REVISED

PALOMAS PARK SUBDIVISION
DRAINAGE REPORT

PREPARED FOR:

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JOB NO. 91181.05

6.4.92
6.24.92

PURPOSE OF REPORT

The purpose of this report is to present the existing and proposed hydrological conditions of the proposed Palomas Park Subdivision (formerly Santa Barbara South Subdivision). Preliminary grading and hydraulic concepts are also submitted.

This drainage report is submitted to support preliminary plat approval, Phase 1 final plat, Phase 1 building permit and rough grading approvals. Final grading and other construction drawings will be submitted in the near future prior to requesting building permit approvals for future. The Preliminary Plat is enclosed for reference. The Final Plat for Phase 1 is also enclosed.

METHODOLOGIES

The Development Process Manual, Chapter 22, as recently revised (August 1991), is used for the hydrological and hydraulic analyses of this report.

SITE DESCRIPTION AND CHARACTERISTICS

The roughly 30-acre site is located immediately west of Wyoming Blvd. and immediately south of the recently constructed, concrete-lined Domingo Baca Channel. A Site Vicinity map is provided on Sheet 1 of 3, enclosed in the rear pocket of this report.

The site is bounded on the west by a large developed mobile home park and on the south by a developed single family residential subdivision. A church is located at the site's southeast corner. An existing, undeveloped 1.9-acre park site is located in the northeast corner of the site.

The site's existing ground slope is approximately 2-3% sloping downward in a westerly direction. Soils across the site are sandy-gravelly soils and are specifically identified by the Soils Map shown on Sheet 2 of 3 enclosed in the rear pocket of this report.

Floodplains, as defined by FEMA Floodway Maps, do not occur on the property but are confined to the Domingo Baca Channel near the north boundary of the site.

EXISTING HYDROLOGIC AND SITE DRAINAGE CONDITIONS

Onsite and Offsite Watershed Conditions

Existing site drainage is limited to that generated within the boundaries of the property being studied. No offsite drainage watersheds contribute to onsite flows. Wyoming Boulevard to the east diverts flow from upstream and transfers it either north to the Domingo Baca or south along the Wyoming Boulevard corridor. Flows from the areas north, south and west of the site are also non-contributing. Existing topography, confirming the statements above, can be reviewed on Sheet 1 of 3. Due to the simplicity of the existing drainage patterns of the property, no separate drainage sheet is provided solely for the existing, undeveloped site condition.

The flows from the site drain in a primarily sheet-flow fashion to the west boundary line. Ponding against an earthen berm of varying height occurs at this boundary. Overflow of the berm appears to occur at a point midway along the west boundary. The overflow passes into the mobile home park.

The church site, at the southeast corner of the site, retains its developed condition runoff. Review of the approved drainage report for the church site, in City files, indicates that the existing retention pond is to be removed with development of the property to the west (the site of this report).

Infrastructure

The Domingo Baca Channel (concrete-lined channel) project, only recently completed, constructed two storm drain stubouts from the channel to the site. One, a 36" RCP pipe, was installed at the old Rancho de Palomas right-of-way, or approximately midway along the site's north boundary line. A second pipe, a 60" diameter RCP stubout, was constructed at the site's northwest corner.

Flowrates

The undeveloped site (including the existing park site, generates approximately 21 cfs in the 10-year storm event and 67 cfs in the 100-year storm event.

The church site in its existing developed condition is anticipated to generate approximately 23.43 cfs in the 100-year storm.

PROPOSED (DEVELOPED) HYDROLOGIC AND HYDRAULIC CONDITIONS

Proposed Development

The site is proposed to be developed into a single-family residential subdivision of 171 lots, called Palomas Park Subdivision. All infrastructure, except for a single backyard channel and retaining walls, will be public. The existing park site is to be reconfigured and will be partially developed by the subdivision. Additionally, the site's south boundary line, common with the church and near Wyoming Boulevard will be slightly replatted to conform with a previous zone change letter of conditions.

Please note that, due to a late change, two lots are labeled 10-A and 11-A. This explains why the highest lot number is only 169 when there are a total of 171 lots.

Drainage Management Concept

Drainage from the developed site will be diverted northward to the new Domingo Baca Channel. Due to the need to balance earthwork across the site, only the 60" RCP stubout will be utilized to pass flows to the channel. The 36" stubout is too high to utilize and meet earthwork needs for the site. Streets and stormdrains will carry stormwater generated by the site to the 60" RCP. The existing retention pond of the church will be removed by agreement with the church and its flows passed onto the site. Flows will also be accepted from the proposed park site and passed through the site. Tract D will be dedicated to the City as right-of-way. With development of Phase 1-A (the second development phase), a final grading/drainage plan for that phase will identify surface improvements to the Tract D.

Phasing

The site's platting and construction is proposed to be phased. Approximately five or six phases are anticipated. Phases 1 and 1-A are identified on the preliminary plat (DRB-91-174) enclosed. Along with the overall ultimate site development requirements, only the drainage plan for Phase 1 is described in detail in this report. Future phases will require submittals of final grades and drainage details similar to that shown on Sheet 3 of 3 for Phase 1.

The extent and scope of each future phase will determine the required infrastructure. Of particular note, the existing retention pond of the church will be removed under a future phase and only upon planned development of the phase immediately adjacent to the pond.

Hydrology

Sheet 1 of 3 identifies the drainage basins of the developed site. The basins are drawn such to determine key flowrate information for site analysis. Tables 1, 2 and 3, provided at the rear of the text, provide a tabular presentation of key hydrological design information and flowrates for the developed condition. Table 1 is basin hydrology information.

Under ultimate, fully developed conditions, the site generates approximately 98.5 cfs in the 10-year storm event and 148.8 cfs in the 100-year storm event.

Street Hydraulics (Ultiate Development)

Table 2 identifies analysis point information, including flow depth in streets and the identification of the type of curb needed for each street reach. All street flows are confined vertically to the top of curb. Where mountable curb depth is exceeded, standard curb is used. Please reference the plans for locations of each.

Table 3 analyzes critical intersections for velocity, depth and hydraulic jump data. Slopes in the reaches/intersections analyzed are 1% or less resulting in subcritical flow for the flowrates entering them. Accordingly, no hydraulic jumps will occur at these intersections and flow will remain within the curb.

Storm Drain System

The storm drainage infrastructure is concentrated in or adjacent to Storrie Place because of its flat slopes and lot fronts on only one side. As a final precaution, Tract D is designed as an outlet for any street overflows in the event of complete storm drain system failure.

To collect site flows, storm drain inlets are placed along Storrie Place intersections with incoming streets. All upstream inlets are Type "A" inlets while downstream easements are double Type "c"'s. See the Appendix foe hydraulic calculations and Sheet 1 of 3 for the design of and approximate locations of these inlets. Final construction drawings will place these inlets exactly so as to avoid conflicts with other utilities and driveways.

A public underground storm drain system will transfer flow from the inlets to the existing 60" RCP storm drain. See the Appendix and Sheet 1 of 3 for the flows, design and approximate locations of this system. As stated, Tract D will be dedicated as right-of-way to the City and will act as a

spillway for any potential storm drain system failure.

In Basin L, private backyard ponds will be required to retain rear-yard flows. The existing utility easement on the west property line will be vacated by plat. The calculations for sizing this pond and a construction detail are provided in the Appendix and on Sheet 2 of 3.

Upon development of lots immediately adjacent to the church site, the retention pond will be filled and paved over. Flows from the church site (Basin A) will be directed to the planned emergency access drive and passed to the site.

Preliminary Grading Plan

Sheet 1 of 3 identifies proposed preliminary grading of the site in order to accomplish the goals of the drainage management plans provided in this report. The proposed grading also provides for a roughly balanced site in terms of anticipated earthwork.

PHASE 1 DEVELOPMENT

Hydrology and Hydraulics

Sheet 3 of 3 identifies the Phase 1 development drainage management plan. Temporary drainage improvements are required to affect the drainage plan. Temporary retention ponds are to be constructed at the termini of Palomas Park Place and Laster Avenue. The north retention pond is anticipated to remain in service until construction of permanent facilities in Phase 1-A, immediately east of Phase 1. The ponds are sized for 2 - 100-year (6-hour) storm events volume (see Appendix) from Basins F (1.82 ac-ft) and B-1 (0.82 ac-ft).

Preliminary Grading Plan

Preliminary grades for Phase 1 streets and lots are shown on Sheet 3 of 3. The public retention ponds are also identified on this plan.

EROSION CONTROL

An erosion control berm is supplied at each lot on its downstream perimeter boundaries. Please reference the detail shown on the Sheet 2 of 3 enclosed in the rear pockets of this report.

APPROVALS SOUGHT BY THIS SUBMITTAL

Ultimate Development:	Preliminary Plat
Phase 1:	Final Plat Rough Grading Building Permit

CONCLUSION

This report has presented a drainage management plan for the proposed Palomas Park Subdivision. The plan provides safe and adequate drainage protection for the proposed development. It is recommended that this plan be approved as requested.

