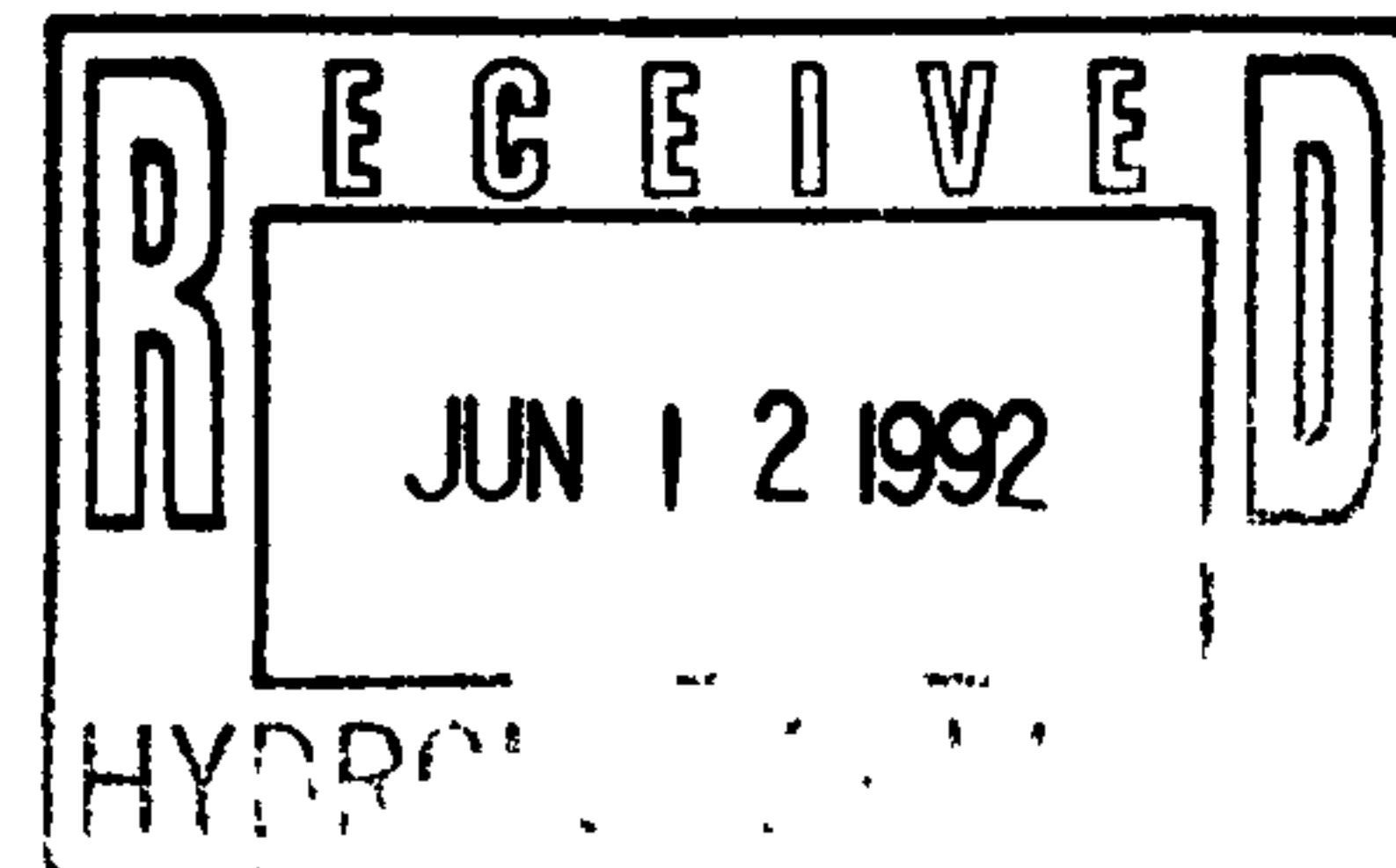




City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103



June 9, 1992

CERTIFICATE OF COMPLETION AND ACCEPTANCE

Ms. Lynn Johnson
Centex Real Estate Corporation
10701 Montgomery Boulevard N.E.
Albuquerque, NM 87111

RE: PROJECT NO. 4308.90, MESA ANTIGUA, UNIT I, (MAP NO. D-11-12, E-11-12)

Dear Ms. Johnson:

This is to certify that the City of Albuquerque accepts Project No. 4308.90 as being completed according to approved plans and construction specifications. The City of Albuquerque will accept for continuous maintenance all public infrastructure improvements constructed as part of Project No. 4308.90.

The project is described as follows:

- Placed sanitary sewer, storm sewer, water lines, paving and curb and gutter for Mesa Antigua, Phase I, located in Taylor Ranch. Acceptance of storm sewer portion is to be deferred to Mesa Antigua, Phase II.
- The contractor's correction period began June 1, 1992 and will be effective for a period of one (1) year.

Sincerely,

Brian L. Speicher, P.E.
Design/Construction Division
Public Works Department

BLS:kj



City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

November 13, 1991

Kerry Davis, P.E.
Bohannon-Huston, Inc.
7500 Jefferson Street, NE
Albuquerque, New Mexico 87109

RE: MESA ANTIGUA SUBDIVISION (C-12/D1J)
ENGINEER'S STAMP DATED OCTOBER 23, 1991

Dear Kerry:

The variances requested in your letter dated October 23, 1991, are approved. These approvals were warranted based on your letter and revised drainage report.

With the approval of these variances, the drainage report is also approved.

As a condition of plat approval, the developer is required to certify the grading for those lots affected by the theoretical 100 year-24 hour storm high water mark. Please forward this as-built certification to this office upon completion of the grading.

Should you wish to discuss this project further, please call me at 768-2650.

Cordially,

Fred J. Aguirre
Fred J. Aguirre, P.E.
Hydrologist

FJA

FJA/bsj
(WP+2769)

PUBLIC WORKS DEPARTMENT

Walter H. Nickerson, Jr., P.E.
Assistant Director Public Works

ENGINEERING GROUP

Telephone (505) 768-2500

AN EQUAL OPPORTUNITY EMPLOYER



City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

September 17, 1991

Kerry Davis, P.E.
Bohannon-Huston, Inc.
7500 Jefferson Street, NE
Albuquerque, New Mexico 87109

RE: GRADING PLAN FOR MESA ANTIGUA SUBDIVISION, (C-12/D1J), ENGINEER'S
STAMP DATED AUGUST 30, 1991

Dear Mr. Davis:

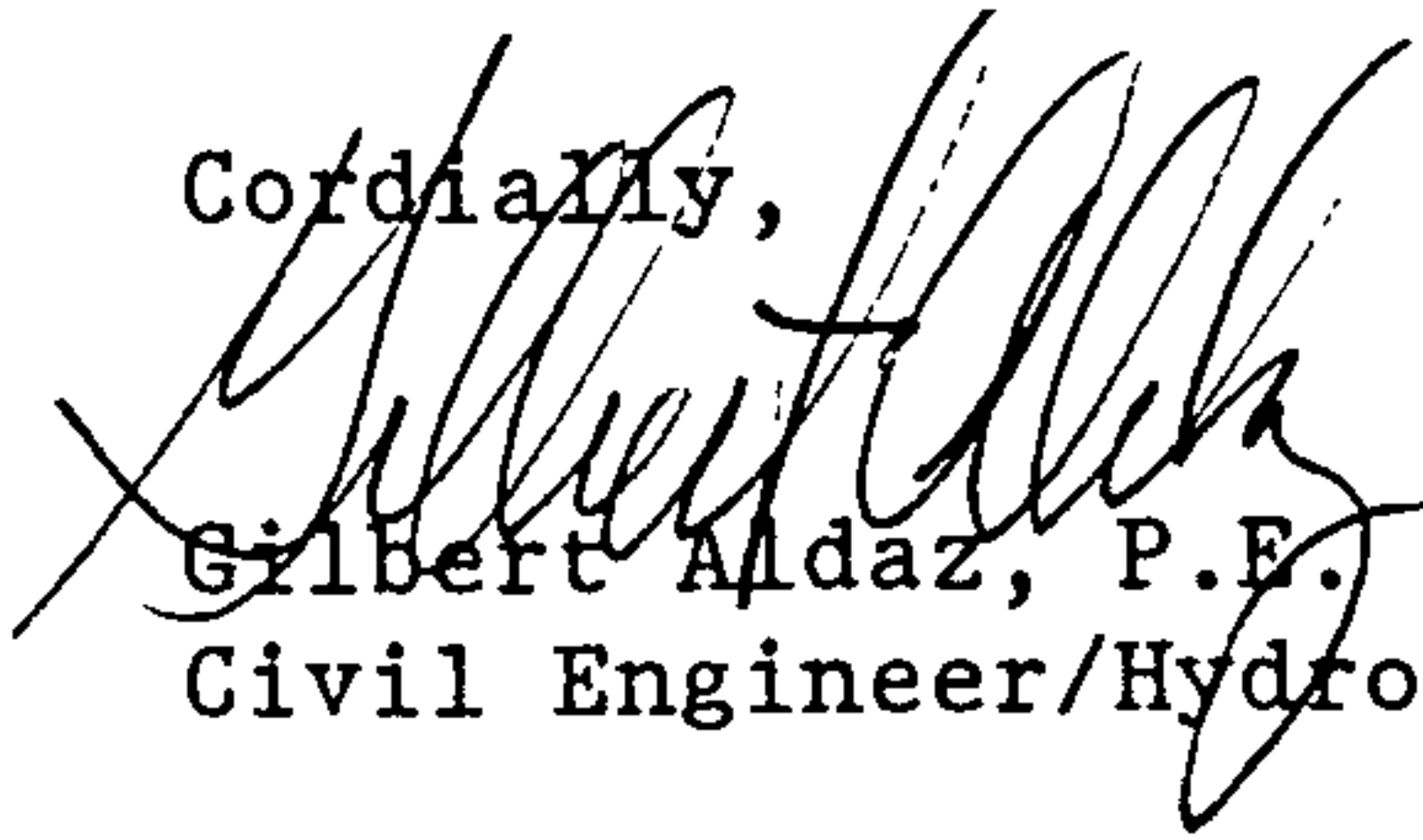
Based on the information provided on the referenced submittal received August 30, 1991, the plan is approved for rough grading.

