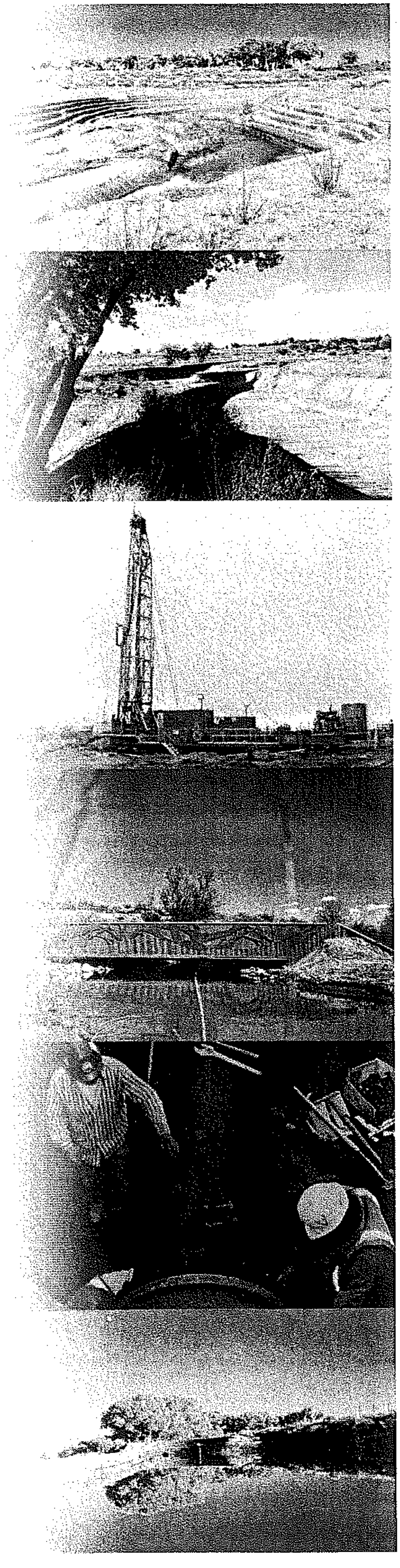
PICACHO HILLS DRAINAGE MASTER PLAN



MARCH 2009

Prepared for:

Dona Ana County Flood Commission
845 N. Motel Boulevard
Las Cruces, NM 88001

Prepared by:

Bohannan Huston INC.

ENGINEERING
SPATIAL DATA
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I. Introduction

The objective of this drainage master plan (DMP) is to assess the functionality of the drainage system within the Picacho Hills community and propose potential improvements. Bohannan-Huston, Inc. (BHI) prepared hydrologic models for the community for both current and fully built out conditions. These models quantify the current and future storm water runoff volumes and flow rates. The project area includes the community of Picacho Hills, NM and surrounding areas which include the Nafzinger Arroyo and its contributing watershed. **Figure 1: Vicinity Map** provides a graphical representation of the study area limits.

The emphasis of the master plan is to determine how to improve drainage issues throughout the community based upon information provided by Doña Ana county and local residents. The quantity and locations of these problems indicate area-wide issues within the study area. The system as a whole was evaluated and improvements were proposed such that the system can perform more effectively. Improvements proposed may not directly mitigate all existing drainage issues throughout the community. However, the proposed improvements will indirectly mitigate many existing local drainage problems by improving the efficiency of the system as a whole. These improvements include modifying existing drainage infrastructure capacities and establishing clear maintenance requirements for existing and proposed drainage infrastructure.

The 100-yr (1% chance) storm event is considered the standard design storm by Doña Ana County and the majority of local, state and federal agencies. Doña Ana County requested that the study area analysis assume a high antecedent soil moisture condition at the time of the modeled storm event. Additionally, the effects of sediment loading within storm flows were included in the analysis. These analysis assumptions are conservative in quantifying storm runoff volumes and flow rates.

II. Background Information

A. Drainage Patterns

Nestled on the escarpment separating the mesa to the west and the river valley to the east, the Picacho Hills community is a medium to low density residential development. The community was originally centered on the Picacho Hills Country Club, an 18-hole golf course. Today, the community has grown westward from the Country Club. The drainage area that impacts the current Picacho Hills community is roughly bounded by the Las Cruces International Airport to the west, farm land to the east, Picacho Mountain to the north and US 70 to the south. In total, this drainage area encompasses of approximately 13 square miles of land. The contributing drainage area ranges in elevation from 4505 ft., west of the community, to 3910 at the southeastern edge of the community. The study area generally slopes from west to east, with an average land slope of approximately 3.5 percent, excluding steep slopes along the escarpment.

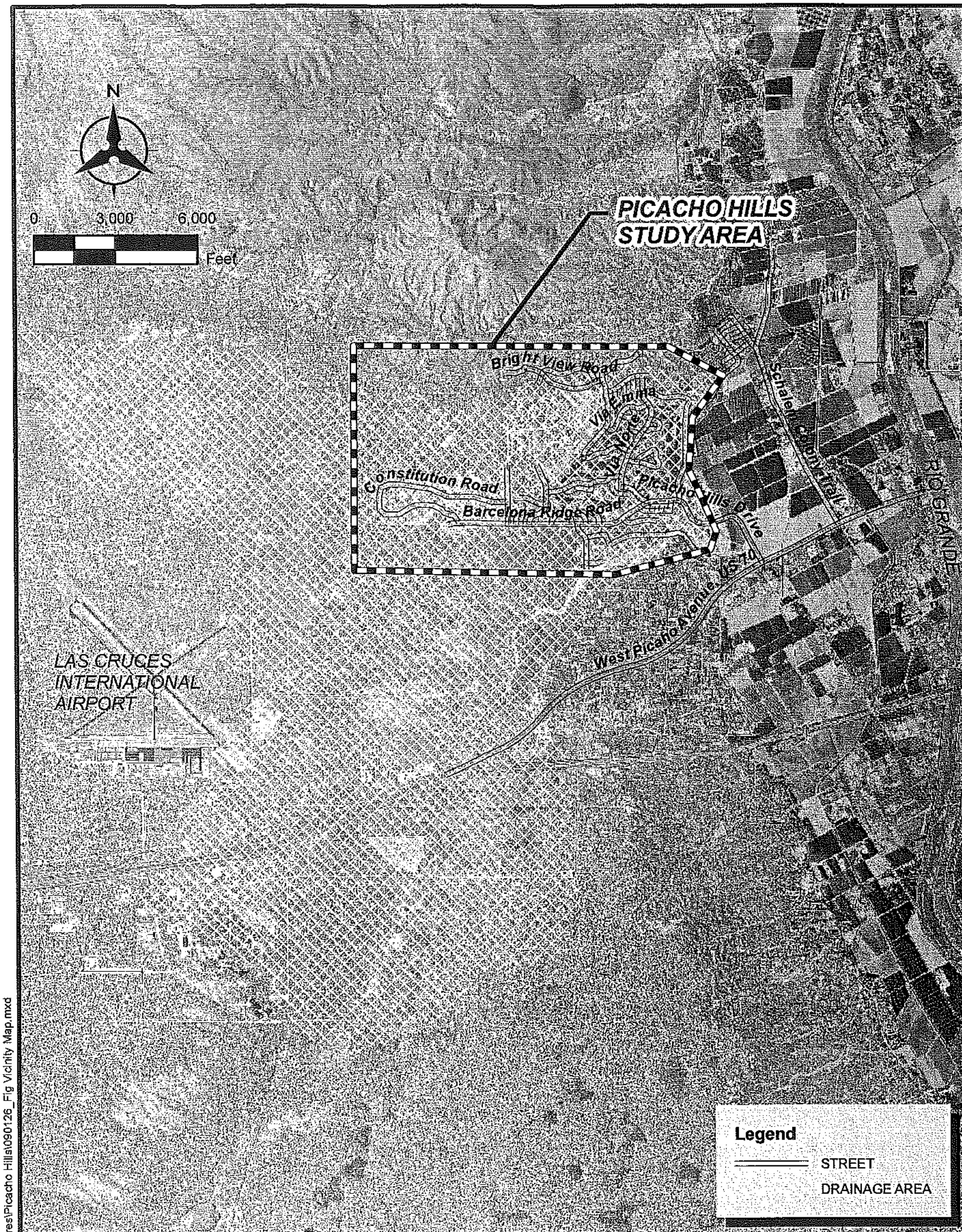

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FIGURE 1: VICINITY MAP

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CHECKED BY: LBS	PROJECT NO: 090126

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Storm water generally flows from the top of the escarpment eastward through the development along one of four principle drainage ways toward the Rio Grande. The principle historic drainage ways are interspersed with small manmade detention and retention facilities linked by natural arroyo channels. Each system conveys water toward the Rio Grande, however there is no direct connection to the river. Currently, storm water reaches the edge of the Picacho Hills community and spills onto local farm land.

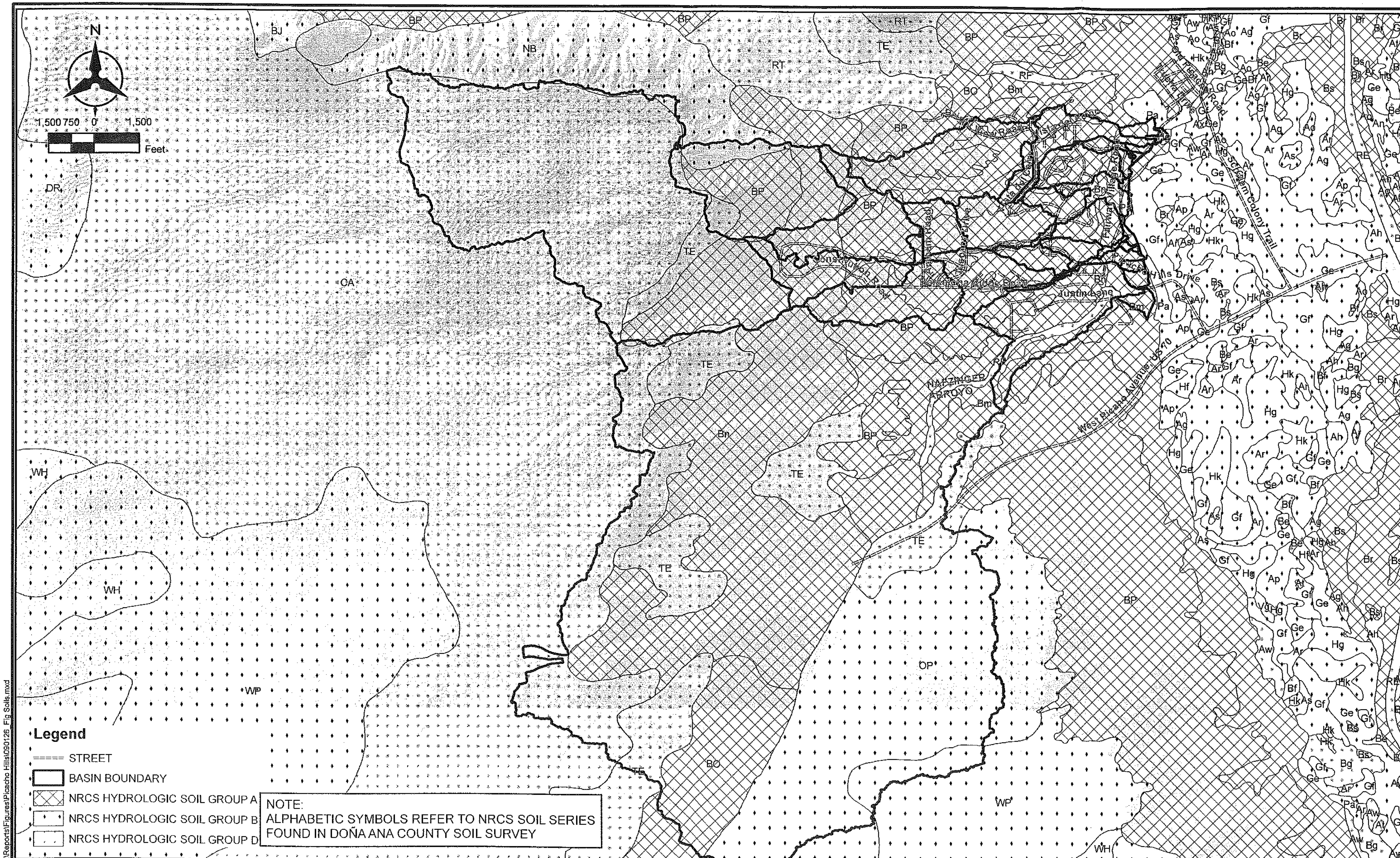
B. **Topographic Data**

A Digital Elevation Model (DEM) was generated for the drainage area which represents the topographic characteristics of the study area. The data utilized to generate the DEM is an assembly of two data sets covering the Picacho Hills area. In 2004, Doña Ana County procured aerial photography and related lidar data for the county. This data remains viable for the majority of the study area; however, certain areas within the Picacho Hills community have changed considerably since the 2004 mapping effort. Areas where development has dramatically altered the landscape since 2004 were updated with data obtained in 2007. Using the 2007 Doña Ana County aerial imagery, BHI prepared a revised digital surface which replaced the out-of-date data within the 2004 mapping. The completed DEM updated with 2007 data was utilized in the creation of the hydrologic models.

C. **Geology**

The Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database for Doña Ana County was utilized for the hydrologic analysis. Knowledge concerning the hydrologic character and performance of different soil types is critical in determining rainfall runoff. The Picacho Hills community and contributing drainage area contains approximately thirteen different soil types. For drainage analysis purposes, the NRCS groups soil types are grouped according to hydrologic performance. Soil composition, runoff potential and infiltration rates are used to classify soils in one of four hydrologic classes A, B, C or D. Generally, runoff rates increase from Group A to Group D soils.

Soils within the Picacho Hills area include Group A, B and D soils with the majority of the soils being Group A soils. Group D soils are principally finer grains and are characterized by lower infiltration rates; these soils are found principally on the western mesa top. **Figure 2 – NRCS Soil Classification,** is a graphical representation of the soil distribution throughout the study area.



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PICACHO HILLS DRAINAGE MASTER PLAN	DRAWN BY: KWJ	DATE: JAN 2009	NRCS SOIL CLASSIFICATION
	CHECKED BY: LBS	PROJECT NO: 090126	FIGURE 2

D. **Land use**

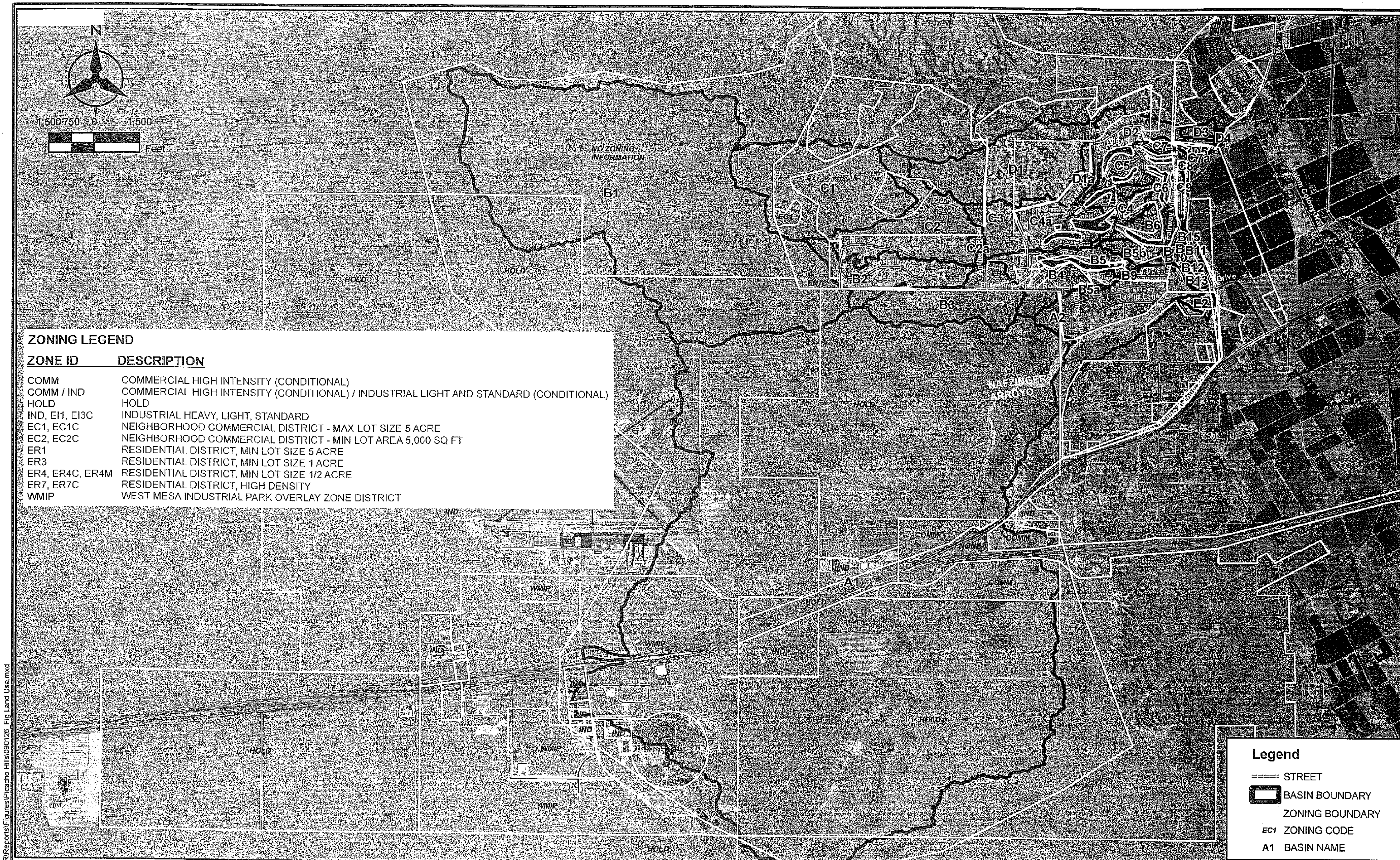
The existing land use and levels of development within the Picacho Hills community was assessed using 2007 aerial photography of the area. Six general land uses were noted within the Picacho Hills community: Agricultural, Residential–1 acre lot, Residential–1/3 acre lot, Residential-1/8 acre lot, Golf Course, and undeveloped land. These land uses were utilized to prepare the existing conditions hydrologic model.

Those basins and sub-basins outside of the currently developed area of the Picacho Hills community were assessed based upon the current property zoning to assess future fully developed conditions. Using the current zoning information for these undeveloped areas added four additional land usages: Residential-4 acre lot, Residential-1/2 acre lot, Commercial/Business, and Industrial. **Figure 3A: Land Use** and **Figure 3B: Land Use Tables** provide additional information.

III. Historical Background

A. Previous Studies

In an effort to better understand the existing drainage conditions within the Picacho Hills area a review of existing literature related to the areas drainage systems was conducted. The majority of residential developments within the Picacho Hills community were required to prepare drainage reports to support their design and construction. **Table 1** is a list of drainage reports made available for review. Unfortunately, the drainage reports for the following subdivisions were not available for review for the purposes of this report: La Quinta, Spanish Ridge, Plaza at Picacho Hills, Pueblo Gardens, Villa Buena Suerte Picacho Hills, Vista Hermosa, Camino Blanco Picacho Hills, Camino Blanco 2, Pueblo Vista, Vista Del Monte Picacho, Picacho Hills #1, Quesenberry Estates #1, Barcelona Ridge Estates, Butterfield Ridge, Alto Estates Unit 1, Alto Estates Unit 2, Alto Estates Unit 3, Via Emma, Villa Chiquita, Vista Del Valle Picacho Hills, Vista Del Oro Picacho Hills, Fairway Village Phase 3, Villa Buena Suerte Picacho Hills, Murano Estates, Tuscany Villas, Fairway 18 Villas, and Picacho Mountain 2. These subdivisions comprise approximately 50% of the study area. However, field visits were conducted to assess conditions and drainage infrastructure to address the lack of technical information.



ZONING LEGEND

ZONE ID	DESCRIPTION
COMM	COMMERCIAL HIGH INTENSITY (CONDITIONAL)
COMM / IND	COMMERCIAL HIGH INTENSITY (CONDITIONAL) / INDUSTRIAL LIGHT AND STANDARD (CONDITIONAL)
HOLD	HOLD
IND, EI1, EI3C	INDUSTRIAL HEAVY, LIGHT, STANDARD
EC1, EC1C	NEIGHBORHOOD COMMERCIAL DISTRICT - MAX LOT SIZE 5 ACRE
EC2, EC2C	NEIGHBORHOOD COMMERCIAL DISTRICT - MIN LOT AREA 5,000 SQ FT
ER1	RESIDENTIAL DISTRICT, MIN LOT SIZE 5 ACRE
ER3	RESIDENTIAL DISTRICT, MIN LOT SIZE 1 ACRE
ER4, ER4C, ER4M	RESIDENTIAL DISTRICT, MIN LOT SIZE 1/2 ACRE
ER7, ER7C	RESIDENTIAL DISTRICT, HIGH DENSITY
WMIP	WEST MESA INDUSTRIAL PARK OVERLAY ZONE DISTRICT

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PICACHO HILLS DRAINAGE MASTER PLAN	DRAWN BY: KWJ	DATE: JAN 2009	LAND USE FIGURE 3A
	CHECKED BY: LBS	PROJECT NO: 090126	

EXISTING CONDITIONS LAND USE

BASIN NAME	LAND USE	PERCENT OF BASIN
A1	Undeveloped	99.99%
	Residential - 1 acre lot	0.01%
A2	Undeveloped	48.30%
	Residential - 1 acre lot	45.88%
	Residential - 1/3 acre lot	5.81%
B1	Undeveloped	99.99%
	Residential - 1 acre lot	0.01%
B10	Agriculture	0.11%
	Undeveloped	39.55%
	Residential - 1 acre lot	34.72%
	Residential - 1/3 acre lot	21.72%
	Golf Course	3.91%
B11	Undeveloped	43.22%
	Residential - 1 acre lot	56.78%
B12	Undeveloped	0.20%
	Residential - 1 acre lot	99.80%
B13	Undeveloped	12.12%
	Residential - 1 acre lot	87.88%
B14	Undeveloped	100.00%
B15	Agriculture	5.00%
	Undeveloped	82.78%
	Residential - 1 acre lot	6.98%
	Residential - 1/8 acre lot	5.24%
B2	Undeveloped	25.78%
	Residential - 1 acre lot	74.22%
B3	Undeveloped	81.74%
	Residential - 1 acre lot	16.52%
	Residential - 1/3 acre lot	1.74%
B4	Undeveloped	33.94%
	Residential - 1 acre lot	27.90%
	Residential - 1/3 acre lot	31.87%
	Golf Course	6.29%
B5	Undeveloped	14.78%
	Residential - 1 acre lot	8.94%
	Residential - 1/3 acre lot	54.99%
	Golf Course	21.28%
B5a	Undeveloped	0.12%
	Residential - 1 acre lot	95.70%
	Residential - 1/3 acre lot	4.19%
B5b	Undeveloped	28.57%
	Residential - 1 acre lot	5.07%
	Residential - 1/3 acre lot	59.71%
	Golf Course	6.65%
B6	Undeveloped	27.68%
	Residential - 1/3 acre lot	34.50%
	Residential - 1/8 acre lot	0.58%
	Golf Course	37.24%
B7	Undeveloped	71.10%
	Residential - 1/3 acre lot	9.52%
	Golf Course	19.38%
B9	Residential - 1 acre lot	56.27%
	Residential - 1/3 acre lot	43.73%

BASIN NAME	LAND USE	PERCENT OF BASIN
C1	Undeveloped	100.00%
C2	Undeveloped	57.25%
	Residential - 1 acre lot	42.75%
C2a	Undeveloped	3.77%
	Residential - 1 acre lot	96.23%
C3	Undeveloped	15.41%
	Residential - 1 acre lot	83.33%
	Residential - 1/3 acre lot	1.26%
C4	Undeveloped	16.01%
	Residential - 1/3 acre lot	67.36%
	Golf Course	16.63%
C4a	Residential - 1 acre lot	6.97%
	Residential - 1/3 acre lot	73.47%
	Golf Course	19.56%
C5	Undeveloped	20.55%
	Residential - 1/3 acre lot	54.07%
	Residential - 1/8 acre lot	3.88%
	Golf Course	21.50%
C6	Agriculture	0.28%
	Undeveloped	32.95%
	Residential - 1/3 acre lot	30.93%
	Residential - 1/8 acre lot	15.98%
	Golf Course	19.87%
C7	Undeveloped	30.45%
	Residential - 1/3 acre lot	61.44%
	Golf Course	8.10%
C7a	Agriculture	13.38%
	Undeveloped	86.62%
C8	Agriculture	3.14%
	Undeveloped	67.21%
	Residential - 1/3 acre lot	0.07%
	Residential - 1/8 acre lot	29.59%
C9	Undeveloped	50.08%
	Residential - 1/8 acre lot	49.92%
D1	Undeveloped	28.20%
	Residential - 1 acre lot	71.72%
	Residential - 1/3 acre lot	0.08%
D1a	Undeveloped	0.09%
	Residential - 1 acre lot	35.83%
	Residential - 1/3 acre lot	64.08%
D2	Agriculture	9.01%
	Undeveloped	22.94%
	Residential - 1 acre lot	36.68%
	Residential - 1/3 acre lot	30.16%
	Golf Course	1.21%
D3	Agriculture	100.00%
D4	Undeveloped	29.33%
	Agriculture	70.67%
D5	Agriculture	15.26%
	Undeveloped	84.74%
E2	Undeveloped	90.27%
	Residential - 1 acre lot	9.73%

FUTURE CONDITIONS LAND USE

BASIN NAME	LAND USE	PERCENT OF BASIN
A1	Agricultural	1.53%
A1	Undeveloped	3.15%
A1	Residential - 1 acre lot	0.01%
A1	Residential - 1/2 acre lot	61.02%
A1	Commercial / Business	4.87%
A1	Industrial	29.42%
A2	Undeveloped	5.67%
A2	Residential - 1 acre lot	45.88%
A2	Residential - 1/3 acre lot	5.81%
A2	Residential - 1/2 acre lot	42.63%
B1	Undeveloped	72.64%
B1	Residential - 1 acre lot	0.01%
B1	Residential - 1/8 acre lot	2.72%
B1	Residential - 1/2 acre lot	8.66%
B1	Industrial	15.97%
B10	Agricultural	0.11%
B10	Undeveloped	39.55%
B10	Residential - 1 acre lot	34.72%
B10	Residential - 1/3 acre lot	21.72%
B10	Golf Course	3.91%
B11	Undeveloped	43.22%
B11	Residential - 1 acre lot	56.78%
B12	Undeveloped	0.20%
B12	Residential - 1 acre lot	99.80%
B13	Undeveloped	11.48%
B13	Residential - 1 acre lot	87.88%
B13	Commercial / Business	0.64%
B14	Undeveloped	100.00%
B15	Agricultural	5.00%
B15	Undeveloped	82.78%
B15	Residential - 1 acre lot	6.98%
B15	Residential - 1/8 acre lot	5.24%
B2	Residential - 1 acre lot	74.22%
B2	Residential - 1/8 acre lot	8.08%
B2	Residential - 1/2 acre lot	17.69%
B2	Commercial / Business	0.01%
B3	Residential - 1 acre lot	16.52%
B3	Residential - 1/3 acre lot	1.74%
B3	Residential - 1/2 acre lot	81.66%
B3	Commercial / Business	0.09%
B4	Undeveloped	2.22%
B4	Residential - 1 acre lot	27.90%
B4	Residential - 1/3 acre lot	31.87%
B4	Golf Course	6.29%
B4	Residential - 1/2 acre lot	31.72%
B5	Undeveloped	14.71%
B5	Residential - 1 acre lot	8.94%
B5	Residential - 1/3 acre lot	54.99%
B5	Golf Course	21.28%
B5	Residential - 1/2 acre lot	0.07%
B5a	Residential - 1 acre lot	95.70%
B5a	Residential - 1/3 acre lot	4.19%
B5a	Residential - 1/2 acre lot	0.12%
B5b	Undeveloped	28.57%
B5b	Residential - 1 acre lot	5.07%
B5b	Residential - 1/3 acre lot	59.71%
B5b	Golf Course	6.65%
B6	Undeveloped	27.67%
B6	Residential - 1/3 acre lot	34.50%
B6	Residential - 1/8 acre lot	0.59%
B6	Golf Course	37.24%
B7	Undeveloped	71.10%
B7	Residential - 1/3 acre lot	9.52%
B7	Golf Course	19.38%
B9	Residential - 1 acre lot	56.27%
B9	Residential - 1/3 acre lot	43.73%

BASIN NAME	LAND USE	PERCENT OF BASIN
C1	Undeveloped	19.61%
C1	Residential - 1/8 acre lot	31.86%
C1	Residential - 1/2 acre lot	44.82%
C1	Commercial / Business	3.71%
C2	Residential - 1 acre lot	42.75%
C2	Residential - 1/8 acre lot	9.09%
C2	Residential - 1/2 acre lot	48.16%
C2a	Residential - 1 acre lot	4.27%
C2a	Residential - 1/2 acre lot	0.17%
C3	Residential - 1 acre lot	83.33%
C3	Residential - 1/3 acre lot	1.26%
C3	Residential - 1/2 acre lot	15.41%
C4	Undeveloped	16.01%
C4	Residential - 1/3 acre lot	67.36%
C4	Golf Course	16.63%
C4a	Residential - 1 acre lot	6.97%
C4a	Residential - 1/3 acre lot	73.47%
C4a	Golf Course	19.56%
C5	Undeveloped	20.55%
C5	Residential - 1/3 acre lot	54.07%
C5	Residential - 1/8 acre lot	3.88%
C5	Golf Course	21.50%
C6	Agricultural	0.28%
C6	Undeveloped	32.95%
C6	Residential - 1/3 acre lot	30.93%
C6	Residential - 1/8 acre lot	15.98%
C6	Golf Course	19.87%
C7	Undeveloped	12.86%
C7	Residential - 1 acre lot	6.63%
C7	Residential - 1/3 acre lot	61.44%
C7	Residential - 1/8 acre lot	0.03%
C7	Golf Course	8.10%
C7	Residential - 5 acre lot	10.94%
C7a	Agricultural	13.38%
C7a	Residential - 1 acre lot	86.62%
C8	Agricultural	3.14%
C8	Undeveloped	53.60%
C8	Residential - 1 acre lot	13.61%
C8	Residential - 1/3 acre lot	0.07%
C8	Residential - 1/8 acre lot	29.59%
C9	Undeveloped	50.08%
C9	Residential - 1/8 acre lot	49.92%
D1	Residential - 1 acre lot	71.72%
D1	Residential - 1/3 acre lot	0.08%
D1	Residential - 1/8 acre lot	0.68%
D1	Residential - 1/2 acre lot	27.52%
D1a	Undeveloped	0.09%
D1a	Residential - 1 acre lot	35.84%
D1a	Residential - 1/3 acre lot	64.07%
D2	Agricultural	0.14%
D2	Undeveloped	9.54%
D2	Residential - 1 acre lot	48.15%
D2	Residential - 1/3 acre lot	30.16%
D2	Residential - 1/8 acre lot	0.10%
D2	Golf Course	1.21%
D2	Residential - 5 acre lot	10.70%
D3	Residential - 1 acre lot	100.00%
D4	Undeveloped	29.33%
D4	Residential - 1 acre lot	70.67%
D5	Agricultural	13.67%
D5	Undeveloped	2.75%
D5	Residential - 1 acre lot	83.58%
E2	Undeveloped	2.47%
E2	Residential - 1 acre lot	9.73%
E2	Residential - 1/2 acre lot	87.80%

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	CHECKED BY: LBS	PROJECT NO: 090126	

Table 1 – Available Existing Drainage Reports

Subdivision Name	Engineering Consultant	Date
Ranchos De Picacho – Phase 1	Southwest Engineering Inc.	May 1998
Ranchos De Picacho – Phase 2	Southwest Engineering Inc.	September 2003
Linda Vista Estates – Phase 1	Southwest Engineering, Inc.	December 2003
Linda Vista - Phase 2	Zia Engineering & Environmental	April 2006
Las Estancias de Picacho Mountain	Zia Engineering & Environmental	March 2006
Coronado Ridge – Phase 1	Rio Vista Engineering	December 2002
Coronado Ridge – Phase 2	Denton Ventures, Inc.	November 2003
Coronado Ridge – Phase 3	Denton Ventures, Inc.	October 2004
Fairway 18	Denton Ventures, Inc.	April 2004
Fairway 18 Townhomes	Denton Ventures, Inc.	April 2005
Mansiones de Galicia	Denton Ventures, Inc.	July 2005
Mansiones de Galicia - UPDATE	Gunaji-Klement & Associates, Inc.	July 2006
Flemish	Gunaji-Klement & Associates, Inc.	January 2007

A review of these reports shed light on the logic behind the existing drainage system. The developments principally rely on on-lot retention and detention ponds. The on-lot ponding systems were intended to reduce runoff increases resulting from home construction. The regional drainage systems include small retention and detention ponds connected by natural arroyos.

The regional system retention and detention ponds were typically designed to address increased runoff from roadways. Principally, the developments were designed to discharge flows not exceeding the historic flow rates into the existing drainage network of arroyos.

B. Site Visits

A series of site visits were conducted to verify the drainage reports. These field visits determined the general condition of the drainage system and confirmed trouble spots within the system, noted by the public and private entities. BHI staff, including Andrew Guerra, Brad Sumrall and Kris Johnson visited the site. Site visits were conducted on 3/8/2008, 9/16/2008 and 10/20/2008. In general, system elements appear to require maintenance. Several principle drainage arroyos appeared to be experiencing substantial degradation due to erosion. In places attempted bank stabilization was entirely undermined by storm flows. It is apparent that storm water flows convey substantial sediment loads, in part due to arroyo degradation and offsite sediment loads. Of note, a number of existing ponds appeared to be filled partially with sediment.

