DRAINAGE AND TRANSPORTATION INFORMATION SHEET

(REV. 1/28/2003rd)

PROJECT TITLE: Tierra Oeste Unit 3 Subdivision ZONE MAP/DRG. FILE # H-9-Z/D14
DRB #: 1001243 EPC#: WORK ORDER#:

LEGAL DESCRIPTION: Tierra Oeste Unit 3
CITY ADDRESS: NW Ladera Drive and Unser Boulevard

ENGINEERING FIRM: Bohannan Huston, Inc. CONTACT: Kevin Patton
ADDRESS: 7500 Jefferson NE – Courtyard I PHONE: (505) 823-1000
CITY, STATE: Albuquerque, NM ZIP CODE: 87109

OWNER: Westland Development Co., Inc. CONTACT: Fred Ambrogi
ADDRESS: 401 Coors Boulevard NW PHONE: 831-9600
CITY, STATE: Albuquerque, NM ZIP CODE: 87121

ARCHITECT: CONTACT:
ADDRESS: PHONE:
CITY, STATE: ZIP CODE:

SURVEYOR: CONTACT:
ADDRESS: PHONE:
CITY, STATE: ZIP CODE:

CONTRACTOR: CONTACT:
ADDRESS: PHONE:
CITY, STATE: ZIP CODE:

CHECK TYPE OF SUBMITTAL:

- ____ DRAINAGE REPORT
- ____ DRAINAGE PLAN 1st SUBMITTAL, ***REQUIRES TCL or equal***
- ____ DRAINAGE PLAN RESUBMITTAL
- ____ CONCEPTUAL GRADING & DRAINAGE PLAN
- ____ GRADING PLAN
- ____ EROSION CONTROL PLAN
- __X__ ENGINEER'S CERTIFICATION (HYDROLOGY)
- ____ CLOMR/LOMR
- ____ TRAFFIC CIRCULATION LAYOUT (TCL)
- ____ ENGINEERS CERTIFICATION (TCL)
- ____ ENGINEERS CERTIFICATION (DRB APPR. SITE PLAN)
- ____ OTHER

CHECK TYPE OF APPROVAL SOUGHT:

- __X__ SIA / FINANCIAL GUARANTEE RELEASE
- ____ PRELIMINARY PLAT APPROVAL
- ____ S. DEV. PLAN FOR SUB'D. APPROVAL
- ____ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ____ SECTOR PLAN APPROVAL
- ____ FINAL PLAT APPROVAL
- ____ FOUNDATION PERMIT APPROVAL
- ____ BUILDING PERMIT APPROVAL
- ____ CERTIFICATE OF OCCUPANCY (PERM.)
- ____ CERTIFICATE OF OCCUPANCY (TEMP.)
- ____ GRADING PERMIT APPROVAL
- ____ PAVING PERMIT APPROVAL
- ____ WORK ORDER APPROVAL
- ____ OTHER (SPECIFY)

WAS A PRE-DESIGN CONFERENCE ATTENDED:

- ____ YES
- ____ NO
- ____ COPY PROVIDED

RECEIVED
AUG 04 2003
HYDROLOGY SECTION

DATE SUBMITTED: BY:

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature , location and scope of the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. Conceptual Grading and Drainage Plan: Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.

2. Drainage Plans: Required for building permits, grading permits, paving permits and site plans less than five (5) acres.

3. Drainage Report: Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

Bohannan ▲ Huston INC.

Courtyard I
7500 Jefferson St. NE
Albuquerque, NM
87109-4335
www.bhinc.com
voice: 505.823.1000
facsimile: 505.798.7988
toll free: 800.877.5332

CLIENT/COURIER TRANSMITTAL

To: Brad Bingham, P.E.
COA Hydrology Development
600 Second St NW, 2nd Floor West

Requested by: Kevin Patton / am

Date: August 4, 2003

Time Due:
- ☒ **This A.M.**
- ☐ **This P.M.**
- ☐ **Rush**
- ☐ **By Tomorrow** _____

Phone: 924-3986

Job No.: 02 0040

Job Name: Tierra Oeste Unit 3

DELIVERY VIA

- ☒ **Courier**
- ☐ **Federal Express**
- ☐ **Mail**
- ☐ **UPS**
- ☐ **Other**

PICK UP

Item: _____

ITEM NO.	QUANTITY	DESCRIPTION
1	1	Letter dated 8/1/03 re: Tierra Oeste - Unit 3 Grading & Drainage Certification.
2	1	Drainage Information Sheet.

COMMENTS / INSTRUCTIONS

RECEIVED
AUG 0 4 2003
HYDROLOGY SECTION

REC'D BY: _____ ***DATE:*** _____ ***TIME:*** _____

ENGINEERING ▲
SPATIAL DATA ▲
ADVANCED TECHNOLOGIES ▲

Bohannan ▲ Huston INC.

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August 1, 2003

Brad Bingham, P.E.
Hydrology Development Division
City of Albuquerque Planning Department
P O Box 1293
Albuquerque, NM 87103

Re: Tierra Oeste – Unit 3
City Drainage File H9/D14, DRB Project #1001243

Dear Brad:

The purpose of this letter is to request your concurrence of the enclosed grading and drainage certification for the above referenced subdivision near Unser Blvd and Ladera. This submittal requests approval of the certification for Unit 3. The enclosed certified plan is the grading plan (engineers stamp dated 8/10/01) approved by DRB on August 22, 2001.

It is my understanding that the SIA is about to expire (our client has already received their first letter from the city and the first day the city has to call on the guarantee is August 22). I believe the enclosed certification is the remaining documentation necessary to close out the package.

If you have any questions, please give me a call at 823-1000.

Sincerely,

Kevin Patton, P.E.
Vice President
Community Development and Planning

KP/am
Enclosure

cc: Fred Ambrogi (w/ encl)

P:\020040\cdp\corres\Grading Cert,ltr1.doc

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

August 13, 2003

Kevin Patton, P.E.
Bohannan Huston, Inc.
7500 Jefferson NE
Albuquerque, New Mexico 87109

RE: TIERRA OESTE SUBDIVISION UNIT 3 (H-9/D14)
Engineers Certification – Submitted for Release of Financial Guaranty
Engineers Stamp dated 8/10/2001
Engineers Certification dated 8/1/2003

Dear Mr. Patton:

Based upon the information provided in your Engineers Certification submittal dated 8/4/2003, the above referenced plan is adequate to satisfy the Grading and Drainage Certification for Release of Financial Guaranty.

If you have any questions, please call me at 924-3981.

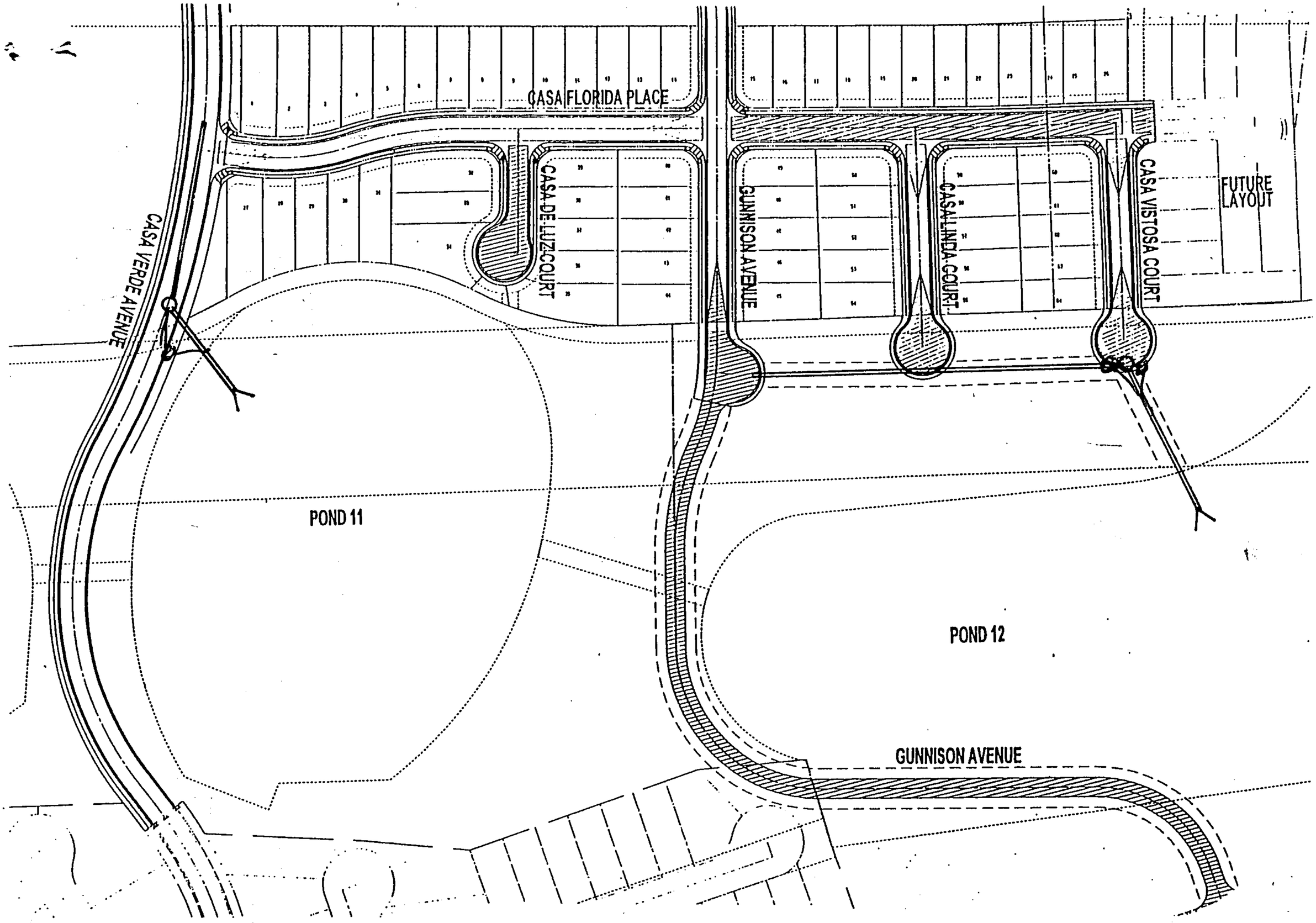
Sincerely,

So/ Teresa A. Martin
Hydrology Plan Checker
Development & Bldg. Ser. Division

BLB

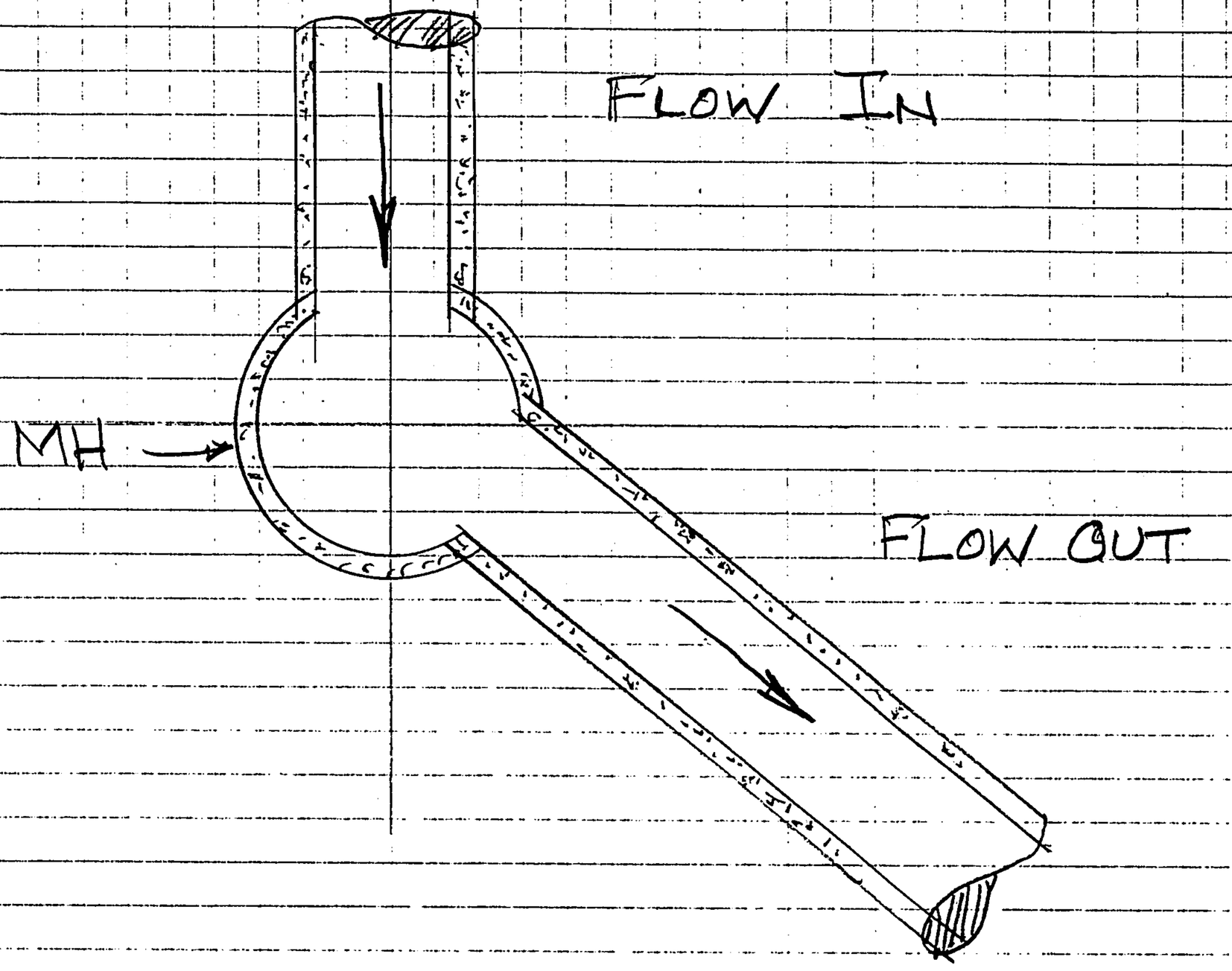
c: Arlene Portillo, COA- Project # 671581
File

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

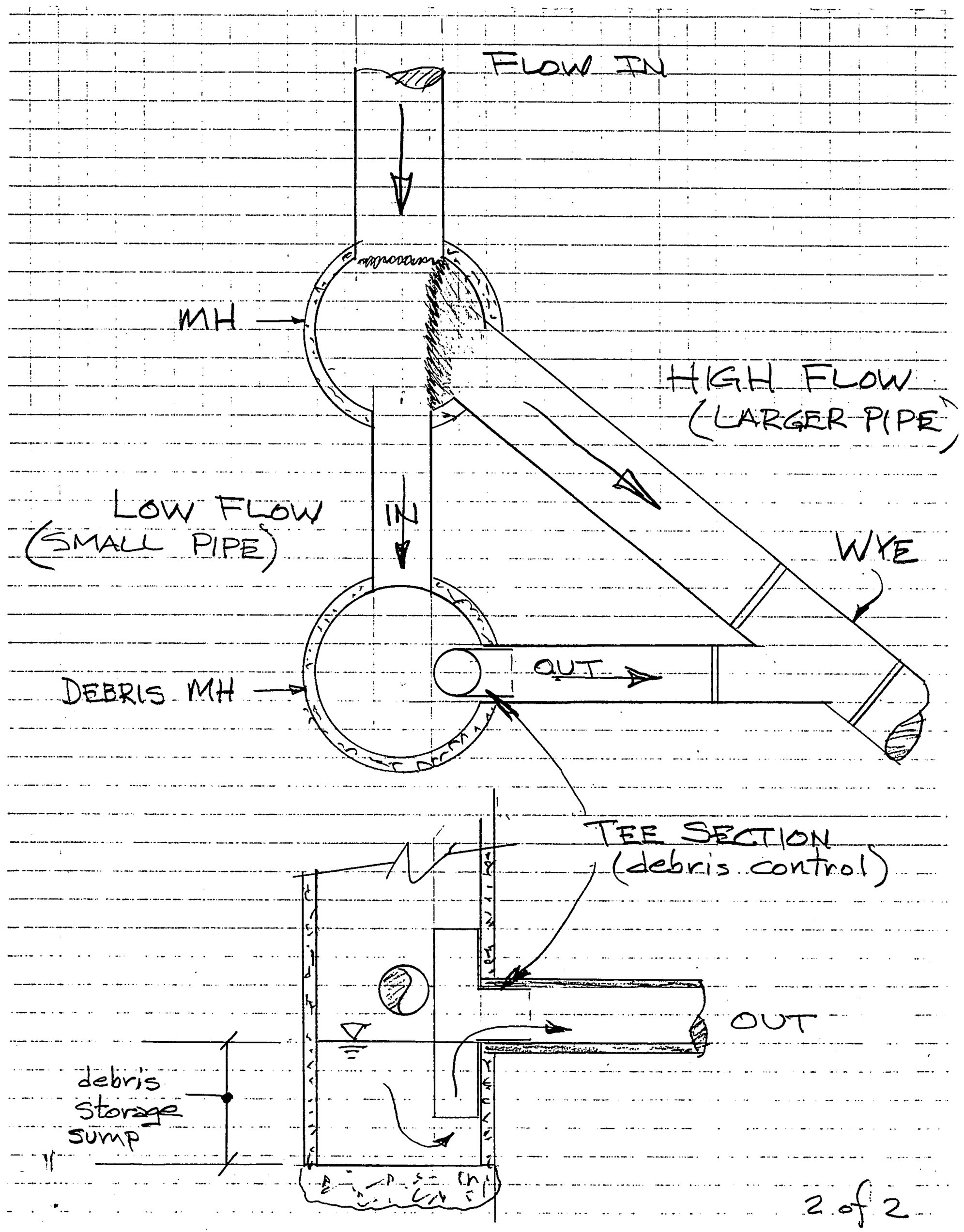


TIERRA OESTE, UNIT 3
DRAINAGE SCHEMATIC

File:
H9/D14

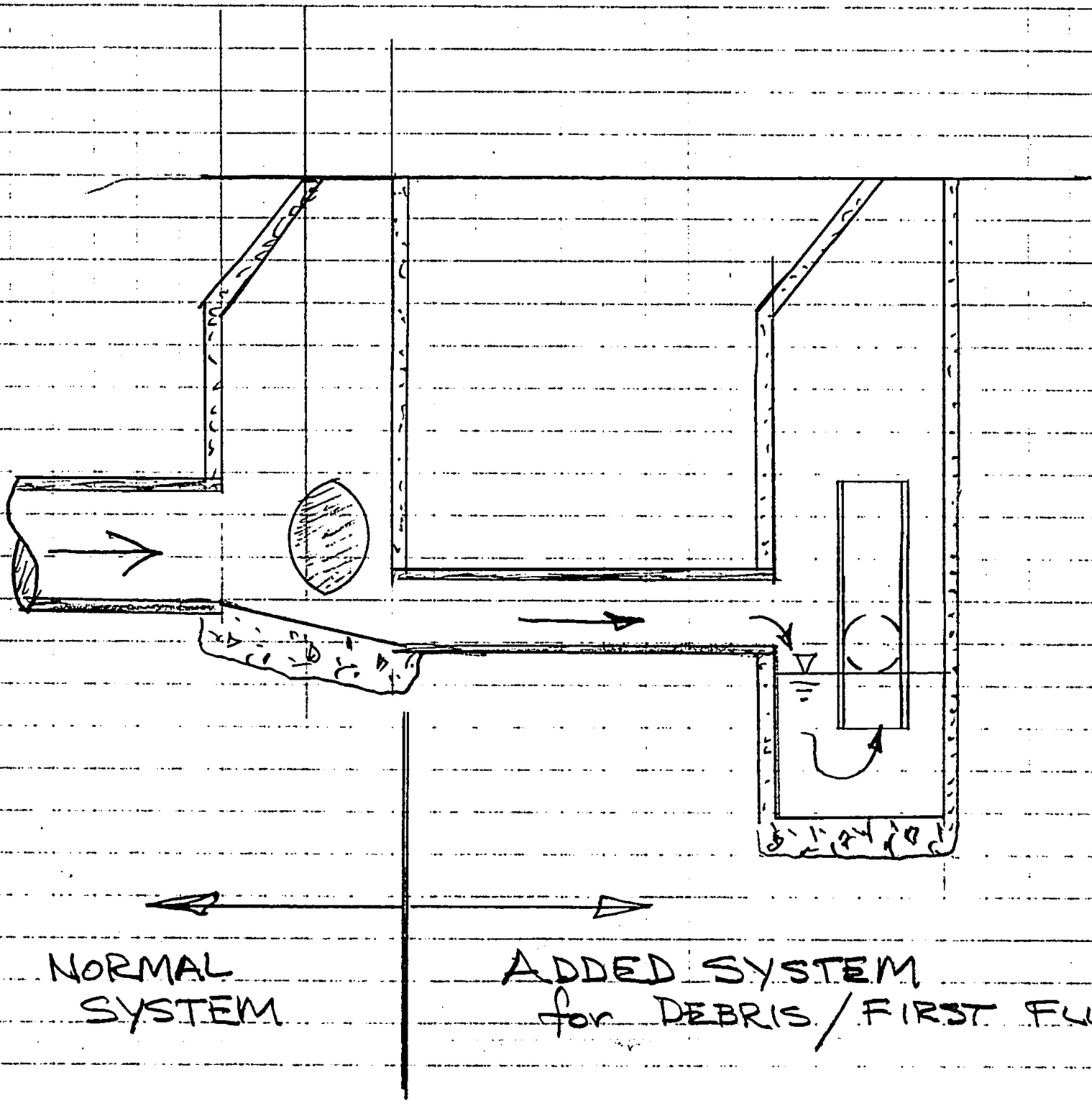


NORMAL SYSTEM


FLOW IN
MH
HIGH FLOW
(LARGER PIPE)
LOW FLOW
(SMALL PIPE)
IN
WYE
DEBRIS MH
OUT
TEE SECTION
(debris control)
OUT
debris
storage
sump

MANHOLE SYSTEM

DEBRIS / FIRST FLUSH TREATMENT



NORMAL SYSTEM

ADDED SYSTEM for DEBRIS / FIRST FLUSH CONTROL

FLOW IN

MH

HIGH FLOW
(LARGER PIPE)

LOW FLOW
(SMALL PIPE)

IN

WYE

OUT

DEBRIS MH

TEE SECTION
(debris control)

OUT

debris
storage
sump

11'

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

August 17, 2001

Kevin Patton, PE
Bohannan Huston, Inc
7500 Jefferson NE
Albuquerque, NM 87109

Re: Tierra Oeste Unit 3 Drainage Addendum
Engineer Stamp dated 8-10-01 (H9/D14)

Dear Mr. Patton,

Based upon the information provided in your report submitted 8-15-01, the above referenced site is approved for Site Development Plan for Subdivision, Site Development Plan for Building Purposes and Preliminary Plat actions by the DRB. AMAFCA will need to sign the infrastructure list and Site Plans

If you have any questions, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham, PE
Sr. Engineer, Hydrology

C: Lynn Mazur, AMAFCA
file

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

DRAINAGE INFORMATION SHEET

PROJECT TITLE: Tierra Oeste Unit 3 ZONE MAP/DRG. FILE #: H9/D14
DRB #: Project 1001243 EPC#: WORK ORDER#:

LEGAL DESCRIPTION: TRACT E Crossings
CITY ADDRESS:

ENGINEERING FIRM: Bohannan Huston Inc CONTACT: Kevin Patten
ADDRESS: Courtyard I 7500 Jefferson Street PHONE: 823-1000
CITY, STATE: Albuquerque, NM 87109 ZIP CODE: 87109

OWNER: Westland Development CONTACT: Leroy Chavez
ADDRESS: PHONE:
CITY, STATE: ZIP CODE:

ARCHITECT: CONTACT:
ADDRESS: PHONE:
CITY, STATE: ZIP CODE:

SURVEYOR: CONTACT:
ADDRESS PHONE:
CITY, STATE: ZIP CODE:

CONTRACTOR: CONTACT:
ADDRESS: PHONE:
CITY, STATE: ZIP CODE:

CHECK TYPE OF SUBMITTAL:
- ____ DRAINAGE REPORT(*)
- ____ DRAINAGE PLAN
- ____ CONCEPTUAL GRADING & DRAINAGE PLAN
- ____ GRADING PLAN
- ____ EROSION CONTROL PLAN
- ____ ENGINEER'S CERTIFICATION
- ____ CLOMR/LOMR
- ____ TRAFFIC CIRCULATION LAYOUT (TCL)
- X OTHER (information required for *)

WAS A PRE-DESIGN CONFERENCE ATTENDED:
- ____ YES
- ____ NO
- ____ COPY PROVIDED

CHECK TYPE OF APPROVAL SOUGHT:
- ____ SIA / FINANCIAL GUARANTEE RELEASE
- X PRELIMINARY PLAT APPROVAL
- X S. DEV. PLAN FOR SUB'D. APPROVAL
- ____ S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ____ SECTOR PLAN APPROVAL
- ____ FINAL PLAT APPROVAL
- ____ FOUNDATION PERMIT APPROVAL
- ____ BUILDING PERMIT APPROVAL
- ____ CERTIFICATE OF OCCUPANCY APPROVAL
- X GRADING PERMIT APPROVAL
- X PAVING PERMIT APPROVAL
- ____ WORK ORDER APPROVAL
- ____ OTHER (SPECIFY)

RECEIVED
AUG 07 2001
HYDROLOGY SECTION

DATE SUBMITTED: BY:

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August 6, 2001

BOHANNAN-HUSTON, INC.