Please be advised that the contractor must secure a top soil disturbance permit from Environmental Health.

Your drainage covenant dated May 28, 1986 is out dated, I have attached a copy of the June 1990 required covenant for the desilting basins, please revise accordingly.

If you should have any questions, please do not hesitate to call me at 768-2650.

Cordially,


Gilbert Aldaz, P.E. & P.S.
Civil Engineer/Hydrology

GA
wp+2769

PUBLIC WORKS DEPARTMENT

Walter H. Nickerson, Jr., P.E.
Assistant Director Public Works

ENGINEERING GROUP

Telephone (505) 768-2500

AN EQUAL OPPORTUNITY EMPLOYER

**MASTER DRAINAGE REPORT
FOR
MESA ANTIGUA SUBDIVISION
FORMERLY RIVERVIEW
PARCEL H-28A**

October 1991

I certify that I am a registered professional engineer
in the State of New Mexico and that this report was
prepared by me or under my supervision.


Kerry L. Davis, P.E.

10/23/91
Date



AMENDED MASTER DRAINAGE REPORT
FOR
MESA ANTIGUA SUBDIVISION
FORMERLY RIVERVIEW PARCEL H-28A

April 22, 1991
Amended October 23, 1991

Prepared for:

CENTEX HOMES CORPORATION
10701 Montgomery, NE
Albuquerque, NM

Prepared by:

BOHANNAN-HUSTON INC.
7500 Jefferson, N.E.
Courtyard I
Albuquerque, NM 87109

Job No. 91157.02

DRAINAGE MANAGEMENT PLAN

PURPOSE

The purpose of this report is to present the drainage management plan for work order and final plat approval for the Mesa Antigua Subdivision, previously identified as Riverview Parcel H-28A. The Drainage Ordinance and the Development Process Manual, including proposed revisions to the hydrologic computational methods, are utilized to develop the plan. Previous comments from the Hydrology Section, City of Albuquerque Public Works Department, have been addressed in this report.

SITE LOCATION AND EXISTING CONDITIONS

The property is located within the Riverview Sector Development Plan Area south of Homestead Circle between Taylor Ranch Drive and Golf Course Road (refer to the Location Map on Plate 1 in Appendix 1.)

The parcel is extremely flat, generally sloping from northwest to southeast at slopes less than 1%. The site vegetation consists of native grasses and weeds, and has been partially disturbed by intermittent dumping of fill dirt along the westerly boundary. Mass grading of the property in accordance with the approved rough grading plan is substantially complete at this time, with the exception of the grading of the detention pond in the southeast quadrant of the site. Existing completed streets surround the property, including Golf Course Road on the east and Taylor Ranch Drive on the west, both four lane arterials, and Homestead Circle on the north, which is a 40' wide major local street.

The property falls within two existing watersheds, which include the basin drained by the Golf Course/La Orilla Storm Drain System, and the basin immediately downstream of the Mariposa/Boca Negra Detention Facility.

Offsite runoff from the Pioneer East Subdivision immediately north of Homestead Circle and east of Taylor Ranch Drive enters the site at the northwest corner of the property. An existing retention pond at this location on the property previously held this runoff until it has seeped into the ground. An existing temporary drainage easement was granted to encumber the property with the conveyance of this offsite runoff toward the south end of the property. Two existing ponding areas were identified by previous drainage reports at the extreme south end of the site and along Golf Course Road on the east boundary of the property. Temporary easements were granted for the purpose of encumbering the property for ponding requirements. Existing drainage easements for conveyance and ponding will be vacated and replaced by new street rights of way for conveyance and drainage right of way for ponding.

Construction of the Mariposa Detention Basin included a drainage structure on Taylor Ranch Drive immediately west of its intersection with Golf Course Road. This structure provides drainage for Taylor Ranch Drive and a portion of the Homestead Hills development through the dam into the Mariposa Basin. Flapgates within the basin allow drainage from Taylor Ranch Drive to enter the basin until the basin begins to fill with water from upstream watersheds. This facility was designed to include a discharge from the project site at a controlled rate of approximately 1.5 CFS.

A 30" diameter storm sewer was constructed in 1987, for Prairie Ridge Unit Three, to convey runoff from the properties west of Golf Course Road, and south of the South Branch of the Piedras Marcadas Arroyo. This storm sewer was extended south along Golf Course Road, and east to La Orilla with this development. The development of Prairie Ridge Unit Six included construction of a large detention pond adjacent to Coors Boulevard (the Coors/Montano Plaza Detention Facility), and extension of this storm sewer south along Via Corta del Sur and into the pond. This pond outfalls through the Montano Plaza Shopping Center, Phase 2, into an existing box culvert in Montano Road. The Golf Course Road Storm Sewer was designed to include a discharge from the project site at a controlled rate of approximately 1.5 CFS.

The Coors/Montano Plaza Detention Facility was discovered to contain minimal capacity for ponding requirements, when a comparison of the original ponding requirement of 668,000 cubic feet is made to the as-built plans for the pond, which identify a total constructed volume of 633,000 cubic feet. It is believed that this pond was expanded to include an additional 440,000 cubic feet of storage as identified on the original master plan drainage report, which is included as a plate in Appendix 3, however, no as-built plans or surveys are available to confirm this belief.

HYDROLOGIC ANALYSIS

The new rational method hydrologic procedures identified within the proposed revision to Chapter 22, Section 22.2 of the Development Process Manual (DPM Update), as well as the HYMO computerized hydrologic model presented within that document (version 3/91), have been utilized to determine peak flow rates for design of the storm drainage improvements within the project.

The peak flow rate computed by the new rational method identified within the referenced DPM update for all onsite basins is 151.6 CFS, compared to the HYMO output, which identified a peak flow rate of 144.7 CFS. The difference between these runoff figures is due to the attenuation of peak hydrograph flows due to routing of flow through the streets within the project.

Please refer to Tables 1 and 2 in Appendix 1 for a detailed summary of hydrologic parameters and basin characteristics. The Hymo computer output is included as Appendix 2, hydraulic computations including the hydraulic grade line analysis of the

proposed storm sewer system is included as Appendix 3, and excerpts from existing approved drainage reports and copies of the construction plans for the existing downstream facilities are included in Appendix 4.

DRAINAGE MANAGEMENT PLAN

Under developed conditions, the site will be graded to deliver runoff from developed lots into the street sections, which will convey this runoff to the south end of the property. The two ponding areas described previously are proposed to be combined into one larger pond, which is sized for the 100-year, 24-hour runoff volume of 235,000 cubic feet. Pond volume calculations are included in Appendix 1.

A field survey of the existing facilities downstream of the site revealed that ~~the invert of the existing storm drain inlet on Taylor Ranch Drive that drains through flapgates into the Mariposa Basin is at elevation 5107.28. This elevation is higher than the proposed elevation of the bottom of the pond, which renders it effectively unavailable for discharge from the site.~~ Therefore, the Mariposa Basin inlet facility cannot not be utilized for discharge from the site. In addition, the proposed recreational improvements to the Mariposa Detention Facility include extensive subcatchments internal to the basin with pump improvements to drain the subcatchments to the channel along the southwest boundary of the facility. This internal drainage system further complicates any attempts to discharge into the Mariposa Detention Facility.

Discharge facilities from the pond were originally designed to drain the pond during a 24 hour period, ~~however, due to the extremely limited downstream capacity for stormwater discharges, a variance is requested to allow evacuation of the pond in a 48 hour period.~~ This will allow the site to continue to fall within the discharge requirements of the previously approved drainage management plans and reports, which include discharge into the Golf Course Road/ La Orilla storm sewer at a controlled rate of 1.5 CFS.

Therefore, the pond outlet is designed to connect into the existing storm sewer in Golf Course Road. This facility was designed to accept 1.5 CFS from the property at the location of the existing inlet approximately halfway between Taylor Ranch Drive and Homestead Circle (please refer to the excerpt from the approved master drainage plan for the Riverview Sector Development Plan, in Appendix 3). In addition, an emergency spillway is provided to spill into the Golf Course Road right of way in the event of storm sewer outlet failure or storm events larger than the design storm.

At the intersection of Mesa Solana Place and Mesa Bonita Place, the collected runoff within the street exceeds the capacity of the street section, at 0.2' above the top of curb. Therefore, a proposed storm sewer will collect runoff at this intersection and deliver it into the pond at the location of the surface rundown connection from the street to the pond.

Hydraulic calculations are included in Appendix 3, for the hydraulic grade line analysis of the proposed storm sewer, as well as the weir analysis computations of both the inlet rundown and the emergency spillway.

