CITY OF ALBUQUERQUE

Planning Department
Alan Varela, Director

Mayor Timothy M. Keller

October 28, 2022

Yolanda Padilla Moyer, P.E.
Bohannan Huston
7500 Jefferson St NE
Albuquerque, NM 87109

RE: Arroyo Vista Median Swale
Grading and Drainage Plans
Engineer's Stamp Date: 06/6/19
Hydrology File: J08D005, CPN 651182

Dear Ms. Padilla Moyer:

PO Box 1293

Albuquerque

NM 87103

www.cabq.gov

Based upon the information provided in your email received on 10/06/2022 and as-builts received 10/24/2022 the proposed submittals are approved.

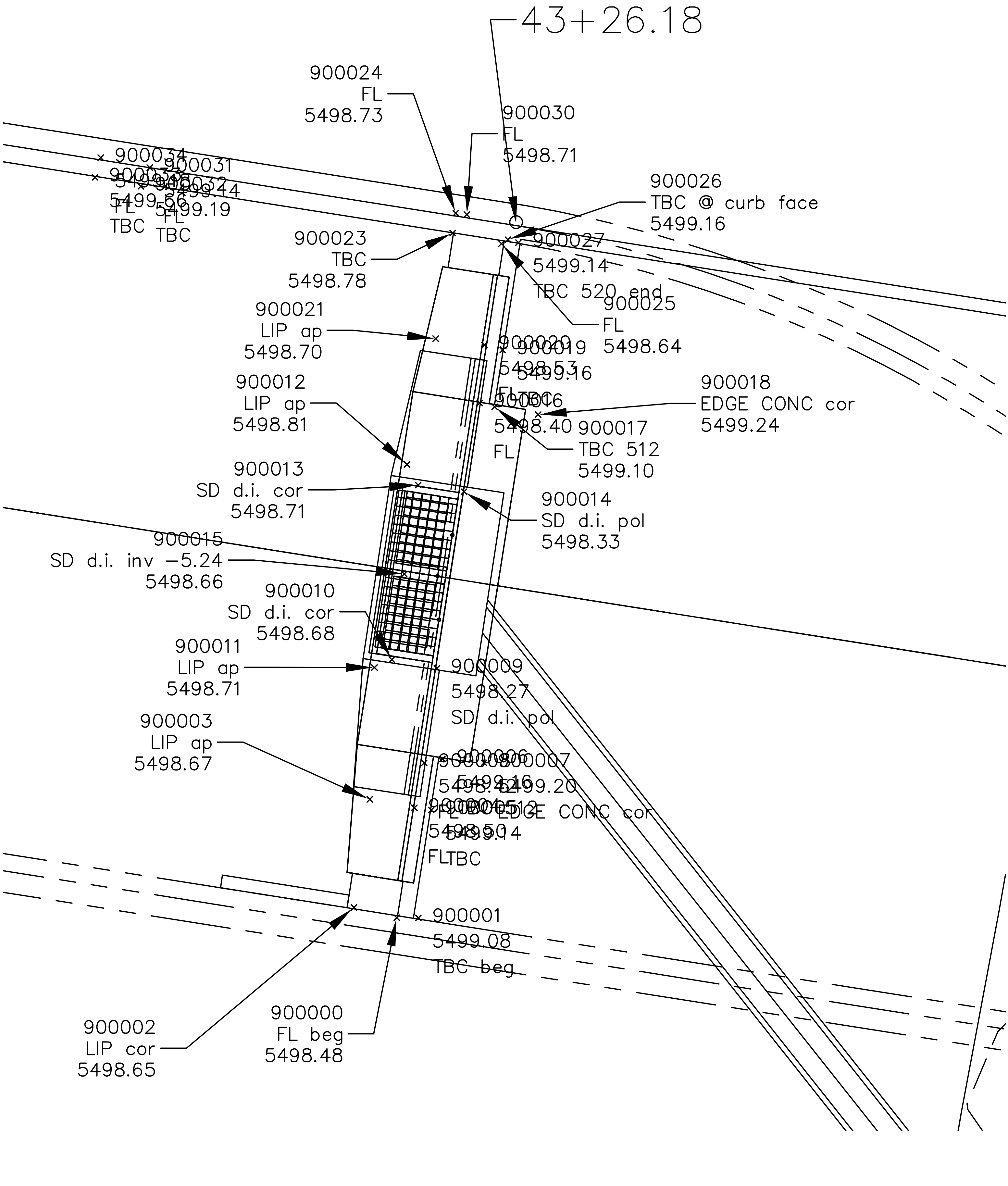
Please submit a Design Revision to DRC to include the berm at the west end of Arroyo Vista Blvd.

When submitting the Engineer's Certification for Releasee of Financial Guaranty; include the berm discussed previously as well as the solution to move the drainage away from the wall at lots 8 and 9 in Phase 1-C, as discussed in the field or have the Developer direct the Contractor to grade this area per the approved grading plan.

If you have any questions, please contact me at 924-3999 or sbiazar@cabq.gov.

Sincerely,

Shahab Biazar, P.E. CFM
City Engineer
Development Review Services
Planning Department


43+26.18
900024
FL
5498.73
900030
FL
5498.71
900026
TBC @ curb face
5499.16
900023
TBC
5498.78
900027
5499.14
TBC 520 end
900025
FL
5498.64
900021
LIP ap
5498.70
900018
EDGE CONC cor
5499.24
900012
LIP ap
5498.81
900017
TBC 512
5499.10
900013
SD d.i. cor
5498.71
900014
SD d.i. pol
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900015
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5498.66
900010
SD d.i. cor
5498.68
900011
LIP ap
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900001
5499.08
TBC beg
900002
LIP cor
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900000
FL beg
5498.48

Bohannan ▲ Huston

7500 Jefferson St. NE
Albuquerque, NM
87109-4335

www.bhinc.com

voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

October 6, 2022

Mr. Shahab Biazar, PE
City Engineer
City of Albuquerque
Planning Department, Development Review Services
600 2nd Street NW
Albuquerque, NM 87103

Subject: Arroyo Vista Median Swale

Dear Shahab:

See below for your original comment and then the responses in red.

1. Per the DPM Figure 6.9.9, the capacity of a double inlet at 0.7' of depth at 0.2% slope is 10 cfs. The submittal states there is 29 cfs. The inlet appears to be undersized. The city does not count the 'throat' for its inlet capacity as is it there in case the grate plugs, which happened during the storm event referenced above.

The information you provide is for an inlet that is on-grade. We are in sump condition. The inlet is sized adequately in sump. We prepared a side weir calculation that indicated 16' of width of curb needed to be removed to pass the flow into the location of the sump inlet. I have attached the submittal and approval to this letter.

2. From a site visit it appears that 2/3 or so of Basin OS-2 drains to Basin U2-H before entering Arroyo Vista Blvd ROW. Grades were altered during wall construction, so existing grades cannot be used. In addition, the land was driven/worked on. Please update the basin calcs to 2/3 of 1.36 acres= 0.9 acres and use 100% Type C land treatment. In addition, Basin OS-2 should be broken up into two basins as there are two outfall locations. This would alsThis would also allow for an "Arrow" showing the outfall location through Basin U2-H.

After a site visit, I disagree that 2/3 of Basin OS-2 gets to Arroyo Vista. I stand by my revised calculation that 14% of OS-2 drains to Arroyo Vista with the remaining portion draining over the walls and into the subdivision. However, the 2/3 portion was calculated along with the 14% and are listed below. I have added the 2/3 of Basin OS-2 of 2.6cfs to the inlet location downstream and the inlet can still accommodate this additional 2.6cfs. See enclosed revised exhibits enclosed.

BASIN I.D.	AREA	% LAND TREATMENT				DISCHARGE (CFS)	VOLUME (AC-FT)
	(AC)	A	B	C	D	100 yr	100 yr
OS-2A	0.90	0.00%	0.00%	100.00%	0.00%	2.6	0.07
OS-2A	0.19	0.00%	0.00%	100.00%	0.00%	0.5	0.02

3. Update the calculations for the inlet at the east end of the swale with the revised flow rate.

See response above and exhibits enclosed.

4. For Basin OS-1, move/point the flow arrow so that it is clear that this basin drains to the
arroyo located south of the Arroyo Vista Blvd ROW.
Flow arrow was previous shown just to light. it has been updated to remove previous arrow and darken new arrow

Submit a Design Revision to DRC to include the berm at the west end of Arroyo Vista Blvd. A design revision will be sent through DRC

When submitting the Engineer's Certification for Releasee of Financial Guaranty; include the berm discussed aboveas well as the solution to move the drainage away from the wall at lots 8 and 9 in Phase 1-C, as discussed in the field or have the Developer direct the Contractor to grade this area per the approved grading plan. The berm will get added to the certification. Based on the site visit on 10-5-2022, a rock diversion berm was add at Lot 9 to divert the water away from the back of the lots to drain along the west boundary adjacent the new berm to get the water to Arroyo Vista.

Please let me know if you have any questions.