Courtyard One

7500 JEFFERSON NE

Albuquerque

NM 87109-4335

voice 505.823.1000

fax 505.821.0892

Mr. Brad Bingham, P.E.
Hydrology Division
Public Works Department
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Re: Tierra Oeste Unit 3 Drainage Report – Engineers Stamp dated 7/13/01
(COA Drainage File H9/D14)

Dear Brad:

The purpose of this letter is to address your letter dated July 30, 2001, and to provide you with the supplemental information you requested in that letter.

As requested we have reanalyzed Offsite Basin 2 from an undeveloped state to that of a developed park. As we had discussed, Tract D of The Crossings (Offsite Basin 2) is reserved for a public park. The 100 year 6 hour runoff increased by 7.9 cfs. I have enclosed a copy of the revised analysis for you files. The minor increase did not change the proposed number of inlets or pipe sizes.

As requested, we have enclosed a copy of the Proposed Basin Map (fully developed conditions) from the approved Crossings Drainage Report to support our analysis.

You noted in your letter that shared drainage swales will not be allowed. As requested, I have revised the detail from the detail sheet and removed any reference to a shared swale. It is my understanding that we will not have to revise the grading plan and that we will be able to as-built this requirement on the certified grading plan.

Your letter mentioned the possibility of performing an erosion setback analysis to determine the floodplain limits on the Mirehaven Arroyo flowing into Dam #12. The easement shown on the preliminary plat is an Existing Interim Flood Plain Drainage Easement Limits as granted by Plat of Tract A of El Rancho Atrisco Phase V (filed 2/12/87; C32-186) that corresponds to FEMA Flood Plain. There is a temporary drainage easement granted to AMAFCA between points 1 and 2 as shown on the recorded bulk land plat for The Crossings upstream of Tract E. This easement corresponds to the maximum lateral erosion limit established by the Las Lomitas Unit IIB Mirehaven Arroyo Scourwall Analysis and Design, prepared by Avid Engineering October 1994. Please note that a financial guarantee has already been provided for a lined channel in the Mirehaven Arroyo from Pond 12 to 98th Street.

As requested, a swale has been added to the grading plan at the southern edge of Basin #9.

I have received comments from AMAFCA and scheduled a meeting with them on Tuesday, August 7, 2001, at their office. I will provide you with a copy of my letter to AMAFCA addressing their comments.

If you have any questions or require additional information, please give me a call 823-1000.

Sincerely,
Bohannan Huston, Inc.

Kevin Patton, P.E.
Project Manager
Community Development
and Planning Group

KP/ca
Enclosures

cc: Leroy Chavez, Westland Development Co., Inc. (w/ enclosures)
Fred Ambrogi, Westland Development Co., Inc. (w/ enclosures)

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Low Point in Casa Verde Avenue**

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

WEIR: Q=C*L*H^1.5

Wing opening
C= 3.0
L= 4.0 ft
Q=3.0(4.0')H**1.5= 12.0H**1.5

Grate opeining
C=3.0
L(single grate)=[(2.67')+2(1.8')]=6.27 ft
Q=3.0(6.27)H^1.5=18.81*H^1.5

ORIFICE: Q=C*A*(2*G*H)**0.5

Grate opening
C=0.6
A(single grate)=4.09 sf
Q=2.46*(64.4*H)^0.5

Wing opening
C=0.6
A=2.0 sf
Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR WING OPENING	Q (CFS) WEIR SINGLE GRATE	Q (CFS) ORIFICE SINGLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Single Grate "A" inlet w/ wing openings on each side
	0.10	0.10	0.38	0.59	6.24	1.35	Weir controls on grate analysis
	0.20	0.20	1.07	1.68	8.82	3.83	
	0.30	0.30	1.97	3.09	10.80	7.03	
	0.40	0.40	3.04	4.76	12.47	10.83	
	0.50	0.50	4.24	6.65	13.94	15.14	
	0.60	0.60	5.58	8.74	15.27	19.90	
TOP OF CURB	0.70	0.70	7.03	11.02	16.50	25.07	
	0.80	0.80	8.59	13.46	17.64	30.63	Q(100 yr) = 58.4cfs; 2 inlets each side take 29.2 cfs each
ROW LIMIT	0.90	0.90	10.25	16.06	18.71	36.55	
	1.00	1.00	12.00	18.81	19.72	42.81	

NOTE: The total runoff intercepted by the inlet at the low point in the cul-de-sac is:
Q(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].
THE 100 YR STORM EVENT = 48 CFS at the sump condition
The High Point Elevation in Casa Flordia Place is below the right of grade at the low point in Casa Verde; therefore acting as

BASIN SUMMARY - FULLY DEVELOPED CONDITION

Tierra Oeste Unit 3 (Tract E - Westland Development)
Fully Developed Drainage Conditions

	BASIN I.D.	AREA (AC)	UNITS #	% LAND TREATMENT A	B	C	D	DISCHARGE (CFS) 10 YR	100YR
	HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (DEVELOPED-ONSITE BASINS)								
	Basin A	0.60	3	0.0%	23.9%	25.3%	49.5%	1.2	2.0
	Basin B-1	1.61	12	0.0%	21.6%	21.6%	56.9%	3.4	5.7
	Basin B-2	0.61	3	0.0%	25.6%	25.6%	48.9%	1.2	2.1
	Basin C	1.20	8	0.0%	21.6%	21.6%	56.9%	2.5	4.2
	Basin D-1	0.71	5	0.0%	20.1%	20.1%	59.9%	1.5	2.6
	Basin D-2	1.01	7	0.0%	21.6%	21.6%	56.9%	2.1	3.6
	Basin E-1	0.50	4	0.0%	21.6%	21.6%	56.9%	1.1	1.8
	Basin E-2	1.34	10	0.0%	21.6%	21.6%	56.9%	2.8	4.7
	Basin F	1.68	11	0.0%	21.6%	21.6%	56.9%	3.6	5.9
	Future Basin 1	1.63	12	0.0%	21.6%	21.6%	56.9%	3.5	5.8
SUB-TOTAL		10.89	75					23.0	38.4
	HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (OFFSITE BASINS)								
	Basin #1	2.10	0	90.0%	5.0%	5.0%	0.0%	0.7	2.9
	Basin #2	9.15	0	0.0%	90.0%	0.0%	10.0%	8.8	20.6
	Basin #3	1.15	0	0.0%	5.0%	5.0%	90.0%	3.1	4.8
	Basin #4	0.55	0	0.0%	5.0%	5.0%	90.0%	1.5	2.3
	Basin #5	3.08	0	90.0%	5.0%	5.0%	0.0%	1.0	4.3
	Basin #6	1.12	0	0.0%	80.0%	20.0%	0.0%	1.0	2.5
	Basin #7	2.80	0	90.0%	5.0%	5.0%	0.0%	0.9	3.9
	Basin #8	0.25	0	0.0%	5.0%	5.0%	90.0%	0.7	1.0
	Basin #9	3.49	0	90.0%	5.0%	5.0%	0.0%	1.2	4.8
SUB-TOTAL		23.69	0					17.2	41.3
TOTAL		**34.58**	**75**					**40.2**	**79.7**

NOTES:

1) Off-site basins (1-5,) have contributing flows to Tract E and have been classified as a "Type A" Hydrologic Soil Group (HSG) according to Table A-4 in the DPM section 22-2.

N=UNITS/ACRES . . . . . = 2.2
%D = 7*SQRT((N*N)+(5*N)) = 27.6 %

***** PC PROGRAM STREAM SEPTEMBER 1994 *****

Casa Verde S= 0.7%

MANNING'S N= .017 SLOPE= .007

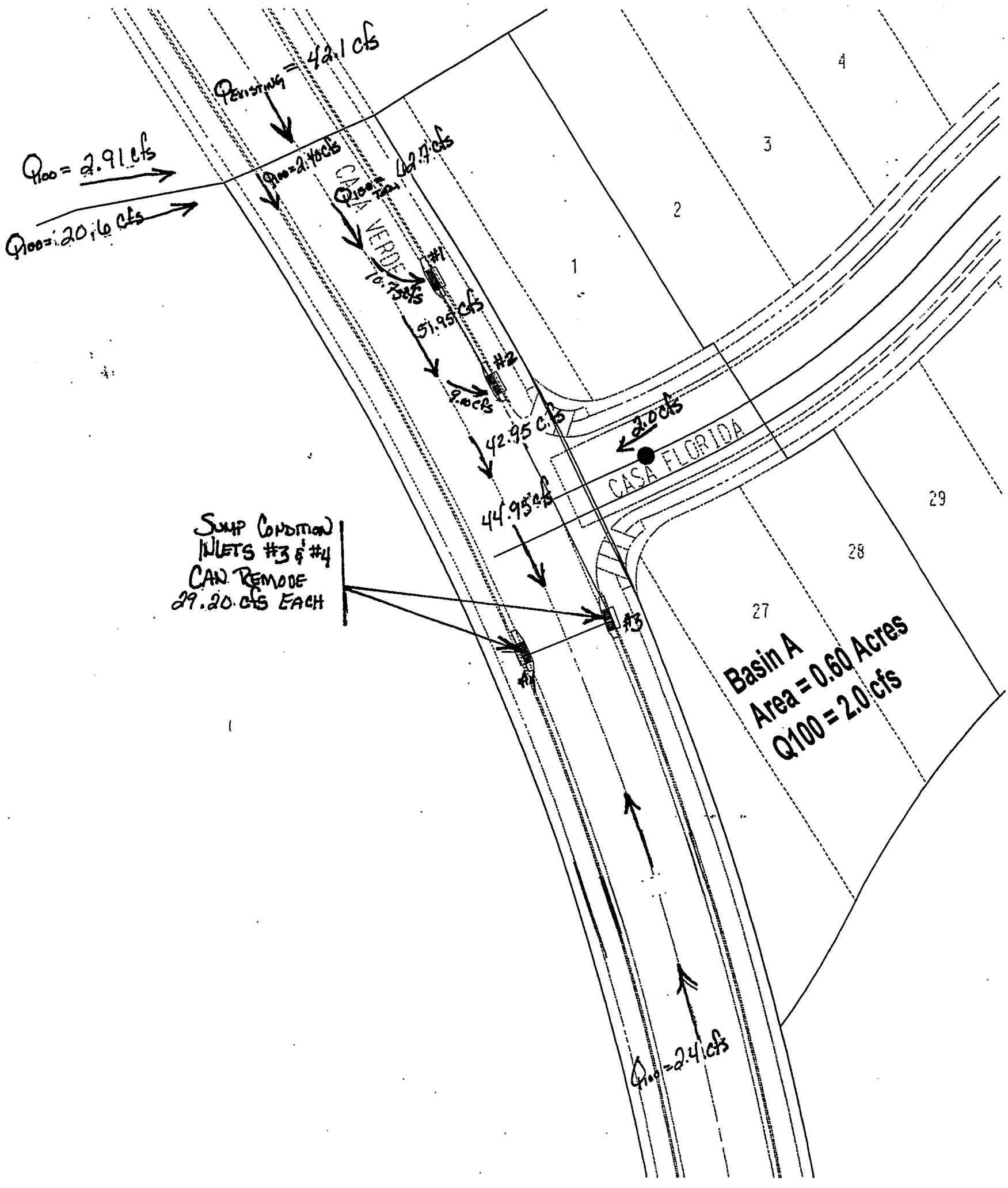
POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.85	5	11.00	0.12	9	51.17	0.67
2	8.37	0.67	6	30.00	0.50	10	51.63	0.67
3	8.83	0.67	7	49.00	0.12	11	60.00	0.85
4	9.00	0.00	8	51.00	0.00	12	0.00	0.00

WSEL (FT)	DEPTH INC (FT)	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID (FT)	VEL HEAD (FT)	ENERGY HEAD (FT)
0.05	0.05	0.04	0.0	1.72	0.61	1.64	0.01	0.06
0.10	0.10	0.16	0.2	3.44	0.96	3.28	0.01	0.11
0.15	0.15	0.39	0.4	6.92	1.08	6.68	0.02	0.17
0.20	0.20	0.85	1.1	12.02	1.25	11.70	0.02	0.22
0.25	0.25	1.56	2.3	17.13	1.48	16.73	0.03	0.28
0.30	0.30	2.52	4.3	22.23	1.71	21.75	0.05	0.35
0.35	0.35	3.74	7.3	27.33	1.94	26.78	0.06	0.41
0.40	0.40	5.20	11.2	32.44	2.16	31.80	0.07	0.47
0.45	0.45	6.92	16.4	37.54	2.37	36.83	0.09	0.54
0.50	0.50	8.88	22.8	42.65	2.57	41.85	0.10	0.60
0.55	0.55	11.00	32.3	43.15	2.94	42.28	0.13	0.68
0.60	0.60	13.11	43.3	43.25	3.30	42.30	0.17	0.77 ②&③
0.65	0.65	15.23	55.4	43.36	3.64	42.33	0.21	0.86 ①
0.70	0.70	17.41	65.6	47.11	3.77	46.05	0.22	0.92
0.75	0.75	19.83	76.5	51.76	3.86	50.70	0.23	0.98
0.80	0.80	22.48	89.1	56.41	3.96	55.35	0.24	1.04
0.85	0.85	25.37	103.3	61.06	4.07	60.00	0.26	1.11

① $Q_{100} = 62.70$ cfs
WSEL = DEPTH = 0.60 ft
V = 3.72 ft/s

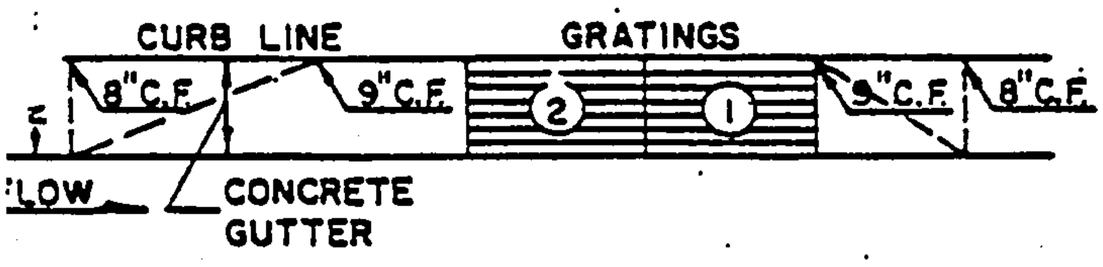
② $Q_{RESIDUAL} = 51.95$ cfs
DEPTH = 0.63 ft
V = 3.50 ft/s

③ $Q_{RESIDUAL\ 100yr} = 44.95$ cfs
DEPTH = 0.604 ft
V = 3.34 ft/s

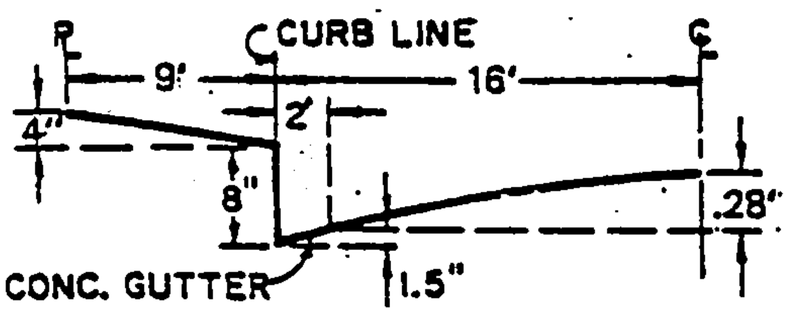

$Q_{EXISTING}$ = 42.1 cfs
Q_{100} = 2.91 cfs
Q_{100} = 20.16 cfs
Q_{100} = 2.4 cfs
Q_{100} = TOTAL 42.7 cfs
CASA VERDE
#1
10.38 cfs
51.95 cfs
#2
9.0 cfs
42.95 cfs
2.0 cfs
CASA FLORIDA
44.95 cfs
#3
#4
SUMP CONDITION
INLETS #3 & #4
CAN REMODE
29.20 cfs EACH
1
2
3
4
27
28
29
Basin A
Area = 0.60 Acres
Q100 = 2.0 cfs
Q_{100} = 2.4 cfs

CASA VERDE, S = 0.7%

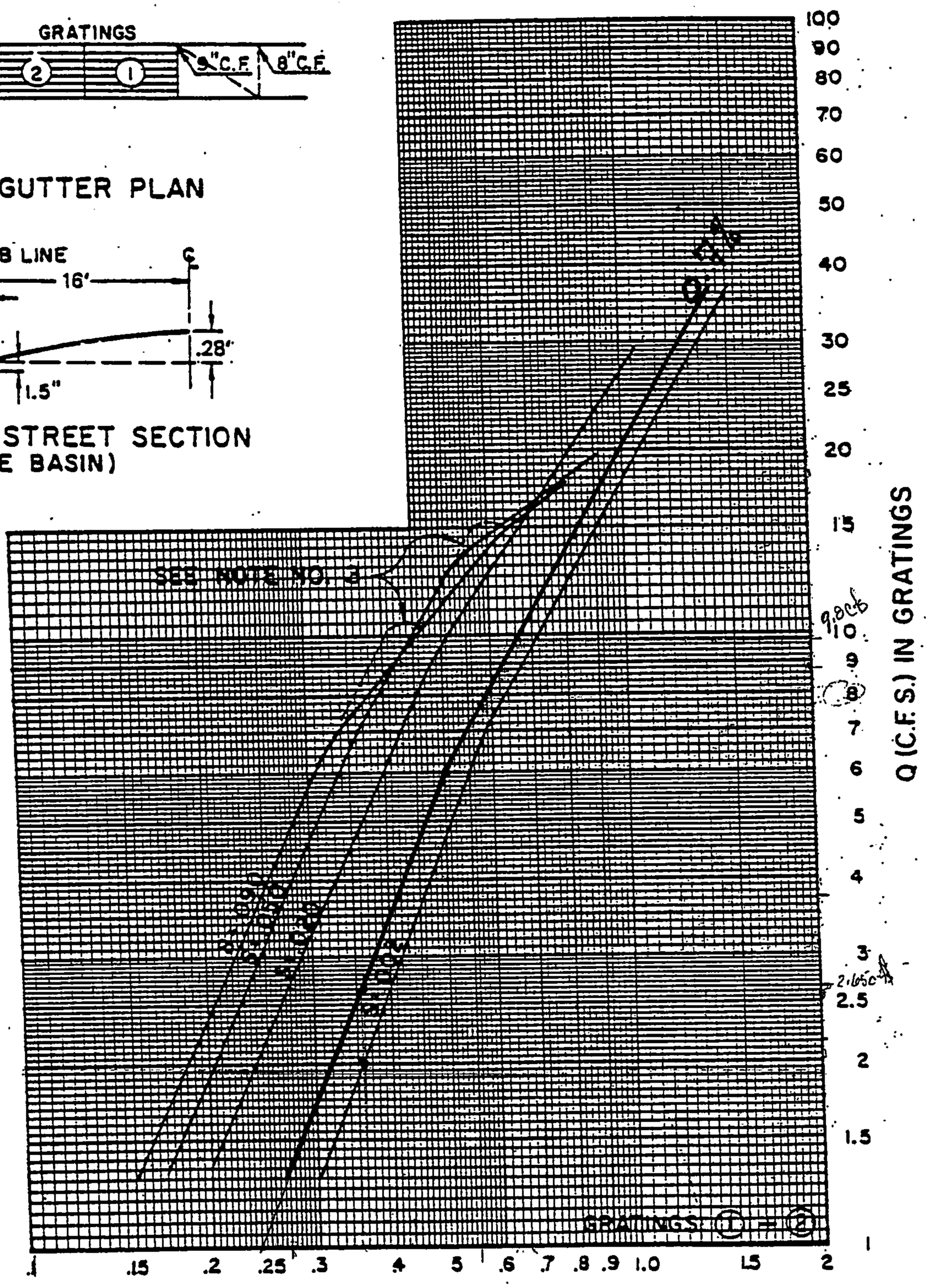
GRATING CAPACITIES FOR TYPE DOUBLE "C," AND "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)



D = DEPTH OF FLOW (FT.) ABOVE NORMAL GUTTER GRADE

COPY

August 16, 2001

BOHANNAN-HUSTON, INC.