CONCLUSIONS

The proposed subdivision of Tract H-28A, Riverview Properties, into a total of approximately 162 single family detached residential lots can be accomplished and protected from flooding during the standard design storm of the 24 hour, 100 year hydrologic event, through the implementation of the drainage management plan provisions identified in this report. Those provisions include:

1. A detention pond to be constructed at the southeast corner of the project site, designed to contain the 24-hour runoff volume of 235,000 cubic feet.

2. The pond is to be provided with an outfall storm sewer connected into the existing Golf Course Road storm sewer (30" diameter) and restricted to an outfall discharge rate of 1.5 CFS, as allowed in the approved Drainage Management Plan for the Riverview Properties.

3. The pond is to be provided with an emergency overflow spillway designed to pass the 100 year discharge rate should the outfall storm sewer fail or a storm event occur larger than the 100 year design storm.

4. An internal storm sewer is to be constructed to remove excess runoff from the internal streets that cannot be contained within the street section, which would deliver such runoff into the pond.

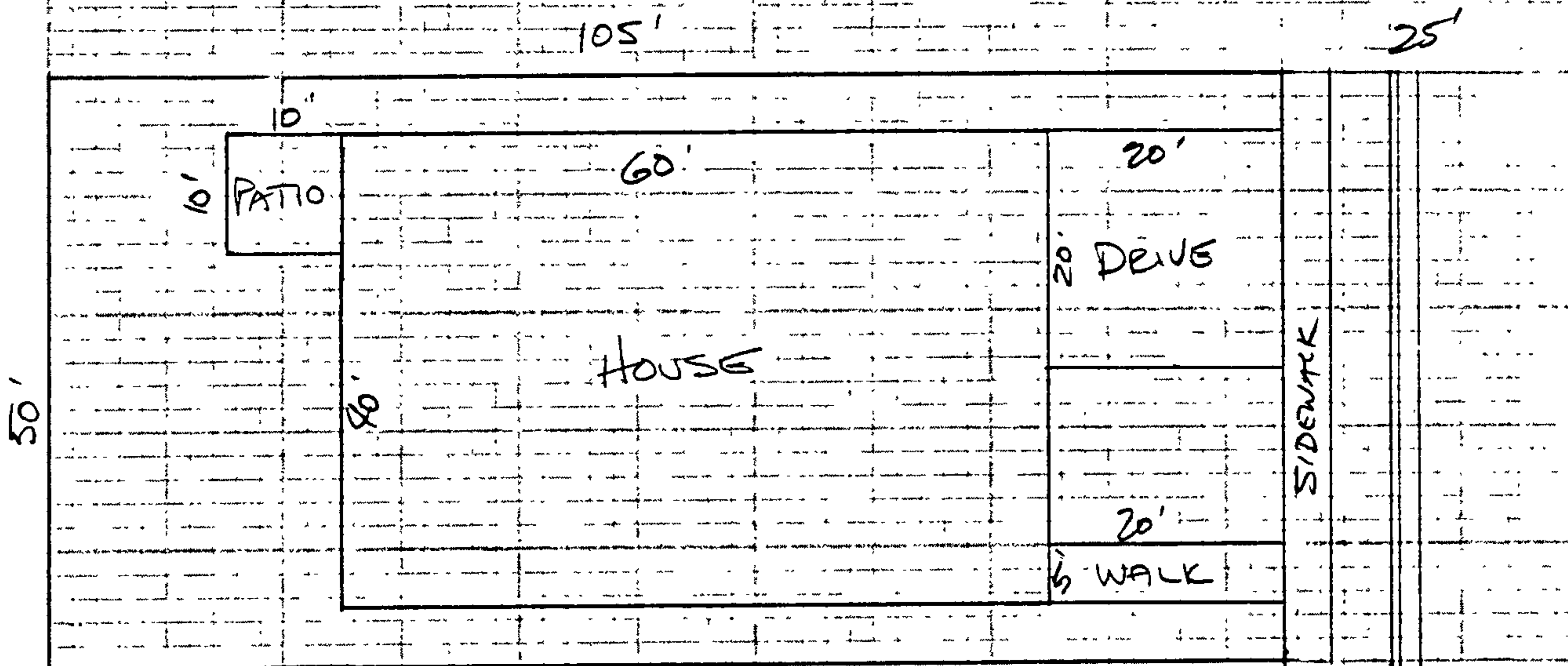
Two variances from city standard design requirements would be required to accomplish these provisions:

1. Street slopes within the subdivision are graded with minimum profile slopes of 0.5% at centerline. In two locations, the outer curve along the gutter grade is much longer than the centerline curve length. Therefore, these valley gutter grades will be less than 0.5%, at an actual profile grade of 0.41%.

2. The pond discharge of 1.5 CFS, as allowed by the existing approved drainage report will evacuate the pond volume of 235,000 cubic feet in a 48 hour period. This is longer than the 24 hour period of evacuation required by current city design standards. However, analysis of the 4-day runoff volume as identified within the DPM Update, reveals that the runoff volume produced during the 3 day period (the difference in volume between the 24-hour volume and the 4-day volume) beyond the first 24 hours of the event would yield an average flow rate of 0.31 CFS, which is less than the outfall capacity of 1.5 CFS. In addition, the difference in volume, when added to the runoff volume

remaining in the pond at the end of the 24 hour period, is less than the total capacity of the pond. Therefore it is concluded that the pond is adequately designed to contain and pass the design storm as well as additional volume generated by the event which will generate runoff during the duration of the pond evacuation period (nominally 4 days).

A - LOTS



IMPERVIOUS AREAS

STREET	50' x 76'	=	800
SIDWALK	50' x 4'	=	200
DRIVE	20' x 20'	=	400
WALK	5' x 20'	=	100
HOUSE	40' x 60'	=	2400
PATIO	10' x 10'	=	100

SUB-TOTAL 4000

= 0.62

TOTAL LOT + 1/2 R/W 130 x 50 = 6500

ASSUME 75% OF REMAINDER IS LUSH LANDSCAPE (B)
 $(0.75)(0.38) = 0.29$

ASSUME 25% OF REMAINDER IS DESERT LANDSCAPE (C)
 $(0.25)(0.38) = 0.09$

LAND TREATMENT

A

B

C

D

$$Q (0)(1.15) + (0.29)(1.91) + (0.09)(2.73) + (0.62)(4.31) = 3.51 \text{ cfs/ft}$$

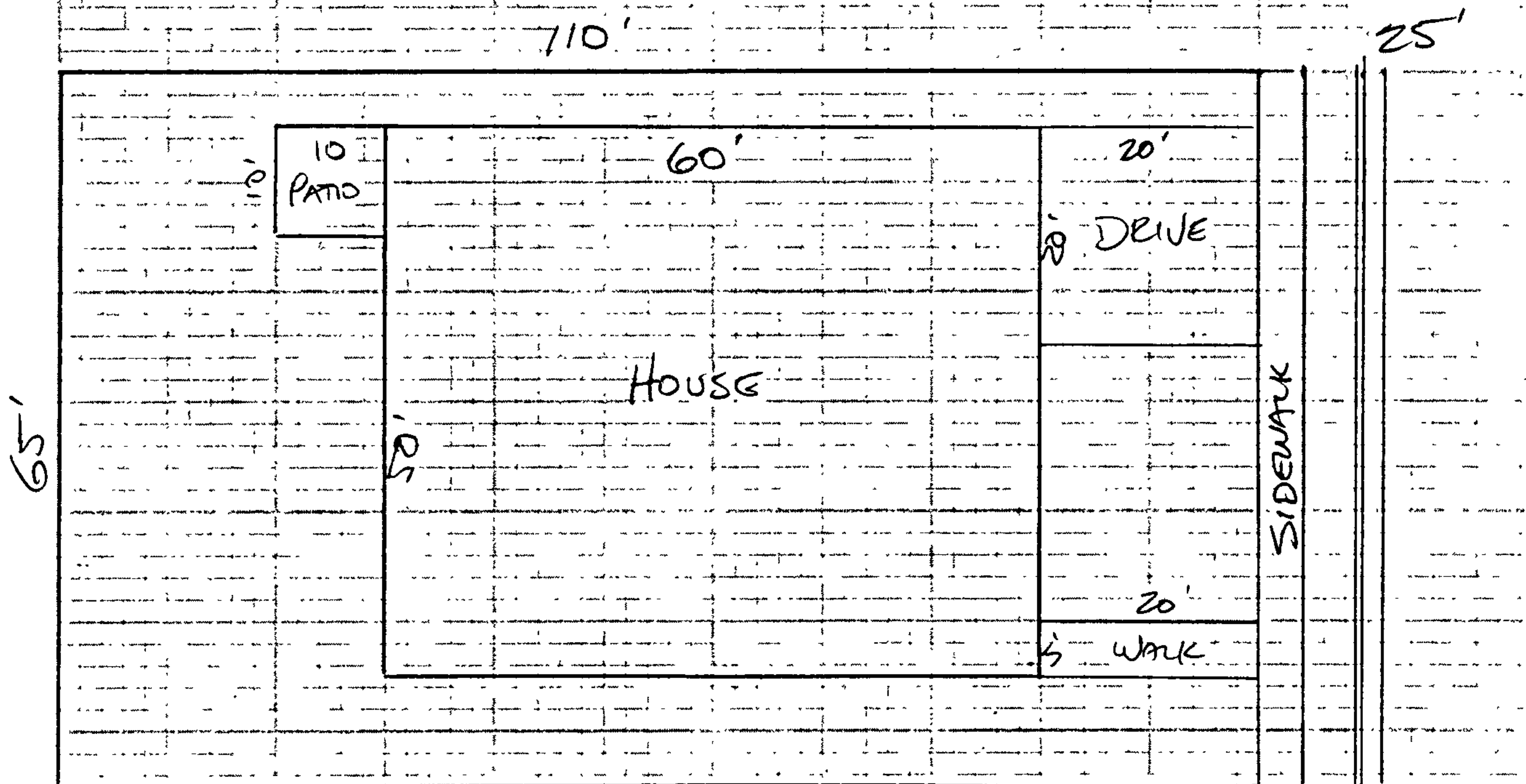
$$\checkmark \text{ in/hr } (0)(0.39) + (0.29)(0.61) + (0.09)(0.94) + (0.62)(1.93) = 1.46 \text{ in/hr}$$



BOHANNAN-HUSTON INC.