Sincerely,

Yolanda Padilla Moyer

Yolanda Padilla Moyer, P.E.
Vice President
Community Development and Planning

Cc: Kevin Patton\Pulte Homes

Updated exhibits based on comments

INSPIRATION SUBDIVISION

PROPOSED BASINS MAP

MAY 2019

DEVELOPED BASIN SUMMARY									
BASIN I.D.	AREA	% LAND TREATMENT				DISCHARGE (CFS)	DISCHARGE (CFS)	VOLUME (AC-FT)	VOLUME (AC-FT)
	(AC)	A	B	C	D	10 yr	100 yr	10 yr	100 yr
U1-A	3.01	0.00%	30.00%	30.00%	40.00%	8.2	9.7	0.17	0.32
U1-B	2.95	0.00%	30.00%	30.00%	40.00%	8.0	9.5	0.17	0.32
U1-C	2.65	0.00%	0.00%	85.00%	15.00%	6.7	8.2	0.12	0.25
U1-D	0.54	0.00%	0.00%	90.00%	10.00%	1.3	50% 1.6	0.02	0.05
U1-E	0.23	0.00%	0.00%	10.00%	90.00%	1.0	1.0	0.02	0.04
U1-F	3.79	0.00%	30.00%	30.00%	40.00%	10.4	12.2	0.22	0.41
U1-G	0.67	0.00%	0.00%	90.00%	10.00%	1.6	2.0	0.03	0.06
U1-H	0.97	0.00%	30.00%	30.00%	40.00%	2.6	3.1	0.06	0.10
U1-I	2.86	0.00%	30.00%	30.00%	40.00%	7.8	9.2	0.17	0.31
U1-J	0.86	0.00%	30.00%	30.00%	40.00%	2.4	2.8	0.05	0.09
U1-K	1.12	0.00%	30.00%	30.00%	40.00%	3.1	3.6	0.06	0.12
U1-L	2.73	0.00%	30.00%	30.00%	40.00%	7.5	8.8	0.16	0.29
U1-M	0.94	0.00%	0.00%	10.00%	90.00%	3.9	4.0	0.09	0.15
U2-A	2.04	0.00%	30.00%	30.00%	40.00%	5.6	6.6	0.12	0.22
U2-B	2.71	0.00%	0.00%	90.00%	10.00%	6.6	8.2	0.12	0.25
U2-C	1.23	0.00%	30.00%	30.00%	40.00%	3.4	4.0	0.07	0.13
U2-D	1.27	0.00%	30.00%	30.00%	40.00%	3.5	4.1	0.07	0.14
U2-E	1.67	0.00%	30.00%	30.00%	40.00%	4.6	5.4	0.10	0.18
U2-F	1.89	0.00%	30.00%	30.00%	40.00%	5.2	6.1	0.11	0.20
U2-G	4.83	0.00%	30.00%	30.00%	40.00%	13.2	15.5	0.28	0.52
U2-H	0.91	0.00%	0.00%	90.00%	10.00%	2.2	2.7	0.04	0.08
U2-I	1.43	0.00%	30.00%	30.00%	40.00%	3.9	4.6	0.08	0.15
U2-J	1.19	0.00%	30.00%	30.00%	40.00%	3.2	3.8	0.07	0.13
U2-K	0.67	0.00%	30.00%	30.00%	40.00%	1.8	2.1	0.04	0.07
U2-L	1.25	0.00%	30.00%	30.00%	40.00%	3.4	4.0	0.07	0.13
U2-M	0.78	0.00%	0.00%	10.00%	90.00%	3.2	3.3	0.08	0.12
U2-O	0.19	0.00%	0.00%	10.00%	90.00%	0.8	0.8	0.02	0.03
U2-N	1.36	0.00%	0.00%	90.00%	10.00%	3.3	4.1	0.06	0.12
U3-A	4.89	0.00%	30.00%	30.00%	40.00%	13.3	15.7	0.28	0.52
U3-B	0.71	0.00%	30.00%	30.00%	40.00%	1.9	2.3	0.04	0.08
U3-C	1.08	0.00%	30.00%	30.00%	40.00%	2.9	3.5	0.06	0.12
U3-D	7.11	0.00%	30.00%	30.00%	40.00%	19.4	22.9	0.41	0.76
U3-E	7.65	0.00%	30.00%	30.00%	40.00%	20.9	24.6	0.44	0.82
U3-F	7.28	0.00%	30.00%	30.00%	40.00%	19.9	23.4	0.42	0.78
U3-G	9.76	0.00%	30.00%	30.00%	40.00%	26.6	31.4	0.56	1.05
U3-H	0.99	0.00%	30.00%	30.00%	40.00%	2.7	3.2	0.06	0.11
U3-I	0.72	0.00%	30.00%	30.00%	40.00%	2.0	2.3	0.04	0.08
U3-J	1.74	0.00%	30.00%	30.00%	40.00%	4.7	5.6	0.10	0.19
TOTAL	**88.66**					**242.6**	**285.6**	**5.1**	**9.5**

BASIN I.D.	AREA	% LAND TREATMENT				DISCHARGE (CFS)	VOLUME (AC-FT)
	(AC)	A	B	C	D	100 yr	100 yr
* OS-2A	0.90	0.00%	0.00%	100.00%	0.00%	2.6	0.07
OS-2A	0.19	0.00%	0.00%	100.00%	0.00%	0.5	0.02
OS-1	10.34	50.00%	25.00%	25.00%	0.00%	15.8	0.66
OS-2	1.36	50.00%	25.00%	25.00%	0.00%	2.1	0.09
OS-3	1.90	50.00%	25.00%	25.00%	0.00%	2.9	0.12
OS-4	3.54	50.00%	25.00%	25.00%	0.00%	5.4	0.23
OS-5	3.35	50.00%	25.00%	25.00%	0.00%	5.1	0.21
OS-6	14.50	50.00%	25.00%	25.00%	0.00%	22.1	0.92
OS-7	3.21	50.00%	25.00%	25.00%	0.00%	4.9	0.20
TOTAL	**34.99**					**58.3**	**2.4**

ARROYO VISTA BASIN SUMMARY									
BASIN I.D.	AREA	% LAND TREATMENT				DISCHARGE (CFS)	DISCHARGE (CFS)	VOLUME (AC-FT)	VOLUME (AC-FT)
	(AC)	A	B	C	D	10 yr	100 yr	10 yr	100 yr
AR-1	4.21	0.00%	0.00%	15.00%	85.00%	16.9	17.5	0.39	0.64
AR-2	2.01	0.00%	0.00%	10.00%	90.00%	8.3	8.5	0.19	0.31
AR-3	2.82	0.00%	0.00%	10.00%	90.00%	11.6	11.9	0.27	0.44
AR-4	2.59	0.00%	0.00%	10.00%	90.00%	75% 10.7	10.9	0.25	0.40
AR-5	2.61	0.00%	0.00%	10.00%	90.00%	10.7	11.0	0.25	0.41
AR-6	2.01	0.00%	0.00%	10.00%	90.00%	8.3	8.5	0.19	0.31
TOTAL	**16.26**					**66.4**	**68.3**	**1.6**	**2.5**
AR-SOUTH	2.11	0.00%	0.00%	100%	0.00%	1.6	2.11		

LEGEND

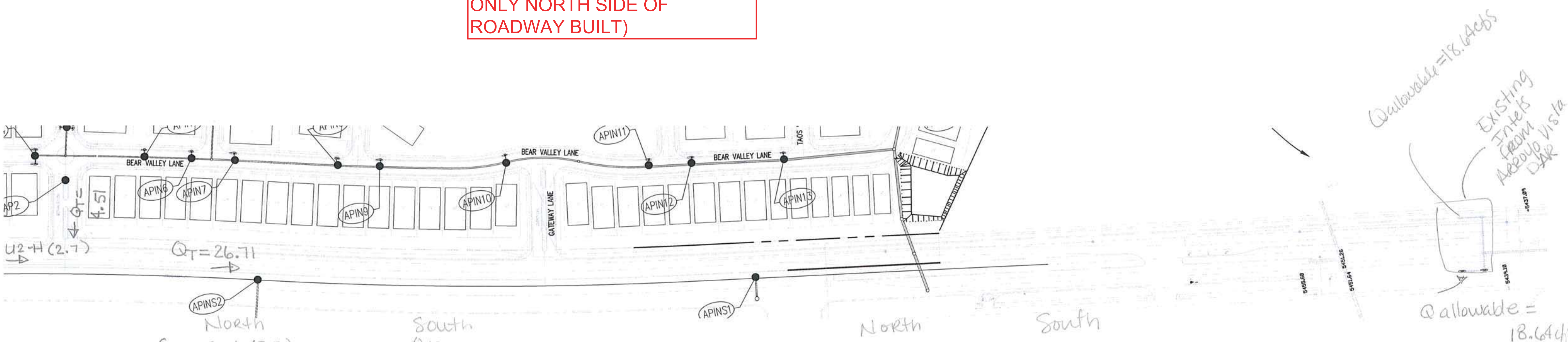
BASIN BOUNDARY	
FLOW ARROW	
PROPOSED STORM DRAIN	
EXISTING STORM DRAIN	
PROPOSED STREET SLOPE OR FLOW PATH	2.19%
PROPOSED STORM DRAIN MANHOLE	
PROPOSED STORM DRAIN INLET	
ANALYSIS POINT	APXX

Sat, 24–Aug–2019 – 10:42:am, Plotted by: YPADILLA
P:\20190120\CDP\Plans\General\DMP\20190120_Ultimate Basins Map.dwg

* REVISION 10-6-2022

Bohannan Huston
www.bhinc.com 800.877.5332

ARROYO VISTA MEDIAN SWALE (INTERIM CONDITION WITH ONLY NORTH SIDE OF ROADWAY BUILT)



North

Q_{100} = U2-H (2.7)

U2-O (.8)

Bear Valley (3.71)(AP2)

AR-6 ~~(8.5)~~ 8.3

~~15.71~~ 15.51

~~14%OS-2=0.29cfs Tot=15.8cfs~~

*2.6 cfs

18.11 cfs

South

Q100

AR-5 (11)

11 cfs

North

Q100 = U1G (2.0cfs)

U1E (1.0cfs)

75AR4 ~~(8.18)~~ 8.03

~~75U1D (1.2)~~ 0.50 0.80

~~AR-3 (11.9)~~

QT = 12.28 cfs

11.38

South

AR-3 (11.9)

QT = 11.9cfs

North

Q100

AR-2 8.5

(25) AR-4 2.72

(25) U1D .4cfs

11.62

South

AR-1 17.5

North Half

Q_{10} = U2-H (2.2)

U2-O (.8)

AR-6 (8.3)

Bear Valley (3.71)

15.01 cfs

South Half

AR-5 (10.7cfs)

10.7cfs

AR-South (Interim) = 2.11cfs

~~Q100total=29.29cfs~~

*31.59 cfs

ARROYO Vista

Q_{10}

North Half

U1G (1.6)

U1E 1.0

75AR4 (8.03)

75U1D (.98)

QT = 11.61

South Half

AR-3 (11.6)

QT = 11.6

Q10

AR2 8.3

25AR4 2.67

25U1D .33

11.3

AR-1 16.9

* REVISION 10-6-2022

Inlet Schematic 7

Double Type "A" Sump- Inlet A

ANALYSIS OF AN INLET IN A SUMP CONDITION - **INLET INS1 INS2 ARROYO VISTA**

INLET TYPE: Double Grate Type "A" with curb opening wings on both sides on inlet.

<u>WEIR:</u> Q=C*L*H^1.5		<u>ORIFICE:</u> Q=C*A*(2*G*H)**0.5	
<u>Wing opening</u>	<u>Grate opeining</u>	<u>Grate opening</u>	<u>Wing opening</u>
C= 3.0	C=3.0	C=0.6	C=0.6
L= 4.0 ft	L(double grate)=[2(2.67')+2(1.8')]=8.94 ft	A(double grate)=7.14 sf	A=2.0 sf
Q=3.0(4.0')H**1.5= 12.0H**1.5	Q=3.0(8.94)H^1.5=26.82*H^1.5	Q=4.194*(64.4*H)^0.5	Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	**COMMENTS:**	
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings	
	0.10	0.10	0.38	0.85	10.87	1.61	Weir controls on grate analysis	
	0.20	0.20	1.07	2.40	15.37	4.55		
	0.30	0.30	1.97	4.41	18.83	8.35		
	0.40	0.40	3.04	6.78	21.74	12.86		
	0.50	0.50	4.24	9.48	24.31	17.97		
	0.60	0.60	5.58	12.46	26.63	23.62	IN S1Q(100 yr) = 24.18 cfs is provided at this dep	ULTIMATE
TOP OF CURB	0.70	0.70	7.03	15.71	28.76	29.76	IN S2 Q(100 yr) = 26.71 cfs is provided at this de	ULTIMATE
	0.80	0.80	8.59	19.19	30.75	36.36	~~IN S2 Q(100YR)29.29 CFS (INTERIM)~~	
	0.90	0.90	10.25	22.90	32.61	43.39	*31.59 cfs, d=.72	
ROW LIMIT	1.00	1.00	12.00	26.82	34.38	50.82		

NOTE: The total runoff intercepted by the inlet at the low point in the road is:

Qr(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].

