PUBLIC WORKS/HYDROLOGY

C23/D14

0000 0000 0314

C23/D14

25×10

0000 0000 0315

DRAINAGE REPORT
FOR
SANDIA COLONY
SUBDIVISION

UNIT 26, SANDIA
HEIGHTS SOUTH

RECEIVED
APR 10 1989
HYDROLOGY SECTION

25×10

0000 0000 0316

C-23-Z-7
8 Dec 2

DRAINAGE INFORMATION SHEET

PROJECT TITLE: SANDIA COLONY SUBD. ZONE ATLAS/DRNG.# C-23D

LEGAL DESCRIPTION: TRACT 8, UNIT 26 SANDIA HEIGHTS SOUTH

CITY ADDRESS:

ENGINEERING FIRM: BOHANNAN-HUSTON CONTACT: RICK BELTRAMO

ADDRESS: 7500 JEFFERSON ST. NE. PHONE: 823-1000

OWNER: HAL JOINT VENTURE CONTACT: HAROLD ALBERT

ADDRESS: 2114 JUAN TABO, NE PHONE:

ARCHITECT: RICHARD ELLIOTT CONTACT: RICHARD ELLIOTT

ADDRESS: PHONE:

SURVEYOR: BOHANNAN-HUSTON INC. CONTACT: DWAIN WEAVER

ADDRESS: PHONE:

CONTRACTOR: CONTACT:

ADDRESS: PHONE:

RECEIVED
APR 10 1989
HYDROLOGY SECTION

PRE-DESIGN MEETING:

___ YES
✓ NO
___ COPY OF CONFERENCE RECAP SHEET PROVIDED

DRB NO. 88-34
EPC NO.
PROJ. NO.

TYPE OF SUBMITTAL:

✓ DRAINAGE REPORT
___ DRAINAGE PLAN
___ CONCEPTUAL GRADE & DRAIN PLAN
___ GRADING PLAN
___ EROSION CONTROL PLAN
___ ENGINEER'S CERTIFICATION

CHECK TYPE OF APPROVAL SOUGHT:

___ SKETCH PLAT APPROVAL
___ PRELIMINARY PLAT APPROVAL
___ SITE DEVELOPMENT PLAN APPROVAL
___ FINAL PLAT APPROVAL
___ BUILDING PERMIT APPROVAL
___ FOUNDATION PRMIT APPROVAL
___ CERTIFICATE OF OCCUPANCY APPROVAL
___ ROUGH GRADING PERMIT APPROVAL
___ GRADING/PAVING PERMIT APPROVAL
✓ OTHER Floodplain Revision Approval (SPECIFY)

DATE SUBMITTED: 4/10/89

BY: R. Beltramo

25×10

0000 0000 03 14

D23/D
C23/D14

R. WARD HUNNICUTT, CHAIRMAN
PAT D. HIGDON, VICE-CHAIRMAN
REX FUNK, SECRETARY-TREASURER
DANIEL W. COOK, DIRECTOR
RONALD D. BROWN, DIRECTOR

LARRY A. BLAIR
EXECUTIVE ENGINEER

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

2600 PROSPECT N.E. · ALBUQUERQUE, N.M. 87107
TELEPHONE (505) 884-2215

RECEIVED
MAY 09 1989
HYDROLOGY SECTION

May 5, 1989

Rick Beltramo, P.E.
Bohannan-Huston Inc.
Courtyard I, 7500 Jefferson St. NE
Albuquerque, NM 87109

RE: Drainage Report for Sandia Colony

Dear Rick:

AMAFCA has reviewed the Drainage Report for Sandia Colony Subdivision, Unit 26 Sandia Heights South (dated April, 1989) and your letter to Mr. Bob Foglesong dated April 5, 1987. We present the following comments for your consideration:

1. The letter of April 5, references a meeting at AMAFCA held on March 19,1989. My understanding of the conclusions of that meeting are somewhat different than stated in the letter. My understanding was that excess storm water runoff volume would be ponded and throttled out at a very slow rate so as not to cause downstream erosional problems. The two year storm existing condition park flow would be a maximum allowable valve but the downstream channel conditions would be a controlling factor. The projection of 0.213 cfs came from a discharge of the 2 year developed runoff volume over a period of several hours. I expressed concern over the increase in any volume to the northern drainage basin (existing condition Basin A) because of the ponding conditions which appeared to exist immediately west of Tennyson Street.

2. The outflow from Pond A goes through an existing culvert pipe onto lot 32, Block 15, Tract 2, Unit 1, North Albuquerque Acres. From the existing topographic mapping, it appears that ponding exists on this lot. There is development on lot 30, two lots to the west of lot 32. It appears that the discharge from Pond A will increase the elevation and frequency of ponding on lot 32. The report contains no information on how this damage will be mitigated.

25×10

0000 0000 0318

3. The existing condition report contains no information on the peak flow and volumes coming from off site areas (Tramway and areas east). It is the apparent intent to take credit for diversions created at the east property line. The offsite flows should be quantified so that existing and developed conditions can be compared. If the existing natural channel west of Tramway serves to reduce peak flows and volumes coming from Tramway, this reduction should be identified. Does the proposed diversion at Tramway serve primarily to protect downstream property from damage caused by existing development?

4. It is not clear which Bernalillo County project will handle flows from Basin D-5 and when such a project will be constructed. It appears that the plans propose a direct discharge from Basin D-5 onto Tennyson street and to the new culvert without flow attention.

5. What will happen when the 38,270 cubic feet of runoff from Basins D-2, D-3, D-4 and D-5 (at a 100 year storm) exceeds the capacity of pond B (7818 cubic feet) and flows over the pond emergency spillway? Will this cause greater damage downstream than under undeveloped conditions?

6. It is not clear that the 1.3 cfs discharging from pond B at a 2 year storm for a period of one to two hours is not more damaging than the existing condition flow from a two year storm?

7. All of the pond routings assume that peak outflow will occur with the pond at or near empty. The time to drain the ponds makes the same assumption. Since pond volumes for some storm events do not include any free board allowance, this assumption would seem to under predict more precisely computed volumes.

8. The rundown from Basin D-2 is proposed to be earth lined. The maximum velocity of 2.65 fps should be checked to make sure that this is compatible with the existing site soils. Figure 6-2 of S.C.S. Technical Release No. 25, Design of Open Channels is a good reference to make this check. What sort of channel protection will be provided

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

25×10

0000 0000 0319

at the outlet to the cattle guard inlet and at the sharp alignment bend? The freeboard of 0.12 feet is not consistent with D.P.M. recommendations.

9. The Concrete Rundowns do not have freeboard levels consistent with DPM criteria. Is additional easement area to be provided which will allow freeboard to occur on the land adjacent to the rundowns? Is there any study which indicates that the full width of 90 degree transition curves can be used to compute minimum inlet widths? Use of this full width (5.33 feet + 6.0 feet) appears to be inconsistent with width factors used with broad crested weirs. What sort of cutoff walls are proposed at the ends of rundowns? What will prevent the vertical walls from cracking at the base?

10. The plan proposes that a retaining wall be constructed at the north boundary of this project. This wall does not appear in the infrastructure listing. Will the wall be constructed with this project?

11. Riprap is proposed for use at the bottom end of the concrete rundowns. What is the size and gradation of the riprap? What filter will be used? We would recommend use of granular filter sized to function on existing site soils.