PROJECT NAME MESA ANTIGUA SHEET _____ OF _____
 PROJECT NO. 91157.02 BY _____ DATE _____
 SUBJECT HYDROLOGIC COMPUTATIONS SCH'D _____ DATE _____

B-LOTS



IMPERVIOUS AREAS

STREET	65' X 16'	=	1040
SIDEWALK	65 X 4'	=	260
DRIVE	20 X 20	=	400
WALK	20 X 5	=	100
HOUSE	60 X 50	=	3000
PATIO	10 X 10	=	100

SUBTOTAL

4900

= 0.56

TOTAL LOT + 1/2 R/W 65 X 135

8775

ASSUME 75% OF REMAINDER IS LUSH LANDSCAPE (B)
 $(0.75)(0.44) = 0.33$

ASSUME 25% OF REMAINDER IS DESERT LANDSCAPE (C)
 $(0.25)(0.44) = 0.11$

LAND TREATMENT A B C D

$$Q (0)(1.15) + (0.33)(1.91) + (0.11)(2.73) + (0.56)(4.37) = 3.38 \text{ CF/AZ}$$

$$V (0)(0.39) + (0.33)(0.61) + (0.11)(0.94) + (0.56)(1.93) = 1.39 \text{ IN/AZ}$$



BOHANNAN-HUSTON INC.

PROJECT NAME MESA ANTIGUA

SHEET

OF

PROJECT NO. 91157.02

BY

DATE

SUBJECT HYDROLOGIC COMPUTATIONS

CH'D

DATE

BASIN	TOTAL AREA	LAND TREATMENT			
		A	B	C	D
		AREA (7)	AREA (7)	AREA (7)	AREA (7)
MISSION R	8.61	- (0)	2.24 (26)	0.77 (9)	5.60 (65)
HOMESTEAD	1.09	- (0)	- (0)	0.20 (18)	0.89 (82)
A-1	2.25	- (0)	0.65 (29)	0.20 (9)	1.40 (62)
A-2	0.30	- (0)	0.08 (29)	0.03 (9)	0.19 (62)
A-3	2.73	- (0)	0.79 (29)	0.25 (9)	1.69 (62)
A-4	2.72	- (0)	0.79 (29)	0.24 (9)	1.69 (62)
A-5	4.93	- (0)	1.49 (30)	0.49 (10)	2.95 (60)
B-1	4.54	- (0)	1.50 (33)	0.50 (11)	2.54 (56)
B-2	1.29	- (0)	0.39 (30)	0.13 (10)	0.77 (60)
B-3	2.55	- (0)	0.84 (33)	0.28 (11)	1.43 (56)
C-1	2.53	- (0)	0.83 (33)	0.28 (11)	1.42 (56)
C-2	2.78	- (0)	0.98 (33)	0.33 (11)	1.67 (56)
C-3	2.58	- (0)	0.86 (33)	0.28 (11)	1.44 (56)
C-4	1.33	- (0)	0.44 (33)	0.15 (11)	0.74 (56)
C-5	1.35	- (0)	0.44 (33)	0.15 (11)	0.76 (56)
C-6	1.81	- (0)	0.60 (33)	0.20 (11)	1.01 (56)
D-1	0.69	- (0)	0.21 (30)	0.07 (10)	0.41 (60)
D-2	0.18	- (0)	0.03 (29)	0.02 (10)	0.13 (70)
D-3	1.77	1.32 (75)	0.27 (15)	0.14 (8)	0.04 (2)
SUB TOTAL	46.23	1.32	13.43	4.71	26.77
E	0.33	- (0)	0.21 (60)	0.08 (20)	0.04 (10)
TOTAL	46.56 ✓	1.32	13.64	4.79	26.81



BOHANNAN-HUSTON INC.

PROJECT NAME MEYA ANTIGUA SHEET _____ OF _____
 PROJECT NO. 91157.03 BY _____ DATE _____
 SUBJECT HYDROLOGY CH'D _____ DATE _____

SUMMARY OF VOLUME CALCULATIONS FOR POND DESIGN*

6HR - 100 YR VOLUME = 230,620 CF (ACCUMULATED) 5.29 AC-FT

MODIFIED RATIONAL METHOD

COA DPM Section 22.2-Hydrology, Part A.5

24hr-100yr Volume = 289,078 CF 6.64 AC-FT

HYMO COMPUTER PROGRAM

COA DPM Section 22.2-Hydrology, Part B

24hr-100yr Volume = 227,688 CF 5.23 AC-FT

HYDROGRAPH FOR SMALL WATERSHED

COA DPM Section 22.2-Hydrology, Part A.8

24hr-100yr Volume = 232,174.80 CF 5.33 AC-FT

MESA ANTICUA'S PROVIDED POND VOLUME 234,517 CF 5.38 AC-FT

*Pond design based on Hymo and Hydrograph Method of Volume Determination, calculations follow.

CONVERT 6 HR. STORM VOLUME TO 24 HOUR

MODIFIED RATIONAL METHOD PART A.5

$$V_{1440} = V_{360} + A_D \left(\frac{P_{1440} - P_{360}}{12 \frac{\text{in}}{\text{hr}}} \right)$$

$$V_{360} = 244,211 \text{ FT}^3, \quad P_{360} = 2.20, \quad P_{1440} = 2.66$$

$$V_{1440} = \left(\frac{244,211}{43,560} \right) + 26.77 \left(\frac{2.66 - 2.20}{12} \right)$$

$$V_{1440} = 5.61 + 1.03 = 6.64 \text{ AC-FT}$$

$$V_{1440} = 289,078 \text{ FT}^3$$



BOHANNAN-HUSTON INC.

PROJECT NAME MEJA ANTIGUA SHEET _____ OF _____
PROJECT NO. _____ BY _____ DATE _____
SUBJECT POND VOLUME ANALYSIS CH'D _____ DATE _____

DETERMINE P_{4DMS} FROM DPM UPDATE 22.2 B.3

$$P_4 = P_{1440} + \left\{ \left[(-0.469 \log_{10}(4)) + 0.059(4-1) \right] (P_{10DMS} - P_{1440}) \right\}$$

$$P_{10DMS} = 10.0 - \left[\frac{24.9}{(P_{1440})^{1.4}} \right] = 10.0 - \frac{24.9}{(2.66)^{1.4}} = 10.0 - 6.329$$

$$P_{10DMS} = 3.671''$$

$$P_4 = 2.66 + \left\{ \left[(0.469)(0.602) + (0.059)(3) \right] (3.671 - 2.66) \right\}$$

$$P_4 = 2.66 + (0.459)(1.011) = 2.66 + 0.464$$

$$P_4 = 3.124'' \quad \checkmark \quad \text{CHECKS w/ TABLE A.2.2}$$

FROM EQUATION A.5 (8)

$$V_{4DMS} = V_{360} + \frac{A_D (P_{4DMS} - P_{360})}{12}$$

$$V_{360} = 0.44 A_A + 0.67 A_B + 0.99 A_C + 1.97 A_D$$

$$E_{360} = (0.44)(1.32) + (0.67)(13.64) + (0.99)(4.79) + (1.97)(26.81)$$

$$E_{360} = \frac{0.58 + 9.14 + 4.74 + 52.82}{46.56} = \frac{67.28}{46.56} = 1.44''$$

$$V_{360} = \left(\frac{1.44}{12} \right) (46.56) (43560) = 244,211 \text{ FT}^3$$

5.61 AC-FT

$$V_{4DMS} = 5.61 + \frac{(26.81)(3.12 - 2.20)}{12} = 5.61 + 2.06 = 7.66 \text{ AC-FT}$$

333,745 FT³



BOHANNAN-HUSTON INC.