* REVISION 10-6-2022

Side Weir Calcs and approval

Yolanda Padilla Moyer

From: Armijo, Ernest M. <earmijo@cabq.gov>
Sent: Wednesday, May 12, 2021 4:19 PM
To: Yolanda Padilla Moyer; Cherne, Curtis
Cc: Kevin Patton
Subject: RE: Arroyo Vista Median Calcs.

Yolanda,
This is good. Much better. I had looked this over and I am giving Hydrology approval of this.

ERNEST ARMIJO, P.E.
principal engineer
o 505.924.3986
e earmijo@cabq.gov
cabq.gov/planning

From: Yolanda Padilla Moyer [mailto:ypadilla@bhinc.com]
Sent: Wednesday, May 12, 2021 2:57 PM
To: Armijo, Ernest M.; Cherne, Curtis
Cc: Kevin Patton
Subject: RE: Arroyo Vista Median Calcs.

Hi Ernest. Is this better? I can try again if you want it darker still.

From: Armijo, Ernest M. <earmijo@cabq.gov>
Sent: Wednesday, May 12, 2021 2:07 PM
To: Yolanda Padilla Moyer <ypadilla@bhinc.com>; Cherne, Curtis <CCherne@cabq.gov>
Cc: Kevin Patton <Kevin.Patton@PulteGroup.com>
Subject: RE: Arroyo Vista Median Calcs.

Yolanda,
I have been looking at this and could you possibly see if you can darken up sheet 2 of the package you sent. I have had a hard time reading the handwritten notes on there. I am inclined to allow this but I want to make sure I have all the info laid out.

ERNEST ARMIJO, P.E.
principal engineer
o 505.924.3986
e earmijo@cabq.gov
cabq.gov/planning

From: Yolanda Padilla Moyer [mailto:ypadilla@bhinc.com]
Sent: Monday, May 10, 2021 10:34 AM
To: Cherne, Curtis; Armijo, Ernest M.
Cc: Kevin Patton
Subject: FW: Arroyo Vista Median Calcs.

Hello Curtis and Ernest,
I wanted to see if you all had a chance to review and if there were any questions.

Can you please provide an update?

Thanks
Yolanda

From: Yolanda Padilla Moyer
Sent: Wednesday, April 21, 2021 1:44 PM
To: Armijo, Ernest M. <earmijo@cabq.gov>; Cherne, Curtis <CCherne@cabq.gov>
Cc: Kevin Patton <Kevin.Patton@PulteGroup.com>
Subject: Arroyo Vista Median Calcs.

Hi Curtis and Ernest,

Per our previous conversations, enclosed are the calculation for a side weir to determine how wide an opening will be needed to collect the flow in Arroyo Vista and be captured by inlet within the median. It was determined that yes the roadway section can hold the total flow of 27.99. We have 34 curb 6" curb openings which will accept approx. 0.5cfs per opening. With that there will be 10.99cfs remaining in Arroyo Vista as it approaches the inlet location. Per the side weir calculation an approx. 15.76' opening will be needed to collect the remaining flow. When we first spoke we had discussed removing a couple of stone of curb and to replace it with rundown curb. This calculation is in line with our original thought.

Side weir calcs are primarily used for a large channel\conveyance (i.e river) where they are trying to divert flow to somewhere else. They provide a side weir vertically offset from the bottom on the channel to divert a certain amount of flow. I was able to use the calculation in a simplified equation to calculate the width of the opening based on the flow depth and the known Q. This equation does not utilize the side slope\cross-slope of the roadway which I assume would only help divert the flow if it were taken into account.

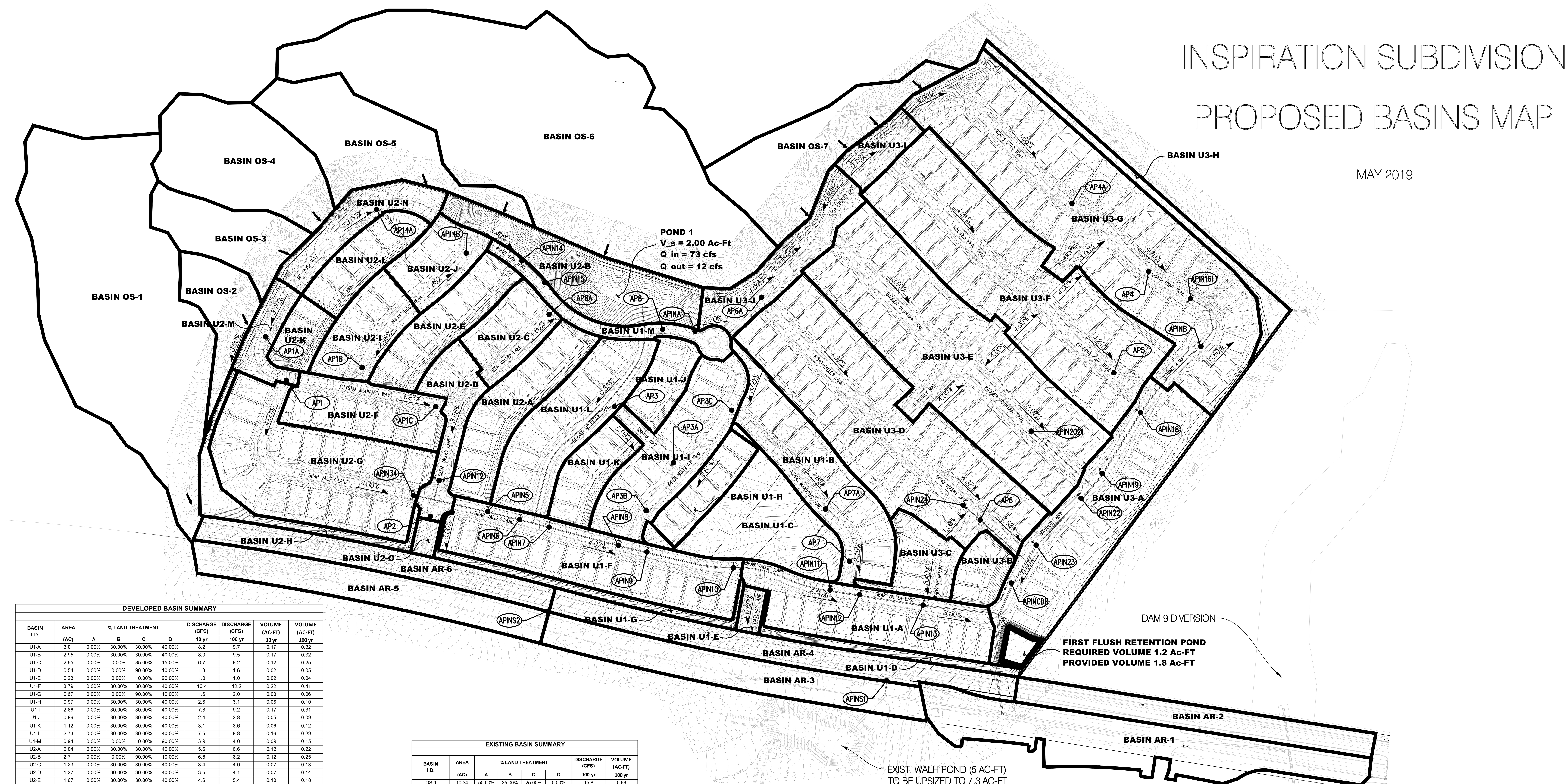
Please let me know if you have any questions.

Thanks
Yolanda

INSPIRATION SUBDIVISION

PROPOSED BASINS MAP

MAY 2019



DEVELOPED BASIN SUMMARY

BASIN I.D.	AREA (AC)	% LAND TREATMENT A	B	C	D	DISCHARGE (CFS) 10 yr	DISCHARGE (CFS) 100 yr	VOLUME (AC-FT) 10 yr	VOLUME (AC-FT) 100 yr
U1-A	3.01	0.00%	30.00%	30.00%	40.00%	8.2	9.7	0.17	0.32
U1-B	2.95	0.00%	30.00%	30.00%	40.00%	8.0	9.5	0.17	0.32
U1-C	2.65	0.00%	0.00%	85.00%	15.00%	6.7	8.2	0.12	0.25
U1-D	0.54	0.00%	0.00%	90.00%	10.00%	1.3	1.6	0.02	0.05
U1-E	0.23	0.00%	0.00%	10.00%	90.00%	1.0	1.0	0.02	0.04
U1-F	3.79	0.00%	30.00%	30.00%	40.00%	10.4	12.2	0.22	0.41
U1-G	0.67	0.00%	0.00%	90.00%	10.00%	1.6	2.0	0.03	0.06
U1-H	0.97	0.00%	30.00%	30.00%	40.00%	2.6	3.1	0.06	0.10
U1-I	2.86	0.00%	30.00%	30.00%	40.00%	7.8	9.2	0.17	0.31
U1-J	0.86	0.00%	30.00%	30.00%	40.00%	2.4	2.8	0.05	0.09
U1-K	1.12	0.00%	30.00%	30.00%	40.00%	3.1	3.6	0.06	0.12
U1-L	2.73	0.00%	30.00%	30.00%	40.00%	7.5	8.8	0.16	0.29
U1-M	0.94	0.00%	0.00%	10.00%	90.00%	3.9	4.0	0.09	0.15
U2-A	2.04	0.00%	30.00%	30.00%	40.00%	5.6	6.6	0.12	0.22
U2-B	2.71	0.00%	0.00%	90.00%	10.00%	6.6	8.2	0.12	0.25
U2-C	1.23	0.00%	30.00%	30.00%	40.00%	3.4	4.0	0.07	0.13
U2-D	1.27	0.00%	30.00%	30.00%	40.00%	3.5	4.1	0.07	0.14
U2-E	1.67	0.00%	30.00%	30.00%	40.00%	4.6	5.4	0.10	0.18
U2-F	1.89	0.00%	30.00%	30.00%	40.00%	5.2	6.1	0.11	0.20
U2-G	4.83	0.00%	30.00%	30.00%	40.00%	13.2	15.5	0.28	0.52
U2-H	0.91	0.00%	0.00%	90.00%	10.00%	2.2	2.7	0.04	0.08
U2-I	1.43	0.00%	30.00%	30.00%	40.00%	3.9	4.6	0.08	0.15
U2-J	1.19	0.00%	30.00%	30.00%	40.00%	3.2	3.8	0.07	0.13
U2-K	0.67	0.00%	30.00%	30.00%	40.00%	1.8	2.1	0.04	0.07
U2-L	1.25	0.00%	30.00%	30.00%	40.00%	3.4	4.0	0.07	0.13
U2-M	0.78	0.00%	0.00%	10.00%	90.00%	3.2	3.3	0.08	0.12
U2-O	0.19	0.00%	0.00%	10.00%	90.00%	0.8	0.8	0.02	0.03
U2-N	1.36	0.00%	0.00%	90.00%	10.00%	3.3	4.1	0.06	0.12
U3-A	4.89	0.00%	30.00%	30.00%	40.00%	13.3	15.7	0.28	0.52
U3-B	0.71	0.00%	30.00%	30.00%	40.00%	1.9	2.3	0.04	0.08
U3-C	1.08	0.00%	30.00%	30.00%	40.00%	2.9	3.5	0.06	0.12
U3-D	7.11	0.00%	30.00%	30.00%	40.00%	19.4	22.9	0.41	0.76
U3-E	7.65	0.00%	30.00%	30.00%	40.00%	20.9	24.6	0.44	0.82
U3-F	7.28	0.00%	30.00%	30.00%	40.00%	19.9	23.4	0.42	0.78
U3-G	9.76	0.00%	30.00%	30.00%	40.00%	26.6	31.4	0.56	1.05
U3-H	0.99	0.00%	30.00%	30.00%	40.00%	2.7	3.2	0.06	0.11
U3-I	0.72	0.00%	30.00%	30.00%	40.00%	2.0	2.3	0.04	0.08
U3-J	1.74	0.00%	30.00%	30.00%	40.00%	4.7	5.6	0.10	0.19
TOTAL	**88.66**					**242.6**	**285.6**	**5.1**	**9.5**

