

FINAL DRAINAGE STUDY
FOR THE
RIDGEVIEW SUBDIVISION
UNIT 1



September 22, 2000
Revised December 15, 2000

PREPARED BY:

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-
I
I



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I. INTRODUCTION

This Drainage Study will address the developed storm runoff and the necessary facilities to adequately convey the flow from the properties described as 'Lands of Feinstein' and a small portion of adjacent tracts to the south, Ridgeview Subdivision Unit 1. This development consists of approximately 22.67 acres and is planned to have 133 single-family dwellings. Ridgeview is located south of the Bernalillo/Sandoval County Line, east of Unser Boulevard, and west of Stonebridge Subdivision Units 2 and 4.

See vicinity map on the preliminary plat for location (Plate 1).

This study supports preliminary plat approval for Ridgeview Subdivision Unit 1. Prior to final plat and building permit approvals of this project, public improvement construction plans must be approved by the City of Albuquerque (COA), the City of Rio Rancho, and the Albuquerque Metropolitan Arroyo Flood Control Authority (AMAFCA).

II. METHODOLOGY

Existing and proposed site hydrological conditions were analyzed for the 100-year, 6-hour storm in accordance with the revised Section 22.2, Hydrology, of the Development Process Manual (DPM) for the City of Albuquerque, dated January 1993. Street capacities were analyzed using Manning's equation, consistent with the revised DPM Section 22.2. All data and calculations supporting this study are located in Appendix B. The new rational method hydrologic procedures identified within the revised DPM Section 22.2 are utilized to determine peak flow rates for design of the storm drainage improvements within the projects. The 100-year, 6-hour storm is used as the design event. The results are included in **Appendix A**.

The storm sewer system internal to the subdivision is analyzed using current DPM methods for gravity flow conditions. Inlet capacity computations, along with all hydraulic computations, are included in **Appendix B**.

III. EXISTING CONDITIONS

A. Topography



The Ridgeview Subdivision will be sited on undeveloped land with slopes ranging from approximately 2% to 10%. Soils are highly absorptive sandy soils with occasional silt lenses. Vegetation is light, consisting of chamisa, weeds and desert grasses. The site is not located within a FEMA floodplain as shown on the FEMA Floodplain Exhibit at the end of this text.

B. Existing Drainage Patterns

Historically, 285 acres of land drained 472 cfs through the Lands of Feinstein and ultimately into the Black Arroyo at the northeast corner of the site. The Historic Basin Map Exhibit displays these basins. According to the Tuscany West Master Drainage Report, McMahon will be the new separation between the Calabacillas' and Black's Drainage Basins. Until McMahon is built, one basin south of McMahon will continue to drain through Ridgeview. Two large basins located west of Unser are assumed to drain to the site. These two basins, Basins A1 and A2, contribute 169 cfs and 90 cfs, respectively.

IV. LAND TREATMENTS

The minimum lot dimensions are 50' x 100'. The percent impervious was determined using the following formula from Table A-5 of the DPM, Section 22.2.

$$\text{percent "D"} = 7 * \sqrt{(N*N) + (5*N)}$$

where N = units/acre.

V. PROPOSED DEVELOPED CONDITIONS

The proposed development is a single-family, detached-unit residential subdivision with 133 lots on 22.67 acres, producing a density of approximately 5.9 D.U. per acre. Proposed street configurations are shown on the Preliminary Plat. See **Plate 1**.

A. Offsite Flow

Lands to the south of Ridgeview are currently undeveloped and slope toward the northeast. These contributing offsite basins are accommodated by this development. Portions of these lands are zoned SU1-C1, some SU1-R1 and SU1-R2, and some RLTL. Several of these tracts are part of the Village Center development. In order to accommodate the flow produced by these tracts, two access points will be provided for storm drain conveyance and acceptance. First, a storm drain will be stubbed to the south in a drainage easement from East Rim Road. This storm drain was designed to accept undeveloped flow from the commercial tracts and developed flow from the two residential tracts. A temporary pond, Pond 1, will be sited south of the Ridgeview property line at the location of the existing arroyo. This pond is designed to accept 100 cfs and release 25.4 cfs to a temporary earthen swale at a velocity of 3.5 ft/second. A CMU Garden wall will be installed along the southern boundary of the Ridgeview Subdivision for added drainage protection and confinement. This swale is temporary and may be eliminated in the future when the property is developed. Elimination of the offsite pond is possible when two conditions are met. First, offsite developments must improve the area and participate in the appropriate upsizing of the downstream storm drain. Second, runoff south of McMahon Boulevard must be accommodated. The offsite flow is conveyed through the development via internal storm drains to a second detention pond, Pond 2. This pond is adequately sized for the fully developed condition from the basins encompassing the lands of Smith, the Lands of Feinstein, and the residential tracts to the south.



Two large offsite basins drain toward Unser from the west. These two basins contribute 169 cfs and 90 cfs respectively. Two large detention ponds, ponds #3 and #4, will be built on the west side of Unser to intercept offsite runoff before it reaches Unser. The first pond, Pond #4, will be located at the low point of Los Suenos Subdivision, Basin 3 on the Offsite Basin Map. This pond will detain the developed flow from Basins 1, 2, and 3 and release the flow to the downstream pond, Pond #3. Pond #3 will be located just south of the Bernalillo/Sandoval County Line and west of Unser Boulevard. This pond will detain all of the contributing developed flow south of the County Line and between Unser and the Los Suenos Subdivision. Runoff from Ponds #3 and #4 collect developed flow and release at a controlled and significantly reduced rate. Retention volumes will be provided such that no runoff is released in storm events equal to or less than the 2 year. The area considered is shown as basins 4, 5, 9, and 13 on the Offsite Basin Map. To get the flow from Basin 5, a swale will be graded along Unser Boulevard. The flow from the low point of Unser will enter the pond through an inlet on the east side of Unser and a pipe stubbed into the pond. Pond #3 will drain into a 24" storm drain located in Black Arroyo Boulevard that then outfalls to Pond #2. Onsite flow from the Ridgeview Subdivision also discharges to Pond #2. Pond #2 discharges to a storm drain in Black Arroyo Boulevard. The storm drain outlets through an energy dissipater at the AMAFCA property. The runoff then travels through an earthen channel to the Black Arroyo. At the arroyo, a grade control structure will be built. The calculations for all storm drain, street capacity, inlet and pond designs are in **Appendix B**.