PROJECT NAME MESA ANTIGUA

SHEET _____ OF _____

PROJECT NO. 91157.02

BY _____ DATE _____

SUBJECT POND VOLUME ANALYSIS

CH'D _____ DATE _____

$$\Delta V = V_{4\text{Days}} - V_{1440} = 333,745 \text{ Ft}^3 - 227,688 \text{ Ft}^3 (\text{HIMO})$$

$$\Delta V = 106,057 \text{ Ft}^3$$

Check:

$$1. Q_{\text{AVG}} (\text{DAY 1} \rightarrow \text{DAY 4}) = \frac{106,057 \text{ Ft}^3}{\left(\frac{4\text{Days}}{3\text{Days}}\right) \left(\frac{24\text{Hours}}{\text{Day}}\right) \left(\frac{3600\text{Sec}}{\text{Hr}}\right)} = \frac{0.31 \text{ CFS}}{0.41}$$

$$Q_{\text{AVG}} = \frac{0.41}{0.31 \text{ CFS}} \leq 1.5 \text{ CFS} = Q_{\text{MAX}} (\text{OUTFALL}) \checkmark$$

2. EXTRAPOLATING, FROM HIMO, RUNOFF VOLUME CONTAINED IN POND @ END OF 24 HOURS

TIME	19.0	20.0	21.0	22.0	23.0	24.0
VOLUME (AC-FT)	3.4	3.3	3.2	(3.1)	(3.0)	(2.9)

$$\text{VOLUME REMAINING @ 24 HOURS} = 2.9 \text{ AC-FT} = 126,324 \text{ Ft}^3$$

$$V_{\text{REMAINING}} + \Delta V = 126,324 + 106,057 = 232,381 \text{ Ft}^3$$

$$V_{\text{REMAINING}} + \Delta V = 232,381 \text{ Ft}^3 \leq 235,000 \text{ Ft}^3 = V_{\text{POND CAPACITY}} \checkmark$$



BOHANNAN-HUSTON INC.

PROJECT NAME MEJA ANTIGUA SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT POND VOLUME ANALYSIS CH'D _____ DATE _____

HYDROGRAPH FOR SMALL WATERSHED (DPM SEC 22.2, A.8)

BASIN A

$$t_{CA} = (1720) / 3 \sqrt{0.5} / 60 = 13.5 \quad K = 3.0 \quad S = 0.5\%$$

BASIN B

$$t_{CB} = 1340 / 3 \sqrt{0.5} / 60 = 10.52 \quad t_c = L / K \sqrt{S}$$

BASIN C

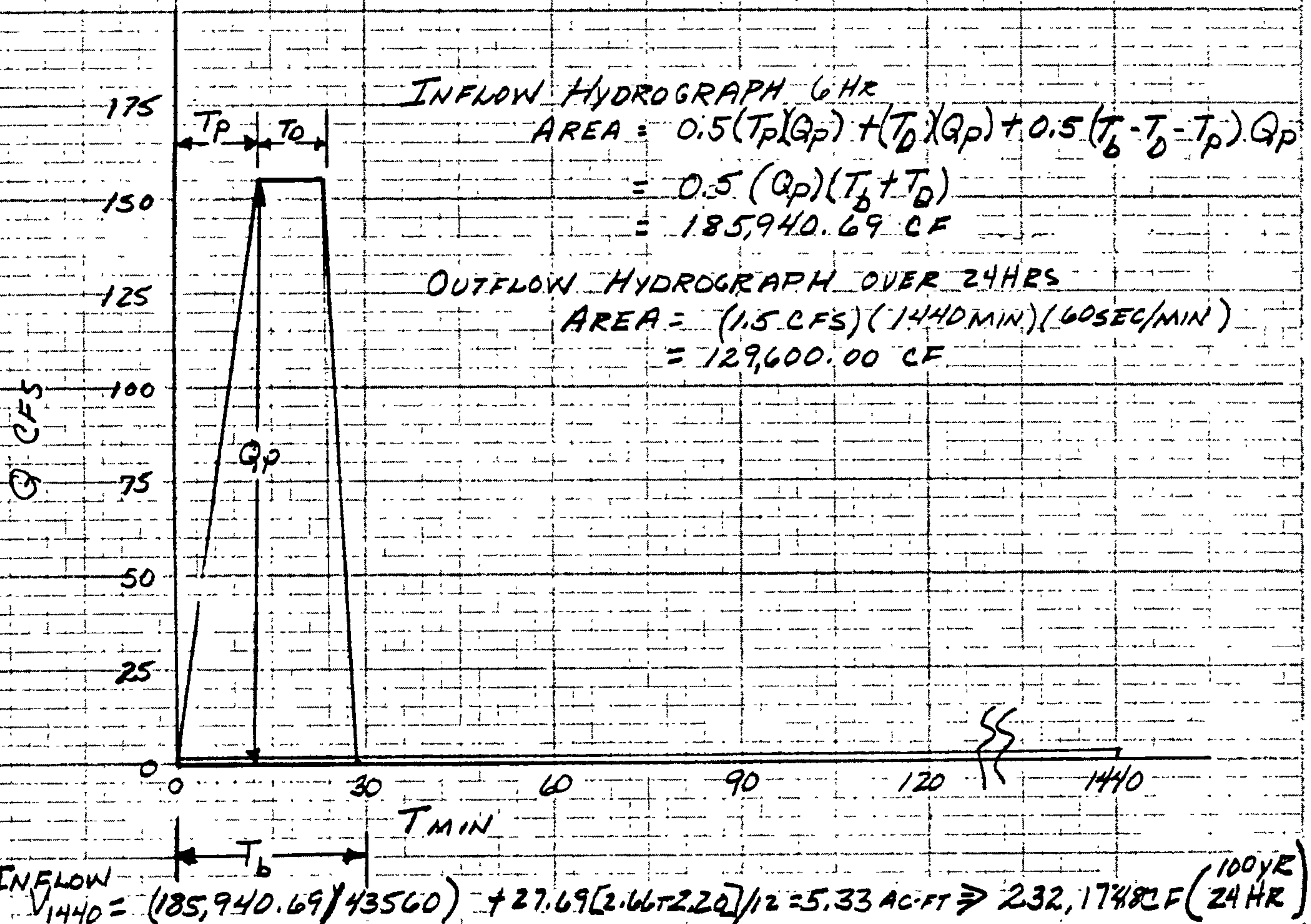
$$t_{CC} = 1585 / 3 \sqrt{0.5} / 60 = 12.45$$

$$T_D = 121(1.39) 36.86 / 155.3 - 15(27.69 / 36.86) = 28.65$$

$$T_P = 0.7(13.5) + 8 - 5(27.69 / 36.86) = 13.69$$

$$T_D = \text{DURATION} = 15(27.69 / 36.86) = 11.26$$

$$Q_P = 155.3 \text{ CFS (MODIFIED RATIONAL METHOD SEE TABLE 1)}$$



BOHANNAN-HUSTON INC.

PROJECT NAME MESA ANTIGUA

SHEET 1 OF 5

PROJECT NO. C91157.03

BY DATE 10/16/91

SUBJECT 100 YR 6 HR 24 HR VOLUME by HYDROGRAPH

DATE

MESA ANTIGUA ON SITE
POND VOLUME ANALYSIS

DEPTH (FT)	WATER SURFACE ELEV (FT)	WATER SURFACE AREA (SQ FT)	VOLUME (CU FT)	
0.7'	5100	7,092	2,482	
1.7'	5101	19,070	15,563	
2.7'	5102	27,766	38,981	
3.7'	5103	30,433	68,081	
4.7'	5104	33,394	99,994	
5.7	5105	36,219	134,800	
6.7	5106	39,079	172,450	
7.7	5107	42,134	213,056	
8.1	5107.4	43,710	234,577	FLOW LINE AT RUNDOWN
8.7	5108	45,645	256,856	

6HR 10yr STORM SURFACE ELEV 5104.04'
* VOLUME 101,549 CF -

24HR 100yr STORM SURFACE ELEV 5107.27'
* VOLUME: 227,514 CF (HYMO) (SEE APPENDIX 2)

24HR 100yr STORM SURFACE ELEV 5107.36'
* VOLUME: 232,175CF (HYDROGRAPH METHOD)
(SEE PREVIOUS SHEET)

* NO OUTFLOW CREDIT USED IN CALCULATIONS, THERE SURFACE ELEV WOULD BE REDUCED WHEN OUTFLOW FROM POND IS APPLIED.



BOHANNAN-HUSTON INC.

PROJECT NAME MESA ANTIGUA SHEET 2 OF 5
PROJECT NO. C91157.03 BY _____ DATE 10/17/91
SUBJECT POND VOLUME ANALYSIS CH'D _____ DATE _____

MESA ANTICUA ON SITE POND

ANALYSIS OF VARIOUS OUTLET FLOW RATES
FOR 24 HR 100 YR VOLUME

INFLOW 232,175 CF

DISCHARGE FLOW RATE REQUIRED FOR 24 HR
RELEASE

$$232,175 / 24(3600) = 2.7 \text{ CFS}$$

DISCHARGE FLOW RATE REQUIRED FOR 36 HR
RELEASE

$$232,175 / 36(3600) = 1.8 \text{ CFS}$$

DISCHARGE FLOW RATE REQUIRED FOR 43 HR
RELEASE

$$232,175 / 43(3600) = 1.5 \text{ CFS}^*$$

1.5 CFS IS ALLOWABLE DISCHARGE BASED ON
MASTER DRAINAGE PLAN



BOHANNAN-HUSTON INC.