12. We note that the overflow section of pond B (Section C-C on sheet 3) proposes a thin layer of soil cement. It is not clear that competent compaction can be obtained on the proposed slope or that a thin section can withstand the proposed flows, along with expected weathering. It would appear appropriate to use a more conventional thickness and section for a soil cement overflow to a pond. The structure should be designed to protect the toe of the embankment from erosional damage.

We would be pleased to meet with you to discuss these comments in a further detail. Enclosed is a copy of AMAFCA's Drainage Policy which provides the guidelines for our comments.

Sincerely,
AMAFCA

Clifford E. Anderson, PE & LS
Drainage Engineer

Albuquerque
Metropolitan
Arroyo
Flood
Control
Authority

25×10

0000 0000 0320

BOHANNAN-HUSTON INC.

Courtyard I 7500 Jefferson Street, N.E. Albuquerque, NM 87109
TEL (505) 823-1000 FAX (505) 821-0892

Transmittal

To: Carlos Montoya
COA - Hydrology

☐ Parcel post ☐ Messenger
☐ First Class ☐ UPS
☐ Express Mail ☐ Air Freight
☐ Bus ☒ Hand

Attention:

Date: 4/10/89

Our job number: 88222.40

Your job number:

Job: Sandia Colony Subdivision

We are enclosing:	For:
1 Drainage Rpt.	Review & Comments.

RECEIVED
APR 10 1989
HYDROLOGY SECTION

Comments:
Carlos, I will be preparing a "Letter of map revision" since the drainage diversion on Tramway is constructed under the Paseo Del Norte / Tramway project. I need your comments regarding the floodplain revision. We were hoping to recieve comments from AMAFCA and Bernalillo County by mid-next week. Your input by the same date would be greatly appreciated.

By: [signature] thank you

Rec'd by: [signature] Date: 4/10/89

☐ Please Return Signed Yellow Copy

9/88

25 × 10

0000 0000 0321

BOHANNAN-HUSTON INC.
ENGINEERS ARCHITECTS PHOTOGRAMMETRISTS
ALBUQUERQUE NM 87109
FAX (505) 821-0892

April 5, 1989

Mr. Bob Fogelsong
County of Bernalillo
Public Works Department
P.O. Box 1293
Albuquerque, NM 87103

Re: Drainage Report for Sandia Colony

Dear Mr. Fogelsong:

Submitted for your review is one copy of the Sandia Colony Drainage Report. Sandia Colony is located at the corner of Live Oak Road and Tramway Blvd. The design presented assumes that the Paseo del Norte/ Tramway project is completed and existing. This is also true with Tennyson Roadway.

Presented in the report is a drainage management plan which consists of collecting all developed flows into two ponds. Ponds A and B then discharge to existing drainage facilities located in Tennyson Roadway. The ponds are designed to reduce the 2-hr. frequency developed flow to that of the existing undeveloped 2-yr. flow rate.

On March 14, 1989, a meeting was scheduled between AMAFCA, and Bohannan-Huston, Inc. Several items were discussed, all of which have been addressed by the report. Item number 4 from the meeting summary notes discusses an allowable discharge equal to the 2-yr. storm. This design uses the computed 2-yr. rate for basin B of 1.3 cfs, which is greater than that stated in the meeting (0.213 cfs). I believe the intention was to use the 1.3 cfs and is so done. This method was used for both ponds A and B.

Please accept this report as a formal submittal for review and comments. Due to the stringent time restraints, a timely review would be greatly appreciated. Review comments returned by Wednesday, April 18, will enable us to keep the project on schedule.

A copy of the report has been sent to AMAFCA for their review and coments along with a copy of this letter.

If there are any questions regarding this project, please feel free to call.

Sincerely,

Rick Beltramo, P.E.
Project Manager

cc: Harold Albert
Cliff Anderson, AMAFCA

Attachment - Drainage Report for Sandia Colony

/da
Job No. 88222.04

25×10

0000 0000 0322

BOHANNAN-HUSTON INC.
ENGINEERS ARCHITECTS PHOTOogrammetrists
COURTYARD I 7500 JEFFERSON STREET N.E. ALBUQUERQUE, N.M. 87109
TEL (505) 823-1000 FAX (505) 821-0892

April 6, 1989

Cliff Anderson
AMAFCA
2600 Prospect, N.E.
Albuquerque, NM 37107

Re: Drainage for Sandia Colony

Dear Cliff:

Accompanying this letter is a copy of the submitted letter to Bob Fogelsong requesting review of the Sandia Colony Drainage Report. Your review of the subject project and comments are requested.

Your comments from the March 14 meeting have been addressed. Please note the discussion in the attached letter concerning the allowable outfall from pond B.

As stated in the attached letter, a timely response is requested. Review comments returned by Wednesday, April 18, would enable us to maintain our time schedule.

If there are any questions regarding this submittal, please call.

Sincerely,

Rick Beltramo, P.E.
Project Manager

cc: Harold Albert

Attachments - Submittal letter to County of Bernalillo
- Drainage Report for Sandia Colony

/da
Job No. 88222.04
Reading

25×10

0000 0000 0323

DRAINAGE REPORT
FOR
SANDIA COLONY
SUBDIVISION

UNIT 26, SANDIA
HEIGHTS SOUTH

APRIL, 1989

Prepared for:

Harold Albert, P.A.
2114 Juan Tabo, N.E.
Albuquerque, NM 87112

Prepared by:

Bohannan-Huston, Inc.
7500 Jefferson St., N.E.
Courtyard I
Albuquerque, NM 87109

Job No. 88222.04

25×10

0000 0000 0324

DRAINAGE REPORT FOR
SANDIA COLONY SUBDIVISION

UNIT 26, SANDIA HEIGHTS SOUTH

TABLE OF CONTENTS

		Page
PURPOSE AND SCOPE		1
SITE LOCATION AND DESCRIPTION		1
Method of Analysis		2
EXISTING CONDITIONS		2
PROPOSED CONDITIONS		3
Basin D-1		3
Basin D-2		4
Basin D-3		4
Basin D-4		4
Basin D-5		5
BACKYARD PONDING		5
EASEMENTS AND COVENANTS		5
APPENDIX	Engineering Computations	
	Infrastructure List	
EXHIBITS	Sht. 1 - Existing Conditions	
	Sht. 2 - Proposed Grading/Drainage	
	Sht. 3 - Detail Sheet	

25×10

DRAINAGE REPORT FOR SANDIA COLONY SUBDIVISION
UNIT 26, SANDIA HEIGHTS SOUTH

PURPOSE AND SCOPE

The purpose of this drainage report is to present the existing and proposed drainage conditions of Tract 8, Unit 26 of Sandia Heights South. Drainage basins are defined to analyze and determine runoff flow rates for the site before and after development during the 100-year storm event.

SITE LOCATION AND DESCRIPTION

The 8.11 acre site is currently an undeveloped parcel located between Tramway Boulevard and Tennyson Road in the Sandia Heights Subdivision. It is bounded to the north by Live Oak Road and to the south by the proposed extension of Paseo del Norte to Tramway Boulevard. The construction plans for the new Paseo del Norte/Tramway intersection are complete and the project is scheduled to start construction sometime in May, 1989. Many portions of the construction for that project affect this subdivision and will be identified when necessary in this report.