HYDRO CALCULATIONS - PALOMAS PARK

	BASIN	AREA (AC)	TREAT B (AC)	TREAT C (AC)	TREAT D (AC)	Q10 (CFS)	Q100 (CFS)
	A	5.00	0.4	0.45	4.15	15.62	23.43
*	B	5.555	1.0277	1.0277	3.4997	15.18	23.70
	C	0.57	0.0777	0.0777	0.4233	1.72	2.57
	D	2.38	0.4293	0.4293	1.5264	6.55	10.23
	E	0.17	0.02	0.02	0.13	0.51	0.77
	F	5.28	2.4426	0.78	2.0621	12.46	18.69
	G	0.36	0.17	0.02	0.17	0.91	1.36
*	H	4.94	0.914	0.914	3.112	13.5	21.08
	I	2.25	0.42	0.42	1.42	6.17	9.64
	J	2.48	0.4468	0.4468	1.5887	7.12	10.68
*	K	0.87	0.161	0.161	0.5481	2.42	3.71
*	L	1.02	0.1887	0.1887	0.6426	2.79	4.35
	M	0.50	0.0925	0.0925	0.315	1.40	2.10
*	H-1	2.41	0.4459	0.4459	1.5183	6.59	10.28
*	H-2	2.57	0.4755	0.4755	1.6191	7.02	10.97
					TOTALS	99.96	153.56

TABLE #1

BOHANNAN-HUSTON INC.

PROJECT NAME PALOMAS PARK SHEET 1 OF 1

PROJECT NO. _____ BY K. PATTON DATE 6-17-92

SUBJECT HYDRO CALCULATIONS CH'D _____ DATE _____

TABLE #2

PROJECT NAME Thomas Park SHEET ___ OF ___

PROJECT NO. C9118104 BY K. Patton DATE ___

SUBJECT Street Flow Characteristics CH'D ___ DATE ___

BOHANNAN-HUSTON INC.

ANALYSIS POINT	CONTRIBUTING BASIN(S)	Q_{100} (CFS)	Q_{10} CFS	STREET SLOPE	(FT) STREET WIDTH	(CFS) STREET CAPACITY 8" CURB	9" CURB	(FT) 100 YR FLOW DEPTH	(FT) 10 YR FLOW DEPTH	(FPS) 10 YR VELOCITY	(46.5) 10 YEAR V x D	REMARKS
AP-1	A (church)	23.43	15.62	2.4%	26'	121.9	23.82	0.328	0.284	3.84	1.09	OK MTB CURB
AP-2	H-2	10.97	7.02	1.0%	26'	78.7	15.38	0.294	0.253	2.22	0.562	OK MTB CURB
AP-3	D	10.23	6.55	2.3%	26'	119.3	23.34	0.25	0.21	2.9	0.609	OK MTB CURB
AP-4	B, C, D, E	37.27	23.96	2.2%	26'	116.7	22.82	0.400	0.336	4.40	1.478	OK STD CURB
AP-5	AP-6, G	20.05	13.37	2.66%	26'	128.3	25.06	0.305	0.265	3.74	0.991	OK MTB CURB
AP-6	F	18.69	12.46	3.2%	28'	147.3	27.26	0.290	0.253	3.94	0.997	OK MTB CURB
AP-7	AP-4, I	46.91	30.13	1.0%	26'	78.7	15.38	0.524	0.431	3.85	1.659	OK STD CURB
* AP-10	AP-15R H-1, K, AP-2R, AP-7R AP-11R			0.5%	26'	55.6	10.84					
AP-11	AP-5, J	30.73	20.49	1.0%	26'	78.7	15.38	0.435	0.368	3.28	1.207	OK STD CURB
AP-12	PIPE FLOW	147.11	95.77	0.3%	ϕ=60" RCP							
AP-15	AP-1, H	44.51	29.12	2.1%	26'	114.0	22.3	0.435	0.366	4.72	1.728	OK STD CURB
AP-9	H-1, AP-2R AP-15R, AP-7R	50.77		0.5%	26'	55.6	10.84	0.640				STD CURB
AP-8	AP-9, K	54.98		0.6%	26'	55.6	10.84	0.663				STD CURB

*THE R DESIGNATION FOLLOWING AN "AP" POINT REFERS TO ITS RESIDUAL AFTER CROSSING AN INLET.

TABLE #3

INTERSECTION FLOW ANALYSIS
(CRITICAL INTERSECTIONS)

POINT DESIGNATION	INTERSECTION	Q	STREET WIDTH	SLOPE	DEPTH	VELOCITY	FN	CRITICAL DEPTH	CRITICAL VELOCITY	JUMP DEPTH	FLOW CHARACTERISTICS	REMARKS
AP-2R	# 1	19.62	26	0.01	0.362	3.22	0.94313	0.34818	3.34781	N/A	SUB-CRITICAL FLOW	MAX. DEPTH = 0.472'
STORRIE-Upstream		6.68	26	0.005	0.278	1.72	0.57488	0.19224	2.48736	N/A	SUB-CRITICAL FLOW	
STORRIE-Downstream		26.3	26	0.005	0.472	2.93	0.75157	0.39021	3.54417	N/A	SUB-CRITICAL FLOW	
AP-7R	# 2	14.19	26	0.01	0.321	2.81	0.87403	0.29348	3.07352	N/A	SUB-CRITICAL FLOW	MAX. DEPTH = 0.472'
STORRIE-Upstream		26.3	26	0.005	0.472	2.93	0.75157	0.39021	3.54417	N/A	SUB-CRITICAL FLOW	
AP-9		50.77	26	0.005	0.64	3.84	0.84589	0.57246	4.29304	N/A	SUB-CRITICAL FLOW	
AP-11R	# 3	13.59	26	0.01	0.316	2.76	0.86524	0.28697	3.03923	N/A	SUB-CRITICAL FLOW	
AP-8R		14.63	26	0.005	0.37	2.41	0.69821	0.29124	3.06176	N/A	SUB-CRITICAL FLOW	

Maximum Depth of Flow in intersection is equal to depth of downstream flow depth.

Intersection #1
Capitan & Storrie

Intersection #2
Cardiff and Storrie

Intersection #3
Laster and Storrie

NOTE: The intersection of Palomas Park/Cardiff, as all of the 0.5% slopes shown in the above Table, has subcritical flows. No jump will occur and flow will remain confined to curbs.