Courtyard One

7500 JEFFERSON NE

Albuquerque

NM 87109-4335

voice 505.823.1000

fax 505.821.0892

Lynn M. Mazur, P.E.
Development Review Engineer
AMAFCA
2600 Prospect NE
Albuquerque, NM 87107

Re: Tierra Oeste Unit 3 Drainage Report – Engineers Stamp Dated 7/13/01
(COA Drainage File H9/D14) ZAP D-17

Dear Lynn:

The purpose of this letter is to respond to your letter dated August 2, 2001 and to provide you with the supplemental information you requested in that letter.

As indicated in item number 1 of your letter referenced above, the adopted West I-40 DMP specified an increase in volume for Dam #11. As you are aware, Bohannan Huston, Inc. prepared the West I-40 DMP for AMAFCA. Further analysis indicates that there are alternative solutions available in lieu of increasing the volume to Pond #11. One possible solution, suggested by your office, is to increase the volume in Pond #10 instead of Pond #11. After performing the analysis associated with this alternate solution, we have concluded that we can increase the volume in Pond #10 by approximately 5.2 acre-feet without having to increase the volume in Pond #11.

check w/A.

Given this solution as an alternative, it doesn't appear that the proposed development of Tract E would require the expansion of Pond #10; therefore, I would request that we address this issue of expanding Pond #10 to future platting and/or development.

Item number 2 from your letter referenced a letter dated June 21, 2000, prepared by our office concerning the Mirehaven Arroyo. This letter stated that "...the proposed development of the future residential subdivisions trigger the construction of the Mirehaven Channel between 98th Street and Dam #12, not the Petroglyph Golf Course construction". It is my understanding that this letter refers to subdivisions that would drain developed runoff to the Mirehaven Arroyo (excluding the Crossings Subdivision Units I and II). The proposed subdivision (Tierra Oeste Unit 3) is not discharging developed runoff to the Mirehaven Arroyo. The future arroyo improvements mentioned in our letter dated June 21, 2000, are currently financially guaranteed from Dam #12 to 98th Street as a part of the Bulk Land Plat for the Crossings. A copy of the recorded Subdivision Improvements Agreement for the financial guaranty associated with arroyo improvements was faxed to your office.

As stated in item number 1 in the additional comments section of your letter, AMAFCA currently owns a temporary blanket drainage easement over Tracts A, C and H, as noted in the recorded bulk land plat for the Crossings. The vacation of a portion of these easements is a part of our vacation action associated with our preliminary plat application to the City's Development Review Board. If approved by AMAFCA and the City, we would coordinate its release through AMAFCA. I would be glad to meet with you as soon as you are available in order to prepare and present this vacation request to your Board of Directors.

COPY

Further discussion with Westland will be required concerning your request for permanent easements over the entirety of Tracts C and H. I would request that we be able to move forward with the approval of the preliminary plat while discussions continue concerning the permanent easement issue. Please note that AMAFCA continues to own the remainder of the temporary blanket easements over Tracts C, H and A and that a separate and future vacation action would be required prior to its release.

As requested from item 2 in the additional comments section of your letter, we will provide an approved barrier at the end of each of the cul-de-sacs (excluding Gunnison at this time) so as to prevent vehicular access to Tracts C and H. The type of barrier will be coordinated with the City and AMAFCA at the time of work order approval.

I am enclosing a copy of a revised grading plan addressing item 3 in the additional comments section of your letter. This plan has been revised to address the City's comments removing any shared side yard swales and your comments concerning the AMAFCA maintenance road within Tracts C and H. As requested, the profile grades on the AMAFCA maintenance road do not exceed 10%, and the cross-slope will not exceed 2% (tie back slopes from the edge of the road to the natural topography will not exceed 3:1).

As requested in Item 4 in the additional comments section of your letter, we will provide the runoff amount, velocities and hydraulic grade line calculated in the storm drain pipes shown on the plan and profiles sheets of the work order plans. We will coordinate with AMAFCA concerning the work within Ponds 11 and 12. Please let me know if an approved work order signed by the City and AMAFCA will be adequate or if, in addition to the work order, we will need to obtain a separate grading license approved by the AMAFCA Board of Directors.

In addition to the comments from your letter, additional analysis was requested at our last meeting concerning the prudent line in the Mireheaven Arroyo. I am enclosing our analysis and an exhibit reflecting the prudent line in the Mireheaven Arroyo. The enclosed exhibit indicates that the prudent line will not cross into the proposed development. This analysis was based upon 1125cfs, which reflects the upstream runoff indicated in the approved I-40 DMP and the undeveloped runoff from the approved drainage report for Crossing Units I and II. Any increase in this runoff would be a result of future development that would require the construction of the arroyo improvements.

If you have any questions or require additional information, please give me a call 823-1000.

Sincerely,
Bohannan Huston, Inc.

Kevin Patton, P.E.
Group Leader/Project Manager
Community Development and Planning

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AUG 17 2001
HYDROLOGY SECTION

KP/am
Enclosures

cc: Fred Ambrogi, Westland Development Co., Inc. (w/enclosures)
Brad Bingham, COA PWD Hydrology (w/enclosures)

P:\020040\cdp\corres\003-prel_plat\Lynn Tract E- rev.doc

ADDENDUM #1
FOR THE
DESIGN ANALYSIS REPORT
FOR
TIERRA OESTE UNIT 3 (TRACT E AND
A PORTION OF TRACT A OF THE CROSSINGS)

AUGUST 16, 2001

BOHANNAN HUSTON

Courtyard One

7500 JEFFERSON NE

Albuquerque

NEW MEXICO 87109

voice 505.823.1000

fax 505.821.0892

PREPARED BY:

BOHANNAN HUSTON, INC.
COURTYARD I
7500 JEFFERSON STREET NE
ALBUQUERQUE, NM 87109

PREPARED FOR:

WESTLAND DEVELOPMENT
401 COORS BOULEVARD NW
ALBUQUERQUE, NM 87121

CRAIG W. HOOVER
NEW MEXICO
11848
REGISTERED PROFESSIONAL ENGINEER

PREPARED BY:

Craig W. Hoover 8/16/01

Craig W. Hoover, P.E. Date

SUMMARY

The purpose of this addendum is to present two additional analyses to the Tierra Oeste Unit 3 Drainage Report. The first analysis was to determine the lateral erosion limit or prudent line in the Mirehaven Arroyo from Ladera Dam #12 to the north boundary of Tract E of the Crossings. The second analysis was to determine if Ladera Dam #10 could be expanded in lieu of expanding Ladera Dam #11 that was indicated in the adopted West I-40 Drainage Management Plan.

PRUDENT LINE

The enclosed calculations have determined that the lateral erosion limit will not encroach into the proposed development of Tierra Oeste Unit 3. The lateral erosion limit is based on the simplified procedure outlined in AMAFCA's Sediment and Erosion Design Guide that aims to determine the maximum erosion limits of an arroyo that can be expected to occur over a long period of time. It is assumed the arroyo is left in its natural state and allowed to meander.

The width of the envelope, as measured from the average down valley direction, is about 123 feet. This value is based on the existing peak 100-year flow in the Mirehaven Arroyo including the addition of the developed runoff from Units I and II of the Crossings Subdivision (Q 100 yr 6 hr = 1122 cfs).

For additional information concerning the lateral erosion limit within the Mirehaven Arroyo upstream of this development please refer to the *Las Lomitas Unit IIB Mirehaven Arroyo Scourwall Analysis and Design, prepared by Avid Engineering for The Presley Companies; dated October, 1994.* The runoff applied to the enclosed analysis differs from that provided in the Las Lomitas Report mentioned above due to differences discovered in the different AHYMO models (94 verse 97). As mentioned above the runoff used in this addendum was taken from the Existing Conditions associated with Option 3C of the West I-40 DMP.

Please refer to the enclosed exhibit and analysis for further review.

LADERA DAMS #10 & #11

The two AHYMO models from the West I-40 Drainage Management Plan for Options 2D and 3C1 were rerun to examine the possibility of expanding Dam #10 rather than Dam #11 to accommodate future development in watershed. Since the recommended option, Option 6A, in the West I-40 DMP is the worst-case scenario of either Option 2D or 3C1 both hydrologic models were considered. For this portion of the watershed Option 2D is the worst-case scenario and so the modification to Option 2D is included with this addendum.

The 2D AHYMO model was revised to increase the volume of Dam #10 in lieu of expanding Dam #11. Based on the results of the model by expanding Dam #10 by approximately 5.2 acre-feet the volume of flow reaching Dam #11 is reduced sufficiently to keep the 100-year water surface from exceeding the crest of the dam. Dam #12 was also checked to insure that these changes did not adversely impact this dam and the 100-year water surface is also below the crest of the spillway for Dam #12. Consequently, expansion of Dam #10 at a future date is recommended in lieu of expansion of Dam #11 since the topography, roadway and platting constraints favor expansion of Dam #10.

CONCLUSION

In summary, this addendum together with the drainage report for Tierra Oeste Unit 3 has provided sound analysis to support the development of the proposed subdivision. The enclosed information provides adequate supporting documentation and guidance for approval of this report and a guide to future developments and/or phasing of the surrounding properties. It is recommended that this plan be approved as requested.

```
*S   ROUTE COMBINED THROUGH DAM #10
*    CREST=5257.0, TOP=5260.0
*    THIS DAM WAS OMITTED IN DAM #15 ANALYSIS
*    INCREASE POND VOLUME BY 10%

ROUTE RESERVOIR      ID=9        HYD=POND10

                     INFLOW ID=10      CODE=10

        OUTFLOW       STORAGE          ELEVATION
        (CFS)         (AC/FT)            (FT)
          0              0                5244
         14             7.45              5246
         30            15.34              5248
         38            23.69              5250
         47            32.52              5252
         54            41.81              5254
         63            56.71              5257 <-----SPILLWAY ELEV.
        195            61.84              5258
        960            72.64              5260

  *
  *
  *

PEAK DISCHARGE =         55.260 CFS - PEAK OCCURS AT HOUR    29.95
MAXIMUM WATER SURFACE ELEVATION =      5254.420
MAXIMUM STORAGE =          43.8964 AC-FT       INCREMENTAL TIME=0.05 HRS
```

```
*S   ROUTE FLOW THROUGH DAM #11
*    CREST=5234.7, TOP=5236.5, 1-24"

ROUTE RESERVOIR      ID=9        HYD=POND11

                     INFLOW ID=10      CODE=10

        OUTFLOW       STORAGE          ELEVATION
        (CFS)         (AC/FT)            (FT)
          0              0               5226.5
          8              4               5228
         37             17               5232
         47             29               5234.7 <-----SPILLWAY ELEV.
         68             30               5235
        276             34               5236
        503          36.17               5236.5

   *
   *
   *

PEAK DISCHARGE =          46.614 CFS - PEAK OCCURS AT HOUR    29.95
MAXIMUM WATER SURFACE ELEVATION =      5234.596
MAXIMUM STORAGE =          28.5366 AC-FT       INCREMENTAL TIME=0.05 HRS
```

```
*S   ROUTE FLOW THROUGH POND #12
*S DIVERSION TO I-40 THRU POND 12 EXISTING CONDITIONS

ROUTE RESERVOIR      ID=10   HYD=POND12

                     INFLOW ID=9   CODE=10

        OUTFLOW              STORAGE              ELEV
        (CFS)                 (AC-FT)              (FT)
          0                   0.0                5202
         75                   5.5                5203
        170                   11.32              5204
        325                   16.5               5205
        500                   23.34              5206
        680                   28.5               5207
        765                   32.3               5207.5
        825                   36.09              5208
        890                   39.5               5208.5
        945                   42.8               5209
       1055                   49.58              5210
       1175                   57.5               5211.3 <------SPILLWAY ELEV.
        235                   63.8               5212
       5810                   71.2               5213
      11370                   75.74              5214
      18420                   82.5               5215
      31485                   91.48              5216
      54150                   99.65              5217

   *
   *
   *

PEAK DISCHARGE =          959.103 CFS - PEAK OCCURS AT HOUR     2.35
MAXIMUM WATER SURFACE ELEVATION =      5209.128
MAXIMUM STORAGE =           43.6692 AC-FT       INCREMENTAL TIME=0.05 HRS
```

Lateral Erosion Widths
The Crossing

Basin Name	Q100	Qd	S	Sc	Sub or Super	Δmax	Wd	λ/Wd	Lv	Total
	(cfs)	(cfs)	(ft/ft)	(ft/ft)		(feet)	(feet)		(feet)	Erosion Width
L12.20	1122	224.4	0.029	0.018	super	102.3	40.1	10.2	205	245

Note: Formulas from AMAFCA Sediment Erosion Design Guide (see pgs. 3-68 through 3-75)
Assumptions:

1) Approximate method based on optimal bend shape
2) Dominant Discharge = Qd = 0.2*Q100; Qd<2000cfs
3) Critical Slope = Sc = 0.037*Qd^-0.133; assumes wide rectangular channel, uniform flow, n=0.035, W/D=40
4) Maximum lateral erosion distance (Δmax) varies due to Qd and S; presence of lateral controls not considered
5) Meander wavelength to channel width (λ/Wd) varies due to Qd
6) Downvalley length = Lv = λ/2
7) Total Erosion Width = 2*(Δmax+0.5*Wd)
8) Critical bank height not considered
9) 100-year flood zone not considered

L12.20 Basin in I-40 AHYMO Model (Rev_E 100.hym)

Total area of basin = 0.3422 mi^2 = 219 acres

Land use for existing model: A = 77

B = 9

C = 14

D = 0

—

Developed area (The Crossing) = 29.5 acres

Land use for developed area: A = 0

B = 27

C = 27

D = 46

—

219 - 29.5 = 189.5 acres

Existing Land Use Area after removing developed conditions:

A = 189.5 * 0.77 = 146 acres

B = 189.5 * 0.09 = 17 acres

C = 189.5 * 0.14 = 26.5 acres

D = $\frac{0 \text{ acres}}{189.5 \text{ acres}}$

Developed land use area:

A = = 0 acres

B = 29.5 * 0.27 = 8 acres

C = 29.5 * 0.27 = 8 acres

D = 29.5 * 0.46 = 13.5 acres

Total land use percentages (Developed and Undeveloped):

A = (146 + 0)/219 = 66.6

B = (17 + 8)/219 = 11.4

C = (26.5 + 8)/219 = 15.8

D = (0 + 13.5)/219 = 6.2

100 % ✓

Bohannan ▲ Huston

PROJECT NAME _____ SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

ENGINEERS PLANNERS PHOTOGRAMMETRISTS

```
*S  ADD SECOND HALF OF FLOW FROM L12.20 TO MIREHAVEN CHAN
*S  TOTAL FLOW IN MIREHAVEN CHANNEL NORTH OF DAM 12
ADD HYD              ID=3     HYD=L12.20_7
          Tp = 1.6 hrs ⇒ID=2     ID=51 ⇒ Tp = 2.85 hrs
PRINT HYD            ID=3     CODE=10
```

HYDROGRAPH FROM AREA L12.20_7

TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS	TIME HRS	FLOW CFS
.000	.0	6.000	71.9	12.000	2.5	18.000	.8	24.000	.6
.500	.0	6.500	52.2	12.500	2.0	18.500	.7	24.500	.5
1.000	.0	7.000	38.1	13.000	1.7	19.000	.7	25.000	.5
1.500	84.8	7.500	27.9	13.500	1.5	19.500	.7	25.500	.4
2.000	364.8	8.000	20.5	14.000	1.3	20.000	.7	26.000	.3
2.500	993.1	8.500	15.2	14.500	1.1	20.500	.7	26.500	.2
3.000	1094.2	9.000	11.4	15.000	1.0	21.000	.7	27.000	.1
3.500	891.3	9.500	8.6	15.500	1.0	21.500	.7	27.500	.0
4.000	615.3	10.000	6.6	16.000	.9	22.000	.6	28.000	.0
4.500	276.7	10.500	5.1	16.500	.9	22.500	.6	28.500	.0
5.000	147.1	11.000	4.0	17.000	.8	23.000	.6	29.000	.0
5.500	99.6	11.500	3.1	17.500	.8	23.500	.6		

RUNOFF VOLUME = .44433 INCHES = 201.9713 ACRE-FEET
PEAK DISCHARGE RATE = 1121.62 CFS AT 2.850 HOURS BASIN AREA = 8.5229 SQ. MI.

****

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```
*S  COMPUTE HYDROGRAPH FOR BASIN L12.20
COMPUTE NM HYD       ID=1       HYD=L12.20    DA=0.3422 SQ MI
                     PER A=77   PER B=9   PER C=14   PER D=0
                     TP=-0.243     RAIN=-1

     K =    .240150HR     TP =    .243000HR     K/TP RATIO =    .988272      SHAPE CONSTANT, N =  3.572773
     UNIT PEAK =    458.52     CFS   UNIT VOLUME =     1.000       B =    325.60       P60 = 1.7630
     AREA =       .342200 SQ MI     IA =     .59450 INCHES     INF =   1.51460 INCHES PER HOUR
     RUNOFF COMPUTED BY INITIAL ABSTRACTION/INFILTRATION NUMBER METHOD - DT =    .050000

    BULKING FACTOR APPLIED TO HYDROGRAPH.  FACTOR =  1.07000 AT PEAK FLOW.

PRINT HYD            ID=1       CODE=10
                                HYDROGRAPH FROM AREA L12.20

     TIME      FLOW          TIME      FLOW          TIME      FLOW          TIME      FLOW          TIME      FLOW
      HRS       CFS           HRS       CFS           HRS       CFS           HRS       CFS           HRS       CFS
      .000       .0          2.000      61.0         4.000       1.9         6.000        .1         8.000        .0
      .500       .0          2.500      15.1         4.500        .9         6.500        .1
     1.000       .0          3.000       7.5         5.000        .5         7.000        .0
     1.500     140.8         3.500       3.8         5.500        .2         7.500        .0

    RUNOFF VOLUME =       .49296 INCHES      =       8.9968 ACRE-FEET
    PEAK DISCHARGE RATE =     214.40 CFS  AT    1.600 HOURS    BASIN AREA =    .3422 SQ. MI.

   *
   *
   *
*S
*S  ADD SECOND HALF OF FLOW FROM L12.20 TO MIREHAVEN CHAN
*S  TOTAL FLOW IN MIREHAVEN CHANNEL NORTH OF DAM 12
ADD HYD              ID=3      HYD=L12.20_7
                     ID=2       ID=51
PRINT HYD            ID=3      CODE=10
                                HYDROGRAPH FROM AREA L12.20_7

     TIME      FLOW          TIME      FLOW          TIME      FLOW          TIME      FLOW          TIME      FLOW
      HRS       CFS           HRS       CFS           HRS       CFS           HRS       CFS           HRS       CFS
      .000       .0          6.000      71.6        12.000       2.3        18.000        .6        24.000        .5
      .500       .0          6.500      51.9        12.500       1.8        18.500        .6        24.500        .5
     1.000       .0          7.000      37.8        13.000       1.5        19.000        .6        25.000        .5
     1.500      70.4         7.500      27.6        13.500       1.3        19.500        .5        25.500        .4
     2.000     356.6         8.000      20.3        14.000       1.1        20.000        .5        26.000        .3
     2.500     991.2         8.500      15.0        14.500       1.0        20.500        .5        26.500        .2
     3.000    1093.4         9.000      11.1        15.000        .9        21.000        .5        27.000        .1
     3.500     890.9         9.500       8.4        15.500        .8        21.500        .5        27.500        .0
     4.000     615.1        10.000       6.3        16.000        .7        22.000        .5        28.000        .0
     4.500     276.4        10.500       4.9        16.500        .7        22.500        .5        28.500        .0
     5.000     146.9        11.000       3.7        17.000        .7        23.000        .5        29.000        .0
     5.500      99.4        11.500       2.9        17.500        .6        23.500        .5