There is an existing sanitary sewer lift station located on-site adjacent to Tennyson Road just south of Live Oak Road. An 8-inch force main line extends south from the lift station approximately 250 feet, then turns east and continues across the tract to Tramway Boulevard where it then turns south and eventually meets the City of Albuquerque sewer system. The lift station is fed by a 10" gravity line which extends north from the lift station to a manhole located at the northwest corner of the tract. The manhole diverts flows from an existing 8-inch line which extends northeast from the manhole and crosses the northern property line and continues to Tramway Boulevard. In addition, there is an 8-inch sanitary sewer line which crosses the northeast corner of the tract.

25×10

0000 0000 0326

Method of Analysis

All runoff calculations in this report have been developed following the latest proposed revisions (2/22/89) to the City of Albuquerque Development Process Manual, Section 22.2. This method was chosen at the recommendation of AMAFCA and was concurred with by County of Bernalillo Public Works Department.

EXISTING CONDITIONS

Soil types consist of Tijeras (TgB) and Embudo Tijeras Complex. The hydrological soil group is Type "B" and can be identified on the soils map shown on Plan Sheet 1. Also identified on Sheet 1 are the two separate drainage basins that exist on-site in the undeveloped state. These basins are labeled A and B.

Basin A discharges in a westerly direction at a slope of approximately 6%. The basin generates approximately 4.92 cfs (100-year, 6-hour storm) which is transported under Tennyson Road via an existing 24-inch CMP culvert. No significant off-site flows contribute to Basin A.

Basin B discharges southwest and northwest at a slope of approximately 4.5% towards an existing arroyo. The arroyo carries approximately 14.4 cfs generated on-site, plus an additional 143 cfs which is generated east of Tramway Boulevard. An existing 24-inch culvert transports the flows across Tramway and into the existing arroyo. Sheet 1 shows the existing arroyo which is identified in the 100-year flood plain boundary.

The Paseo del Norte/Tramway intersection plans call for the construction of a diversion system which will convey the 143 cfs south along Tramway to the Arroyo de Domingo Baca Tributary. This diversion system is scheduled to be complete at the end of May, 1989, and is therefore, considered in place for the purpose of this analysis. No other significant off-site flows contribute to Basin B.

25×10

0000 0000 0327

Completion of the diversion would remove the flood plain from the property. An application for conditional approval of map changes will be submitted to FEMA in accordance with National Flood Insurance Program Regulations.

PROPOSED CONDITIONS

The site contains approximately 50 dwelling units and includes County-dedicated streets. The proposed site will thus generate an estimated 37.2 cfs in the 100-year storm event. A retaining wall, which will be constructed as part of the Paseo del Norte/Tramway intersection, will contain flow generated in Tramway Boulevard. The flow will be directed along an asphalt ditch and will discharge into the new storm drain system constructed by that project. All runoff in Tramway Boulevard and Live Oak Road will remain in the right-of-way and will be handled as part of the roadway improvements.

The FEMA Flood Plain Boundary, as shown on Plan Sheet 1, will be removed by submittal of the Flood Plain Letter of Map Amendment after the diversion facility is complete.

The site has been divided into five separate drainage basins. The drainage basins are labeled D-1 through D-5, and are shown on Plan Sheet 2.

Basin D-1

Basin D-1 generates 10.4 cfs (100-year, 6-hour) in the developed condition and will drain to the existing 24-inch CMP culvert. In order to protect downstream properties from the increase in runoff due to development, a detention pond will be constructed. The pond (labeled as Pond A on Plan Sheet 2 and in the calculations in Appendix A) will detain the developed 100-year storm to discharge at the undeveloped rate. The required pond volume was calculated to be 5,360 ft^3, which was the difference between the developed and undeveloped discharge rates shown on the hydrograph on Sheet 3, Appendix A.

25×

0000 0000 0328

The 2-year storm will be completely detained and discharged through a 4-inch bleed pipe at a rate of 0.44 cfs.

The time required to completely drain the pond (when full) will be slightly more than three hours.

Basin D-2

Basin D-2 generates approximately 7.6 cfs (100-year, 6-hour) in the developed condition. The flow will drain in the street west to a new cattle guard storm inlet located just east of Tennyson Road. The flow will then be diverted along a new bar ditch to Pond B. Pond B will detain the 2-year storm and will allow larger storms to flow over the proposed berm to the proposed 24" culvert. The proposed 24" culvert was designed and will be constructed as part of the Paseo del Norte/Tramway intersection.

Pond B will completely detain the 2-year storm in order to discharge through a 6" bleed pipe at the undeveloped rate.

Basin D-3

Basin D-3 generates approximately 12.0 cfs (100-year, 6-hour) in the developed condition. The flows are discharged to the existing arroyo (proposed open space) from adjacent lots and through a concrete rundown to be located just west of Shara Road. The flow will be discharged to Pond B for detainment of lesser storms, and ultimate discharge through the proposed 24-inch culvert identified earlier.

Basin D-4

Basin D-4 generates approximately 3.13 cfs (100-year, 6-hour) in the developed condition. The flow will be directed to a concrete rundown which discharges into Pond B and finally through the proposed 24-inch culvert.

25×10

0000 0000 0329

Basins D-2 through D-4 will discharge to the existing arroyo (proposed open space). Pond B was sized to detain the difference between the developed 2-year discharge and the undeveloped 2-year discharge. The required pond volume to detain the excess flows due to development was calculated to be 7,725 ft^3. The time required to completely drain the pond is about 96 minutes. The pond will discharge 1.3 cfs through a 6-inch bleed pipe at the undeveloped rate. The pond was developed to protect downstream properties of lesser storms that normally might not affect them.

Basin D-5

Basin D-5 generates approximately 4.05 cfs (100-year, 6-hour) in the developed condition. The flow will be directed into the street and will discharge into the proposed bar ditch along the east side of Tennyson Road. The flows will continue south in the ditch and will be collected by the new storm drain system being constructed as part of the Paseo del Norte improvements.

BACKYARD PONDING

All houses will be designed to discharge all roof flow to the front of the house in order to drain to the street. All calculations were made assuming no ponding will be necessary. Backyard ponds were provided where it is not possible to drain the lot towards the street and/or the arroyo. Two configurations were utilized for the ponds and are shown on the detail sheet. The maximum volume anticipated for the ponds during the 100-year storm was calculated to be 156 ft^3 (see Sheet 12, Appendix A).

EASEMENTS AND COVENANTS

Public drainage easements will be dedicated for Ponds "A" and "B" so as to accept public waters off the county roadways. The major drainage

25×10

0000 0000 0330

swale which discharges into pond "B" will also require a public drainage easement. Drainage covenants will be provided for all drainage facilities except the cattle grate type inlet located in Basin D-2.

Dedicated drainage easements will be shown as such on the Final Plat. Necessary covenants will be provided prior to obtaining final plat approval.