B. Onsite Flow

The proposed basins are illustrated on the Proposed Conditions Basin Map, **Plate 3**. All flows generated by Ridgeview drain east to the Ridge Rock connection with Stonebridge Unit 4. The runoff is then collected by storm drains located in East Rim Rd, combined with offsite flows from the south, then is conveyed by storm drains to a proposed, offsite detention pond, pond #2. Pond #2 is located east of Stonebrook Place and adjacent to the future Black Arroyo Blvd. The detention pond releases flow at rates less than historic. The runoff rate for the 100-year storm was decreased from the historic



rate of 472 cfs to 85.0 cfs. This pond is 9 feet deep and detains 2.0 acre-feet of water. An additional analysis was performed to compare the existing and proposed flow during the 2-year and 10-year storms. During the 10-year, the flow was also significantly decreased from the existing conditions. The 10-year runoff was decreased from 126.5 cfs to 40 cfs from historic to developed. The 2-year storm historically produced no runoff at all. Therefore, Ponds #2, #3 and #4 were each designed to retain the 2-year runoff by installing the outlet pipe above the bottom of the pond. This retention volume reduces the lower frequency storm event flow rates. An AHYMO analysis, shown in **Appendix A**, is included to show the calculation of the flows created by this subdivision and the design of the pond.

C. Outlet Structure

The outlet structure consists of a 48" RC pipe which collects flow under "inlet control" conditions. The pipe discharges to an energy dissipater. Runoff exits the energy dissipater and is conveyed via an earthen channel and is reintroduced to the existing arroyo at flow rates and velocities significantly less than historic. Grade control structures are planned to eliminate the potential for upstream erosion on the Black Arroyo. The locations of these structures will be determined during the final design.

D. Black Arroyo Boulevard

Black Arroyo Boulevard will not be used as a drainage conveyance for the offsite flow. Only water that falls on Black Arroyo Boulevard and a small portion of Unser will be conveyed by Black Arroyo Boulevard to Pond #2.

E. Unser Boulevard / Basin 5 / McMahon Boulevard

Currently, Basin 5 drains to Pond #3 via existing earthen swales. It is assumed that fully developed runoff volumes and flow rates will be conveyed to Pond #3 via McMahon Boulevard storm drains. These storm drains will be built by the McMahon

Boulevard project or by the developer of Basin 5. Unser Boulevard also is assumed to discharge to pond #3. The approved horizontal and vertical alignment for Unser Boulevard has been revised to tie to the Rio Rancho section of Unser Boulevard. Catch basins are placed at the low point of the street.



F. Rio Rancho Outfall

The Rio Rancho Department of Public Works has conditionally approved an outfall to the Black Arroyo to the north of the St. Joseph's tract subject to several conditions. A letter dated 11/30/00 is attached at the end of this text describing the conditions of approval. This is not the primary option proposed in this report due to the extensive agreements that would be required between the City of Rio Rancho and the City of Albuquerque, however, it is a valid alternate option.