IV. Public Input

The literature review provided a useful understanding of how the drainage system within the Picacho Hills community was intended to function. However, there is a discrepancy between the expected functionality of the drainage system and the actual system performance. In an effort to determine how the system actually performs, Doña Ana County sought public input about the drainage conditions throughout the Picacho Hills community. Two public meetings were held during development of this report to collect public input about their concerns and to propose potential improvements to the drainage system.

A. **Meetings**

The two public meetings were held on October 20, 2008 and November 18, 2008. The principle goal of the October public meeting was to inform the public about the function of the Doña Ana County Flood Commission and the intent of the proposed Drainage Master Plan. This meeting also sought to provide the community a forum to voice their initial concerns related to the drainage situation within the Picacho Hills area. Public comment forms were provided to all attendees, allowing residents to provide detailed comments and concerns for review within the DMP. The first meeting was well attended by area residents, with over 60 individuals signing in and participating. Representatives from Doña Ana County, including Paul Dugie, Tish Segovia, and Jorge Granados attended the meetings. Rob Richardson, Andrew Guerra, and Brad Sumrall attended the meetings on behalf of BHI. Additional information concerning advertisement, agendas and data obtained from the meeting can be found in **Appendix E, Public Input.**

B. **Comments**

Comment Sheets were provided to area residents who were encouraged to use these forms to provide detailed accounts of their concerns and observations to the County and BHI for review during the creation of the DMP. These community comments along with photographs provided by residents were valuable in assessing the performance of the existing drainage system. Numerous public comments note high flow rates within the natural arroyos, characterized by very high sediment loads. Photographs taken of arroyos during and after storm events illustrated the magnitude of the drainage problems within the area.

Please refer to **Table 2** which summarizes resident's comments. The ID numbers in Table 2 correspond with the comment number locations shown on **Figure 4: COMMUNITY COMMENT LOCATIONS.** Please refer to **Appendix E, Public Input** for the complete collection of public comments received.

Table 2 - Public Comments Summary

Id	Problem	Location
1	Flooding Sediment	Vista del Reino & Vista del Cerro
2	Sewer Line Erosion	Arroyo North of San Marcos
3	Sediment Deposits	Via Campestre
4	GC Runoff and Erosion	4th Hole and Fairway Village Dr.
5	Street flooding	Campestre and Norte
6	Arroyo erosion	Arroyo along Via Norte
7	Barcelona Flooding	Barcelona
8	Pond Inlet Plugged	Anthem Pond
9	Pond undermining Road	Barcelona
10	Arroyo eroding Road	Tuscany
11	Pond Undersized	Catalonia Pond
12	Sewer Undermined by Pond	Anthem Pond
13	Arroyo Erosion	Arroyo North of Constitution
14	Flooding no flow path	Area between Picacho and Coronado Ridge
15	Pond inlet blocked	Pond E north of Constitution
16	Pond inlet blocked	Pond M south of Constitution
17	Flood damage	Lot 117 south of Constitution
18	General pond issues	Throughout Coronado Ridge Subdivision
19	Disturbed area Erosion	Vista del Reino
20	GC Runoff	Via Campestre
21	Undersized Culvert	Via Norte
22	Flooding and Sediment	Fairway Village
23	Flooding and Sediment	Via Campestre
24	Pond outlet inadequate	Old Picacho Picacho Arroyo
25	Ditch overflow	Old Picacho
26	Water and mud	Vista Del Cerro & Vista Del Reino
27	Offsite mud and water	Vista Del Cerro & Vista Del Reino
28	Offsite mud and water	Vista Del Cerro & Vista Del Reino
29	Offsite mud and water	Vista Del Cerro & Vista Del Reino
30	Channel is insufficient	Vista Del Cerro & Vista Del Reino
31	Channel overtops	Old Pichacho
32	Justin Ln is washed out	Linda Vista Estates
33	Silting of pond	Near San Marcos Ct and Barcelona Ridge Rd
34	Erosion at culverts	Barcelona Ridge Road & Picacho Hills Dr.
35	Arroyo inadequate	Barcelona Ridge Road & Picacho Hills Dr.
36	Excessive water flows	Barcelona Ridge Road & Tuscany Drive
37	None	Mira Montes & Picacho Hills Dr.
38	Excessive water	
39	Excessive water	
40	Drainage facility no good	Alto Estates III Neighborhood
41	Pond overtops	Alto Estates III Neighborhood
42	Water bypasses arroyo	Alto Estates III Neighborhood
43	Pond insufficient	Alto Estates III Neighborhood
44	Farm land flooding	Farm lands east of the Picacho Hills developments
45	Intersection floods, sediment buildup	Vista del Reino & Vista del Cerro Intersection
46	Pooling water/sediment	Mira Montes Area
47	Water & Silt	Area west of Phase 3 of Fairway Village
48	Damage to walls by water	Fairway Village
49	Arroyo redirected	Bright View Road
50	Flows damaging property	Barcelona and Tuscany
51	Pond spillway insufficient	Barcelona and Tuscany
52	Arroyo should not be here	Barcelona and Tuscany

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PICACHO HILLS DRAINAGE MASTER PLAN	DRAWN BY: KWJ	DATE: JAN. 2009	COMMUNITY COMMENT LOCATIONS - FIGURE 4
	CHECKED BY: LBS	PROJECT NO: 090126	

V. Watershed Analysis and Evaluation

A. Modeling Software and Analysis Methods

The hydrologic modeling within this study is based upon methods developed by the Army Corps of Engineers and the Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service (SCS)). Modeling parameters include precipitation data, lag time calculations, curve number calculations, sediment bulking calculations, and routing methods. Each drainage area was evaluated for other physical parameters that affect runoff rates and volumes. The following applications were used to create the hydrologic models.

1. Geographic Information System (GIS) Processing System – HEC-GeoHMS

The public domain software HEC-GeoHMS 4.2 (Beta) was used for generating parameters needed for the hydrologic model and is an extension created for use with the ArcView Version 9.2 platform developed by ESRI, (Environmental Systems Research Institute). This software package utilizes DEMs to define basin limits and flow paths. The output from this program can be applied directly to the U.S. Army Corps of Engineers Hydrologic Modeling System (HEC-HMS) model. The data processed by this software package was reviewed for consistency, accuracy and precision.

2. Hydrologic Modeling Software – HEC-HMS

The HEC-HMS program, Version 3.2, was used to prepare a hydrologic model of the Picacho Hills area. This model was used to quantify storm water runoff volumes and flow rates for the study area. The U.S. Army Corps of Engineers Hydrologic Engineering Center developed HEC-HMS for watershed model creation based on user defined inputs. The HEC-HMS model for this DMP was created using data prepared within HEC-GeoHMS described above. Adjustments were made to the HEC-HMS model to reflect man-made controls such as culverts, arroyos and detention facilities not defined within the HEC-GeoHMS output. Digital copies of the existing and future condition HEC-HMS models are found on the CD's in **Appendix C: Digital Data.**

B. Rainfall and Model Storm

Earlier studies have based their total rainfall on values derived from the National Oceanic and Atmospheric Administration (NOAA) Precipitation Frequency Atlas of the United States, but their methods for deriving the rainfall hyetograph have varied. This study applied the NM Type II-75 Rainfall Distribution which was developed to best model storm events for the region. This is a commonly applied distribution and is accepted by numerous State and Federal Agencies in New Mexico.

For the purposes of this study, only the 100-yr return event was analyzed (1% chance). The 100-yr, 24-hr rainfall depth utilized for this study was obtained from NOAA Atlas 14, for a point at latitude 32.311° N and longitude 106.876° W. The total rainfall depth for this return period at this location is 3.5 inches. Please refer to **Appendix A: Hydrologic Calculations** for the detailed calculations used to generate the rainfall distribution for the study area.

C. Basin Topography

The combined DEM prepared for this study was utilized to define drainage basins, sub-basins, flow path lengths and slopes. The DEM is comprised of a series of squares, 5ft x 5ft, that are assigned one elevation, defining the land surface.

This served as the basis for all further analysis from which flow direction and flow accumulation grids were created. The flow direction used the 8-point pour method, and is defined by the direction with the steepest descent in any of 8 directions derived from 8 polygonal cells surrounding a given point, or cell. The principle goal of the flow direction grid is to define the direction where water will flow. The flow accumulation grid was created by summarizing the number of upstream cells draining to a given cell. Essentially, the flow accumulation grid assists in defining flow paths within the study area. Streams were defined by a threshold number of cells draining to a given cell. Streams were divided into stream segments which define flows from the basin divide to a stream junction, between successive stream junctions or from a junction to the basin outlet. A watershed grid defines the contributing area for each stream. In essence, the watershed grid defines macro basin areas.

In the final steps of processing the stream and watershed grids were converted to vector representations, and watersheds were aggregated at confluences for computation efficiency. Once the terrain preprocessing was complete, basins were evaluated, to both add new delineations based on structures such as culverts, flow barriers and ponds and to develop stream and watershed characteristics including stream length, basin slope, basin centroid, and centroid length. Analysis points were added to the model, based on known structures, and to investigate areas with known drainage issues. Once the analysis points were determined and inserted, new sub-basins were re-delineated.

Overall, basin boundaries were checked against topography and aerial photographs to ensure the processor had created logical boundaries. **Figure 5A: Basin Map** and **Figure 5B: Detailed Basin Map** display drainage basin and sub-basin delineation within the Picacho Hills area. The calculated characteristics derived from HEC-GeoHMS include the sub-basin area, sub-basin slope, arroyo length, arroyo slope, longest flow path.

D. **Loss Method (NRCS Curve Number)**

NRCS curve numbers were assigned to each watershed area. The curve number seeks to capture the effects of land usage, soil type, soil condition, antecedent soil moisture content and vegetative growth on the hydrologic modeling. The curve number addresses indirectly initial abstraction and infiltration rates for soils. CN values are dimensionless and range from 0 to 100. The higher the CN value the greater the runoff volume and flow rate. This method is commonly utilized because of the relative simplicity and ability to be adjusted to reflect empirical data. The NRCS has generated curve numbers for a variety of different land usage types, vegetative cover types and general hydrologic condition of the soils. TR-55 is a NRCS technical release, and computer program, that provides detailed break downs of curve numbers for different land usage and land conditions. Upon review of the different land usages and conditions defined by TR-55, the Picacho Hills area was divided into ten different land usages and conditions. Please refer to **Table 3: Curve Number Summary** below which lists the curve numbers utilized for different land usages within the Picacho Hills community.

Table 3 - Curve Number Summary

Cover type and hydrologic condition	CN for Wet Condition (High Antecedent Moisture Condition)			
	Soil Group A	Soil Group B	Soil Group C	Soil Group D
Agriculture - Straight Row Crop Residue Good	81	88	92	93
Desert shrub - poor	80	89	93	95
Open Space - golf courses	60	79	87	91
Residential - 5 acre lot	82	90	94	95
Residential - 1 acre lot	85	92	95	96
Residential - 1/2 acre lot	86	92	95	96
Residential - 1/3 acre lot	87	93	96	97
Residential - 1/8 acre lot	94	96	97	97
Commercial / Business	95	97	98	98
Industrial	91	95	96	97

The CN values were adjusted, per TR-55 methodology, to reflect expected impervious percentages as noted within TR-55. Modeling assumed a hydrologic soil condition for watersheds in poor condition having limited potential to infiltrate runoff due to soil surface crusts, reduced vegetative cover and compaction due to human activity. At the request of the County, the Picacho Hills area was modeled for antecedent moisture condition III, saturated soil conditions. Modeling the area for moisture condition III, high antecedent soil moisture content, reduces infiltration rates, thus increasing runoff volumes and flow rates from the drainage basins. The CN values provided by TR-55 are for antecedent moisture condition II – average conditions. Curve numbers were adjusted according to NRCS methodology to reflect the high antecedent moisture condition for this analysis. Refer to the curve number calculations that can be found in **Appendix A: Hydrologic Calculations** for additional information.

E. **Hydrograph Transformation**

For the majority of the Picacho Hills area, the Upland Method was utilized to estimate travel times for drainage flows. The New Mexico Department of Transportation (NMDOT) utilizes the Upland Method of estimating travel times for flows from basins less than 200 acres. For basins larger than 200 acres a modified method was utilized to generate travel times. The Upland Method seeks to quantify travel times by classifying flow as either Overland Flow or Shallow Concentrated Flow. The upper extent of the sub-basin is characterized as overland flow, while the remainder of the basin is classified as Shallow Concentrated Flow. Using the flow classification and flow path slope, the velocity, and subsequently lag time, was computed for each sub-basin. Detailed lag time calculations are found in **Appendix A: Hydrologic Calculations.**

F. **Routing**

This study utilized the Muskingum-Cunge procedure for channel routing, which is consistent with other local studies. This method is appropriate for natural channels such as arroyos, which are the dominant channel type encountered throughout the study area. The channel cross section geometry required for this method was derived from the DEMs created for the study. Mannings "n" values for the main arroyo channels were assumed to be 0.030 for both the channel bottom and overbank areas.

G. **Hydraulic Structures**

Structures such as culverts and reservoirs were located from drainage reports, aerial photos and field investigations. The locations of these structures served as some of the analysis points for sub-basin delineation. Pond operation in each model was assessed by quantifying stage-storage-discharge relationships. Culvert capacities were determined using a hydraulic modeling software package, Bentley InRoads Storm and Sanitary - Drainage Structure Analyzer. This software employs the method described in the United States Department of Transportation (USDOT) publication "Hydraulic Design of Highway Culverts," HDS-5. All structures were assumed to be maintained free of sediment and obstructions when assessing their efficiency. **Figure 5B** provides a depiction of the location of known large drainage conveyance structures (ponds, culverts, etc.) and sub-basin delineation within the Picacho Hills area.

H. **Sediment Bulking**

The Picacho Hills Community is characterized by erosive soils. Storm flows commonly convey sediment and debris and have a direct effect on flow rates by increasing the volume of conveyed flow. This increase, referred to as bulking, was assessed for a nearby area by Mussetter Engineering in 2008 (Sediment Load Bulking Factors for Four Arroyos in the Overlook Subdivision, Las Cruces NM). This report determined the recommended bulking factors when modeling storm runoff flow rates and volumes. Generally, the Overlook Subdivision is very similar in hydrologic character and soil type to that of the

Picacho Hills area. Flows accumulate along the mesa top and travel through the development along the eroded escarpment.

The Overlook Subdivision is characterized principally by SCS type BP and WP soils. The drainage basins most similar to those within the Picacho Hills area are predominately BP. BP soils have a USDA texture of loamy sand and WP soils have a USDA texture of Loamy fine sand. The soils within the Picacho Hills area are also principally BP soils. Noting similar soil types, current and future land use, and general basin characteristics, it is reasonable to use the findings from the Overlook Subdivision. This data is reasonable in the absence of a detailed sediment bulking analysis specific to the Picacho Hills area. Please refer to **Appendix F – Soils Information** for additional information.

The data presented within this report was utilized to approximate the sediment bulking factors utilized for the analysis of the Picacho Hills area. **Table 4: Sediment Bulking** summarizes the sediment bulking factors utilized during analysis. Detailed sediment bulking factor calculations are found in **Appendix A: Hydrologic Calculations.**

Table 4 – Bulking Sediment
Factors for Existing and Future Development Conditions

Basin Name	Bulking Factor	
	Existing	Future
A1	1.21	1.22
A2	1.14	1.15
B1	1.16	1.16
B10	1.05	1.05
B11	1.02	1.02
B12	1.04	1.04
B13	1.04	1.04
B14	1.03	1.03
B15	1.04	1.04
B2	1.12	1.13
B3	1.13	1.14
B4	1.12	1.12
B5	1.08	1.08
B5a	1.04	1.04
B5b	1.09	1.09
B6	1.1	1.1
B7	1.03	1.03
B9	1.03	1.03
C1	1.15	1.16

Basin Name	Bulking Factor	
	Existing	Future
C2	1.14	1.15
C2a	1.05	1.05
C3	1.11	1.11
C4	1.09	1.09
C4a	1.11	1.11
C5	1.1	1.1
C6	1.09	1.09
C7	1.05	1.05
C7a	1.03	1.03
C8	1.04	1.05
C9	1.03	1.03
D1	1.15	1.15
D1a	1.08	1.08
D2	1.11	1.11
D3	1.05	1.06
D4	1.04	1.04
D5	1.04	1.04
E2	1.05	1.05

I. Hydraulic Analysis of Arroyos

HEC-RAS is a software package created by the U.S. Army Corps of Engineers Hydrologic Engineering Center. This program is a river analysis system that models flow depths and extents within arroyos, channels and rivers. This tool was utilized for arroyos in Picacho Hills where there is known flooding or drainage issues. Utilizing flow rates calculated by the HEC-HMS models, BHI modeled existing critical portions of arroyo systems. The HEC-RAS models were used in this study to determine which areas benefit by the various projects proposed. Approximately 4 miles of arroyo were modeled but only 2.2 miles are included in the report due to their being appropriate for the final options considered.

VI. Analysis Results

Two comprehensive watershed hydrologic models were developed for the Picacho Hills community and contributing area. One model seeks to capture the existing conditions of the study area while the other model seeks to forecast the impact of future development within the study area. The future conditions model also includes proposed improvements and additions to the existing Picacho Hills drainage system.

The Picacho Hills community was broken into four major drainage basins, comprised of smaller sub-basins. The sub-basins divide the macro basins at critical points along known flow paths. Basins A and B are the largest basins within the Picacho Hills community, totaling drainage areas of 7.9 sq. mi. and 3.2 sq. mi. respectively. A summary of important basin characteristics can be found in **Table 5: Basin Characteristics,** and supporting calculations can be found in **Appendix A: Hydrologic Calculations.**

Table 5 – Basin Characteristics

NAME	Area (Acre)	Weighted Whole Basin CN		Average Basin Slope (%)	Longest Flow Path (FT)	Lag Time (min)
		Existing	Future			
A1	4817.33	86	91	7.93	31190	102
A2	227.58	84	86	10.74	8134	22
B1	1529.32	93	94	3.61	21304	197.67
B10	13.93	83	83	7.57	2718	9.73
B11	0.76	83	83	3.29	358	7.00
B12	5.86	85	85	6.05	956	8.46
B13	9.03	84	84	8.47	953	13.62
B14	2.29	80	80	8.42	830	7.00
B15	5.62	84	84	7.04	264	7.00
B2	118.90	84	86	10.73	7377	18.44
B3	155.76	81	86	12.63	6486	18.72
B4	102.32	82	84	10.22	5367	14.75
B5	33.16	80	80	8.95	3047	9.98
B5a	4.08	85	85	10.17	1666	7.00
B5b	27.25	83	83	10.54	1464	7.00
B6	52.45	75	75	9.58	3676	7.00
B7	4.22	77	77	7.69	1580	7.00
B9	1.78	86	86	9.58	1070	7.00
C1	324.94	83	90	12.43	8714	27.77
C2	191.96	82	86	10.63	6552	18.23
C2a	8.53	85	85	7.03	821	7.00
C3	56.73	84	85	11.40	2986	8.87
C4	41.75	81	81	10.22	3132	10.01

Table 5 – Basin Characteristics (continued)

NAME	Area (Acre)	Weighted Whole Basin CN		Average Basin Slope (%)	Longest Flow Path (FT)	Lag Time (min)
		Existing	Future			
C4a	98.12	82	82	8.63	4550	17.44
C5	**66.38**	**80**	**80**	**8.71**	**4588**	**12.63**
C6	34.23	81	81	8.72	3499	9.51
C7	13.53	83	83	7.04	3097	9.62
C7a	2.01	80	84	7.31	486	7.00
C8	6.91	84	85	7.13	1449	7.58
C9	2.47	89	89	3.85	482	7.00
D1	243.78	84	85	12.84	8143	22.57
D1a	21.82	86	86	10.00	2093	8.21
D2	77.48	84	85	11.80	7164	22.58
D3	11.78	83	87	3.95	1658	7.00
D4	4.04	87	91	3.05	849	7.00
D5	4.27	80	85	8.39	773	7.00
E2	12.77	81	86	5.18	1712	7.00

BHI performed both hydrologic and hydraulic analysis of the Picacho Hills community to evaluate existing and future conditions relative to runoff rates and volumes for the 100-year (1% chance) storm event. We also analyzed the impact of these flows on several large arroyos with respect to the water surface extent and depth; discussion of both of these analyses follows. A small area south of the Nafzinger Arroyo was analyzed but not included in this report as it was not appropriate to the final options considered.

A. Existing Condition Hydrologic Analysis Assumptions

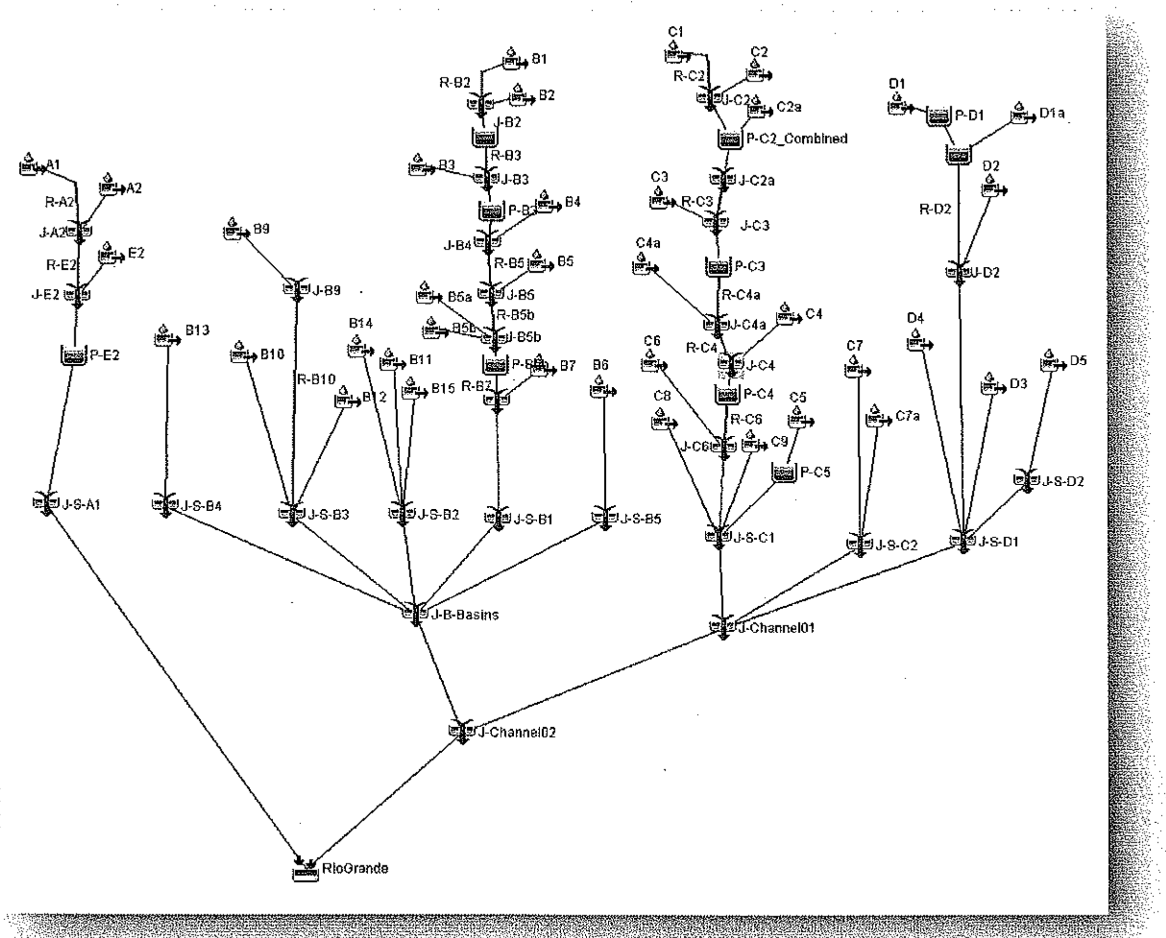
A hydrologic model was prepared for the Picacho Hills community and contributing offsite drainage basins for existing conditions. The existing conditions model represents conditions on the ground as of the 2007 aerial mapping activity. Major regional ponding areas were analyzed, while small local ponding areas and on-lot ponding were not included in the analysis. The basin schematic is shown on **Figure 6: Hydrologic Model Schematic. Table 6: 100-Year Hydrologic Model Results – Existing and Future Conditions** provides flow rates and volumes for every basin, pond and analysis point modeled within the study area. Junction / Analysis Points can be found graphically in **Figures 2A and 2B.**

B. Future Condition Hydrologic Analysis Assumptions

The future conditions model reflects fully developed conditions for all areas zoned for development based on Doña Ana County assessor's maps. Currently, some basins are relatively undeveloped; however, the assessor's maps indicate these areas will eventually be fully developed. County assessor's data notes that these areas may be developed as one of a number of different land usages, including, residential, commercial and industrial areas. Proposed improvements modeled by the future conditions

HEC-HMS model include existing pond enhancement and the inclusion of new ponding areas. Detention ponds like these are critical to attenuating storm flows within downstream arroyos. Improving the functionality of pond spillways and increasing the storage volume of existing ponding areas will improve how the pond attenuates storm flows. Only the major ponding areas were including in the HEC-HMS models. Small ponding areas and on-lot ponding were not included. The final future condition model includes all proposed improvements to the drainage system; these improvements are discussed later in the report. The basin schematic is shown on **Figure 6: Hydrologic Model Schematic.**

Figure 6 - Hydrologic Model Schematic



C. Hydrologic Analysis Results

Table 6: 100-Year Hydrologic Model Results – Existing and Future Conditions provides flow rates and volumes for every basin, pond and analysis point for the study area. Junction / Analysis Points are shown in **Figures 5A and 5B.**

1. Nafzinger Arroyo Basin – Southern Limit of Study Area

The Nafzigner Arroyo Basin is comprised of sub-basins A1, A2 and E2. Flows from each basin collect within the Nafzinger Arroyo. Flow rates increase approximately 20% from current to fully developed conditions. This watershed, given its significant size, will require careful management as development continues along its banks. Ultimately, channel stabilization particularly along the banks and a detention pond at the outfall are necessary and discussed in more detail in the recommendations section.

2. Barcelona Ridge Arroyo Basin

The Barcelona Ridge Arroyo Basin is comprised of only B sub-basins. In general, peak flows increase from 10 to 25% between the existing and future fully developed conditions. Flows from offsite sub-basin B1 are conveyed into the Picacho Hills community via the Barcelona Ridge Arroyo. These flows are combined with flows from sub-basin B2 and routed through the Barcelona Ridge Arroyo Pond at Analysis Point P-B2 which is recommended to be expanded and improved. Flows currently overtop the roadway due to limited capacity in the existing culverts and cross Barcelona Ridge Road where they combine with the offsite sub-basin B3. In the future, flows can be contained within improved ponds and larger drainage structures. Flows are routed through the proposed Barcelona Ridge Arroyo Pond B3, P-B3, prior to crossing Barcelona Ridge one last time. Drainage flows are principally conveyed via the Barcelona Ridge Arroyo, where sub-basins B4, B5, B5a and B5b are added. The Barcelona Ridge Arroyo will ultimately be routed through one last proposed detention facility, the Barcelona Ridge Arroyo Pond B5b, (Analysis point P-B5b).

3. Golf Course Arroyo Basin

The Golf Course Arroyo Basin is comprised of only C sub-basins. Peak flows increase up to 40% in developed areas when full build-out occurs. Flows from offsite sub-basin C1 are conveyed into the Picacho Hills community via the Golf Course Arroyo. These flows are combined with runoff from sub-basin C2 and C2a and routed through the existing Golf Course Arroyo Pond C2, (Analysis Point P-C2_Combined) located just west of Anthem Rd. Outflow from this pond is conveyed through an earthen channel through sub-basin C3. Currently this flow routes through the Golf Course Arroyo Pond C3, (Analysis Point P-C3) just west of Tuscany Rd. Outflow from this pond is conveyed through the existing earthen channel, collecting runoff from sub-basins C4a and C4. This flow is routed through the proposed detention facility, Golf Course Arroyo Pond C4, (Analysis Point P-C4) and on into Basin C5 discharging into Golf Course Arroyo Pond C5, (Analysis Point P-C5). The outflows from these ponds are combined with the remainder of the C sub-basins before reaching the limit of the study area.

4. Mansiones de Galicia Arroyo Basin

The Mansiones de Galicia Arroyo Basin is comprised of only D sub-basins located on the far northern border of Picacho Hills. Peak flows within this watershed increase in the future but not significantly. There are no major offsite sub-basins which impact this watershed. Sub-basins D1 and D1a contribute flows to the existing ponds P-D1 and P-D2 located within the Mansiones de Galicia subdivision. The drainage system within these basins, including ponds P-D1 and P-D2, constructed by the developer per the direction of Doña Ana County, are slated for improvement in the near future. Outflow from these sub-basins flow through sub-basin D2 along a series of small arroyos. These flows are eventually combined with runoff from sub-basins D3, D4 and D5.

Table 6 – 100 Yr Hydrologic Model Results-Existing and Future Conditions

HEC-HMS Structure ID	Drainage Area (sq mi)	Existing Condition		Future Condition	
		Volume (ac-ft)	Peak Discharge (cfs)	Volume (ac-ft)	Peak Discharge (cfs)
Basins					
A1	7.5271	1005.9	4275	1230.1	5338
A2	0.3556	41.7	666	45.6	735
B1	2.3896	388.4	931	410	984
B10	0.0218	2.3	63	2.3	63
B11	0.0012	0.1	4	0.1	4
B12	0.0092	1	31	1	31
B13	0.0141	1.5	35	1.5	35
B14	0.0036	0.3	11	0.3	11
B15	0.0088	0.9	31	0.9	31
B2	0.1858	21.4	395	23.4	436
B3	0.2434	25	448	31	570
B4	0.1595	16.9	365	18.4	400
B5	0.0518	4.9	134	4.9	134
B5a	0.0064	0.7	23	0.7	23
B5b	0.0430	4.6	151	4.6	151
B6	0.0820	6.3	204	6.3	204
B7	0.0066	0.5	17	0.5	17
B9	0.0028	0.3	11	0.3	11
C1	0.5077	57.7	759	76.6	1046
C2	0.2999	32.4	596	38.5	721
C2a	0.0133	1.5	49	1.5	49
Basins					
C3	0.0886	10.2	300	10.6	313
C4	0.0652	6.5	178	6.5	178
C4a	0.1533	16.1	306	16.1	306
C5	0.1037	9.9	236	9.9	236
C6	0.0535	5.3	149	5.3	149
C7	0.0211	2.2	62	2.2	62
C7a	0.0031	0.3	9	0.3	11
C8	0.0108	1.2	37	1.2	39

Table 6 – 100 Yr Hydrologic Model Results-Existing and Future Conditions (continued)

HEC-HMS Structure ID	Drainage Area (sq mi)	Existing Condition		Future Condition	
		Volume (ac-ft)	Peak Discharge (cfs)	Volume (ac-ft)	Peak Discharge (cfs)
Basins					
C9	0.0039	0.5	16	0.5	16
D1	0.3809	45.1	709	47	743
D1a	0.0341	3.8	117	4.1	127
D2	0.1551	17.7	279	18.5	292
D3	0.0184	1.9	62	2.3	74
D4	0.0063	0.8	25	0.9	29
D5	0.0067	0.6	20	0.7	24
E2	0.0200	1.9	46	2.3	57
Junction/Analysis Points					
J-A2	7.8827	1046.6	4296	1274.7	5360
J-B2	2.5753	409.6	935	433.2	990
J-B3	2.8187	433.6	941	454.1	996
J-B4	2.9782	450.3	1012	469.7	998
J-B5	3.0300	455.1	1039	474.5	999
J-B5b	3.0794	460.3	1054	479.7	1000
J-B7	3.0859	460.7	1056	479.7	961
J-B9	0.0028	0.3	11	0.3	11
J-B-Basins	3.2293	-	-	492.5	963
J-C2	0.8077	90.1	1171	115.1	1573
J-C2a	0.8210	91.4	1168	105.4	1395
J-C3	0.9096	101.6	1210	115.9	1418
J-C4	1.1282	123.2	1365	118.9	1399
J-C4a	1.0629	116.8	1348	112.4	1394
J-C6	1.1817	128.5	1376	124	782
J-Channel01	1.9258	-	-	210.9	1592
J-Channel02	5.1551	-	-	703.4	2218
J-D2	0.5701	66	968	68.9	1016
J-E2	7.9026	1048.2	4295	1276.8	5359
J-S-B1	3.0859	-	-	479.7	961
J-S-B2	0.0135	-	-	1.4	45
J-S-B3	0.0337	-	-	3.6	101
J-S-B4	0.0141	-	-	1.5	35
J-S-B5	0.0820	-	-	6.3	204
J-S-C1	1.3000	-	-	135.6	792
J-S-C2	0.0243	-	-	2.5	72
Junction/Analysis Points					
J-S-D1	0.6015	-	-	72.8	1027
J-S-D2	0.0067	-	-	0.7	24
Ponds					
P-B2 (Pond B2)	2.5753	408.8	935	423.4	989
P-B3 (Pond B3)	2.8187	-	-	451.5	995
P-B5b (Pond B5b)	3.0794	-	-	479.3	961
P-C2_Combined (Pond C2)	0.8210	91.4	1168	105.4	1395

Table 6 – 100 Yr Hydrologic Model Results-Existing and Future Conditions (continued)

HEC-HMS Structure ID	Drainage Area (sq mi)	Existing Condition		Future Condition	
		Volume (ac-ft)	Peak Discharge (cfs)	Volume (ac-ft)	Peak Discharge (cfs)
		Ponds			
P-C3 (Pond C3)	0.9096	100.7	1205	96.3	1331
P-C4 (Pond C4)	1.1282	-	-	118.7	779
P-C5 (Pond C5)	0.1037	-	-	9.9	191
P-D1	0.3809	44.9	706	46.8	740
P-D2	0.4150	48.3	726	50.4	761
P-E2 (Pond E2)	7.9026	-	-	1234.6	5358
		Outfalls			
Rio Grande	13.0577	-	-	1938	6331
S-A1	7.9026	1048.2	4295	-	-
S-B1	3.0859	460.7	1056	-	-
S-B2	0.0135	1.4	45	-	-
S-B3	0.0337	3.6	101	-	-
S-B4	0.0141	1.5	35	-	-
S-B5	0.0820	6.3	204	-	-
S-C1	1.3000	140.1	1421	-	-
S-C2	0.0243	2.5	71	-	-
S-D1	0.5949	68.7	976	-	-
S-D2	0.0067	0.6	20	-	-

D. Hydraulic Analysis Results

As part of the evaluation of the drainage system in Picacho Hills, a hydraulic analysis of the arroyo network was performed. The analysis was performed using HEC-RAS, a publically available software program produced by the U.S. Army Corps of Engineers. The model creates a water surface profile and extent based on cross-sections developed from topographic information and modeled storm water flows.