25×10

0000 0000 0331

APPENDIX:

ENGINEERING COMPUTATIONS

INFRASTRUCTURE LIST

25×10

Existing Conditions:

A. The undeveloped flow can be divided into 2 (two) separate basins. (Basins A and B, see plan for undeveloped conditions)

Basin A:

Total Area = 89,979 ☐ = 2.066 acres

$Q_p = Q_{p_1} A_1$ where Q_{p_1} = Peak Discharge for treatment #1 (cfs/acre)

A_1 = Area in treatment #1

$Q_{p_{100yr}} = (2.38)(2.066) = 4.92$ cfs $\quad V_{100} = \frac{0.65}{12}(2.066) = 4875$ ft³

$Q_{p_{10yr}} = (1.077)(2.066) = 2.14$ cfs

$Q_{p_{2yr}} = (0.213)(2.066) = 0.45$ cfs

Basin B:

Total Area = 263,229 ☐ = 6.043 acres

$Q_{p_{100yr}} = (2.38)(6.043) = 14.38$ cfs

$Q_{p_{10yr}} = (1.037)(6.043) = 6.27$ cfs

$Q_{p_{2yr}} = (0.213)(6.043) = 1.29$ cfs

Developed Conditions:

Basin D-1:

Total Area = 98,925 ☐ = 2.271 acres

Area Treatment #1 22,265.5 ☐ = 0.511 acres

Area Treatment #2 22,265.5 ☐ = 0.511 acres

Area Treatment #3 54,394 ☐ = 1.249 acres

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 2. OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

25×10

$Q_{p_{100\,yr}} = (0.511)(2.38) + (0.511)(3.44) + (1.250)(5.74) = 10.40$ cfs

$Q_{p_{10\,yr}} = (0.511)(1.037) + (0.511)(2.137) + (1.250)(3.741) = 6.30$ cfs

$Q_{p_{2\,yr}} = (0.511)(0.213) + (0.511)(1.076) + (1.250)(2.784) = 3.62$ cfs

Hydrograph for Basin D-1:

$$\text{Weighted } P_e = \frac{(0.65)(0.511) + (1.13)(0.511) + 2.57(1.25)}{2.271}$$

Weighted $P_e = 1.814''$

$Q_p/\text{acre} = 10.40 \text{ cfs} / 2.271 = 4.58 \text{ cfs/acre}$

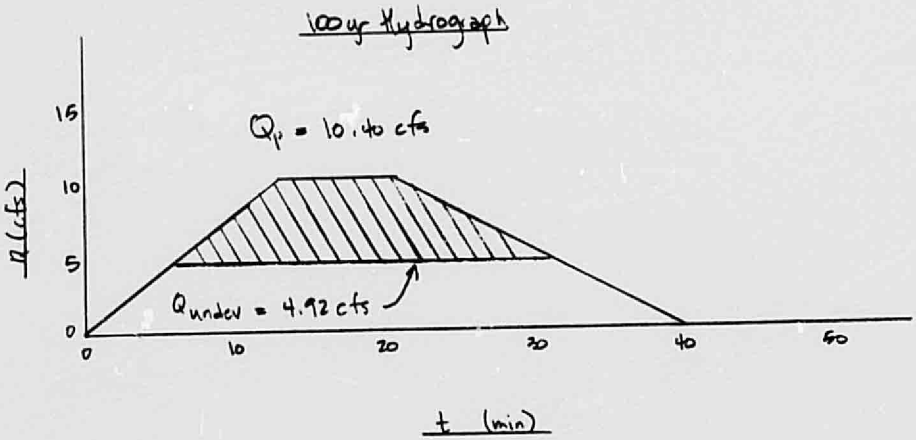
$t_b = 121\, P_e/Q_p - 15\, P_3 = 121 \dfrac{(1.814'')}{4.58} - 15(0.54)$

$= 39.8$ min, say 40 min

$t_p = 15 - 5P_3 = 15 - 5(0.54) = 12.3$ min, say 13 min

Duration of Peak $= 15(0.54) = 8.1$ min, say 8 min

100 yr Hydrograph



BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 3 OF _____
PROJECT NO _____ BY _____ DATE _____
SUBJECT _____ CH'D _____ DATE _____

25×10

Total Volume = 14,955 ft^3

Discharge Rate = 4.92 cfs ($Q_{p\,100yr}$ undeveloped rate)

Required Pond Volume = 5,360 ft^3

Basin D-2 :

Total Area = 70,704 ☐ = 1.627 acres

Area Treatment #1 = 14581.5 ☐ = 0.3347 acres

Area Treatment #2 = 14581.5 ☐ = 0.3347 acres

Area Treatment #3 = 41,541 ☐ = 0.9540 acres

$Q_{p\,100\,yr}$ = 7.60 cfs

$Q_{p\,10yr}$ = 4.63 cfs

$Q_{p\,2yr}$ = 2.69 cfs

Basin D-3 :

Total Area = 119,591 ☐ = 2.745 acres

Treatment #1 = 31,726 ☐ = 0.7283 acres

treatment #2 = 31,726 ☐ = 0.7283 acres

treatment #3 = 56,139 ☐ = 1.289 acres

$Q_{p\,100yr}$ = 12.00 cfs

$Q_{p\,10yr}$ = 7.13 cfs

$Q_{p\,2yr}$ = 3.98 cfs

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 4 OF _____

PROJECT NO _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

25×10

Basin D-4:

Total Area = 29862 ☐ = 0.6855 acres

Area Treatment #1 = 5247 ☐ = 0.120 acres

Area Treatment #2 = 5247 ☐ = 0.12 acres

Area Treatment #3 = 19368 ☐ = 0.4446 acres

$Q_{p\ 100yr}$ = 3.31 cfs

$Q_{p\ 10yr}$ = 2.05 cfs

$Q_{p\ 2yr}$ = 1.21 cfs

Basin D-5:

Total Area = 41185 ☐ = 0.9455 acres

Area Treatment #1 = 11662 ☐ = 0.2677 acres

Area Treatment #2 = 11662 ☐ = 0.2677 acres

Area Treatment #3 = 17,861 ☐ = 0.410 acres

$Q_{p\ 100yr}$ = 4.05 cfs

$Q_{p\ 10yr}$ = 2.38 cfs

$Q_{p\ 2yr}$ = 1.31 cfs

Summary of Flows:

Flows	Basin D-1	D-2	D-3	D-4	D-5
Q_{100}	10.40	7.60	12.00	3.31	4.05
Q_{10}	6.30	4.63	7.13	2.05	2.38
Q_2	3.62	2.69	3.98	1.21	1.31

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 5 OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

25×10

Hydrograph for Basin D-2 thru D-4:

$Q_{p\ 100yr}$ = 22.91 cfs

$Q_{p\ 10yr}$ = 13.81 cfs

$Q_{p\ 2yr}$ = 7.88 cfs

$$2yr - \text{Weighted } P_e = \frac{(0.047)(1.184) + (0.191)(1.184) + (0.957)(2.687)}{5.054}$$

$$= 0.564''$$

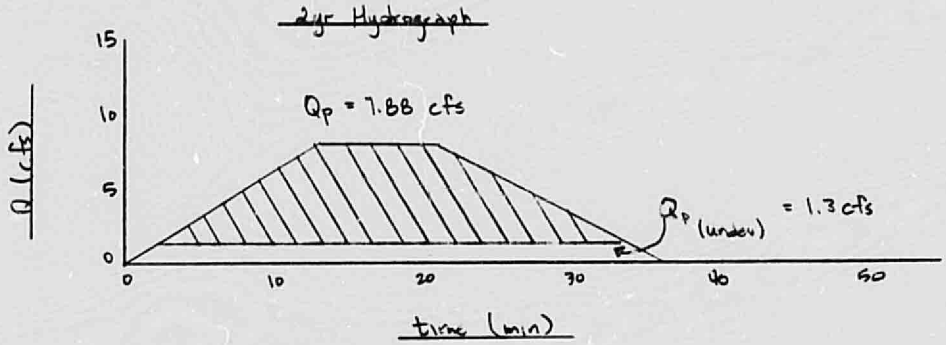
Q_p /acre = 7.88 / 5.054 = 1.56 cfs/acre

$t_b = 121\left(\frac{0.564}{1.56}\right) - 15(0.53) = 35.8$ min, say 36 min

$t_p = 15 - 5(0.53) = 12.3$ min, say 12 min

Duration of Peak = 15(0.53) = 7.9 min, say 8 min

2yr Hydrograph



Total Volume = 10,357 ft³

Discharge Rate = 1.3 cfs

Required Pond Volume = 7,725 ft³

BOHANNAN-HUSTON INC.

