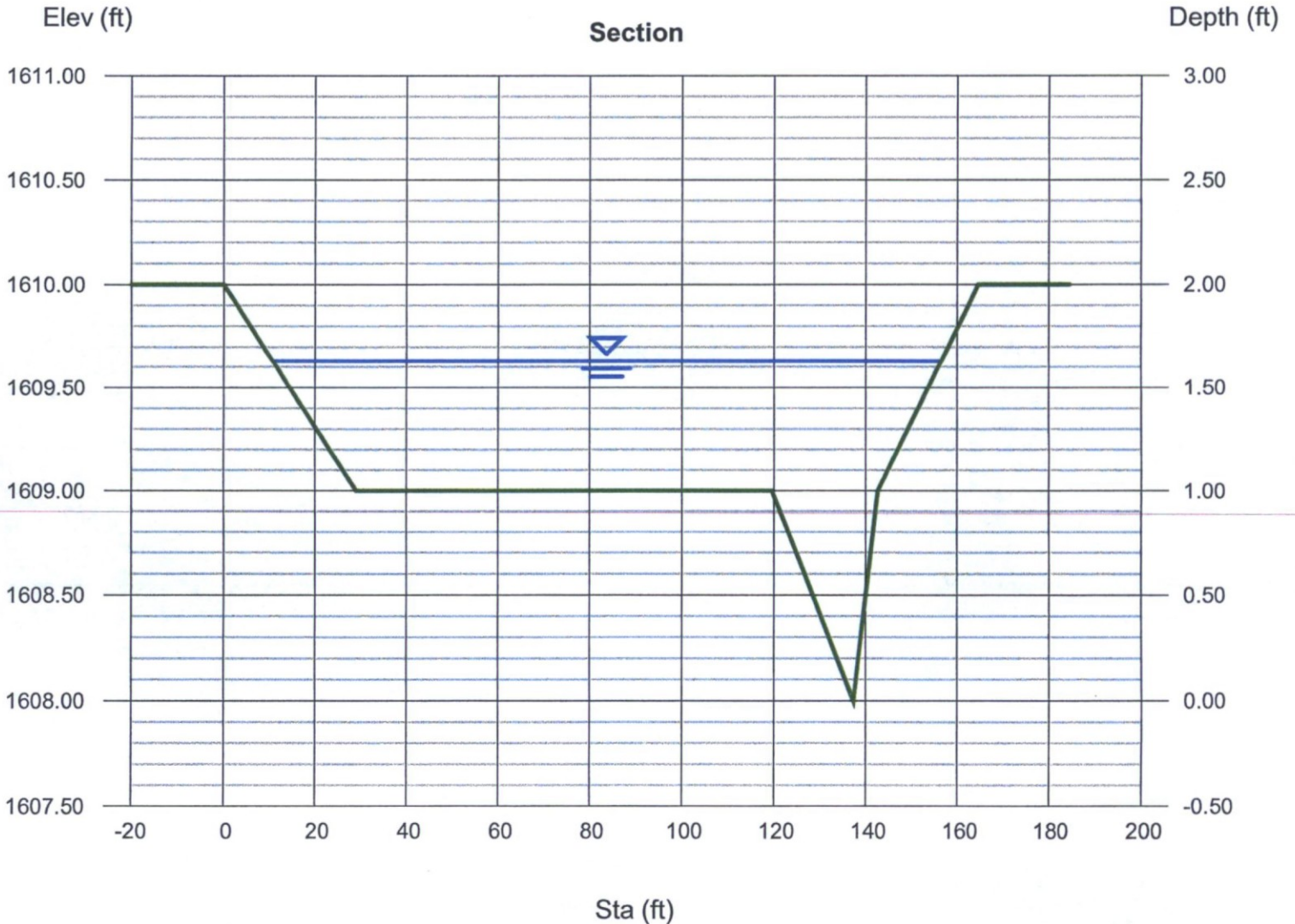
Compute by: Known Q
 Known Q (cfs) = 488.00

Highlighted

Depth (ft) = 1.63
 Q (cfs) = 488.00
 Area (sqft) = 93.31
 Velocity (ft/s) = 5.23
 Wetted Perim (ft) = 145.94
 Crit Depth, Yc (ft) = 1.70
 Top Width (ft) = 145.79
 EGL (ft) = 2.06

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

(0.00, 1610.00)-(29.10, 1609.00, 0.032)-(119.50, 1609.00, 0.032)-(137.40, 1608.00, 0.032)-(142.70, 1609.00, 0.032)-(164.70, 1610.00, 0.032)