EXISTING BASIN SUMMARY

BASIN I.D.	AREA (AC)	% LAND TREATMENT A	B	C	D	DISCHARGE (CFS) 100 yr	VOLUME (AC-FT) 100 yr
OS-1	10.34	50.00%	25.00%	25.00%	0.00%	15.8	0.66
OS-2	1.36	50.00%	25.00%	25.00%	0.00%	2.1	0.09
OS-3	1.90	50.00%	25.00%	25.00%	0.00%	2.9	0.12
OS-4	3.54	50.00%	25.00%	25.00%	0.00%	5.4	0.23
OS-5	3.35	50.00%	25.00%	25.00%	0.00%	5.1	0.21
OS-6	14.50	50.00%	25.00%	25.00%	0.00%	22.1	0.92
OS-7	3.21	50.00%	25.00%	25.00%	0.00%	4.9	0.20
TOTAL	**34.99**					**58.3**	**2.4**

ARROYO VISTA BASIN SUMMARY

BASIN I.D.	AREA (AC)	% LAND TREATMENT A	B	C	D	DISCHARGE (CFS) 10 yr	DISCHARGE (CFS) 100 yr	VOLUME (AC-FT) 10 yr	VOLUME (AC-FT) 100 yr
AR-1	4.21	0.00%	0.00%	15.00%	85.00%	16.9	17.5	0.39	0.64
AR-2	2.01	0.00%	0.00%	10.00%	90.00%	8.3	8.5	0.19	0.31
AR-3	2.82	0.00%	0.00%	10.00%	90.00%	11.6	11.9	0.27	0.44
AR-4	2.59	0.00%	0.00%	10.00%	90.00%	10.7	10.9	0.25	0.40
AR-5	2.61	0.00%	0.00%	10.00%	90.00%	10.7	11.0	0.25	0.41
AR-6	2.01	0.00%	0.00%	10.00%	90.00%	8.3	8.5	0.19	0.31
TOTAL	**16.26**					**66.4**	**68.3**	**1.6**	**2.5**

LEGEND

- BASIN BOUNDARY
- FLOW ARROW
- PROPOSED STORM DRAIN
- EXISTING STORM DRAIN
- PROPOSED STREET SLOPE OR FLOW PATH (2.19%)
- PROPOSED STORM DRAIN MANHOLE
- PROPOSED STORM DRAIN INLET
- ANALYSIS POINT (APXX)

Sat, 24-Aug-2019 - 10:42:am, Plotted by: YPADILLA
P:\20190120\CDP\Plans\General\DMP\20190120_Ultimate Basins Map.dwg

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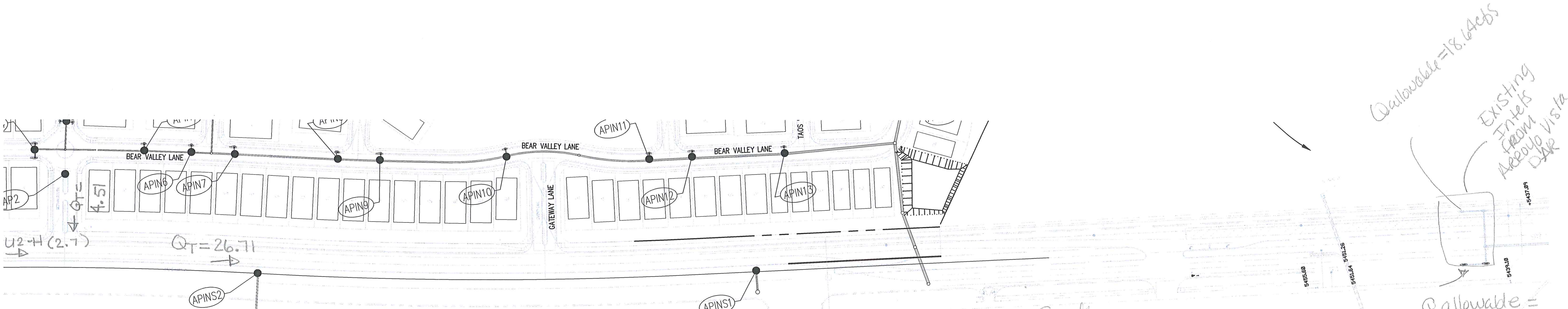


North

Q_{100} = U2-H (2.7)
U2-O (.8)
Bear Valley (3.71) (AP2)
AR-6 (8.5)

15.71 cfs

South
Q_{100}
AR-5 (11)

11 cfs

North
Q_{100} = U1G (2.0 cfs)
U1E (1.0 cfs)
75AR4 (8.18)
75U1D (1.2)

Q_T = 12.28 cfs

South
AR-3 (11.9)

Q_T = 11.9 cfs

North
Q_{100}
AR-2 8.5
(25) AR-4 2.72
(25) U1D .46
11.62

South
AR-1 17.5

North Half
Q_{10} = U2-H (2.2)
U2-O (.8)
AR-6 (8.3)
Bear Valley (3.71)

15.01 cfs

South Half
AR-5 (10.7 cfs)

10.7 cfs

Q_{10} North Half
U1G (1.6)
U1E 1.0)
75AR 4 (8.03)
75U1D (.98)

Q_T = 11.61

South Half
AR-3 (11.6)

Q_T = 11.6

Q_{10}
AR2 8.3
25AR4 2.67
25U1D .33
11.3

AR-1 16.9)

ARROYO Vista

Inlet Schematic 7

TEMPORARY ASPHALT PAVEMENT Curve Table				
ID	ARC	RADIUS	DELTA	TANGENT
C4	190.02'	693.00'	15°42'37"	95.61'
C5	191.65'	699.00'	15°42'35"	96.43'
C6	22.49'	693.00'	01°51'34"	11.25'
C7	175.54'	675.00'	14°54'01"	88.27'

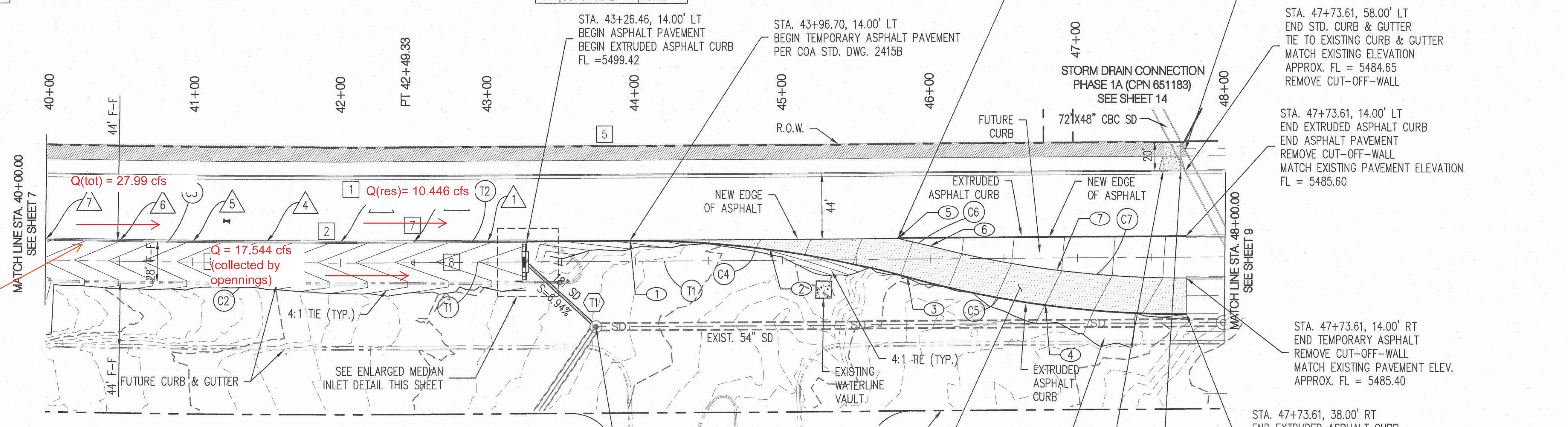
CL Curve Table				
ID	ARC	RADIUS	DELTA	TANGENT
C2	953.03'	8988.00'	06°04'31"	476.96'

CL Tangent Table		
ID	BEARING	LENGTH
T1	S81°01'30"E	1974.02'

MEDIAN CURB Curve Table				
ID	ARC	RADIUS	DELTA	TANGENT
C3	951.54'	8974.00'	06°04'31"	476.22'

MEDIAN CURB Tangent Table		
ID	BEARING	LENGTH
T2	S81°01'30"E	76.46'

SD Tangent Table		
ID	BEARING	LENGTH
T1	N38°24'20"W	64.74'