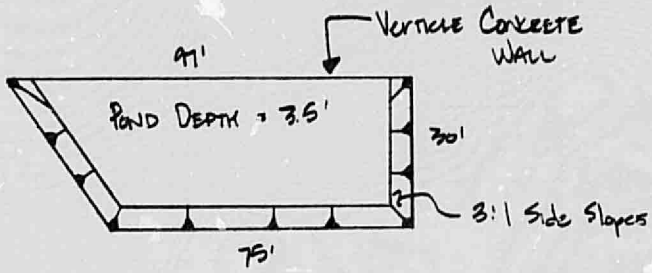
PROJECT NAME		SHEET 6	OF
PROJECT NO.		BY	DATE
SUBJECT		CH'D	DATE

25×

0000 0000 0337

Pond A Size:

Required Pond Volume = 5360 ft^3



$$\text{Volume} = (116)(3.5)\left[(75)(30) + (0.5)(32)(30) - (64.5)(19.5) - (0.5)(19.5)(8.98)\right]$$
$$+ (7.5)\left[(64.5)(19.5) + (0.5)(19.5)(8.98)\right]$$
$$= 5429\ ft^3$$

Pipe for 100yr Discharge:

$Q = CA\sqrt{2gH}$

C = 0.6 (King & Prater, Handbook of Hydraulics, Sixth Edition)

H = 3.5'

Q_{100} (undeveloped) = 4.9 cfs

$$4.9 = (0.6)(A)\sqrt{(2)(32.2)(3.5)}$$

$A = 0.54\ ft^3 \Rightarrow d^2 = 0.69\ ft^2 \Rightarrow d = 0.83'$

Use d = 12" with orifice plate such that Q = 4.9 cfs

Note: A Catch Basin may be utilized and placed at water surface elevation 3.45' above pond bottom. Extend existing culvert (if necessary) to catch basin and provide bleed pipe.

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 7 OF _____
PROJECT NO. _____ BY _____ DATE _____
SUBJECT _____ CH'D _____ DATE _____

25×10

Hydrograph for 2-yr Storm at Basin D-1:

$$\text{Weighted } P_e = \frac{(0.047)(0.511) + (0.191)(0.511) + (0.957)(1.249)}{2.271}$$

$$= 0.58''$$

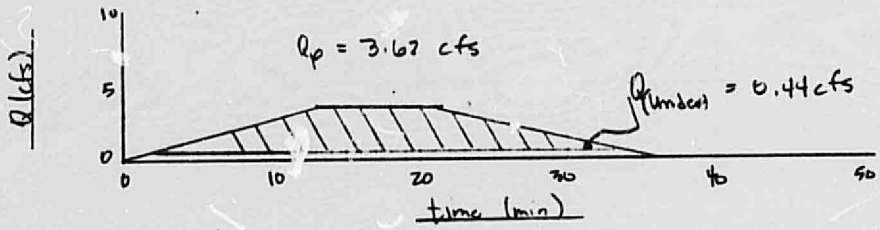
$$Q_p/\text{acre} = 3.62/2.271 = 1.594$$

$$t_b = 121\left(\frac{0.58}{1.594}\right) - 15(0.55) = 35.8 \text{ min, say } 36 \text{ min}$$

$$t_p = 15 - 5(0.55) = 12.25 \text{ min, say } 13 \text{ min}$$

$$\text{Duration} = 15(0.55) = 8.25 \text{ min, say } 8.5 \text{ min}$$

2yr Hydrograph



Total Volume = 4833 ft³

Discharge Rate = 0.44 cfs

Required Pond Volume = 3876 ft³

Water Surface Elevations:

100yr $\quad \frac{\text{Volume Storm}}{\text{Pond Volume}}$ (height Berm) $= \frac{6360}{6429}(3.5) = 3.45'$

- Elevation @ discharge pt should be 3.45 above pond bottom in order to discharge undeveloped flows

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 8 OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

25 × 10

10yr Weighted Pe = $\frac{(0.244)(0.511)+(0.507)(0.511)+(1.597)(1.25)}{2.271}$

= 1.047"

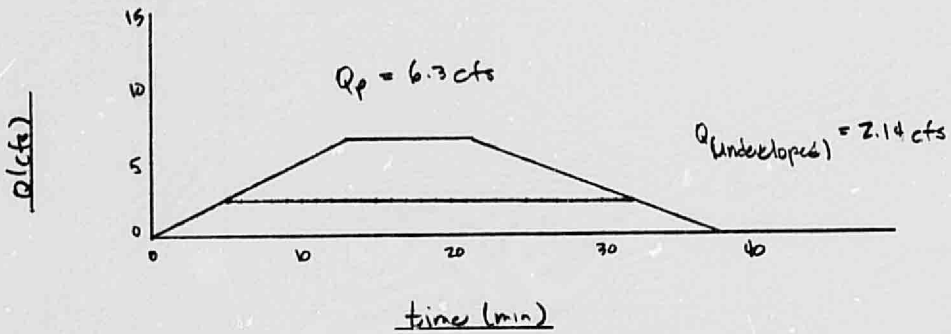
Volume = $\frac{(1.047")}{12}(2.271)(43560)$ = 8635 ft³

Qp / acre = 6.30 / 2.271 = 2.774 cfs / acre

t_b = 121 $\left(\frac{1.047}{2.774}\right)$ − 15 (0.55) = 37.43 min, say 38 min

t_p = 15 − 5 (0.55) = 12.25 min, say 13 min

Duration = 85 min



Total Volume = 8635 ft³
Discharge rate = 2.14 cfs
Required Volume = 5038 ft³

- Since the required volume is less than the total pond volume, there will not be an increase in volume (over undeveloped rate) to affect down stream properties

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 9 OF _____
PROJECT NO. _____ BY _____ DATE _____
SUBJECT _____ CH'D _____ DATE _____

W.S.E = $\frac{5038}{5429}(3.5)$ = 3.25' ft above pond bottom

2yr $\frac{3876}{5429}(3.5)$ = 2.50 ft above pond bottom

Bleed line for 2yr Discharge:

$Q = C A \sqrt{2gh}$ $C = 0.6$

$Q_{under} = 2.14$ cfs

$(0.44) = (0.6)(A)\sqrt{2(32.2)(3.5)}$ $h = 3.5'$

$A = 0.05\ ft^2$, $\frac{\pi}{4} d^2 = 0.05$, $d^2 = .062$, $d = 0.25'$

Use $d = 4''$ with orifice plate such that $Q = 0.44$ cfs

Time required to drain Ponds:

Pond A:

$Q_{2yr\ undeveloped} = 0.44$ cfs

Time required (for 2yr) = $\left(\frac{4833}{0.44}\right)\left(\frac{1hr}{3600s}\right)$ = 3.05 hrs

Time required (10yr, 100yr) = $\left(\frac{5429}{0.44}\right)\left(\frac{1hr}{3600s}\right)$ = 3.4 hrs

Pond B:

$Q_{2yr\ undeveloped} = 1.3$ cfs

Time required (2yr) = $\left(\frac{7785}{1.3}\right)\left(\frac{1hr}{3600s}\right)$ = 1.6 hrs