Channel Report

CS-4

User-defined

Invert Elev (ft) = 1604.00
 Slope (%) = 2.06
 N-Value = 0.032

Calculations

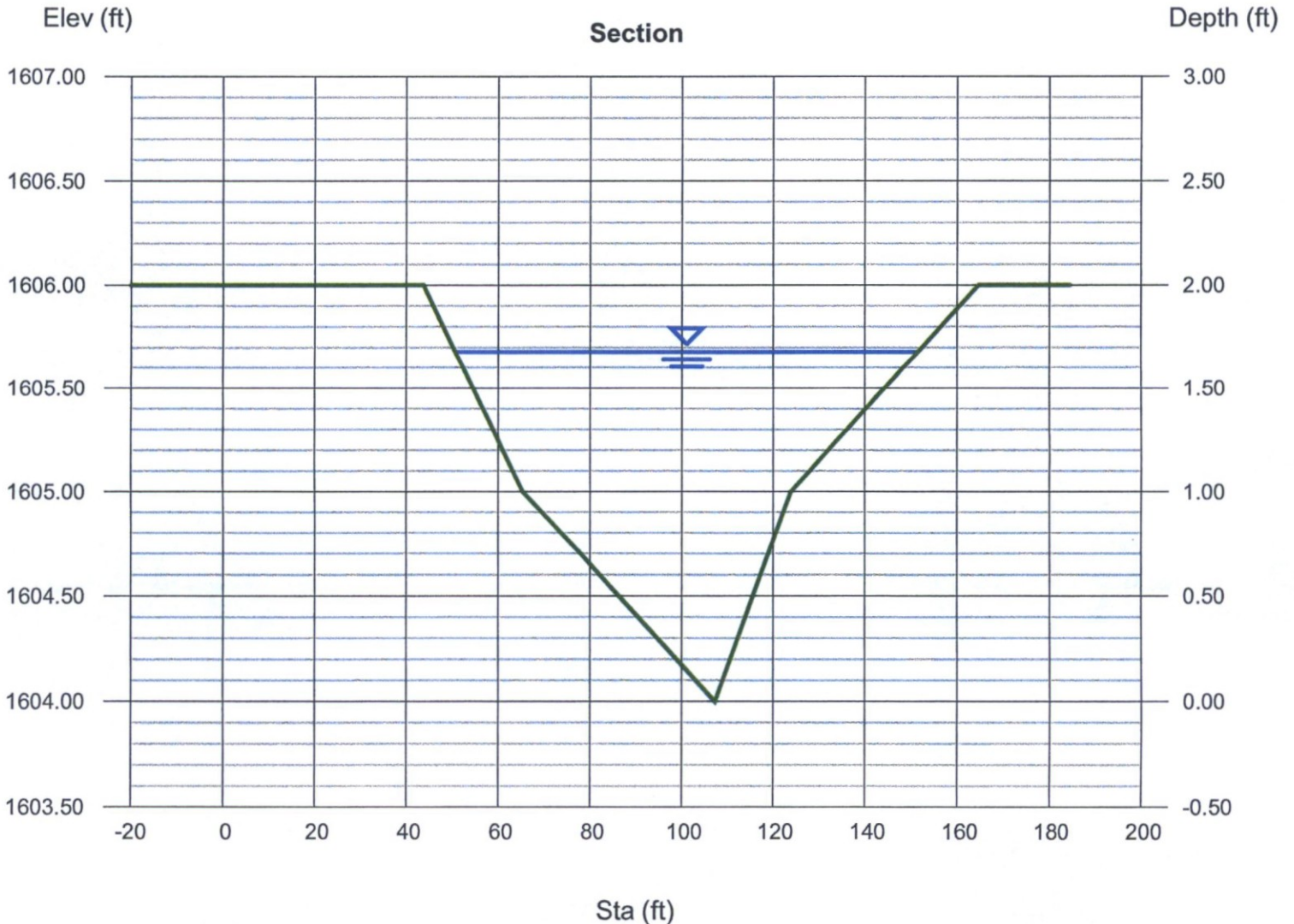
Compute by: Known Q
 Known Q (cfs) = 488.00

Highlighted

Depth (ft) = 1.68
 Q (cfs) = 488.00
 Area (sqft) = 83.56
 Velocity (ft/s) = 5.84
 Wetted Perim (ft) = 101.03
 Crit Depth, Yc (ft) = 1.77
 Top Width (ft) = 100.97
 EGL (ft) = 2.21

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

(0.00, 1606.00)-(43.70, 1606.00, 0.032)-(65.30, 1605.00, 0.032)-(107.40, 1604.00, 0.032)-(123.90, 1605.00, 0.032)-(164.60, 1606.00, 0.032)