SHEET 1 of 2

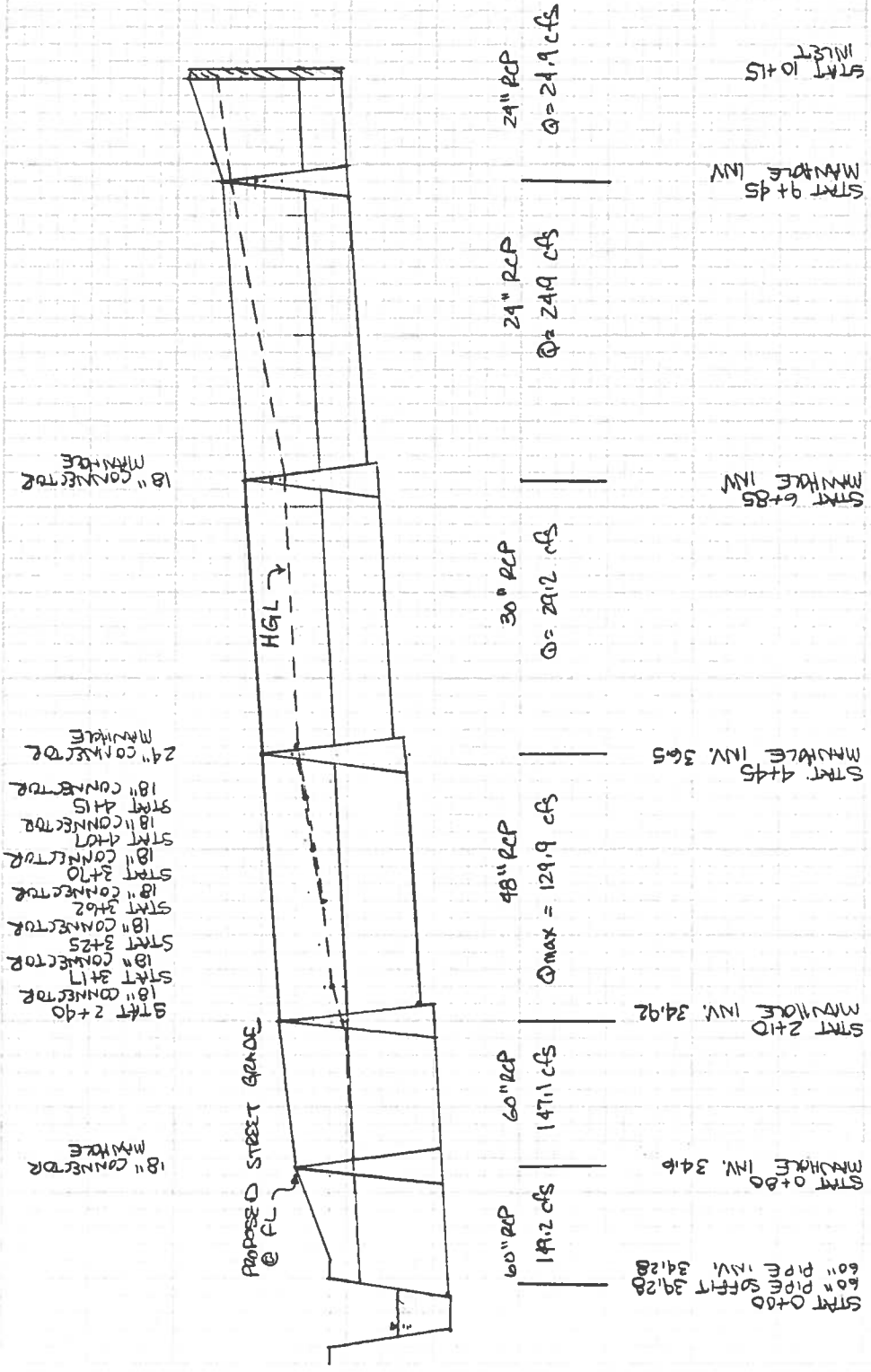
SUMMARY OF HYDRAULIC CALCULATIONS

Station	Structure	Diam.	Q	Area	Vel.	K	Sf	Length	Dia.	Angle	Hf	Hb	Hj	Hmh	Ht	Total Losses	HGL(dn)	HGL(up)	Low Point	HV
0+00	CHANNEL											0.00	0.00	0.00	0.00	0.00		5339.28		0.81
		60	149.2	19.63	7.60	2603	0.0033	80.00			0.26					0.26				
0+80	MANHOLE								60	15		0.07	0.00	0.00	0.00	0.07	5339.54	5339.55		0.87
		60	147.1	19.63	7.49	2604	0.0032	130.00			0.41					0.41				
2+10	MANHOLE								60	45		0.17	0.79	0.00	0.03	0.99	5339.97	5340.17		1.66
		48	130.0	12.57	10.34	1436	0.0082	30.00			0.25					0.25				
2+40	CONNECTOR								48	0		0.00	-0.12	0.00	0.00	-0.12	5340.41	5340.94		1.02
		48	101.7	12.57	8.10	1436	0.0050	77.00			0.39					0.39				
3+17	CONNECTOR								48	0		0.00	0.08	0.00	0.00	0.08	5341.32	5341.49		0.93
		48	97.4	12.57	7.75	1436	0.0046	8.00			0.04					0.04				
3+25	CONNECTOR								48	0		0.00	-0.03	0.00	0.00	-0.03	5341.53	5341.69		0.75
		48	93.1	12.57	7.41	1436	0.0042	37.00			0.16					0.16				
3+62	CONNECTOR								48	0		0.00	0.09	0.00	0.00	0.09	5341.85	5342.04		0.65
		48	87.1	12.57	6.93	1436	0.0037	8.00			0.03					0.03				
3+70	CONNECTOR								48	0		0.00	0.08	0.00	0.00	0.08	5342.07	5342.14		0.65
		48	81.0	12.57	6.45	1436	0.0032	37.00			0.12					0.12				
4+07	CONNECTOR								48	0		0.00	0.06	0.00	0.00	0.06	5342.26	5342.46		0.5
		48	71.4	12.57	5.69	1436	0.0025	8.00			0.02					0.02				
4+15	CONNECTOR								48	0		0.00	-0.08	0.00	0.00	-0.08	5342.48	5342.53		0.38
		48	61.9	12.57	4.92	1436	0.0019	30.00			0.06					0.06				
4+45	MANHOLE								48	0		0.00	0.65	0.00	0.00	0.66	5342.58	5343.06		0.55
		30	29.2	4.91	5.94	410	0.0051	240.00			1.21					1.21				
6+85	MANHOLE								30	0		0.00	0.00	0.00	0.03	0.03	5344.28	5343.88		0.98
		24	24.9	3.14	7.93	226	0.0121	260.00			3.15					3.15				
9+45	MANHOLE								24	0		0.00		0.00		0.00	5347.03	5347.03		0.98
		24	24.9	3.14	7.92	226	0.0121	70.00			0.85					0.85				
10+15	INLET								24	90		0.19		0.00		0.19	5347.87			0.97

SUMMARY OF HYDRAULIC CALCULATIONS

SHEET 2 OF 2

Station	Structure	Diam.	EGL(dn)	EGL(up)	Dia. 3	Dia. 3 area	Dia.1&2 (hidden)	Angle	Hj	Ht(inc.)	Ht(dec.)	Actual Slope	Depth
0+00	CHANNEL		5340.09	5340.09	0.00	0.00		0.00	0	0.0000	0.0000	0	
		60										0.00	
0+80	MANHOLE		5340.35	5340.43	0.00	0.00		0.00	0	0.0000	0.0000		
		60										0.00	
2+10	MANHOLE		5340.84	5341.83	18.00	1.77		45.00	-0.6649	0.0000	0.0252		
		48										0.00	
2+40	CONNECTOR		5342.07	5341.96	18.00	1.77		45.00	0.52467	0.0000	0.0000		
		48										0.00	
3+17	CONNECTOR		5342.34	5342.43	18.00	1.77		41.00	0.16814	0.0000	0.0000		
		48										0.00	
3+25	CONNECTOR		5342.46	5342.44	18.00	1.77		45.00	0.16131	0.0000	0.0000		
		48										0.00	
3+62	CONNECTOR		5342.59	5342.68	18.00	1.77		41.00	0.19125	0.0000	0.0000		
		48										0.00	
3+70	CONNECTOR		5342.71	5342.79	18.00	1.77		45.00	0.17729	0.0000	0.0000		
		48										0.00	
4+07	CONNECTOR		5342.91	5342.97	18.00	1.77		41.00	0.20168	0.0000	0.0000		
		48										0.00	
4+15	CONNECTOR		5342.99	5342.90	18.00	1.77		45.00	0.18543	0.0000	0.0000		
		48										0.00	
4+45	MANHOLE		5342.96	5343.61	24.00	3.14		90.00	0.48047	0.0000	0.0032		
		30										0.00	
6+85	MANHOLE		5344.83	5344.85	18.00	1.77		90.00	-0.171	0.0000	0.0280		
		24										0.00	
9+45	MANHOLE		5348.00	5348.00	24.00	3.14		90.00	0.01523	0.0000	0.0122		
		24										0.00	
10+15	INLET		5348.85		24.00	3.14		90.00					