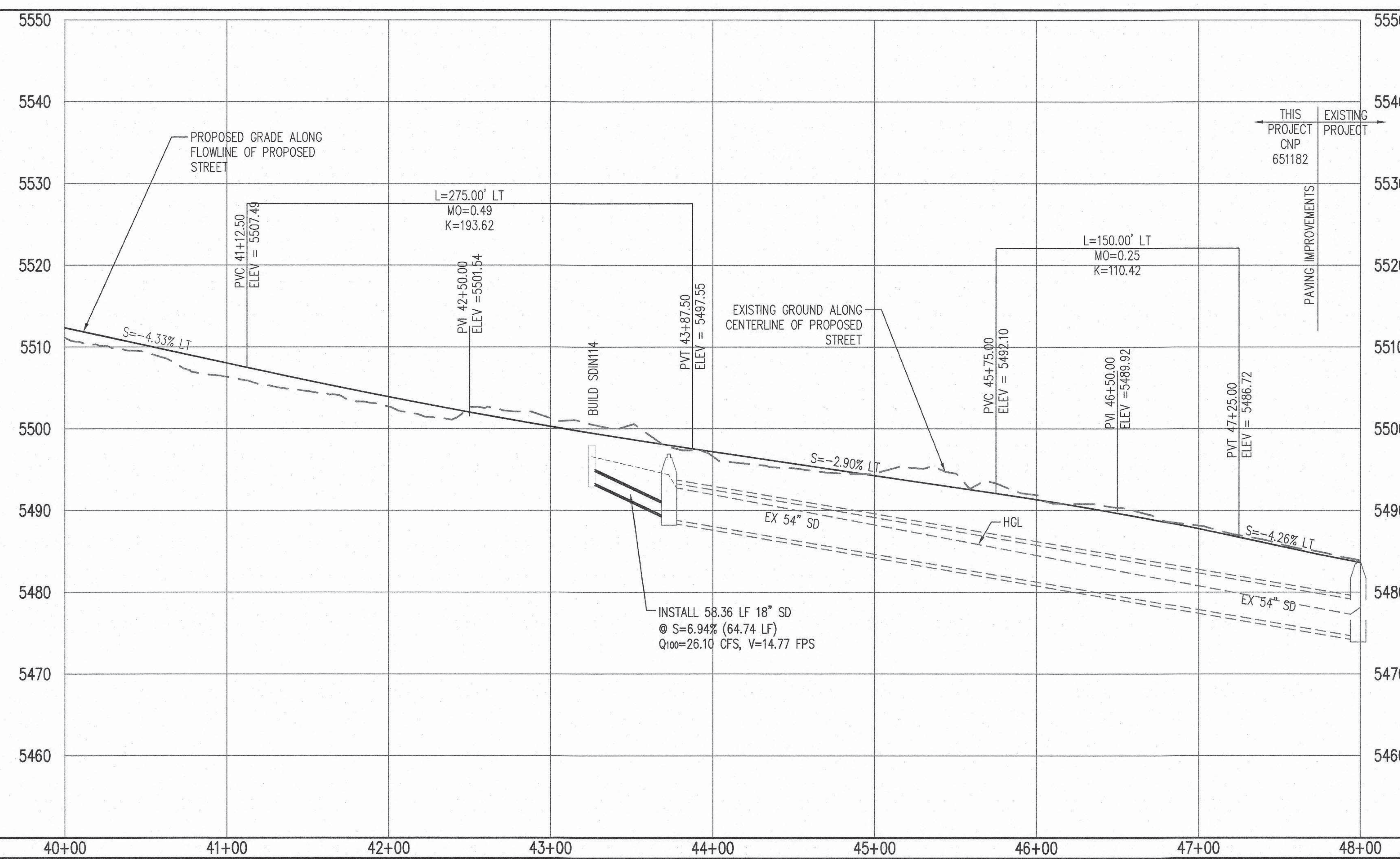


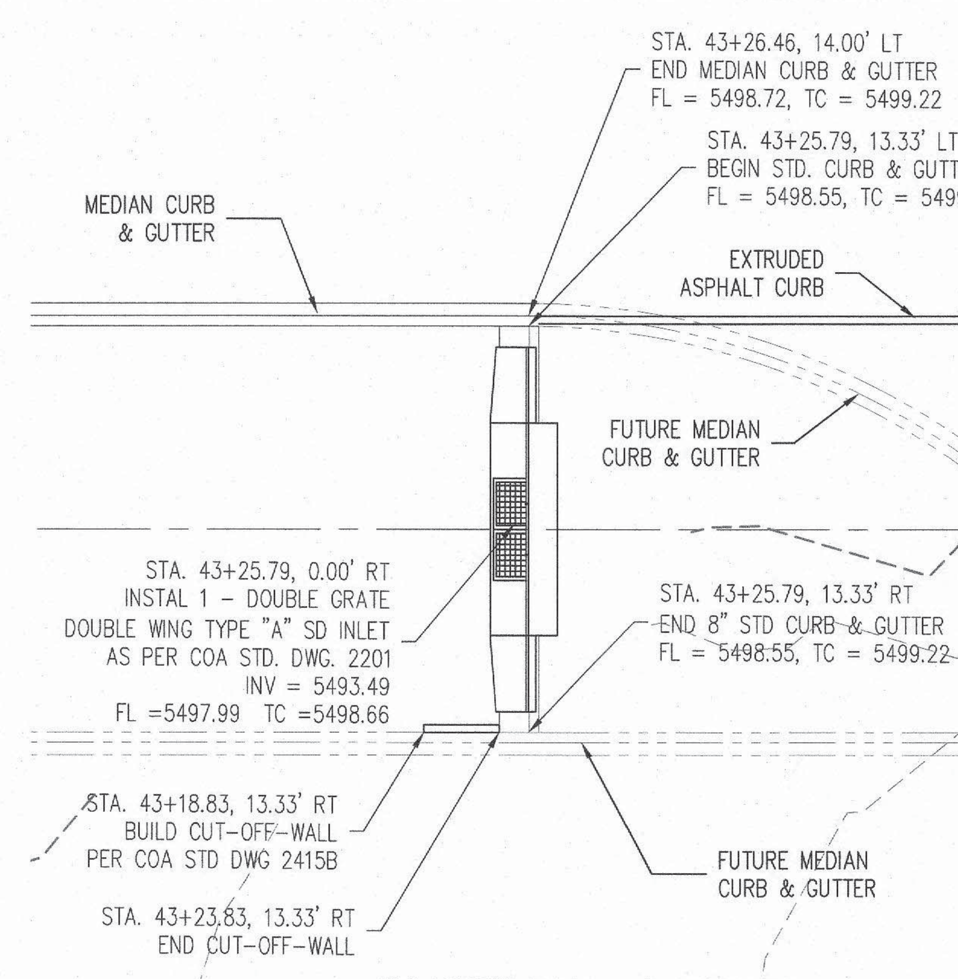
TEMPORARY ASPHALT PAVEMENT Point Table			
○	EASTING	NORTHING	ELEVATION
1	1486122.67	1491820.68	5496.58
2	1486215.21	1491799.48	5493.72
3	1486304.00	1491765.83	5490.87
4	1486393.54	1491731.90	5787.99
5	1486301.96	1491792.36	5491.30
6	1486322.71	1491783.71	5490.65
7	1486405.06	1491753.50	5488.10

MEDIAN CURB Point Table			
△	STATION	OFFSET	ELEVATION
1	43+00.00	14.00' LT	5499.59
2	42+50.00	14.00' LT	5501.33
3	42+00.00	14.00' LT	5503.20
4	41+50.00	14.00' LT	5505.20
5	41+00.00	14.00' LT	5507.33
6	40+50.00	14.00' LT	5509.49
7	40+00.00	14.00' LT	5511.65

CURB CUT OPENING EVERY 50' SEE DETAIL SHEET 12

ARROYO VISTA BLVD





ENLARGED MEDIAN CURB INLET
NOT TO SCALE

NOTES

1. THE CONTRACTOR SHALL FIELD VERIFY ALL EXISTING UTILITY LOCATIONS AND NOTIFY THE ENGINEER IMMEDIATELY OF ANY DISCREPANCIES.

2. ALL CURB RETURN RADII SHALL BE 15' UNLESS OTHERWISE SPECIFIED.

3. ALL CURVE DATA AND DIMENSIONS REFER TO FACE OF CURB UNLESS OTHERWISE SPECIFIED.

4. GRADE ELEVATIONS, WHERE NOTED, ARE FOR FLOWLINE OF CURB UNLESS OTHERWISE SPECIFIED.

5. CONTRACTOR IS TO INSTALL A 4"x 4"x 5' POST AND E.M.S. AT THE END OF EACH SANITARY SEWER SERVICE.

6. CONTRACTOR IS RESPONSIBLE FOR REPAIR AND/OR REPLACEMENT OF ALL UTILITY CONDUITS AND EXISTING LINES.

7. ANY ADDITIONAL GRADING REQUIRED TO MATCH PROPOSED STREET GRADES SHALL BE INCIDENTAL TO PAVING ITEMS.

8. CONTRACTOR SHALL PROVIDE THE INSPECTORS, (CITY AND PRIVATE) WITH THE PROPOSED HYDROSTATIC TESTING PLAN. THE PLAN MUST BE APPROVED BEFORE TESTING OPERATIONS BEGIN.

9. CONTRACTOR SHALL PARK EQUIPMENT AND VEHICLES AS NOT TO INTERFERE WITH NORMAL ACTIVITIES OF RESIDENTS OR OTHER CONTRACTORS ON SITE.

10. ANY DAMAGE TO THE EXISTING FACILITIES (CURB & GUTTER, PAVEMENT, CONDUITS, LANDSCAPING, UTILITY LINES ETC.) DURING CONSTRUCTION SHALL BE REPLACED AT THE CONTRACTORS' EXPENSE.

11. REMOVAL OF THE EXISTING CURB & GUTTER TO NEAREST JOINT.

12. CURB RAMPS SHALL BE CONSTRUCTED PRIOR TO ACCEPTANCE OF CURB & GUTTER.

13. RCP SHALL BE INSTALLED SO THAT THE JOINT GAP AT THE HOME POSITION SHALL CONFORM TO THE APPROVED MANUFACTURER'S RECOMMENDATIONS. MANUFACTURER'S RECOMMENDED JOINT GAP TOLERANCES FOR EACH PIPE SIZE AND TYPE SHALL BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO PLACEMENT OF PIPE. RCP JOINTS SHALL NOT BE GROUTED UNLESS DIRECTED BY THE ENGINEER AFTER CITY APPROVAL.

14. ALL EXCAVATION, TRENCHING, AND SHORING ACTIVITIES MUST BE CARRIED-OUT IN ACCORDANCE WITH OSHA 29 CFR 1926.650 SUBPART P.