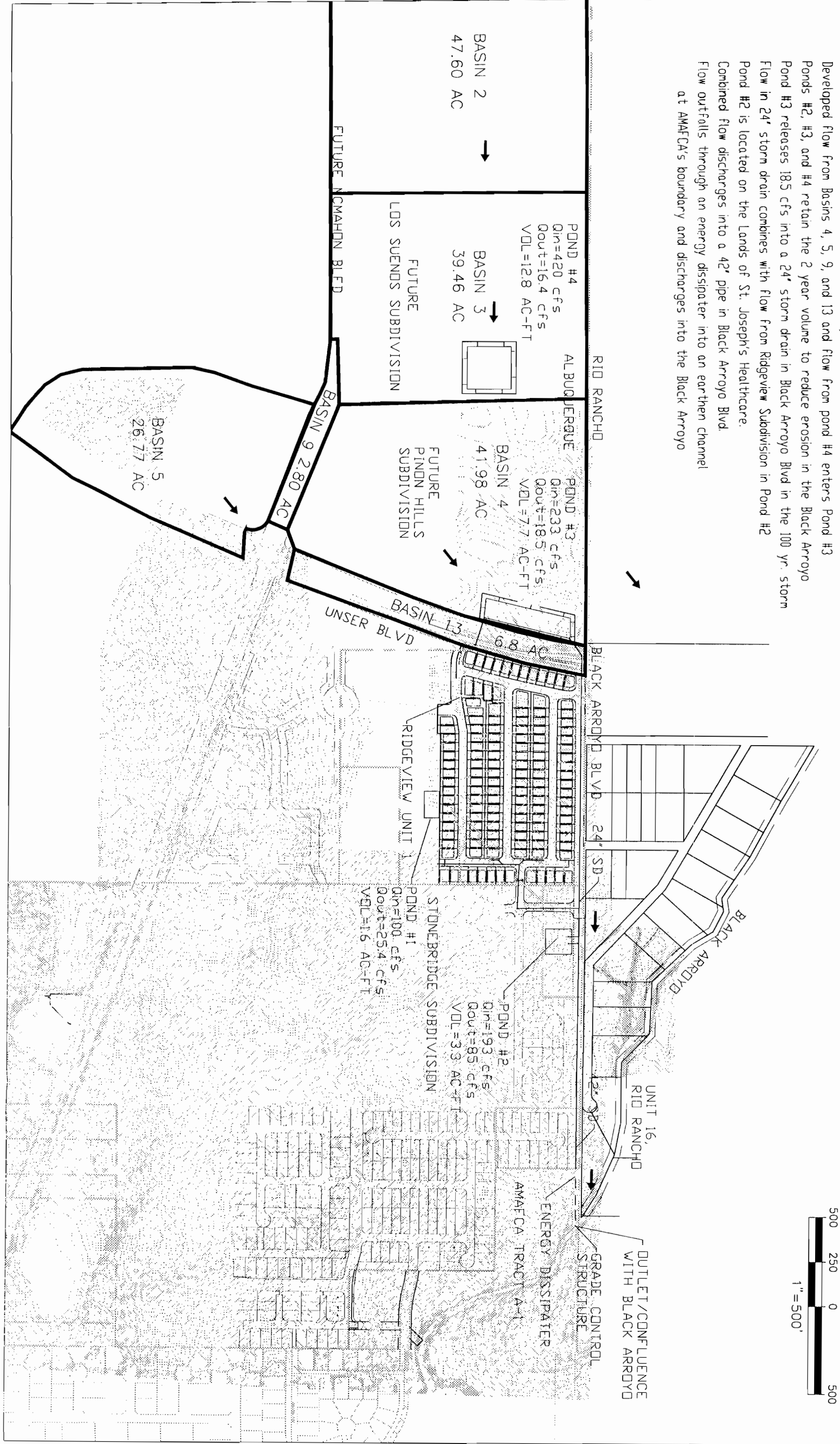
VI. CONCLUSION

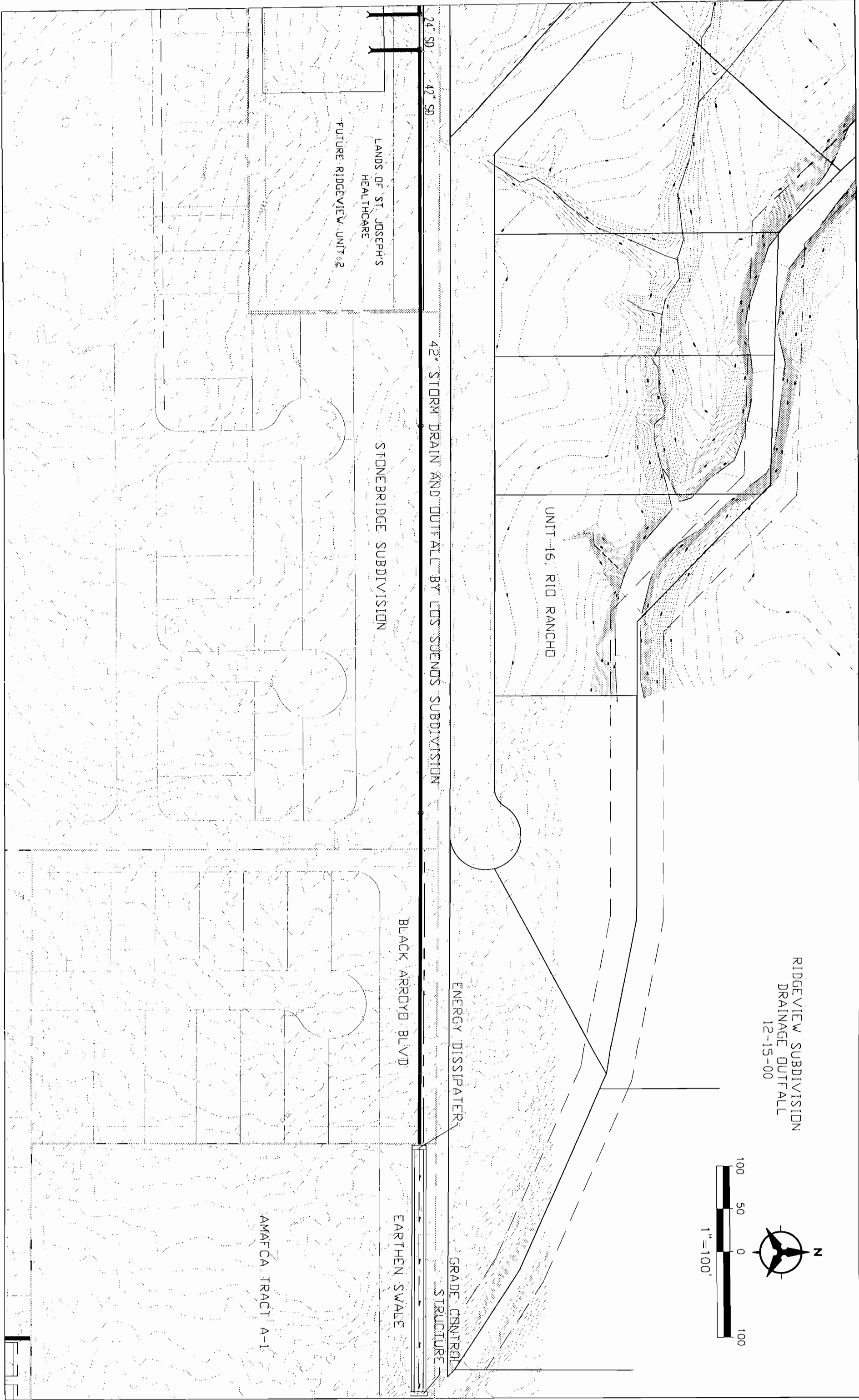
This report includes a detailed study of the existing and proposed runoff, street capacities, and pond volumes. Attached are the preliminary plat, existing conditions basin map, proposed conditions basin map, and grading plan. This drainage plan supports the planned development and provides for safe management of storm runoff. The plan addresses offsite flow runoff generated by existing and proposed developments upstream. In addition, the planned storm drain improvements protect and improve downstream basins.