    RUNOFF VOLUME =       .44142 INCHES      =     200.6491 ACRE-FEET
    PEAK DISCHARGE RATE =    1120.65 CFS  AT    2.850 HOURS    BASIN AREA =  8.5229 SQ. MI.
```

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PRUDENT LINE ESTABLISHED
BY AVID ENGINEERING STUDY

FUTURE CROSSING
SUBDIVISION

N

100 50 0 100
SCALE: 1" = 100'
(HORIZ.)

Q100=1125 CFS

122.5'

EXISTING FLOOD PLAIN
DRAINAGE EASEMENT

PRUDENT LINE

TRACT E-2

TIERRA OESTE UNIT 3
SUBDIVISION
BOUNDARY

AVERAGE DOWN
VALLEY DIRECTION

SUBDIVISION BOUNDARY

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AUG 17 2001
HYDROLOGY SECTION

RONALD D. BROWN, CHAIR
DANIEL W. COOK, VICE CHAIR
TIM EICHENBERG, SECRETARY-TREASURER
LINDA STOVER, ASST. SECRETARY-TREASURER
DANNY HERNANDEZ, DIRECTOR

JOHN P. KELLY, P.E.
EXECUTIVE ENGINEER

Albuquerque Metropolitan Arroyo Flood Control Authority
2600 PROSPECT NE • ALBUQUERQUE, NM 87107
PHONE: (505) 884-2215
FAX: (505) 884-0214

Post-it® Fax Note 7671	Date 8-2-01	# of pages ▶ 2
To BRAD BINGHAM	From LYNN MAZUR	
Co./Dept. HYDROLOGY	Co. AMAFCA	
Phone #	Phone #	
Fax #	Fax #	

August 2, 2001

Mr. Kevin Patton, P.E.
Bohannan Huston, Inc.
7500 Jefferson St. NE, Courtyard I
Albuquerque, New Mexico 87109

File
H9/D14

Re: Drainage Report for Tierra Oeste, Unit 3, ZAP ~~B-17~~
Engineer's Stamp Dated July 13, 2001

Dear Kevin:

AMAFCA has reviewed the referenced report. The report does not address two significant items discussed in previous reports, as listed below:

1. The adopted West I-40 DMP specified an increase in volume for Dam 11 from 29 to 45.5 acre-feet. However, not knowing the status of negotiations between the National Park Service and Westland Development Co. to purchase upstream easements, we are not sure what improvements will be required for Dam 11.
2. AMAFCA will require construction of the Mirehaven Arroyo improvements from Dam 12 to the northern terminus of the subdivision, with an appropriate inlet structure. This item was proposed in a letter from Bohannan Huston, Inc. to AMAFCA, dated June 21, 2000, which states "...the proposed development of the future residential subdivisions trigger the construction the Mirehaven Channel between 98th Street and Dam No. 12, not the (Petroglyph) golf course construction".

Additional comments follow:

1. AMAFCA currently has blanket "Temporary Drainage Easements" on Tracts A, C and H as stated in Note 6 on the April 1996 Plat of The Crossing. The blanket easement on Tract A will need to be revised to accommodate the proposed subdivision. This will require a vacation action, which will require approval of

the AMAFCA Board of Directors. AMAFCA also requests that permanent easements be granted on the entirety of Tracts C and H.

2. Re-routing the access road around the cul-de-sacs will be allowed. Some type of barrier at the end of the cul-de-sacs will be required to prevent vehicular access to the easement.
3. On the 1" = 40' plot of the relocated access road, I cannot figure out existing from proposed contours for grading on the access roads. Roadway slopes should not exceed 10:1. The relocated road will be in the permanent easement of Tract H, so a separate description will not be required.
4. On final construction plans, show pipe and channel flows, velocities and hydraulic grade line on plan and profile sheets. Coordinate with AMAFCA on work within Dams 11 & 12. This work may require a Grading License approved by the AMAFCA Board of Directors.

We also noted on a field visit that the western diversion channel for offsite flows is draining *away* from Dam 10, not *into* it, as noted in the "Drainage Report for Westland Phase I Subdivision" (Bohannan Huston, Inc., November 1995).

The primary items need to be discussed at a meeting with Westland Development, the City and AMAFCA. We are available to meet with you early next week. Please call me at 884-2215 to make arrangements.

Sincerely,
AMAFCA

Lynn M. Mazur

Lynn M. Mazur, P.E.
Development Review Engineer

Cc: Brad Bingham, COA Hydrology
Leroy Chavez, Westland Development

DRAINAGE INFORMATION SHEET

H9 | D14

PROJECT TITLE: Tierra Oeste Unit 3 ZONE MAP/DRG. FILE #: H-9 / J-9
DRB #: 1001243 EPC#: WORK ORDER#:

LEGAL DESCRIPTION: TRACT E AND A PORTION OF TRACT A, THE CROSSINGS
CITY ADDRESS:

ENGINEERING FIRM: Bohannan Huston CONTACT: Kevin Patton
ADDRESS: PHONE: 823-1000
CITY, STATE: ZIP CODE:

OWNER: Westland Development CONTACT: Fred Ambrogi
ADDRESS: PHONE: 831-9600
CITY, STATE: ZIP CODE:

ARCHITECT: CONTACT:
ADDRESS: PHONE:
CITY, STATE: ZIP CODE:

SURVEYOR: CONTACT:
ADDRESS PHONE:
CITY, STATE: ZIP CODE:

CONTRACTOR: CONTACT:
ADDRESS: PHONE:
CITY, STATE: ZIP CODE:

TYPE OF SUBMITTAL:
- X DRAINAGE REPORT
- ____ DRAINAGE PLAN
- ____ CONCEPTUAL GRADING & DRAINAGE PLAN
- ____ GRADING PLAN
- ____ EROSION CONTROL PLAN
- ____ ENGINEER'S CERTIFICATION
- ____ CLOMR/LOMR
- ____ OTHER

WAS A PRE-DESIGN CONFERENCE ATTENDED:
- ____ YES
- ____ NO
- ____ COPY PROVIDED

CHECK TYPE OF APPROVAL SOUGHT:
- ____ SIA / FINANCIAL GUARANTEE RELEASE
- X PRELIMINARY PLAT APPROVAL
- X S. DEV. PLAN FOR SUB'D. APPROVAL
- X S. DEV. PLAN FOR BLDG. PERMIT APPROVAL
- ____ SECTOR PLAN APPROVAL
- X FINAL PLAT APPROVAL
- ____ FOUNDATION PERMIT APPROVAL
- ____ BUILDING PERMIT APPROVAL
- ____ CERTIFICATE OF OCCUPANCY APPROVAL
- X GRADING PERMIT APPROVAL
- ____ PAVING PERMIT APPROVAL
- ____ WORK ORDER APPROVAL
- ____ OTHER (SPECIFY)

DATE SUBMITTED: Kevin Patton BY: 7/13/01

Requests for approvals of Site Development Plans and/or Subdivision Plats shall be accompanied by a drainage submittal. The particular nature , location and scope ot the proposed development defines the degree of drainage detail. One or more of the following levels of submittal may be required based on the following:

1. **Conceptual Grading and Drainage Plan**: Required for approval of Site Development Plans greater than five (5) acres and Sector Plans.
2. **Drainage Plans**: Required for building permits, grading permits, paving permits and site plans less than five (5) acres.
3. **Drainage Report**: Required for subdivisions containing more than ten (10) lots or constituting five (5) acres or more.

RECEIVED
JUL 13 2001
HYDROLOGY SECTION

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

July 30, 2001

Kevin Patton, PE
Bohannan Huston, Inc
7500 Jefferson NE
Albuquerque, NM 87109

Re: Tierra Oeste Unit 3 Drainage Report

Engineer Stamp dated 7-13-01 (H9/D14)

Dear Mr. Patton,

Based upon the information provided in your report submitted 7-13-01, the above referenced site cannot be approved for Site Development Plan for Subdivision, Site Development Plan for Building Purposes, or Preliminary Plat until the following comments are addressed.

- Offsite Basin 2 is analyzed as undeveloped. If this area were to develop (similar to T.O., Unit 3), where would the runoff be programmed to go? I think it would have to go to Casa Verde and, as such, the storm drain would need to be sized accordingly.

- Please supply the offsite basin map (Crossings) that shows approved runoff amounts. As you know, each report should stand alone.

- The use of shared drainage swales is highly discouraged. Please revise your detail and grading plan accordingly. See attached.

- An erosion setback analysis should be performed to determine floodplain easement limits on the Mirehaven. Floodwall may be necessary. Also, a swale for the southern edge of Basin #9 should be shown

- AMAFCA concurrence will be required.

If you have any questions about my comments, you can contact me at 924-3986.

Sincerely,

Bradley L. Bingham, PE
Sr. Engineer, Hydrology

C: Lynn Mazur, AMAFCA
file

THE CITY OF ALBUQUERQUE IS AN EQUAL OPPORTUNITY/REASONABLE ACCOMMODATION EMPLOYER

DRAINAGE REPORT
FOR
TIERRA OESTE UNIT 3
(TRACT E AND A PORTION OF TRACT A OF THE CROSSINGS)

BOHANNAN HUSTON

Courtyard One

7500 JEFFERSON NE

Albuquerque

NEW MEXICO 87109

voice 505.823.1000

fax 505.821.0892

July 13, 2001

RECEIVED
JUL 1 ° 2001
HYDROLOGY SECTION

PREPARED FOR:

WESTLAND DEVELOPMENT
401 COORS BOULEVARD NW
ALBUQUERQUE, NEW MEXICO 87121

DESIGN ANALYSIS REPORT
FOR
TIERRA OESTE UNIT 3 (TRACT E AND A PORTION OF TRACT A OF THE CROSSINGS)

JULY 13, 2001

PREPARED BY:

BOHANNAN HUSTON, INC.
COURTYARD I
7500 JEFFERSON STREET NE
ALBUQUERQUE, NM 87109

PREPARED FOR:

WESTLAND DEVELOPMENT
401 COORS BOULEVARD NW
ALBUQUERQUE, NM 87121

PREPARED BY:

Yolanda Padilla 7/13/01

Yolanda Padilla, E.I. **Date**

UNDER THE SUPERVISION OF:

Kevin Patton, P.E. **Date**

KEVIN G. PATTON NEW MEXICO 13685 REGISTERED PROFESSIONAL ENGINEER

SITE LOCATION MAPS

(VICINITY MAPS H-9/J-9)

LEGAL DESCRIPTION

TRACT E AND A
PORTION OF TRACT A
OF THE CROSSINGS

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I. PURPOSE

The purpose of this report is to present the drainage management plan for Tierra Oeste, Unit 3 (Tract E and a Portion of Tract A of The Crossings) and to obtain approval of the preliminary/final plat and grading plan by the Development Review Board (DRB). The proposed development of Tierra Oeste, Unit 3 consists of 64 single family detached residential lots on approximately 9.26 acres.

II. METHODOLOGIES

Site conditions will be analyzed for a 10-year and 100-year, 6-hour storm event in accordance with the City of Albuquerque Drainage Ordinance and the Development Process Manual (DPM) Volume 2, Design Criteria, Section 22.2, Hydrology, for the City of Albuquerque, January 1993.

The site, as described in the 'Site Location and Characteristics' section below, is approximately 9.26 acres. Therefore, Part A of the DPM, Section 22.2, which provides a simplified procedure for projects with sub-basins smaller than 40 acres was used.

III. REFERENCED REPORTS

This report will reference the *West Interstate 40 Diversion Drainage Management Plan* dated March 2000, which was prepared for AMAFCA by Bohannan Huston, Inc. The West I-40 DMP addresses the drainage issues covering approximately 40 square miles of the West Side. The DMP boundaries are: the Rio Puerco escarpment on the west, Double Eagle II Airport and Vulcan Volcano on the north, Coors Boulevard and the Rio Grande Bluff on the east, and Bluewater Road and I-40 on the south. That report was prepared to support future drainage plans submitted for the development of individual land parcels within the study area, and to provide design guidance for the installation of major drainage infrastructure to be constructed in advance of, or simultaneously with individual parcel development. In addition, it provides fully developed flow rates for basins within the study area.

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Also referenced will be the revised *Drainage Report for The Crossing, Units 1 & 2 (Including Addendum #1)*, dated October 1996, which was prepared by Bohannan Huston, Inc. This referenced drainage report discusses future flows and offsite/AMAFCA issues impacted by the development in this area, which includes the impact analysis of the Ladera Ponds (11 & 12) to the south of the site

IV. SITE LOCATION AND CHARACTERISTICS

The site consists of approximately 9.26 acres of undeveloped land located north of Ladera Drive and west of Unser Boulevard. It is covered with native vegetation. The soils on the site are very sand and land generally slopes from northwest to southeast.