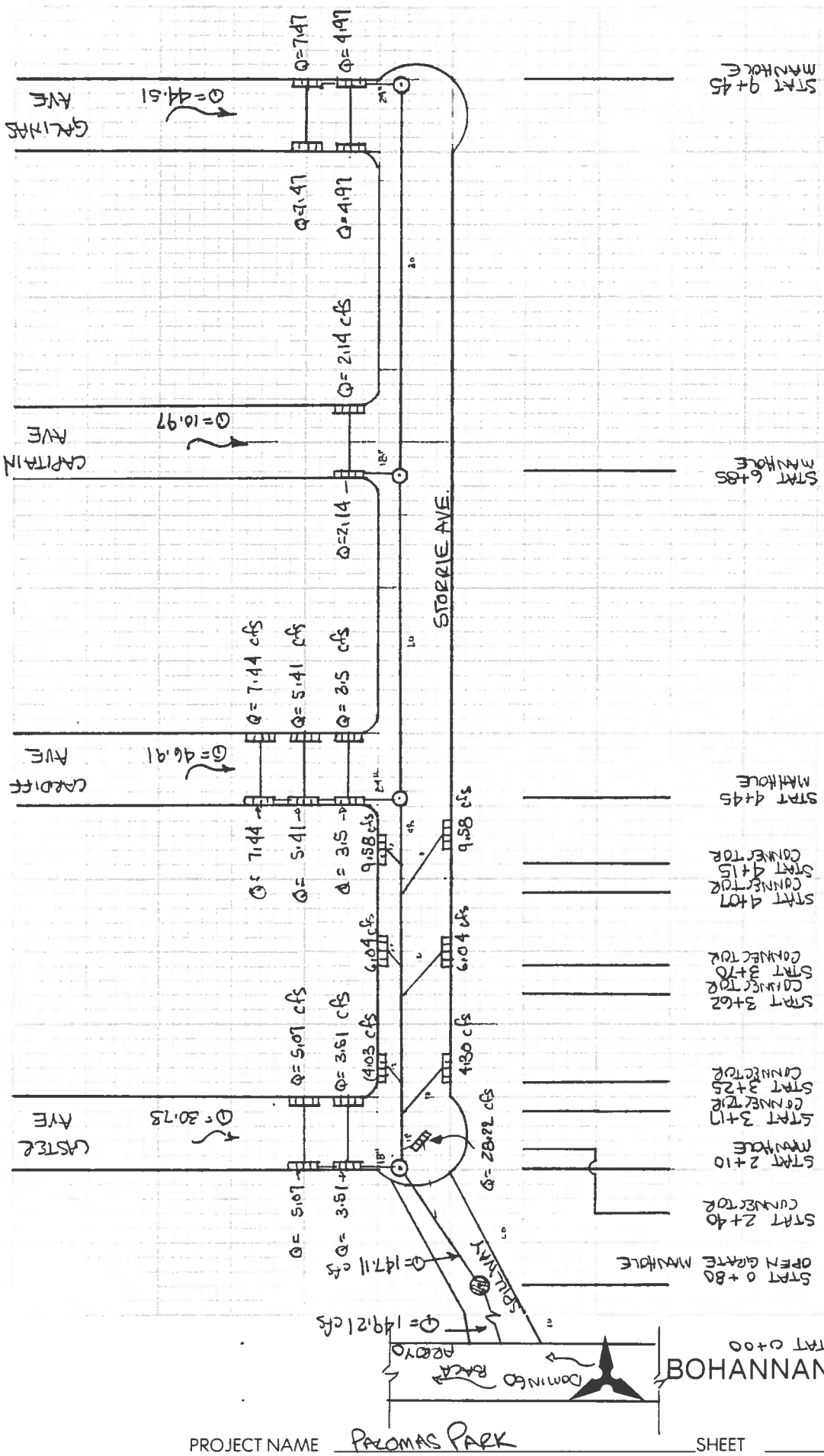
PROFILE

BOHANNAN-HUSTON INC.

PROJECT NAME PALOMAS PARK SHEET ____ OF ____

PROJECT NO. ____ BY K. PATTON DATE ____

SUBJECT HYDRAULIC CALCULATIONS PROFILE CH'D ____ DATE ____



NO SCALE

BOHANNAN-HUSTON INC.

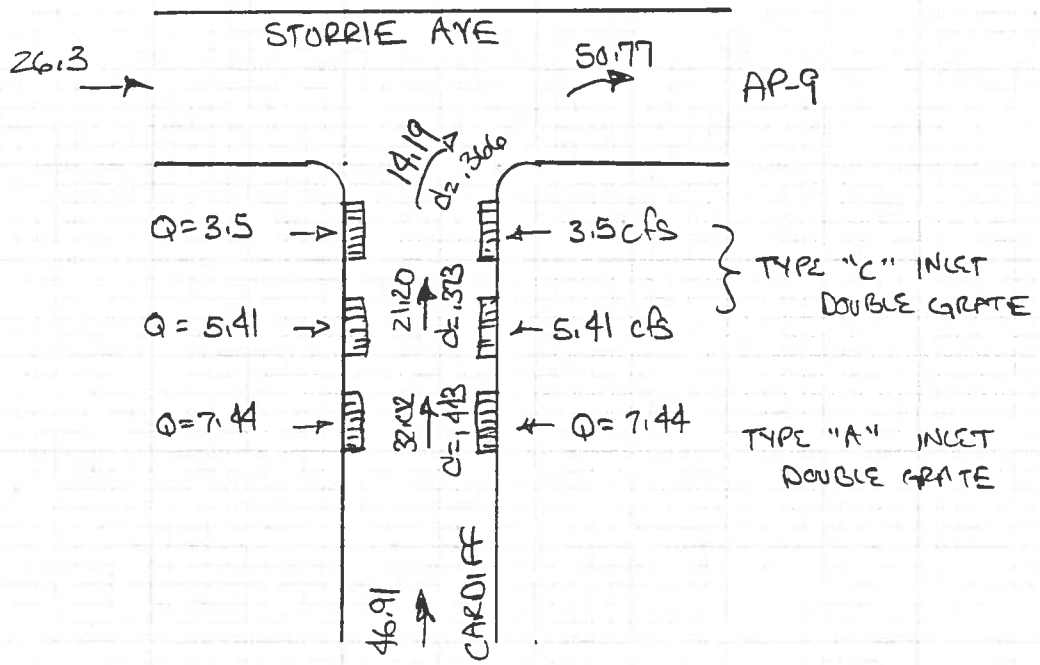
PROJECT NAME PALOMAS PARK SHEET _____ OF _____

PROJECT NO. _____ BY K. PATTON DATE _____

SUBJECT MANHOLE/INLET LAYOUT CH'D _____ DATE _____

AP-7

Q_{100} = 46.91 cfs
Flow depth = 0.524
Slope = 1.0%



AP-9

Q_{100} = (AP-2R + AP-15R + AP-7R) + Basin H-1 = 40.49 + 10.28 = <u>50.77</u> cfs

AP-8

Q_{100} = (AP-9) + Basin K = 50.77 + 3.71 = <u>54.48</u> cfs

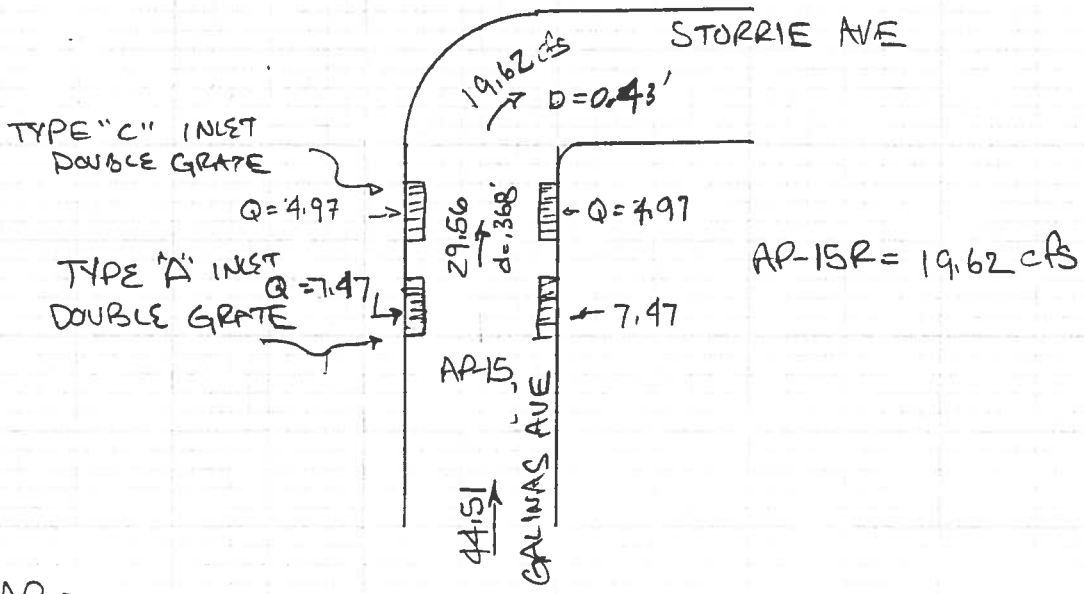
Flow depth = 0.663
Slope = 0.6%

BOHANNAN-HUSTON INC.

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

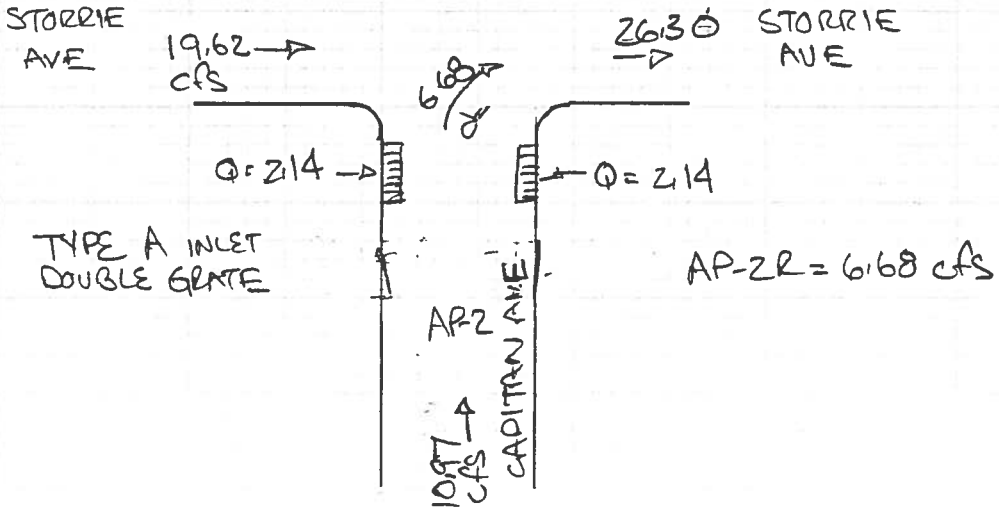
AP-15

Q_{100} = 44.61 cfs
Flow depth 0.435 ft
Slope = 2.1%



AP-2

Q_{100} = 10.97 cfs
Flow depth = 0.294 ft
Slope = 1.0%



BOHANNAN-HUSTON INC.