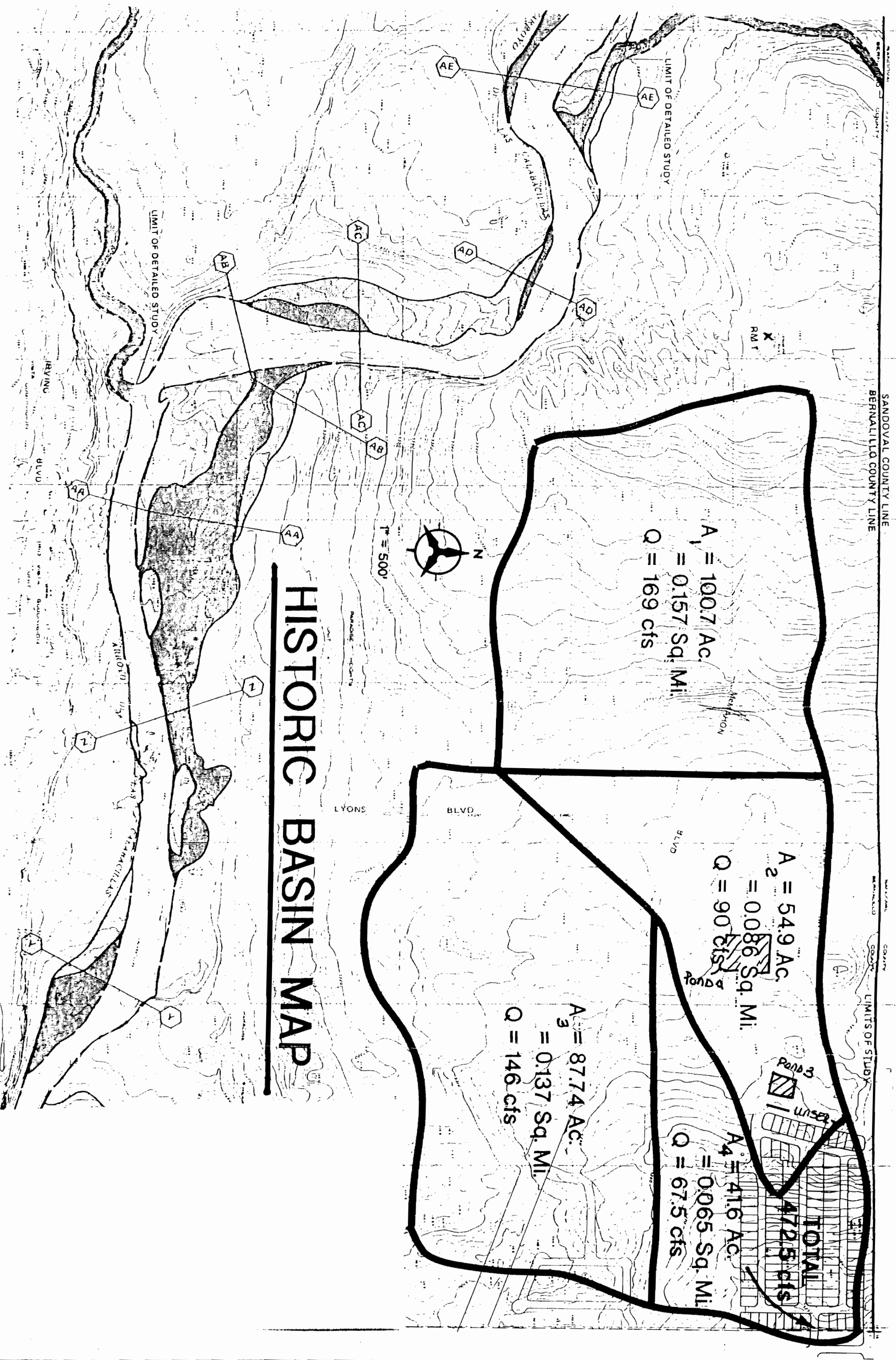
DRAINAGE PLAN SUMMARY

Developed flow from Basins 1, 2, and 3 enters pond #4
Pond #4 releases 16 cfs and retains the 2-yr flow
Developed flow from Basins 4, 5, 9, and 13 and flow from pond #4 enters Pond #3
Ponds #2, #3, and #4 retain the 2 year volume to reduce erosion in the Black Arroyo
Pond #3 releases 185 cfs into a 24" storm drain in Black Arroyo Blvd in the 100 yr. storm
flow in 24" storm drain combines with flow from Ridgeview Subdivision in Pond #2
Pond #2 is located on the Lands of St. Joseph's Healthcare.
Combined flow discharges into a 42" pipe in Black Arroyo Blvd.
Flow outfalls through an energy dissipater into an earthen channel
at AMAFCA's boundary and discharges into the Black Arroyo

RIDGEVIEW SUBDIVISION
OVERALL DRAINAGE EXHIBIT
12-15-00







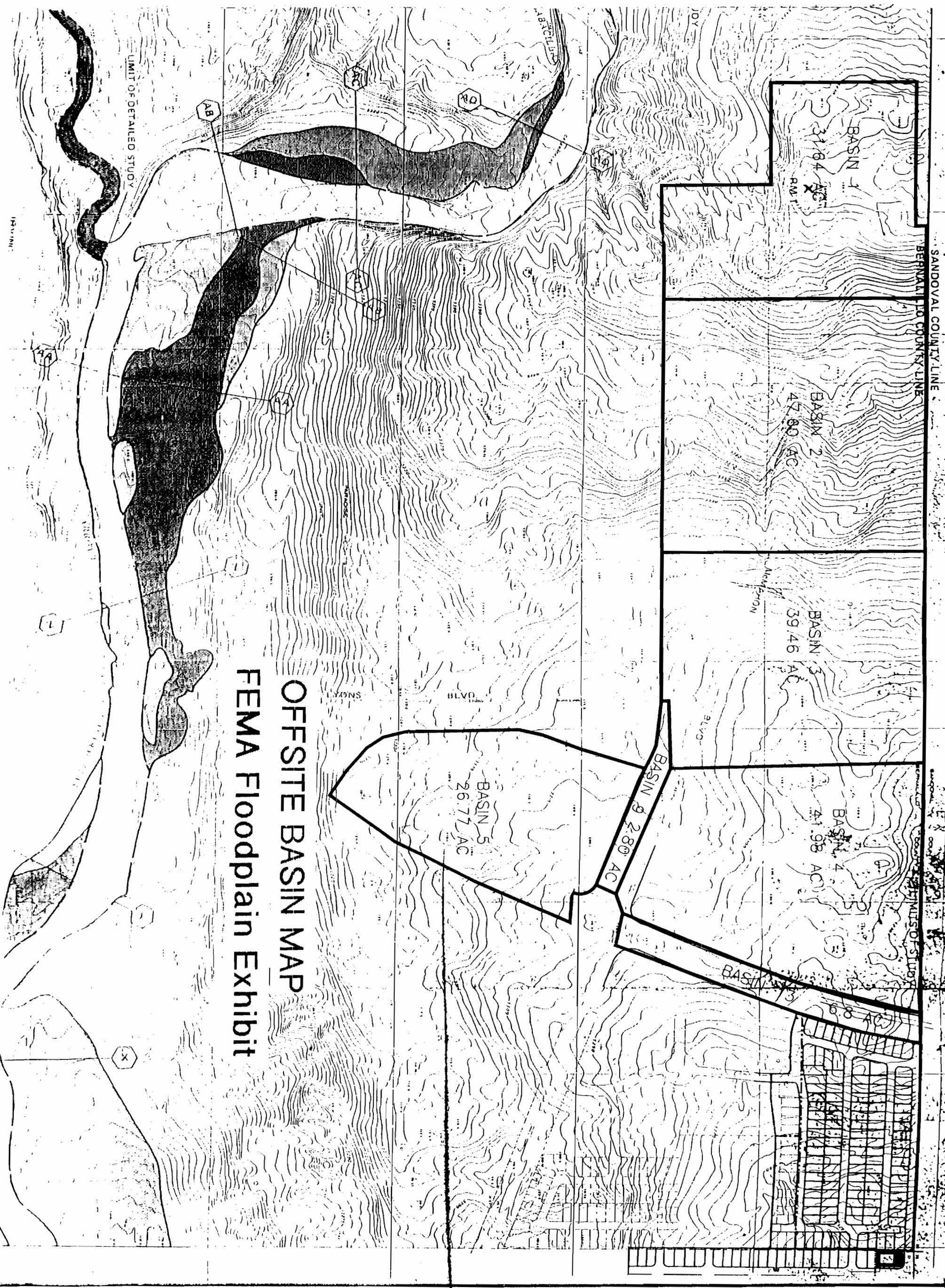
$A_1 = 100.7 \text{ Ac.}$
 $= 0.157 \text{ Sq. Mi.}$
 $Q = 169 \text{ cfs}$