Please refer to the Bulk Land Plat enclosed (Exhibit 1) with this report and the A.G.I.S. vicinity map pages H-9 and J-9.

V. EXISTING HYDRAULIC AND HYDROLOGIC CONDITIONS

The existing drainage basins and patterns for developed flows are shown graphically on the Existing Drainage Conditions Map (Exhibit 2) located in the Exhibits section of this report.

There are a number of drainage facilities (FEMA floodplains) currently in this development area. The two major ones that impact our analysis area are the Ladera Dam System and the Mirehaven Arroyo. The Ladera System collects the flows that discharge from the Ladera watershed, located north of I-40. The Ladera watershed flows are routed in the series of dams numbered from Zero to 15 (Dam 15 is the Ladera Golf Course). The Mirehaven Arroyos A, B, and C convey flows from the upper Ladera basins through the Petroglyph National Monument. These three arroyos converge at the base of the escarpment within the Petroglyph National Monument. Below this point, the Mirehaven Arroyo discharges to Dam 12. The Mirehaven Arroyo is unlined except for a 1,300' long, soil cement scour wall along its northeastern bank, just north of Dam 12.

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For additional information regarding the existing drainage conditions, please refer to the West 1-40 DMP (March 2000).

VI. PROPOSED HYDRAULIC AND HYDROLOGIC CONDITIONS

Discharge generated by the site will flow in the internal roadways when fully developed. Inlets at lowpoints and various other locations along the roadway will capture the fully developed flows. The intercepted flow will be carried through storm drain systems, which will discharge into two ponds # 11 and #12. Ring Chamber Energy Dissipaters will be installed at the ends of the storm drains prior to discharging into the ponds to prevent scour, see Appendix F. Fully developed conditions were used to design the storm drainage system, see Appendix D.

A. On-Site Basins

The proposed site is broken into six (6) major basins. Three of the six major basins have each been divided into two (2) sub-basins for analysis reasons. Each on-site basin is described below.

Basin A (0.60ac, Q_{100}=2.0cfs) borders the east side of Casa Verde and consists of three (3) lots, #1, 27, and 28. The runoff, 2.0 cfs, will flow offsite onto Casa Verde to be collected by two Type "A" double wing, single grate inlets at the low point just south of the intersection of Casa Florida.

Basin B has been divided into two sub-basins along the centerline of Casa Florida. Sub-Basin B-1 (1.61ac, Q_{100}=5.7cfs) borders the north side of Casa Florida and extends up to the intersection of Gunnison Place and consists of twelve (12) lots, #2-14. The developed runoff will flow on the left side of Casa Florida and 2.55cfs will be collected by a Type "A" single wing, double grate inlet prior to the intersection of Gunnison. The residual flow will flow south onto Gunnison and be collected by a Type "A" double wing, double grate in the cul-de-sac. Sub-basin B-2 (0.61ac, Q_{100}=2.1 cfs) borders the south side of Casa Florida up to the intersection of Gunnison Place and consists of three (3) lots,

east toward

#29-31. The runoff will flow ~~south onto~~ Gunnison Place, combine with the flow from Basin C. See Basin C below for further analysis.

Basin C (1.2ac, Q_{100}=4.2cfs) encompasses the entire length of Casa de Luz and consists of eight (8) lots, #32-39. The developed runoff will flow north to Casa Florida and combine with the runoff from Basin B-2. The total combined flow (5.3cfs) will flow east on Casa Florida where 2.65cfs will be collected by the Type "A" single wing, double grate inlet prior to the intersection of Gunnison Place. The residual flow (3.65cfs) will flow south on Gunnison Place and be collected by a Type "A" double wing, double grate inlet at the low point of the cul-de-sac.

Basin D has been divided into two sub-basins, D-1 and D-2, along the centerline of Gunnison Place. Sub-basin D-1 (0.71ac, Q_{100}=2.6cfs) borders the western portion of Gunnison Place, and consists of five (5) lots, #40-41. A small portion of the developed flow will be collected by a Type "A" single wing, double grate inlet above the intersection of Gunnison Place and Casa Florida. The majority of the developed flow will combine with the residual flow from Gunnison Place and be collected at the low point in the cul-de-sac at the end of Gunnison Place. Sub-basin D-2 (1.01 ac, Q_{100}=3.6 cfs) borders the east side of Gunnison Place, and consists of seven (7) lots, #15-16 and #45-49. Similar to sub-basin D-1, only a small portion of the developed flow will be collected by a Type "A" single wing, double grate inlet while the remaining flow will be collected by a Type "A" double wing, double grate inlet at the low point in the cul-de-sac of Gunnison Place.

Basin E has also been divided into two Sub-basins, E-1 and E-2. Sub-basin E-1 (0.50ac, Q_{100}=1.80 cfs) borders the north side of Casa Florida and consists of four (4) lots, #17-20. Due to the one percent cross-slope on Casa Florida, it was assumed that half of the flow will combine with sub-basin E-2 and be collected by a Type "A" double wing, double grate inlet at the low point in the cul-de-sac of Casa Linda. The residual flow from Sub-basin E-1 will combine with the flow in Basin F. Sub-basin E-2 (1.34 ac, Q_{100}=4.7 cfs) encompasses the entire length of Casa Linda and consists of ten (10) lots, #51-59. All of the flow from Sub-basin E-2 will be collected by a Type "A" double wing, single grate inlet at the end of the cul-de-sac on Casa Linda.

Basin F (1.68 ac, Q_{100}=5.9 cfs) encompasses the entire length of Casa Vistosa and a portion of Casa Florida and consists of eleven (11) lots, #21-26 and #60-64. All of the developed flow within this basin will be collected by one Type "A" double wing, double grate inlet located at the end of the cul-de-sac on Casa Vistosa. This inlet has been designed to receive the additional flow from the future on-site basin #1, see below

The future on-site basin #1 (1.63ac, Q_{100}=5.8 cfs) encompasses the end of Casa Florida and consists of twelve (12) lots, ultimately #64-76. When this future site is developed, the flow will combine with the existing flow in Basin F and be collected by the Type "A" double wing, single grate inlet in the cul-de-sac portion of Casa Vistoso.

B. Offsite Basins

There are nine (9) off-site basins surrounding this sub-division. The six basins, which impact the sub-division, are mainly (90%) Class "A" Hydrologic Soil Group (HSG) according to the DPM table A-4. Each off-site basin is described below. See Exhibits 3 & 4 for exact locations of Offsite Basins.

Basin #1 (2.04 ac, Q_{100}=2.8 cfs) borders the western future portion of Casa Verde, shares a south boundary with off-site basin #2, and borders the east side of the existing lined drainage channel. During the interim period of development, all of the runoff caused by the 100-yr storm will flow around the subdivision and into pond #12. When the subdivision has been fully developed all of the flow from off-site basin #1 will flow onto Casa Verde and be collected by a series of inlets as described below in Section C. Storm Drain Analysis.

Basin #2 (4.56 ac, Q_{100}=6.3 cfs) borders the western portion of Casa Verde and ends just north of pond #10. The inlets on Casa Verde will collect all of the flow from this basin during both the interim and fully developed conditions.

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Basin #3 (1.15 ac, Q_{100}=4.8 cfs) encompasses the majority of Casa Verde up to the high point in the road near pond #11. All of the developed flow will be collected inlets at the low point in Casa Verde as previously mentioned in this report.

Basin #5 (3.08 ac, Q_{100}=4.3 cfs) begins at the eastern top of pond #10 and extends up to Casa Verde. The runoff will join the flow from Basin #4 (0.55 ac, Q_{100}=2.3 cfs - the remaining portion of Casa Verde beginning at the high point and heading south to the existing Tierra Oeste Unit 1 Subdivision) flow south and be collected by existing inlets downstream. where are these. - Include Tierra Oeste basin map.

Basin #6 (1.12 ac, Q_{100}=2.5 cfs) is located at the southern boundary of on-site basins B-2, C, D-1, and a small portion of D-2. The flow will run onto Gunnison Place's cul-de-sac and join the residual runoff from Gunnison Place. This combined flow will be collected by one Type "A" double wing, double grate inlet.

Basin #7 (2.80 ac, Q_{100}=3.9 cfs) borders the north side of on-site basin B-1. All of the developed flow will combine with the future flow of 24.4cfs and that of off-site Basin #8 (0.25ac, Q_{100}=1.0 cfs – the future Gunnison connection to the future Crossing Subdivision. Inlets will collect this flow on Gunnison Place. For additional information concerning this combined flow, refer to the on-site basin discussion of this report previous to this section.

Basin #9 (3.49 ac, Q_{100}=4.8 cfs) borders the north boundary to on-site basins D-1, E-1, F, and Future on-site basin #1. This runoff will flow into the future lined channel, see Exhibit 4 for a diagram depicting this area, and into pond #12. See referenced report *West Interstate 40 Diversion Drainage Management Plan* dated March 2000 for more information.

C. Storm Drain Analysis

Two separate storm drains systems need to be constructed within the site to collect the 100-yr storm flows. The first storm drain will be constructed in Casa Verde to

Pond #11 and the second storm drain will be built in Gunnison Place, Casa Linda, Casa Vistosa to Pond #12. Both storm drain systems are discussed in greater detail below.

INCLUDE BASIN MAPS FROM THE CROSSINGS

In the fully developed state, the first storm drain system in Casa Verde will collect flows from Off-site Basins 1 (2.9cfs), 2 (12.17cfs) and 3 (4.8cfs), an future, developed off-site flow of 42.1 cfs, and the flow from onsite Basin A (2.0 cfs), see Exhibit 4 . The combined flow of 64cfs is the maximum amount of flow for the ultimate conditions for this storm drain during the 100–year storm, thus was used for design analysis. The first Type "A" single wing, double grate inlet will collect 8.8 cfs of runoff during the 100-year storm. An additional 7.8 cfs will be collected by the second Type "A" single wing, double grate inlet. All residual flow (47.4 cfs) will be collected by two Type "A" double wing, single grate inlets at the low point on Casa Verde just south of the intersection of Casa Florida. As this is a sump condition, Casa Florida was designed as an emergency spillway with the highpoint being 0.77' higher than the low point in Casa Verde. The 2 x 100yr flow would travel down Casa Florida before it would breach the right-of-way in Casa Verde. The flow will than be transported to pond #11 via a 36" storm drain and 54" Ring Chamber Energy Dissipater. The 54 " RCP Ring Chamber Dissipater, 24' in length, will be used to minimize scour at the outlet of the storm drain. Rock riprap shall be installed to further protect the pond for scour. The calculations and dimensions for the Ring Chamber Dissipater can be found in Appendix E of this report.