The analysis was performed for 4 miles of arroyo (only 2.2 miles included in this report) within the developed area for both existing conditions and future conditions with proposed pond and channel improvements in place. Figure 8: HEC-RAS Model Results of all HEC-RAS model runs showing the extent of the water surface for the 100-year storm, both existing and future flow. In all cases, either marginal or no change in the extent of the impacted area resulted with the inclusion of the proposed improvements.

To offset significant increases in peak flow rates under future fully developed conditions drainage management improvements have been recommended (see section VII). As a result, increases to arroyo water surfaces and resultant increases to the floodplain width and potential flooding will be avoided through implementation of the recommended improvements. Consequently, the water surface and extents have changed only minimally between existing and future conditions.

VII. General Observations and Recommendations

A. Conservation Improvements

The primary issue throughout the Picacho Hills community is the volume of water flowing within existing arroyos and drainage conveyances. There are a number of solutions that can delay, detain or retain water to reduce flows into the community from undeveloped offsite areas. These include land pitting, mild terracing, land ripping, root plowing and reseeding. The goal of all of these alternatives is to increase the amount of water than will be absorbed by soils, reducing runoff volumes and flow rates. These alternatives are best suited for implementation on currently undeveloped lands to the west of the existing Picacho Hills community. Basins A and B would most directly benefit from the implementation of one or more of these alternatives. These basins extend westward onto currently undeveloped land. Minimizing flows off of the undeveloped land would help mitigate the amount of runoff entering the developing community of Picacho Hills.

B. Ponding

1. Observations:

The existing capacity and geometry of ponds and arroyos were reviewed by means using the DEM of the Picacho Hills drainage area. Please refer to **Table 7** that relates the design storage capacity of major ponding areas to their actual storage capacities.

Table 7 – Major Ponding Area Storage Capacity Comparison

Name	Drainage ID	Actual Pond Volume (ac-ft) (No freeboard)	Design Pond Volume (ac-ft)
Barcelona Ridge Arroyo Pond 1	Pond B2	1.48	1.2 (2)
Golf Course Pond 2 (a)	Pond C2 Combined (Part)	1.58	1.0 (1) Increased to 4.25 (3)
Golf Course Pond 2 (b)	Pond C2 Combined (Part)	1.67	5.36 (3)
Golf Course Pond 3	Pond C3	6.29	9.7 (4)

(1) Coronado Ridge – Phase 1 Final Drainage Report
(2) Coronado Ridge – Phase 2 Final Drainage Study
(3) Las Estancias de Picacho Mountain Final Drainage Report
(4) Fairway 18 Subdivisions Final Drainage Report

Note that some of the ponds have reduced storage capacities due to sediment build-up and apparent lack of maintenance. Similarly, a number of the smaller localized drainage ponds interspersed throughout the Picacho Hills community appear to have reduced storage capacities but were not evaluated in detail. Some appear to have no storage capacity at this time due to sediment accumulation. At numerous locations, the small localized facilities are in such poor condition that they can only be identified by means of referring to historical drainage reports for locations.

Many of the developments utilize on-lot ponding to attenuate developed flow rates. Depending on the development, these on-lot ponds were proposed to range in volume from 400 cu-ft to 2829 cu-ft. Other developments require the use of on-lot ponds yet do not specify the size required for the pond. Developments such as these require the County to dictate the on-lot pond size requirements at the time of building permit issuance. Still others rely on the use of the regional ponds (retention or detention) to attenuate the increases in developed flows.

Onsite or on-lot ponding allowance can be a viable manager to mitigate increases to runoff rates and volumes due to development. This method of drainage management is most effective in rural developments but becomes difficult to enforce and less viable in urbanized developments. During recent site visits it was unclear to BHI staff whether properties that are required to utilize on-lot ponding, indeed have on-lot detention ponds. It is unlikely that residents are actively maintaining their required on-lot ponds and in many instances these ponds may no longer be functional. As a result these smaller ponds were not assumed to assist in the attenuation of flows in the HEC-HMS Models.

2. Recommendations:

a) Implementation of Routine Maintenance Plan:

It is critical to the proper function of the drainage system that community ponding areas be maintained on a regular basis. Lack of routine maintenance has allowed ponding areas to fill with sediment, vastly reducing their functionality. Due to the erosive nature of soils within the study area, these ponding areas will likely require semi-annual maintenance at a minimum. Maintenance activities must include excavation and removal of sediment deposits, ensuring the storage capacity of the pond. Ponding areas must not be over-excavated for maintenance beyond their original design at any point, as any modifications to the facility beyond its design may endanger public safety.

Proper maintenance of both the larger and smaller drainage facilities is vital to their continued functionality. However, for the purposes of this report, maintenance to existing small drainage facilities was not included in our future conditions analysis. Conservative engineering judgment necessitated that these smaller, privately owned and maintained, ponding areas could not be relied upon as a piece of the regional drainage system. It is important to note region wide improvements to small drainage facilities will likely produce very noticeable positive change within the drainage system.

b) Onsite Ponding Drainage Allowance:

It is recommended that Doña Ana County implement either one of two solutions to this problem. Option 1: do not allow on-lot ponding to be used to mitigate runoff increases for development in urbanized areas because they are not maintained and lose their effectiveness. Option 2: Require routine inspections of on-lot ponding facilities the same as is required for regional county maintained facilities.

VIII. Specific Drainage Improvement Recommendations

Proposed improvements were grouped together according to Basin, Nafzinger Arroyo (Watershed A), Barcelona Ridge Arroyo (Watershed B), Golf Course Arroyo (Watershed C) and Mansiones de Galicia Arroyo (Watershed D). As mentioned above, systematic area wide improvements are critical in improving overall performance of the drainage system. The future condition hydrologic analysis indicates that drainage infrastructure within the Picacho Hills area is substantially undersized. Property ownership and development conditions greatly limit the potential drainage system improvements.

Existing ponding areas must be improved to increase water storage capacity while improving the principle spillways from each pond. Total pond volume for some ponds will include dead storage. Dead storage is water retained within a pond below the invert of the principle spillway of the pond. This water will infiltrate into the surrounding soils or evaporate, thus reducing the volume of water reaching downstream arroyos and ponds. New ponding facilities must be constructed to further reduce the peak flow rate and volume of water along the downstream side of Picacho Hills.

These ponding facilities should be connected via the existing arroyos which also require improvement with an ultimate connection to the river. The ponding improvements discussed were included in the future conditions hydrologic model. Depths and volumes are illustrated in Table 9. The proposed improvements cannot fix all of the current drainage problems within the Picacho Hills area. The improvements are geared to improve how the drainage system conveys flows from the 100-year storm event. Conceptual cost estimates were assembled for each proposed improvement and are found in **Appendix B – Conceptual Project Construction Cost Estimates.**

It is important to note that the proposed improvements are on both public and/or private property. Doña Ana County is traditionally limited to utilizing public funds on public property. As such, improvements on private property will require coordination and agreements between public and private entities.

A. Picacho Hills Diversion Outfall

Historically storm water draining from the mesa top and escarpment collected in arroyos which emptied into the Rio Grande floodplain. Presently, the historic arroyos no longer reach the Rio Grande having been cut off by farmland. Water from these arroyos spills onto the farmland where it floods the land and deposits sediment. In order to mediate this problem, a diversion system is needed to capture flows from all four watersheds (A, B, C, D) within the Picacho Hills area. A channel should be constructed along the eastern boundary of the Picacho Hills area.

The channel would capture storm flows before flooding farm land to the east. Flows could then be carried via a large partially riprap lined earthen channel across the existing farmland, reestablishing a storm water outfall to the Rio Grande. The proposed channels were modeled as trapezoidal, earthen channels with riprap armored 3:1 side slopes in the future conditions hydrologic model. See **Table 8: Conceptual Channel Design** for additional information. **Figure 7: Proposed Improvements** provides the graphical location of the proposed Diversion system.

Table 8 - Conceptual Channel Design

Channel	Contributing Watersheds	Bottom Width (FT)	Depth (FT)	Channel Material	Channel Slope (%)	Flow Capacity (CFS)	Flow Velocity (FPS)
Section 1	C,D	40	4.9	Earthen	0.3	1603	5.98
Section 2	B,C,D	70	4.9	Earthen	0.2	2283	5.50
Section 3 (River Outfall)	A,B,C,D	240	5	Earthen	0.1	6460	5.01

1. Nafzinger Arroyo Basin (Basin A)

a) Arroyo Improvements

The Nafzinger Arroyo Basin is the largest drainage basin analyzed within the Master Plan area. The magnitude of the storm flow within this arroyo makes it difficult to attenuate the peak flow rate and runoff volume and therefore, stabilization of the arroyo channel is the recommended option. Riprap revetment can be installed at points where arroyo meander will adversely impact property or endanger life. Specific locations must be established based on a localized evaluation and through review of detailed HEC-RAS analysis.

b) Pond Improvements (Pond E2)

The existing ponding area created by the culverts under Picacho Hills Drive at the base of the Nafzinger Arroyo could be improved. The existing ponding area is sufficiently undefined and in poor condition so it was not analyzed within the existing condition hydrologic model. An improved pond should have a principle spillway, emergency spillway, increased storage capacity and include dead storage. The goal of these improvements is to attenuate flows the maximum extent possible while improving public safety. The principle spillway and emergency spillway should be designed to convey the peak flow rate from the 100-yr storm event. The spillways should convey flow into the proposed Diversion system. These improvements are proposed to prevent water from overtopping the roadway during a typical 100-yr storm event. **Figure 7: Proposed Improvements** provides the graphical location of the improved pond. See **Table 9: Conceptual Pond Design** for additional information.

2. Barcelona Ridge Arroyo (Basin B)

a) Barcelona Ridge Arroyo Pond 2 (Pond B2)

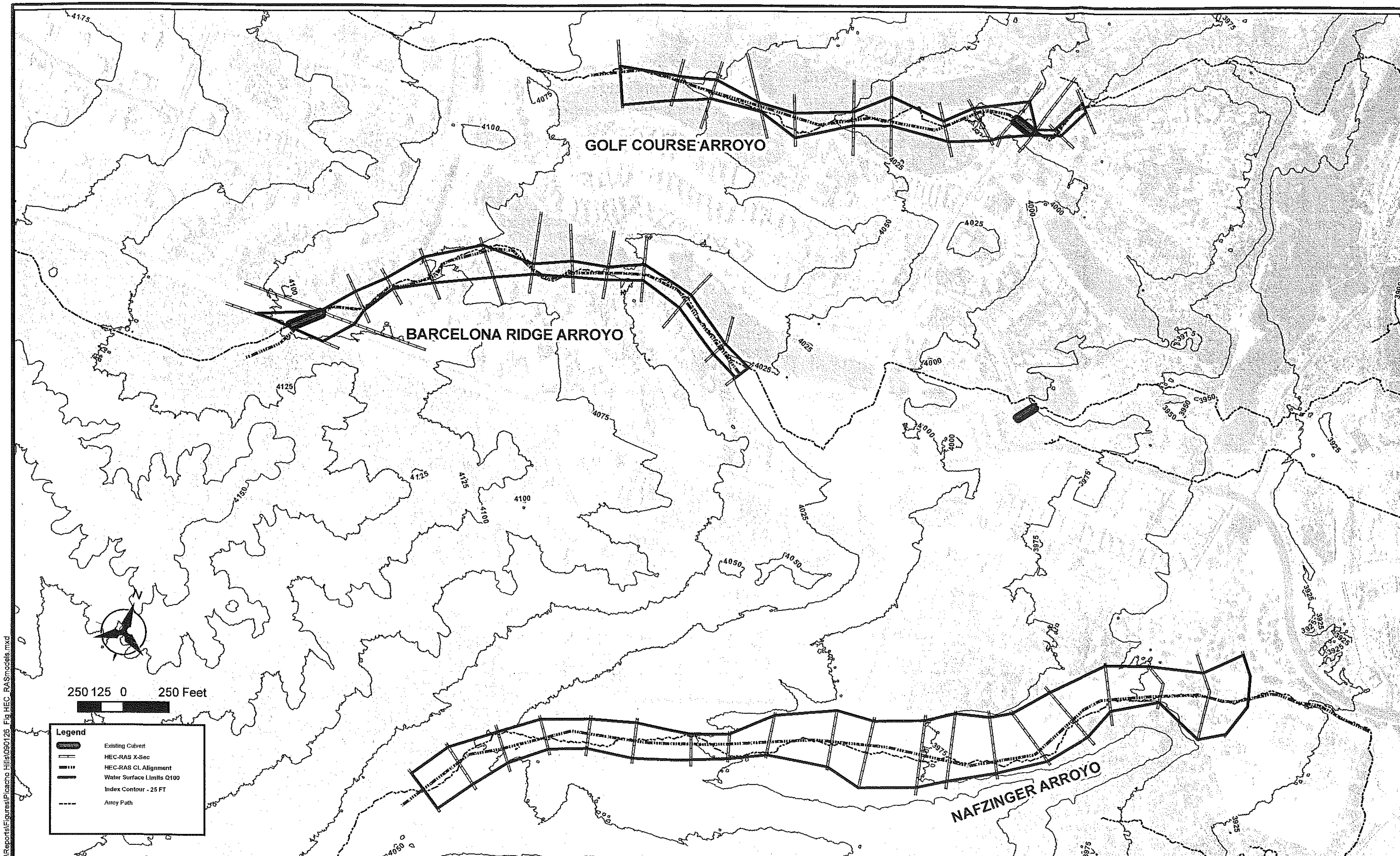
The existing ponding area, Barcelona Ridge Arroyo Pond B2 (Pond B2) could be improved. The improved pond should include an engineered principle spillway, emergency spillway and increased storage capacity. The pond would be modified to include dead storage. The goal of these improvements is to attenuate flows the maximum extent possible while improving public safety. The principle spillway and emergency spillway should be sized to convey the peak flow rate from the 100-yr storm event. The spillways would convey flow into the existing downstream arroyo. These improvements are intended to prevent water from overtopping the roadway during a typical 100-yr storm event. **Figure 7: Proposed Improvements** provides the graphical location of the improved pond. See **Table 9: Conceptual Pond Design** for additional information.

b) Barcelona Ridge Arroyo Pond 3 (Pond B3)

A new ponding area should be added to the Barcelona Ridge Arroyo system. The pond would have a principle spillway, emergency spillway and should include dead storage. The goal of this pond is to further attenuate flows the while improving public safety. The principle spillway and emergency spillway should be sized to convey the peak flow rate from the 100-yr storm event. The spillways would convey flow into the existing downstream arroyo. This improvement should prevent water from overtopping the roadway during a typical 100-yr storm event. **Figure 7: Proposed Improvements** provides the graphical location of the proposed pond. See **Table 9: Conceptual Pond Design** for additional information.

c) Barcelona Ridge Arroyo Pond 5b (Pond B5b)

A new ponding area is needed for the Barcelona Ridge Arroyo system. The goal of this pond is to attenuate the peak flow rate from the 100-yr storm event of storm water entering the Picacho Hills Diversion. The principle spillway and emergency spillway should be sized to convey the peak flow rate from the 100-yr storm event. The spillways would convey flow into the proposed Diversion system. **Figure 7: Proposed Improvements** provides the graphical location of the proposed pond. See **Table 9: Conceptual Pond Design** for additional information.



P:\090126\WR\Reports\Figures\Picacho Hills\090126_Fig HEC_RASmodels.mxd

Bohannan Huston INC.
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ENGINEERING ▲ SPATIAL DATA ▲ ADVANCED TECHNOLOGIES

PICACHO HILLS DRAINAGE MASTER PLAN	DRAWN BY: JT	DATE: JAN 2009	HEC-RAS MODEL RESULTS FIGURE 8
	CHECKED BY: LBS	PROJECT NO: 090126	

d) Barcelona Ridge Arroyo Picacho Hills Drive Crossing

The existing arroyo crossing across Picacho Hills Drive is insufficient to pass the 100-yr peak flow rate under the roadway without flows overtopping the roadway. This crossing requires 11-48' CMP culverts to convey the peak 100-yr flow rate under the roadway without allowing water to cross overtop the roadway. **Figure 7: Proposed Improvements** provides the graphical location of the improved arroyo crossing. .

3. Golf Course Arroyo Basin (Basin C)

a) Golf Course Arroyo Pond 2 (Pond C2)

The existing Pond C2 needs improvement by adding an engineered principle spillway, emergency spillway and increased storage capacity. This pond is intended to combine two existing ponds at this location and be modified to include dead storage. The principle spillway and emergency spillway should be sized to convey the peak flow rate from the 100-yr storm event and convey flow into the existing downstream arroyo. The magnitude of the peak flow rate and property boundary constraints necessitate that 100-yr storm flow overtop Anthem Road. Culverts under the roadway can only convey a portion of the peak 100-yr storm flow. The proposed principle spillway would include a dip section within Anthem Road. The dip section should be designed to safely convey flows across the roadway in a controlled manner. **Figure 7: Proposed Improvements** provides the graphical location of the improved pond. See **Table 9: Conceptual Pond Design** for additional information.

b) Golf Course Arroyo Pond 3 (Pond C3)

Pond C3 also requires improvement including design and construction of a principle spillway, emergency spillway, and increased storage capacity along with dead storage. The magnitude of the peak flow rate and property boundary constraints necessitate that 100-yr storm flow cross overtop Tuscany Drive since culverts under the roadway can only convey a portion of the total 100-yr storm flow. The proposed principle spillway should include a dip section within Tuscany Drive and be designed to safely convey flows overtop the roadway in a controlled manner. **Figure 7: Proposed Improvements** provides the graphical location of the improved pond. See **Table 9: Conceptual Pond Design** for additional information.

c) Golf Course Arroyo Via Norte Crossing

The existing arroyo crossing across Via Norte is insufficient to pass the 100-yr peak flow rate under the roadway without flows overtopping the roadway. This crossing requires 3-84' CMP culverts to convey the peak 100-yr flow rate under the roadway without allowing overtopping of the roadway. **Figure 7: Proposed Improvements** provides the graphical location of the improved arroyo crossing. .

d) Golf Course Arroyo Pond 4 (Pond C4)

A new ponding area is needed in the Golf Course Arroyo system that includes a principle spillway and emergency spillway. **Figure 7: Proposed Improvements** provides the graphical location of the proposed pond. See **Table 9: Conceptual Pond Design** for additional information.

e) Fairway Village Pond (Pond C5)

This proposed new ponding area would address local flows from Basin C5, which impact the Fairway Village Subdivision. The principle spillway for this pond is proposed to discharge to the existing drainage pathway toward the proposed Picacho Hills Diversion. The spillways are intended to convey flow into the proposed Diversion system. **Figure 7: Proposed Improvements** provides the graphical location of the proposed pond. See **Table 9: Conceptual Pond Design** for additional information.

f) Via Campestre Storm Drain

Storm flows resulting from the 100-yr event within Via Campestre can be collected by a storm drainage system to be installed within Via Campestre. This storm drain can outfall into the existing Golf Course Arroyo. **Figure 7: Proposed Improvements** provides the graphical location of the proposed storm drain system. This storm drain based upon conceptual design analysis, should consist of a 1990 LF of 36" RCP storm drain with 9 inlets strategically located along the length of the storm drain trunkline.

g) Vista Hermosa Curb and Gutter

Storm flows within the roadway currently flow in an uncontrolled manner across residential property along Vista Hermosa. Curb and gutter can be installed to protect residential property along the roadway and discharge to a new storm water outfall into an existing arroyo. **Figure 7: Proposed Improvements** provides the graphical location of the proposed curb and gutter.

h) Villa Chiquita Curb and Gutter

Storm flows within the roadway currently flow in an uncontrolled manner across residential property along Villa Chiquita. Curb and Gutter can be installed to protect residential property along the roadway and discharge to a new storm water outfall into an existing arroyo. **Figure 7: Proposed Improvements** provides the graphical location of the proposed curb and gutter.

Table 9 - Conceptual Pond Design

	Existing				Proposed			
Pond Name	Depth (FT)	Storage Volume (AC-FT)	Principle Spillway	Emergency Spillway Present	Depth (FT)	Storage Volume (AC-FT)	Principle Spillway	Emergency Spillway Present
Pond B2	4	1.48	2-36" CMP	No	18	15.65	9-60" CMP	Yes
Pond B3	-	-	-	-	18	8.33	8-48" CMP	Yes
Pond B5b	-	-	-	-	16	28.28	8-48" CMP	Yes
Pond C2*	5	3.24	2-24" CMP	No	32	20.27	9-48" CMP	Yes
Pond C3	9	6.29	None	No	39.5	26.22	7-30" CMP	Yes
Pond C4	-	-	-	-	16	25.45	4-48" CMP	Yes
Pond C5	-	-	-	-	8	3.02	3-36" CMP	Yes
Pond E2	-	-	-	-	32	54.47	16-Triple 3'(H) x 6'(W) CBC	Yes

* Pond C2 is also named Pond C2 Combined. Pond C2 is a combination of two adjacent existing ponds, each constructed for a different subdivision. During the 100-yr event, these ponds function as one continuous ponding area.

4. Mansiones de Galicia Arroyo (Basin D)

The flows within the existing Mansiones de Galicia Arroyo are principally from the Mansiones de Galicia subdivision. Doña Ana County is working with the developer to address the existing drainage problems resulting from this development. The Mansiones de Galicia Arroyo system was analyzed to determine how current flows would impact proposed downstream drainage facilities including the Picacho Hills Diversion System. Two existing major ponding areas were included in the hydrologic models, Pond D1 and Pond D2. However, no specific recommendations for improvements within the Mansiones de Galicia Arroyo area are included within this report.

Appendix

APPENDIX A - Hydrologic Calculations

- Rainfall Distribution
- Curve Number
- Lag Time
- Sediment Bulking
- Basin Characteristics
- Existing Pond Capacity
- Proposed Pond Capacity
- HEC-HMS Output

delta y	II-75	Accum x
0	0	0
0.028016	0.028016	1
0.033965	0.061981	2
0.043381	0.105362	3
0.060723	0.166085	4
0.040742	0.206828	4.5
0.05703	0.263858	5
0.038265	0.302123	5.25
0.053562	0.355685	5.5
0.092167	0.447852	5.75
2.315422	2.763274	6
0.149934	2.913209	6.25
0.067476	2.980685	6.5
0.044574	3.025258	6.75
0.033581	3.058839	7
0.04746	3.106299	7.5
0.035755	3.142054	8
0.050533	3.192587	9
0.03807	3.230658	10
0.030691	3.261349	11
0.025789	3.287138	12
0.04619	3.333327	14
0.040536	3.373863	16
0.036164	3.410027	18
0.032678	3.442705	20
0.029831	3.472536	22
0.027459	3.499995	24

100-yr Rainfall Distribution
Picacho Hills
BHI No: 090126
Prepared By: Kris Johnson
Date: 10/10/2008

Sheet Goal:

This sheet prepares a rainfall distribution with a consistent time step. Note that Column C (Accum x) transitions from hourly increments to quarter hour, to hourly to bihourly. Column E & F prepare a quarter hour distribution by linearly interpolating rainfall depths.

This sheet references the NM Type II-75 Unit Hyetograph multiplied by the appropriate actual rainfall depth. This calculation can be found on the Picacho Hills tab within this excel file.

Duration (hr)	Depth (inch)
0	0
0.25	0.007004
0.5	0.014008
0.75	0.021012
1	0.028016
1.25	0.036508
1.5	0.044999
1.75	0.05349
2	0.061981
2.25	0.072826
2.5	0.083672
2.75	0.094517
3	0.105362
3.25	0.120543
3.5	0.135724
3.75	0.150904
4	0.166085
4.25	0.187814
4.5	0.206828
4.75	0.2367
5	0.263858
5.25	0.302123
5.5	0.355685
5.75	0.447852
6	2.763274
6.25	2.913209
6.5	2.980685
6.75	3.025258
7	3.058839
7.25	3.081593
7.5	3.106299
7.75	3.123201
8	3.142054
8.25	3.154687
8.5	3.167321
8.75	3.179954
9	3.192587
9.25	3.202105
9.5	3.211622
9.75	3.22114
10	3.230658
10.25	3.23833
10.5	3.246003
10.75	3.253676
11	3.261349
11.25	3.267796
11.5	3.274243
11.75	3.28069
12	3.287138

12.25	3.292911
12.5	3.298685
12.75	3.304459
13	3.310232
13.25	3.316006
13.5	3.32178
13.75	3.327554
14	3.333327
14.25	3.338394
14.5	3.343461
14.75	3.348528
15	3.353595
15.25	3.358662
15.5	3.363729
15.75	3.368796
16	3.373863
16.25	3.378384
16.5	3.382904
16.75	3.387425
17	3.391945
17.25	3.396466
17.5	3.400986
17.75	3.405507
18	3.410027
18.25	3.414112
18.5	3.418197
18.75	3.422281
19	3.426366
19.25	3.430451
19.5	3.434536
19.75	3.43862
20	3.442705
20.25	3.446434
20.5	3.450163
20.75	3.453892
21	3.457621
21.25	3.461349
21.5	3.465078
21.75	3.468807
22	3.472536
22.25	3.475968
22.5	3.479401
22.75	3.482833
23	3.486265
23.25	3.489698
23.5	3.49313
23.75	3.496563
24	3.499995

Tabulation of the rainfall power curves for NM type IIa storms			Type II-60 y =0.60 x^0.160735		Type II-65 y =0.65 * x^0.135549		Type II-70 y =0.70* x^0.112231		Type II-75 y =0.75 * x^0.090521	
	hours	time	inches	rainfall	inches	rainfall	inches	rainfall	inches	rainfall
n	x	delta x	y	delta y	y	delta y	y	delta y	y	delta y
1	0.00		0.000		0.000		0.000		0.000	
2	0.25	0.250	0.480	0.480	0.539	0.539	0.599	0.599	0.662	0.662
3	0.50	0.250	0.537	0.057	0.592	0.053	0.648	0.048	0.704	0.043
4	0.75	0.250	0.573	0.036	0.625	0.033	0.678	0.030	0.731	0.026
5	1.00	0.250	0.600	0.027	0.650	0.025	0.700	0.022	0.750	0.019
6	1.25	0.250	0.622	0.022	0.670	0.020	0.718	0.018	0.765	0.015
7	1.50	0.250	0.640	0.018	0.687	0.017	0.733	0.015	0.778	0.013
8	1.75	0.250	0.656	0.016	0.701	0.015	0.745	0.013	0.789	0.011
9	2.00	0.250	0.671	0.014	0.714	0.013	0.757	0.011	0.799	0.010
10	2.50	0.500	0.695	0.024	0.736	0.022	0.776	0.019	0.815	0.016
11	3.00	0.500	0.716	0.021	0.754	0.018	0.792	0.016	0.828	0.014
12	3.50	0.500	0.734	0.018	0.770	0.016	0.806	0.014	0.840	0.012
13	4.00	0.500	0.750	0.016	0.784	0.014	0.818	0.012	0.850	0.010
14	5.00	1.000	0.777	0.027	0.808	0.024	0.839	0.021	0.868	0.017
15	6.00	1.000	0.800	0.023	0.829	0.020	0.856	0.017	0.882	0.014
16	7.00	1.000	0.820	0.020	0.846	0.017	0.871	0.015	0.894	0.012
17	8.00	1.000	0.838	0.018	0.862	0.015	0.884	0.013	0.905	0.011
18	9.00	1.000	0.854	0.016	0.876	0.014	0.896	0.012	0.915	0.010
19	10.00	1.000	0.869	0.015	0.888	0.013	0.906	0.011	0.924	0.009
20	11.00	1.000	0.882	0.013	0.900	0.012	0.916	0.010	0.932	0.008
21	12.00	1.000	0.895	0.012	0.910	0.011	0.925	0.009	0.939	0.007
22	14.00	2.000	0.917	0.022	0.930	0.019	0.941	0.016	0.952	0.013
23	16.00	2.000	0.937	0.020	0.947	0.017	0.956	0.014	0.964	0.012
24	18.00	2.000	0.955	0.018	0.962	0.015	0.968	0.013	0.974	0.010
25	20.00	2.000	0.971	0.016	0.976	0.014	0.980	0.012	0.984	0.009
26	22.00	2.000	0.986	0.015	0.988	0.013	0.990	0.011	0.992	0.009
27	24.00	2.000	1.000	0.014	1.000	0.012	1.000	0.010	1.000	0.008

NRCS-NM Type II Rainfall Distributions

Rearranged	delta x	Accum x	delta y	II-60	delta y	II-65	delta y	II-70	delta y	II-75	Type II
		0.00		0.0000		0.0000		0.0000		0.0000	0.0000
19	1.00	1.00	0.0134	0.0134	0.0115	0.0115	0.0097	0.0097	0.0080	0.0080	0.0105
17	1.00	2.00	0.0160	0.0294	0.0139	0.0254	0.0118	0.0215	0.0097	0.0177	0.0220
15	1.00	3.00	0.0201	0.0495	0.0175	0.0429	0.0149	0.0364	0.0124	0.0301	0.0345
13	1.00	4.00	0.0274	0.0769	0.0241	0.0670	0.0207	0.0572	0.0173	0.0475	0.0480
11	0.50	4.50	0.0180	0.0948	0.0159	0.0829	0.0138	0.0710	0.0116	0.0591	0.0553
9	0.50	5.00	0.0245	0.1193	0.0219	0.1049	0.0192	0.0902	0.0163	0.0754	0.0630
7	0.25	5.25	0.0161	0.1354	0.0145	0.1194	0.0128	0.1030	0.0109	0.0863	0.0670
5	0.25	5.50	0.0219	0.1573	0.0200	0.1393	0.0178	0.1207	0.0153	0.1016	0.0712
3	0.25	5.75	0.0361	0.1935	0.0334	0.1727	0.0302	0.1509	0.0263	0.1280	0.0756
1	0.25	6.00	0.4802	0.6736	0.5386	0.7114	0.5991	0.7500	0.6615	0.7895	0.0800
2	0.25	6.25	0.0566	0.7302	0.0531	0.7645	0.0485	0.7985	0.0428	0.8323	0.0846
4	0.25	6.50	0.0271	0.7573	0.0249	0.7893	0.0222	0.8207	0.0193	0.8516	0.0892
6	0.25	6.75	0.0185	0.7758	0.0168	0.8061	0.0148	0.8356	0.0127	0.8644	0.0940
8	0.25	7.00	0.0142	0.7901	0.0128	0.8189	0.0113	0.8468	0.0096	0.8740	0.0990
10	0.50	7.50	0.0207	0.8107	0.0184	0.8373	0.0160	0.8629	0.0136	0.8875	0.1093
12	0.50	8.00	0.0159	0.8266	0.0141	0.8514	0.0122	0.8750	0.0102	0.8977	0.1200
14	1.00	9.00	0.0231	0.8498	0.0202	0.8716	0.0173	0.8924	0.0144	0.9122	0.1470
16	1.00	10.00	0.0178	0.8676	0.0155	0.8871	0.0131	0.9055	0.0109	0.9230	0.1810
18	1.00	11.00	0.0146	0.8821	0.0126	0.8996	0.0107	0.9162	0.0088	0.9318	0.2350
20	1.00	12.00	0.0124	0.8946	0.0107	0.9103	0.0090	0.9252	0.0074	0.9392	0.6630
21	2.00	14.00	0.0224	0.9170	0.0192	0.9295	0.0161	0.9413	0.0132	0.9524	0.8200
22	2.00	16.00	0.0199	0.9369	0.0170	0.9465	0.0142	0.9555	0.0116	0.9640	0.8800
23	2.00	18.00	0.0179	0.9548	0.0152	0.9618	0.0127	0.9682	0.0103	0.9743	0.9210
24	2.00	20.00	0.0163	0.9711	0.0138	0.9756	0.0115	0.9797	0.0093	0.9836	0.9520
25	2.00	22.00	0.0150	0.9861	0.0127	0.9883	0.0105	0.9903	0.0085	0.9922	0.9770
26	2.00	24.00	0.0139	1.0000	0.0117	1.0000	0.0097	1.0000	0.0078	1.0000	1.0000

Picacho Hills Total NOAA Atlas 14 Depths (in)

100-yr, 24-hr depth =	3.5
10-yr, 24-hr depth =	2.21
2-yr, 24-hr depth =	1.44

Type B, 6-hour Distribution for Auxiliary Spillway Design

Time	Time in hours	rainfall
0.00	0.00	0.0000
0.02	0.12	0.0080
0.04	0.24	0.0162
0.06	0.36	0.0246
0.08	0.48	0.0333
0.10	0.60	0.0425
0.12	0.72	0.0524
0.14	0.84	0.0630
0.16	0.96	0.0743
0.18	1.08	0.0863
0.20	1.20	0.0990
0.22	1.32	0.1124
0.24	1.44	0.1265
0.26	1.56	0.1420
0.28	1.68	0.1595
0.30	1.80	0.1800
0.32	1.92	0.2050
0.34	2.04	0.2550
0.36	2.16	0.3450
0.38	2.28	0.4370
0.40	2.40	0.5300
0.42	2.52	0.6030
0.44	2.64	0.6330
0.46	2.76	0.6600
0.48	2.88	0.6840
0.50	3.00	0.7050
0.52	3.12	0.7240
0.54	3.24	0.7420
0.56	3.36	0.7590
0.58	3.48	0.7750
0.60	3.60	0.7900
0.62	3.72	0.8043
0.64	3.84	0.8180
0.66	3.96	0.8312
0.68	4.08	0.8439
0.70	4.20	0.8561
0.72	4.32	0.8678
0.74	4.44	0.8790
0.76	4.56	0.8898
0.78	4.68	0.9002
0.80	4.80	0.9103
0.82	4.92	0.9201
0.84	5.04	0.9297
0.86	5.16	0.9391
0.88	5.28	0.9483
0.90	5.40	0.9573
0.92	5.52	0.9661
0.94	5.64	0.9747
0.96	5.76	0.9832
0.98	5.88	0.9916
1.00	6.00	1.0000