15. GRATE PER MODIFIED COA STANDARD DWG. 2220

KEYED NOTES

1. STD. CURB & GUTTER PER COA STD. DWG. 2415A
2. MEDIAN CURB & GUTTER PER COA STD. DWG. 2415B WITH CURB CUT EVERY 50'
3. INSTALL 6' CONCRETE VALLEY GUTTER PER COA STD. DWG. 2420 SEE VALLEY GUTTER SLOPE DETAIL SHEET 12 FOR GUTTER SLOPE
4. BUILD WHEEL CHAIR RAMP PER DETAIL 'C' SHEET 12

4A. BUILD WHEEL CHAIR RAMP PER DETAIL 'D' SHEET 12

5. BUILD 10' ASPHALT TRAIL, SEE SHEET 12 FOR DETAIL
6. BUILD WHEEL CHAIR RAMP PER DETAIL 'B' SHEET 12
7. PAVEMENT DESIGN SECTION SEE SHEET 12
8. BUILD SWALE SECTION PER DETAIL SEE SHEET 12
9. MEDIAN NOSES SHALL BE PAINTED YELLOW TO APPROX. 6' BEHIND PC/PT.

GENERAL NOTE:
ALL STORM DRAIN MANHOLES SHALL BE 4' DIAMETER TYPE "E" AS PER C.O.A. STANDARD DRAWING 2102 UNLESS OTHERWISE NOTED.

STORM DRAIN LINE TO BE CLASS III RCP UNLESS OTHERWISE NOTED

AS-BUILT INFORMATION
CONTRACTOR / DATE
WORK STARTED BY / DATE
INSPECTOR'S ACCEPTANCE BY / DATE
FIELD VERIFICATION BY / DATE
DRAWINGS CORRECTED BY / DATE

MICRO-FILM INFORMATION
RECORDED BY / DATE
NO.

BENCH MARKS
USC&GS BRASS DISC STAMPED "REWARD 1969"
GEOGRAPHIC POSITION (NAD 83)
N.M. STATE PLANE COORDINATES (CENTRAL ZONE)
N=1487364.063 E=1491190.819
GROUND TO GRID = 0.999675005
DELTA ALPHA = -0°17'12.26"
NAVD 1988 ELEVATION = 5319.688

SURVEY INFORMATION
FIELD NOTES
NO. / BY / DATE

ENGINEER'S SEAL
YOLANDA PADILLA MOYER
NEW MEXICO
LICENSED PROFESSIONAL ENGINEER
11-18-19

NO. / DATE / REMARKS / BY
REVISIONS

DESIGN		
DESIGNED BY	YPM	DATE 04/2019
DRAWN BY	AR	DATE 04/2019
CHECKED BY	YPM	DATE 04/2019

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CITY OF ALBUQUERQUE
DEPARTMENT OF MUNICIPAL DEVELOPMENT

INSPIRATION SUBDIVISION - OFFSITE
PAVING PLAN & PROFILE
ARROYO VISTA BLVD

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	MO./DAY/YR.	MO./DAY/YR.
APPROVED DEC 11 2019 DESIGN REVIEW COMMITTEE	APPROVED DEC 11 2019 CITY ENGINEER		
LAST DESIGN UPDATE			

CITY PROJECT NO.	ZONE MAP NO.	SHEET	OF
651182	H-7, J-7	8	21

SCALE: HORIZ. 1"=50' VERT. 1"=10'

BHI JOB NO. 20190120

P:\20190120\CDP\Plans\PNP\Offsite\Paving\20190120_ppnp03.dwg
Tue, 26-Nov-2019 - 8:32:am, Plotted by: AROMERO

Weir Report

Curb cut weir calc

Trapezoidal Weir

Crest	= Sharp
Bottom Length (ft)	= 0.50
Total Depth (ft)	= 0.33
Side Slope (z:1)	= 2.00

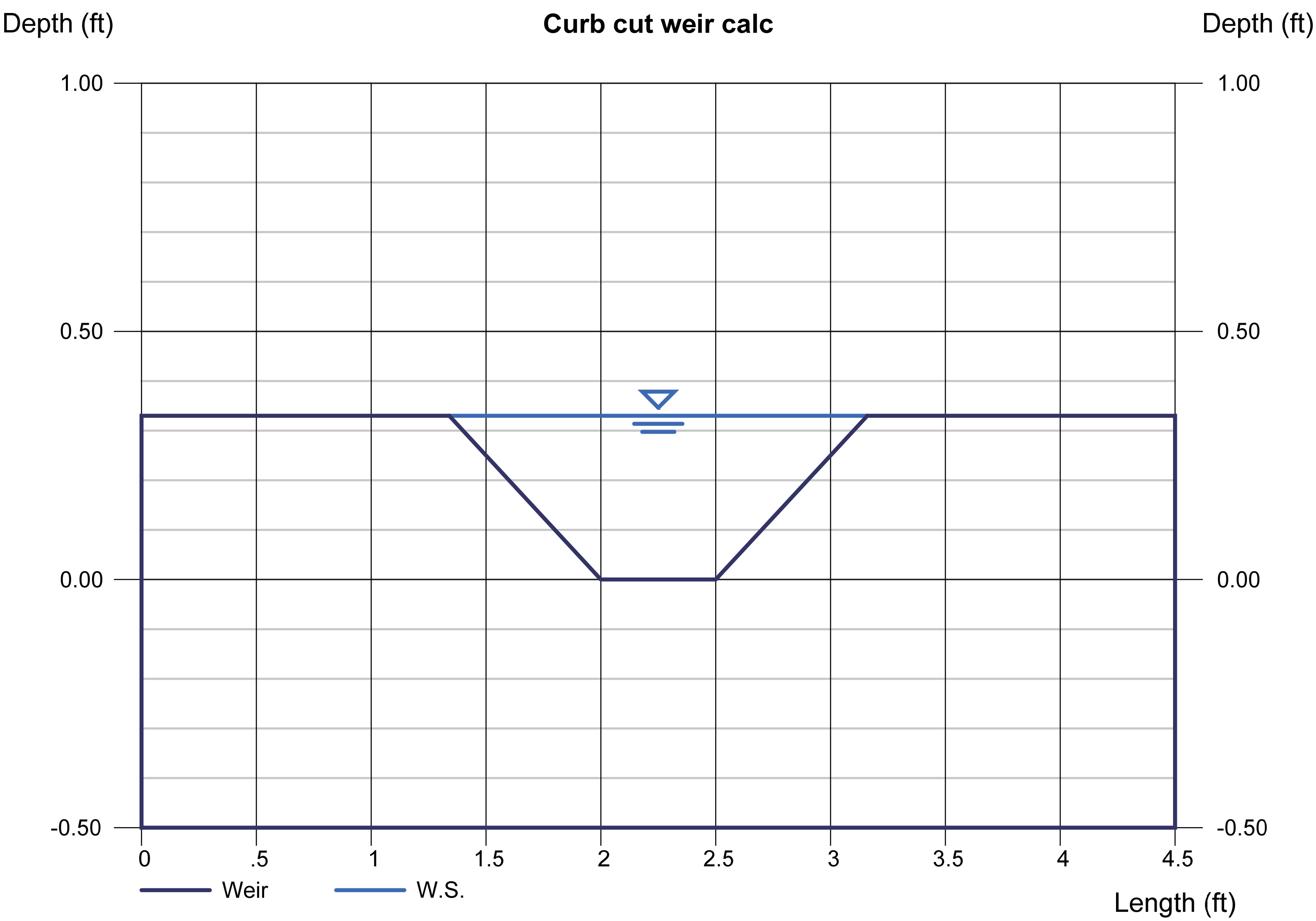
Calculations

Weir Coeff. Cw	= 2.65
Compute by:	Q vs Depth
No. Increments	= 20

Highlighted

Depth (ft)	= 0.33
Q (cfs)	= 0.516
Area (sqft)	= 0.38
Velocity (ft/s)	= 1.35
Top Width (ft)	= 1.82

Q = (34x0.516) cfs
= 17.544 cfs



MANNING'S N = 0.017 SLOPE = 0.029

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1.0	0.0	1.8	4.0	22.0	0.8	7.0	64.7	0.5
2.0	19.4	1.4	5.0	63.2	0.0			
3.0	20.0	0.7	6.0	64.0	0.0			

WSEL FT.	DEPTH INC	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID PLUS OBSTRUCTIONS	TOTAL ENERGY (FT)
0.050	0.050	0.106	0.155	3.424	1.467	3.407	0.083
0.100	0.100	0.341	0.748	6.019	2.195	5.985	0.175
0.150	0.150	0.704	1.976	8.613	2.805	8.562	0.272
0.200	0.200	1.197	4.011	11.208	3.351	11.139	0.375
0.250	0.250	1.818	7.008	13.802	3.854	13.717	0.481
0.300	0.300	2.569	11.111	16.397	4.326	16.294	0.591
0.350	0.350	3.448	16.455	18.991	4.773	18.872	0.704
0.400	0.400	4.456	23.167	21.586	5.199	21.449	0.820
0.450	0.450	5.593	31.369	24.180	5.609	24.026	0.939
0.500	0.500	6.858	41.177	26.775	6.004	26.604	1.061

Q = 27.99 - 17.544
= 10.446 cfs
y = 0.29 ft

Calculation for weir width:

$$\Delta Q = C_s \frac{2}{3}\sqrt{\frac{2}{3}g}\, s \left[\frac{y_1+y^2}{2} - P_1\right]^{1.5}$$

$$10.446 = (2.65)\frac{2}{3}\sqrt{\frac{2}{3}(32.2)}\, s \left[\frac{0.29+0.29^2}{2} - 0\right]^{1.5}$$

$$s = 15.76'$$

In our application, y2 and y are the same and p1=0 since our weir starts at the bottom of the "channel".

Annex 3

Side weirs and oblique weirs

3.1 Introduction

Most of the weirs described in this book serve mainly to measure discharges. Some, however, such as those described in Chapters 4 and 6 can also be used to control upstream water levels. To perform this dual function, the weirs have to be installed according to the requirements given in the relevant chapters. Since these weirs are usually relatively wide with respect to the upstream head, the accuracy of their flow measurements is not very high. Sometimes the discharge measuring function of the weir is entirely superseded by its water level control function, resulting in a contravention in their installation rules. The following weirs are typical examples of water level control structures.

Side weir: This weir is part of the channel embankment, its crest being parallel to the flow direction in the channel. Its function is to drain water from the channel whenever the water surface rises above a predetermined level so that the channel water surface downstream of the weir remains below a maximum permissible level.

Oblique weir: The most striking difference between an oblique weir and other weirs is that the crest of the oblique weir makes an angle with the flow direction in the channel. The crest must be greater than the width of the channel so that with a change in discharge the water surface upstream of the weir remains between narrow limits. Some other weir types which can maintain such an almost constant upstream water level will also be described.

3.2 Side weirs

3.2.1 General

In practice, sub-critical flow will occur in almost all rivers and irrigation or drainage canals in which side weirs are constructed. Therefore, we shall restrict our attention to side weirs in canals where the flow remains subcritical. The flow profile parallel to the weir, as illustrated in Figure A3.1, shows an increasing depth of flow.