Channel Report

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CS-5

User-defined

Invert Elev (ft) = 1601.00
Slope (%) = 1.82
N-Value = 0.032

Calculations

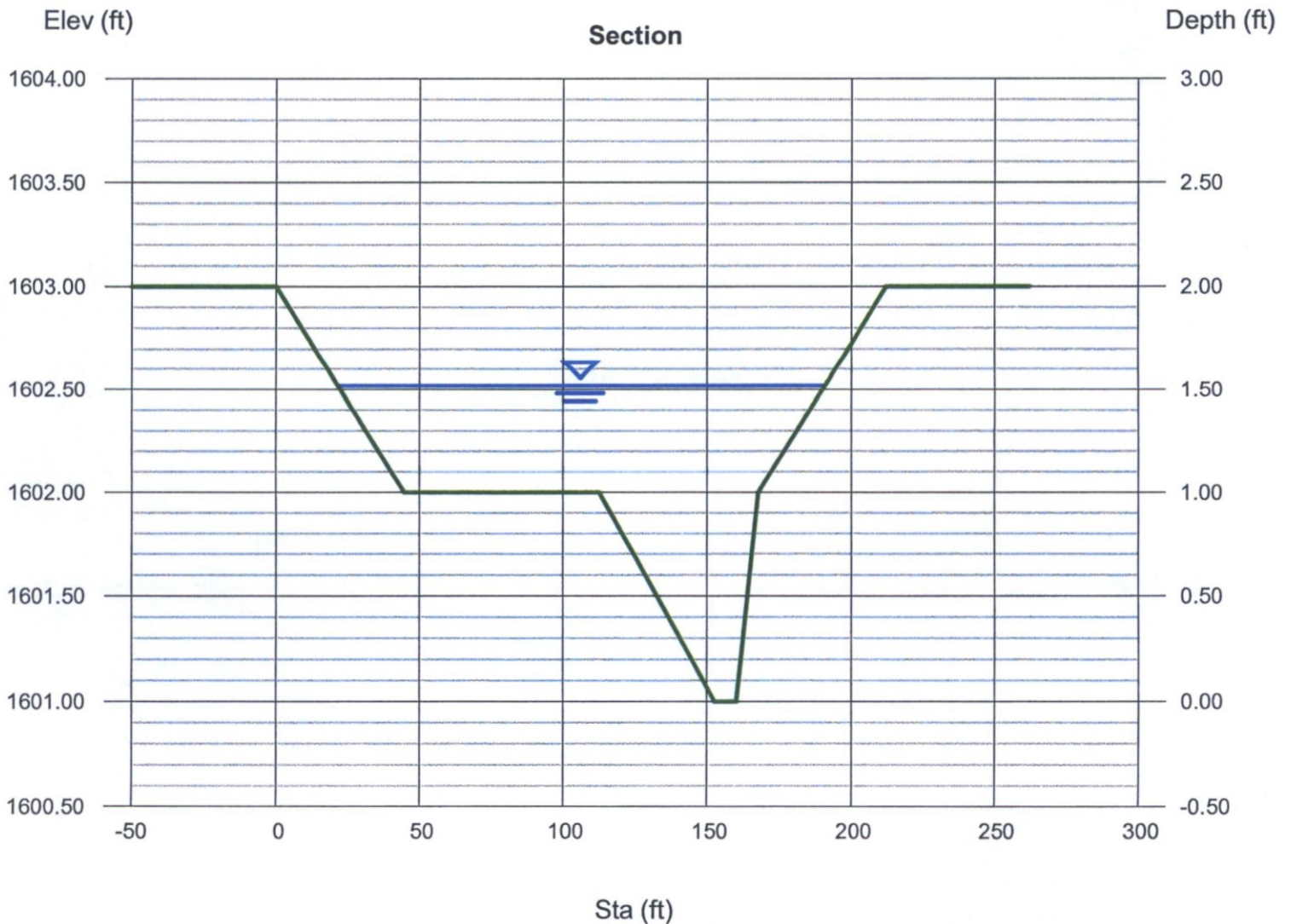
Compute by: Known Q
Known Q (cfs) = 488.00

Highlighted

Depth (ft) = 1.52
Q (cfs) = 488.00
Area (sqft) = 107.17
Velocity (ft/s) = 4.55
Wetted Perim (ft) = 169.48
Crit Depth, Yc (ft) = 1.53
Top Width (ft) = 169.39
EGL (ft) = 1.84

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

(0.00, 1603.00)-(44.70, 1602.00, 0.032)-(112.80, 1602.00, 0.032)-(152.80, 1601.00, 0.032)-(160.20, 1601.00, 0.032)-(167.70, 1602.00, 0.032)-(212.20, 1603.00, 0.0)



Channel Report

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CS-6

User-defined

Invert Elev (ft) = 1600.00
 Slope (%) = 1.62
 N-Value = 0.032

Calculations

Compute by: Known Q
 Known Q (cfs) = 488.00

Highlighted

Depth (ft) = 0.45
 Q (cfs) = 488.00
 Area (sqft) = 151.55
 Velocity (ft/s) = 3.22
 Wetted Perim (ft) = 360.69
 Crit Depth, Yc (ft) = 0.42
 Top Width (ft) = 360.65
 EGL (ft) = 0.61

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

(0.00, 1602.00)-(22.60, 1601.00, 0.032)-(122.10, 1600.00, 0.032)-(435.10, 1600.00, 0.032)-(441.50, 1601.00, 0.032)-(534.40, 1602.00, 0.032)