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 10 OF _____

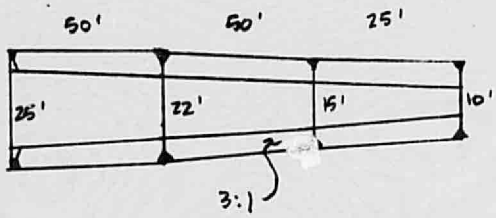
PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

25×10

Pond B Size:

Required Pond Volume = 7,725 ft³



Pond Depth = 2.5'

$$\text{Volume} = (2.5)\Big[(25-(0.5)(25-22))(50) + (1/6)(40-(0.5)(40-37))(50)$$
$$+ (22-(0.5)(22-15))(50) + (1/6)(37-(0.5)(37-30))(50)$$
$$+ (15-(0.5)(15-10))(25) + (1/6)(30-(0.5)(30-25))(25)\Big]$$
$$= 7,818 \text{ ft}^3$$

Pipe Required for 2yr Discharge:

$$Q = C\,A\sqrt{2g\,\Delta h}$$

C = 0.6 (King & Brater, Handbook of Hydraulics, Sixth Edition)

$\Delta h = 2.5'$

$Q_{2yr\ (under)} = 1.3$ cfs

$$(1.3) = (0.6)(A)\sqrt{(2)(32.2)(2.5)}$$

$A = 0.17$, $\frac{\pi}{4}d^2 = 0.17$, $d^2 = 0.22$, $d = 0.47'$

Use d = 6" @ Q = 1.49 cfs

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 11 OF _____
PROJECT NO. _____ BY _____ DATE _____
SUBJECT _____ CH'D _____ DATE _____

25×10

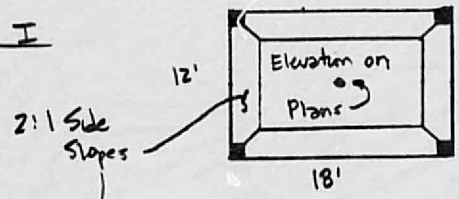
BACKYARD PONDING

A_{max} = 2100 ⌀ = 0.0482 acres

Weighted P_e = $\frac{(0.65)(0.0241) + (1.13)(0.0241)}{0.0482}$ = 0.89"

Volume = $\left(\frac{0.89"}{12}\right)(0.0482)(43560)$ = 156 ft³

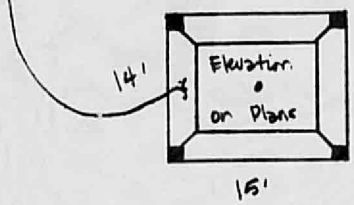
Type I



Pond Depth = 1'

Volume = (16)(10)(1)
= 160 ft³

Type II



Pond Depth = 1'

Volume = (13)(12)(1)
= 156 ft³

* Ponds are sized to handle flows from yards. All houses will be built to direct roof flows to the street.

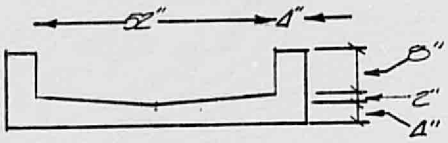
BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 12 OF _____
PROJECT NO. _____ BY _____ DATE _____
SUBJECT _____ CH'D _____ DATE _____

25×10

0000 0000 0343

Rundown Design (Concrete Section)



Check Normal Depth

$$Q = \frac{1.486}{n} A R^{2/3} \sqrt{S}$$

$$= \frac{1.486}{.013}(.67 \times 4.33)\left(\frac{.67 \times 4.33}{5.67}\right)^{2/3}\sqrt{S}$$

$$= 212.22\sqrt{S}$$

S (ft/ft)	Q (cfs)
0.05	47
0.10	67

Max Q carried in rundown = 12 cfs
Min Slope = 0.06 ft/ft

Check Inlet Control

Critical depth occurs @ $F = 1 = \frac{V}{\sqrt{gL}}$ L = hyd. depth $= \frac{A}{\text{Top Width}}$

$$1 = \frac{V}{\sqrt{g\,A/TW}} \quad \therefore \quad V^2 = g\frac{A}{TW}$$

$$\left(\frac{Q}{A}\right)^2 = g\frac{A}{TW}$$

Total Energy @ Entrance $= \frac{3}{2}Y_c = \frac{3}{2}\frac{A}{TW}$

Max depth = 8" $\frac{3}{2}Y_c = .67'$ $Y_c = 0.447\text{ ft} = A/TW$

$V^2 = g(.447) = 14.39 \quad \therefore \quad V = 3.79$ fps

$A = 0.447 \times 52''/12 = 1.937\text{ ft}^2 \quad Q = VA = 3.79 \times 1.937 = 7.34$ cfs

BOHANNAN-HUSTON INC.

PROJECT NAME Jandia Colony SHEET 13 OF
PROJECT NO. 88222 BY DATE 3/30/89
SUBJECT Drainage Computations CH'D DATE

25×

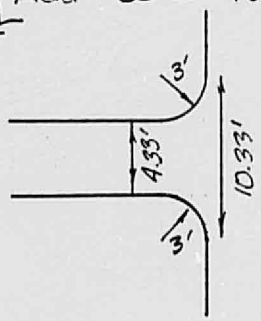
0000 0000 0344

- Max inlet capacity of rundowns = 7.3 cfs for standard C&G.

Basin D-1

Q_{100} = 10.4 cfs > 7.3 allowable.

[[Add curb returns of 3' Radius.]]



Y_c = .447 ft

TW = 10.33 ft

A = 4.62 ft²

$V^2 = g \cdot .447$

V = 3.79

Q = AV = 3.79 × 4.62 = 17.5 cfs

17.5 cfs > 10.4 [ok]

Basin D-3

Q_{100} = 12 cfs [[USE 3' RAD. CURB RETURNS]]

17.5 cfs > 12 cfs [ok]

BOHANNAN-HUSTON INC.

PROJECT NAME Sandia Colony SHEET 14 OF

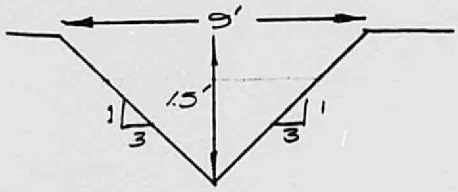
PROJECT NO. 88222 BY DATE 3/30/89

SUBJECT DRAINAGE COMPUTATIONS CH'D DATE

25×

0000 0000 0345

RUNDOWN FROM BASIN D-2



$Q_{100} = 7.6$ cfs $S = 1.98\%$

$Q = \frac{1.48}{n} A R_H^{2/3} S^{1/2}$ $n = 0.030$ (earth lined)

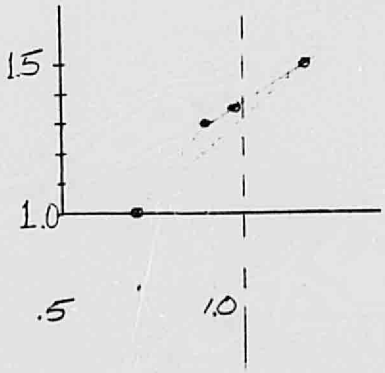
$7.6 = \frac{1.48}{.03} A R_H^{2/3} \sqrt{.0198}$

$1.0943 = A R_H^{2/3} = A \left(\frac{A}{WP}\right)^{2/3}$

$A = d \times 3d \times \frac{1}{2} = \frac{3}{2} d^2 = 1.5 d^2$

$WP = \sqrt{d^2 + (3d)^2} \times 2 = 2d^2\sqrt{10}$
$= 6.32 d^2$

d	A	WP	$AR_H^{2/3}$
1	1.5	6.32	0.575
1.5	3.38	14.22	1.2958
1.3	2.54	10.88	0.9718
1.37	2.82	11.86	1.0790
1.38	2.86	12.03	1.0970



$Q/A = 7.6/2.86 = 2.65$ fps [ok]

$d = 1.38$ ft
$FB = 0.12$ ft

Check $Q = \frac{1.48}{.030} 2.86 \left(\frac{2.86}{12.03}\right)^{2/3} \sqrt{.0198}$
$= 7.6$ cfs [ok]

BOHANNAN-HUSTON INC.