PROJECT NAME MESA ANTICUA SHEET _____ OF _____
PROJECT NO. C91157.03 BY _____ DATE 10/17/91
SUBJECT DISCHARGE FLOW RATE CH'D _____ DATE _____

EXISTING DOWNSTREAM AT COORSÉ MONTANO POND VOLUME (INCREASE) PLAZA

GIVEN: PONDS INFLOW AND OUTFLOW HYDROGRAPHS FROM
EXISTING REPORT PREPARED BY COMMUNITY SCIENCE
CORPORATION. ORIGINAL 100YR VOL 633,000 CF @ T=220

ASSUME: INFLOW HYDROGRAPH INCREASED BY 1.8 CFS
OUTFLOW HYDROGRAPH UNCHANGED.
 $T = 5 \text{ MIN} = 300 \text{ SEC}$

ORIGINAL HYDROGRAPHS			INFLOW + 1.8 CFS	VOLUME
TIME	INFLOW Q(CFS)	OUTFLOW Q(CFS)	Q(CFS)	(CF)
165	0.2	0	2.0	600.00
170	0.4	0	2.2	1260.00
175	0.4	0	2.2	1920.00
180	0.6	0	2.4	2540.00
185	0.8	0	2.6	3120.00
190	1.2	0	3.0	4320.00
195	1.8	0	3.6	5400.00
200	7.8	0.2	9.6	8220.00
205	18.3	0.4	20.1	14130.00
210	26.6	0.9	28.4	22623.00
215	52.3	1.6	54.1	38373.00
220	90.3	3.0	92.1	65103.00
225	121.2	5.1	123.0	100473.00
230	207.8	8.3	209.6	160863.00
235	338.7	14.9	340.5	256543.00
240	440.9	25.1	442.7	383823.00
245	428.2	37.4	430.0	501603.00
250	314.9	43.2	316.7	583653.00
255	222.9	46.9	224.7	636993.00
260	146.4	49.1	150.2	667323.00
265	89.0	50.1	90.8	679533.00
270	52.9	50.5	54.7	680793.00 ← MAX. VOL.
275	35.2	50.4	37.0	676773.00
280	27.2	50.1	29.0	670443.00

$680,793.00 - 633,000 = 47,793 \text{ CF INCREASE}$



BOHANNAN-HUSTON INC.

PROJECT NAME WEST PLAZA SHEET 1 OF 3
PROJECT NO 2015702 BY PH? DATE _____
SUBJECT _____ CH D _____ DATE _____

COORS/MONTANO PATA POND
EXISTING POND SURFACE AREA

GIVEN: 100YR W.S. ELEV IN PONDS 5007.3'
BOTTOM POND ELEV. 5003.0
PONDS 100YR VOLUME TOTAL 633,000 CF
(AS INDICATED ON ASBUILTS)

ASSUME: NO SIDE SLOPE IN POND

$$\begin{aligned} 100YR \text{ DEPTH OF WATER} &= 5007.3 - 5003.0 \\ &= 4.3' \end{aligned}$$

$$= 100YR \text{ VOLUME} \div 100YR \text{ DEPTH}$$

$$= 633,000 \text{ CF} \div 4.3'$$

$$= 147,209 \text{ SF} \quad \text{SURFACE AREA}$$



BOHANNAN-HUSTON INC.

PROJECT NAME WESF INTERIOR SHEET 2 OF 3
PROJECT NO 291157.02 BY TKH DATE _____
SUBJECT _____ CH'D _____ DATE _____

INCREASE IN POND DEPTH:

FROM SHEETS 1 & 2:

POND SURFACE AREA - 147,209 SF

VOLUME INCREASE - 47,793 CF

ORIGINAL 100YR DEPTH 5007.3

$$47,793 \div 147,209 = 0.32' \approx 4''$$



BOHANNAN-HUSTON INC.

PROJECT NAME WEST AVENUE SHEET 3 OF 3
PROJECT NO 09-157-1-1 BY TKM DATE _____
SUBJECT _____ CH'D _____ DATE _____

STORM SEWER ANALYSIS
INLET CAPACITY

MESA MARIPOSA PL

$$Q_{TOTAL} = 81.1 \text{ CFS}$$

INSTALL 2 - TYPE A INLETS
ONE IN NORTH CURB LINE
ONE IN SOUTH CURB LINE

$$\frac{1}{2} \text{ STREET } Q = 40.5 \text{ CFS}$$

$$Q_{40.5 \text{ CFS}} \quad d = 0.8$$

USING PLATE 22.3 D-5 $S = 0.005$

$$Q_{INLET} = 10.5 \text{ CFS}$$

$$Q_{REMAINING \frac{1}{2} \text{ STREET}} = 40.5 \text{ CFS} - 10.5 \text{ CFS} = 30.0 \text{ CFS}$$

REMAINING STREET FLOW ON MESA ANTIGUA
 $Q = 60 \text{ CFS}$

MESA ANTIGUA PL - EAST OF INTERSECTION OF MESA MARIPOSA,
MESA SOLANA AND MESA ANTIGUA PL AT ANALYSIS PT 4 (SEE
TABLE 3 APPENDIX 1).

INSTALL TYPE A INLET
DOUBLE WING, CONSIDER
SUMP CONDITIONS.

$$Q_{TOTAL} = (81.1 \text{ CFS} - 21 \text{ CFS}) + 27.1 \text{ CFS} + 2.4 + 38.4$$

FOR INLET ANALYSIS

$$Q_{T_4} = 128.00 \text{ CFS}$$

CAPACITY OF CURB OPENING (SEE FIGURE 6 NEXT PAGE)
USING HEIGHT OF OPEN $H = 2.55$

$$\text{DEPTH OF WATER } H = 0.32'$$

$$\text{RATIO } H/h = 0.59 \Rightarrow Q/L = 0.56 \text{ CFS/FT}$$

$$Q_{OPENING} = 0.56 \text{ CFS/11'} = 6.16 \text{ CFS}$$



BOHANNAN-HUSTON INC.

PROJECT NAME MESA ANTIGUA SUBDIVISION SHEET A-1 OF 4-11
PROJECT NO. 9.15222 BY TKH DATE 2-22-11
SUBJECT STORM SEWER DESIGN CH'D _____ DATE _____

CAPACITY OF GRATE - BASE ON WATER FLOWING
FROM THREE SIDES OF
USING $Q/P = 3.0 H^{3/2}$ GRATE

$$P = 7.5'$$
$$H = 0.32'$$

$$Q_G = 3.0(7.5)(0.32)^{3/2}$$
$$= 4.07 \text{ CFS}$$

$$Q_{\text{TINLET}} = Q_0 + Q_G = 6.16 \text{ CFS} + 4.07 \text{ CFS}$$
$$= 10.23 \text{ CFS}$$

$$Q_{\text{REMAINING}} = 128 \text{ CFS} - 10.23 \text{ CFS}$$
$$= 117.77 \text{ CFS}$$



BOHANNAN-HUSTON INC.

PROJECT NAME MESA ANTIGUA SUBDIVISION SHEET A-3 OF A 11
PROJECT NO. 9115702 BY TKM DATE 6-24-91
SUBJECT STORM SEWER DESIGN CH'D _____ DATE _____

Storm Sewer - G 10.5 FROM INLET #1 TO INLET #2
 G = 11.0 FROM INLET #3 TO ACH #2

CULVERT RATING TABLE

18. INCH DIAMETER PIPE

N = 0.01300 INCREMENT = 1.00 SLOPE = 0.05000

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)
1.00000	0.03862	0.14122	3.65640
2.00000	0.10733	0.61165	5.69875
3.00000	0.19359	1.41826	7.32605
4.00000	0.29241	2.54372	8.69930
5.00000	0.40056	3.95973	9.88550
6.00000	0.51564	5.63090	10.92027
7.00000	0.63565	7.51640	11.82483
8.00000	0.75883	9.57076	12.61252
9.00000	0.88357	11.74419	13.29171
10.00000	1.00831	13.98251	13.86722
11.00000	1.13150	16.22674	14.34093
12.00000	1.25151	18.41211	14.71195
13.00000	1.36659	20.46622	14.97617
14.00000	1.47474	22.30552	15.12506
15.00000	1.57355	23.82779	15.14267
16.00000	1.65981	24.89333	14.99766
17.00000	1.72852	25.25900	14.61305
18.00000	1.76715	23.48840	13.29172

G = 10.5 CFS

d ≈ 8"

@ G = 11 CFS

d ≈ 9"

STORM SEWER - INLET # 3 TO MH #1

CULVERT RATING TABLE

24. INCH DIAMETER PIPE

N = 0.01300 INCREMENT = 1.00 SLOPE = 0.05000

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)
1.00000	0.04479	0.16450	3.67275
2.00000	0.12504	0.71921	5.75177
3.00000	0.22665	1.68459	7.43243
4.00000	0.34416	3.05441	8.87488
5.00000	0.47417	4.81092	10.14607
6.00000	0.61418	6.92923	11.28202
7.00000	0.76224	9.37927	12.30479
8.00000	0.91669	12.12683	13.22896
9.00000	1.07605	15.13425	14.06459
10.00000	1.23901	18.36069	14.81882
11.00000	1.40432	21.76236	15.49671
12.00000	1.57079	25.29257	16.10177
13.00000	1.73727	28.90161	16.63623
14.00000	1.90258	32.53650	17.10127
15.00000	2.06554	36.14058	17.49694
16.00000	2.22490	39.65278	17.82226
17.00000	2.37935	43.00644	18.07491
18.00000	2.52741	46.12749	18.25092
19.00000	2.66742	48.93121	18.34399
20.00000	2.79743	51.31612	18.34404
21.00000	2.91494	53.15144	18.23417
22.00000	3.01655	54.24514	17.98252
23.00000	3.09680	54.22998	17.51161
24.00000	3.14159	50.58519	16.10177

Q = 21
d ≈ 11"