$A_2 = 54.9 \text{ Ac.}$
 $= 0.086 \text{ Sq. Mi.}$
 $Q = 90 \text{ cfs}$

$A_3 = 87.74 \text{ Ac.}$
 $= 0.137 \text{ Sq. Mi.}$
 $Q = 146 \text{ cfs}$

$A_4 = 41.6 \text{ Ac.}$
 $= 0.065 \text{ Sq. Mi.}$
 $Q = 67.5 \text{ cfs}$

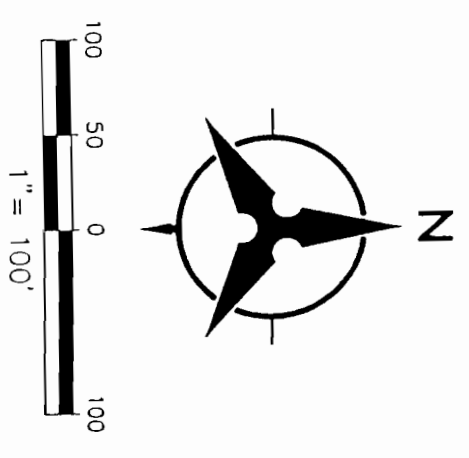
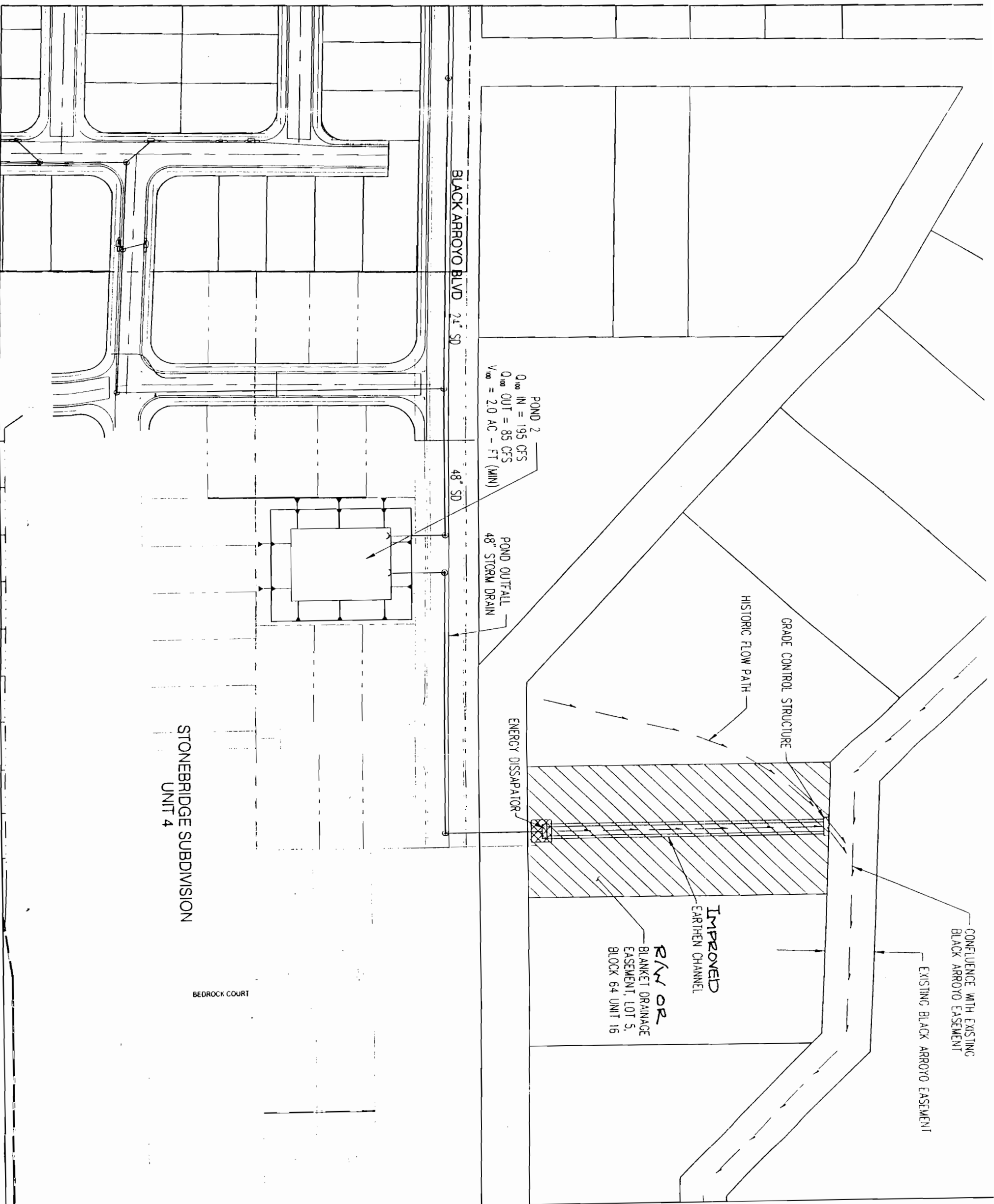
TOTAL	
472.5 cfs	