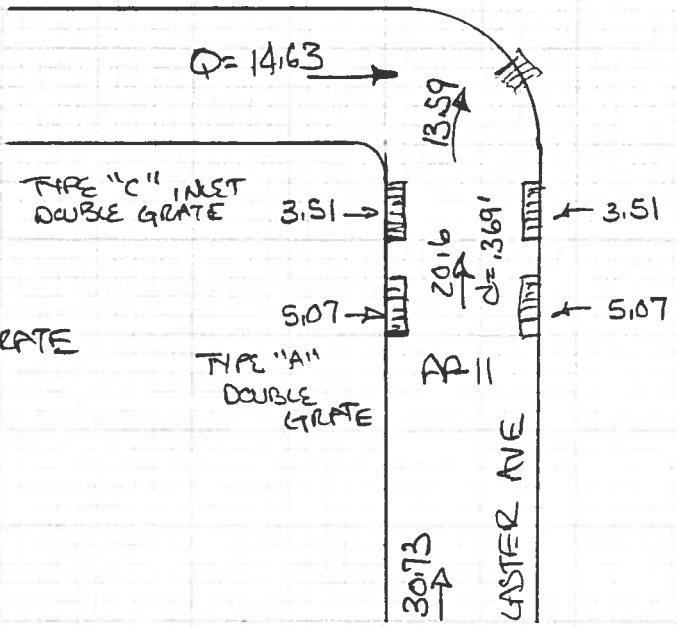
PROJECT NAME _____ SHEET _____ OF _____
PROJECT NO. _____ BY _____ DATE _____
SUBJECT INLET _____ CH'D _____ DATE _____

AP-11

Q_{100} = 30.73

Flow depth = 0.435

Slope = 1.0%



TYPE A DOUBLE GRATE

AP-11R = 13.59 cfs

BOHANNAN-HUSTON INC.

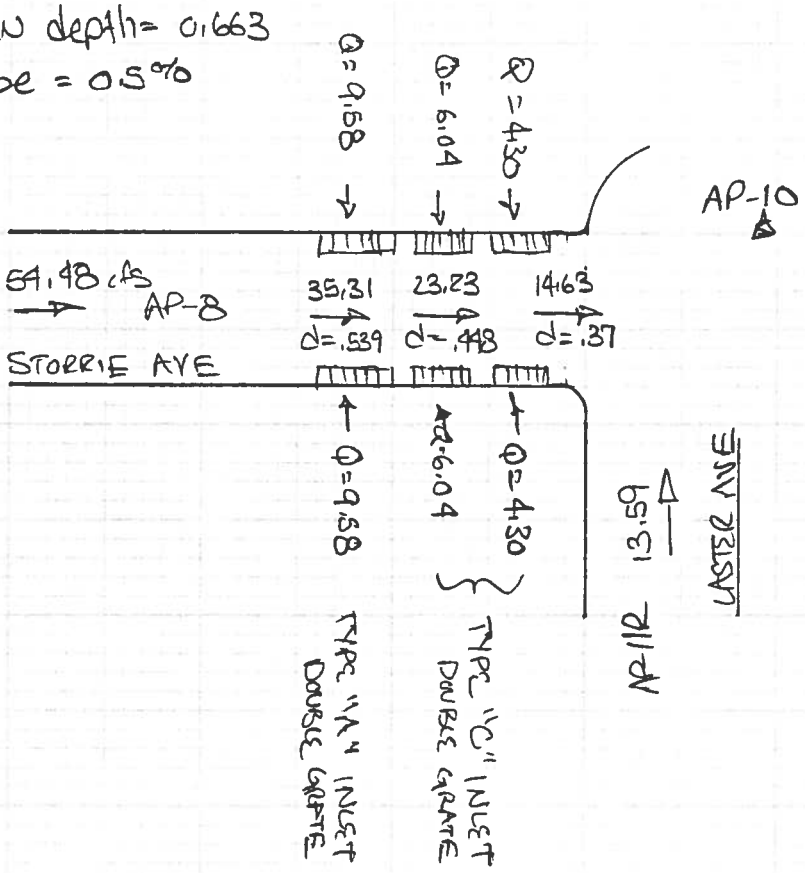
PROJECT NAME _____ SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

AP-8

Q_{100} = 54.48 cfs
Flow depth = 0.663
Slope = 0.5%



AP-10 ·

Q_{100} = 28.22 cfs

Sump condition
Assume 30% clogging factor

Q = 36.69 cfs

From rating curve enclosed a head of 0.8 FT is needed using a double grate Type 'D' inlet.

BOHANNAN-HUSTON INC.

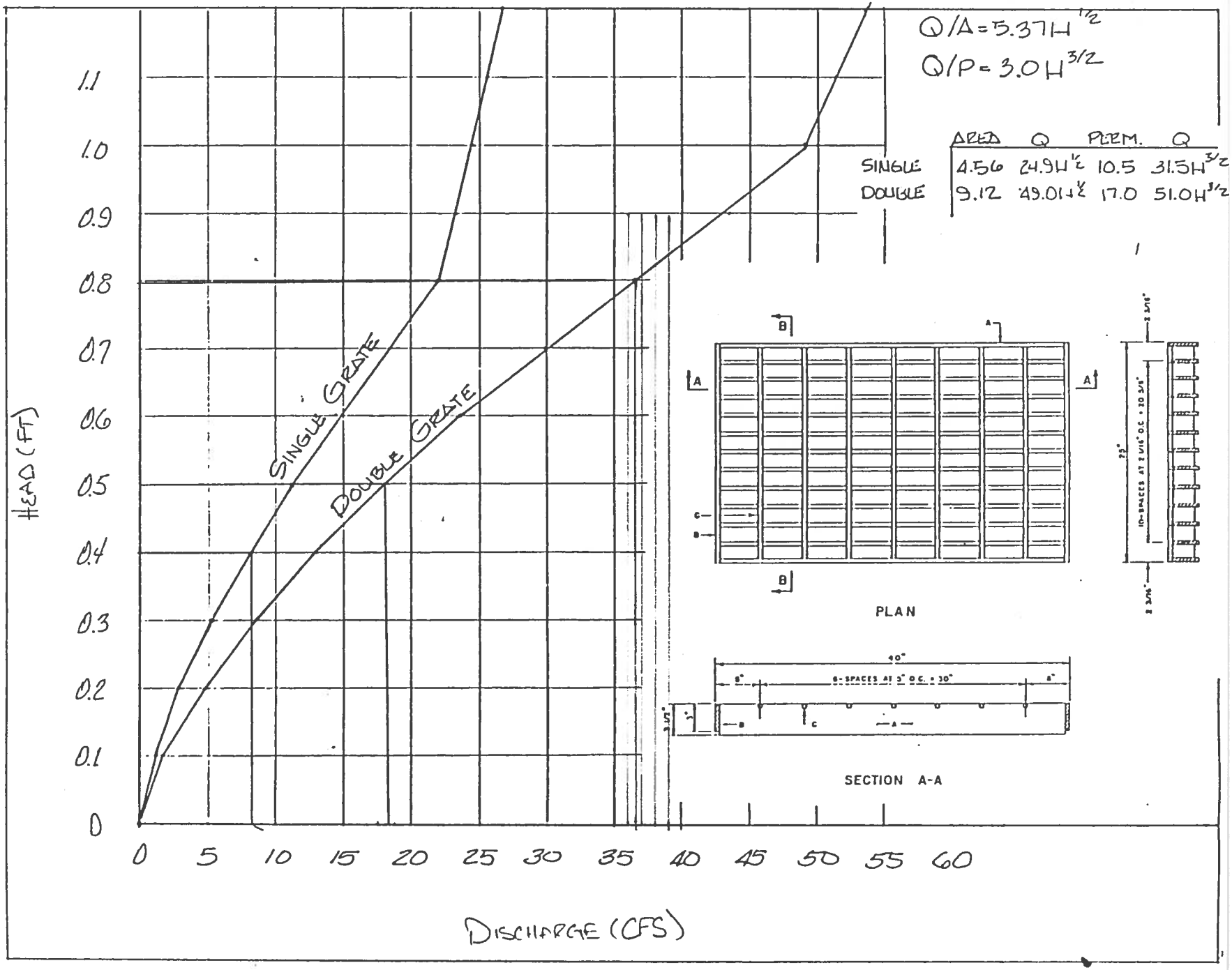
PROJECT NAME _____ SHEET _____ OF _____
PROJECT NO. _____ BY _____ DATE _____
SUBJECT _____ CH'D _____ DATE _____

RATING CURVE FOR TYPE D INLET IN A SUMP

$Q/A = 5.37H^{1/2}$

$Q/P = 3.0H^{3/2}$

	AREA	Q	PERM.	Q
SINGLE	4.56	$24.9H^{1/2}$	10.5	$31.5H^{3/2}$
DOUBLE	9.12	$49.0H^{1/2}$	17.0	$51.0H^{3/2}$



5/14/93

Hydrology (Retention Ponds)

To size the retention basin for phase 1 for Basin F_B & Basin B-1. Bernalillo county storm Drainage ordinance p. 8
The storms being used will be

2 - 100 yr - 6 Hr storm Back to Back or
1 - 100 yr - 10 day storm o

Volume no less than 1-100 yr - 24 Hour storm w/o infiltration and the greater storm will be used to size the retention basin & spillway.