STORM SEWER - MH # 1 to MH # 2

CULVERT RATING TABLE

24. INCH DIAMETER PIPE

N = 0.01300 INCREMENT = 1.00 SLOPE = 0.03300

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)
1.00000	0.04479	0.13364	2.98376
2.00000	0.12504	0.58429	4.67276
3.00000	0.22665	1.36857	6.03814
4.00000	0.34416	2.48141	7.20999
5.00000	0.47417	3.90841	8.24270
6.00000	0.61418	5.62933	9.16556
7.00000	0.76224	7.61975	9.99646
8.00000	0.91669	9.85189	10.74726
9.00000	1.07605	12.29512	11.42613
10.00000	1.23901	14.91629	12.03887
11.00000	1.40432	17.67982	12.58959
12.00000	1.57079	20.54778	13.08114
13.00000	1.73727	23.47978	13.51534
14.00000	1.90258	26.43278	13.89314
15.00000	2.06554	29.36075	14.21459
16.00000	2.22490	32.21407	14.47887
17.00000	2.37935	34.93860	14.68412
18.00000	2.52741	37.47416	14.82712
19.00000	2.66742	39.75190	14.90273
20.00000	2.79743	41.68942	14.90277
21.00000	2.91494	43.18044	14.81351
22.00000	3.01655	44.06897	14.60907
23.00000	3.09680	44.05664	14.22650
24.00000	3.14159	41.09560	13.08114

G = 21
d ≈ 12"

CULVERT RATING TABLE

36. INCH DIAMETER PIPE

N = 0.01300 INCREMENT = 1.00 SLOPE = 0.03300

FLOW DEPTH (IN)	FLOW AREA (SQ FT)	DISCHARGE (CFS)	VELOCITY (FPS)
1.00000	0.05509	0.16510	2.99696
2.00000	0.15449	0.72845	4.71533
3.00000	0.28134	1.72268	6.12304
4.00000	0.42932	3.15514	7.34917
5.00000	0.59457	5.02271	8.44768
6.00000	0.77437	7.31604	9.44776
7.00000	0.96662	10.02135	10.36740
8.00000	1.16962	13.12162	11.21871
9.00000	1.38191	16.59715	12.01027
10.00000	1.60224	20.42602	12.74845
11.00000	1.82946	24.58438	13.43807
12.00000	2.06255	29.04666	14.08290
13.00000	2.30056	33.78571	14.68589
14.00000	2.54258	38.77291	15.24943
15.00000	2.78778	43.97822	15.77538
16.00000	3.03532	49.37023	16.26525
17.00000	3.28442	54.91613	16.72020
18.00000	3.53429	60.58174	17.14114
19.00000	3.78416	66.33143	17.52870
20.00000	4.03326	72.12804	17.88331
21.00000	4.28080	77.93269	18.20516
22.00000	4.52600	83.70477	18.49422
23.00000	4.76802	89.40154	18.75023
24.00000	5.00603	94.97785	18.97269
25.00000	5.23912	100.38577	19.16080
26.00000	5.46634	105.57384	19.31343
27.00000	5.68667	110.48634	19.42902
28.00000	5.89896	115.06177	19.50544
29.00000	6.10196	119.23107	19.53981
30.00000	6.29421	122.91431	19.52816
31.00000	6.47401	126.01519	19.46478
32.00000	6.63926	128.41083	19.34114
33.00000	6.78723	129.93002	19.14330
34.00000	6.91409	130.29710	18.84516
35.00000	7.01349	128.92734	18.38276
36.00000	7.06858	121.16355	17.14114

Q = 33 c
d ≈ 13"

- WEIR ANALYSIS OF RUNDOWN INTO POND

AT CURB LINE

$$Q_{\text{SURFACE}} = 113.6 \text{ CFS (FROM HYMO)}$$

$$Q = CLH^{3/2} \quad \text{UNIT } H \text{ TO } 0.2' \text{ ABOVE CURB}$$
$$H = 0.87'$$

$$113.6 = (3.0) L (0.87)^{3/2}$$

$$\begin{aligned} 46.7' &= L \quad \text{FOR } C = 3.0 \\ 42.1 &= L \quad \text{FOR } C = 3.33 \end{aligned} \quad \left. \vphantom{\begin{aligned} 46.7' &= L \\ 42.1 &= L \end{aligned}} \right\} 45' \text{ PROVIDED } \checkmark$$

AT R/W LINE BELOW CMU BOND BEAM

$$Q = 113.6 \text{ CFS}$$

$$Q = CLH^{3/2} \quad H = 1.67' = 1'-8" \text{ FROM BOTTOM OF BOND BEAM}$$

$$113.6 = (3.0) L (1.67)^{3/2}$$

$$17.55' = L \text{ REQUIRED}$$

$$20' = L \text{ PROVIDED } \checkmark$$

- CHECK WEIR ANALYSIS AT EMERGENCY SPILLWAY

AT SPILLWAY

$$Q_{\text{TOTAL}} = 145.7 \text{ CFS}$$

$$Q = CLH^{3/2} \quad L = 48'$$

$$145.7 = 3.0 (48) H^{3/2}$$

$$1.01 = H^{3/2}$$

$$(1.01)^2 = H^3 =$$

$$H = 1.01 \checkmark$$

AT WALL

$$Q = 145.7$$

$$Q = CLH^{3/2}, \quad L = 40'$$

$$145.7 = 3.0 (40) H^{3/2}$$

$$1.21 = H^{3/2}$$

$$(1.21)^2 = H^3 = 1.47$$

$$H = 1.17 \checkmark$$



BOHANNAN-HUSTON INC.

PROJECT NAME MEJA ANTIGUA SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CHECKED _____ DATE _____

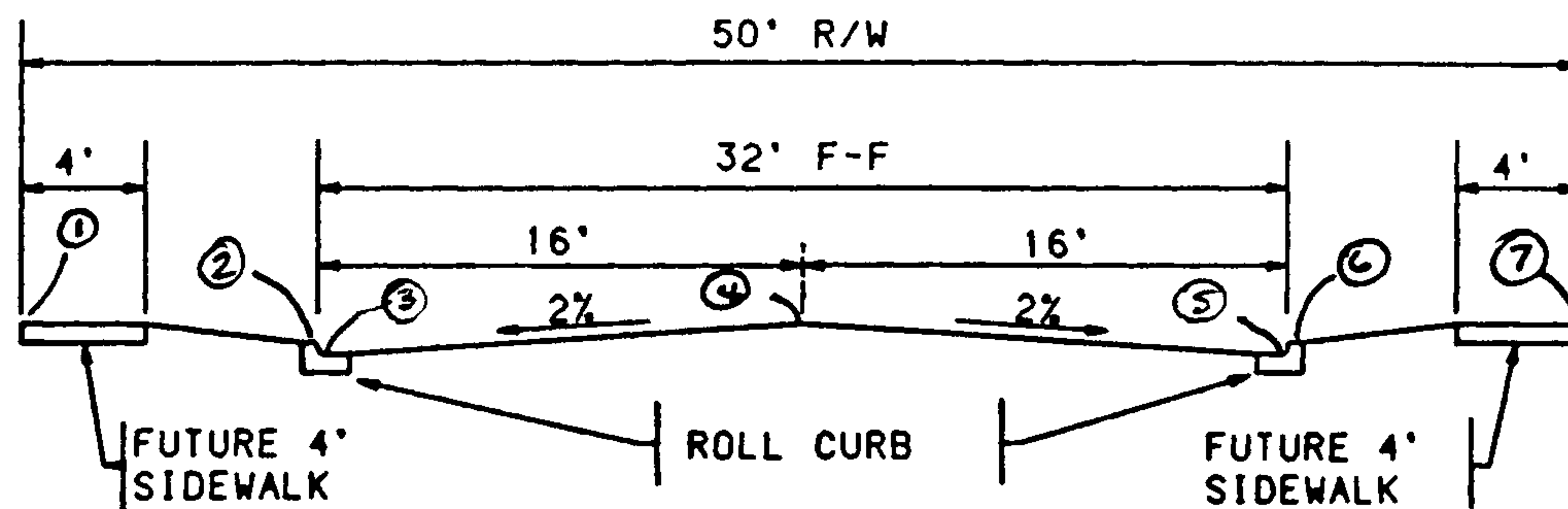
TYPICAL 32' WIDE STREET WITH STANDARD CURB

MANNING'S N = .0170

SLOPE = .0050

	POINT	DIST	ELEV			
	1	0.00	0.87			
	2	9.00	0.67			
	3	9.10	0.00			
	4	25.00	0.32			
	5	40.90	0.00			
	6	41.00	0.67			
	7	50.00	0.87			

WSEL	DEPTH	FLOW	FLOW	WETTED	FLOW	TOP
(FT)	INC	AREA	RATE	PER	VEL	WID
		(SQ FT)	(CFS)	(FT)	(FPS)	
0.1	0.1	0.5	0.4	10.1	0.8	10.0
0.2	0.2	2.0	2.6	20.3	1.3	19.9
0.3	0.3	4.5	7.7	30.4	1.7	29.9
0.4	0.4	7.7	18.0	32.6	2.4	31.9
0.5	0.5	10.8	32.1	32.8	3.0	31.9
0.6	0.6	14.0	49.1	33.0	3.5	32.0
0.7	0.7	17.3	65.7	35.9	3.8	34.7
0.8	0.8	21.2	79.5	44.9	3.8	43.7
0.9	0.9	24.5	92.6	51.2	3.8	50.0