POND #2
FLOW RATE COMPARISON
RIDGEVIEW SUBDIVISION UNIT 1
11/29/00

Flow Entering Rio Rancho Before and After Development

	Existing Flow Rate (cfs)	Volume (ac-ft)	Proposed Flow Rate (cfs)	Volume (ac-ft)
100 year	473	12.9	85	27
10 year	127	3.4	40	6.6
5 year	52	1.4	20	5.5
2 year	0	0	0	0
1 year	0	0	0	0



POND 2 OUTFALL EXHIBIT 11-30-00

Bohannan & Histon



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 7500 JEFFERSON NE
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 NEW MEXICO 87109

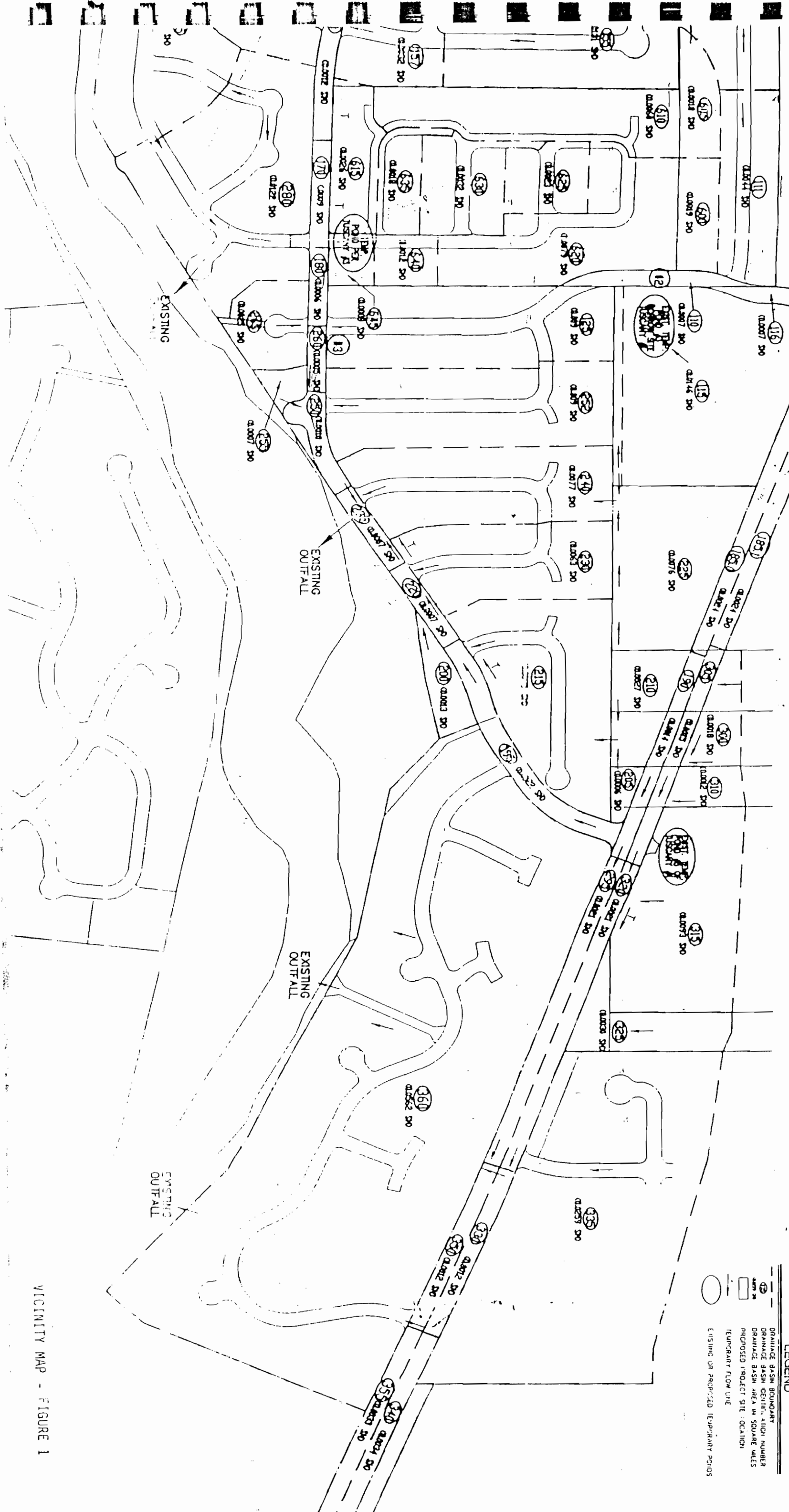
ENGINEERS PLANNERS PHOTOGRAMMETRISTS
 SURVEYORS SOFTWARE DEVELOPERS

Mc MAHON BLVD NW

STONEBRIDGE SUBDIVISION

1 LATIC 2
DRAINAGE AREA BASIN MAP
FOR
TUSCANY WEST SUBDIVISION
UNITS 1 AND 2
COMPRISED OF
TRACTS 10A-1, 11A-1, AND 12A-1, PARADISE NORTH,
AND A PORTION OF BATHILUEIR DRIVE NW
TOWN OF ALAMEDA, GRANI
"PROJECTED" SECTIONS 11 AND 12, T11H, R2E, N43PM,
CITY OF ALBUQUERQUE, BERNALILLO COUNTY, NEW MEXICO
MARCH, 1995

- LEGEND
- DRAINAGE BASIN BOUNDARY
 - DRAINAGE BASIN CENTER, ALCH NUMBER
 - DRAINAGE BASIN AREA IN SQUARE MILES
 - PROPOSED PROJECT SITE LOCATION
 - TEMPORARY FLOW LINE
 - EXISTING OR PROPOSED TEMPORARY POND