Basin B-1

Area total = 2.37 Acres
w/ the following Distribution

Treatment B = 1.33 Acres
Treatment C = 0.03 Acr
Treatment D = 1.01 Ac

$$\text{Weight } E = \frac{(.92)(1.33) + (1.29)(.03) + 2.36(1.01)}{2.37 \text{ Ac}}$$

$E = 1.538$ inches

$$\text{Volume } (V_{360}) \text{ 6 Hr storm} = \frac{1.538 \text{ inches}}{12} (2.37 \text{ Acres}) = 0.30 \text{ Ac Ft.}$$

BOHANNAN-HUSTON INC.

PROJECT NAME Santa Barbara SHEET 1 OF 7
PROJECT NO. 91181.05 BY MT DATE 6-1-92
SUBJECT Pond Volumes CH'D _____ DATE _____

Basin B-1

100-yr -6 hr storm Back to Back w/ 2nd storm w/o infiltration provided.

$P_{360} = 2.60$ inches

$E = 1.539 + 2.60 \text{ in} = 4.14$ inches

$\text{Volume} = \frac{4.14 \text{ inches}}{12 \text{ in/ft}} (2.37) = 0.817$ Ac-Ft.

100yr-10 day storm

$\text{Volume (10day)} = V_{360} + \text{Ad} (P_{10days} - P_{360})/12 \text{ in ft}$

$V_{360} = .30$ Ac Ft

$V = (0.30) + 1.01 (4.50 - 2.60)/12 = 0.49$ Ac-FT

100 yr - 24 storm no infiltration

$P_{24\,Hr} = 3.10''$

$\text{Volume} = \left(\frac{3.10 \text{ in}}{12}\right)(2.37) = 0.61$ Ac FT

∴ Volume of Pond for Basin B-1
= 2-100 yr-6 Hr storm back to back.

= 0.817 Ac-FT

Assume Pond depth 1.5' feet w/o Fence

$\text{Area} = \frac{.817(43560)}{1.5} = 23725.68 \text{ ft}^2$ or 155'x155'

PROJECT NAME Santa Barbara SHEET 2 OF 4
PROJECT NO. 91181105 BY MT DATE 6-1-92
SUBJECT Pond Volumes CH'D DATE

Basin F

A_{total} = 5.28 Acres

w/ the following Distribution

treatment B = 2.44 Ac

treatment C = .73 Ac

Treatment D = 2.06 Ac

$$\text{Weight } E = \frac{(0.92)(2.44) + 1.29(.73) + 2.36(2.06)}{5.28 \text{ Ac}}$$

$$= 1.5365 \text{ inches}$$

$$\text{Volume } (V_{360}) = \frac{1.5365}{12}(5.28) = 0.676 \text{ Ac FT}$$

100yr 6hr storm Back to Back w/ 2nd storm w/ no infiltration

$P_{360} = 2.60$ inches

$E = 1.5365 + 2.60 = 4.14$ inches

$$\text{Volume} = \frac{4.14}{12}(5.28) = 1.82 \text{ Ac Ft}$$

100 yr - 10 day storm

$$\text{Volume (10day)} = V_{360} + A_D(P_{10day} - P_{360})/12$$

$$V_{360} = .67 + 2.06(4.90 - 2.60)/12 = 1.06 \text{ Ac·Ft}$$

100yr - 24 storm no infiltration

$P_{24H} = 3.10"$

$$\text{Volume} = \frac{3.10}{12}(5.28) = 1.36 \text{ Ac Ft}$$

Basin F

Volume of Pond for Basin F.
Is 2-100yr-6hr Storm Back to Back

= 1.82 Ac Ft

Pond depth 1.5'

$$\text{Area} = \frac{1.82 \text{ Ac Ft}}{1.5} (43560) = 52852.80 \text{ ft}^2$$

or 230' x 230' Area

PROJECT NAME Santa Barbara SHEET 4 OF 4
PROJECT NO. 9113.05 BY MH DATE 6-1-97
SUBJECT Pond Volume CH'D _____ DATE _____

Basin H

LOCATION : Zone 3

Total Area = 4.94 acre

Treatment B = 0.914 ac (8.5%)
Treatment C = 0.914 ac (8.5%)
Treatment D = 3.112 ac (63.0%)

100 YR STORM

Excess Precipitation & Volume

WEIGHTED E - 6 hour storm

$$E_W = \frac{(0.914 \times 0.92) + (0.914 \times 1.29) + (3.112 \times 2.36)}{4.94}$$

$E_W = 1.896$ inches

Volume

$V_{360} = (1.896/12) \times 4.94 = 0.032$ acre-ft

$V_{360} = 0.032$ ac-ft

Peak Discharge - Q_{100} $Q = C\,I\,A$

I for Zone 3 = 5.38 in/hr @ t_c = 12 min

$Q_{100} = I(\Sigma CA) = 5.38[(0.48 \times 0.914) + (0.64 \times 0.914) + (0.93 \times 3.112)]$

$Q_{100} = 5.38(3.9178) = 21.08$ cfs

$Q_{100} = 21.08$ cfs

10 YR STORM

$$E_W = \frac{(0.914 \times 0.36) + (0.914 \times 0.62) + (3.112 \times 1.5)}{4.94}$$

$E_W = 1.1263$ inches

Volume $V_{360} = (1.1263/12) \times 4.94 = 0.4636$ ac-ft

$V_{360} = 0.464$ ac-ft

BOHANNAN-HUSTON INC.

BASIN H

PROJECT NAME PALOMAS PARK SHEET 1 OF 7

PROJECT NO. BY K. PATTON DATE

SUBJECT Q_{100} & Q_{10} & V_{360} CH'D DATE

Basin H

10 YR STORM CONTINUED

$Q_{10} = CIA$

I for Zone 3 = 3.65 in/hr @ t_c = 12 min

$Q_{10} = I(\Sigma CA) = 3.65[(0.914 \times .33) + (0.914 \times .55) + (3.112 \times .93)]$

$Q_{10} = 3.65(3.6985) = 13.4995$ cfs

$Q_{10} = 13.5$ cfs

BOHANNAN-HUSTON INC.

BASIN H

PROJECT NAME _____ SHEET 2 OF 7

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

Basin B

Location Zone 3

Total Area = 5.555 acre

Treatment B = 1.0277 ac (8.5 %)

Treatment C = 1.0277 ac (8.5 %)

Treatment D = 3.4997 ac (63 %)

100 YEAR STORM

Excess Precipitation & Volume

Weighted E - 6 hour storm

$$E_W = \frac{(1.0277 \times 0.92) + (1.0277 \times 1.29) + (3.4997 \times 2.36)}{5.555}$$

$E_W = 1.8957$ in

Volume $V_{360} = 1.8957/12 \times 5.555 = 0.8775$ ac-ft

$V_{360} = 0.876$ ac-ft

Peak Discharge

$I = 5.38$ in/hr @ $t_c = 12$ min

$Q_{100} = 5.38[(0.48 \times 1.0277) + (0.64 \times 1.0277) + (0.93 \times 3.4997)]$

$Q_{100} = 5.38(4.4057) = 23.7029$

$Q_{100} = 23.7$ cfs

10 YEAR STORM

Peak Discharge

$I = 3.65$ in/hr @ $t_c = 12$ min

$Q_{10} = 3.65[(0.33 \times 1.0277) + (0.55 \times 1.0277) + (0.93 \times 3.4997)]$

$Q_{10} = 3.65(4.1591) = 15.1807$

$Q_{10} = 15.18$ cfs

BOHANNAN-HUSTON INC.