The second storm drain will collect runoff (68cfs) from on-site basins (B-1, B-2, C, D-1, D-2, E-1, E-2, F, and the future off-site basins) bordering Gunnison Place as well all the off-site basins (Basin #6, #7, and the ultimate developed flow from the future Crossings Subdivision to the north of the site. Two Type "A" single grate, double wing inlets located on Casa Verde just west of the intersection of Gunnison will collect a combined flow of 5.2 cfs. Two Type "A" single wing, double grate inlets located on Gunnison Place north of the intersection with Casa Florida will collect a combined flow of 14.4 cfs into the storm drainage system. The total residual flow of 30.4 cfs will be collected by one Type "A" double wing, double grate inlet at the low point in the cul-de-sac located at the end of Gunnison Place. A 30" RCP section will be used to connect the

inlets of Gunnison Place to Casa Linda and a 36" RCP will connect inlet from Casa Linda to Casa Vistosa. The total collected flow, from the inlets of Gunnison Place, Casa Linda, and Casa Vistosa, of 68.30 cfs will be discharged into Pond #12 by means of a 42" RCP and a 60" RCP Ring Chamber Energy Dissipater. *The West I-40 DMP* indicates that the water surface elevation for this pond is 5211.30, for more information please see this report. The 60" RCP Ring Chamber Energy Dissipater, with a length of 32 feet, will be used to minimize scour to detention pond #12. A flared riprap section shall be constructed at the outlet of the Ring Chambers to further prevent scour. The calculations and dimension for the Ring Chamber Dissipater can be found in Appendix E of this report.

VII. CONCLUSION

This report has provided hydrologic and hydraulic considerations of the proposed development of Tract E and a Portion of Tract A for Westland Development. This information provides adequate supporting documentation and guidance for approval of this report and to guide future development and phasing of the properties previously mentioned. It is recommended that this plan be approved as requested.

APPENDICES

APPENDIX A: BASINS

APPENDIX B: STREET HYDRAULICS

APPENDIX C: INLET ANALYSIS

APPENDIX D: STORM DRAIN

APPENDIX E: RING CHAMBER ENERGY DISSIPATER

APPENDIX A

BASINS

BASIN SUMMARY - EXISTING CONDITIONS

Tierra Oeste Phase III
Tract E - Westland Development

BASIN I.D.	AREA (AC)	UNITS #	% LAND TREATMENT A	B	C	D	DISCHARGE (CFS) 10 YR	100YR
HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (EXISTING)								
Tract E	9.20		98.0%	0.0%	2.0%	0.0%	2.5	12.0
HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (EXISTING BASINS)								
Basin #1	21.36	0	90.0%	5.0%	5.0%	0.0%	7.2	29.6
Basin #2	29.67	0	90.0%	5.0%	5.0%	0.0%	10.0	41.1
Basin #3	71.94	0	90.0%	5.0%	5.0%	0.0%	24.3	99.7
Basin #4	6.70	0	80.0%	10.0%	10.0%	0.0%	2.8	10.1
TOTAL	**129.67**	**0**					**44.3**	**180.6**

NOTES: 1) Impervious percentages were calculated from the DPM equation A-4, with the remaining percentages distributed evenly between land treatment types B and C.

N=UNITS/ACRES = 0.0
%D= 7*SQRT((N*N)+(5*N)) = 0.0 %

A-1

BASIN SUMMARY- INTERIM CONDITION

Tierra Oeste Phase III
Tract E - Westland Development

	BASIN I.D.	AREA (AC)	UNITS #	% LAND TREATMENT A	B	C	D	DISCHARGE (CFS) 10 YR	100YR
				HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (EXISTING)					
	Tract E	9.20		98.0%	0.0%	2.0%	0.0%	2.5	12.0
				HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (DEVELOPED-ONSITE BASINS)					
	Basin A	0.60	3	0.0%	23.9%	25.3%	49.5%	1.2	2.0
	Basin B-1	1.61	12	0.0%	21.6%	21.6%	56.9%	3.4	5.7
	Basin B-2	0.61	3	0.0%	25.6%	25.6%	48.9%	1.2	2.1
	Basin C	1.20	8	0.0%	21.6%	21.6%	56.9%	2.5	4.2
	Basin D-1	0.71	5	0.0%	20.1%	20.1%	59.9%	1.5	2.6
	Basin D-2	1.01	7	0.0%	21.6%	21.6%	56.9%	2.1	3.6
	Basin E-1	0.50	4	0.0%	21.6%	21.6%	56.9%	1.1	1.8
	Basin E-2	1.34	10	0.0%	21.6%	21.6%	56.9%	2.8	4.7
	Basin F	1.68	11	0.0%	21.6%	21.6%	56.9%	3.6	5.9
SUB-TOTAL		9.26	63					19.5	32.6
				HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (FUTURE-ONSITE BASIN)					
	Basin 1	1.63	12	0.0%	21.6%	21.6%	56.9%	3.5	5.8
				HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (INTERIM OFFSITE BASINS)					
	Basin #1	8.84	0	90.0%	5.0%	5.0%	0.0%	3.0	12.3
	Basin #2	9.15	0	90.0%	5.0%	5.0%	0.0%	3.1	12.7
	Basin #3	0.88	0	0.0%	5.0%	5.0%	90.0%	2.4	3.7
	Basin #4	0.55	0	0.0%	5.0%	5.0%	90.0%	1.5	2.3
	Basin #5	3.08	0	90.0%	5.0%	5.0%	0.0%	1.0	4.3
	Basin #6	1.12	0	0.0%	5.0%	5.0%	90.0%	3.0	4.7
SUB-TOTAL		23.62	0					14.0	39.9
TOTAL		**34.51**	**75**					**37.0**	**78.3**

NOTES: 1) Impervious percentages were calculated from the DPM equation A-4, with the remaining percentages distributed evenly between land treatment types B and C.

N=UNITS/ACRES .. .... = 2.2
%D= 7*SQRT((N*N)+(5*N)) = 27.6 %

A-2

BASIN SUMMARY - FULLY DEVELOPED CONDITION

Tierra Oeste Phase III
Tract E - Westland Development

	BASIN I.D.	AREA (AC)	UNITS #	% LAND TREATMENT A	B	C	D	DISCHARGE (CFS) 10 YR	100YR
	HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (DEVELOPED-ONSITE BASINS)								
	Basin A	0.60	3	0.0%	23.9%	25.3%	49.5%	1.2	2.0
	Basin B-1	1.61	12	0.0%	21.6%	21.6%	56.9%	3.4	5.7
	Basin B-2	0.61	3	0.0%	25.6%	25.6%	48.9%	1.2	2.1
	Basin C	1.20	8	0.0%	21.6%	21.6%	56.9%	2.5	4.2
	Basin D-1	0.71	5	0.0%	20.1%	20.1%	59.9%	1.5	2.6
	Basin D-2	1.01	7	0.0%	21.6%	21.6%	56.9%	2.1	3.6
	Basin E-1	0.50	4	0.0%	21.6%	21.6%	56.9%	1.1	1.8
	Basin E-2	1.34	10	0.0%	21.6%	21.6%	56.9%	2.8	4.7
	Basin F	1.68	11	0.0%	21.6%	21.6%	56.9%	3.6	5.9
	Future Basin 1	1.63	12	0.0%	21.6%	21.6%	56.9%	3.5	5.8
SUB-TOTAL		10.89	75					23.0	38.4
	HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (OFFSITE BASINS)								
	Basin #1	2.10	0	90.0%	5.0%	5.0%	0.0%	0.7	2.9
	Basin #2	9.15	0	90.0%	5.0%	5.0%	0.0%	3.1	12.7
	Basin #3	1.15	0	0.0%	5.0%	5.0%	90.0%	3.1	4.8
	Basin #4	0.55	0	0.0%	5.0%	5.0%	90.0%	1.5	2.3
	Basin #5	3.08	0	90.0%	5.0%	5.0%	0.0%	1.0	4.3
	Basin #6	1.12	0	0.0%	80.0%	20.0%	0.0%	1.0	2.5
	Basin #7	2.80	0	90.0%	5.0%	50.0%	0.0%	2.8	7.5
	Basin #8	3.08	0	90.0%	5.0%	5.0%	0.0%	1.0	4.3
	Basin #9	0.55	0	0.0%	5.0%	5.0%	90.0%	1.5	2.3
SUB-TOTAL		23.58	0					13.3	36.9
TOTAL		**34.47**	**75**					**36.3**	**75.3**

NOTES:

1) Off-site basins (1-5,) have contributing flows to Tract E and have been classified as a "Type A" Hydrologic Soil Group (HSG) according to Table A-4 in the DPM section 22-2.

N=UNITS/ACRES = 2.2
%D = 7*SQRT((N*N)+(5*N)) = 27.7 %

APPENDIX B

STREET HYDRAULICS

***** PC PROGRAM STREAM SEPTEMBER 1994 *****

Casa Verde S= 0.7%

MANNING'S N= .017 SLOPE= .007

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.85	5	11.00	0.12	9	51.17	0.67
2	8.37	0.67	6	30.00	0.50	10	51.63	0.67
3	8.83	0.67	7	49.00	0.12	11	60.00	0.85
4	9.00	0.00	8	51.00	0.00	12	0.00	0.00

WSEL (FT)	DEPTH INC (FT)	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID (FT)	VEL HEAD (FT)	ENERGY HEAD (FT)
0.05	0.05	0.04	0.0	1.72	0.61	1.64	0.01	0.06
0.10	0.10	0.16	0.2	3.44	0.96	3.28	0.01	0.11
0.15	0.15	0.39	0.4	6.92	1.08	6.68	0.02	0.17
0.20	0.20	0.85	1.1	12.02	1.25	11.70	0.02	0.22
0.25	0.25	1.56	2.3	17.13	1.48	16.73	0.03	0.28
0.30	0.30	2.52	4.3	22.23	1.71	21.75	0.05	0.35
0.35	0.35	3.74	7.3	27.33	1.94	26.78	0.06	0.41
0.40	0.40	5.20	11.2	32.44	2.16	31.80	0.07	0.47
0.45	0.45	6.92	16.4	37.54	2.37	36.83	0.09	0.54
0.50	0.50	8.88	22.8	42.65	2.57	41.85	0.10	0.60
0.55	0.55	11.00	32.3	43.15	2.94	42.28	0.13	0.68 ②
0.60	0.60	13.11	43.3	43.25	3.30	42.30	0.17	0.77 ① ≈③
0.65	0.65	15.23	55.4	43.36	3.64	42.33	0.21	0.86
0.70	0.70	17.41	65.6	47.11	3.77	46.05	0.22	0.92
0.75	0.75	19.83	76.5	51.76	3.86	50.70	0.23	0.98
0.80	0.80	22.48	89.1	56.41	3.96	55.35	0.24	1.04
0.85	0.85	25.37	103.3	61.06	4.07	60.00	0.26	1.11

$Q_{100} = 48.92$ cfs
WSEL = DEPTH = 0.62 ft
V = 3.44 ft/s

② $Q_{RESIDUAL} = 39.74$ cfs
DEPTH = 0.58 ft
V = 3.116 ft/s

③ $Q_{RESIDUAL} = 47.37$ cfs
DEPTH = 0.614 ft
V = 3.413 ft/s

***** PC PROGRAM STREAM SEPTEMBER 1994 *****

Casa Florida S= 2.0%

MANNING'S N= .017 SLOPE= .02

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.85	5	11.00	0.12	9	41.17	0.67
2	8.37	0.67	6	25.00	0.40	10	41.62	0.67
3	8.83	0.67	7	39.00	0.12	11	50.00	0.85
4	9.00	0.00	8	41.00	0.00	12	0.00	0.00

WSEL (FT)	DEPTH INC (FT)	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID (FT)	VEL HEAD (FT)	ENERGY HEAD (FT)
0.05	0.05	0.04	0.0	1.72	1.02	1.64	0.02	0.07
0.10	0.10	0.16	0.3	3.44	1.62	3.28	0.04	0.14
0.15	0.15	0.39	0.7	6.92	1.82	6.68	0.05	0.20
0.20	0.20	0.85	1.8	12.02	2.12	11.70	0.07	0.27
0.25	0.25	1.56	3.9	17.13	2.50	16.73	0.10	0.35 ① ②
0.30	0.30	2.52	7.3	22.23	2.90	21.75	0.13	0.43
0.35	0.35	3.74	12.3	27.33	3.28	26.78	0.17	0.52
0.40	0.40	5.20	19.0	32.44	3.65	31.80	0.21	0.61
0.45	0.45	6.81	29.4	32.94	4.32	32.23	0.29	0.74
0.50	0.50	8.42	41.9	33.04	4.97	32.25	0.38	0.88
0.55	0.55	10.04	55.9	33.15	5.57	32.28	0.48	1.03
0.60	0.60	11.65	71.6	33.25	6.14	32.30	0.59	1.19
0.65	0.65	13.27	88.7	33.35	6.69	32.33	0.69	1.34
0.70	0.70	14.95	100.9	37.10	6.75	36.04	0.71	1.41
0.75	0.75	16.87	114.0	41.75	6.76	40.69	0.71	1.46
0.80	0.80	19.02	129.8	46.41	6.82	45.35	0.72	1.52
0.85	0.85	21.41	148.2	51.06	6.92	50.00	0.74	1.59

① $Q_{100} = 5.3$ cfs (BASIN B-1)
DEPTH = 0.27 ft
V = 2.66 ft/s

② $Q_{100} = 6.3$ cfs (BASIN B-2 AND BASIN C COMBINED)
DEPTH = 0.28 ft
V = 2.78 ft/s

***** PC PROGRAM STREAM SEPTEMBER 1994 *****

Gunnison S= 1.78%

MANNING'S N= .017 SLOPE= .0178

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	1.00	5	11.00	0.12	9	41.17	0.67
2	8.37	0.67	6	25.00	0.40	10	41.62	0.67
3	8.83	0.67	7	39.00	0.12	11	50.00	1.00
4	9.00	0.00	8	41.00	0.00	12	0.00	0.00

WSEL (FT)	DEPTH INC (FT)	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID (FT)	VEL HEAD (FT)	ENERGY HEAD (FT)
0.05	0.05	0.04	0.0	1.72	0.97	1.64	0.01	0.06
0.10	0.10	0.16	0.3	3.44	1.53	3.28	0.04	0.14
0.15	0.15	0.39	0.7	6.92	1.72	6.68	0.05	0.20
0.20	0.20	0.85	1.7	12.02	2.00	11.70	0.06	0.26
0.25	0.25	1.56	3.7	17.13	2.36	16.73	0.09	0.34
0.30	0.30	2.52	6.9	22.23	2.73	21.75	0.12	0.42
0.35	0.35	3.74	11.6	27.33	3.09	26.78	0.15	0.50
0.40	0.40	5.20	17.9	32.44	3.44	31.80	0.18	0.58
0.45	0.45	6.81	27.8	32.94	4.08	32.23	0.26	0.71 ①
0.50	0.50	8.42	39.5	33.04	4.69	32.25	0.34	0.84
0.55	0.55	10.04	52.8	33.15	5.26	32.28	0.43	0.98
0.60	0.60	11.65	67.5	33.25	5.80	32.30	0.52	1.12
0.65	0.65	13.27	83.7	33.35	6.31	32.33	0.62	1.27
0.70	0.70	14.93	97.2	35.83	6.51	34.77	0.66	1.36
0.75	0.75	16.74	112.3	38.37	6.71	37.31	0.70	1.45
0.80	0.80	18.67	129.0	40.91	6.91	39.85	0.74	1.54
0.85	0.85	20.72	147.5	43.45	7.12	42.39	0.79	1.64
0.90	0.90	22.90	167.8	45.99	7.33	44.92	0.83	1.73
0.95	0.95	25.21	190.0	48.53	7.54	47.46	0.88	1.83
1.00	1.00	27.65	214.2	51.07	7.75	50.00	0.93	1.93

① Q_{100} = 29.3 cfs (OFF-SITE FLOWS)

DEPTH = 0.46 ft

V = 4.2 ft/s

***** PC PROGRAM STREAM SEPTEMBER 1994 *****

Xslope S= 1.0%
Gunnison Cul-de-sac Cross-slope Data
MANNING'S N= .017 SLOPE= .01

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.75	5	7.00	0.12	9	71.83	1.29
2	4.17	0.67	6	69.00	0.74	10	80.00	1.47
3	4.83	0.67	7	71.00	0.62	11	0.00	0.00
4	5.00	0.00	8	71.17	1.29	12	0.00	0.00

WSEL (FT)	DEPTH INC (FT)	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID (FT)	VEL HEAD (FT)	ENERGY HEAD (FT)