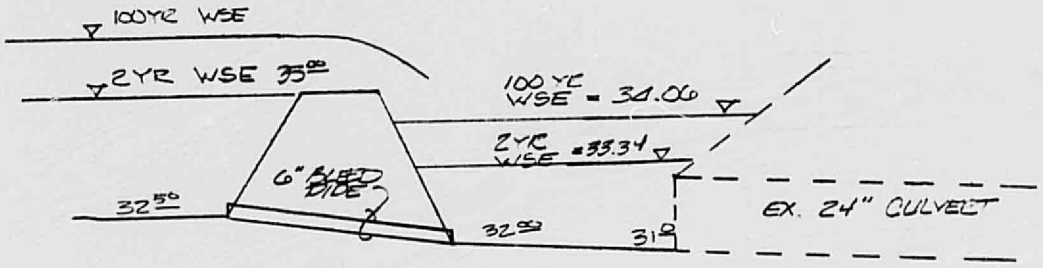
PROJECT NAME Sandia Colony SHEET 15 OF
PROJECT NO. 88222 BY DATE 3/30/89
SUBJECT Drainage Computations CH'D DATE

25 × 10

0000 0000 0346

POND B OUTLET COMPUTATIONS

BASIN D-3



$Q_{100} = 12$ cfs
Q_2 (UNDEV.) = 1.3 cfs
Q_2 (DEV.) = 398 cfs
$V_{100} = 10357$ ft³

$Q_{100} = 22.7$ cfs
$HW_{100} = 6034.06'$

APPROX $Q_2 = 0.68 \times Q_{100}$
$= 15.4$ cfs
$HW_2 = 31.0 + 2.34$
$= 33.34$

Check flow rate of BLEED PIPE.

EG(OUTLET)	Hf	HE	HV	EG(INLET)
33.34	$S_f \cdot L$			
$-HV = Q^2/.1963^2 \cdot 2/2g$	$+ \left(\frac{Q^2}{K^2}\right) \cdot L$	$+ 12\frac{V^2}{2g}$	$+ \frac{V^2}{2g}$	$= 35.00$
HG = _____	$+ \frac{Q^2 \times 25'}{(5.6087)^2}$	$\frac{1.2[Q/(.1963)]^2}{64.4}$	$\frac{Q^2/.1963^2}{64.4}$	

$$33.34 - Q^2(.4030) + Q^2(.7949) + Q^2(.4830) + Q^2(.4030) = 35.00$$

$$Q^2(-.403 + .7949 + .4830 + .403) = 35 - 33.34 = 1.66$$

$$Q^2(1.2765) = 1.66$$

$$\boxed{Q = 1.13 \text{ cfs}} < 1.3 \text{ cfs [ok]}$$

NOTE: $\frac{Q^2}{K^2} = S_f$ $\quad K = \frac{1.486}{.013}(.1963)\left(\frac{.1963}{1.5708}\right)^{2/3}\sqrt{5}$ $\quad K = 5.6087$

BOHANNAN-HUSTON INC.

PROJECT NAME Jandia Colony SHEET 16 OF
PROJECT NO. 88222 BY DATE 3/30/89
SUBJECT Drainage Computations CH'D DATE

25 X

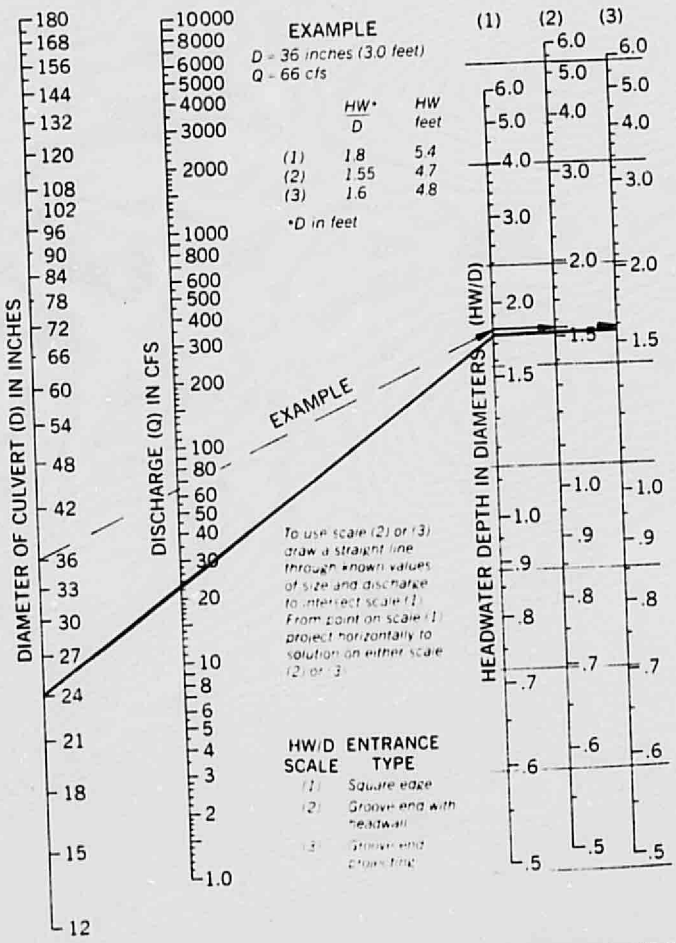
0000 0000 0347

Flowline Elevation = 6031.0'
HW Elevation = 6034.06'

D = 24"
Q_{100} = 22.73 cfs
$\frac{HW}{D}$ = 1.53'
HW = 3.06'

FIGURE 33

HEADWATER DEPTH FOR CIRCULAR CONCRETE PIPE CULVERTS WITH INLET CONTROL



HEADWATER SCALES 2&3
REVISED MAY 1964

25×10

0000 0000 0348

DRB-88-34
D.R.B. Case No. SC5-88-8
D.R.C. Project No. N/A
Date Submitted 08/11/88

Figure 11

EXHIBIT "D"
County Improvements

D.R.B. REQUIRED INFRASTRUCTURE LISTING
for
SANDIA COLONY SUBDIVISION, UNIT 26, SANDIA HEIGHTS

Following is a summary of Public/Private Infrastructure required to be constructed or financially guaranteed to be constructed for the above development.