Basin K

Location Zone 3

Total Area = 0.87

Treatment B = 0.161 ac (18.5%)

Treatment C = 0.161 ac (18.5%)

Treatment D = 0.5481 ac (63.%)

100 YEAR STORM

Excess Precipitation & Volume

Weighted E - 6 hour storm

$$E_W = \frac{(.161 \times .92) + (.161 \times 1.29) + (.5481 \times 2.36)}{0.87} = 1.8$$

Volume $V_{360} = (1.8958/12) \times .87 = 0.1374$ ac-ft

Peak Discharge - Q_{100}

$V_{360} = 0.137$ a

$I = 5.38$ in/hr @ $t_c = 12$ min

$Q_{100} = 5.38[(.161 \times .48) + (.161 \times .64) + (.5481 \times .93)] =$

$Q_{100} = 5.38(.6901) = 3.7125$ cfs

$Q_{100} = 3.71$ cfs

10 YEAR STORM

Peak Discharge - Q_{10}

$I = 3.65$ in/hr

$Q_{10} = 3.65[(.161 \times .33) + (.161 \times .55) + (.5481 \times .93)]$

$Q_{10} = 3.65(.6514) = 2.4184$ cfs

$Q_{10} = 2.42$ cfs

BOHANNAN-HUSTON I

Basin L

Location Zone 3

Total Area = 1.02 acre

Treatment B = 0.1887 ac (18.5%)

Treatment C = 0.1887 ac (18.5%)

Treatment D = 0.6426 ac (63%)

100 Year Storm

Excess Precipitation & Volume

Weighted E - 6 hr storm

$$E_W = \frac{(.92 \times .1887) + (1.29 \times .1887) + (2.36 \times .6426)}{1.02} = 1.8957"$$

Volume $V_{360} = (1.8957/12) \times 1.02 = 0.1611$ ac-ft

$V_{360} = 0.161$ ac-ft

Peak Discharge

$I = 5.38$ in/hr @ $t_c = 12$ min

$Q_{100} = 5.38[(.48 \times .1887) + (.64 \times .1887) + (.93 \times .6426)]$

$Q_{100} = 5.38(0.809) = 4.3522$ cfs

$Q_{100} = 4.35$ cfs

10 Year Storm

Peak Discharge

$I = 3.65$ in/hr

$Q_{10} = 3.65[(.1887 \times .33) + (.1887 \times .55) + (.93 \times .6426)]$

$Q_{10} = 3.65(.7637) = 2.7874$ cfs

$Q_{10} = 2.79$ cfs

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 5 OF 7

Basin L

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

Basin H-1 Location Zone 3

Total Area = 2.41 ac
Treatment B = 0.446 ac (8.5%)
Treatment C = 0.446 ac (8.5%)
Treatment D = 1.518 ac (63%)

100 Year Storm

Excess Precipitation & Volume

$$E_W = \frac{(.92 \times .446) + (1.29 \times .446) + (2.36 \times 1.518)}{2.41} = 1.8955''$$

Volume $V_{360} = (1.8955/12) \times 2.41 = 0.3807$ ac-ft

$V_{360} = 0.381$ ac-ft

Peak Discharge

$I = 5.38$ in/hr @ $t_c = 12$ min

$Q_{100} = 5.38[(.48 \times .446) + (.64 \times .446) + (.93 \times 1.518)]$

$Q_{100} = 538(1.9113) = 10.2826$ cfs

$Q_{100} = 10.28$ cfs

10 YEAR STORM

Peak Discharge

$I = 3.65$ in/hr

$Q_{10} = 3.65[(.33 \times .446) + (.55 \times .446) + (.93 \times 1.518)]$

$Q_{10} = 1.8042(3.65) = 6.5854$ cfs

$Q_{10} = 6.59$ cfs

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 6 OF 7

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

Basin H-1

Basin H-2 Location Zone 3

Total Area = 2.57
Treatment B = 0.4755 ac (85%)
Treatment C = 0.4755 ac (85%)
Treatment D = 1.6191 ac (63%)

100 Year Storm

Excess Precipitation & Volume

$$E_W = \frac{(.92 \times .4755) + (1.29 \times .4755) + (2.36 \times 1.6191)}{2.57} = 1.8957"$$

Volume $V_{360} = (1.8957/12) \times 2.57 = 0.406$ ac-ft

$V_{360} = 0.406$ ac-ft

Peak Discharge

$I = 5.38$ in/hr

$$Q_{100} = 5.38[(.48 \times .4755) + (.64 \times .4755) + (.93 \times 1.6191)]$$

$$Q_{100} = 5.38(2.0383) = 10.9662 \text{ cfs}$$

$Q_{100} = 10.97$ cfs

10 Year Storm

Peak Discharge

$I = 3.65$ in/hr

$$Q_{10} = 3.65[(.53 \times .4755) + (.55 \times .4755) + (.93 \times 1.6191)]$$

$$Q_{10} = 3.65(1.9242) = 7.0233 \text{ cfs}$$

$Q_{10} = 7.0233$ cfs

BOHANNAN-HUSTON INC.

PROJECT NAME _____ SHEET 7 OF 7

Basin H-2 PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

BASIN H

Area

$(485 \times 210) + (225 \times 460) + (390 \times 25)$

$101850 + 103500 + 9750 = 215,100 \text{ ft}^2$

4.938 acre

BASIN H-2

Area

$(460 \times 100) + (400 \times 145) + (.5 \times 90 \times 125) + (25 \times 90) = 111,875 \text{ ft}^2$

2.5683 acre

BASIN L

Area

$(35 \times 960) + (.5 \times 30 \times 45) + (315 \times 20) + (40 \times 40 \times .5)$

$+ (45 \times 55) + (15 \times 45 \times .5) + (110 \times 30 \times .5) = 44337.5 \text{ ft}^2$ | 1.018 acre

BASIN B

Area

$(485 \times 160) + (.5 \times 65 \times 120) + (420 \times 95) + (45 \times 25) + (.5 \times 75 \times 25) +$

$(220 \times 200 \times .5) + (425 \times 200) + (115 \times 200 \times .5) = 241,962.5 \text{ ft}^2$

5.555 acres

BASIN H-1

Area

$(620 \times 45) - (.5 \times 45 \times 45) + (140 \times 325) + (100 \times 50) = 77,387.5 \text{ ft}^2$

1.777 acre $+ 0.63$ ac $= 2.407$ acre

BASIN K

Area

$(50 \times 195) = 9750\ ft^2 \Rightarrow 0.2238$ // $0.65 + 0.22 =$ 0.874 acre

Hydrology

Existing conditions

Zone 3

Area = 35.49 Ac

Assume land treatment A for Existing conditions only.

Intensity

$I_{100} = 5.39$ in/hr

$I_{10} = 3.65$ in/hr

Coefficient

$I_{100} = .35$
$I_{10} = .16$
} Land treatment "A"

$Q_{100} = (.35)(5.39)(35.49) = 66.81$ cfs ✓

$Q_{10} = (.16)(3.65)(35.49) = 20.72$ cfs ✓

BOHANNAN-HUSTON INC.

PROJECT NAME Santa Barbara SHEET 1 OF

PROJECT NO. 91191.05 BY MH DATE 6-1-92

SUBJECT Hydrology CH'D DATE

Hydrology

Basin : F-1 (Park Area)

Area = 470(150) + $\frac{310(150)}{2}$ = 93 750 ft^2 = 2.15 Acres

100 % Land treatment 'B' Zone 3

Intensity	Coefficient	
I_{100} = 5.39 in/hr	C_{100} = 0.49	} treatment 'B'
I_{10} = 3.65 in/hr	C_{10} = 0.33	

$Q_{100} = (.49)(5.39)(2.15) = 5.6$ cfs

$Q_{10} = (.33)(3.65)(2.15) = 2.6$ cfs

Assume 1% slope + a 'V' ditch 1.0 deep

ft	ft
1.0	0
0	2
1	4

Basin F-2

Flow from F-2 will be the remaining of the Total Basin F

Q_{100} = 18.7 } Total of Basin 'F'
Q_{10} = 12.5 }

$Q_{100} = 18.7 - 5.6 = 13.1$ cfs

$Q_{10} = 12.5 - 2.6 = 9.9$ cfs

BOHANNAN-HUSTON INC.

PROJECT NAME Santa Barbara SHEET 2 OF

PROJECT NO. 9118L.05 BY MH DATE 6-4-92

SUBJECT Hydrology CH'D DATE

Hydrology

Basin B-1 — 100yr-6 Hr storm

Planimeter Reling : $41.28 (50)^2 = 103,200 = 2.37$ Acres (Total Area)

Park Area = 1.33 Acres Land Treatment "B"

Impervious Area (Road) = Treatment D' $\frac{600(55)}{43560} = 0.76$ Acres

(Pad) = $(45)(60)\,4 = 10800\ ft^2 = .25$ Acres

1.01 Acres

Park	1.33	'B'
Road / Pads	1.01	'D'

Remaining Area = 2.37 − 2.34 = 0.03 Acres Treatment 'C'

$Q_{100} = (0.48)(5.38)(1.33) + (.64)(5.39)(.03) + (.93)(5.39)(1.01)$

$Q_{100} = 8.6$ cfs

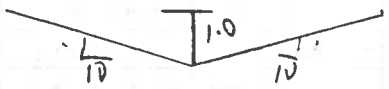
$Q_{10} = (0.33)(3.65)(1.33) + (.55)(3.65)(.03) + (.93)(3.65)(1.01)$

$Q_{10} = 5.1$ cfs

BOHANNAN-HUSTON INC.

PROJECT NAME Santa Barbara SHEET 3 OF _____
PROJECT NO. 91181.05 BY MH DATE 6-1-92
SUBJECT Hydrology CH'D _____ DATE _____

Parks Ditch sizing



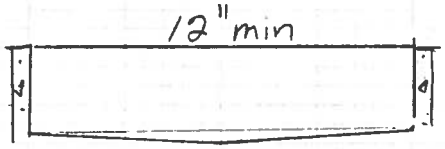
Q = 5.6 cfs

n = .030

Mannings.

Normal depth =

0.6



Weir Eq.