100 Yr Type II-75 y =0.75 * x^0.090521		10 Yr Type II-75 y =0.75 * x^0.090521		2 Yr Type II-75 y =0.75 * x^0.090521	
inches y	rainfall delta y	inches y	rainfall delta y	inches y	rainfall delta y
0		0		0	
2.315422	2.315	1.462024	1.462	0.952631	0.953
2.465357	0.150	1.556697	0.095	1.014318	0.062
2.557524	0.092	1.614894	0.058	1.052238	0.038
2.625	0.067	1.6575	0.043	1.08	0.028
2.678562	0.054	1.691321	0.034	1.102037	0.022
2.723136	0.045	1.719466	0.028	1.120376	0.018
2.7614	0.038	1.743627	0.024	1.136119	0.016
2.794981	0.034	1.764831	0.021	1.149935	0.014
2.852011	0.057	1.800641	0.036	1.173399	0.023
2.899471	0.047	1.830809	0.030	1.192925	0.020
2.940214	0.041	1.856535	0.026	1.209688	0.017
2.975969	0.036	1.879112	0.023	1.224399	0.015
3.036692	0.061	1.917454	0.038	1.249382	0.025
3.087225	0.051	1.949362	0.032	1.270173	0.021
3.130606	0.043	1.976754	0.027	1.288021	0.018
3.168677	0.038	2.000793	0.024	1.303684	0.016
3.202641	0.034	2.022239	0.021	1.317658	0.014
3.233332	0.031	2.041618	0.019	1.330285	0.013
3.261349	0.028	2.059309	0.018	1.341812	0.012
3.287138	0.026	2.075593	0.016	1.352422	0.011
3.333327	0.046	2.104758	0.029	1.371426	0.019
3.373863	0.041	2.130354	0.026	1.388104	0.017
3.410027	0.036	2.153189	0.023	1.402983	0.015
3.442705	0.033	2.173822	0.021	1.416427	0.013
3.472536	0.030	2.192658	0.019	1.428701	0.012
3.499995	0.027	2.209997	0.017	1.439998	0.011

delta y	II-75	Accum x	delta y	II-75	Accum x	delta y	II-75	Accum x
	0	0		0	0		0	0
0.028016	0.028016	1	0.01769	0.01769	1	0.011527	0.011527	1
0.033965	0.061981	2	0.021446	0.039137	2	0.013974	0.025501	2
0.043381	0.105362	3	0.027392	0.066528	3	0.017848	0.043349	3
0.060723	0.166085	4	0.038342	0.104871	4	0.024983	0.068332	4
0.040742	0.206828	4.5	0.025726	0.130597	4.5	0.016763	0.085095	4.5
0.05703	0.263858	5	0.036011	0.166607	5	0.023464	0.108559	5
0.038265	0.302123	5.25	0.024161	0.190769	5.25	0.015743	0.124302	5.25
0.053562	0.355685	5.5	0.033821	0.224589	5.5	0.022037	0.146339	5.5
0.092167	0.447852	5.75	0.058197	0.282787	5.75	0.03792	0.184259	5.75
2.315422	2.763274	6	1.462024	1.74481	6	0.952631	1.13689	6
0.149934	2.913209	6.25	0.094673	1.839483	6.25	0.061687	1.198577	6.25
0.067476	2.980685	6.5	0.042606	1.882089	6.5	0.027762	1.226339	6.5
0.044574	3.025258	6.75	0.028145	1.910234	6.75	0.018339	1.244678	6.75
0.033581	3.058839	7	0.021204	1.931438	7	0.013816	1.258494	7
0.04746	3.106299	7.5	0.029968	1.961406	7.5	0.019526	1.27802	7.5
0.035755	3.142054	8	0.022577	1.983983	8	0.014711	1.292731	8
0.050533	3.192587	9	0.031908	2.015891	9	0.020791	1.313522	9
0.03807	3.230658	10	0.024039	2.03993	10	0.015663	1.329185	10
0.030691	3.261349	11	0.019379	2.059309	11	0.012627	1.341812	11
0.025789	3.287138	12	0.016284	2.075593	12	0.01061	1.352422	12
0.04619	3.333327	14	0.029166	2.104758	14	0.019004	1.371426	14
0.040536	3.373863	16	0.025595	2.130354	16	0.016678	1.388104	16
0.036164	3.410027	18	0.022835	2.153189	18	0.014879	1.402983	18
0.032678	3.442705	20	0.020634	2.173822	20	0.013445	1.416427	20
0.029831	3.472536	22	0.018836	2.192658	22	0.012273	1.428701	22
0.027459	3.499995	24	0.017338	2.209997	24	0.011297	1.439998	24

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

New Mexico 32.311 N 106.876 W 4097 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006
Extracted: Thu Oct 9 2008

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.22	0.33	0.41	0.56	0.69	0.79	0.83	0.94	1.03	1.13	1.22	1.39	1.59	1.76	2.23	2.66	3.22	3.69
2	0.28	0.43	0.54	0.72	0.89	1.02	1.07	1.20	1.31	1.44	1.55	1.77	2.02	2.25	2.86	3.38	4.08	4.68
5	0.38	0.58	0.72	0.97	1.20	1.37	1.42	1.57	1.70	1.87	2.00	2.30	2.63	2.95	3.70	4.34	5.18	5.93
10	0.46	0.70	0.86	1.16	1.44	1.65	1.70	1.86	2.00	2.21	2.37	2.71	3.11	3.49	4.34	5.06	5.98	6.82
25	0.56	0.85	1.06	1.42	1.76	2.03	2.08	2.25	2.39	2.69	2.89	3.27	3.76	4.24	5.18	6.00	7.00	7.93
50	0.64	0.98	1.21	1.63	2.02	2.33	2.39	2.55	2.69	3.08	3.30	3.71	4.27	4.82	5.83	6.71	7.75	8.73
100	0.73	1.11	1.37	1.85	2.29	2.64	2.71	2.86	3.00	3.50	3.75	4.16	4.80	5.44	6.48	7.42	8.48	9.51
200	0.81	1.24	1.54	2.07	2.56	2.97	3.04	3.19	3.31	3.95	4.22	4.64	5.36	6.07	7.13	8.12	9.18	10.24
500	0.94	1.43	1.77	2.38	2.95	3.42	3.50	3.63	3.72	4.59	4.89	5.35	6.12	6.93	8.02	9.05	10.08	11.16
1000	1.04	1.58	1.96	2.63	3.26	3.78	3.87	3.98	4.05	5.13	5.47	5.95	6.72	7.61	8.69	9.76	10.73	11.81

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting forces estimates near zero to appear as zero.

*** Upper bound of the 90% confidence interval**
Precipitation Frequency Estimates (inches)

ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.25	0.38	0.47	0.64	0.79	0.90	0.94	1.06	1.15	1.24	1.33	1.51	1.73	1.92	2.43	2.89	3.48	3.99
2	0.33	0.49	0.61	0.83	1.02	1.16	1.22	1.35	1.47	1.57	1.69	1.93	2.21	2.46	3.11	3.68	4.43	5.07
5	0.43	0.66	0.82	1.11	1.37	1.56	1.62	1.77	1.90	2.04	2.19	2.51	2.87	3.22	4.02	4.72	5.62	6.42
10	0.52	0.79	0.98	1.32	1.64	1.87	1.93	2.08	2.23	2.43	2.60	2.97	3.40	3.82	4.73	5.51	6.50	7.39
25	0.64	0.97	1.20	1.61	2.00	2.30	2.35	2.52	2.66	3.01	3.22	3.63	4.16	4.69	5.70	6.60	7.66	8.65
50	0.73	1.11	1.38	1.85	2.29	2.63	2.69	2.85	2.99	3.52	3.75	4.18	4.79	5.41	6.48	7.46	8.54	9.59
100	0.82	1.25	1.55	2.09	2.59	2.98	3.05	3.20	3.34	4.10	4.36	4.78	5.48	6.18	7.30	8.35	9.44	10.52
200	0.93	1.41	1.75	2.35	2.91	3.35	3.43	3.56	3.69	4.75	5.03	5.42	6.22	7.03	8.16	9.29	10.36	11.47
500	1.07	1.62	2.01	2.71	3.35	3.86	3.94	4.07	4.16	5.80	6.07	6.46	7.33	8.24	9.38	10.62	11.61	12.72
1000	1.18	1.79	2.23	3.00	3.71	4.27	4.36	4.47	4.54	6.75	7.04	7.40	8.27	9.27	10.38	11.70	12.56	13.65

* The upper bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are greater than.
** These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

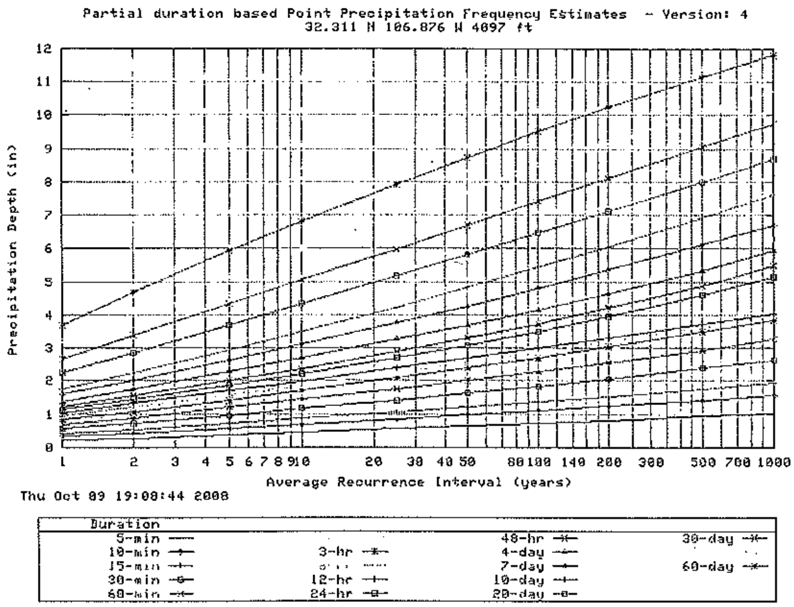
*** Lower bound of the 90% confidence interval**
Precipitation Frequency Estimates (inches)

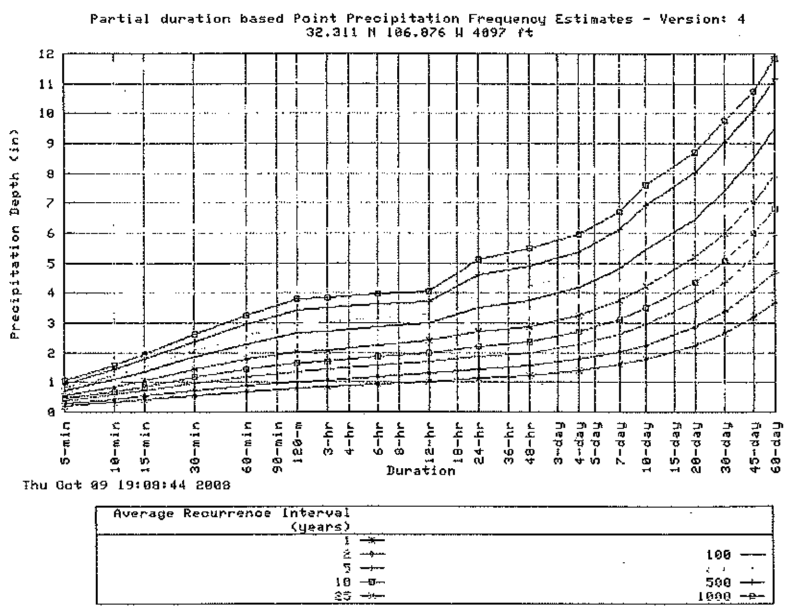
ARI** (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.19	0.29	0.36	0.48	0.60	0.69	0.73	0.84	0.92	1.04	1.12	1.27	1.46	1.62	2.05	2.45	2.96	3.39
2	0.25	0.38	0.47	0.63	0.78	0.89	0.94	1.07	1.18	1.32	1.42	1.62	1.86	2.06	2.62	3.11	3.77	4.32
5	0.33	0.51	0.63	0.85	1.05	1.20	1.26	1.40	1.52	1.70	1.83	2.10	2.41	2.70	3.40	3.99	4.78	5.48
10	0.40	0.61	0.75	1.01	1.25	1.43	1.49	1.64	1.78	1.99	2.14	2.46	2.82	3.17	3.96	4.62	5.50	6.27
25	0.48	0.74	0.91	1.23	1.52	1.75	1.81	1.97	2.11	2.38	2.57	2.93	3.36	3.79	4.67	5.41	6.38	7.24
50	0.55	0.84	1.04	1.40	1.74	2.00	2.07	2.22	2.37	2.68	2.89	3.28	3.77	4.26	5.19	5.99	7.00	7.91
100	0.62	0.95	1.17	1.58	1.96	2.25	2.32	2.48	2.62	2.98	3.21	3.62	4.17	4.72	5.70	6.54	7.58	8.54
200	0.69	1.06	1.31	1.76	2.18	2.51	2.59	2.73	2.88	3.28	3.53	3.94	4.57	5.17	6.19	7.06	8.12	9.09
500	0.79	1.20	1.49	2.01	2.48	2.85	2.93	3.08	3.21	3.69	3.95	4.42	5.08	5.75	6.81	7.71	8.78	9.77
1000	0.87	1.32	1.64	2.21	2.73	3.12	3.21	3.35	3.46	3.99	4.30	4.81	5.47	6.19	7.26	8.19	9.24	10.24

* The lower bound of the confidence interval at 90% confidence level is the value which 5% of the simulated quantile values for a given frequency are less than.

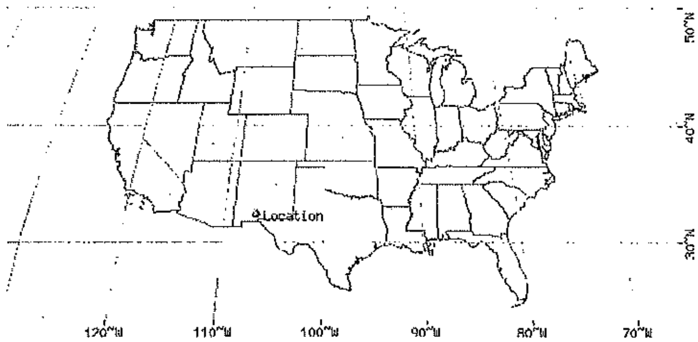
** These precipitation frequency estimates are based on a partial duration maxima series. ARI is the Average Recurrence Interval.
Please refer to NOAA Atlas 14 Document for more information. NOTE: Formatting prevents estimates near zero to appear as zero.

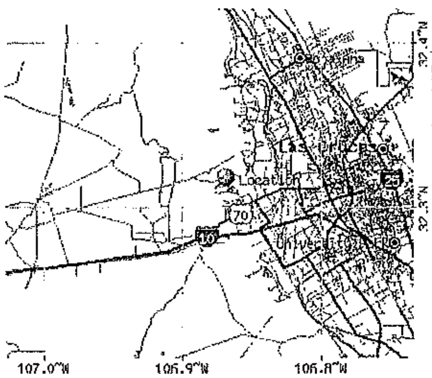
Text version of tables





Maps -





These maps were produced using a direct map request from the U.S. Census Bureau Mapping and Cartographic Resources Tiger Map Server.

Please read disclaimer for more information.

LEGEND

State
County
Indian Resv
Lake/Pond/Ocean
Street
Expressway
Highway
Connector
Stream
Military Area
National Park
Other Park
City
County

Scale 1:228583
*average—true scale depends on monitor resolution

Other Maps/Photographs -

View USGS digital orthophoto quadrangle (DOQ) covering this location from TerraServer; USGS Aerial Photograph may also be available from this site. A DOQ is a computer-generated image of an aerial photograph in which image displacement caused by terrain relief and camera tilts has been removed. It combines the image characteristics of a photograph with the geometric qualities of a map. Visit the USGS for more information.

Watershed/Stream Flow Information -

Find the Watershed for this location using the U.S. Environmental Protection Agency's site.

Climate Data Sources -

Precipitation frequency results are based on data from a variety of sources, but largely NCDC. The following links provide general information about observing sites in the area, regardless of if their data was used in this study. For detailed information about the stations used in this study, please refer to NOAA Atlas 14 Document.

Using the National Climatic Data Center's (NCDC) station search engine, locate other climate stations within:

+/-30 minutes ...OR... +/-1 degree of this location (32.311/-106.876). Digital ASCII data can be obtained directly from NCDC.

Find Natural Resources Conservation Service (NRCS) SNOTEL (SNOwpack TELemetry) stations by visiting the Western Regional Climate Center's state-specific SNOTEL station maps.

Hydrometeorological Design Studies Center
DOC/NOAA/National Weather Service
1325 East-West Highway
Silver Spring, MD 20910
(301) 713-1669
Questions?: HDSC.Questions@noaa.gov

Disclaimer

Curve Number Modification
Picacho Hills / Old Picacho Hills

BHI No. 090126
Date 10/30/2008
Prepared By: Kjohnson
Goal: Prepare CN values that are representative of the study area.

References: NRCS TR-55 (Table 2-2a through Table 2-2d & Figure 2-3)
NMDOT Drainage Manual

Assumptions: Developed areas within Picacho Hills / Old Picacho have following cover type and hydrologic condition:
Western desert urban areas, natural desert urban areas (pervious areas only)

Methodology: Adjust the pervious area CN to reflect average percent impervious area per NRCS requirements.
Adjust all CNs to reflect high antecedent moisture content within the soil per NRCS requirements.

	CN for Average Condition			
Cover type and hydrologic condition	**A**	**B**	**C**	**D**
Western desert urban area: Natural desert landscaping	63	77	85	88

		% Impervious adjusted CN			
Cover type and hydrologic condition	**Average Percent impervious area**	**A**	**B**	**C**	**D**
Residential - 1 acre lot	20	70	82	88	90
Residential - 1/3 acre lot	30	74	84	90	92
Residential - 1/8 acre lot	65	86	91	92	93

Note:
- Curve numbers increased / adjusted to represent increased impervious area due to development, per Figure 2-3 - Composite CN with connected impervious area (TR-

	CN for Average Condition				CN for Wet Condition (High Antecedent Moisture Condition)			
Cover type and hydrologic condition	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
Agriculture - Straight Row Crop ResidueGood	64	75	82	85	81	88	92	93
Desert shrub - poor	63	77	85	88	80	89	93	95
Residential - 1 acre lot (w/ % Impervious)	70	82	88	90	85	92	95	96
Residential - 1/3 acre lot (w/ % Impervious)	74	84	90	92	87	93	96	97
Residential - 1/8 acre lot (w/ % Impervious)	86	91	92	93	94	96	97	97
Open Space - golf courses	39	61	74	80	60	79	87	91

Note:
- Curve numbers increased / adjusted to represent the high antecedent moisture content for modeling purposes.
- Curve numbers adjusted per USDA SCS TR-55, 1986 (As found in table 3-5 NMDOT Drainage Manual, pg. 3-27)

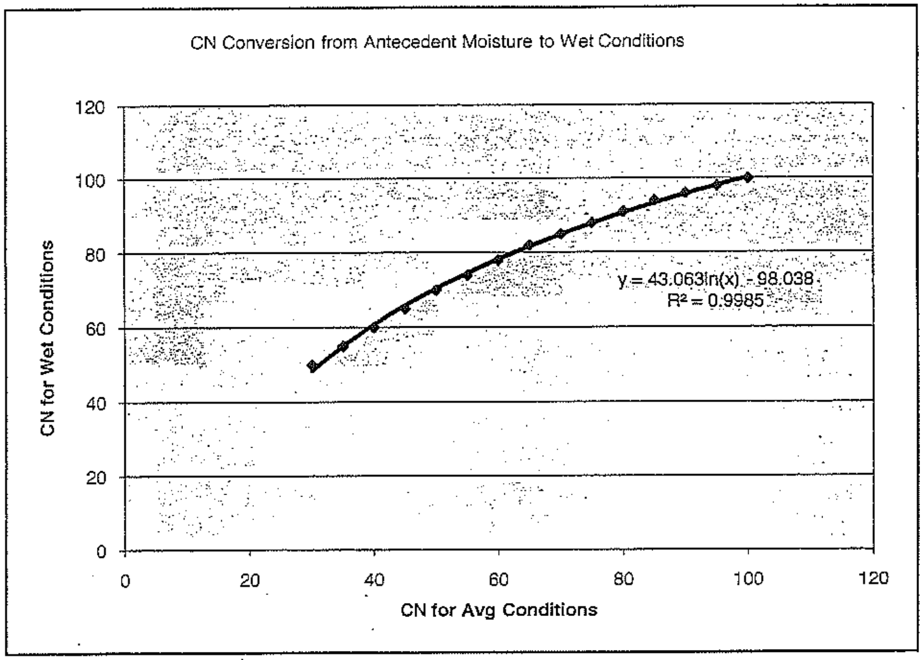


Table 3-5 - Conversion from Avg. Antecedent Moisture Conditions to Wet Conditions (NMDOT Drainage Manual)

CN for Avg. Conditions	CN (Wet)
100	100
95	98
90	96
85	94
80	91
75	88
70	85
65	82
60	78
55	74
50	70
45	65
40	60
35	55
30	50

Reference:
USDA, NRCS Conservation Engineering Division, TR-55 "Urban Hydrology for Small Watersheds" (June 1986)

Figure 2-3 Composite CN with connected impervious area.

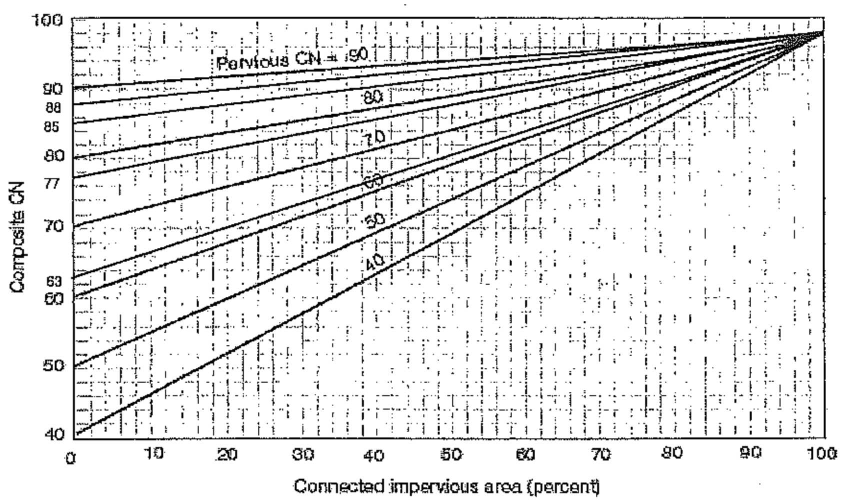
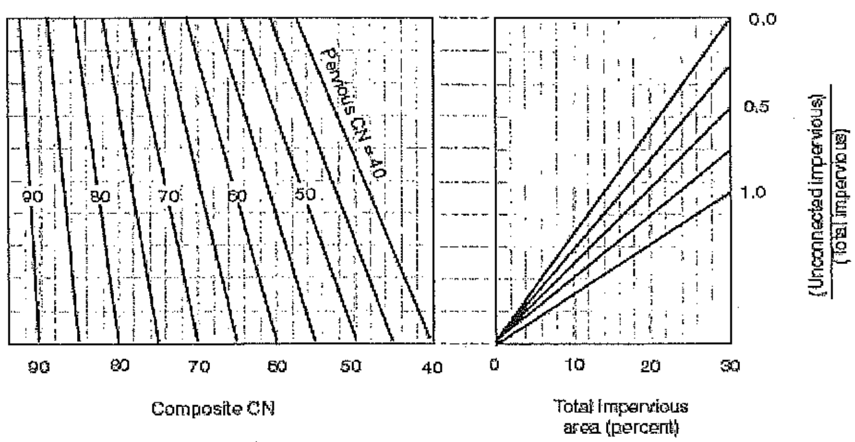


Figure 2-4 Composite CN with unconnected impervious areas and total impervious area less than 30%



Future Condition Curve Number Modification

Picacho Hills / Old Picacho Hills

BHI No. 090126
Date 10/31/2008
Prepared By: Kjohnson
Goal: Prepare CN values that are representative of the study area.

References: NRCS TR-55 (Table 2-2a through Table 2-2d & Figure 2-3)
NMDOT Drainage Manual

Assumptions: Developed areas within Picacho Hills / Old Picacho have following cover type and hydrologic condition:
Western desert urban areas, natural desert urban areas (pervious areas only)
5 acre residential lot % impervious is approximated from the 2 acre residential percent impervious value.

Methodology: Adjust the pervious area CN to reflect average percent impervious area per NRCS requirements.
Adjust all CNs to reflect high antecedent moisture content within the soil per NRCS requirements.

	CN for Average Condition			
Cover type and hydrologic condition	**A**	**B**	**C**	**D**
Western desert urban area: Natural desert landscaping	63	77	85	88

		% Impervious adjusted CN			
Cover type and hydrologic condition	**Average Percent impervious area**	**A**	**B**	**C**	**D**
Residential - >5 acre lot	8	66	79	86	89
Residential - 1 acre lot	20	70	82	88	90
Residential - 1/2 acre lot	25	72	83	89	91
Residential - 1/3 acre lot	30	74	84	90	92
Residential - 1/8 acre lot	65	86	91	92	93

Note:

- Curve numbers increased / adjusted to represent increased impervious area due to development, per Figure 2-3 - Composite CN with connected impervious area (TR-55)

	Cover type and hydrologic condition	CN for Average Condition A	B	C	D	CN for Wet Condition (High Antecedent Moisture Condition) A	B	C	D
1	Agriculture - Straight Row Crop ResidueGood	64	75	82	85	81	88	92	93
2	Desert shrub - poor	63	77	85	88	80	89	93	95
6	Open Space - golf courses	39	61	74	80	60	79	87	91
7	Residential - 5 acre lot	66	79	86	89	82	90	94	95
3	Residential - 1 acre lot	70	82	88	90	85	92	95	96
8	Residential - 1/2 acre lot	72	83	89	91	86	92	95	96
4	Residential - 1/3 acre lot	74	84	90	92	87	93	96	97
5	Residential - 1/8 acre lot	86	91	92	93	94	96	97	97
9	Commercial / Business	89	92	94	95	95	97	98	98
10	Industrial	81	88	91	93	91	95	96	97

Note:

- Curve numbers increased / adjusted to represent the high antecedent moisture content for modeling purposes.
- Curve numbers adjusted per USDA SCS TR-55, 1986 (As found in table 3-5 NMDOT Drainage Manual, pg. 3-27) & WinTR-55 Program

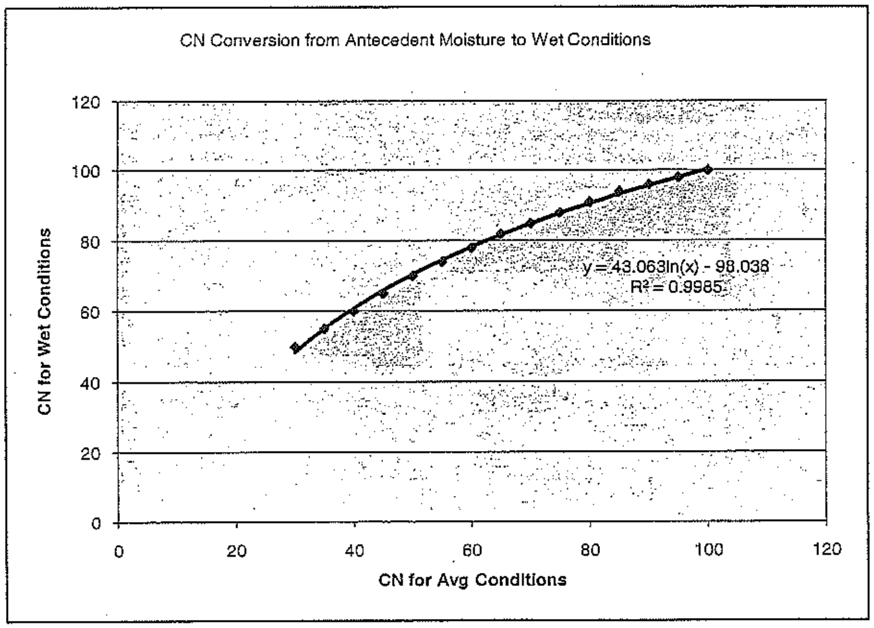


Table 3-5 - Conversion from Avg. Antecedent Moisture Conditions to Wet Conditions (NMDOT Drainage Manual)

CN for Avg. Conditions	CN (Wet)
100	100
95	98
90	96
85	94
80	91
75	88
70	85
65	82
60	78
55	74
50	70
45	65
40	60
35	55
30	50

Reference:
USDA, NRCS Conservation Engineering Division, TR-55 "Urban Hydrology for Small Watersheds" (June 1986)

Figure 2-3 Composite CN with connected impervious area.

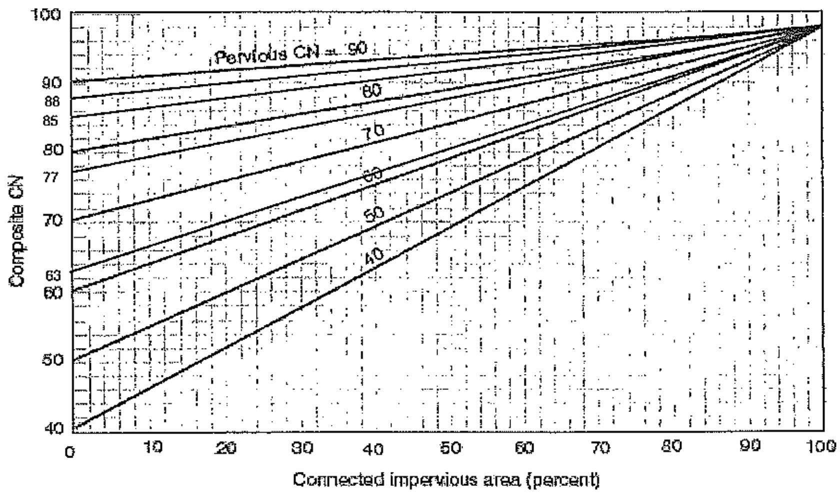
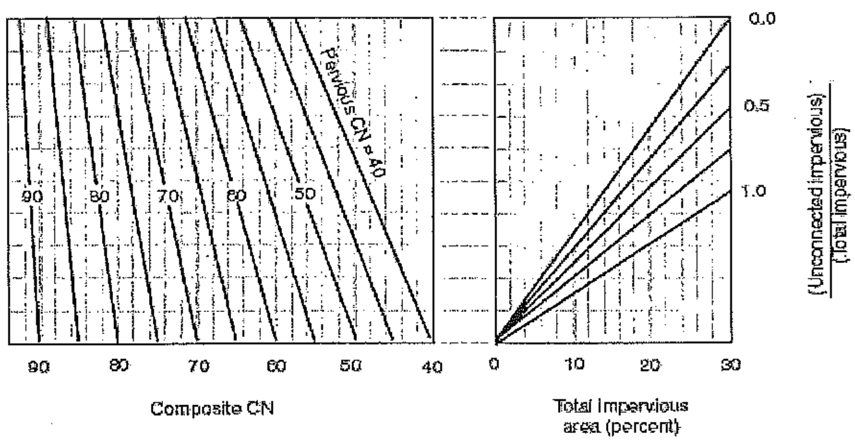


Figure 2-4 Composite CN with unconnected impervious areas and total impervious area less than 30%



Existing and Future Condition Time of Concentration

Picacho Hills

BHI No. 090126

Prepared By: Kris Johnson

Date: 9-Mar-09

References: NMDOT Drainage Manual - Volume 1, Hydrology (1995): Section 3.3.1.4.1 The Upland Method
This section is a modified SCS method for watersheds less than 2000 acres in size.

Assumptions: Conservative assumptions in the use of nomograph for Flow Velocities should account for any variation in Lag time for existing conditions to future development conditions.

Note:
1. Sheet Velocity & Shallow Velocity are interpolated from NMDOT Drainage Manual Volume 1, Figure 3-10.
2. Using Nearly Bare and Untilled (Overland Flow) & Small Upland Gulleys (Shallow Concentrated Flow)
3. HEC HMS notes that simulation interval is greater than 0.29xlag for the subbasin. To correct this warning, lag times increased to min time of 7 min.