VICINITY MAP - FIGURE 1

TABLE 1
TUSCANY WEST #1 & #2
EXISTING DEVELOPMENT CONDITIONS

Basin I.D.	Area (Sq.Mi.)	Contr. Basin	Sum Area (Sq.Mi.)	Tc (M in.)	LAND TREATMENT				INCREMENTAL		FUTURE TOTAL	
					A	B	C	D	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	Q ₁₀ (cfs)
455	0.0071	450	0.0575	12	---	30	30	40	14.8		128.3	
460	0.0083	455 & 515	0.0863	12	---	30	30	40	8.4		174.7	
Q100 Total in Proposed S.D. to Outfall @ Arroyo 174.7 CFS												
S @ Point 'C'												
291	0.0017	-----	0.0017	12	---	30	30	40	2.5		2.5	
Q on Slope supporting Unser Blvd.: Q = 2.5 CFS												
461	0.0012	-----	0.0012	12	---	50	50	---	1.9		1.9	
Q to Ponds (Rear yard) at East Boundry : Q = 1.9 CFS (Rear yard Q to be divided by 10 lots)												
Drainage Areas tributary to Bandelier Drive/Tuscany Dr. And McMahon Storm Drain Systems: (Portions constructed with Tuscany #1, #2, and #3 and Paloma Del Sol projects)												
Future Developments -- Off-site to Tuscany #1, #2, and #3												
101	0.0046	---	0.0046	12	---	5	5	90	12.5		12.5	
100	0.0035	101	0.0081	12	---	5	5	90	9.5		22.0	
Q on S/S McMahon Blvd. At Point #1												
100.1	0.0035	100	0.0116	12	---	5	5	90	9.5		31.6	
105	0.0183	100.1	0.0299	12	---	30	30	40	38.2		69.8	
Total Q at Point #1; Q100 = 69.8 CFS: Divide Q 40 CFS to McMahon and 29.8 CFS to Tuscany Drive												
116	0.0007	105D	-----	12	---	5	5	90	1.9		31.7	
111	0.0044	116	0.0199	12	---	20	20	60	10.3		42.0	
110	0.0007	111	0.0206	12	---	5	5	90	1.9		43.9	
115	0.0146	110	0.0352	12	---	21	22	57	33.7		77.6	
Total Q at Point #2 - Q100 = 83.7 CFS												
125	0.0090	115	0.0442	12	---	29	29	42	19.0		94.5	
Tuscany Dr. Q A TN/S Bandelier Drive Point #3 Q100 = 94.5 CFS												
Future Off-Site Developments - N/S Bandelier Dr. (P.H. #2):												
155	0.0131		0.0131	12		30	30	40	27.4		27.4	
506	0.0003		0.0003	12		5	5	90	0.8		28.2	
156	0.0082	506	0.0085	12		30	30	40	17.1		45.3	
157	0.0032	506 & 155	0.0248	12		30	30	40	6.7		52.0	
Total Q at Bandelier Drive in Hillside Drive - Q100 = 52.0 CFS												



BOHANNON-HOUSTON, INC.

Courtyard One

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29-Nov-00

**ULTIMATE SIZED ST. JOSEPH'S POND
ACCEPTS FLOW FROM RIDGEVIEW 1, OFFSITE TO SOUTH,
AND FLOW OUT OF POND TO WEST OF UNSER WITH 24" OUTLET**

Elevation	Area ft ²	Avg Area ft ²	Increment Vol ft ³	Cum Vol ft ³	Cum Vol ac-ft	H ft	Q cfs	d (ft)=
5227.8	0		0	0	0	0	0	0.5
5228	7980.3	3990.15	798.03	798.03	0.01832	0.2	0.42	
5229	9098.9	8539.6	8539.6	9337.63	0.214362	1.2	1.04	
5230	10289.6	9694.25	9694.25	19031.88	0.43691	2.2	1.40	
5231	11552	10920.8	10920.8	29952.68	0.687616	3.2	1.69	
5232	12886.9	12219.45	12219.45	42172.13	0.968135	4.2	1.94	
5233	14293.5	13590.2	13590.2	55762.33	1.280122	5.2	2.16	
5234	15772.1	15032.8	15032.8	70795.13	1.625226	6.2	2.35	
5235	17322.8	16547.45	16547.45	87342.58	2.005102	7.2	2.54	
5236	18945.4	18134.1	18134.1	105476.7	2.421402	8.2	2.71	
5237	88958.8	53952.1	53952.1	159428.8	3.659967	9.2	2.87	
5238	93499.6	91229.2	91229.2	250658	5.754293	10.2	3.02	
5239	18897	56198.3	56198.3	306856.3	7.044423	11.2	3.16	

WEST OF UNSER- WATER SURFACE MUST BE LESS THAN 86.7

Elevation	Area ft ²	Avg Area ft ²	Increment Vol ft ³	Cum Vol ft ³	Cum Vol ac-ft	H ft	Q cfs	d (ft)=
5275.9	0		0	0	0	0	0	1.8
5276	52817.5	26408.75	2640.875	2640.875	0.060626	0.01	1.23	
5277	56419	54618.25	54618.25	57259.13	1.314484	0.02	1.73	
5278	60093	58256	58256	115515.1	2.651852	0.03	2.12	
5279	63841	61967	61967	177482.1	4.074413	0.04	2.45	
5280	67663	65752	65752	243234.1	5.583865	1	12.25	
5281	71558	69610.5	69610.5	312844.6	7.181896	2	17.33	
5282	75526	73542	73542	386386.6	8.870182	3	21.22	
5283	79569	77547.5	77547.5	463934.1	10.65042	4	24.51	
5284	83684	81626.5	81626.5	545560.6	12.5243	5	27.40	



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LOS SUENOS POND

Elevation	Area ft ²	Avg Area ft ²	increment Vol ft ³	Cum Vol ft ³	Cum Vol ac-ft	H ft	Q cfs	d (ft)=	1.4
5288.9	0		0	0	0	0	0		
5289	58081	29040.5	2904.05	2904.05	0.066668	0.01	0.74		
5290	61009	59545	59545	62449.05	1.433627	0.02	1.05		
5291	64009	62509	62509	124958.1	2.868631	0.03	1.28		
5292	67081	65545	65545	190503.1	4.373331	0.04	1.48		
5293	70225	68653	68653	259156.1	5.949381	1	7.41		
5294	73441	71833	71833	330989.1	7.598433	2	10.48		
5295	76729	75085	75085	406074.1	9.322141	3	12.84		
5296	80089	78409	78409	484483.1	11.12216	4	14.82		
5297	83521	81805	81805	566288.1	13.00013	5	16.57		
5298	87025	85273	85273	651561.1	14.95773	6	18.16		