Size	Type Improvement	Location	From	To
	PAVING AND ACCESS			
48' DIVIDED (16' INGRESS, 22' EGRESS)	2" ASPHALT PAVEMENT OVER 6" BASE COURSE W/6" CURB & GUTTER, BOTH SIDES OF MEDIAN; W/CURB & GUTTER* BOTH SIDES OF STREET	COLONY ROAD (NORTH-SOUTH PORTION, ENTRANCE)	LIVE OAK ROAD	COLONY ROAD (EAST-WEST) PORTION)
30' WIDE	2" ASPHALT PAVEMENT OVER 6" BASE COURSE W/CURB & GUTTER*	COLONY ROAD (EAST-WEST PORTION)	COLONY ROAD (NORTH-SOUTH PORTION, ENTRANCE)	SHARA PLACE
30' WIDE	2" ASPHALT PAVEMENT OVER 6" BASE COURSE W/CURB & GUTTER*	SHARA PLACE	COLONY ROAD (EAST-WEST PORTION)	40' RADIUS CUL-DE-SAC (FULLY PAVED)
30' WIDE	2" ASPHALT PAVEMENT OVER 6" BASE COURSE W/CURB & GUTTER*	CARMEL AVENUE	SHARA PLACE	TENNYSON STREET
30' WIDE	2" ASPHALT PAVEMENT OVER 6" BASE COURSE	MARIEL COURT	TENNYSON STREET	40' RADIUS CUL-DE-SAC (FULLY PAVED)
24' WIDE	2" ASPHALT PAVEMENT OVER 6" BASE COURSE	TENNYSON STREET	CARMEL ROAD	LIVE OAK ROAD

*MOUNTABLE CURB - ROLL TYPE, DPM DWG. 2415

25×10

DRAINAGE IMPROVEMENTS

A. AN UPSTREAM DIVERSION (EAST OF TRAMWAY BOULEVARD) SHALL BE CONSTRUCTED BY (1) THE DEVELOPER (IN WHICH CASE THE DIVERSION SHALL BE A TEMPORARY GRADED DITCH), OR (2) BY THE TRAMWAY BOULEVARD IMPROVEMENTS PROJECT WITH DEVELOPER CONTRIBUTION.

B. IMPROVEMENTS, INCLUDING PERMANENT ON-SITE DETENTION POND(S), WILL BE PROVIDED AS REQUIRED TO:

(1) REDUCE THE DEVELOPED CONDITION 100-YEAR, 6-HOUR STORM RUNOFF DISCHARGE RATE FROM THE SITE TO THE EXISTING, UNDEVELOPED CONDITION RUNOFF RATE;

(2) EXCEPT FOR A SMALL CONTROLLED DISCHARGE, REDUCE THE FREQUENCY AND RATE OF DEVELOPED RUNOFF TO THAT EXPERIENCED IN THE UNDEVELOPED CONDITION;

(3) CONVEY RUNOFF ACROSS TENNYSON STREET FROM THE POND(S) IN CULVERTS SIZED TO COMPLY WITH THE ABOVE REQUIREMENTS AND WITH THE PASEO DEL NORTE/TRAMWAY INTERSECTION PROJECT.

(4) ENSURE THAT RUNOFF LEAVING THE SITE ROADS WILL NOT BE CARRIED ACROSS OR SIGNIFICANTLY INTO TENNYSON OR FUTURE TENNYSON.

(5) PROVIDE ADEQUATE BAR DITCH CAPACITY TO DIRECT TENNYSON FLOW TO THE CULVERTS.

PRIOR TO FINAL PLAT APPROVAL, THE ABOVE WILL BE INCORPORATED INTO A FINAL (REVISED) DRAINAGE REPORT AND GRADING PLAN. THIS REPORT AND GRADING PLAN MUST BE APPROVED BY THE COUNTY AND AMAFCA.

NOTE: DEVELOPER UNDERSTANDS THAT IF DRAINAGE CANNOT BE DONE ACCEPTABLY WITH THE CURRENTLY PROPOSED LAYOUT, THEN A NEW LAYOUT WILL BE NECESSARY.

Prepared by: James Topmiller
Print Name James Topmiller
Firm Bohannan-Huston, Inc.

****

Development Review Board Approvals

*		*		*	
Traffic, DRB	Date	WUD DRB	Date	Parks & Rec.	Date
*					
City Engineer	Date	AMAFCA	08/15/88 Date		
*					
DRB Chairman	Date	for County of Bernalillo Road Department	8/15/88 Date		

*see sheet 4 of 4 for DRB approval signatures

25×

0000.0000 0350

DRB Case # DRB-88-34
DRC Project No. SC5-88-8
Date Submitted 08/15/88

DEVELOPMENT REVIEW BOARD
REQUIRED INFRASTRUCTURE LISTING
FOR
SANDIA COLONY SUBDIVISION, UNIT 26, SANDIA HEIGHTS

Following is a summary of Public/Private Infrastructure required to be constructed or financially guaranteed to be constructed for the above development.

Size	Type Improvement	Location*	From*	To*
	WATER			
6" P.V.C. MAINLINE	WATERLINE WITH 14 3/4" METERED SERVICES. 2 HYDRANTS.	COLONY ROAD (STREET A)	LIVE OAK ROAD	SHARA ROAD (STREET B)
6" P.V.C. MAINLINE	WATERLINE WITH 5 3/4" METERED SERVICES. 2 HYDRANTS.	SHARA ROAD (STREET B)	COLONY ROAD (STREET A)	40' RADIUS CUL-DE-SAC
6" P.V.C. MAINLINE	WATERLINE WITH 18 3/4" METERED SERVICES. 1 HYDRANT.	CARMEL AVENUE (STREET C)	SHARA ROAD (STREET B)	TENNYSON STREET
6" P.V.C. MAINLINE	WATERLINE WITH 12 3/4" METERED SERVICES. 1 HYDRANT.	MARIEL COURT (STREET D)	TENNYSON STREET	40' RADIUS CUL-DE-SAC
	SANITARY SEWER			
8" P.V.C. SANITARY SEWER LINE	SANITARY SEWER WITH 14 SERVICES. 4 MANHOLES.	COLONY ROAD (STREET A)	LIVE OAK ROAD	SHARA ROAD (STREET B)
8" P.V.C. SANITARY SEWER LINE	SANITARY SEWER WITH 5 SERVICES. 1 MANHOLE.	SHARA ROAD (STREET B)	COLONY ROAD (STREET A)	40' RADIUS CUL-DE-SAC
8" P.V.C. SANITARY SEWER LINE	SANITARY SEWER WITH 18 SERVICES. 2 MANHOLES.	CARMEL AVENUE (STREET C)	SHARA ROAD (STREET B)	TENNYSON STREET
8" P.V.C. SANITARY SEWER LINE	SANITARY SEWER WITH 12 SERVICES. 5 MANHOLES.	MARIEL COURT (STREET D)	TENNYSON STREET	40' RADIUS CUL-DE-SAC

* STREET NAMES IN PARENTHESIS ARE GIVEN FOR THE CONVENIENCE OF THE REVIEWER AND REFLECT THE STREET NAMES AS SHOWN IN THE ORIGINAL SUBMITTAL.

25×10

0000 0000 0351

Prepared by: _____
Print Name George Radnovich
Firm Bohannan-Huston, Inc.

****

Development Review Board Approvals

David W. Hamm	8/16/88		8-16-88		8/16/88
Traffic	Date	WUD	Date	Parks & Rec.	Date
	8/16/88		8.16.88.		
C.E., AMAFCA	Date	DRB Chairman	Date		
	8/15/88		8/15/88		
Sandia Peak Utilities Co. - Water	Date	Sandia Peak Service Inc. - Sewer	Date		

25×10

0000 0000 0352

PLANS/PLATS ON FILE

FILE DESC: C23/D14

PLANS/PLATS 3

25×10

0000 0000 0353