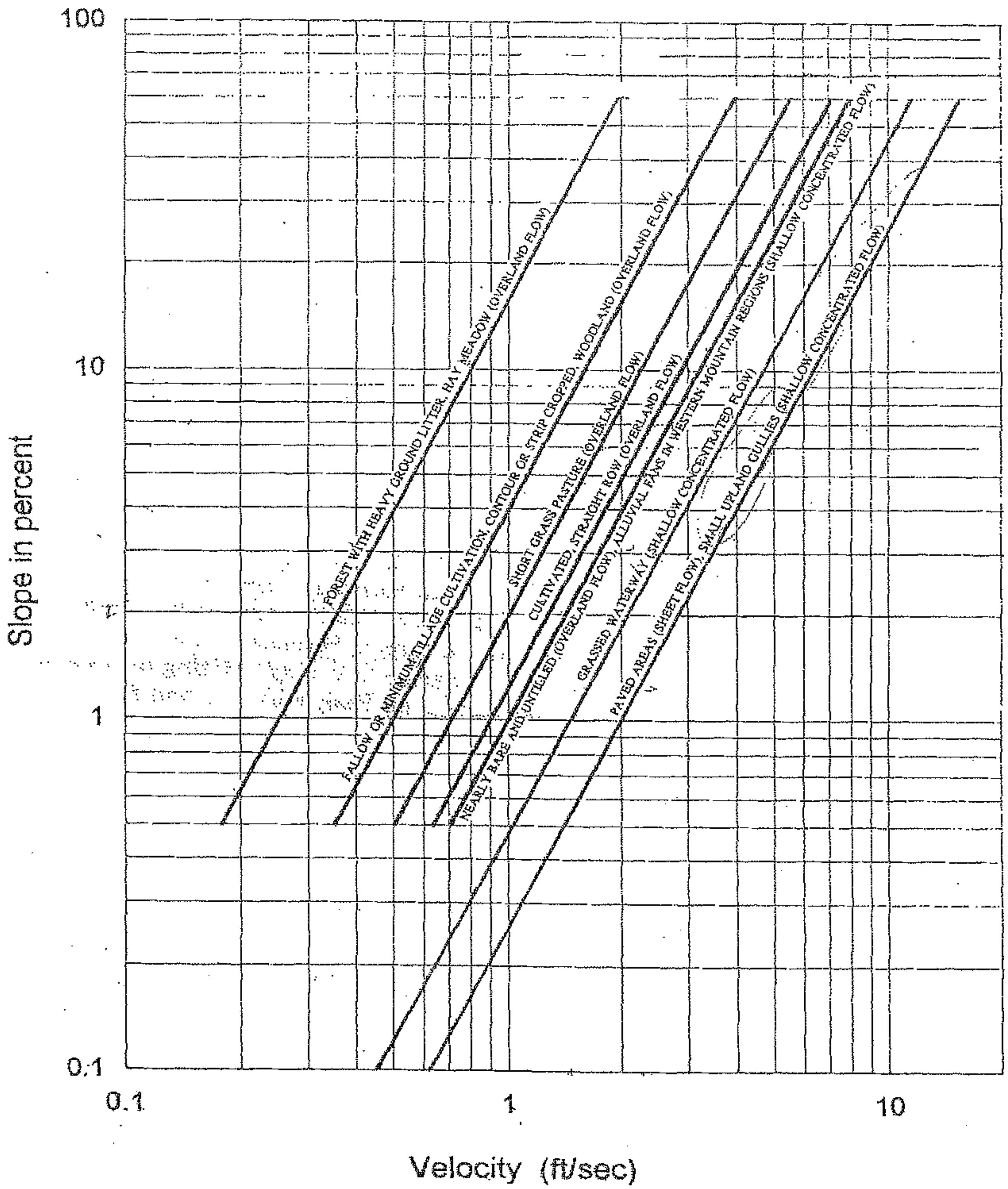
Basin	Area (ac)	Area (mi^2)	Sheet Slope (ft/ft)	Conc Slope (ft/ft)	Channel Length (ft)	Sheet Length (ft)	Shallow Length (ft)	Sheet Vel (ft/sec)	Shallow Vel (ft/sec)	Tc (min)	Tc (hr)	AdjustedTc (hr)	Adjusted Tl (min)	HEC-HMS Adjusted Tl (min)
N-A1a	4817.3	7.527062	0.027	0.027	6590.0	400.0	6190.0	1.70	3.30	35.18	0.586403	0.5864032	21.11	21.11
N-A1b			0.003	0.003	8100.0	0.0	8100.0	1.50	1.50	90.00	1.5	1.5	54.00	54.00
N-A1c			0.020	0.020	7655.0	0.0	7655.0	2.80	2.80	45.57	0.759425	0.7594246	27.34	27.34
											sum =	2.8458279	102.45	102.45
A2	227.6	0.355593	0.073	0.024	8134.2	400.0	7734.2	3.30	3.70	36.86	0.614313	0.6143127	22.12	22.12
B1	1529.3	2.389565	0.005	0.005	21303.8	10474.0	4046.0	0.70	1.50	294.34	4.905608	4.9056085	176.60	176.60
				0.028	6783.8	0.0	6783.8		3.22	35.11	0.585211	0.5852106	21.07	21.07
											sum =	5.4908191	197.67	197.67
B10	13.9	0.021772	0.028	0.025	2718.2	400.0	2318.2	1.76	3.11	16.21	0.270192	0.2701915	9.73	9.73
B11	0.8	0.001183	0.027		357.9	357.9	0.0	1.74	0.00	3.43	0.057134	0.16667	6.00	7.00
B12	5.9	0.00916	0.043		955.9	955.9	0.0	1.13		14.10	0.234982	0.2349819	8.46	8.46
B13	9.0	0.014112	0.005		953.3	953.3	0.0	0.70		22.70	0.378294	0.3782945	13.62	13.62
B14	2.3	0.003584	0.027		830.4	830.4	0.0	1.74		7.95	0.132568	0.16667	6.00	7.00
B15	5.6	0.008778	0.005		263.9	263.9	0.0	0.70		6.28	0.104716	0.16667	6.00	7.00
B2	118.9	0.185786	0.067	0.042	7376.7	400.0	6976.7	2.80	4.10	30.74	0.512357	0.5123569	18.44	18.44
B3	155.8	0.243374	0.046	0.033	6486.0	400.0	6086.0	2.15	3.61	31.20	0.519981	0.5199809	18.72	18.72
B4	102.3	0.15987	0.044	0.031	5366.9	400.0	4966.9	5.25	3.55	24.59	0.409808	0.4098081	14.75	14.75
B5	33.2	0.051817	0.029	0.029	3047.3	400.0	2647.3	1.75	3.44	16.64	0.277258	0.2772576	9.98	9.98
B5a	4.1	0.006368	0.039	0.039	1665.8	400.0	1265.8	2.00	3.94	8.69	0.144798	0.16667	6.00	7.00
B5b	27.2	0.042574	0.100	0.053	1463.7	400.0	1063.7	3.22	4.61	5.92	0.098601	0.16667	6.00	7.00
B6	52.5	0.081958	0.116	0.046	3675.9	400.0	3275.9	3.44	6.50	10.34	0.172297	0.1722975	6.20	7.00
B7	4.2	0.006587	0.037	0.030	1580.1	400.0	1180.1	1.90	3.50	9.13	0.152141	0.16667	6.00	7.00
B9	1.8	0.002787	0.032	0.032	1070.3	400.0	670.3	1.80	3.66	6.76	0.1126	0.16667	6.00	7.00
C1	324.9	0.507721	0.005	0.038	8713.9	400.0	8313.9	0.70	3.77	46.28	0.771307	0.7713069	27.77	27.77
C2	192.0	0.299936	0.119	0.031	6552.3	400.0	6152.3	3.50	3.60	30.39	0.506457	0.5064568	18.23	18.23
C2a	8.5	0.01332	0.084	0.084	821.3	400.0	421.3	2.75	5.60	3.68	0.061303	0.16667	6.00	7.00
C3	56.7	0.088644	0.060	0.031	2985.7	400.0	2585.7	2.52	3.55	14.79	0.246419	0.2464187	8.87	8.87

Basin	Area (ac)	Area (mi^2)	Sheet Slope (ft/ft)	Conc Slope (ft/ft)	Channel Length (ft)	Sheet Length (ft)	Shallow Length (ft)	Sheet Vel (ft/sec)	Shallow Vel (ft/sec)	Tc (min)	Tc (hr)	AdjustedTc (hr)	Adjusted Tl (min)	HEC-HMS Adjusted Tl (min)
C4	41.8	0.065242	0.056	0.033	3132.1	400.0	2732.1	**2.63**	**3.22**	16.68	0.277939	0.2779386	10.01	10.01
C4a	98.1	0.153314	0.020	0.020	4550.5	400.0	4150.5	1.50	2.81	29.06	0.484362	0.4843622	17.44	17.44
C5	66.4	0.103721	0.039	0.039	4588.2	400.0	4188.2	2.00	3.94	21.05	0.350832	0.3508316	12.63	12.63
C6	34.2	0.053486	0.054	0.040	3499.5	400.0	3099.5	2.38	3.96	15.85	0.2641	0.2641001	9.51	9.51
C7	13.5	0.021141	0.025	0.038	3096.7	400.0	2696.7	1.62	3.77	16.04	0.267286	0.2672862	9.62	9.62
C7a	2.0	0.003139	0.016	0.016	486.5	400.0	86.5	1.17	2.52	6.27	0.104499	0.16667	6.00	7.00
C8	6.9	0.010798	0.016	0.016	1448.9	400.0	1048.9	1.17	2.52	12.64	0.210586	0.2105858	7.58	7.58
C9	2.5	0.00386	0.016	0.016	482.1	400.0	82.1	1.17	2.52	6.24	0.10402	0.16667	6.00	7.00
D1	243.8	0.3809	0.044	0.031	8143.1	400.0	7743.1	5.25	3.55	37.62	0.627042	0.627042	22.57	22.57
D1a	21.8	0.034082	0.033	0.037	2092.6	400.0	1692.6	1.83	2.81	13.68	0.22794	0.2279401	8.21	8.21
D2	77.5	0.121056	0.028	0.028	7163.6	400.0	6763.6	1.76	3.33	37.64	0.627331	0.6273307	22.58	22.58
D3	11.8	0.018413	0.024	0.024	1657.5	400.0	1257.5	1.59	3.28	10.58	0.17638	0.1763798	6.35	7.00
D4	4.0	0.006313	0.010	0.010	848.8	400.0	448.8	3.22	2.00	5.81	0.096841	0.16667	6.00	7.00
D5	4.3	0.006669	0.028	0.028	772.6	400.0	372.6	1.76	3.33	5.65	0.094214	0.16667	6.00	7.00
E2	12.8	0.019955	0.026	0.015	1712.5	400.0	1312.5	1.76	3.33	10.36	0.172616	0.1726158	6.21	7.00

Flow Velocity Nomagraph for Overland (Sheet) and Shallow Concentrated Flows

Picacho Hills

Reference: NMDOT Drainage Manual - Volume 1, Hydrology 1995



Note: For watercourses with slopes less than 0.5 percent, use the overland flow velocity given for 0.5 percent, except for shallow concentrated flow where a flatter slope may be considered.

Figure 3–10
Flow Velocities for Overland and Shallow Concentrated Flows

Modified from SCS, NEH–4, 1972

Nafzinger Arroyo.

The Nafzinger Arroyo Drains from a steeper Escarpment across a mesa. The mesa is very flat and may contain playas.
There is an area of overlap with the Cotheran Dam Basin
the overlap between basins may need to be studied in more detail later.

Nafzinger basin A1 Area 4817.3 AC

Segment 1 – upper basin S: = 175/6590 = 0.0266
9800

Segment 2 – mesa S: 20/8100 = 0.0025
8930

Segment 3 – D.S of I-40 S: 150/7655 = 0.0196
8000

With Kirpich:

$Tc_1 = 0.0078(9800)^{0.77}(0.0266)^{-0.385}$
$9.233(4.04) = 37.3$

$Tc_2 = 0.0078(8930)^{0.77}(0.0025)^{-0.385}$
$8.595(10.04) = 86.29$

$Tc_3 = 0.0078(8000)^{0.77}(0.0196)^{-0.385}$
$(7.897)(4.54) = 35.88$

159.5 min.
2.65 hrs.

Bohannan ▲ Huston Inc.

PROJECT NAME Picacho Hills SHEET 1 OF 4
PROJECT NO. 090126 BY DATE
SUBJECT CH'D DATE

ENGINEERING ▲
SPATIAL DATA ▲
ADVANCED TECHNOLOGIES ▲

Basin Lag:

$$t_L = \frac{l^{0.8}(1000 - 9CN)^{0.7}}{1,900\ CN^{0.7}\ Y^{0.5}}$$

Example Calc OP_A1

$l = 18,401$

$CN = 91.4$

$Y = 20.81$

$$t_L = \frac{(18,401)^{0.8}\left(1000 - 9(91.4)\right)^{0.7}}{1,900\ (91.4)^{0.7}\ (20.81)^{0.5}}$$

$$= \frac{(2,581.5)(37.5)}{(1,900)(23.58)(4.562)} = \frac{96806}{204,443}$$

≈ 0.473 hr.

Bohannan ▲ Huston INC.

PROJECT NAME ______ SHEET ______ OF ______

PROJECT NO. ______ BY ______ DATE ______

SUBJECT ______ CH'D ______ DATE ______

ENGINEERING ▲
SPATIAL DATA ▲
ADVANCED TECHNOLOGIES ▲

Existing Conditions Sediment Bulking Approximation

Picacho Hills
BHI NO. 090126
Date: 14-Nov-08
Prepared By: Kjohnson
Revised By: DGrochowski

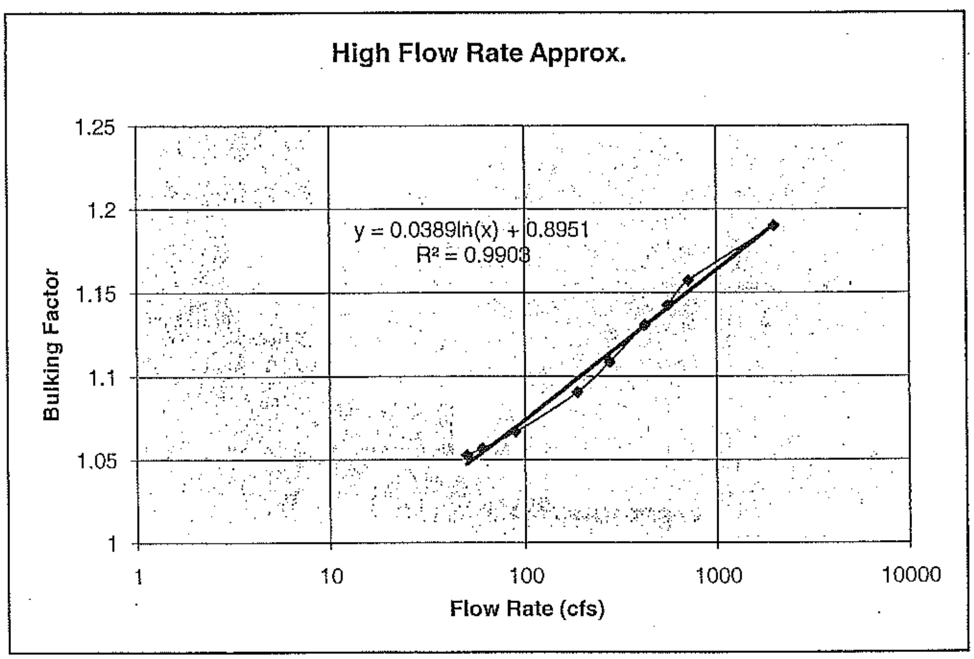
Goal:
Utilize data and analysis from the Overlook Subdivion project to prepare sediment bulking values for the Picacho Hills area.

Data:
Taken from Sediment Load Bulking Factors for Four Arroyos in the Overlook Subdivsion, Las Cruces, NM Report Letter
P:\090126\WR\Delivery from Others\Mussetter Engineering - Overlook Sub\Overlook Subdivision Bulking Factor Summary-5-9-08.pdf

Data Analysis:
To better approximate the bulking factor at higher flow rates the below graph and trendline was created. However, flow rates 2-20 cfs were excluded from the trendline in an effort to better approximate the trendline.

Table 4. Summary of computed bulking factors... (pg. 6)
Stream 17

	D50 = 0.5 mm	
Flow (cfs)	Existing/Proposed Conditions	
2	1.0143	
5	1.0203	
10	1.0275	
20	1.0364	
50	1.0525	
60	1.0567	
89	1.0666	
187	1.0904	
277	1.1084	
424	1.1307	
558	1.1424	
715	1.157	
2000	1.19	Value approximated by Mussetter via phone conversation.



Existing Conditions Sediment Bulking Approximation

Picacho Hills
BHI NO. 090126
Date: 14-Nov-08
Prepared By: Kjohnson
Revised By: DGrochowski

Basin Name	Flow Rate (cfs)	Bulking Factor (flows > 50cfs)	Bulking Factor (flows <50cfs)	Bulking Factor (rounded)
A1	3533	1.212909213		1.21
A2	584	1.142889148		1.14
B1	816.3	1.155916017		1.16
B10	60.3	1.054564019		1.05
B11	3.8	0	1.0179	1.02
B12	29.9	0	1.041713	1.04
B13	33.3	0	1.043538	1.04
B14	10.2	0	1.027678	1.03
B15	29.5	0	1.041498	1.04
B2	352.6	1.123261503		1.12
B3	396.1	1.127786835		1.13
B4	325.7	1.120174494		1.12
B5	124.1	1.082640311		1.08
B5a	22.3	0	1.037634	1.04
B5b	138.2	1.086826504		1.09
B6	185.3	1.098234872		1.1
B7	16.4	0	1.033196	1.03
B9	10.2	0	1.027678	1.03
C1	660.4	1.147671698		1.15
C2	522.4	1.138553066		1.14
C2a	46.6	0	1.050675	1.05
C3	270.5	1.112950585		1.11
C4	163.4	1.093342226		1.09
C4a	275.7	1.113691288		1.11
C5	214.1	1.10385464		1.1
C6	136.8	1.086430428		1.09
C7	58.7	1.053517905		1.05
C7a	8.9	0	1.025916	1.03
C8	35.3	0	1.044611	1.04
C9	15.8	0	1.032662	1.03
D1	616.7	1.145008486		1.15
D1a	108.2	1.077306875		1.08
D2	251.1	1.110055614		1.11
D3	59.2	1.053847848		1.05
D4	23.9	0	1.038493	1.04
D5	19	0	1.03551	1.04
E2	43.6	0	1.049065	1.05

Max
Avg.
Min

Note:

1 Flow rates referenced within this sheet are taken from HEC-HMS Output summary excel file.
P:\090126\WR\Calculations\Misc Calcs\090126 HEC-HMS Output_PH.xls - Tab "Existing No_Bulking"

2 Bulking factors are approximated using calculated trendline equation for all flow rates equal to or above 50cfs.

3 Bulking factors are approximated by linear interpolation for all flow rates less than 50 cfs.

Future Conditions Sediment Bulking Approximation
Picacho Hills
BHI NO. 090126
Date: 14-Nov-08
Prepared By: Kjohnson
Revised By: DGrochowski

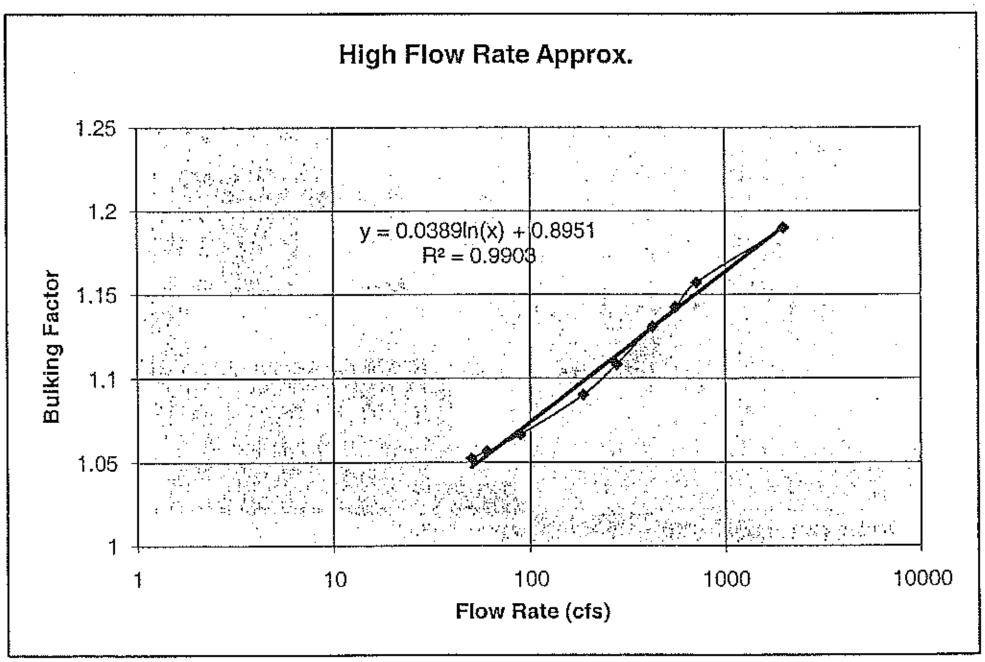
Goal:
Utilize data and analysis from the Overlook Subdivion project to prepare sediment bulking values for the Picacho Hills area.

Data:
Taken from Sediment Load Bulking Factors for Four Arroyos in the Overlook Subdivsion, Las Cruces, NM Report Letter
P:\090126\WR\Delivery from Others\Mussetter Engineering - Overlook Sub\Overlook Subdivision Bulking Factor Summary-5-9-08.pdf

Data Analysis:
To better approximate the bulking factor at higher flow rates the below graph and trendline was created. However, flow rates 2-20 cfs were excluded from the trendline in an effort to better approximate the trendline.

Table 4. Summary of computed bulking factors... (pg. 6)
Stream 17

	D50 = 0.5 mm	
Flow (cfs)	**Existing/Proposed Conditions**	
2	1.0143	
5	1.0203	
10	1.0275	
20	1.0364	
50	1.0525	
60	1.0567	
89	1.0666	
187	1.0904	
277	1.1084	
424	1.1307	
558	1.1424	
715	1.157	
2000	1.19	Value approximated by Mussetter via phone conversation.



Future Conditions Sediment Bulking Approximation

Picacho Hills
BHI NO. 090126
Date: 14-Nov-08
Prepared By: Kjohnson
Revised By: DGrochowski

Basin Name	Flow Rate (cfs)	Bulking Factor (flows > 50cfs)	Bulking Factor (flows <50cfs)	Bulking Factor (rounded)
A1	4375.2	1.221226222		1.22
A2	639.1	1.14639637		1.15
B1	848.7	1.157430154		1.16
B10	60.3	1.054564019		1.05
B11	3.8	0	1.0179	1.02
B12	29.9	0	1.041713	1.04
B13	33.3	0	1.043538	1.04
B14	10.2	0	1.027678	1.03
B15	29.5	0	1.041498	1.04
B2	385.6	1.126741742		1.13
B3	500.4	1.136879363		1.14
B4	357.4	1.123787483		1.12
B5	124.1	1.082640311		1.08
B5a	22.3	0	1.037634	1.04
B5b	138.2	1.086826504		1.09
B6	185.3	1.098234872		1.1
B7	16.4	0	1.033196	1.03
B9	10.2	0	1.027678	1.03
C1	901.5	1.159777936		1.16
C2	627	1.14565282		1.15
C2a	46.6	0	1.050675	1.05
C3	282.2	1.114597764		1.11
C4	163.4	1.093342226		1.09
C4a	275.7	1.113691288		1.11
C5	214.1	1.10385464		1.1
C6	136.8	1.086430428		1.09
C7	58.7	1.053517905		1.05
C7a	10.5	0	1.027945	1.03
C8	36.7	0	1.045362	1.05
C9	15.8	0	1.032662	1.03
D1	645.7	1.146796031		1.15
D1a	117.2	1.080415005		1.08
D2	262.9	1.111841998		1.11
D3	69.8	1.060255163		1.06
D4	27.6	0	1.040479	1.04
D5	23.3	0	1.038171	1.04
E2	54.4	1.050558566		1.05

Max
Avg.
Min

Note:

1 Flow rates referenced within this sheet are taken from HEC-HMS Output summary excel file.
P:\090126\WR\Calculations\Misc Calcs\090126 HEC-HMS Output_PH.xls - Tab "Future No_Bulking"

2 Bulking factors are approximated using calculated trendline equation for all flow rates equal to or above 50cfs.

3 Bulking factors are approximated by linear interpolation for all flow rates less than 50 cfs.

Existing Conditions Basin Characteristics

Picacho Hills

BHI No. 090126

Prepared By: Kris Johnson

Date: 14-Nov-08

Data Source: Data contained within this spreadsheet is the combination of data from two GIS shape files. (Subasins & Longestflowpath)

Note:
1. All data was generated within ARC-MAP using HEC-GeoHMS 4.2 (Beta). All data was verified for validity and reasonability.
2. Curve numbers were generated to address land treatment type and soil type specific to the basin.
   P:\090126\WR\Calculations\Misc Calcs\090126_CurveNo01_Existing.xls
3. Weighted CN values were generated by HEC-GeoHMS 4.2 (Beta)

Note:

NAME	Weighted Basin CN	Weighted Whole Basin CN	Lag Method	Area_HMS (SQ MI)	Area (Acre)	Basin Slope (%)	LongestFL (FT)	Longest Flow Path Slope (FT/FT)	Longest Flow Path ElevUP	Longest Flow Path ElevDS
A1	86.00	86.00		7.527082	4817.33	7.9346	31190.06	0.0130	4423.00	4019.00
A2	84.39	84.00	CNLag	0.355592	227.58	10.7381	8134.16	0.0280	4143.00	3915.00
B1	92.59	93.00	CNLag	2.389555	1529.32	3.6110	21303.76	0.0104	4504.00	4282.00
B10	82.55	83.00	CNLag	0.021772	13.93	7.5743	2718.25	0.0320	3989.00	3902.00
B11	82.87	83.00	CNLag	0.001183	0.76	3.2922	357.89	0.0084	3912.00	3909.00
B12	84.99	85.00	CNLag	0.009160	5.86	6.0460	955.91	0.0314	3934.00	3904.00
B13	84.39	84.00	CNLag	0.014112	9.03	8.4662	953.30	0.0231	3934.00	3912.00
B14	80.00	80.00	CNLag	0.003584	2.29	8.4162	830.40	0.0205	3925.00	3908.00
B15	83.89	84.00	CNLag	0.008778	5.62	7.0368	263.88	0.0455	3915.00	3903.00
B2	83.71	84.00	CNLag	0.185785	118.90	10.7291	7376.67	0.0366	4424.00	4154.00
B3	80.95	81.00	CNLag	0.243373	155.76	12.6270	6486.04	0.0347	4315.00	4090.00
B4	82.37	82.00	CNLag	0.159870	102.32	10.2166	5366.87	0.0285	4161.00	4008.00
B5	80.04	80.00	CNLag	0.051817	33.16	8.9466	3047.27	0.0295	4071.00	3981.00
B5a	85.08	85.00	CNLag	0.006368	4.08	10.1694	1665.81	0.0468	4095.00	4017.00
B5b	83.11	83.00	CNLag	0.042574	27.25	10.5435	1463.71	-0.0191	3981.00	4009.00
B6	75.05	75.00	CNLag	0.081958	52.45	9.5779	3675.95	0.0367	4046.00	3911.00
B7	76.79	77.00	CNLag	0.006587	4.22	7.6869	1580.14	0.0367	3967.00	3909.00
B9	85.86	86.00	CNLag	0.002787	1.78	9.5791	1070.29	0.0299	4012.00	3980.00
C1	83.07	83.00	CNLag	0.507719	324.94	12.4268	8713.89	0.0324	4484.00	4202.00
C2	82.14	82.00	CNLag	0.299934	191.96	10.6330	6552.25	0.0406	4401.00	4135.00
C2a	84.82	85.00	CNLag	0.013320	8.53	7.0323	821.33	0.0438	4171.00	4135.00
C3	84.26	84.00	CNLag	0.088644	56.73	11.4016	2985.74	0.0322	4186.00	4090.00
C4	81.40	81.00	CNLag	0.065241	41.75	10.2210	3132.13	0.0393	4067.00	3944.00
C4a	81.57	82.00	CNLag	0.153314	98.12	8.6313	4550.46	0.0321	4143.00	3997.00
C5	80.03	80.00	CNLag	0.103720	66.38	8.7132	4586.20	0.0347	4065.00	3906.00
C6	81.17	81.00	CNLag	0.053486	34.23	8.7188	3499.46	0.0360	4030.00	3904.00
C7	82.68	83.00	CNLag	0.021141	13.53	7.0395	3096.74	0.0265	3999.00	3917.00
C7a	80.13	80.00	CNLag	0.003139	2.01	7.3052	486.48	0.0267	3926.00	3913.00
C8	84.18	84.00	CNLag	0.010798	6.91	7.1320	1448.90	0.0304	3948.00	3904.00
C9	89.11	89.00	CNLag	0.003860	2.47	3.8515	482.13	0.0166	3914.00	3906.00
D1	83.59	84.00	CNLag	0.380899	243.78	12.8432	8143.12	0.0316	4273.00	4016.00
D1a	86.28	86.00	CNLag	0.034092	21.82	9.9979	2092.64	0.0400	4097.60	4018.40
D2	83.87	84.00	CNLag	0.121056	77.48	11.7992	7163.62	0.0252	4094.30	3913.90
D3	83.16	83.00	CNLag	0.018413	11.78	3.9519	1657.54	0.0211	3946.00	3911.00
D4	86.85	87.00	CNLag	0.006313	4.04	3.0488	848.80	0.0141	3921.00	3909.00
D5	80.47	80.00	CNLag	0.006669	4.27	8.3895	772.62	0.0337	3940.00	3914.00
E2	80.52	81.00	CNLag	0.019955	12.77	5.1849	1712.47	0.0158	3937.00	3910.00

Future Conditions Basin Characteristics

Picacho Hills
BHI No. 090126
Prepared By: Kris Johnson
Date: 14-Nov-08
Data Source: Data contained within this spreadsheet is the combination of data from two GIS shape files. (Subasins & Longestflowpath)
Note:
1. All data was generated within ARC-MAP using HEC-GeoHMS 4.2 (Beta). All data was verified for validity and reasonability.
2. Curve numbers were generated to address land treatment type and soil type specific to the basin.
P:\090126\WR\Calculations\Misc Calcs\090126_CurveNo01_Future.xls
3. Weighted CN values were generated by HEC-GeoHMS 4.2 (Beta)
4. Curve numbers adjusted to relate future development condition.