The side weir shown in Figure A3.1 is broad-crested and its crest is parallel to the channel bottom. It should be noted, however, that a side weir need not necessarily be broad-crested. The water depth downstream of the weir y_2 and also the specific energy head $H_{o,2}$ are determined by the flow rate remaining in the channel (Q_2) and the hydraulic characteristics of the downstream channel. This water depth is either controlled by some downstream construction or, in the case of a long channel, it will equal the normal depth in the downstream channel. Normal depth being the only water depth which remains constant in the flow direction at a given discharge (Q_2), hydraulic radius, bottom slope, and friction coefficient of the downstream channel.

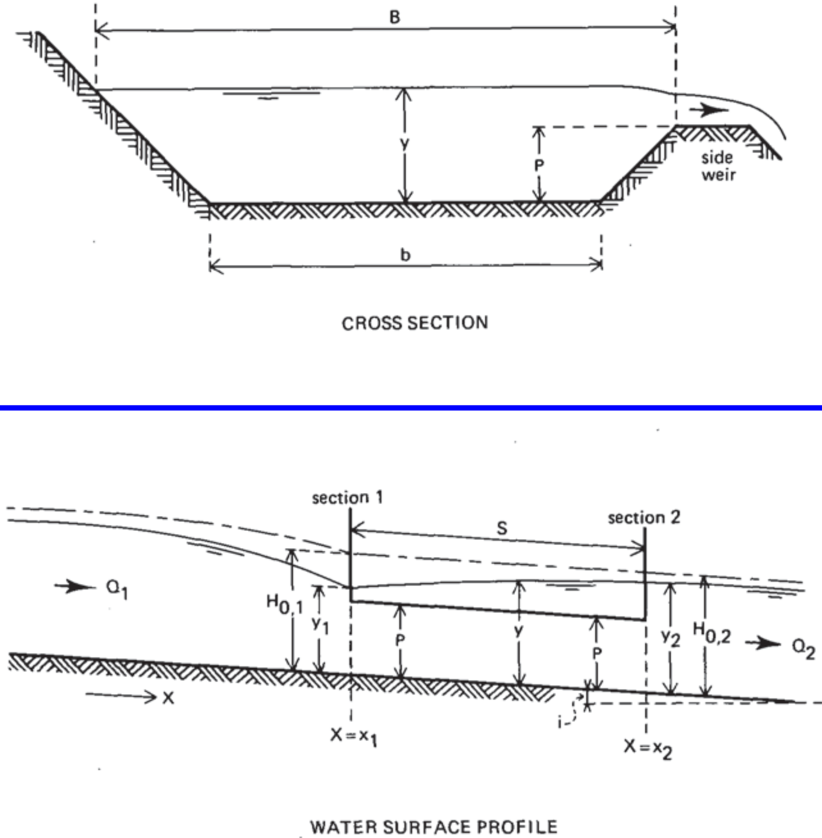


Figure A3.1 Dimension sketch of side weir.

3.2.2 Theory

The theory on flow over side weirs given below is only applicable if the area of water surface drawdown perpendicular to the centre line of the canal is small in comparison with the water surface width of this canal. In other words, if $y - p_1 < 0.1$ B.

For the analysis of spatially varied flow with decreasing discharge, we may apply the energy principle as introduced in Chapter 1, Sections 1.6 and 1.8. When water is being drawn from a channel as in Figure A3.1, energy losses in the overflow process are assumed to be small, and if we assume in addition that losses in specific energy head due to friction along the side weir equal the fall of the channel bottom, the energy line is parallel to this bottom. We should therefore be able to write

$$H_{o,1} = y_1 + \frac{Q_1^2}{2g\,A_1^2} = y_2 + \frac{Q_2^2}{2g\,A_2^2} = H_{o,2} \qquad \text{(A3.1)}$$

If the specific energy head of the water remaining in the channel is (almost) constant

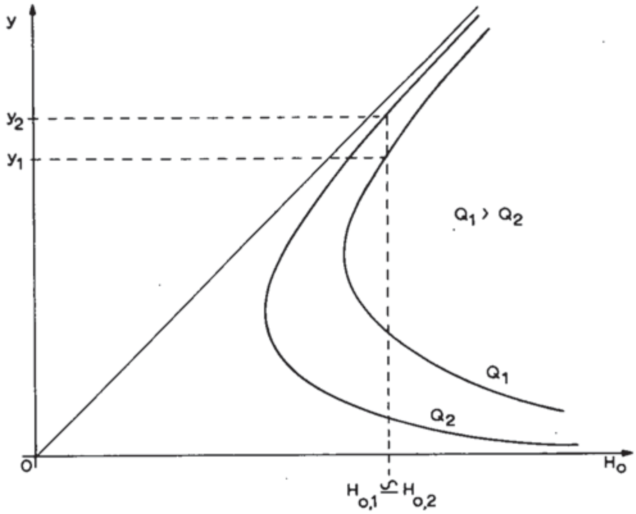


Figure A3.2 H_o-y diagram for the on-going channel

while at the same time the discharge decreases, the water depth y along the side weir should increase in downstream direction as indicated in Figures A3.1 and A3.2, which is the case if the depth of flow along the side weir is subcritical (see also Chapter 1, Figure 1.9).

Far upstream of the side weir, the channel water depth y equals the normal depth related to the discharge Q_1 and the water has a specific energy $H_{o,0}$, which is greater than $H_{o,2}$. Over a channel reach upstream of the weir, the water surface is drawn down in the direction of the weir. This causes the flow velocity to increase and results in an additional loss of energy due to friction expressed in the loss of specific energy head $H_{o,0} - H_{o,2}$. Writing Equation A3.1 as a differential equation we get

$$\frac{dH_o}{dx} = \frac{dy}{dx} + \frac{d}{dx}\frac{Q^2}{2gA^2} \tag{A3.2}$$

or

$$\frac{dH_o}{dx} = 0 = \frac{dy}{dx} + \frac{1}{2g}\left(\frac{2Q}{A^2}\frac{dQ}{dx} - \frac{2Q^2}{A^3}\frac{dA}{dx}\right) \tag{A3.3}$$

The continuity equation for this channel reach reads $dQ/dx = -q$, and the flow rate per unit of channel length across the side weir equals

$$q = C_s \frac{2}{3}\sqrt{\frac{2}{3}g}\,(y - p_1)^{1.5} \tag{A3.4}$$

The flow rate in the channel at any section is

$$Q = A\sqrt{2g(H_o - y)}$$

and finally

$$\frac{dA}{dx} = B\frac{dy}{dx}$$

so that Equation A3.3 can be written as follows

$$\frac{dy}{dx} = \frac{4C_s}{3^{1.5}B}\frac{(H_o - y)^{0.5}(y - p)^{1.5}}{A/B + 2y - 2H_o} \tag{A3.5}$$

where C_s denotes the effective discharge coefficient of the side weir. Equation A3.4 differs from Equation 1-36 (Chapter 1) in that, since there is no approach velocity towards the weir crest, y has been substituted for H_o. Equation A3.5, which describes the shape of the water surface along the side weir, can be further simplified by assuming a rectangular channel where B is constant and $A/B = y$, resulting in

$$\frac{dy}{dx} = \frac{4C_s}{3^{1.5}B}\frac{(H_o - y)^{0.5}(y - p_1)^{1.5}}{3y - 2H_o} \tag{A3.6}$$

For this differential equation De Marchi (1934) found a solution which was confirmed experimentally by Gentilini (1938) and Collinge (1957) and reads

$$x = \frac{3^{1.5}B}{2C_s}\left[\frac{2H_o - 3p}{H_o - p}\left(\frac{H_o - y}{y - p}\right)^{0.5} - 3\arcsin\left(\frac{H_o - y}{H_o - p}\right)^{0.5}\right] + K \tag{A3.7}$$

where K is an integration constant. The term in between the square brackets may be denoted as $\phi(y/H_o)$ and is a function of the dimensionless ratios $y/H_{o,2}$ and $p/H_{o,2}$ as shown in Figure A3.3. If p_1, y_2, and $H_{o,2}$ are known, the water surface elevation at any cross section at a distance $(x - x_2)$ along the side weir can be determined from the equation*

$$x - x_2 = \frac{3^{1.5}B}{2C_s}\left[\phi(y/H_{o,2}) - \phi(y_2/H_{o,2})\right] \tag{A3.8}$$

If the simplifying assumptions made to write Equation A3.1 cannot be retained or in other words, if the statement

$$\int\frac{v^2}{C^2R} - S\tan i \ll y_2 - y_1 \tag{A3.9}$$

is not correct, the water surface elevation parallel to the weir can only be obtained by making a numerical calculation starting at the downstream end of the side weir (at $x = x_2$). This calculation also has to be made if the cross section of the channel is not rectangular.

For this procedure the following two equations can be used

$$y_u - y_d = -\frac{(v_u + v_d)(v_u - v_d)}{2g} + \left[\frac{{v_d}^2}{C^2R_d} - i\right]\Delta x \tag{A3.10}$$

* If the flow along the weir is supercritical and no hydraulic jump occurs along the weir and the same simplifying assumptions are retained, Equations A3.1 to A3.8 are also valid. Greater discrepanties, however, occur between theory and experimental results. Also, the water surface profile along the weir has a shape different form that shown in Figure A3.1.

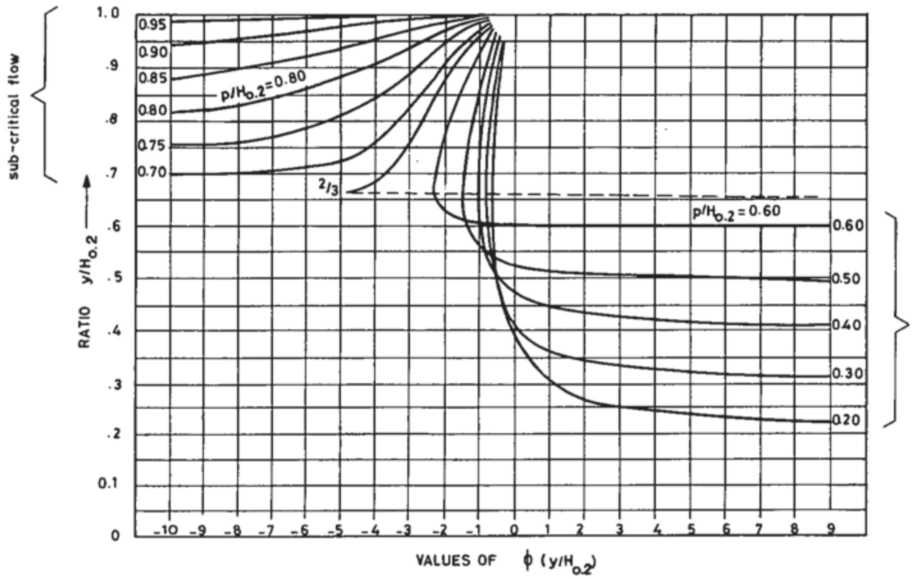


Figure A3.3 Values of $\phi(y/H_{o,2})$ for use in Equation A3.8

$$v_u A_u - v_d A_d = C_s \frac{2}{3}\sqrt{\frac{2}{3}g}\,(y_d - p_1)^{1.5}\,\Delta x \tag{A3.11}$$

where; Δx = length of the considered channel section, u = subscript denoting upstream end of section, d = subscript denoting downstream end of section, C = coefficient of Chézy, R = hydraulic radius of channel.