$Q = CLH^{3/2}$ C = 3.0

L = 12" = 1.0'

$5.6 = (3)(1.0)\ H^{3/2}$ $^{2/3}$

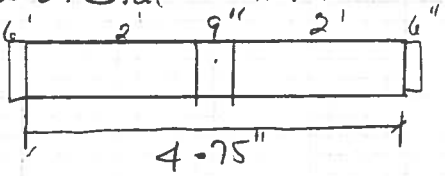
H = 1.5' To much Head try

L = 24" = 2.0'

$5.6 = (3)(2)\ H^{3/2}$

H = 0.96' = 11.46"

Try 2-24" Side culverts



1 Pier = 9" = 0.75'

$5.6 = (3)(4)\ H^{3/2}$

H = .60' = 7.2" > .54 ∴ no good

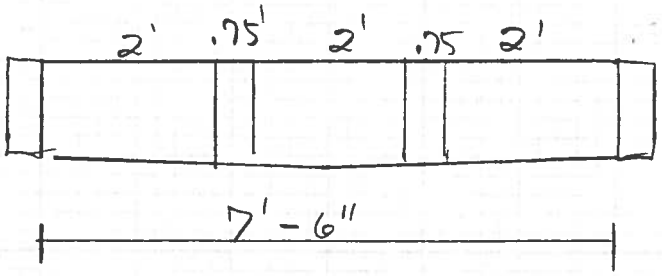
BOHANNAN-HUSTON INC.

PROJECT NAME Santa Barbara SHEET ____ OF ____

PROJECT NO. 5118105 BY MH DATE 6-1-92

SUBJECT Park Sidewalk Culverts CH'D ____ DATE ____

Try 3- 2' sidewalk culverts



2 piers $= 2(.75) = 1.5$

$L = 6'$

$Q = CLH^{3/2}$

$5.6 = (3)(6)H^{3/2}$

$H = 0.45' = 5.5'' < .54'$ OK

∴ Use 3- 2' Wide Sidewalk culvert

BOHANNAN-HUSTON INC.

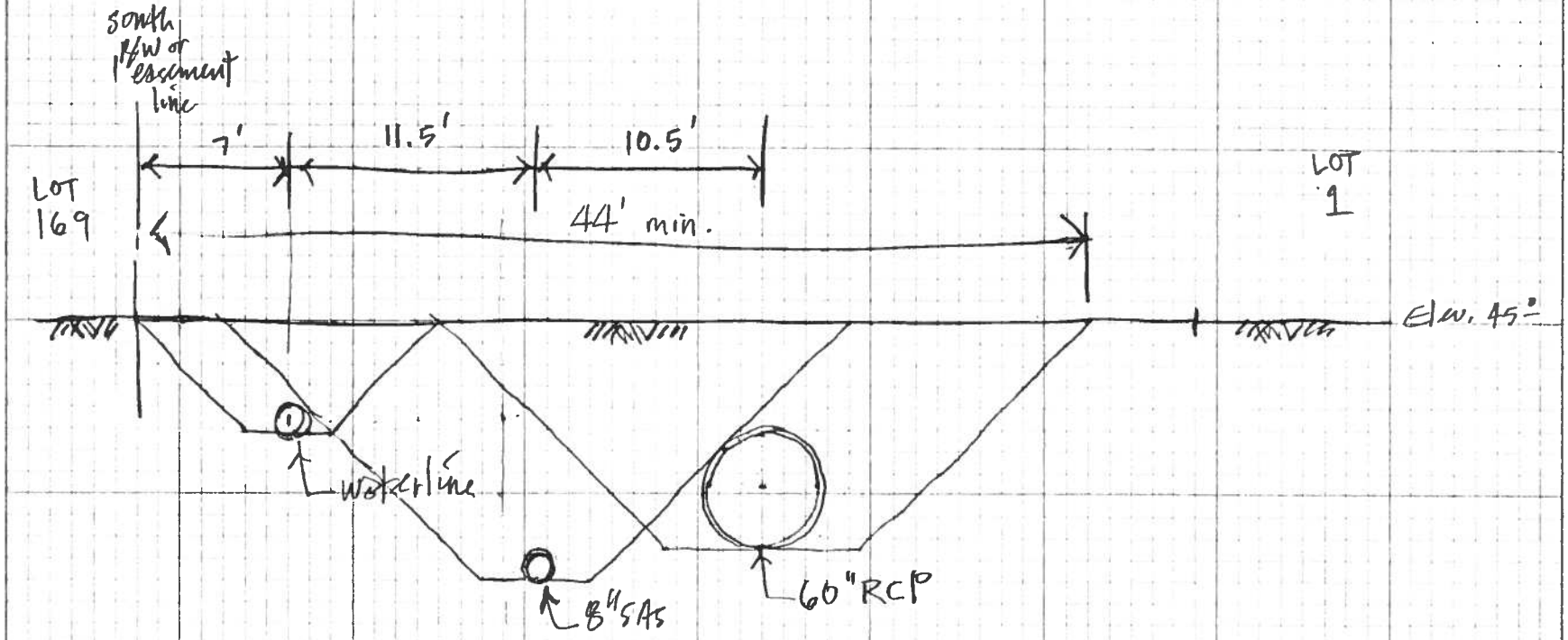
PROJECT NAME _____ SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

UTILITY corridor between lots 169 and lot 1

Scale 1" = 8' (vert. & hor.)



Easement width (typ.)
= [2 X Depth] + ϕ12. + 4'

PROJECT NAME _____ SHEET _____ OF _____

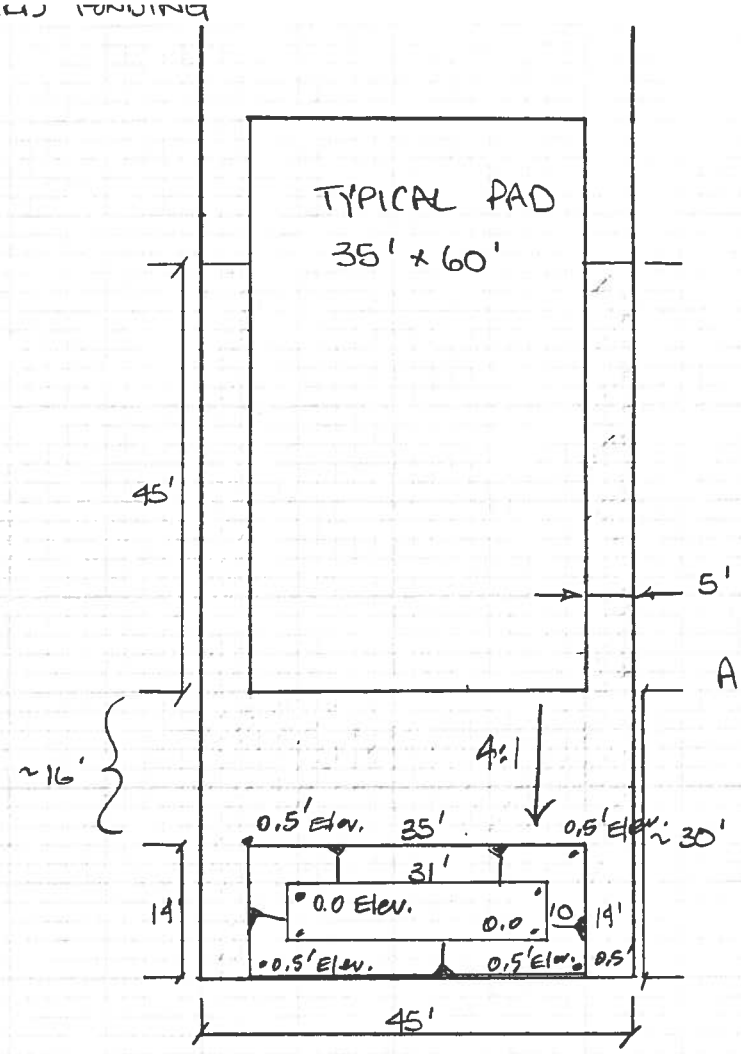
PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

BOHANNAN-HUSTON INC.

BACKYARD PONDING

BASIN L



Place on sheet 2 of 3

Area of concern
A = 1800 SF

$$V = \frac{H}{3}\left(A_T + A_B + (A_T A_B)^{1/2}\right)$$

VOLUME FOR PONDING CONDITION

	TOP WIDTH	TOP LENGTH	BOTTOM WIDTH	BOTTOM LENGTH	AREA T SF	AREA B SF	HEIGHT FT	VOLUME CF	REMARKS
* → ①	14	35	10	31	490	310	0.5'	198.29	OK
②	13	35	9	31	455	279	0.5'	181.72	NG
③	13	35	9	31	455	279	1.0'	363.43	OK

VOLUME NEEDED

Assume 100% of the area considered is treatment C in zone 3

E = 1.29 in

V = (1.29/12) x 1800 = 193.5 CF use ①

BOHANNAN-HUSTON INC.

PROJECT NAME Palomas Park SHEET ____ OF ____

PROJECT NO. ____ BY K. Patton DATE ____

SUBJECT Backyard Ponding CH'D ____ DATE ____