Note:

NAME	Weighted Basin CN	Weighted Whole Basin CN	Lag Method	Area_HMS (SQ MI)	Area (Acre)	Basin Slope (%)	LongestFL (FT)	Longest Flow Path Slope (FT/FT)	Longest Flow Path ElevUP	Longest Flow Path ElevDS
A1	90.98	91.00	CNLag	7.527082	4817.33	7.9346	31190.06	0.0130	4423.00	4019.00
A2	86.41	86.00	CNLag	0.355592	227.58	10.7381	8134.16	0.0280	4143.00	3915.00
B1	94.30	94.00	CNLag	2.389555	1529.32	3.6110	21303.76	0.0104	4504.00	4282.00
B10	82.55	83.00	CNLag	0.021772	13.93	7.5743	2718.25	0.0320	3989.00	3902.00
B11	82.87	83.00	CNLag	0.001183	0.76	3.2922	357.89	0.0084	3912.00	3909.00
B12	84.99	85.00	CNLag	0.009160	5.86	6.0460	955.91	0.0314	3934.00	3904.00
B13	84.49	84.00	CNLag	0.014112	9.03	8.4662	953.30	0.0231	3934.00	3912.00
B14	80.00	80.00	CNLag	0.003584	2.29	8.4162	830.40	0.0205	3925.00	3908.00
B15	83.89	84.00	CNLag	0.008778	5.62	7.0368	263.88	0.0455	3915.00	3903.00
B2	85.90	86.00	CNLag	0.185785	118.90	10.7291	7376.67	0.0366	4424.00	4154.00
B3	85.86	86.00	CNLag	0.243373	155.76	12.6270	6486.04	0.0347	4315.00	4090.00
B4	84.27	84.00	CNLag	0.159870	102.32	10.2166	5366.87	0.0285	4161.00	4008.00
B5	80.04	80.00	CNLag	0.051817	33.16	8.9466	3047.27	0.0295	4071.00	3981.00
B5a	85.08	85.00	CNLag	0.006368	4.08	10.1694	1665.81	0.0468	4095.00	4017.00
B5b	83.11	83.00	CNLag	0.042574	27.25	10.5435	1463.71	-0.0191	3981.00	4009.00
B6	75.05	75.00	CNLag	0.081958	52.45	9.5779	3675.95	0.0367	4046.00	3911.00
B7	76.79	77.00	CNLag	0.006587	4.22	7.6869	1580.14	0.0367	3967.00	3909.00
B9	85.88	86.00	CNLag	0.002787	1.78	9.5791	1070.29	0.0299	4012.00	3980.00
C1	89.81	90.00	CNLag	0.507719	324.94	12.4268	8713.89	0.0324	4484.00	4202.00
C2	86.30	86.00	CNLag	0.299934	191.96	10.6330	6552.25	0.0406	4401.00	4135.00
C2a	85.04	85.00	CNLag	0.013320	8.53	7.0323	821.33	0.0438	4171.00	4135.00
C3	85.18	85.00	CNLag	0.088644	56.73	11.4018	2985.74	0.0322	4186.00	4090.00
C4	81.40	81.00	CNLag	0.065241	41.75	10.2210	3132.13	0.0393	4067.00	3944.00
C4a	81.57	82.00	CNLag	0.153314	98.12	8.6313	4550.48	0.0321	4143.00	3997.00
C5	80.03	80.00	CNLag	0.103720	66.38	8.7132	4588.20	0.0347	4065.00	3906.00
C6	81.17	81.00	CNLag	0.053486	34.23	8.7188	3499.46	0.0360	4030.00	3904.00
C7	83.24	83.00	CNLag	0.021141	13.53	7.0395	3096.74	0.0265	3999.00	3917.00
C7a	84.49	84.00	CNLag	0.003139	2.01	7.3052	486.48	0.0267	3926.00	3913.00
C8	84.86	85.00	CNLag	0.010798	6.91	7.1320	1448.90	0.0304	3948.00	3904.00
C9	89.11	89.00	CNLag	0.003860	2.47	3.8515	482.13	0.0166	3914.00	3906.00
D1	85.34	85.00	CNLag	0.380899	243.78	12.8432	8143.12	0.0316	4273.00	4016.00
D1a	86.28	86.00	CNLag	0.034082	21.81	9.9963	2092.64	0.0400	4097.60	4016.40
D2	84.58	85.00	CNLag	0.121056	77.48	11.7992	7163.62	0.0252	4094.30	3913.90
D3	87.16	87.00	CNLag	0.018413	11.78	3.9519	1657.54	0.0211	3946.00	3911.00
D4	90.85	91.00	CNLag	0.006313	4.04	3.0488	848.80	0.0141	3921.00	3909.00
D5	84.61	85.00	CNLag	0.006669	4.27	8.3895	772.62	0.0337	3940.00	3914.00
E2	85.77	86.00	CNLag	0.019955	12.77	5.1849	1712.47	0.0158	3937.00	3910.00

Existing Pond B2
Picacho Hills
BHI No: 090126
Date: 27-Oct-08
Prepared By: Kris Johnson
Data and Assumptions:

1. Pond may have been modified by residents after current mapping data.
2. See shape file "X-Pond" for top and bottom contour.
P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond.shp
3. All data above the "Top of current storage" elevation is taken from the following CAD file. This CAD file is generated from the x-pond shape file noted above.
P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond_Contour_Pond Stage Storage.DWG

Conic Method for Reservoir Volumes

$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)	
4153.5	0.0	4876	0.1119	0.0000	
4154	0.5	7695.455	0.1767	0.0715	
4154.5	1.0	10514.91	0.2414	0.1756	
4155	1.5	13334.37	0.3061	0.3122	
4155.5	2.0	16153.82	0.3708	0.4812	
4156	2.5	18973.28	0.4356	0.6826	
4156.5	3.0	21792.73	0.5003	0.9163	
4157	3.5	24612.19	0.5650	1.1825	
4157.5	4.0	27431.64	0.6297	1.4810	Top of current storage
4158	4.5	30251.1	0.6945	1.8120	
4158.5	5.0	33070.55	0.7592	2.1753	
4159	5.5	35890.01	0.8239	2.5709	
4159.5	6.0	38709.47	0.8886	2.9990	
4160	6.5	41528.92	0.9534	3.4594	
4160.5	7.0	44348.38	1.0181	3.9522	
4161	7.5	47167.83	1.0828	4.4773	
4161.5	8.0	49987.29	1.1476	5.0348	
4162	8.5	52806.74	1.2123	5.6247	
4162.5	9.0	55626.2	1.2770	6.2469	
4163	9.5	58445.65	1.3417	6.9016	
4163.5	10.0	61265.11	1.4065	7.5885	
4164	10.5	64084.56	1.4712	8.3079	
4164.5	11.0	66904.02	1.5359	9.0596	
4165	11.5	69723.47	1.6006	9.8437	
4165.5	12.0	72542.93	1.6654	10.6601	
4166	12.5	75362.39	1.7301	11.5089	
4166.5	13.0	78181.84	1.7948	12.3901	
4167	13.5	81001.3	1.8595	13.3036	
4167.5	14.0	83820.75	1.9243	14.2495	
4168	14.5	86640.21	1.9890	15.2278	
4168.5	15.0	89459.66	2.0537	16.2384	
4169	15.5	92279.12	2.1184	17.2814	
4169.5	16.0	95098.57	2.1832	18.3568	
4170	16.5	97918.03	2.2479	19.4645	Depth for calc purposes only

Existing Pond C2 Combined

Picacho Hills
BHI No: 090126
Date: 27-Oct-08
Prepared By: Kris Johnson
Data and Assumptions:

1. See shape file "X-Pond" for top and bottom contour.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond.shp
2. All data above the "Top of current storage" elevation is taken from the following CAD file. This CAD file is generated from the x-pond shape file noted above.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond_Contour_Pond Stage Storage.DWG

Conic Method for Reservoir Volumes

$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

Pond

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)
4129	0.0	4023.00	0.0924	0.00
	0.5	7322.56	0.1681	0.06
	1.0	10622.12	0.2439	0.17
	1.5	13921.68	0.3196	0.31
	2.0	17221.24	0.3953	0.49
	2.5	20520.80	0.4711	0.70
	3.0	23820.36	0.5468	0.96
	3.5	27119.92	0.6226	1.25
4133	4.0	30419.48	0.6983	1.58

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)
4128	0.0	602.00	0.0138	0.00
	0.5	3393.89	0.0779	0.02
	1.0	6185.78	0.1420	0.07
	1.5	8977.67	0.2061	0.16
	2.0	11769.56	0.2702	0.28
5	2.5	14561.45	0.3343	0.43
	3.0	17353.34	0.3984	0.61
	3.5	20145.23	0.4625	0.83
	4.0	22937.12	0.5266	1.08
	4.5	25729.00	0.5907	1.36
4133	5.0	28520.89	0.6547	1.67

Combined Pond C2

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)	
4128	0.0	602.00	0.01	0.00	
4128.5	0.5	3393.89	0.08	0.02	
4129	1.0	10208.78	0.23	0.07	
4129.5	1.5	16300.23	0.37	0.23	
4130	2.0	22391.68	0.51	0.45	
4130.5	2.5	28483.13	0.65	0.74	
4131	3.0	34574.58	0.79	1.10	
4131.5	3.5	40666.03	0.93	1.53	
4132	4.0	46757.48	1.07	2.03	
4132.5	4.5	52848.93	1.21	2.60	
4133	5.0	58940.38	1.35	3.24	Top of current storage
4133.5	5.5	67500.31	1.5496	3.97	
4134	6.0	76060.25	1.7461	4.79	
4134.5	6.5	84620.19	1.9426	5.71	
4135	7.0	93180.13	2.1391	6.73	
4135.5	7.5	101740.06	2.3356	7.85	
4136	8.0	110300.00	2.5321	9.07	
4136.5	8.5	118859.94	2.7286	10.38	
4137	9.0	127419.87	2.9252	11.80	
4137.5	9.5	135979.81	3.1217	13.31	
4138	10.0	144539.75	3.3182	14.92	
4138.5	10.5	153099.68	3.5147	16.63	
4139	11.0	161659.62	3.7112	18.43	
4139.5	11.5	170219.56	3.9077	20.34	
4140	12.0	178779.49	4.1042	22.34	Depth for calc purposes only

Existing Pond C3
Picacho Hills
BHI No: 090126
Date: 27-Oct-08
Prepared By: Kris Johnson
Data and Assumptions:

1. See shape file "X-Pond" for top and bottom contour.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond.shp
2. All data above the "Top of current storage" elevation is taken from the following CAD file. This CAD file is generated from the x-pond shape file noted above.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond_Contour_Pond Stage Storage.DWG

Conic Method for ReservoirVolumes

$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)	
4087	0.0	602	0.0138	0.00	
4087.5	0.5	3923.389	0.0901	0.02	
4088	1.0	7244.778	0.1663	0.09	
4088.5	1.5	10566.17	0.2426	0.19	
4089	2.0	13887.56	0.3188	0.33	
4089.5	2.5	17208.94	0.3951	0.51	
4090	3.0	20530.33	0.4713	0.72	
4090.5	3.5	23851.72	0.5476	0.98	
4091	4.0	27173.11	0.6238	1.27	
4091.5	4.5	30494.5	0.7001	1.60	
4092	5.0	33815.89	0.7763	1.97	
4092.5	5.5	37137.28	0.8526	2.38	
4093	6.0	40458.67	0.9288	2.82	
4093.5	6.5	43780.06	1.0051	3.30	
4094	7.0	47101.44	1.0813	3.83	
4094.5	7.5	50422.83	1.1575	4.39	
4095	8.0	53744.22	1.2338	4.98	
4095.5	8.5	57065.61	1.3100	5.62	
4096	9.0	60387	1.3863	6.29	Top of current storage
4096.5	9.5	63121.56	1.4491	7.00	
4097	10.0	65856.12	1.5118	7.74	
4097.5	10.5	68590.68	1.5746	8.51	
4098	11.0	71325.23	1.6374	9.32	
4098.5	11.5	74059.79	1.7002	10.15	
4099	12.0	76794.35	1.7630	11.02	
4099.5	12.5	79528.91	1.8257	11.91	
4100	13.0	82263.47	1.8885	12.84	Depth for calc purposes only

Existing Pond D1
Picacho Hills
BHI No: 090126
Date: 27-Oct-08
Prepared By: Kris Johnson
Data and Assumptions:

1 See shape file "X-Pond" for top and bottom contour.
P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond.shp

2 All data above the "Top of current storage" elevation is taken from the following CAD file. This CAD file is generated from the x-pond shape file noted above.
P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond_Contour_Pond Stage Storage.DWG

Conic Method for Reservoir Volumes

$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)	
4021	0.0	602	0.0138	0.00	
4021.5	0.5	1544.656	0.0355	0.01	
4022	1.0	2487.313	0.0571	0.03	
4022.5	1.5	3429.969	0.0787	0.07	
4023	2.0	4372.625	0.1004	0.11	
4023.5	2.5	5315.281	0.1220	0.17	
4024	3.0	6257.938	0.1437	0.24	
4024.5	3.5	7200.594	0.1653	0.31	
4025	4.0	8143.25	0.1869	0.40	
4025.5	4.5	9085.906	0.2086	0.50	
4026	5.0	10028.56	0.2302	0.61	
4026.5	5.5	10971.22	0.2519	0.73	
4027	6.0	11913.88	0.2735	0.86	
4027.5	6.5	12856.53	0.2951	1.00	
4028	7.0	13799.19	0.3168	1.16	
4028.5	7.5	14741.84	0.3384	1.32	
4029	8.0	15684.5	0.3601	1.49	
4029.5	8.5	16627.16	0.3817	1.68	
4030	9.0	17569.81	0.4033	1.88	
4030.5	9.5	18512.47	0.4250	2.08	
4031	10.0	19455.13	0.4466	2.30	
4031.5	10.5	20397.78	0.4683	2.53	
4032	11.0	21340.44	0.4899	2.77	
4032.5	11.5	22283.09	0.5115	3.02	
4033	12.0	23225.75	0.5332	3.28	
4033.5	12.5	24168.41	0.5548	3.55	
4034	13.0	25111.06	0.5765	3.84	
4034.5	13.5	26053.72	0.5981	4.13	
4035	14.0	26996.38	0.6198	4.43	
4035.5	14.5	27939.03	0.6414	4.75	
4036	15.0	28881.69	0.6630	5.07	
4036.5	15.5	29824.34	0.6847	5.41	
4037	16.0	30767	0.7063	5.76	Top of current storage
4037.5	16.5	32056.79	0.7359	6.12	
4038	17.0	33346.57	0.7655	6.50	
4038.5	17.5	34636.36	0.7951	6.89	
4039	18.0	35926.14	0.8248	7.29	
4039.5	18.5	37215.93	0.8544	7.71	
4040	19.0	38505.72	0.8840	8.14	
4040.5	19.5	39795.5	0.9136	8.59	
4041	20.0	41085.29	0.9432	9.06	
4041.5	20.5	42375.07	0.9728	9.54	
4042	21.0	43664.86	1.0024	10.03	
4042.5	21.5	44954.65	1.0320	10.54	
4043	22.0	46244.43	1.0616	11.06	
4043.5	22.5	47534.22	1.0912	11.60	
4044	23.0	48824.01	1.1208	12.15	
4044.5	23.5	50113.79	1.1505	12.72	
4045	24.0	51403.58	1.1801	13.30	Depth for calc purposes only

Existing Pond D2
Picacho Hills
BHI No: 090126
Date: 27-Oct-08
Prepared By: Kris Johnson
Data and Assumptions:

1. See shape file "X-Pond" for top and bottom contour.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond.shp
2. All data above the "Top of current storage" elevation is taken from the following CAD file. This CAD file is generated from the x-pond shape file noted above.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond_Contour_Pond Stage Storage.DWG

Conic Method for Reservoir Volumes

$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)	
4019	0.0	6750	0.1550	0.00	
4019.5	0.5	8357.833	0.1919	0.09	
4020	1.0	9965.667	0.2288	0.19	
4020.5	1.5	11573.5	0.2657	0.32	
4021	2.0	13181.33	0.3026	0.46	
4021.5	2.5	14789.17	0.3395	0.62	
4022	3.0	16397	0.3764	0.80	
4022.5	3.5	18004.83	0.4133	0.99	
4023	4.0	19612.67	0.4502	1.21	
4023.5	4.5	21220.5	0.4872	1.44	
4024	5.0	22828.33	0.5241	1.70	
4024.5	5.5	24436.17	0.5610	1.97	
4025	6.0	26044	0.5979	2.26	Top of current storage
4025.5	6.5	30496.74	0.7001	2.58	
4026	7.0	34949.47	0.8023	2.96	
4026.5	7.5	39402.21	0.9046	3.38	
4027	8.0	43854.95	1.0068	3.86	
4027.5	8.5	48307.69	1.1090	4.39	
4028	9.0	52760.42	1.2112	4.97	
4028.5	9.5	57213.16	1.3134	5.60	
4029	10.0	61665.9	1.4157	6.28	
4029.5	10.5	66118.64	1.5179	7.02	
4030	11.0	70571.37	1.6201	7.80	Depth for calc purposes only

Existing Pond E2
Picacho Hills
BHI No: 090126
Date: 27-Oct-08
Prepared By: Kris Johnson
Data and Assumptions:

1. See shape file "X-Pond" for top and bottom contour.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond.shp
2. All data above the "Top of current storage" elevation is taken from the following CAD file. This CAD file is generated from the x-pond shape file noted above.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\X-Pond_Contour_Pond Stage Storage.DWG

Conic Method for ReservoirVolumes

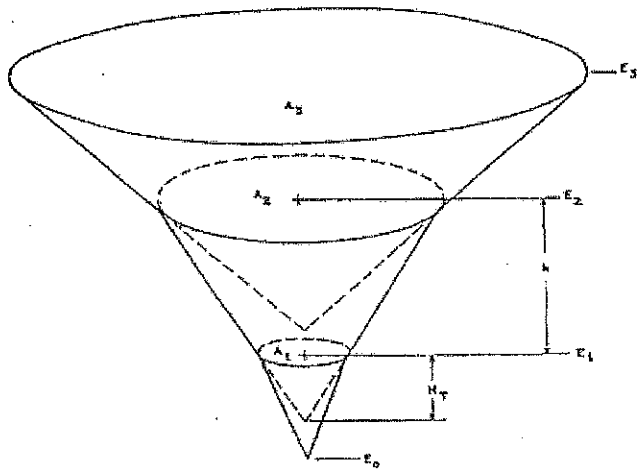
$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)
3897	0.0	676	0.0155	0.00
	0.5	2001.238	0.0459	0.01
	1.0	3326.476	0.0764	0.04
10.5	1.5	4651.714	0.1068	0.09
	2.0	5976.952	0.1372	0.15
	2.5	7302.19	0.1676	0.23
	3.0	8627.429	0.1981	0.32
	3.5	9952.667	0.2285	0.43
	4.0	11277.9	0.2589	0.55
	4.5	12603.14	0.2893	0.68
	5.0	13928.38	0.3198	0.84
	5.5	15253.62	0.3502	1.00
	6.0	16578.86	0.3806	1.19
	6.5	17904.1	0.4110	1.38
	7.0	19229.33	0.4414	1.60
	7.5	20554.57	0.4719	1.83
	8.0	21879.81	0.5023	2.07
	8.5	23205.05	0.5327	2.33
	9.0	24530.29	0.5631	2.60
	9.5	25855.52	0.5936	2.89
	10.0	27180.76	0.6240	3.20
3907.5	10.5	28506	0.6544	3.51

HEC-1 - Users Manual
US Army Corps of Engineers

HEC-1 - Manual
" Flood Hydrograph Package"

If pumps or dam breaks are not being simulated, an outflow rating curve is computed for 20 elevations which span the range of elevations given for storage data. Storages are computed for those elevations. The routing is then accomplished by the modified Puls method using the derived storage-outflow relation. For level-pool reservoir routing with pumping or dam-break simulation, outflows are computed for the orifice and weir equations for each time interval.



$$\Delta V_{12} = \frac{h}{3}(A_1 + A_2 + \sqrt{A_1 A_2})$$

$$H_T = h/(\sqrt{A_2/A_1} - 1)$$

Where

ΔV_{12} = volume between base areas 1 and 2,

A_i = surface area of base i,

E_i = elevation of base i,

h = vertical distance $(E_2 - E_1)$ between bases A_1 and A_2, and

H_T = height of truncated part of cone,

Figure 3.11 Conic Method for Reservoir Volumes

(3) Trapezoidal and Ogee Spillways. Trapezoidal and ogee spillways (Corps of Engineers, 1965) may be simulated as shown in Figure 3.12. The outflow rating curve is computed for 20 stages which span the range of given storage data. If there is a low-level outlet, the stages are evenly spaced between the low-level outlet and the maximum elevation, with the spillway crest located at the tenth elevation. In the absence of a low-level outlet, the second stage is at the spillway crest.

Proposed Pond B2
Picacho Hills
BHI No: 090126
Date: 23-Dec-08
Prepared By: Kris Johnson
Data and Assumptions:

1. Ponds assumed to have 3:1 side slopes. Ponding volume does not include any dead storage, or retention.
2. See the following cad file for linework defining the proposed ponding geometry.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\N-Pond_Contour_Pond Stage Storage.DWG
3. An InRoads DTM was generated for this pond. The stage storage curve noted below was generated by Inroads using the Pond Volume Calculator. InRoads output can be found in the following location:
   P:\090126\WR\Calculations\Misc Calcs\Proposed Ponds\

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	VOLUME (AC-FT)	
4139	0.0	12748	0	No water is allowed to overtop the roadway.
4140	1.0	15226	0.3069	
4141	2.0	17755	0.6713	
4142	3.0	20342	1.0947	
4143	4.0	22974	1.5784	
4144	5.0	25712	2.1237	
4145	6.0	28481	2.732	
4146	7.0	31368	3.4047	
4147	8.0	34246	4.1431	
4148	9.0	37178	4.9485	
4149	10.0	40192	5.8223	
4150	11.0	43337	6.7659	
4151	12.0	46488	7.7807	
4152	13.0	53056	8.8678	
4153	14.0	56734	10.0909	
4154	15.0	60344	11.3955	
4155	16.0	64024	12.783	
4156	17.0	67744	14.2548	
4157	18.0	71159	15.65	Top of storage prior to spill over roadway.

Proposed Pond B3
Picacho Hills
BHI No: 090126
Date: 9-Dec-08
Prepared By: Kris Johnson
Data and Assumptions:

1. Ponds assumed to have 3:1 side slopes. Ponding volume does not include any dead storage, or retention.
2. See the following cad file for linework defining the proposed ponding geometry.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\N-Pond_Contour_Pond Stage Storage.DWG

Conic Method for Reservoir Volumes

$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

No water is allowed to overtop the roadway.

SIDE SLOPE = 3:1

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	VOLUME (CU-FT)	VOLUME (AC-FT)
4082	0.0	4305.00	0.00	0.000
4083	1.0	5401.00	4842.65	0.111
4084	2.0	6619.00	10842.34	0.249
4085	3.0	7957.00	18120.09	0.416
4086	4.0	9415.00	26795.87	0.615
4087	5.0	10994.00	36990.17	0.849
4088	6.0	12694.00	48823.99	1.121
4089	7.0	14514.00	62417.84	1.433
4090	8.0	16455.00	77892.19	1.788
4091	9.0	18517	95368.05	2.189
4092.0	10.0	20699	114965.92	2.639
4093.0	11.0	23002	136806.30	3.141
4094.0	12.0	25425	161009.69	3.696
4095.0	13.0	27969	187696.59	4.309
4096.0	14.0	30634	216987.98	4.981
4097.0	15.0	33417	249003.40	5.716
4098.0	16.0	36351	283877.12	6.517
4099.0	17.0	39401	321742.88	7.386
4100.0	18.0	42446	362656.93	8.325

Proposed Pond B5b
Picacho Hills
BHI No: 090126
Date: 9-Dec-08
Prepared By: Kris Johnson
Data and Assumptions:

1. Ponds assumed to have 3:1 side slopes. Ponding volume does not include any dead storage, or retention.
2. See the following cad file for linework defining the proposed ponding geometry.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\N-Pond_Contour_Pond Stage Storage.DWG

Conic Method for ReservoirVolumes

$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

SIDE SLOPE = 3:1

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	VOLUME (CU-FT)	VOLUME (AC-FT)
3950	0.0	2688	0.00	0.000
3952.0	2.0	13589	14880.52	0.342
3954.0	4.0	31547	58774.44	1.349
3956.0	6.0	50270	139867.74	3.211
3958.0	8.0	70202	259786.31	5.964
3960.0	10.0	98347	427546.47	9.815
3962.0	12.0	121428	646916.36	14.851
3964.0	14.0	146435	914389.41	20.991
3966.0	16.0	171166	1231668.96	28.275

Proposed Pond C2
Picacho Hills
BHI No: 090126
Date: 29-Dec-08
Prepared By: Kris Johnson
Data and Assumptions:

1 Ponds assumed to have 3:1 side slopes. Ponding volume does not include any dead storage, or retention.
2 See the following cad file for linework defining the proposed ponding geometry.
P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\N-Pond_Contour_Pond Stage Storage.DWG
3 An InRoads DTM was generated for this pond. The stage storage curve noted below was generated by Inroads using the Pond Volume Calculator. InRoads output can be found in the following location:
P:\090126\WR\Calculations\Misc Calcs\Proposed Ponds\

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	VOLUME (AC-FT)	
4100	0.0	829.7736	0	
4100.5	0.5	1033.642	0.0107	
4101	1.0	1269.5562	0.0238	
4101.5	1.5	1519.9719	0.0396	
4102	2.0	1790.736	0.0584	
4102.5	2.5	2095.4801	0.0803	
4103	3.0	2409.2243	0.1056	
4103.5	3.5	2742.9515	0.1346	
4104	4.0	3096.9753	0.1674	
4104.5	4.5	3471.1597	0.2044	
4105	5.0	3865.5046	0.2457	
4105.5	5.5	4278.9883	0.2916	
4106	6.0	4713.4602	0.3423	
4106.5	6.5	5168.0758	0.3981	
4107	7.0	5720.8332	0.4592	
4107.5	7.5	6222.5502	0.5259	
4108	8.0	6745.208	0.5983	
4108.5	8.5	7288.2541	0.6767	
4109	9.0	7851.6885	0.7614	
4109.5	9.5	8435.5113	0.8526	
4110	10.0	9048.8354	0.9505	
4110.5	10.5	9674.762	1.0553	
4111	11.0	10321.16	1.1674	
4111.5	11.5	10988.029	1.2869	
4112	12.0	11675.37	1.414	
4112.5	12.5	12383.182	1.5491	
4113	13.0	13161.561	1.6923	
4113.5	13.5	13914.404	1.8439	
4114	14.0	14687.879	2.0042	
4114.5	14.5	15481.966	2.1733	
4115	15.0	16282.191	2.3515	
4115.5	15.5	17118.098	2.539	
4116	16.0	17974.703	2.7361	
4116.5	16.5	18852.005	2.943	
4117	17.0	19750.005	3.1599	
4117.5	17.5	20668.702	3.3872	
4118	18.0	27731.734	3.6249	
4118.5	18.5	29069.232	3.936	
4119	19.0	30188.302	4.26	
4119.5	19.5	31321.833	4.5971	
4120	20.0	32455.278	4.9476	
4120.5	20.5	33603.536	5.3116	
4121	21.0	35052.686	5.6895	
4121.5	21.5	36274.013	6.0814	
4122	22.0	42614.775	6.4876	
4122.5	22.5	44175.909	6.9497	
4123	23.0	45749.54	7.4293	
4123.5	23.5	47328.135	7.9266	
4124	24.0	49126.572	8.4419	
4124.5	24.5	51022.842	8.9756	
4125	25.0	58646.203	9.5279	
4125.5	25.5	60319.388	10.1391	
4126	26.0	62004.632	10.7703	
4126.5	26.5	63875.42	11.422	
4127	27.0	65593.393	12.0944	
4127.5	27.5	67411.819	12.7878	
4128	28.0	69261.654	13.5025	
4128.5	28.5	75421.631	14.2387	
4129	29.0	77385.623	15.0301	
4129.5	29.5	79385.993	15.8449	
4130	30.0	81366.261	16.6833	
4130.5	30.5	83427.735	17.5453	
4131	31.0	85442.125	18.4311	
4131.5	31.5	88256.811	19.3409	
4132	32.0	90538.272	20.2748	Top of Pond
4137	37.0	151193.72	34.00	Overtop contour

Proposed Pond C3

Picacho Hills
BHI No: 090126
Date: 29-Dec-08
Prepared By: Kris Johnson
Data and Assumptions:

1. Ponds assumed to have 3:1 side slopes. Ponding volume does not include any dead storage, or retention.
2. See the following cad file for linework defining the proposed ponding geometry.
P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\N-Pond_Contour_Pond Stage Storage.DWG
3. An InRoads DTM was generated for this pond. The stage storage curve noted below was generated by Inroads using the Pond Volume Calculator. InRoads output can be found in the following location:
P:\090126\WR\Calculations\Misc Calcs\Proposed Ponds\

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	VOLUME (AC-FT)
4056	0.0	1732.078	0
4056.5	0.5	2004.428	0.0214
4057	1.0	2292.058	0.0461
4057.5	1.5	2594.962	0.0741
4058	2.0	2913.145	0.1057
4058.5	2.5	3246.613	0.141
4059	3.0	3595.359	0.1803
4059.5	3.5	3959.38	0.2236
4060	4.0	4338.686	0.2712
4060.5	4.5	4733.61	0.3232
4061	5.0	5143.496	0.3799
4061.5	5.5	5568.799	0.4413
4062	6.0	6009.25	0.5077
4062.5	6.5	6465.043	0.5793
4063	7.0	6941.365	0.6562
4063.5	7.5	7427.913	0.7385
4064	8.0	7929.628	0.8265
4064.5	8.5	8446.717	0.9204
4065	9.0	8979.057	1.0203
4065.5	9.5	9526.639	1.1263
4066	10.0	10089.53	1.2388
4066.5	10.5	10667.67	1.3577
4067	11.0	11261.07	1.4834
4067.5	11.5	11869.74	1.616
4068	12.0	12493.67	1.7557
4068.5	12.5	13132.87	1.9026
4069	13.0	13787.33	2.0569
4069.5	13.5	14457.02	2.2188
4070	14.0	15142	2.3885
4070.5	14.5	15842.26	2.5661
4071	15.0	16557.77	2.7519
4071.5	15.5	17288.55	2.9459
4072	16.0	18034.6	3.1484
4072.5	16.5	18795.91	3.3596
4073	17.0	19572.66	3.5795
4073.5	17.5	20364.49	3.8085
4074	18.0	21171.6	4.0466
4074.5	18.5	21993.96	4.2941
4075	19.0	22831.59	4.5511
4075.5	19.5	23684.48	4.8178
4076	20.0	24552.73	5.0944
4076.5	20.5	25436.14	5.381
4077	21.0	26334.83	5.6779
4077.5	21.5	27249.07	5.9851
4078	22.0	28178.27	6.3029
4078.5	22.5	29122.76	6.6315
4079	23.0	30082.54	6.9709

4079.5	23.5	31057.53	7.3215	
4080	24.0	32047.79	7.6834	
4080.5	24.5	33053.31	8.0567	
4081	25.0	34074.09	8.4416	
4081.5	25.5	35110.18	8.8383	
4082	26.0	36161.49	9.247	
4082.5	26.5	37228.55	9.6679	
4083	27.0	38310.4	10.1011	
4083.5	27.5	39407.51	10.5467	
4084	28.0	40519.89	11.0051	
4084.5	28.5	41647.53	11.4763	
4085	29.0	42791.15	11.9605	
4085.5	29.5	43950.44	12.4579	
4086	30.0	45123.78	12.9687	
4086.5	30.5	46312.39	13.4931	
4087	31.0	47516.25	14.0312	
4087.5	31.5	48735.37	14.5832	
4088	32.0	49969.76	15.1492	
4088.5	32.5	51219.77	15.7295	
4089	33.0	52485.68	16.3243	
4089.5	33.5	53797.71	16.9336	
4090	34.0	55094.16	17.5577	
4090.5	34.5	56406.41	18.1968	
4091	35.0	65101.46	18.851	
4091.5	35.5	66617.64	19.5989	
4092	36.0	68150.01	20.3642	
4092.5	36.5	69708.46	21.1469	
4093	37.0	71270.31	21.9473	
4093.5	37.5	72842.23	22.7655	
4094	38.0	74431.34	23.6017	
4094.5	38.5	76042.47	24.456	
4095	39.0	77659.08	25.3286	
4095.5	39.5	79294.71	26.2197	Top of Pond
4099	43.0	92832.38	33.13	Overtop contour

Proposed Pond C4
Picacho Hills
BHI No: 090126
Date: 9-Dec-08
Prepared By: Kris Johnson
Data and Assumptions:

1. Ponds assumed to have 3:1 side slopes. Ponding volume does not include any dead storage, or retention.
2. See the following cad file for linework defining the proposed ponding geometry.
P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\N-Pond_Contour_Pond Stage Storage.DWG

Conic Method for Reservoir Volumes

$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)
3944	0.0	5508	0.1264	0.00
3946.0	2.0	12573	0.2886	0.40
3948.0	4.0	23933	0.5494	1.23
3950.0	6.0	37720	0.8659	2.63
3952.0	8.0	50420	1.1575	4.65
3954.0	10.0	99950	2.2945	8.04
3956.0	12.0	117458	2.6965	13.02
3958.0	14.0	135341	3.1070	18.82
3960.0	16.0	153505	3.5240	25.45

Proposed Pond C5
Picacho Hills
BHI No: 090126
Date: 10-Dec-08
Prepared By: Kris Johnson
Data and Assumptions:

1. Ponds assumed to have 3:1 side slopes. Ponding volume does not include any dead storage, or retention.
2. See the following cad file for linework defining the proposed ponding geometry.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\N-Pond_Contour_Pond Stage Storage.DWG

Conic Method for Reservoir Volumes

$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)
3908	0.0	5219	0.1198	0.00
3910.0	2.0	10520	0.2415	0.35
3912.0	4.0	16306	0.3743	0.97
3914.0	6.0	22357	0.5132	1.85
3916.0	8.0	28669	0.6581	3.02

Proposed Pond E2
Picacho Hills
BHI No: 090126
Date: 9-Dec-08
Prepared By: Kris Johnson
Data and Assumptions:

1. Ponds assumed to have 3:1 side slopes. Ponding volume does not include any dead storage, or retention.
2. See the following cad file for linework defining the proposed ponding geometry.
   P:\090126\WR\Calculations\Programs\ArcView\HEC_GeoHMS\N-Pond_Contour_Pond Stage Storage.DWG

Conic Method for Reservoir Volumes

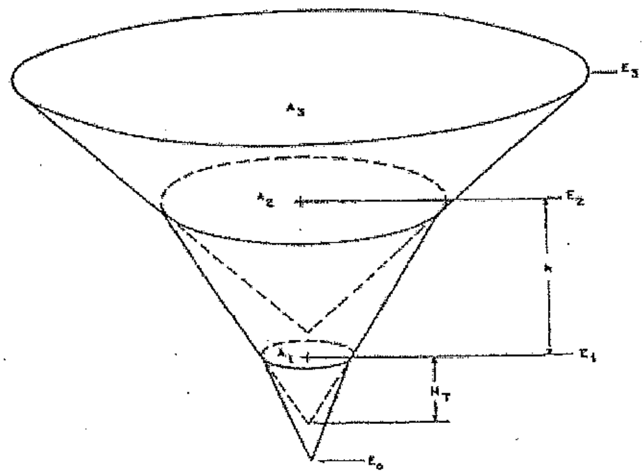
$$V_{23} = \frac{h}{3}\left(A_1 + A_2 + \sqrt{A_1 A_2}\right) + V_{12}$$

ELEV. (FT)	STAGE (FT)	AREA (SQ FT)	AREA (AC)	VOLUME (AC-FT)
3880	0	15728.03	0.3611	0.00
3908	28.0	131642	3.0221	41.33
3910	30.0	143060	3.2842	47.63
3912	32.0	155044	3.5593	54.47

HEC-1 - Users Manual
US Army Corps of Engineers

HEC-1 - Manual
"Flood Hydrograph Package"

If pumps or dam breaks are not being simulated, an outflow rating curve is computed for 20 elevations which span the range of elevations given for storage data. Storages are computed for those elevations. The routing is then accomplished by the modified Puls method using the derived storage-outflow relation. For level-pool reservoir routing with pumping or dam-break simulation, outflows are computed for the orifice and weir equations for each time interval.



$$\Delta V_{12} = \frac{h}{3}(A_1 + A_2 + \sqrt{A_1 A_2})$$

$$H_T = h/(\sqrt{A_2/A_1} - 1)$$

Where

ΔV_{12} = volume between base areas 1 and 2,

A_i = surface area of base i,

E_i = elevation of base i,

h = vertical distance $(E_2 - E_1)$ between bases A_1 and A_2, and

H_T = height of truncated part of cone,

Figure 3.11 Conic Method for Reservoir Volumes

(3) Trapezoidal and Ogee Spillways. Trapezoidal and ogee spillways (Corps of Engineers, 1965) may be simulated as shown in Figure 3.12. The outflow rating curve is computed for 20 stages which span the range of given storage data. If there is a low-level outlet, the stages are evenly spaced between the low-level outlet and the maximum elevation, with the spillway crest located at the tenth elevation. In the absence of a low-level outlet, the second stage is at the spillway crest.

Pond Characteristics Summary

Picacho Hills
BHI No: 090126
Date: 12/29/2008
Prepared By: Kris Johnson

Pond B2

Total Storage Capacity	15.65 AC-FT
Dead Storage Capacity	8.87 AC-FT
Pond Top Elev.	4157 FT
Pond Invert Elev.	4139 FT
Principle Spillway	9-60" CMP Culverts
Culvert Inv. Elev.	4152 FT

Note: No flow overtop roadway.