0.05	0.05	0.02	0.0	0.86	0.72	0.82	0.01	0.06
0.10	0.10	0.08	0.1	1.72	1.15	1.64	0.02	0.12
0.15	0.15	0.21	0.2	4.76	1.10	4.64	0.02	0.17
0.20	0.20	0.57	0.7	9.81	1.31	9.65	0.03	0.23
0.25	0.25	1.18	1.9	14.86	1.61	14.66	0.04	0.29
0.30	0.30	2.04	3.9	19.91	1.91	19.68	0.06	0.36
0.35	0.35	3.15	6.9	24.97	2.20	24.69	0.07	0.42
0.40	0.40	4.51	11.1	30.02	2.47	29.70	0.09	0.49
0.45	0.45	6.12	16.7	35.07	2.73	34.71	0.12	0.57
0.50	0.50	7.98	23.8	40.12	2.98	39.73	0.14	0.64
0.55	0.55	10.09	32.5	45.17	3.22	44.74	0.16	0.71
0.60	0.60	12.45	42.9	50.23	3.45	49.75	0.18	0.78
0.65	0.65	15.07	55.0	55.79	3.65	55.26	0.21	0.86
0.70	0.70	18.02	67.8	63.90	3.76	63.30	0.22	0.92
0.75	0.75	21.40	83.5	71.67	3.90	71.03	0.24	0.99
0.80	0.80	24.95	107.9	71.72	4.32	71.05	0.29	1.09
0.85	0.85	28.50	134.6	71.77	4.72	71.06	0.35	1.20
0.90	0.90	32.05	163.6	71.82	5.10	71.07	0.40	1.30
0.95	0.95	35.61	194.9	71.87	5.47	71.08	0.47	1.42
1.00	1.00	39.16	228.3	71.92	5.83	71.10	0.53	1.53
1.05	1.05	42.72	263.7	71.98	6.17	71.11	0.59	1.64
1.10	1.10	46.27	301.2	72.03	6.51	71.12	0.66	1.76
1.15	1.15	49.83	340.5	72.08	6.83	71.13	0.73	1.88
1.20	1.20	53.39	381.8	72.13	7.15	71.15	0.79	1.99
1.25	1.25	56.94	425.0	72.18	7.46	71.16	0.86	2.11
1.30	1.30	60.51	468.0	72.68	7.74	72.28	0.93	2.23
1.35	1.35	64.18	503.0	75.61	7.84	74.55	0.95	2.30
1.40	1.40	67.97	542.6	77.88	7.98	76.82	0.99	2.39
1.45	1.45	71.86	584.1	80.15	8.13	79.09	1.03	2.48
1.47	1.47	73.46	601.3	81.06	8.19	80.00	1.04	2.51

② Q_{100} (ONSITE) = 30.4 cfs

DEPTH = 0.537 ft

V = 3.15 ft/s

***** PC PROGRAM STREAM SEPTEMBER 1994 *****

Casa Linda S= 1.40%

MANNING'S N= .017 SLOPE= .014

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.85	5	11.00	0.12	9	37.17	0.67
2	8.37	0.67	6	23.00	0.36	10	37.62	0.67
3	8.83	0.67	7	35.00	0.12	11	46.00	0.85
4	9.00	0.00	8	37.00	0.00	12	0.00	0.00

WSEL (FT)	DEPTH INC (FT)	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID (FT)	VEL HEAD (FT)	ENERGY HEAD (FT)
0.05	0.05	0.04	0.0	1.72	0.86	1.64	0.01	0.06
0.10	0.10	0.16	0.2	3.44	1.36	3.28	0.03	0.13
0.15	0.15	0.39	0.6	6.92	1.52	6.68	0.04	0.19
0.20	0.20	0.85	1.5	12.02	1.77	11.70	0.05	0.25
0.25	0.25	1.56	3.3	17.13	2.10	16.73	0.07	0.32
0.30	0.30	2.52	6.1	22.23	2.42	21.75	0.09	0.39
0.35	0.35	3.74	10.3	27.33	2.74	26.78	0.12	0.47
0.40	0.40	5.14	16.8	28.84	3.27	28.20	0.17	0.57
0.45	0.45	6.55	25.1	28.94	3.84	28.23	0.23	0.68
0.50	0.50	7.96	34.7	29.04	4.36	28.25	0.30	0.80
0.55	0.55	9.37	45.5	29.15	4.85	28.28	0.37	0.92
0.60	0.60	10.79	57.4	29.25	5.32	28.30	0.44	1.04
0.65	0.65	12.20	70.3	29.35	5.76	28.33	0.52	1.17
0.70	0.70	13.69	78.6	33.10	5.74	32.04	0.51	1.21
0.75	0.75	15.41	87.7	37.75	5.69	36.69	0.50	1.25
0.80	0.80	17.36	99.0	42.40	5.70	41.35	0.50	1.30
0.85	0.85	19.54	112.5	47.06	5.76	46.00	0.51	1.36

(1) $Q_{100} = 5.1$ cfs
DEPTH = 0.29 ft
V = 2.30 ft/s

***** PC PROGRAM STREAM SEPTEMBER 1994 *****

Casa Vistoso S= 2.74%

MANNING'S N= .017 SLOPE= .0274

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1	0.00	0.85	5	11.00	0.12	9	37.17	0.67
2	8.37	0.67	6	23.00	0.36	10	37.62	0.67
3	8.83	0.67	7	35.00	0.12	11	46.00	0.85
4	9.00	0.00	8	37.00	0.00	12	0.00	0.00

WSEL (FT)	DEPTH INC (FT)	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID (FT)	VEL HEAD (FT)	ENERGY HEAD (FT)
0.05	0.05	0.04	0.0	1.72	1.20	1.64	0.02	0.07
0.10	0.10	0.16	0.3	3.44	1.90	3.28	0.06	0.16
0.15	0.15	0.39	0.8	6.92	2.13	6.68	0.07	0.22
0.20	0.20	0.85	2.1	12.02	2.48	11.70	0.10	0.30
0.25	0.25	1.56	4.6	17.13	2.93	16.73	0.13	0.38
0.30	0.30	2.52	8.6	22.23	3.39	21.75	0.18	0.48
0.35	0.35	3.74	14.3	27.33	3.84	26.78	0.23	0.58
0.40	0.40	5.14	23.5	28.84	4.58	28.20	0.33	0.73
0.45	0.45	6.55	35.2	28.94	5.37	28.23	0.45	0.90
0.50	0.50	7.96	48.6	29.04	6.10	28.25	0.58	1.08
0.55	0.55	9.37	63.7	29.15	6.79	28.28	0.72	1.27
0.60	0.60	10.79	80.3	29.25	7.44	28.30	0.86	1.46
0.65	0.65	12.20	98.4	29.35	8.06	28.33	1.01	1.66
0.70	0.70	13.69	110.0	33.10	8.03	32.04	1.00	1.70
0.75	0.75	15.41	122.7	37.75	7.96	36.69	0.98	1.73
0.80	0.80	17.36	138.5	42.40	7.98	41.35	0.99	1.79
0.85	0.85	19.54	157.4	47.06	8.05	46.00	1.01	1.86

(1) Q_{100} = 12.46 cfs (BASIN F AND FUTURE BASIN #1)

DEPTH= 0.335 ft

V= 3.70 ft/s

APPENDIX C

INLET ANALYSIS

ANALYSIS OF AN INLET IN A SUMP CONDITION - **Low Point in Casa Verde Avenue**

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

WEIR: Q=C*L*H^1.5

Wing opening
C= 3.0
L= 4.0 ft
Q=3.0(4.0')H**1.5= 12.0H**1.5

Grate opeining
C=3.0
L(single grate)=[(2.67')+2(1.8')]=6.27 ft
Q=3.0(6.27)H^1.5=18.81*H^1.5

ORIFICE: Q=C*A*(2*G*H)**0.5

Grate opening
C=0.6
A(single grate)=4.09 sf
Q=2.46*(64.4*H)^0.5

Wing opening
C=0.6
A=2.0 sf
Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR WING OPENING	Q (CFS) WEIR SINGLE GRATE	Q (CFS) ORIFICE SINGLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Single Grate "A" inlet w/ wing openings on each side
	0.10	0.10	0.38	0.59	6.24	1.35	Weir controls on grate analysis
	0.20	0.20	1.07	1.68	8.82	3.83	
	0.30	0.30	1.97	3.09	10.80	7.03	
	0.40	0.40	3.04	4.76	12.47	10.83	
	0.50	0.50	4.24	6.65	13.94	15.14	
	0.60	0.60	5.58	8.74	15.27	19.90	
TOP OF CURB	0.70	0.70	7.03	11.02	16.50	25.07	Q(100 yr) = 48 cfs; 2 inlets each side take 24 cfs each
	0.80	0.80	8.59	13.46	17.64	30.63	
ROW LIMIT	0.90	0.90	10.25	16.06	18.71	36.55	
	1.00	1.00	12.00	18.81	19.72	42.81	

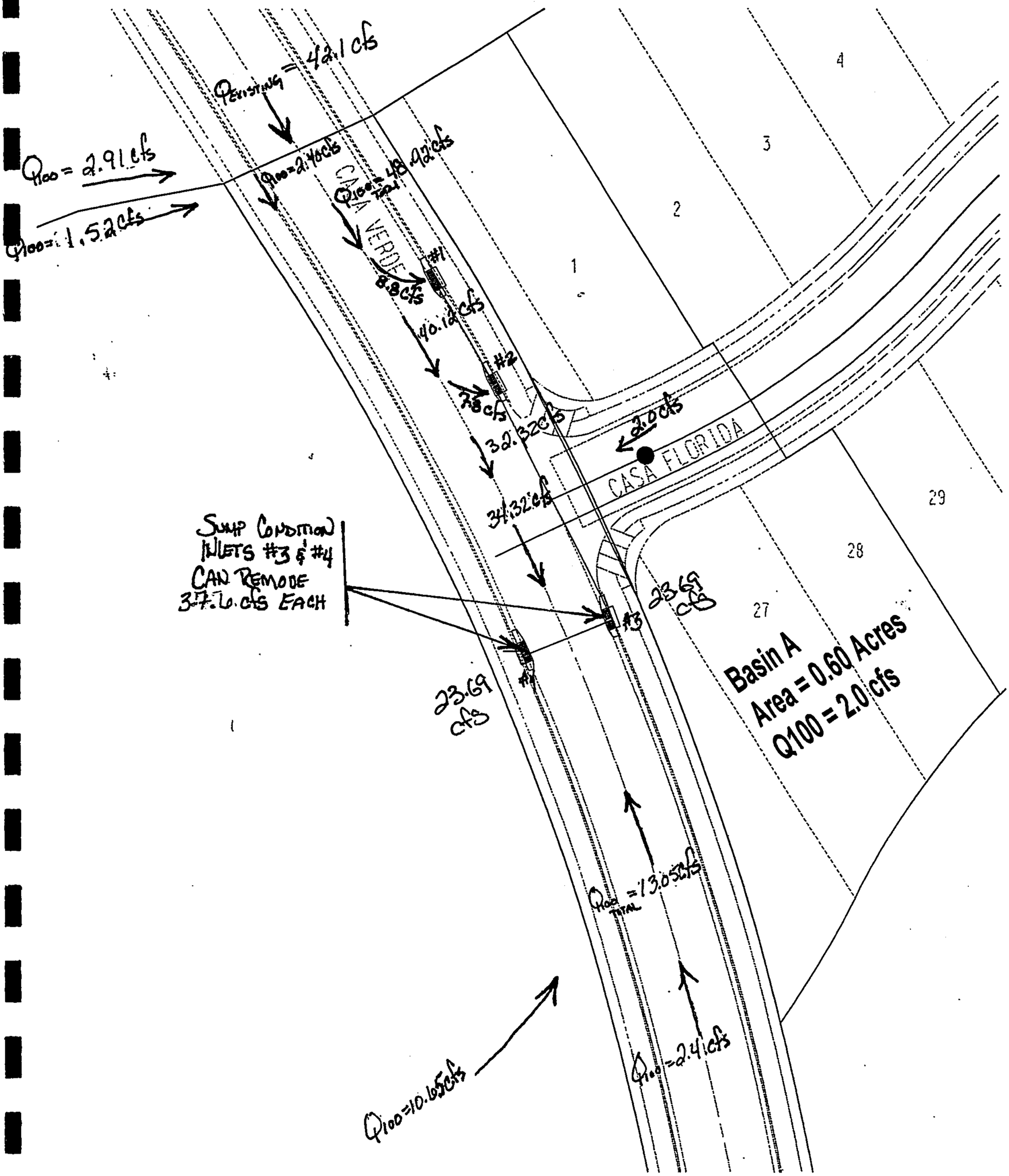
NOTE: The total runoff intercepted by the inlet at the low point in the cul-de-sac is:

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

THE 100 YR STORM EVENT = 48 CFS at the sump condition

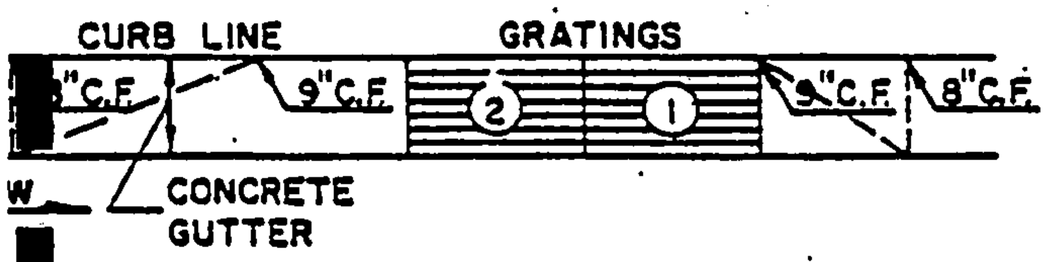
The High Point Elevation in Casa Flordia Place is below the right of grade at the low point in Casa Verde; therefore acting as

C-1

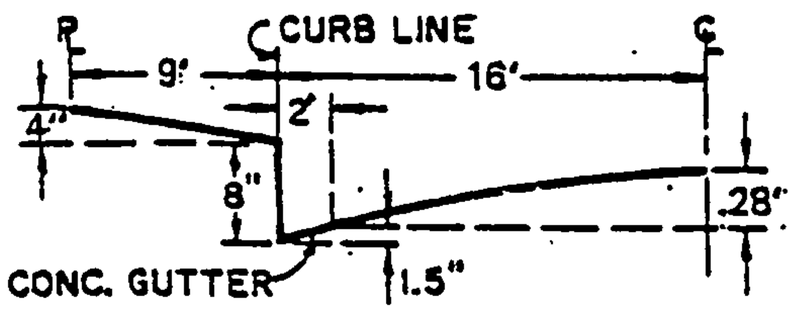

$Q_{EXISTING}$ = 42.1 cfs
Q_{100} = 2.91 cfs
Q_{100} = 1.52 cfs
Q_{100} = 2.40 cfs
Q_{100} TOTAL = 48.42 cfs
CASA VERDE
#1
8.8 cfs
40.12 cfs
#2
7.8 cfs
32.32 cfs
2.0 cfs
CASA FLORIDA
34.32 cfs
23.69 cfs
#3
#4
23.69 cfs
SUMP CONDITION
INLETS #3 & #4
CAN REMODE
37.6 cfs EACH
Basin A
Area = 0.60 Acres
Q100 = 2.0 cfs
Q_{100} TOTAL = 13.05 cfs
Q_{100} = 2.4 cfs
Q_{100} = 10.65 cfs
1
2
3
4
27
28
29

CASA VERDE, S= 0.7%

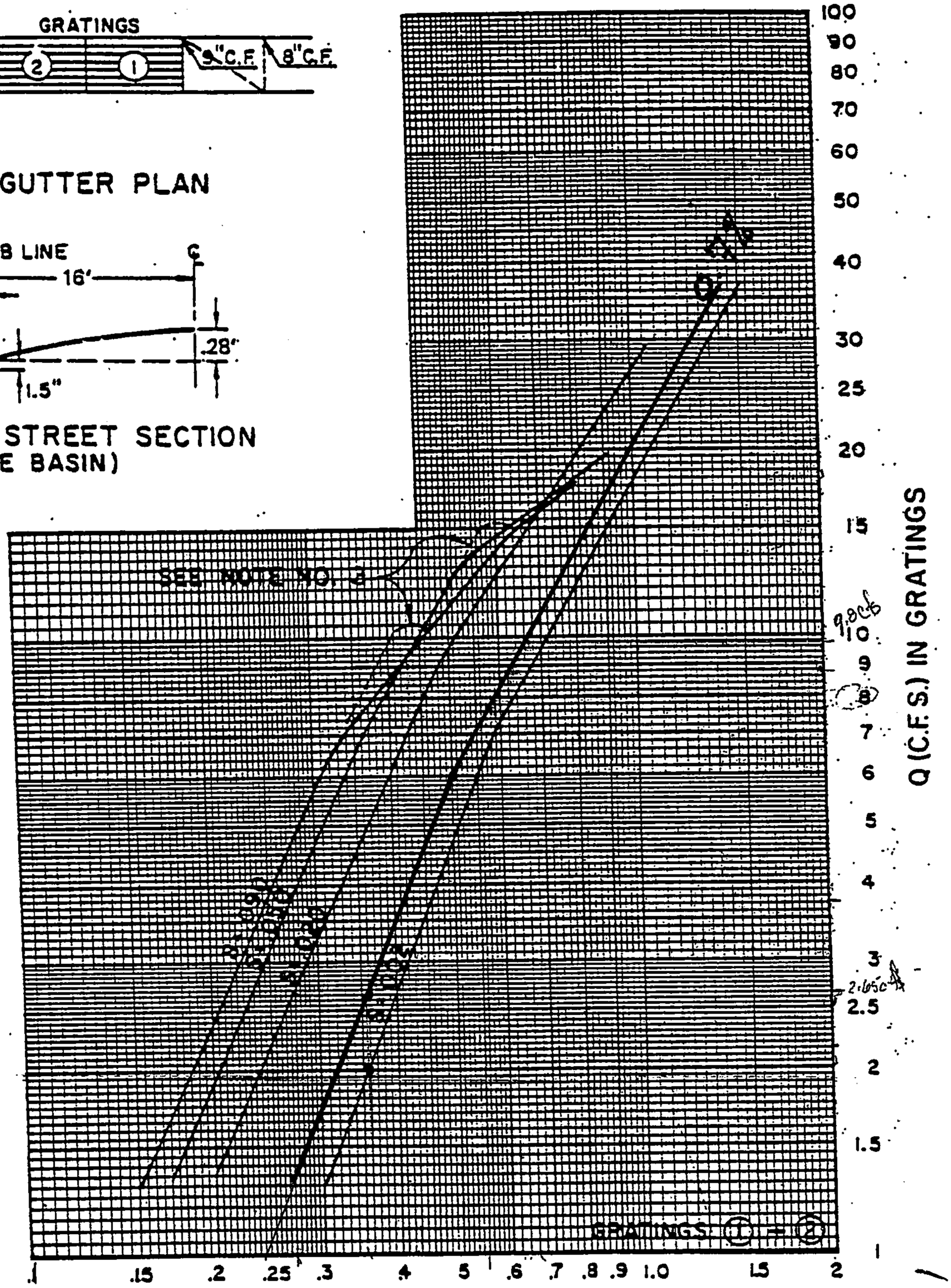
GRATING CAPACITIES FOR TYPE DOUBLE "C," AND "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)



D= DEPTH OF FLOW (FT.) ABOVE NORMAL GUTTER GRADE

GUNNISON CUL-DE-SAC INLET

ANALYSIS OF AN INLET IN A SUMP CONDITION - **At the end of the cul-de-sac low point**

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

WEIR: Q=C*L*H^1.5		ORIFICE: Q=C*A*(2*G*H)**0.5	
Wing opening	Grate opeining	Grate opening	Wing opening
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.	A(double grate)=8.19 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

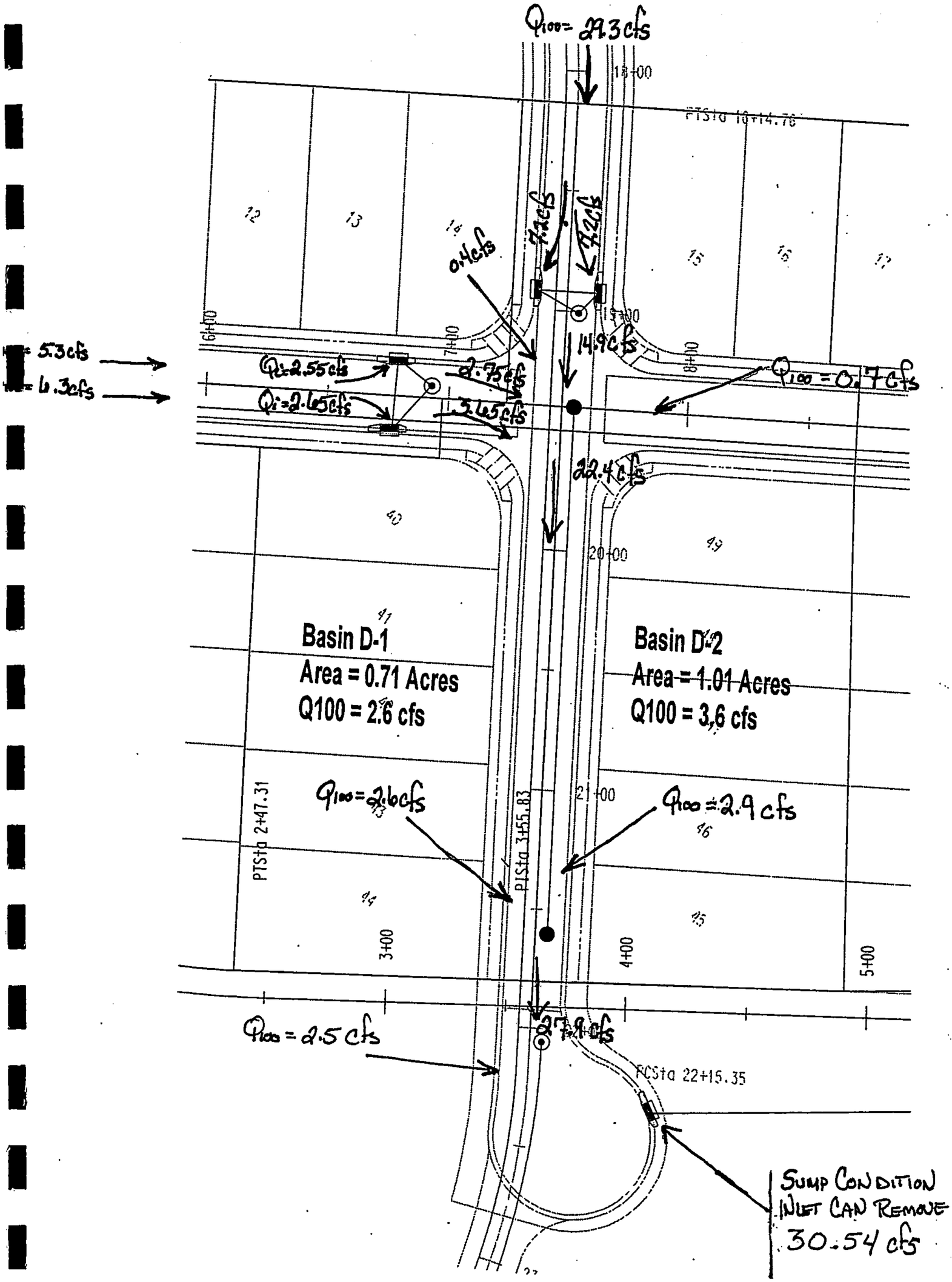
	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR "A" OPENING	Q (CFS) WEIR DOUBLE GRATE	Q (CFS) ORIFICE DOUBLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Flow at double "A" inlet w/ two wing openings
	0.10	0.10	0.38	0.85	12.47	1.61	Weir controls on grate analysis
	0.20	0.20	1.07	2.40	17.64	4.55	
	0.30	0.30	1.97	4.41	21.60	8.35	
	0.40	0.40	3.04	6.78	24.94	12.86	
	0.50	0.50	4.24	9.48	27.88	17.97	
	0.60	0.60	5.58	12.46	30.55	23.62	
TOP OF CURB	0.70	0.70	7.03	15.71	32.99	29.76	
	0.80	0.80	8.59	19.19	35.27	36.36	Q(100 yr) = 30.4 cfs is provided at this depth
	0.90	0.90	10.25	22.90	37.41	43.39	
ROW LIMIT	1.00	1.00	12.00	26.82	39.43	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)].

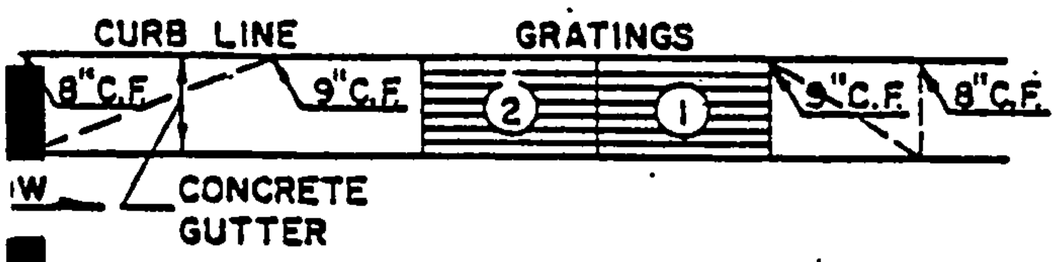
THE 100 YR STORM EVENT =29.12 cfs at the sump condition

THE 2 x 100 YR STORM EVENT =Does not apply to this subdivision

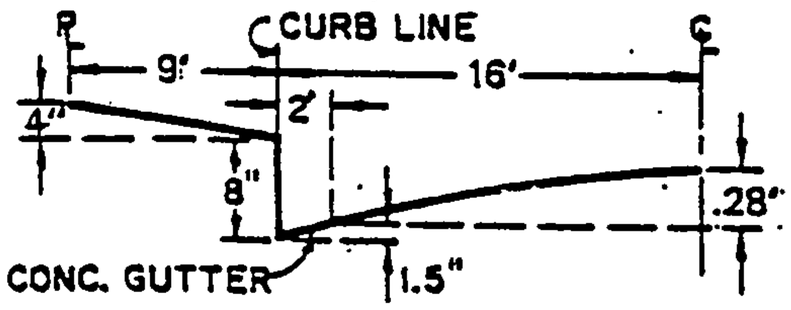

Q100= 27.3 cfs
PTSta 10+14.76
12
13
14
15
16
17
0.4cfs
7.7cfs
7.2cfs
6+00
7+00
8+00
14.9cfs
Q100 = 0.7cfs
Q=2.55cfs
2.75cfs
Q=2.65cfs
3.65cfs
= 5.3cfs
= 6.3cfs
22.4cfs
40
41
49
20+00
Basin D-1
Area = 0.71 Acres
Q100 = 2.6 cfs
Basin D-2
Area = 1.01 Acres
Q100 = 3.6 cfs
Q100=2.6cfs
PTSta 2+47.31
PTSta 3+55.83
21+00
Q100=2.9 cfs
46
45
3+00
4+00
5+00
Q100 = 2.5 cfs
27.9 cfs
PCSta 22+15.35
SUMP CONDITION
INLET CAN REMOVE
30.54 cfs

CASA FLORIDA, S = 2.0%

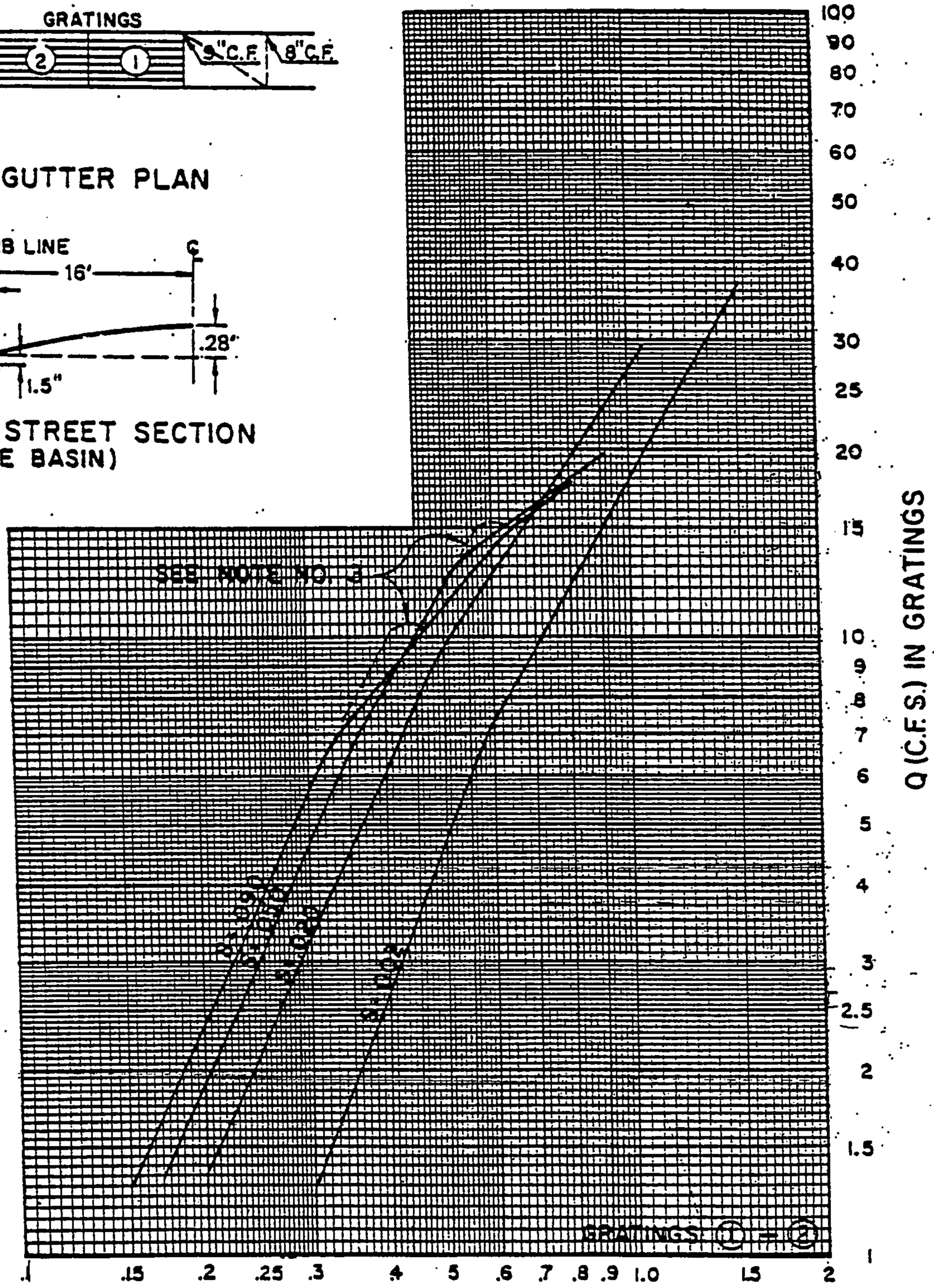
GRATING CAPACITIES FOR TYPE DOUBLE "C," AND "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)



D = DEPTH OF FLOW (FT.) ABOVE NORMAL GUTTER GRADE

REV. 3-83

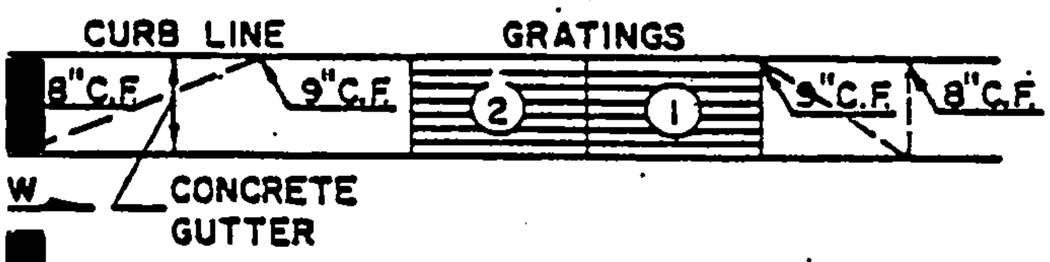
75%

PLATE 22.3 D-6

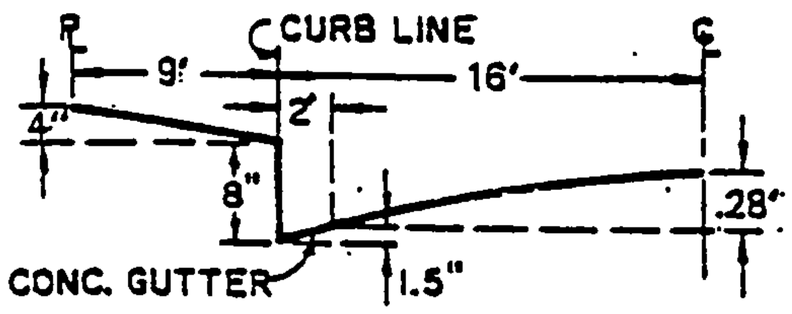
C6

GUNNISON, S= 1.78%

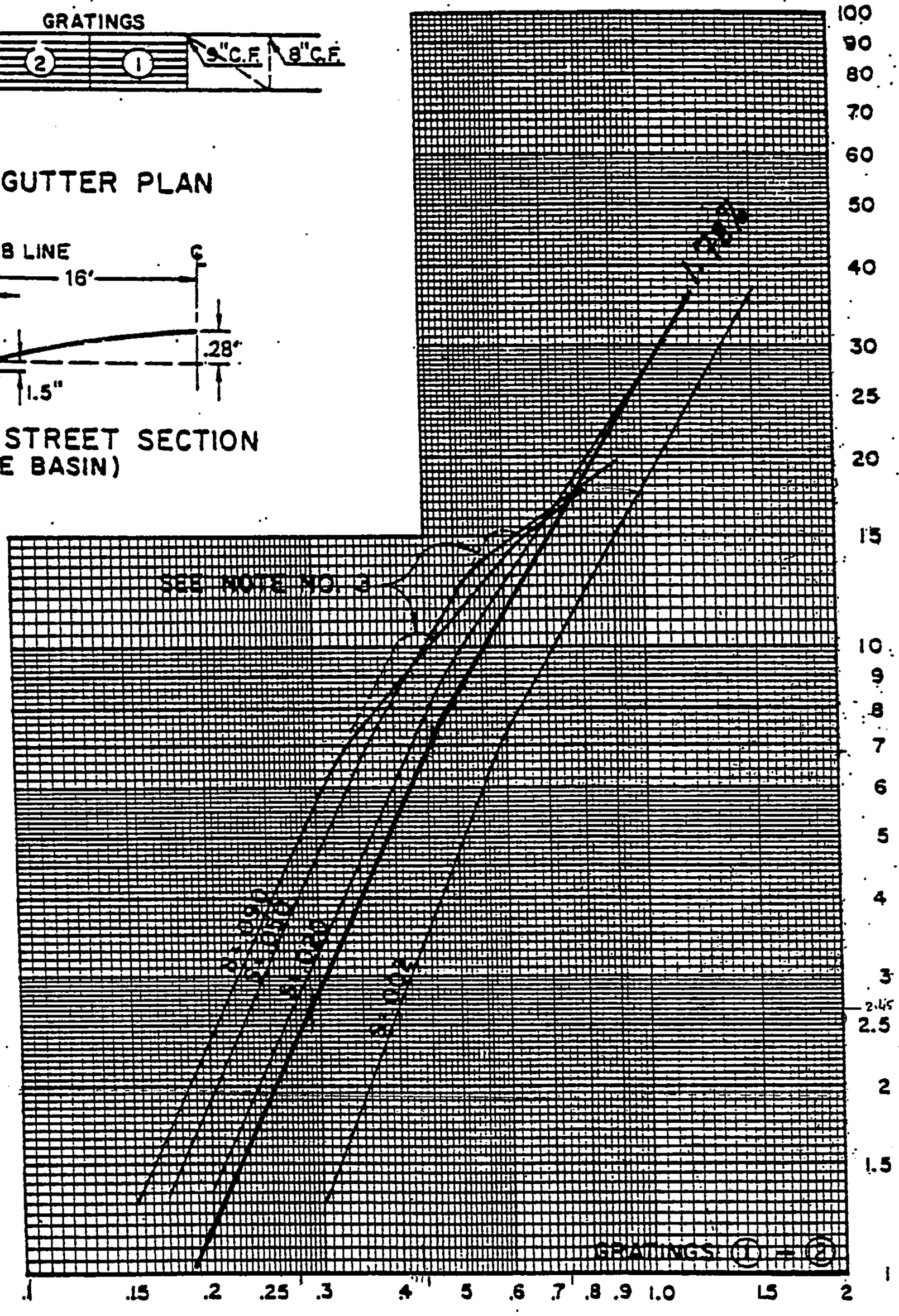
GRATING CAPACITIES FOR TYPE DOUBLE "C," AND "D"



GRATING & GUTTER PLAN

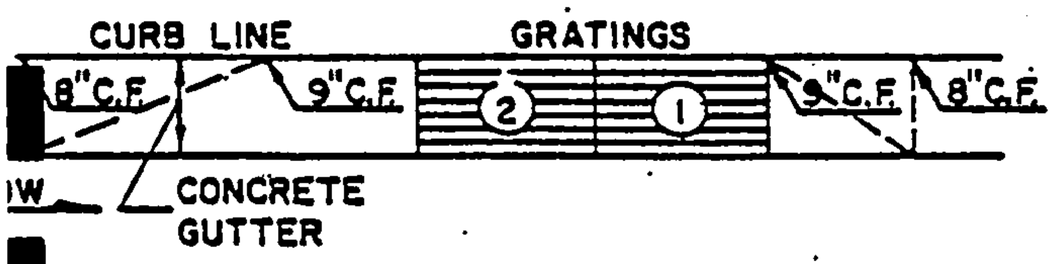


TYPICAL HALF STREET SECTION
(ABOVE BASIN)

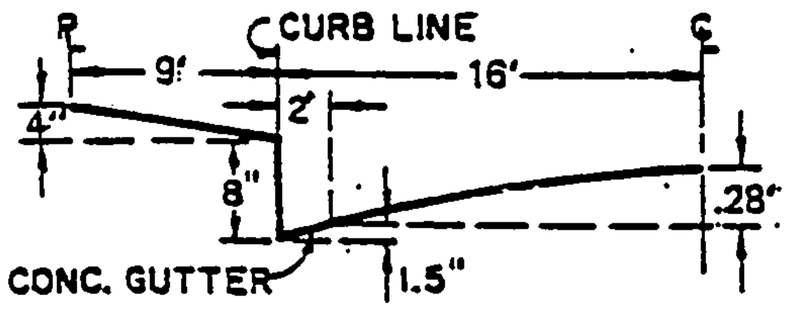


D = DEPTH OF FLOW (FT.) ABOVE NORMAL GUTTER GRADE

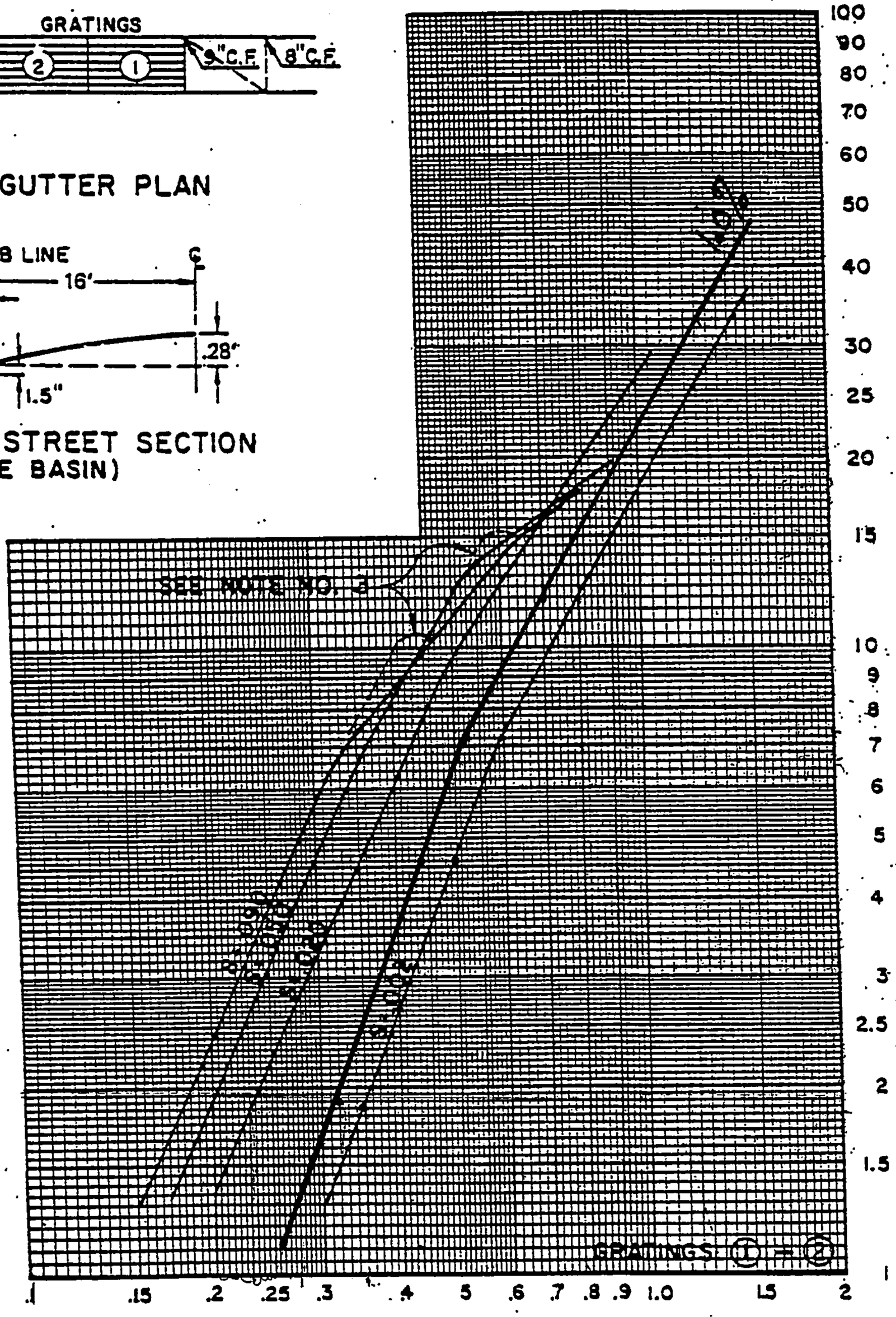
GRATING CAPACITIES FOR TYPE DOUBLE "C," AND "D"



GRATING & GUTTER PLAN



TYPICAL HALF STREET SECTION
(ABOVE BASIN)



D = DEPTH OF FLOW (FT.) ABOVE NORMAL GUTTER GRADE

INLET ON CASA LINDA

ANALYSIS OF AN INLET IN A SUMP CONDITION - **At the end of the cul-de-sac low point**

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

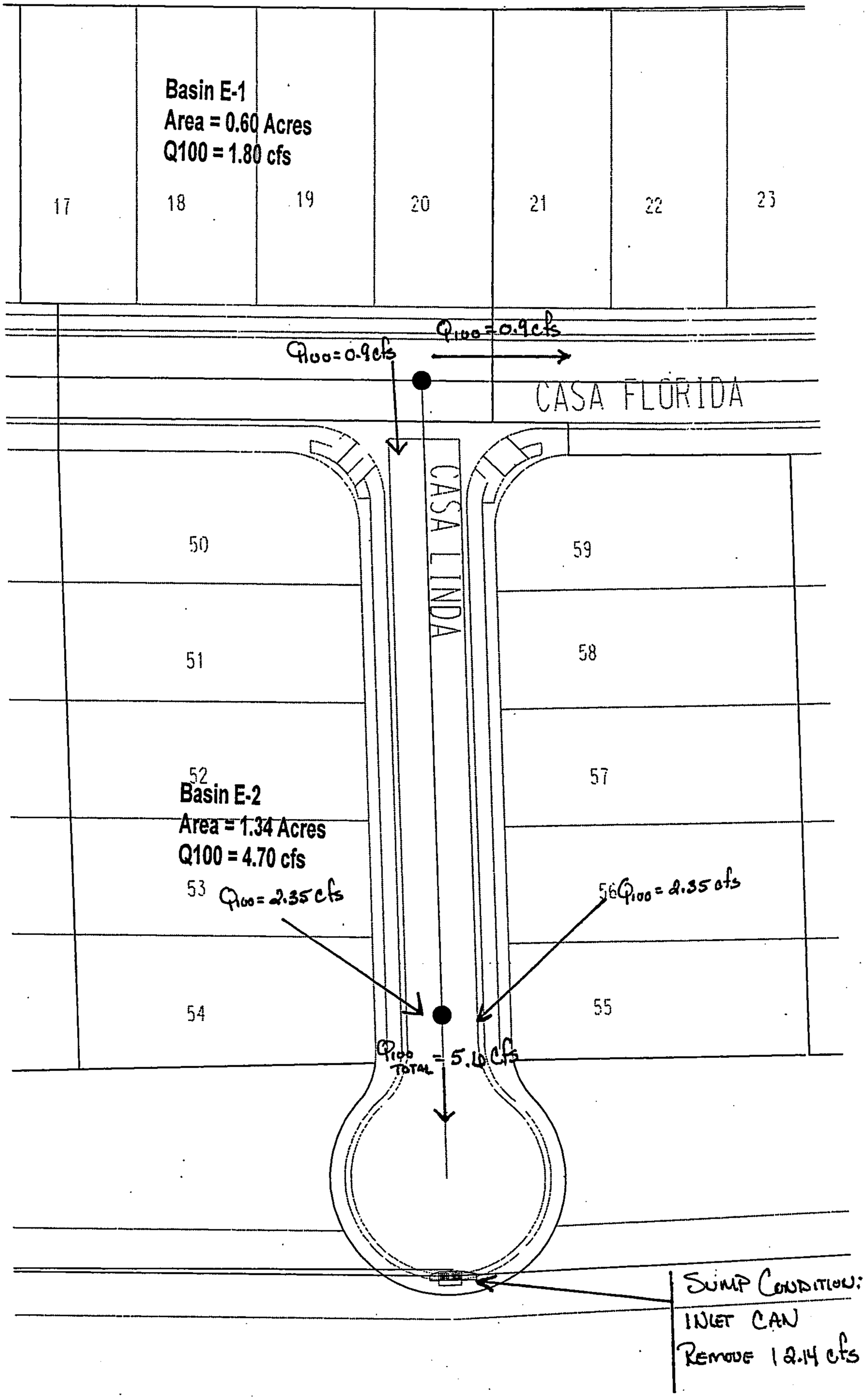
WEIR: Q=C*L*H^1.5

Wing opening	Grate opeining	ORIFICE: Q=C*A*(2*G*H)**0.5 Grate opening	Wing opening
C= 3.0	C=3.0	C=0.6	C=0.6
L= 4.0 ft	L(single grate)=[(2.67')+2(1.8')]=6.27 ft	A(single grate)=4.09 sf	A=2.0 sf
Q=3.0(4.0')H**1.5= 12.0H**1.5	Q=3.0(6.27)H^1.5=18.81*H^1.5	Q=2.46*(64.4*H)^0.5	Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR WING OPENING	Q (CFS) WEIR SINGLE GRATE	Q (CFS) ORIFICE SINGLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Single Grate "A" inlet w/ wing openings on each side
	0.10	0.10	0.38	0.59	6.24	1.35	Weir controls on grate analysis
	0.20	0.20	1.07	1.68	8.82	3.83	
	0.30	0.30	1.97	3.09	10.80	7.03	
	0.40	0.40	3.04	4.76	12.47	10.83	
	0.50	0.50	4.24	6.65	13.94	15.14	Q(100 yr) = 12.14 cfs
	0.60	0.60	5.58	8.74	15.27	19.90	
TOP OF CURB	0.70	0.70	7.03	11.02	16.50	25.07	
	0.80	0.80	8.59	13.46	17.64	30.63	
ROW LIMIT	0.90	0.90	10.25	16.06	18.71	36.55	
	1.00	1.00	12.00	18.81	19.72	42.81	

NOTE: The total runoff intercepted by the inlet at the low point in the cul-de-sac is:
Q(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].
THE 100 YR STORM EVENT = 12 CFS at the sump condition

C9


Basin E-1
Area = 0.60 Acres
Q100 = 1.80 cfs
17
18
19
20
21
22
23
Q100 = 0.9 cfs
Q100 = 0.9 cfs
CASA FLORIDA
CASA LINDA
50
51
52
59
58
57
56
55
54
53
Basin E-2
Area = 1.34 Acres
Q100 = 4.70 cfs
Q100 = 2.35 cfs
Q100 = 2.35 cfs
Q100 TOTAL = 5.10 cfs
SUMP CONDITION:
INLET CAN
REMOVE 12.14 cfs

INLET ON CASA VISTOSO (FUTURE CONDITIONS)

ANALYSIS OF AN INLET IN A SUMP CONDITION - **At the end of the cul-de-sac low point**

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

WEIR: Q=C*L*H^1.5

Wing opening
C= 3.0
L= 4.0 ft
Q=3.0(4.0')H**1.5= 12.0H**1.5

Grate opeining
C=3.0
L(single grate)=[(2.67')+2(1.8')]=6.27 ft
Q=3.0(6.27)H^1.5=18.81*H^1.5

ORIFICE: Q=C*A*(2*G*H)**0.5

Grate opening
C=0.6
A(single grate)=4.09 sf
Q=2.46*(64.4*H)^0.5

Wing opening
C=0.6
A=2.0 sf
Q=1.2*(64.4*H)^0.5

	WS ELEVATION	HEIGHT ABOVE INLET	Q (CFS) WEIR WING OPENING	Q (CFS) WEIR SINGLE GRATE	Q (CFS) ORIFICE SINGLE GRATE	TOTAL Q (CFS)	COMMENTS:
~FL @ INLET	0.00	0.00	0.00	0.00	0.00	0.00	Single Grate "A" inlet w/ wing openings on each sid
	0.10	0.10	0.38	0.59	6.24	1.35	Weir controls on grate analysis
	0.20	0.20	1.07	1.68	8.82	3.83	
	0.30	0.30	1.97	3.09	10.80	7.03	
	0.40	0.40	3.04	4.76	12.47	10.83	
	0.50	0.50	4.24	6.65	13.94	15.14	Q(100 yr) = 15.06 cfs
	0.60	0.60	5.58	8.74	15.27	19.90	
TOP OF CURB	0.70	0.70	7.03	11.02	16.50	25.07	
	0.80	0.80	8.59	13.46	17.64	30.63	
ROW LIMIT	0.90	0.90	10.25	16.06	18.71	36.55	
	1.00	1.00	12.00	18.81	19.72	42.81	

NOTE: The total runoff intercepted by the inlet at the low point in the cul-de-sac is:
Q(100) = 2*[(runoff of the wing opening) + (the lesser of the weir or orifice amount taken by the double grate)].
THE 100 YR STORM EVENT = 15 CFS at the sump condition

21

22

23

24

25

26

$Q_{100} = 2.7$ cfs

$Q_{100} = 0.9$ cfs

CASA FLORIDA

$Q_{100} = 5.8$ cfs

60

Basin F
Area = 1.68 Acres
Q100 = 5.9 cfs

Future Onsite Basin
Area = 1.63 Acres
Q100 = 5.8 cfs

61

62

63

64

$Q_{100} = 3.2$ cfs

CASA VICTOSO

$Q_{100\ TOTAL} = 12.6$ cfs

SUMP CONDITION:
INLET CAN
REMOVE 15.04 cfs

APPENDIX D

STORM DRAIN

Max RCP flow (non-pressure, full pipe)

Table assumes Manning's n = 0.013

Pipe Size (in)/ Slope (%)	18	24	30	36	42
	Pipe Capacity (cfs)				
0.60%	**8.16**	17.57	31.86	51.80	**78.14**
0.76%	**9.18**	19.77	35.85	58.30	87.95
0.79%	9.36	**20.16**	36.55	**59.44**	89.66
1.41%	12.51	**26.93**	48.84	79.41	119.79
1.43%	12.60	**27.13**	49.18	79.97	120.64
1.51%	12.94	27.87	50.54	**82.18**	123.96
1.57%	13.20	28.42	51.53	**83.80**	126.40
2.25%	15.80	34.02	**61.69**	100.32	151.32
4.11%	**21.35**	45.99	83.38	135.58	204.52
4.19%	21.56	**46.43**	84.19	136.90	206.50
5.73%	**25.21**	54.30	98.45	160.09	241.48
9.17%	**31.89**	68.69	124.54	202.52	305.49

APPENDIX E

RING CHAMBER ENERGY DISSIPATER

CASA VERDE

Size (in)	**36**
Radius (ft)	1.50
Dia. (ft)	3.00
Mannings 'n'	**0.013**
Slope	**0.0157**
Depth Inc. (in)	1

Depth (Inches)	Depth (Feet)	Top Width (Feet)	Area (Sq. Ft.)	Wet. Peri. (Feet)	Hyd. Rad. (Feet)	Velocity (FPS)	Flow (CFS)	Flow (GPM)
12	1.000	2.828	2.063	3.693	0.559	9.740	20.089	9016.530
23	1.917	2.882	4.768	5.557	0.858	12.968	61.831	27751.566
24	**2.000**	**2.828**	**5.006**	**5.732**	**0.873**	**13.122**	**65.688**	**29482.538**
25	2.083	2.764	5.239	5.911	0.886	13.252	69.428	31161.236
26	2.167	2.687	5.466	6.094	0.897	13.357	73.016	32771.696
27	2.250	2.598	5.687	6.283	0.905	13.437	76.413	34296.603
28	2.333	2.494	5.899	6.479	0.910	13.490	79.578	35716.887
29	2.417	2.375	6.102	6.685	0.913	13.514	82.461	37011.102
30	2.500	2.236	6.294	6.902	0.912	13.506	85.009	38154.432
31	2.583	2.075	6.474	7.133	0.908	13.462	87.153	39116.991
32	2.667	1.886	6.639	7.386	0.899	13.377	88.810	39860.636
33	2.750	1.658	6.787	7.668	0.885	13.240	89.861	40332.210
34	2.833	1.374	6.914	7.997	0.865	13.033	90.115	40446.159
35	2.917	0.986	7.013	8.420	0.833	12.714	89.167	40020.955

Size (in)	**54**
Radius (ft)	2.25
Dia. (ft)	4.50
Mannings 'n'	**0.033**
Slope	**0.007**
Depth Inc. (in)	1

Baffles along the bottom of the the larger pipe allow for a larger Mannings Coefficient of Friction, n, to be used when sizing the Ring Chamber Dissipater. Reference Heggins, 1999)

Depth (Inches)	Depth (Feet)	Top Width (Feet)	Area (Sq. Ft.)	Wet. Peri. (Feet)	Hyd. Rad. (Feet)	Velocity (FPS)	Flow (CFS)	Flow (GPM)
12	1.000	3.742	2.632	4.418	0.596	2.674	7.038	3158.908
24	2.000	4.472	6.829	6.568	1.040	3.877	26.481	11885.385
36	3.000	4.243	11.264	8.598	1.310	4.523	50.943	22864.945
37	3.083	4.180	11.615	8.776	1.323	4.554	52.889	23738.129
38	3.167	4.110	11.960	8.957	1.335	4.581	54.786	24589.691
39	3.250	4.031	12.299	9.141	1.345	4.604	56.627	25415.825
40	3.333	3.944	12.632	9.329	1.354	4.623	58.402	26212.498
41	3.417	3.848	12.956	9.522	1.361	4.639	60.102	26975.411
42	3.500	3.742	13.273	9.719	1.366	4.650	61.716	27699.945
43	3.583	3.625	13.580	9.923	1.369	4.656	63.233	28381.076
44	3.667	3.496	13.876	10.133	1.369	4.658	64.642	29013.278
45	3.750	3.354	14.162	10.352	1.368	4.655	65.928	29590.363
46	3.833	3.197	14.435	10.581	1.364	4.647	67.075	30105.265
47	3.917	3.023	14.694	10.822	1.358	4.632	68.065	30549.696
48	4.000	2.828	14.938	11.079	1.348	4.611	68.876	30913.596
49	4.083	2.609	15.165	11.354	1.336	4.581	69.479	31184.178
50	4.167	2.357	15.372	11.656	1.319	4.543	69.835	31344.122
51	4.250	2.062	15.557	11.996	1.297	4.492	69.888	31367.693
52	4.333	1.700	15.714	12.394	1.268	4.425	69.538	31210.582
53	4.417	1.213	15.837	12.909	1.227	4.329	68.560	30772.005
54	**4.500**	**0.000**	**15.904**	**14.137**	**1.125**	**4.086**	**64.989**	**29168.884**

A 54" DIAMETER RING CHAMBER WILL SATISFY FLOW CONDITIONS. USE THE DIMENSIONS FROM THE DIAGRAM AND TABLE BELOW:

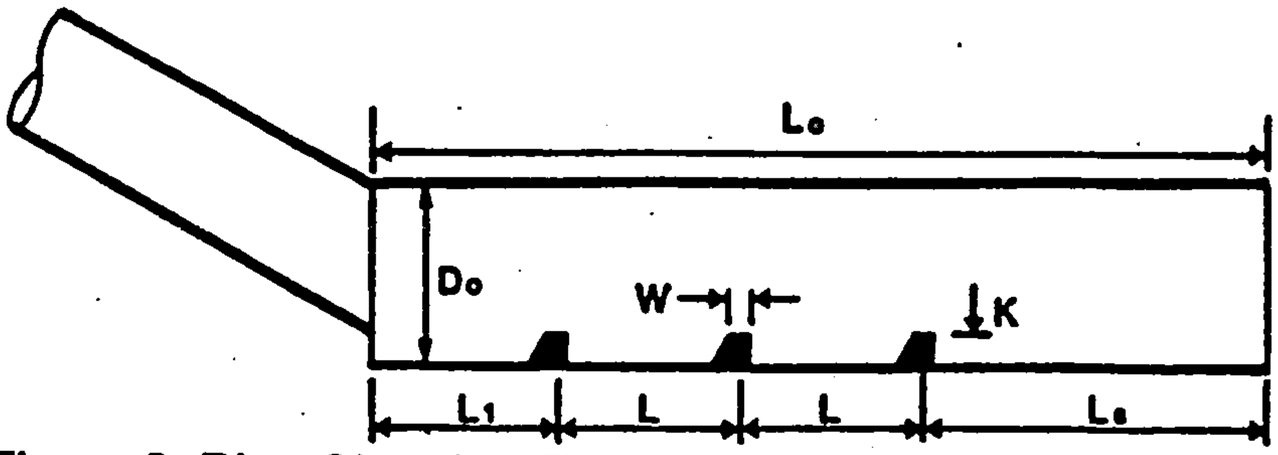


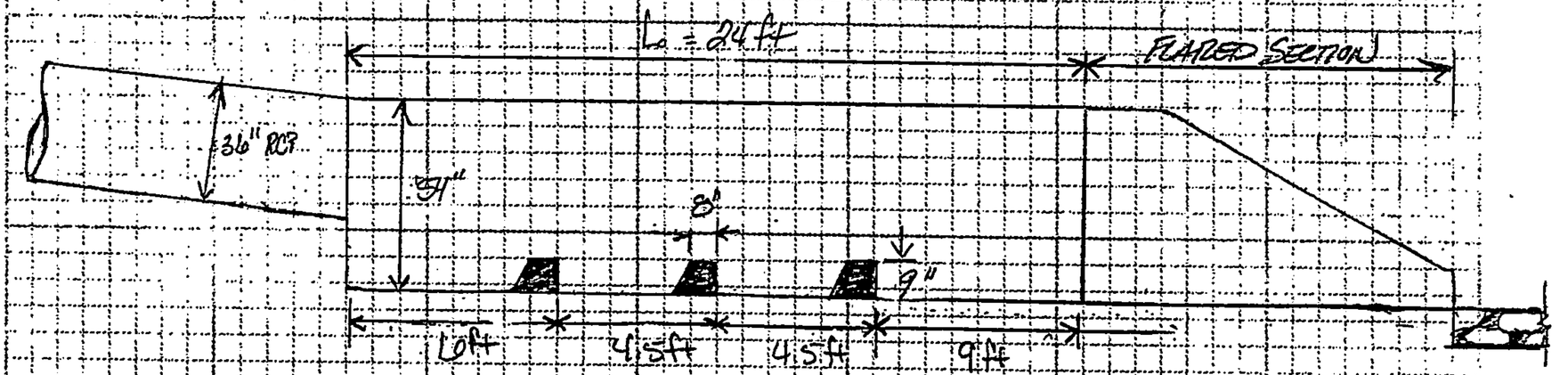
Figure 2. Ring Chamber Energy Dissipator

Table 2. Ring Chamber Energy Dissipator Dimensions

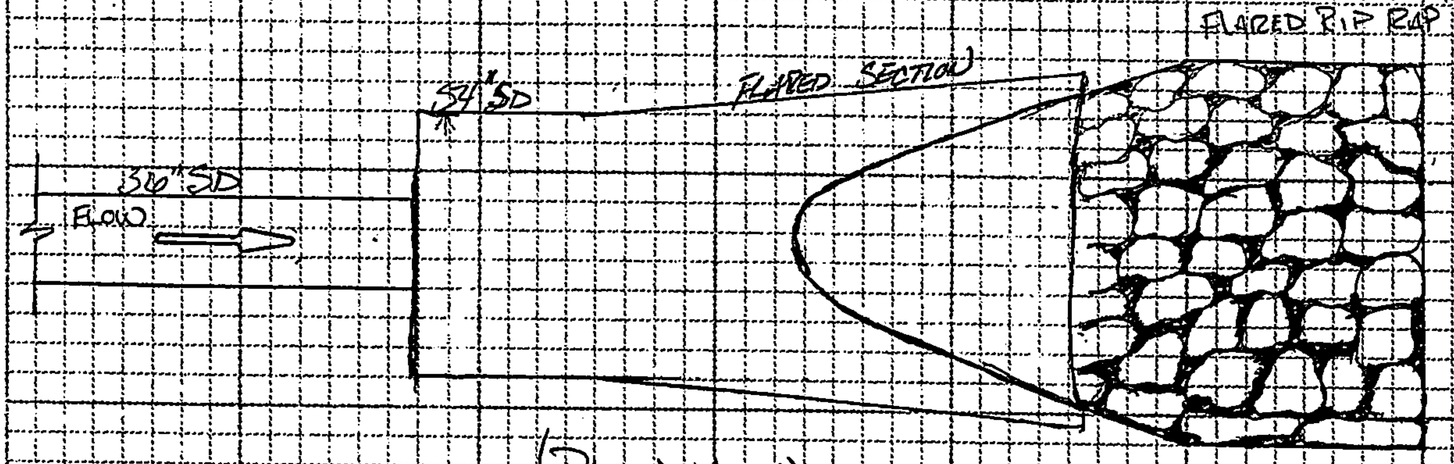
D_0 (in.)	L_1 (ft.)	L (ft.)	L_s (ft.)	L_0 (ft.)	K (in.)	W (in.)
36	4	3	6	16	6	7
42	6	4.5	9	24	7	7
48	6	4.5	9	24	8	8
54	6	4.5	9	24	9	8
60	8	6	12	32	10	9
66	8	6	12	32	11	9
72	8	6	12	32	12	9
78	10	7.5	15	40	13	9
84[1]	**10**	**7.5**	**15**	**40**	**14**	**9**
90	10	7.5	15	40	15	9
96	12	9	18	48	16	10
102	12	9	18	48	17	10
108	12	9	18	48	18	10
114	14	10.5	21	56	19	10
120	14	10.5	21	56	20	10
126	14	10.5	21	56	21	12
132	16	12	24	64	22	12
138	16	12	24	64	23	12
144	**16**	**12**	**24**	**64**	**24**	**12**
150	18	13.5	27	72	25	12
156	18	13.5	27	72	26	12
162	18	13.5	27	72	27	15
168	20	15	30	80	28	15
174	20	15	30	80	29	15
180	20	15	30	80	30	15

Bohannan Huston
ENGINEERS PLANNERS PHOTOGRAMMETRISTS
SURVEYORS SOFTWARE DEVELOPERS

RING CHAMBER DIMENSIONS: (CASA VERDE)



(PROFILE)



(PLAN VIEW)

PROJECT NAME WESTLAND DEVELOPMENT TRACT E SHEET 5 OF 5
PROJECT NO. 020048 BY ROBERT LACKEY DATE 7-5-01
SUBJECT SANITARY SEWER & RING CHAMBER CH'D _____ DATE _____
SIZES

Bohannan ▲ Huston
ENGINEERS PLANNERS PHOTOGRAMMETRISTS
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E 4

GUNNISON PLACE

Size (in)	**42**
Radius (ft)	1.75
Dia. (ft)	3.50
Mannings 'n'	**0.013**
Slope	**0.0157**
Depth Inc. (in)	1

Depth (Inches)	Depth (Feet)	Top Width (Feet)	Area (Sq. Ft.)	Wet. Peri. (Feet)	Hyd. Rad. (Feet)	Velocity (FPS)	Flow (CFS)	Flow (GPM)
12	1.000	3.162	2.268	3.948	0.575	9.926	22.515	10105.358
23	1.917	3.484	5.393	5.832	0.925	13.632	73.517	32996.464
24	2.000	3.464	5.683	6.000	0.947	13.851	78.709	35327.003
25	2.083	3.436	5.970	6.169	0.968	14.052	83.890	37652.423
26	2.167	3.399	6.255	6.339	0.987	14.234	89.032	39960.442
27	2.250	3.354	6.536	6.512	1.004	14.397	94.107	42238.225
28	2.333	3.300	6.814	6.687	1.019	14.542	99.085	44472.305
29	2.417	3.236	7.086	6.866	1.032	14.667	103.934	46648.479
30	2.500	3.162	7.353	7.048	1.043	14.772	108.619	48751.672
31	**2.583**	**3.078**	**7.613**	**7.235**	**1.052**	**14.857**	**113.107**	**50765.750**
32	2.667	2.981	7.865	7.427	1.059	14.921	117.357	52673.265
33	2.750	2.872	8.109	7.627	1.063	14.961	121.327	54455.086
34	2.833	2.749	8.344	7.834	1.065	14.978	124.969	56089.870
35	2.917	2.609	8.567	8.052	1.064	14.968	128.229	57553.238

Size (in)	**60**
Radius (ft)	2.50
Dia. (ft)	5.00
Mannings 'n'	**0.033**
Slope	**0.007**
Depth Inc. (in)	1

Baffles along the bottom of the the larger pipe allow for a larger Mannings Coefficient of Friction, n, to be used when sizing the Ring Chamber Dissipater. Reference Heggins, 1999)

Depth (Inches)	Depth (Feet)	Top Width (Feet)	Area (Sq. Ft.)	Wet. Peri. (Feet)	Hyd. Rad. (Feet)	Velocity (FPS)	Flow (CFS)	Flow (GPM)
12	1.000	4.000	2.796	4.636	0.603	2.696	7.537	3382.997
24	2.000	4.899	7.334	6.847	1.071	3.955	29.005	13018.290
36	3.000	4.899	12.301	8.861	1.388	4.701	57.826	25954.088
37	3.083	4.862	12.707	9.032	1.407	4.743	60.276	27053.760
38	3.167	4.819	13.111	9.204	1.425	4.783	62.705	28143.790
39	3.250	4.770	13.510	9.377	1.441	4.819	65.105	29221.072
40	3.333	4.714	13.906	9.553	1.456	4.852	67.470	30282.390
41	3.417	4.652	14.296	9.731	1.469	4.882	69.791	31324.399
42	3.500	4.583	14.681	9.912	1.481	4.909	72.062	32343.614
43	3.583	4.506	15.059	10.095	1.492	4.932	74.274	33336.389
44	3.667	4.422	15.432	10.282	1.501	4.952	76.418	34298.888
45	3.750	4.330	15.796	10.472	1.508	4.969	78.486	35227.058
46	3.833	4.230	16.153	10.667	1.514	4.982	80.468	36116.589
47	3.917	4.120	16.501	10.866	1.519	4.991	82.354	36962.856
48	4.000	4.000	16.839	11.071	1.521	4.996	84.132	37760.857
49	4.083	3.869	17.167	11.283	1.521	4.997	85.790	38505.114
50	4.167	3.727	17.484	11.503	1.520	4.994	87.315	39189.549
51	4.250	3.571	17.788	11.731	1.516	4.986	88.691	39807.296
52	4.333	3.399	18.079	11.970	1.510	4.973	89.901	40350.435
53	4.417	3.210	18.354	12.222	1.502	4.954	90.924	40809.575
54	4.500	3.000	18.613	12.490	1.490	4.928	91.734	41173.181
55	4.583	2.764	18.853	12.780	1.475	4.896	92.299	41426.409
56	4.667	2.494	19.073	13.096	1.456	4.854	92.572	41548.887
57	4.750	2.179	19.268	13.453	1.432	4.800	92.485	41509.939
58	4.833	1.795	19.434	13.872	1.401	4.730	91.919	41256.032
59	4.917	1.280	19.564	14.413	1.357	4.631	90.599	40663.755
60	**5.000**	**0.000**	**19.635**	**15.708**	**1.250**	**4.384**	**86.071**	**38631.342**

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A Ring Chamber energy dissipator is also suited for conduit outlets. Figure 2 and Table 2 show design dimensions. Simon and Sarikelle (1984) provide further detail.

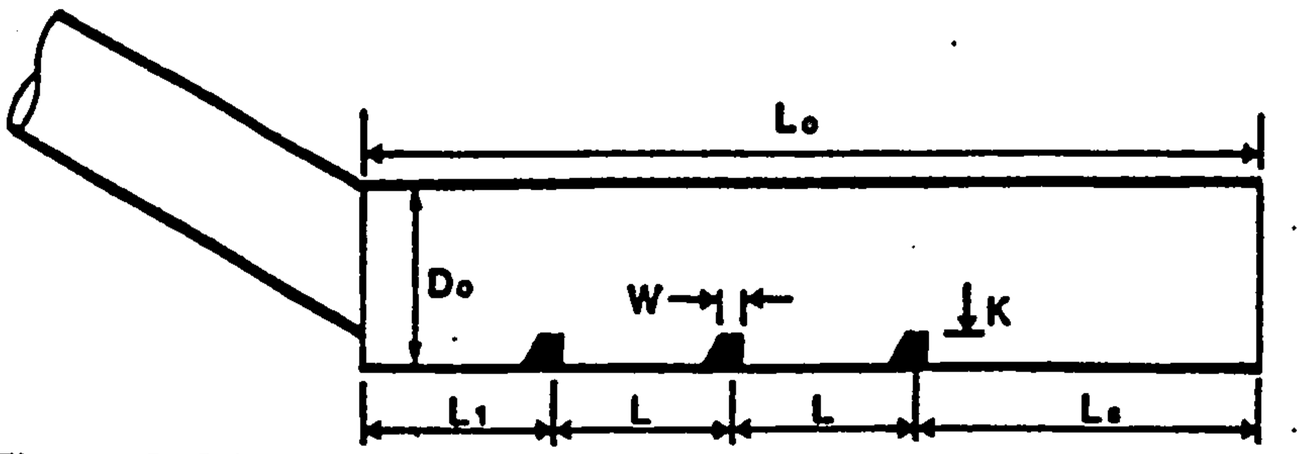

Figure 2. Ring Chamber Energy Dissipator

Table 2. Ring Chamber Energy Dissipator Dimensions

D_0 (in.)	L_1 (ft.)	L (ft.)	L_s (ft.)	L_0 (ft.)	K (in.)	W (in.)
36	4	3	6	16	6	7
42	6	4.5	9	24	7	7
48	6	4.5	9	24	8	8
54	6	4.5	9	24	9	8
60	8	6	12	32	10	9
66	8	6	12	32	11	9
72	8	6	12	32	12	9
78	10	7.5	15	40	13	9
84[1]	**10**	**7.5**	**15**	**40**	**14**	**9**
90	10	7.5	15	40	15	9
96	12	9	18	48	16	10
102	12	9	18	48	17	10
108	12	9	18	48	18	10
114	14	10.5	21	56	19	10
120	14	10.5	21	56	20	10
126	14	10.5	21	56	21	12
132	16	12	24	64	22	12
138	16	12	24	64	23	12
144	**16**	**12**	**24**	**64**	**24**	**12**
150	18	13.5	27	72	25	12
156	18	13.5	27	72	26	12
162	18	13.5	27	72	27	15
168	20	15	30	80	28	15
174	20	15	30	80	29	15
180	20	15	30	80	30	15

Ref: Simon, A.L. and Sarikelle, S. (1984), Internal Energy Dissipators for Culverts, Dept. of Civil Engineering, University of Akron, Akron, OH

Notes: [1]For subsequent reference, boldface font indicates sizes modeled in this study.

Simon and Sarikelle (1984) cite a 1972 study for discharge-diameter guidance.

The Ring Chamber is less expensive than the Type 6, as the barrel is standard pipe and the rings can be shop-constructed.

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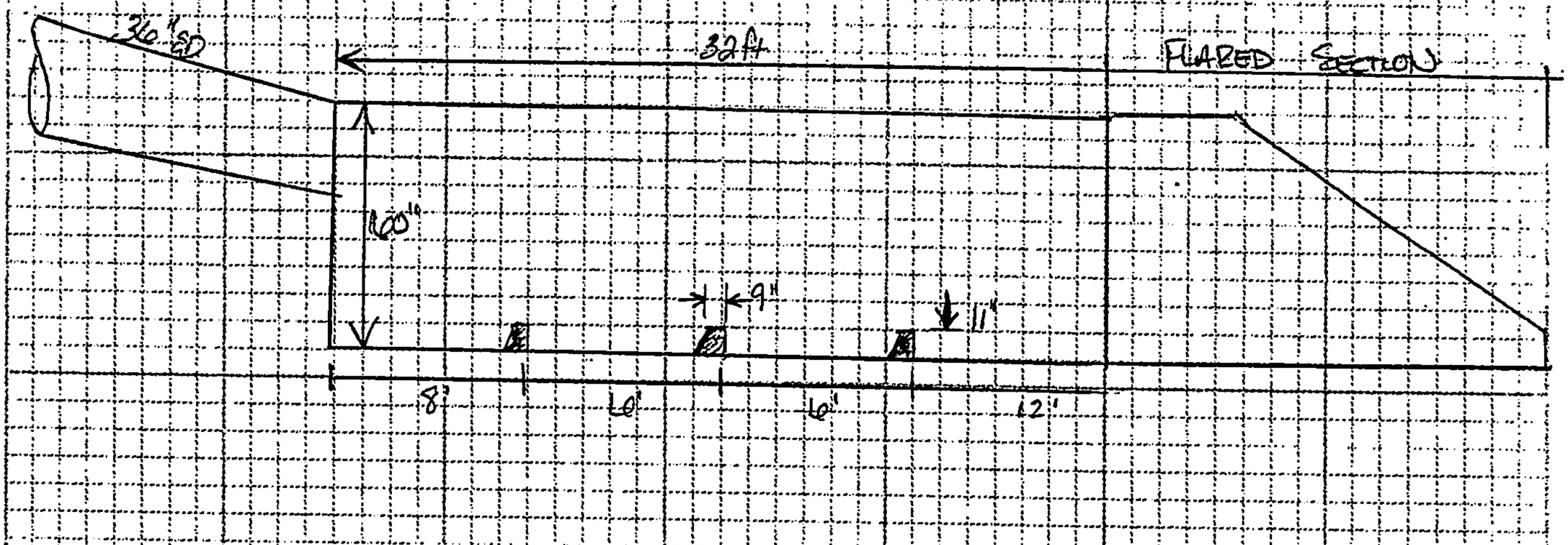
DIMENSIONS FOR RISER CHAMBER DISSIPATER (GUNNISON PLACE)



Bohannan ▲ Huston

PROJECT NAME _____ SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

ENGINEERS PLANNERS PHOTOGRAMMETRISTS
SURVEYORS SOFTWARE DEVELOPERS

E 8

EXHIBITS

EXHIBIT 1: BULK LAND PLAT

EXHIBIT 2: EXISTING DRAINAGE CONDITIONS

EXHIBIT 3: INTERIM DRAINAGE CONDITIONS

EXHIBIT 4: ULTIMATE DRAINAGE CONDITIONS

EXHIBIT 5: FEMA FLOODPLAIN MAP

EXHIBIT 6: GRADING PLAN

EXHIBIT 1

BULK LAND PLAT

EXHIBIT 2

EXISTING DRAINAGE BASIN MAP

EXHIBIT 3

INTERIM DRAINAGE CONDITIONS

EXHIBIT 4

ULTIMATE DRAINAGE CONDITIONS

EXHIBIT 5

FEMA FLOODPLAIN MAP

EXHIBIT 6

GRADING PLAN