It should be noted that before one can use Equations A3.10 and A3.11 sufficient information must be available on both A and R along the weir. The accuracy of the water surface elevation computation will depend on the length and the chosen number of elementary reaches Δx.

3.2.3 Practical C_s-value

The reader will have noted that in Equations A3.3 to A3.9 an effective discharge coefficient C_s is used. For practical purposes, a value

$$C_s = 0.95\, C_d \tag{A3.12}$$

may be used, where C_d equals the discharge coefficient of a standard weir of similar crest shape to those described in Chapters 4 and 6.

If Equations A3.4 to A3.11 are used for a sharp-crested side weir, the reader should be aware of a difference of $\sqrt{3}$ in the numerical constant between the head-discharge equations of broad-crested and sharp-crested weirs with rectangular control section. In addition it is proposed that the discharge coefficient (C_s) of a sharp-crested weir be reduced by about 10% if it is used as a side weir. This leads to the following C_s-value to be used in the equations for sharp-crested side weirs

$$C_s \doteq 0.90\sqrt{3}\,C_e \simeq 1.55\,C_e \qquad \text{(A3.13)}$$

3.2.4 Practical evaluation of side weir capacity

Various authors proposed simplified equations describing the behaviour of sharp-crested side weirs along rectangular channels. However, discrepancies exist between the experimental results and the equations proposed, and it follows that each equation has only a restricted validity. In this Annex we shall only give the equations as proposed by Forchheimer (1930), which give an approximate solution to the Equations A3.3 and A3.4 assuming that the water surface profile along the side weir is a straight line. The Forchheimer equations read

$$\Delta Q = C_s \frac{2}{3}\sqrt{\frac{2}{3}g}\; S\left[\frac{y_1 + y^2}{2} - p_1\right]^{1.5} \qquad \text{(A3.14)}$$

and

$$\xi_1 = \frac{y_2 - y_1}{v_1^2/2g - v_2^2/2g - \Delta H_o} \qquad \text{(A3.15)}$$

where ΔH_o is the loss of specific energy head along the side weir due to friction. ΔH_o can be estimated from

$$\Delta H_o = 2\left(\frac{v_1 - v_2}{2g}\right)^2 \frac{S}{C^2R} - i\,S \qquad \text{(A3.16)}$$

The most common problem is how to calculate the side weir length S, if $\Delta Q = Q_1 - Q_2$, y_2 and p_1 are known. To find S an initial value of y_1 has to be estimated, which is then substituted into the Equations A3.14 and A3.15. By trial and error y_1 (and thus S) should be determined in such a way that $\xi_1 = 1.0$.
The Equations A3.14 and A3.15 are applicable if

$$Fr_1 = \frac{v_1}{\sqrt{g y_1}} < 0.75 \qquad \text{(A3.17)}$$

and

$$y_1 - p \geqslant 0 \qquad \text{(A3.18)}$$

If the above limits do not apply, the water depth y_1 at the entrance of the side weir and the side weir length S required to discharge a flow $Q_1 - Q_2$ should be calculated by the use of Equation A3.1, which reads

$$H_{o,2} = y_1 + \frac{Q_1^2}{2gA_1^2} = y_2 + \frac{Q_2^2}{2gA_2^2} \qquad \text{(A3.19)}$$

In combination with the equation

$$-S = x_1 - x_2 = 2.73\frac{B}{C_d}\left[\phi(y_1/H_{o,2}) - \phi(y_2/H_{o,2})\right] \qquad \text{(A3.20)}$$

The latter equation is a result of substituting Equation A3.12 into Equation A3.8. In using Equation A3.20 the reader should be aware that the term $x_1 - x_2$ is negative since $x_1 < x_2$. As mentioned before, values of $\phi(y/H_{o,2})$ can be read from Figure A3.3 as a function of the ratios $p_1/H_{o,2}$ and $y/H_{o,2}$.

3.3 Oblique weirs

3.3.1 Weirs in rectangular channels

According to Aichel (1953), the discharge q per unit width of crest across oblique weirs placed in a rectangular canal as shown in Figure A3.4 can be calculated by the equation

$$q = \left(1 - \frac{h_1}{p_1}\beta\right) q_n \qquad \text{(A3.21)}$$

where q_n is the discharge over a weir per unit width if the same type of weir had been placed perpendicular to the canal axis ($\varepsilon = 90°$) and β is a dimensionless empirical function of the angle of the weir crest (in degrees) with the canal axis.

Equation A3.21 is valid provided that the length of the weir crest L is small with respect to the weir width b and the upstream weir face is vertical. Values of the β coefficient are available (see Figure A3.5) for

$$h_1/p_1 < 0.62 \quad \text{and} \quad \varepsilon > 30° \qquad \text{(A3.22)}$$

or

$$h_1/p_1 < 0.46 \quad \text{and} \quad \varepsilon < 30° \qquad \text{(A3.23)}$$

3.3.2 Weirs in trapezoidal channels

Three weir types, which can be used to suppress water level variations upstream of the weir are shown in Figure A3.6. Provided that the upstream head over the weir crest does not exceed 0.20 m ($h_1 < 0.20$ m) the unit weir discharge can be estimated by the equation

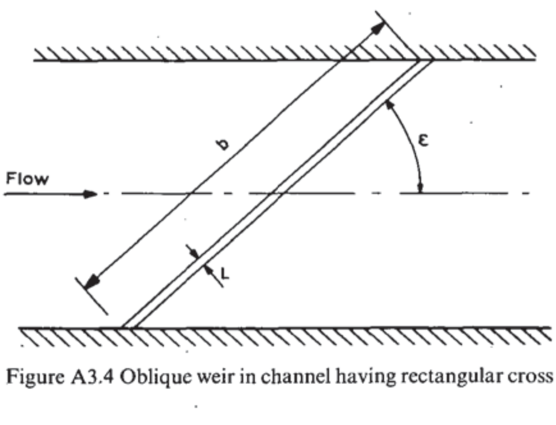


Figure A3.4 Oblique weir in channel having rectangular cross section

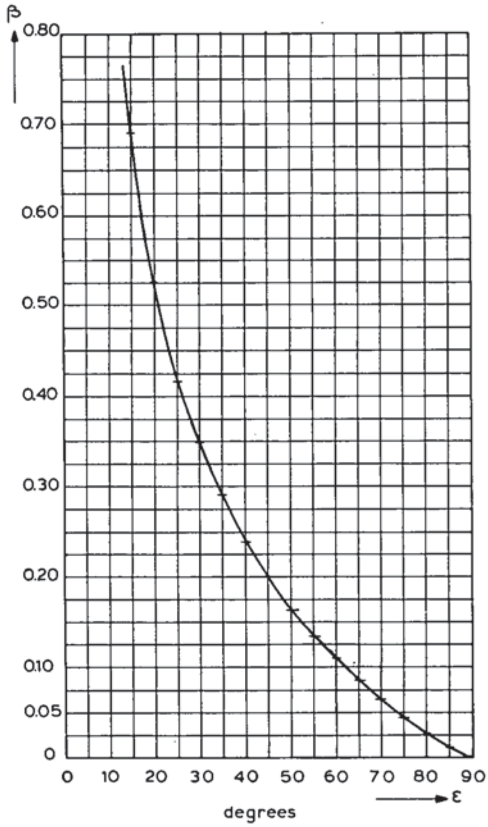


Figure A3.5 β-values as a function of ε

$$q = r\, q_n \tag{A3.24}$$

where q_n is the discharge across a weir per unit width if the weir had been placed perpendicular to the canal axis (see Chapters 4 and 6) and r is a reduction factor as shown in Figure A3.6.

3.4 Selected list of references

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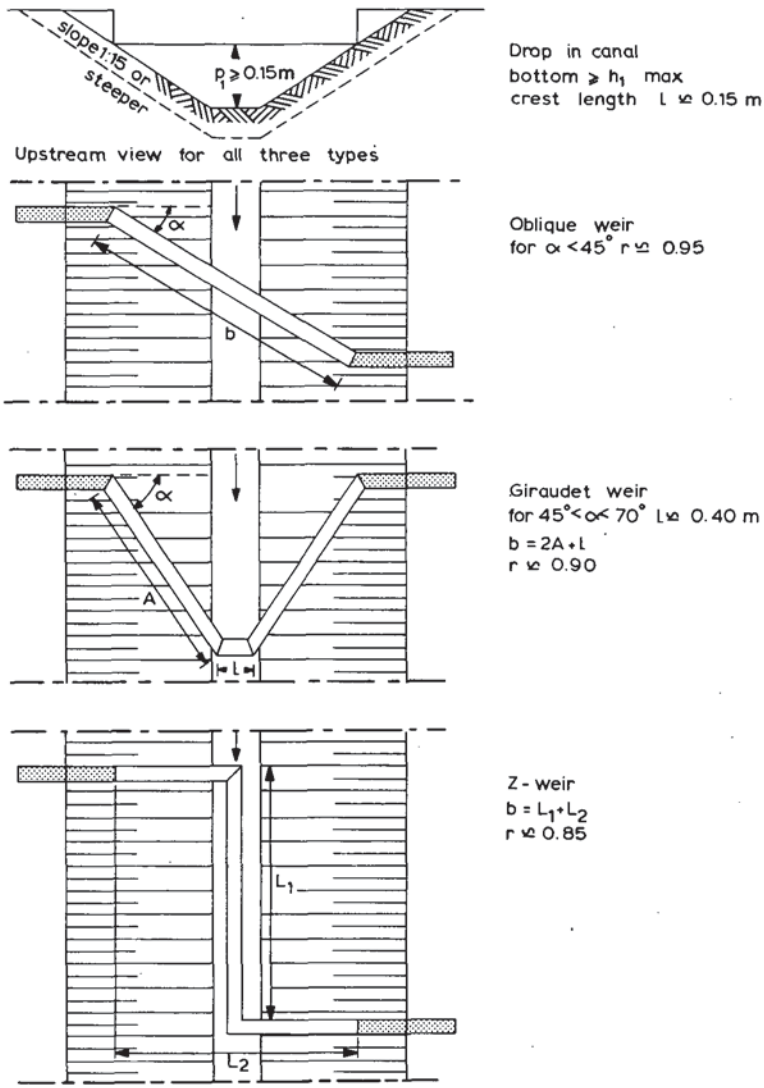

Figure A3.6 Weirs in trapezïodal channels