TYPICAL STREET SECTION

NO SCALE

ORIFICE CALCULATIONS

Equation: $Q = Ca \sqrt{2gh}$

Constants: Orifice Coefficient $C=0.60$

Standard gravity $g=32.2 \text{ ft/sec}$

Area of 2" Dia hole $a=0.0218 \text{ ft}$

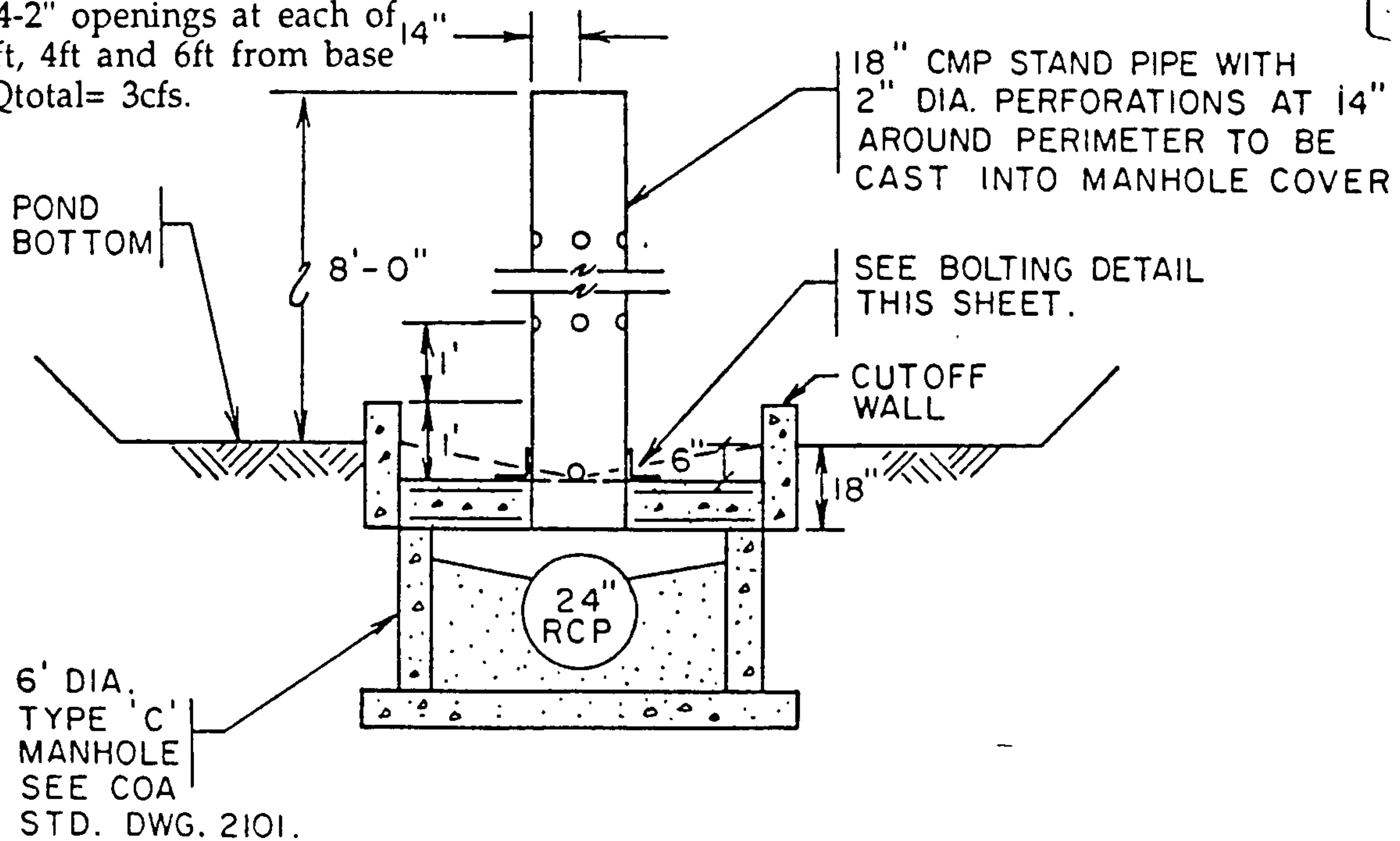
h is head acting on Openings during the 100yr event

$$Q = 0.1049 \sqrt{h}$$

h	Q
8	0.29
7.8	0.29
7	0.26
6	0.25
5.8	0.25
5	0.22
4	0.21
3.8	0.20
3	0.17
2	0.14
1.8	0.14
1	0.10

$$Q = 2(0.29) + 4(0.25) + 4(0.20) + 4(0.14) \\ = 2.94 \text{ cfs}$$

Use 14 perforations spaced with 2- 2" openings at base of standpipe, 4-2" openings at each of the following levels 2ft, 4ft and 6ft from base of standpipe to give $Q_{\text{total}} = 3\text{cfs}$.



FOR 3.0 CFS DISCHARGE
STAND PIPE DETAIL
SECTION K-K

NO SCALE

ORIFICE CALCULATIONS

For Controlled Discharge of 1.5 cfs

Equation: $Q = Ca \sqrt{2gh}$

Constants: Orifice Coefficient $C = 0.60$

Standard Gravity $g = 32.2 \text{ ft/sec}$

Area of 2" Dia hole $a = 0.0218 \text{ ft}$

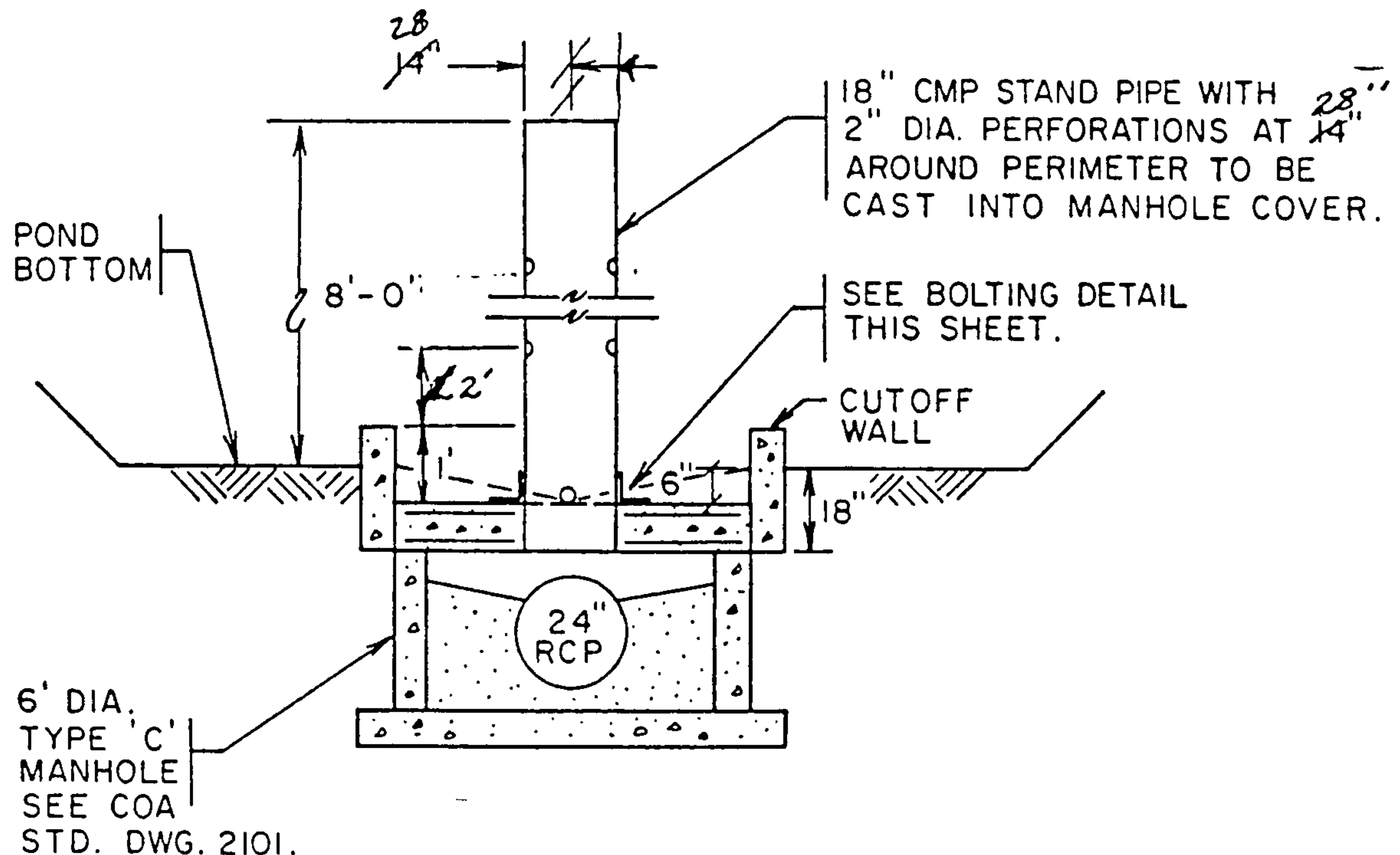
h is head acting on Opening during the 100yr event

$$Q = 0.1049 \sqrt{h}$$

h	Q
8	0.29
7	0.26
6	0.25
5	0.22
4	0.21
3	0.17
2	0.14
1	0.10

$$Q = 2(0.26) + 2(0.22) + 2(0.17) + 2(0.10) = 1.5 \text{ cfs}$$

Use 8 perforations spaced with 2 - 2" openings at base of standpipe, and 2-2" openings at each of the following levels 3', 5', & 7' from base of standpipe.



FOR 1.5 CFS DISCHARGE
STAND PIPE DETAIL
SECTION K-K

NO SCALE