=====

Drainage Structure Analyzer

Channel Hydraulic Analysis

Date: Tuesday, October 24, 2000 02:58:11 PM
=====

Input Data

Shape	V-Shaped
Material	Bare Soil
Roughness	0.020000
Left Slope	5.50%
Right Slope	4.50%
Bed Slope	2.00%
Flow Rate	472.50 cfs

Output Results

Flow Rate	472.50 cfs
Depth	1.61 ft
Velocity	9.07 ft/s
Top Width	64.88 ft
Critical Depth	2.02 ft

Super Critica

POND #2
FLOW RATE COMPARISON
RIDGEVIEW SUBDIVISION UNIT 1
11/29/00

Flow Entering Rio Rancho Before and After Development

	Existing Flow Rate (cfs)	Volume (ac-ft)	Proposed Flow Rate (cfs)	Volume (ac-ft)
100 year	473	12.9	85	27
10 year	127	3.4	40	6.6
5 year	52	1.4	20	5.5
2 year	0	0	0	0
1 year	0	0	0	0

RIDGE VIEW SUBDIVISION

INLET & STREET CAPACITY CALCULATIONS

9/21/00



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I. WEST Rim DRIVE.

$$S = 0.5\%$$

$$Q = 50 \text{ cfs (Basin A1) see AHynno summary table or Basin map}$$

At 0.5%, a road can handle 12.7 cfs in roll curb. No inlets needed. See PC Stream output.

- Add Basin A2

$$\begin{array}{r} 5 \text{ cfs} \\ + 2.6 \text{ cfs} \\ \hline 7.6 \text{ cfs} < 12.7 \text{ cfs OK} \end{array}$$

- Water Flows into Crown Ridge Rd

II Crown Ridge Rd.

$$S = 2.35\%$$

$$Q = 24.41 \text{ cfs (7.6 A1+A2 + 16.8 Basin B)}$$

At slope of 2.35%, the road can convey 31.8 cfs. No inlets required.

At 2.63%, the road can convey 29.3 cfs. OK

The water then enters East Rim Drive.

III East Rim

$$\begin{array}{l} Q = 24.41 + 4.1 \text{ (Basin C)} \\ = 28.5 \text{ cfs} \end{array}$$

$$S = 1.5\%$$

At 1.5%, the road can handle 36.4 cfs.

Add inlets to relieve Ridge Rock Intersection.

At 28.5 cfs, the depth is 0.48' (see PC Stream output)
6 cfs/grate - use 2 grates = 12 cfs in storm drain
16.5 in Street

IV Mesa Ridge Road

Basin D

$$Q = 17.1 \text{ cfs}$$

$$S = 3.01\%$$

At 3%, the road can handle 31.8 cfs.

$$17.1 < 31.8 \text{ no inlets required.}$$

roll curb can handle 9.5 cfs

$$33 \text{ lots} / 17.1 \text{ cfs} = 2 \text{ lots/cfs or } 0.5 \text{ cfs/lot}$$

After 18 lots, need standard curb

This water joins remaining water from
Crown Ridge and Summer Ridge on
East Rim Drive.

$$\underline{Q = 17.1 \text{ cfs}} \text{ contributing.}$$

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V Summer Ridge

Basins F + G

$$Q = 11 + 7.8 \text{ cfs} = 18.8 \text{ cfs.}$$

$$S = 2.51\%$$

At 2.51%, the road can handle 30.7 cfs w/ standard curb
and 8.9 cfs with roll

$$18.8 < 30.7 \quad \underline{\text{no inlets needed}}$$

36 lots and 18.8 cfs

$$\frac{18.8 \text{ cfs}}{36 \text{ lots}} = 0.52 \text{ cfs/lot}$$

$$\frac{8.9 \text{ cfs}}{0.52 \text{ cfs/lot}} = 17 \text{ lots before you need std. curb.}$$

This flow adds to Basin H on East Rim RD.

VI East Rim

$$\begin{array}{r} Q = 18.8 \text{ cfs - Summer Ridge} \\ + \\ 2.8 \text{ cfs Basin H} \\ \hline 21.6 \text{ cfs.} \end{array}$$

$$S = 0.78\%$$

At 0.78%, the road can convey 41.0 cfs.

$$21.6 < 41 \text{ cfs.}$$

This 21.6 cfs adds to Mesa Ridge and

Crown Ridge on East Rim.

Add inlets to relieve intersection of East Rim/Mesa Ridge

$$d = 0.49' \quad \text{see PC Stream output}$$

$$Q = 5.6 \text{ cfs/inlet}$$

$$\text{USE 2 grates } Q_{in} = 11.2 \text{ cfs}$$

$$\underline{10.4 \text{ cfs}} \text{ remains in street}$$

VII East Run at Ridge Rock

$$\begin{aligned} Q &= 10.4 \text{ from Summer Ridge} \\ &+ 17.1 \text{ from Mesa Ridge} \\ &+ 16.5 \text{ from Crain Ridge} \\ &\hline &44 \text{ cfs total} \end{aligned}$$

At low point $S=0\%$

Half street flow turns onto Ridge Rock

Half street flow captured by inlets

22 cfs in half street

At curb depth, a double 'A' can take
28 cfs. > 22 cfs.

Install a double 'A' inlet at the low point.

VIII Ridge Rock

$$Q = 22 \text{ cfs.}$$

$$S = 2.05\%$$

At 2.05%, the road can convey 34.2 cfs.

Install inlets because Stonebridge will
only accept 15.62 cfs.

At 22 cfs, the road is 0.43' deep.

The inlet takes 6.1 cfs/grate

Install 2 inlets

$$6.1 \times 2 = 12.2$$

$$22 - 12.2 = 9.8 \text{ cfs bypassed to Stonebridge.}$$



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