Summary Results for Reservoir "P-B2"

Project: Future_PH01
Simulation Run: 100-yr 24hr Reservoir: P-B2

Start of Run:	01Jan2009, 00:00	Basin Model:	Picacho Hills
End of Run:	02Jan2009, 00:00	Meteorologic Model:	100_yr
Compute Time:	29Dec2008, 11:08:38	Control Specifications:	Control 1

Volume Units: ○ IN ⦿ AC-FT

Computed Results

Peak Inflow :	989.5 (CFS)	Date/Time of Peak Inflow :	01Jan2009, 09:24
Peak Outflow :	989.3 (CFS)	Date/Time of Peak Outflow :	01Jan2009, 09:28
Total Inflow :	433.2 (AC-FT)	Peak Storage :	15.6 (AC-FT)
Total Outflow :	423.4 (AC-FT)	Peak Elevation :	4157.0 (FT)

Pond B3

Total Storage Capacity	8.33 AC-FT
Dead Storage Capacity	2.19 AC-FT
Pond Top Elev.	4100 FT
Pond Invert Elev.	4082 FT
Principle Spillway	8-48" CMP Culverts
Culvert Inv. Elev.	4091 FT

Note: No flow overtop roadway.

Summary Results for Reservoir "P-B3"

Project: Future_PH01
Simulation Run: 100-yr 24hr Reservoir: P-B3

Start of Run:	01Jan2009, 00:00	Basin Model:	Picacho Hills
End of Run:	02Jan2009, 00:00	Meteorologic Model:	100_yr
Compute Time:	29Dec2008, 11:08:38	Control Specifications:	Control 1

Volume Units: ○ IN ⦿ AC-FT

Computed Results

Peak Inflow :	995.6 (CFS)	Date/Time of Peak Inflow :	01Jan2009, 09:32
Peak Outflow :	994.5 (CFS)	Date/Time of Peak Outflow :	01Jan2009, 09:36
Total Inflow :	454.1 (AC-FT)	Peak Storage :	7.4 (AC-FT)
Total Outflow :	451.5 (AC-FT)	Peak Elevation :	4099.0 (FT)

Pond B5b

Total Storage Capacity	28.28 AC-FT
Dead Storage Capacity	0 AC-FT
Pond Top Elev.	3966 FT
Pond Invert Elev.	3950 FT
Principle Spillway	8-48" CMP Culverts
Culvert Inv. Elev.	3950 FT

Note: No flow overtop pond embankment

Summary Results for Reservoir "P-B5b"

Project: Future_PH01
Simulation Run: 100-yr 24hr Reservoir: P-B5b

Start of Run:	01Jan2009, 00:00	Basin Model:	Picacho Hills
End of Run:	02Jan2009, 00:00	Meteorologic Model:	100_yr
Compute Time:	29Dec2008, 11:08:38	Control Specifications:	Control 1

Volume Units: ○ IN ⦿ AC-FT

Computed Results

Peak Inflow :	1000.2 (CFS)	Date/Time of Peak Inflow :	01Jan2009, 09:44
Peak Outflow :	960.5 (CFS)	Date/Time of Peak Outflow :	01Jan2009, 10:14
Total Inflow :	479.7 (AC-FT)	Peak Storage :	21.9 (AC-FT)
Total Outflow :	479.3 (AC-FT)	Peak Elevation :	4008.1 (FT)

Pond C2

Total Storage Capacity	20.27 AC-FT
Dead Storage Capacity	10.77 AC-FT
Pond Top Elev.	4132 FT
Pond Invert Elev.	4100 FT
Principle Spillway	9-48" CMP Culverts
Culvert Inv. Elev.	4126 FT

Note: 2 FT flow overtop roadway.

Summary Results for Reservoir "P-C2_Combined"

Project: Future_PH01
Simulation Run: 100-yr 24hr Reservoir: P-C2_Combined

Start of Run:	01Jan2009, 00:00	Basin Model:	Picacho Hills
End of Run:	02Jan2009, 00:00	Meteorologic Model:	100_yr
Compute Time:	29Dec2008, 11:08:38	Control Specifications:	Control 1

Volume Units: ○ IN ⊙ AC-FT

Computed Results

Peak Inflow :	1579.8 (CFS)	Date/Time of Peak Inflow :	01Jan2009, 06:20
Peak Outflow :	1395.4 (CFS)	Date/Time of Peak Outflow :	01Jan2009, 06:28
Total Inflow :	116.6 (AC-FT)	Peak Storage :	25.7 (AC-FT)
Total Outflow :	105.4 (AC-FT)	Peak Elevation :	4134.0 (FT)

Pond C3

Total Storage Capacity	26.22 AC-FT
Dead Storage Capacity	18.85 AC-FT
Pond Top Elev.	4095.5 FT
Pond Invert Elev.	4056 FT
Principle Spillway	7-30" CMP Culverts
Culvert Inv. Elev.	4091 FT

Note: 2.5 FT flow overtop roadway.

Summary Results for Reservoir "P-C3"

Project: Future_PH01
Simulation Run: 100-yr 24hr Reservoir: P-C3

Start of Run:	01Jan2009, 00:00	Basin Model:	Picacho Hills
End of Run:	02Jan2009, 00:00	Meteorologic Model:	100_yr
Compute Time:	29Dec2008, 11:08:38	Control Specifications:	Control 1

Volume Units: ○ IN ⊙ AC-FT

Computed Results

Peak Inflow :	1417.7 (CFS)	Date/Time of Peak Inflow :	01Jan2009, 06:30
Peak Outflow :	1330.7 (CFS)	Date/Time of Peak Outflow :	01Jan2009, 06:36
Total Inflow :	115.9 (AC-FT)	Peak Storage :	31.1 (AC-FT)
Total Outflow :	96.3 (AC-FT)	Peak Elevation :	4098.0 (FT)

Pond C4

Total Storage Capacity	25.45 AC-FT
Dead Storage Capacity	0 AC-FT
Pond Top Elev.	3960 FT
Pond Invert Elev.	3944 FT
Principle Spillway	4-48" CMP Culverts
Culvert Inv. Elev.	3944 FT

Note: No flow overtop pond embankment

Summary Results for Reservoir "P-C4"

Project: Future_PH01
Simulation Run: 100-yr 24hr Reservoir: P-C4

Start of Run:	01Jan2009, 00:00	Basin Model:	Picacho Hills
End of Run:	02Jan2009, 00:00	Meteorologic Model:	100_yr
Compute Time:	29Dec2008, 11:08:38	Control Specifications:	Control 1

Volume Units: ○ IN ⊙ AC-FT

Computed Results

Peak Inflow :	1398.7 (CFS)	Date/Time of Peak Inflow :	01Jan2009, 06:42
Peak Outflow :	778.5 (CFS)	Date/Time of Peak Outflow :	01Jan2009, 07:06
Total Inflow :	118.9 (AC-FT)	Peak Storage :	19.2 (AC-FT)
Total Outflow :	118.7 (AC-FT)	Peak Elevation :	3958.1 (FT)

Pond C5

Total Storage Capacity	3.02 AC-FT
Dead Storage Capacity	0 AC-FT
Pond Top Elev.	3916 FT
Pond Invert Elev.	3908 FT
Principle Spillway	3-36" CMP Culverts
Culvert Inv. Elev.	3908 FT

Note: No flow overtop pond embankment

Summary Results for Reservoir "P-C5"

Project: Future_PH01
Simulation Run: 100-yr 24hr Reservoir: P-C5

Start of Run:	01Jan2009, 00:00	Basin Model:	Picacho Hills
End of Run:	02Jan2009, 00:00	Meteorologic Model:	100_yr
Compute Time:	29Dec2008, 11:08:38	Control Specifications:	Control 1

Volume Units: ○ IN ⊙ AC-FT

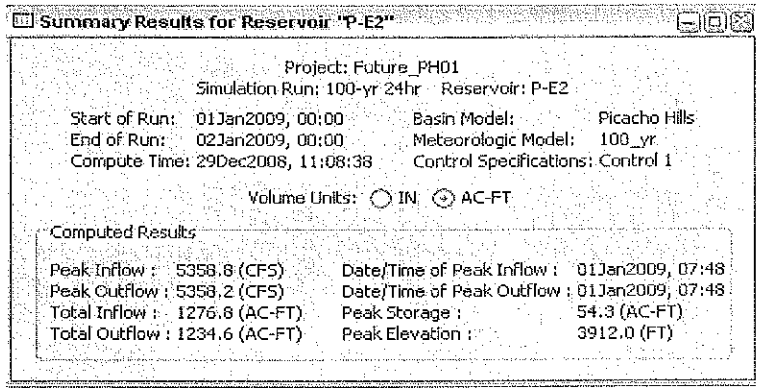
Computed Results

Peak Inflow :	235.5 (CFS)	Date/Time of Peak Inflow :	01Jan2009, 06:08
Peak Outflow :	190.8 (CFS)	Date/Time of Peak Outflow :	01Jan2009, 06:14
Total Inflow :	9.9 (AC-FT)	Peak Storage :	1.5 (AC-FT)
Total Outflow :	9.9 (AC-FT)	Peak Elevation :	3913.2 (FT)

Pond E2 (Nafzinger Arroyo Pond)

Total Storage Capacity	54.47 AC-FT
Dead Storage Capacity	41.33 AC-FT
Pond Top Elev.	3912 FT
Pond Invert Elev.	3880 FT
Principle Spillway	10- 3FT (H) x 29FT (W) CBC
Culvert Inv. Elev.	3908 FT

Note: No flow overtop roadway.



Summary Results for Reservoir "P-E2"

Project: Future_PH01
Simulation Run: 100-yr 24hr Reservoir: P-E2

Start of Run:	01Jan2009, 00:00	Basin Model:	Picacho Hills
End of Run:	02Jan2009, 00:00	Meteorologic Model:	100_yr
Compute Time:	29Dec2008, 11:08:38	Control Specifications:	Control 1

Volume Units: ◯ IN ⦿ AC-FT

Computed Results

Peak Inflow :	5358.8 (CFS)	Date/Time of Peak Inflow :	01Jan2009, 07:48
Peak Outflow :	5358.2 (CFS)	Date/Time of Peak Outflow :	01Jan2009, 07:48
Total Inflow :	1276.8 (AC-FT)	Peak Storage :	54.3 (AC-FT)
Total Outflow :	1234.6 (AC-FT)	Peak Elevation :	3912.0 (FT)

Note:

Due to constraints within HEC-HMS, the number of culverts which can be modeled as a pond spillway is limited to 10 culverts. 48 CBCs each 3 FT (H) x 6 FT (W) will be utilized instead of the 10 culverts each, 3FT (H) x 29FT (W)

Please see the additional culvert calculation which verifies the use of the 48 CBCs.

P:\090126\WR\Calculations\Misc Calcs\090126 CulvertCapacity01.txt

Existing Conditions Basin HEC-HMS Model Results - Sediment Bulking -

Picacho Hills

BHI No. 090126

Date: 3/24/2009

Prepared By: Kjohnson

Structure ID	Drainage Area (SQ MI)	Time of Peak	Volume (AC-FT)	Peak Discharge (cfs)	Drainage Area (AC)	Discharge (cfs/ac)
Basin						
A1	7.527082	01Jan2009, 07:42	1005.9	4274.9	4817.33	0.887
A2	0.355592	01Jan2009, 06:18	41.7	665.8	227.58	2.926
B1	2.389555	01Jan2009, 09:22	388.4	930.6	1529.32	0.609
B10	0.021772	01Jan2009, 06:06	2.3	63.3	13.93	4.543
B11	0.001183	01Jan2009, 06:02	0.1	3.9	0.76	5.151
B12	0.00916	01Jan2009, 06:04	1	31.1	5.86	5.305
B13	0.014112	01Jan2009, 06:08	1.5	34.6	9.03	3.831
B14	0.003584	01Jan2009, 06:04	0.3	10.5	2.29	4.578
B15	0.008778	01Jan2009, 06:02	0.9	30.7	5.62	5.465
B2	0.185785	01Jan2009, 06:14	21.4	394.9	118.90	3.321
B3	0.243373	01Jan2009, 06:14	25	447.6	155.76	2.874
B4	0.159497	01Jan2009, 06:10	16.9	364.8	102.08	3.574
B5	0.051817	01Jan2009, 06:06	4.9	134.1	33.16	4.044
B5a	0.006368	01Jan2009, 06:02	0.7	23.2	4.08	5.693
B5b	0.042955	01Jan2009, 06:02	4.6	150.6	27.49	5.478
B6	0.081958	01Jan2009, 06:04	6.3	203.8	52.45	3.885
B7	0.006587	01Jan2009, 06:04	0.5	16.9	4.22	4.009
B9	0.002787	01Jan2009, 06:02	0.3	10.5	1.78	5.887
C1	0.507719	01Jan2009, 06:24	57.7	759.4	324.94	2.337
C2	0.299934	01Jan2009, 06:14	32.4	595.6	191.96	3.103
C2a	0.01332	01Jan2009, 06:02	1.5	49	8.52	5.748
C3	0.088644	01Jan2009, 06:04	10.2	300.3	56.73	5.293
C4	0.065241	01Jan2009, 06:06	6.5	178.1	41.75	4.265
C4a	0.153314	01Jan2009, 06:12	16.1	306	98.12	3.119
C5	0.10372	01Jan2009, 06:08	9.9	235.5	66.38	3.548
C6	0.053486	01Jan2009, 06:06	5.3	149.1	34.23	4.356
C7	0.021141	01Jan2009, 06:06	2.2	61.7	13.53	4.560
C7a	0.003139	01Jan2009, 06:04	0.3	9.2	2.01	4.579
C8	0.010798	01Jan2009, 06:04	1.2	36.8	6.91	5.325
C9	0.00386	01Jan2009, 06:02	0.5	16.2	2.47	6.558
D1	0.380899	01Jan2009, 06:18	45.1	709.2	243.78	2.909
D1a	0.0340823	01Jan2009, 06:04	3.8	117.2	21.81	5.373
D2	0.155143	01Jan2009, 06:18	17.7	278.7	99.29	2.807
D3	0.018413	01Jan2009, 06:02	1.9	62.2	11.78	5.278
D4	0.006313	01Jan2009, 06:02	0.8	24.9	4.04	6.163
D5	0.006669	01Jan2009, 06:04	0.6	19.7	4.27	4.616
E2	0.019955	01Jan2009, 06:04	1.9	62.1	12.77	4.863
Junction Points						
J-A2	7.882674	01Jan2009, 07:48	1046.6	4295.7		
J-B2	2.57534	01Jan2009, 09:26	409.6	935.3		
J-B3	2.818713	01Jan2009, 09:30	433.6	941.1		
J-B4	2.97821	01Jan2009, 06:20	450.3	1011.8		

J-B5	3.030027	01Jan2009, 06:20	455.1	1039.3
J-B5b	3.07935	01Jan2009, 06:22	460.3	1053.8
J-B7	3.085937	01Jan2009, 06:24	460.7	1055.6
J-B9	0.002787	01Jan2009, 06:02	0.3	10.5
J-C2	0.807653	01Jan2009, 06:20	90.1	1171.3
J-C2a	0.820973	01Jan2009, 06:22	91.4	1168.4
J-C3	0.909617	01Jan2009, 06:24	101.6	1210.2
J-C4	1.128172	01Jan2009, 06:30	123.2	1365.4
J-C4a	1.062931	01Jan2009, 06:28	116.8	1347.6
J-C6	1.181658	01Jan2009, 06:32	128.5	1376.4
J-D2	0.5701243	01Jan2009, 06:24	66	967.8
J-E2	7.902629	01Jan2009, 07:50	1048.2	4294.5
Ponds				
P-B2	2.57534	01Jan2009, 09:28	408.8	935.3
C2_Combined	0.820973	01Jan2009, 06:22	91.4	1168.4
P-C3	0.909617	01Jan2009, 06:24	100.7	1205.2
P-D1	0.380899	01Jan2009, 06:18	44.9	705.8
P-D2	0.4149813	01Jan2009, 06:20	48.3	725.5
Routing				
R-A2	7.527082	01Jan2009, 07:48	1004.8	4274.1
R-B10	0.002787	01Jan2009, 06:10	0.3	10.4
R-B2	2.389555	01Jan2009, 09:28	388.1	930.6
R-B3	2.57534	01Jan2009, 09:30	408.6	935.3
R-B4	2.818713	01Jan2009, 09:34	433.3	941
R-B5	2.97821	01Jan2009, 06:22	450.2	1007.1
R-B5b	3.030027	01Jan2009, 06:24	454.9	1036.6
R-B7	3.07935	01Jan2009, 06:24	460.2	1053.9
R-C2	0.507719	01Jan2009, 06:28	57.6	758.1
R-C3	0.820973	01Jan2009, 06:24	91.4	1167.3
R-C4	1.062931	01Jan2009, 06:30	116.8	1345.1
R-C4a	0.909617	01Jan2009, 06:30	100.6	1203.7
R-C6	1.128172	01Jan2009, 06:32	123.2	1363.2
R-D2	0.4149813	01Jan2009, 06:26	48.3	723.1
R-E2	7.882674	01Jan2009, 07:50	1046.3	4293.8
Outfalls				
S-A1	7.902629	01Jan2009, 07:50	1048.2	4294.5
S-B1	3.085937	01Jan2009, 06:24	460.7	1055.6
S-B2	0.013545	01Jan2009, 06:02	1.4	44.9
S-B3	0.033719	01Jan2009, 06:06	3.6	100.6
S-B4	0.014112	01Jan2009, 06:08	1.5	34.6
S-B5	0.081958	01Jan2009, 06:04	6.3	203.8
S-C1	1.300036	01Jan2009, 06:30	140.1	1420.7
S-C2	0.02428	01Jan2009, 06:04	2.5	70.5
S-D1	0.5948503	01Jan2009, 06:24	68.7	975.5
S-D2	0.006669	01Jan2009, 06:04	0.6	19.7

Existing Conditions Basin HEC-HMS Model Results - No Sediment Bulking -

Picacho Hills

BHI No. 090126

Date: 11/14/2008

Prepared By: Kjohnson

Structure ID	Drainage Area (SQ MI)	Time of Peak	Volume (AC-FT)	Peak Discharge (cfs)	Drainage Area (AC)	Discharge (cfs/ac)
Basin						
A1	7.527082	01Jan2009, 07:42	831.3	3533	4817.33	0.733
A2	0.355592	01Jan2009, 06:18	36.6	584	227.58	2.566
B1	2.389555	01Jan2009, 09:22	340.7	816.3	1529.32	0.534
B10	0.021772	01Jan2009, 06:06	2.2	60.3	13.93	4.328
B11	0.001183	01Jan2009, 06:02	0.1	3.8	0.76	5.019
B12	0.00916	01Jan2009, 06:04	1	29.9	5.86	5.100
B13	0.014112	01Jan2009, 06:08	1.5	33.3	9.03	3.687
B14	0.003584	01Jan2009, 06:04	0.3	10.2	2.29	4.447
B15	0.008778	01Jan2009, 06:02	0.9	29.5	5.62	5.251
B2	0.185785	01Jan2009, 06:14	19.1	352.6	118.90	2.965
B3	0.243373	01Jan2009, 06:14	22.1	396.1	155.76	2.543
B4	0.159497	01Jan2009, 06:10	15.1	325.7	102.08	3.191
B5	0.051817	01Jan2009, 06:06	4.5	124.1	33.16	3.742
B5a	0.006368	01Jan2009, 06:02	0.7	22.3	4.08	5.472
B5b	0.042955	01Jan2009, 06:02	4.3	138.2	27.49	5.027
B6	0.081958	01Jan2009, 06:04	5.7	185.3	52.45	3.533
B7	0.006587	01Jan2009, 06:04	0.5	16.4	4.22	3.890
B9	0.002787	01Jan2009, 06:02	0.3	10.2	1.78	5.719
C1	0.507719	01Jan2009, 06:24	50.1	660.4	324.94	2.032
C2	0.299934	01Jan2009, 06:14	28.4	522.4	191.96	2.721
C2a	0.01332	01Jan2009, 06:02	1.4	46.6	8.52	5.466
C3	0.088644	01Jan2009, 06:04	9.1	270.5	56.73	4.768
C4	0.065241	01Jan2009, 06:06	5.9	163.4	41.75	3.913
C4a	0.153314	01Jan2009, 06:12	14.5	275.7	98.12	2.810
C5	0.10372	01Jan2009, 06:08	9	214.1	66.38	3.225
C6	0.053486	01Jan2009, 06:06	4.9	136.8	34.23	3.996
C7	0.021141	01Jan2009, 06:06	2.1	58.7	13.53	4.338
C7a	0.003139	01Jan2009, 06:04	0.3	8.9	2.01	4.430
C8	0.010798	01Jan2009, 06:04	1.1	35.3	6.91	5.108
C9	0.00386	01Jan2009, 06:02	0.5	15.8	2.47	6.396
D1	0.380899	01Jan2009, 06:18	39.2	616.7	243.78	2.530
D1a	0.0340823	01Jan2009, 06:04	3.5	108.2	21.81	4.960
D2	0.155143	01Jan2009, 06:18	16	251.1	99.29	2.529
D3	0.018413	01Jan2009, 06:02	1.8	59.2	11.78	5.024
D4	0.006313	01Jan2009, 06:02	0.7	23.9	4.04	5.915
D5	0.006669	01Jan2009, 06:04	0.6	19	4.27	4.452
E2	0.019955	01Jan2009, 06:08	1.8	43.6	12.77	3.414

Future Conditions Basin HEC-HMS Model Results

Picacho Hills -Bulked Flows -

BHI No. 090126

Date: 3/24/2009

Prepared By: Kjohnson

Structure ID	Drainage Area (SQ MI)	Time of Peak	Volume (AC-FT)	Peak Discharge (cfs)	Drainage Area (AC)	Discharge (cfs/ac)
Basin						
A1	7.527	01Jan2009, 07:40	1230.1	5337.8	4817.33	1.108
A2	0.356	01Jan2009, 06:18	45.6	735	227.58	3.230
B1	2.390	01Jan2009, 09:22	410	984.4	1529.32	0.644
B10	0.022	01Jan2009, 06:06	2.3	63.3	13.93	4.543
B11	0.001	01Jan2009, 06:02	0.1	3.9	0.76	5.151
B12	0.009	01Jan2009, 06:04	1	31.1	5.86	5.305
B13	0.014	01Jan2009, 06:08	1.5	34.6	9.03	3.831
B14	0.004	01Jan2009, 06:04	0.3	10.5	2.29	4.578
B15	0.009	01Jan2009, 06:02	0.9	30.7	5.62	5.465
B2	0.186	01Jan2009, 06:14	23.4	435.7	118.90	3.664
B3	0.243	01Jan2009, 06:14	31	570.4	155.76	3.662
B4	0.159	01Jan2009, 06:10	18.4	400.3	102.08	3.922
B5	0.052	01Jan2009, 06:06	4.9	134.1	33.16	4.044
B5a	0.006	01Jan2009, 06:02	0.7	23.2	4.08	5.693
B5b	0.043	01Jan2009, 06:02	4.6	150.6	27.49	5.478
B6	0.082	01Jan2009, 06:04	6.3	203.8	52.45	3.885
B7	0.007	01Jan2009, 06:04	0.5	16.9	4.22	4.009
B9	0.003	01Jan2009, 06:02	0.3	10.5	1.78	5.887
C1	0.508	01Jan2009, 06:22	76.6	1045.8	324.94	3.218
C2	0.300	01Jan2009, 06:14	38.5	721.1	191.96	3.757
C2a	0.013	01Jan2009, 06:02	1.5	49	8.52	5.748
C3	0.089	01Jan2009, 06:04	10.6	313.2	56.73	5.521
C4	0.065	01Jan2009, 06:06	6.5	178.1	41.75	4.265
C4a	0.153	01Jan2009, 06:12	16.1	306	98.12	3.119
C5	0.104	01Jan2009, 06:08	9.9	235.5	66.38	3.548
C6	0.053	01Jan2009, 06:06	5.3	149.1	34.23	4.356
C7	0.021	01Jan2009, 06:06	2.2	61.7	13.53	4.560
C7a	0.003	01Jan2009, 06:02	0.3	10.9	2.01	5.426
C8	0.011	01Jan2009, 06:04	1.2	38.6	6.91	5.586
C9	0.004	01Jan2009, 06:02	0.5	16.2	2.47	6.558
D1	0.381	01Jan2009, 06:18	47	742.6	243.78	3.046
D1a	0.034	01Jan2009, 06:04	4.1	126.6	21.81	5.804
D2	0.155	01Jan2009, 06:18	18.5	291.8	99.29	2.939
D3	0.018	01Jan2009, 06:02	2.3	74	11.78	6.280
D4	0.006	01Jan2009, 06:02	0.9	28.7	4.04	7.103
D5	0.007	01Jan2009, 06:02	0.7	24.3	4.27	5.693
E2	0.020	01Jan2009, 06:02	2.3	76.4	12.77	5.982
Junction Points						
J-A2	7.883	01Jan2009, 07:46	1274.7	5360.3		
J-B2	2.575	01Jan2009, 09:24	433.2	989.5		
J-B3	2.819	01Jan2009, 09:32	454.1	995.6		
J-B4	2.978	01Jan2009, 09:40	469.7	998.1		
J-B5	3.030	01Jan2009, 09:42	474.5	999.2		

J-B5b	3.079	01Jan2009, 09:44	479.7	1000.2
J-B7	3.086	01Jan2009, 10:14	479.7	960.5
J-B9	0.003	01Jan2009, 06:02	0.3	10.5
J-B-Basins	3.229	01Jan2009, 10:14	492.5	962.9
J-C2	0.808	01Jan2009, 06:20	115.1	1573.3
J-C2a	0.821	01Jan2009, 06:28	105.4	1395.4
J-C3	0.910	01Jan2009, 06:30	115.9	1417.7
J-C4	1.128	01Jan2009, 06:42	118.9	1398.7
J-C4a	1.063	01Jan2009, 06:40	112.4	1393.9
J-C6	1.182	01Jan2009, 07:10	124	781.9
J-Channel01	1.926	01Jan2009, 06:22	210.9	1591.7
J-Channel02	5.155	01Jan2009, 06:22	703.4	2217.6
J-D2	0.570	01Jan2009, 06:24	68.9	1016.1
J-E2	7.903	01Jan2009, 07:48	1276.8	5358.7
J-S-B1	3.086	01Jan2009, 10:14	479.7	960.5
J-S-B2	0.014	01Jan2009, 06:02	1.4	44.9
J-S-B3	0.034	01Jan2009, 06:06	3.6	100.6
J-S-B4	0.014	01Jan2009, 06:08	1.5	34.6
J-S-B5	0.082	01Jan2009, 06:04	6.3	203.8
J-S-C1	1.300	01Jan2009, 07:08	135.6	791.8
J-S-C2	0.024	01Jan2009, 06:04	2.5	72.1
J-S-D1	0.602	01Jan2009, 06:24	72.8	1026.7
J-S-D2	0.007	01Jan2009, 06:02	0.7	24.3
Ponds				
P-B2	2.575	01Jan2009, 09:28	423.4	989.3
P-B3	2.819	01Jan2009, 09:36	451.5	994.5
P-B5b	3.079	01Jan2009, 10:14	479.3	960.5
C2_Combined	0.821	01Jan2009, 06:28	105.4	1395.4
P-C3	0.910	01Jan2009, 06:36	96.3	1330.7
P-C4	1.128	01Jan2009, 07:06	118.7	778.5
P-C5	0.104	01Jan2009, 06:14	9.9	190.8
P-D1	0.381	01Jan2009, 06:18	46.8	739.8
P-D2	0.415	01Jan2009, 06:20	50.4	761.3
P-E2	7.903	01Jan2009, 07:48	1234.6	5358.2
Routing				
R-A2	7.527	01Jan2009, 07:46	1229.1	5336.6
R-B10	0.003	01Jan2009, 06:10	0.3	10.4
R-B2	2.390	01Jan2009, 09:26	409.7	984.4
R-B3	2.575	01Jan2009, 09:32	423.2	989.3
R-B4	2.819	01Jan2009, 09:42	451.3	994.4
R-B5	2.978	01Jan2009, 09:42	469.6	998.1
R-B5b	3.030	01Jan2009, 09:44	474.3	999.1
R-B7	3.079	01Jan2009, 10:14	479.2	960.4
R-C2	0.508	01Jan2009, 06:26	76.6	1043.8
R-C3	0.821	01Jan2009, 06:30	105.3	1392
R-C4	1.063	01Jan2009, 06:42	112.5	1389.1
R-C4a	0.910	01Jan2009, 06:40	96.3	1326.6
R-C6	1.128	01Jan2009, 07:10	118.7	778.4
R-D2	0.415	01Jan2009, 06:26	50.4	758.5
R-E2	7.883	01Jan2009, 07:48	1274.4	5357.9
Outfalls				
RioGrande	13.0577353	01Jan2009, 07:40	1938	6330.5

Future Conditions Basin HEC-HMS Model Results - No Sediment Bulking -

Picacho Hills

BHI No. 090126

Date: 11/14/2008

Prepared By: Kjohnson

Structure ID	Drainage Area (SQ MI)	Time of Peak	Volume (AC-FT)	Peak Discharge (cfs)	Drainage Area (AC)	Discharge (cfs/ac)
Basin						
A1	7.527082	01Jan2009, 07:40	1008.3	4375.2	4817.33	0.908
A2	0.355592	01Jan2009, 06:18	39.7	639.1	227.58	2.808
B1	2.389555	01Jan2009, 09:22	353.5	848.7	1529.32	0.555
B10	0.021772	01Jan2009, 06:06	2.2	60.3	13.93	4.328
B11	0.001183	01Jan2009, 06:02	0.1	3.8	0.76	5.019
B12	0.00916	01Jan2009, 06:04	1	29.9	5.86	5.100
B13	0.014112	01Jan2009, 06:08	1.5	33.3	9.03	3.687
B14	0.003584	01Jan2009, 06:04	0.3	10.2	2.29	4.447
B15	0.008778	01Jan2009, 06:02	0.9	29.5	5.62	5.251
B2	0.185785	01Jan2009, 06:14	20.7	385.6	118.90	3.243
B3	0.243373	01Jan2009, 06:14	27.2	500.4	155.76	3.213
B4	0.159497	01Jan2009, 06:10	16.4	357.4	102.08	3.501
B5	0.051817	01Jan2009, 06:06	4.5	124.1	33.16	3.742
B5a	0.006368	01Jan2009, 06:02	0.7	22.3	4.08	5.472
B5b	0.042955	01Jan2009, 06:02	4.3	138.2	27.49	5.027
B6	0.081958	01Jan2009, 06:04	5.7	185.3	52.45	3.533
B7	0.006587	01Jan2009, 06:04	0.5	16.4	4.22	3.890
B9	0.002787	01Jan2009, 06:02	0.3	10.2	1.78	5.719
C1	0.507719	01Jan2009, 06:22	66.1	901.5	324.94	2.774
C2	0.299934	01Jan2009, 06:14	33.5	627	191.96	3.266
C2a	0.01332	01Jan2009, 06:02	1.4	46.6	8.52	5.466
C3	0.088644	01Jan2009, 06:04	9.5	282.2	56.73	4.974
C4	0.065241	01Jan2009, 06:06	5.9	163.4	41.75	3.913
C4a	0.153314	01Jan2009, 06:12	14.5	275.7	98.12	2,810
C5	0.10372	01Jan2009, 06:08	9	214.1	66.38	3.225
C6	0.053486	01Jan2009, 06:06	4.9	136.8	34.23	3.996
C7	0.021141	01Jan2009, 06:06	2.1	58.7	13.53	4.338
C7a	0.003139	01Jan2009, 06:02	0.3	10.5	2.01	5.227
C8	0.010798	01Jan2009, 06:04	1.2	36.7	6.91	5.311
C9	0.00386	01Jan2009, 06:02	0.5	15.8	2.47	6.396
D1	0.380899	01Jan2009, 06:18	40.8	645.7	243.78	2.649
D1a	0.0340823	01Jan2009, 06:04	3.8	117.2	21.81	5.373
D2	0.155143	01Jan2009, 06:18	16.6	262.9	99.29	2.648
D3	0.018413	01Jan2009, 06:02	2.1	69.8	11.78	5.923
D4	0.006313	01Jan2009, 06:02	0.9	27.6	4.04	6.831
D5	0.006669	01Jan2009, 06:02	0.7	23.3	4.27	5.459
E2	0.019955	01Jan2009, 06:08	2.2	54.4	12.77	4.260

APPENDIX B

Conceptual Project Construction Cost Estimates

Conceptual Cost Estimate - Assumptions

Picacho Hills Drainage Master Plan

BHI No. 090126
Date: 3/12/2009
Prepared By: Kris Johnson
Reviewed By: Dan Grochowski

Bid Item Assumptions:

Existing pond improvements

1 Earthwork, excavation and backfill
Earthwork equals the difference between the existing pond water storage volume and the proposed pond storage volume
There is no new embankment construction for existing ponds, there is only excavation.

2 Remove and dispose of existing culvert pipe
Assume 100 FT per culvert pipe.

3 Asphalt removal and replacement (I will not be quantifying curb and gutter replacement.)
= [(culvert dia/12)*(no. culverts)+(1.5 FT for spacing between pipes)*(no. culverts)+1.5 FT] * width of roadway + 20 FTlimits. account for trenching
Unless: Construction of the emergency spillway requires the removal of more asphalt than that removed to install the culverts.
Then the bid item becomes only Asphalt removal and disposal and use the quantity for concrete pavement install.

4 Wire-tied riprap pad (Emergency spillway)
Assume 1/2 the length of the edge of the pond abutting roadway.
Use 1.5' Wire-Tied Riprap. Approximate needed extents based loosely on topography.

5 Concrete Pavement (Emergency spillway)
Assume 1/2 the length of the edge of the pond abutting roadway. Use 6" Pavement. Use approx. roadway width from aerial photos.

6 Culverts
Assume 100 FT for each culvert

7 Trenching for culverts
=culvert total length x total culvert width (includes all culvert barrels) x approx. depth of culverts

New ponds

1 Earthwork, excavation and backfill
The majority of ponding areas are excavation only, with no embankment construction.
For ponds with only the embankment being constructed, rough estimate of embankment volume only, there will be no excavation.

2 Culverts
Assume 100 FT for each culvert

3 Trenching for culverts
=culvert total length (100 ft) x total culvert width (includes all culvert barrels) x approx. depth of culverts

4 Asphalt removal and replacement (I will not be quantifying curb and gutter replacement.)
= [(culvert dia/12)*(no. culverts)+(1.5 FT for spacing between pipes)*(no. culverts)+1.5 FT] * width of roadway + 20 FTlimits. account for trenching

5 Wire-tied riprap pad (Emergency spillway
Assume 1/2 the length of the edge of the pond abutting roadway.
Use 1.5' Wire-Tied Riprap. Approximate needed extents based loosely on topography.

6 Concrete Pavement (Emergency spillway)
Assume 1/2 the length of the edge of the pond abutting roadway. Use 6" Pavement. Use approx. roadway width from aerial photos.

Crossing Culverts

1 Culverts
Use topograhic imagery to approximate location of culvert and length.

2 Trenching for culverts

=culvert total length x total culvert width (includes all culvert barrels) x approx. depth of culverts

3 Asphalt removal and replacement (I will not be quantifying curb and gutter replacement.)
= [(culvert dia/12)*(no. culverts)+(1.5 FT for spacing between pipes)*(no. culverts)+1.5 FT] * width of roadway + 20 FTlimits. account for trenching

Storm Drain

1 Pipe
Assume total length of roadway

2 Trenching
Assume less than 8 FT trenching depth
= [(Trench layback at 1.5:1 for depth beyond 3FT deep)+Pipe dia. + pipe thickness+1.5 FT on either side of pipe] x Length of SD

3 Inlets
Assume inlets can capture 5 cfs per inlet.
Equivalent NMDOT inlet to a COA Type A inlet.

4 Asphalt removal and replacement
= [(culvert dia/12)*(no. culverts)+(1.5 FT for spacing between pipes)*(no. culverts)+1.5 FT] * width of roadway + 20 FTlimits. account for trenching

5 Curb and gutter
= 2 x length of SD

6 Wire-tied riprap pad for SD outfall
10x10 pad that is 1.5 FT thick

Arroyo Improvements

1 Dumped Riprap
Assume 1000 FT (Long) x 10 FT (Wide) x 2 FT (Thick) per bank protected. Assume two banks protected.

Curb and Gutter

1 Curb and Gutter (assume urban 6" Curb and Gutter)
Use length of roadway x 2 to account for installing curb and gutter on both sides of the roadway.

2 Dumped Riprap
Assume 50 FT (Long) x 10 FT (Wide) x 1.5 FT (Thick) per curb and gutter project

3 Earthwork, excavation and backfill
Equals quantity of riprap

Channels

1 Earthwork, excavation and backfill
See attached calc. Assume channels have berms on either side, sufficient in height to contain the 100-yr event. (Perched channels)

2 Wire-tied
Sides of channel only. Earthern channel bottom.
Tie side wall riprap into ground 2 ft. Channel lengths (Long) x entire channel surface area x 1.5 FT (Thick)

<u>All projects will include the following costs</u>

25% Contingency = [(subtotal of all construction items listed above) x 0.25]
25% Soft Costs = [(construction costs + contingency costs) x 0.25]

Conceptual Cost Estimate
Picacho Hills Drainage Master Plan
BHI No : 090126
Date: 3/12/2009
Prepared By: Kris Johnson
Reviewed By: Dan Grochowski

Picacho Hills Diversion System

	Item Description	Approx. Quantity	Unit	Unit Price	Total
Section 1	Excavation, Placement and Compaction	19330	CY	$15	$ 289,950.00
	Dumped Riprap	6831	CY	$110	$ 751,410.00
Section 2	Excavation, Placement and Compaction	17580	CY	$15	$ 263,700.00
	Dumped Riprap	6213	CY	$110	$ 683,430.00
Section 3	Excavation, Placement and Compaction	59240	CY	$15	$ 888,600.00
	Dumped Riprap	21229	CY	$110	$ 2,335,190.00
				Construction Cost Subtotal	$ 5,212,280.00
				25% Contingency	$ 1,303,070.00
				Construction Total	$ 6,515,350.00
				Soft Costs	$ 1,628,837.50
				Project Total	**$ 8,144,187.50**

Nafzinger Arroyo Basin

	Item Description	Approx. Quantity	Unit	Unit Price	Total
Arroyo Improvements	Excavation, Placement and Compaction	1481	CY	$15	$ 22,222.22
	Dumped Riprap	1481	CY	$110	$ 162,962.96
				Construction Cost Subtotal	$ 185,185.19
				25% Contingency	$ 46,296.30
				Construction Total	$ 231,481.48
				Soft Costs	$ 57,870.37
				Project Total	**$ 289,351.85**
Nafzinger Arroyo Pond (Pond E2)	Excavation, Placement and Compaction	87880	CY	$15	$ 1,318,200.00
	Wire-Tied Riprap (Emergency Spillway)	560	CY	$175	$ 98,000.00
	Concrete Pavement - 6"	1120	SY	$100	$ 112,000.00
	Triple 3' (H) x 6' (W) x 100' (Long) CBC	16	EA	$72,605	$ 1,161,680.00
	Excavation & Backfill for Culverts	4267	CY	$15	$ 64,000.83
	Asphalt Removal and Replacement	482	SY	$52	$ 24,834.60
				Construction Cost Subtotal	$ 2,778,715.43
				25% Contingency	$ 694,678.86
				Construction Total	$ 3,473,394.29
				Soft Costs	$ 868,348.57
				Project Total	**$ 4,341,742.86**

Barcelona Ridge Arroyo Basin

	Item Description	Approx. Quantity	Unit	Unit Price	Total
Barcelona Ridge Arroyo Pond 2 (Pond B2)	Excavation, Placement and Compaction	22860	CY	$15	$ 342,900.00
	Wire-Tied Riprap (Emergency Spillway)	840	CY	$175	$ 147,000.00
	Concrete Pavement - 6"	1530	SY	$100	$ 153,000.00
	60" Culvert Pipe	900	LF	$730	$ 657,000.00
	60" Culvert Pipe End Sections	18	EA	$1,715	$ 30,870.00
	Excavation & Backfill for Culverts	1322	CY	$15	$ 19,833.33
	Asphalt Removal and Disposal	1530	SY	$52	$ 78,795.48
				Construction Cost Subtotal	$ 1,429,398.82
				25% Contingency	$ 357,349.70
				Construction Total	$ 1,786,748.52
				Soft Costs	$ 446,687.13
				Project Total	**$ 2,233,435.65**
Barcelona Ridge Arroyo Pond 3 (Pond B3)	Excavation, Placement and Compaction	13340	CY	$15	$ 200,100.00
	Wire-Tied Riprap (Emergency Spillway)	670	CY	$175	$ 117,250.00
	Concrete Pavement - 6"	1230	SY	$100	$ 123,000.00
	48" Culvert Pipe	800	LF	$112	$ 89,600.00
	48" Culvert Pipe End Section	16	EA	$1,100	$ 17,600.00
	Excavation & Backfill for Culverts	820	CY	$15	$ 12,305.56
	Asphalt Removal and Replacement	1230	SY	$52	$ 63,345.39
				Construction Cost Subtotal	$ 623,200.94
				25% Contingency	$ 155,800.24
				Construction Total	$ 779,001.18
				Soft Costs	$ 194,750.29
				Project Total	**$ 973,751.47**
Barcelona Ridge Arroyo Pond 5b (Pond B5b)	Excavation, Placement and Compaction	14930	CY	$15	$ 223,950.00
	Wire-Tied Riprap (Emergency Spillway)	1230	CY	$175	$ 215,250.00
	48" Culvert Pipe	800	LF	$112	$ 89,600.00
	48" Culvert Pipe End Section	16	EA	$1,100	$ 17,600.00
				Construction Cost Subtotal	$ 546,400.00
				25% Contingency	$ 136,600.00
				Construction Total	$ 683,000.00
				Soft Costs	$ 170,750.00
				Project Total	**$ 853,750.00**
Barcelona Ridge Arroyo Crossing @ Picacho Hills Drive	Wire-Tied Riprap (Erosion Protection)	40	CY	$175	$ 7,000.00
	11-48" Culvert Pipe	1375	LF	$112	$ 154,000.00
	48" Culvert Pipe End Section	16	EA	$1,100	$ 17,600.00
	Excavation & Backfill for Culverts	1463	CY	$15	$ 21,944.44
	Asphalt Removal and Replacement	378	SY	$52	$ 19,455.67
				Construction Cost Subtotal	$ 220,000.12
				25% Contingency	$ 55,000.03
				Construction Total	$ 275,000.15
				Soft Costs	$ 68,750.04
				Project Total	$ 343,750.19

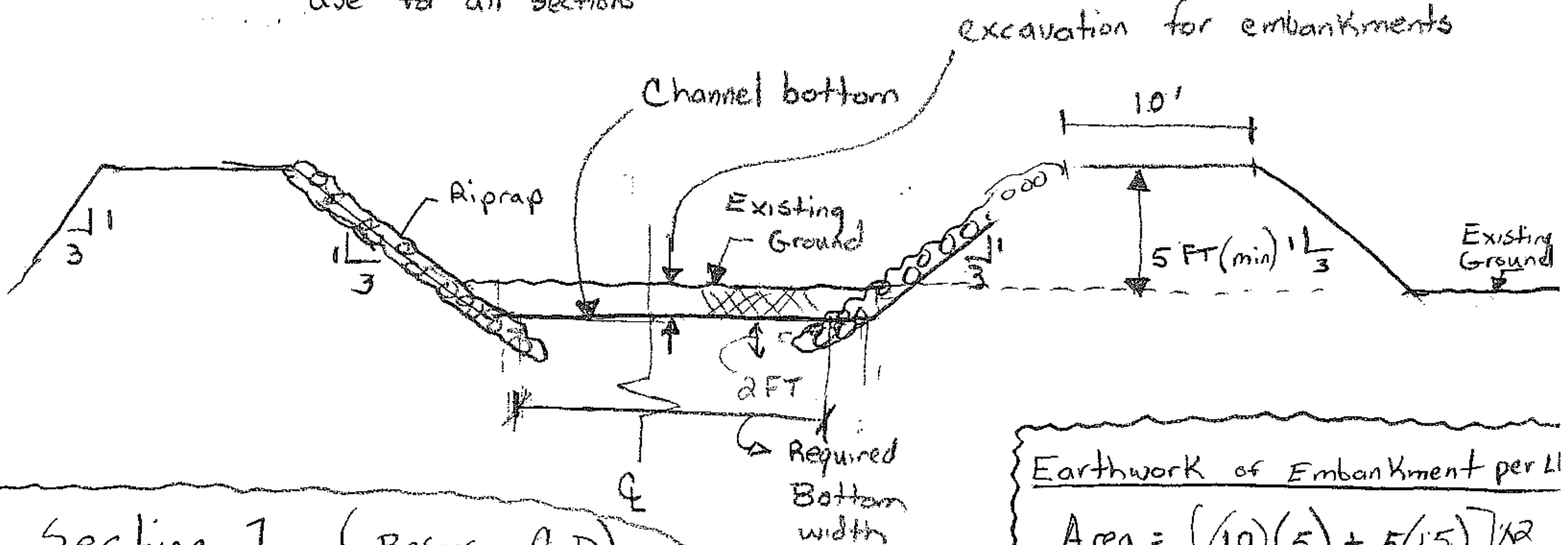
Golf Course Arroyo Basin

	Item Description	Approx. Quantity	Unit	Unit Price	Total	
Golf Course Arroyo Pond 2 (Pond C2)	Excavation, Placement and Compaction	27480	CY	$15	$	412,200.00
	Wire-Tied Riprap (Emergency Spillway)	1050	CY	$175	$	183,750.00
	Concrete Pavement - 6"	1350	SY	$100	$	135,000.00
	48" Culvert Pipe	900	LF	$112	$	100,800.00
	48" Culvert Pipe End Section	18	EA	$1,100	$	19,800.00
	Excavation & Backfill for Culverts	967	CY	$15	$	14,500.00
	Asphalt Removal and Replacement	1350	SY	$52	$	69,525.43
				Construction Cost Subtotal	$	935,575.43
				25% Contingency	$	233,893.86
				Construction Total	$	1,169,469.28
				Soft Costs	$	292,367.32
				Project Total	**$**	**1,461,836.60**
Golf Course Arroyo Pond 3 (Pond C3)	Excavation, Placement and Compaction	32150	CY	$15	$	482,250.00
	Wire-Tied Riprap (Emergency Spillway)	550	CY	$175	$	96,250.00
	Concrete Pavement - 6"	800	SY	$100	$	80,000.00
	30" Culvert Pipe	700	LF	$73	$	51,100.00
	30" Culvert Pipe End Section	14	EA	$485	$	6,790.00
	Excavation & Backfill for Culverts	382	CY	$15	$	5,736.11
	Asphalt Removal and Replacement	800	SY	$52	$	41,200.25
				Construction Cost Subtotal	$	763,326.36
				25% Contingency	$	190,831.59
				Construction Total	$	954,157.95
				Soft Costs	$	238,539.49
				Project Total	**$**	**1,192,697.44**
Golf Course Arroyo Pond 4 (Pond C4)	Excavation, Placement and Compaction	10270	CY	$15	$	154,050.00
	Wire-Tied Riprap (Emergency Spillway)	975	CY	$175	$	170,625.00
	48" Culvert Pipe	400	LF	$112	$	44,800.00
	48" Culvert Pipe End Section	8	EA	$1,100	$	8,800.00
				Construction Cost Subtotal	$	378,275.00
				25% Contingency	$	94,568.75
				Construction Total	$	472,843.75
				Soft Costs	$	118,210.94
				Project Total	**$**	**591,054.69**
Golf Course Arroyo Pond 5 (Pond C5)	Excavation, Placement and Compaction	4872	CY	$15	$	73,080.00
	Wire-Tied Riprap (Emergency Spillway)	140	CY	$175	$	24,500.00
	36" Storm Drain Culvert Pipe	300	LF	$112	$	33,600.00
	36" Culvert Pipe End Section	6	EA	$1,100	$	6,600.00
				Construction Cost Subtotal	$	137,780.00
				25% Contingency	$	34,445.00
				Construction Total	$	172,225.00
				Soft Costs	$	43,056.25
				Project Total	**$**	**215,281.25**
Golf Course Arroyo Crossing @ Via Norte	Wire-Tied Riprap (Erosion Protection)	15	CY	$175	$	2,625.00
	84" Culvert Pipe	375	LF	$375	$	140,625.00
	84" Culvert Pipe End Section	6	EA	$3,470	$	20,820.00
	Excavation & Backfill for Culverts	1174	CY	$15	$	17,604.17
	Asphalt Removal and Replacement	233	SY	$52	$	12,016.74
				Construction Cost Subtotal	$	193,690.91
				25% Contingency	$	48,422.73
				Construction Total	$	242,113.63
				Soft Costs	$	60,528.41
				Project Total	**$**	**302,642.04**

	Item Description	Approx. Quantity	Unit	Unit Price	Total	
Via Campestre Storm Drain	36" Storm Drain Culvert Pipe	1990	LF	$112	$	222,880.00
	36" Culvert Pipe End Section	1	EA	$1,100	$	1,100.00
	Asphalt Removal and Replacement	2875	SY	$52	$	148,063.41
	Curb and Gutter	3980	LF	$16	$	63,680.00
	Curb Drop Inlet	9	EA	$4,620	$	41,580.00
	Wire-Tied Riprap Storm Drain Outfall	6	CY	$175	$	972.22
				Construction Cost Subtotal	$	478,275.63
				25% Contingency	$	119,568.91
				Construction Total	$	597,844.53
				Soft Costs	$	149,461.13
				Project Total	**$**	**747,305.67**
Vista Hermoas Curb and Gutter	Excavation, Placement and Compaction	28	CY	$15	$	416.67
	Dumped Riprap (Connection to nearby arroyo)	28	CY	$175	$	4,861.11
	Curb and Gutter	5280	LF	$16	$	84,480.00
				Construction Cost Subtotal	$	89,757.78
				25% Contingency	$	22,439.44
				Construction Total	$	112,197.22
				Soft Costs	$	28,049.31
				Project Total	**$**	**140,246.53**
Villa Chiquita Curb and Gutter	Excavation, Placement and Compaction	28	CY	$15	$	416.67
	Dumped Riprap (Connection to nearby arroyo)	28	CY	$175	$	4,861.11
	Curb and Gutter	1800	LF	$16	$	28,800.00
				Construction Cost Subtotal	$	34,077.78
				25% Contingency	$	8,519.44
				Construction Total	$	42,597.22
				Soft Costs	$	10,649.31
				Project Total	**$**	**53,246.53**

Picacho Hills Diversion System Earthwork

Embankment Quantity
use for all sections



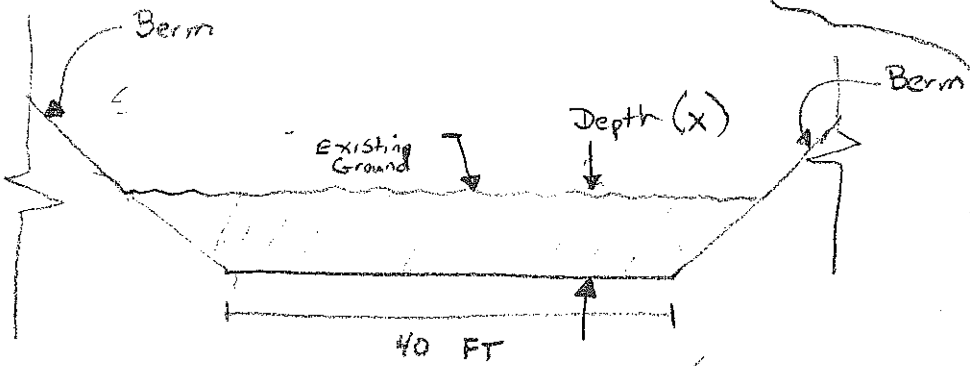
Earthwork of Embankment per LF

Area = [(10)(5) + 5(15)] x2
= [125 SQ FT] x2
250 (SQ FT)

Area = Above − Riprap
250 − 65 = 185 cu f / LF

Smaller of riprap cf / LF

Section 1 (Basins C, D)



(Section 1 Area) = (Embankment Area)

Length
2820 LF

$3X^2 + (40)X = 185\ FT^2$

$X = 3.63\ FT$

Excavation, Placement and Compaction Quantity

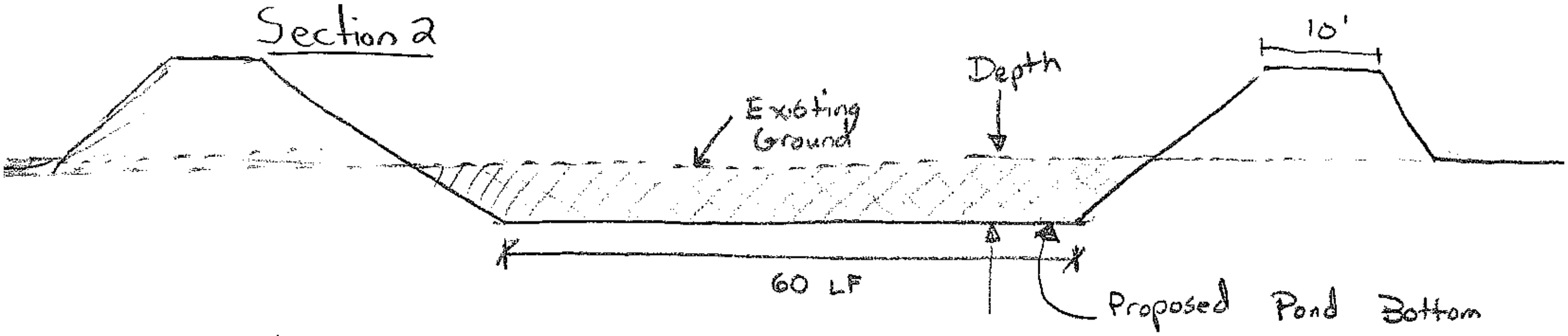
$\forall = (185)(2820)\ Ft^3$
$= \underline{19{,}330\ cy}$ ✓

Bohannan Huston Inc.
ENGINEERING
SPATIAL DATA
ADVANCED TECHNOLOGIES

PROJECT NAME Picacho Hills SHEET 1 OF 2
PROJECT NO. 090126 BY KJohnson DATE 3/10/2009
SUBJECT Picacho Hills Diversion CH'D [signature] DATE 3/11/09

Picacho Hills Diversion system Earthwork (continued)

Section 2



Length
2565 LF

(Section 2 Area) = (Berm Area)

3(Depth)(Depth) + (60) (Depth) = 185 Sq. ft

Depth = 2.71 FT

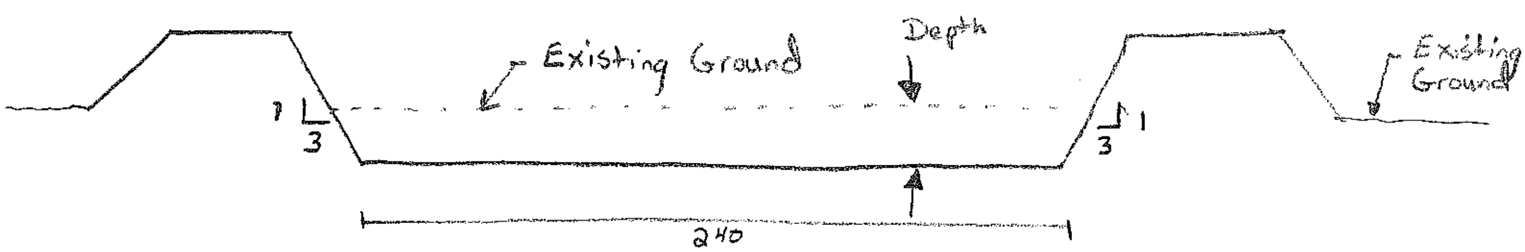
$x^2 + 20x - 83.333 = 0$

Excavation, Placement & Compaction Quantity

$\forall = (185)(2565)\ ft^3$

$= 17,580\ cy$ ✓

Section 3



Length
8645 LF

D

$3(\text{Depth})^2 + 240(\text{Depth}) = 185\ sq.\ ft$

Depth = 0.76 FT

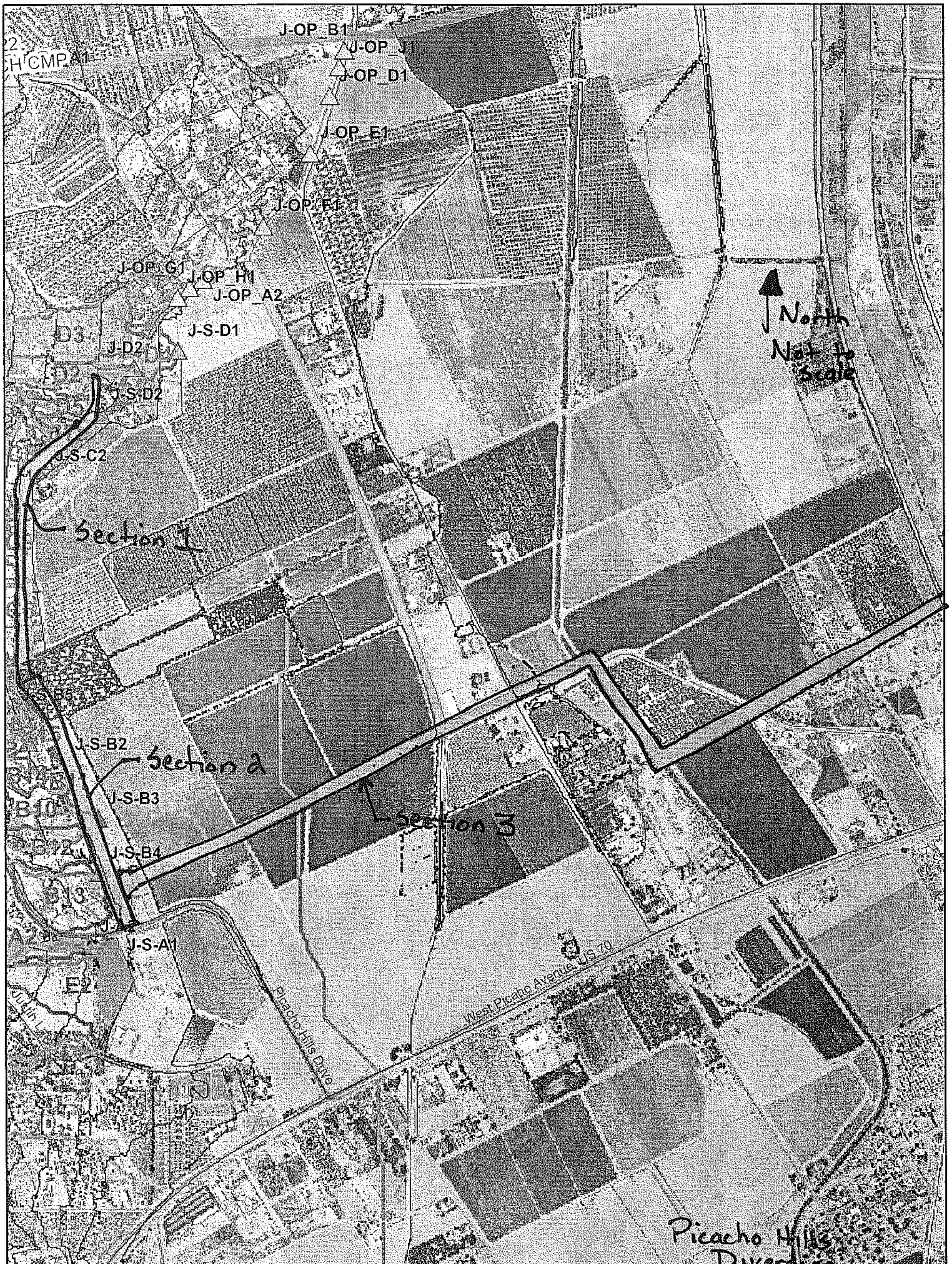
Excavation, Placement & Compaction Quantity

$\forall = (185)(8645)\ ft^3$

$= 59,240\ cy$ ✓

Bohannan Huston Inc.

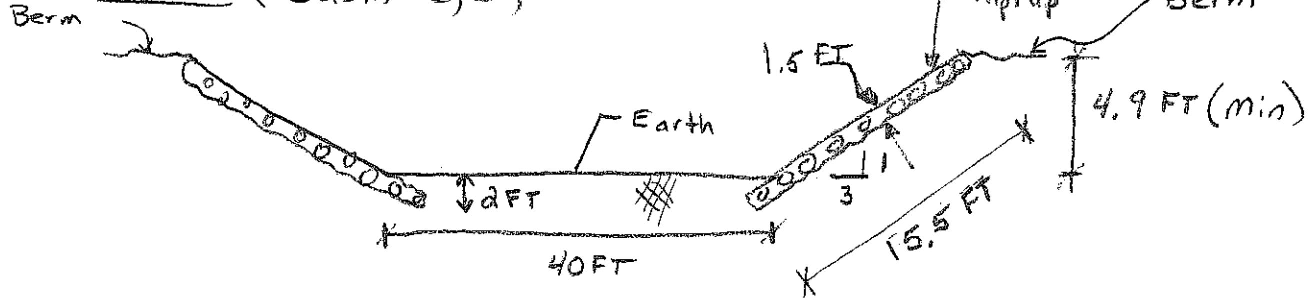
PROJECT NAME Picacho Hills	SHEET 2	OF 2	ENGINEERING
PROJECT NO. 090126	BY K Johnson	DATE	SPATIAL DATA
SUBJECT Picacho Hills Diversion Earthwork Quantities	CH'D	DATE 2/11/09	ADVANCED TECHNOLOGIES


J-OP_B1
J-OP_J1
J-OP_D1
J-OP_E1
J-OP_F1
J-OP_G1
J-OP_H1
J-OP_A2
J-S-D1
J-D2
J-S-D2
J-S-C2
North
Not to Scale
Section 1
J-S-B2
Section 2
J-S-B3
J-S-B4
Section 3
J-S-A1
Picacho Hills Drive
West Picacho Avenue US 70
Picacho Hills Diversion

3/11/09

Picacho Hills Diversion System - Riprap Quantity

Section 1 (Basin C, D)



Length of section 1
2820 LF

Riprap Quantity per LF channel

Area = 2 × [(21.8)(1.5)] SF

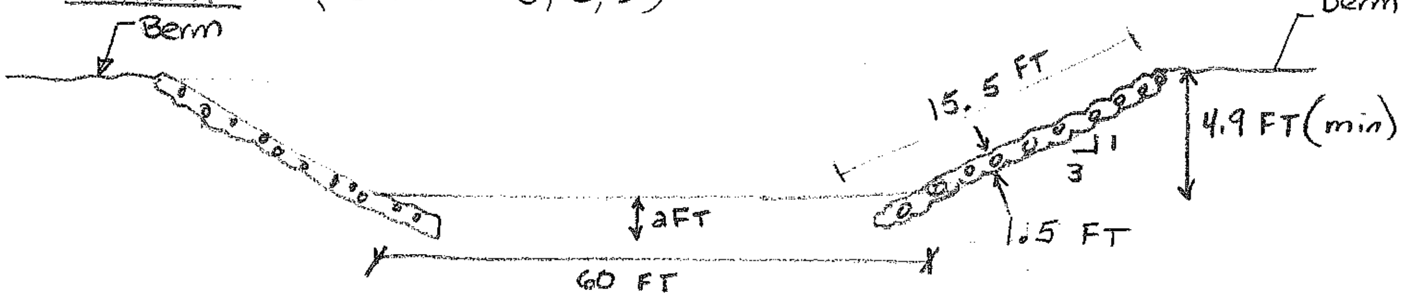
Volume = 65.4 SQ FT

Wire-tied Riprap Volume

$\forall$ = 184,428 cu ft
$\forall$ = 6,831 cy ✓

NOTE: Riprap revetment will only be installed up to required y_{ws} depth (4.9 or 5') NO DEEPE[R]

Section 2 (Basins B, C, D)



Length Section 2
2565 LF

Riprap Quantity per LF of Channel

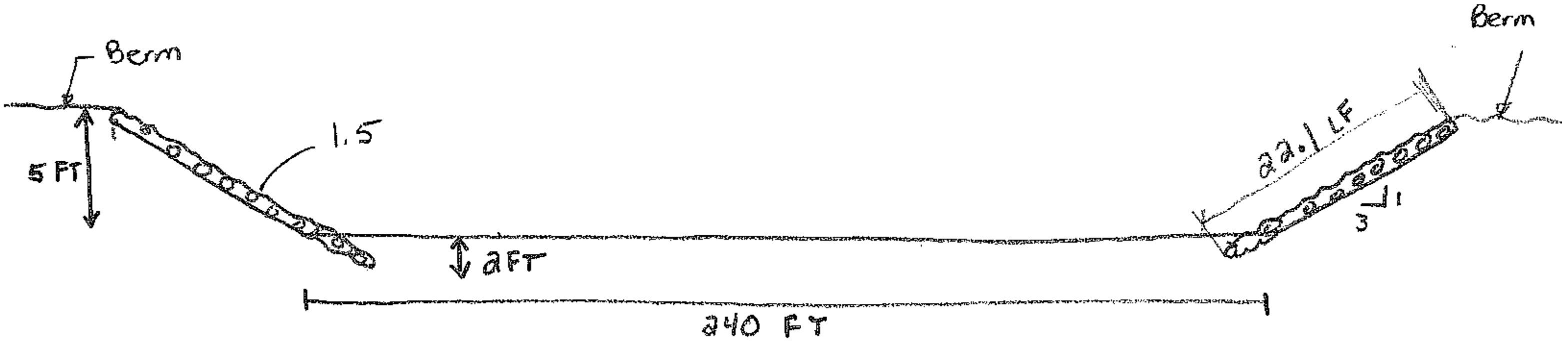
Area = 2 [(21.8)(1.5)] SF
= 65.4 cu ft / LF

Wire-Tied Riprap Volume

$\forall$ = 167,751 cF
$\forall$ = 6,213 cy ✓

Picacho Hills Diversion System (continued)

Section 3 (River Outfall, Basins A, B, C, D)



Length of Section 3

8645 LF

Riprap Quantity per LF of Chan

Area = 2 (22.1)(1.5) SF

= 66.3 $\frac{\text{cu ft}}{\text{LF}}$

Wire-Tied Riprap Quantity

∀ = 573,164

∀ = 21,229 cy ✓

Bohannan Huston Inc.

PROJECT NAME Picacho Hills SHEET 2 OF 2

PROJECT NO. 090126 BY K Johnson DATE 3/10/2009

SUBJECT Proposed Improvement CH'D [illegible] DATE 3/11/09

ENGINEERING
SPATIAL DATA
ADVANCED TECHNOLOGIES

Goal: Estimate cost of Principle spillway w/ no specific unit cost. for 3'(H) x 6'(W) CBC.

48 – 3'(H) x 6'(W) CBC

(H) x (W) x (Long)

Use 16 NMDOT Triple 3' x 6' x 100'

1.117 cy/Ft per 1 Triple 3' x 6' CBC

Total of 1787.2 CY concrete for all 16 Triple 3' x 6' x 100' CB

or

111.7 cy per 100 LF of 1 - Triple 3' x 6' CBC

Determine Unit price per 1 - Triple 3'(H) x 6'(W) x 100' (Long) CBC

Use NMDOT structural Concrete Class A
Dan's estimate @ cost $650/cy

Thus

Unit Price = (111.7 cy)($650/cy)

Unit Price (1-Triple 3'x6') = $72,605 ✓

Bohannan Huston Inc.

ENGINEERING
SPATIAL DATA
ADVANCED TECHNOLOGIES

PROJECT NAME Picacho Hills SHEET 1 OF 1
PROJECT NO. 090126 BY KJohnson DATE 3/11/2009
SUBJECT Nafzinger Arroyo Principle Spillway Quantity CH'D DATE

Assumptions

- Wire-tied Riprap utilized to armor emergency spillway on either side of roadway (if applicable)
- Roadway sections shall have 6" Thick Concrete Dip Section @ emergency spillway.
- See attached plan view for extents of riprap + concrete.
- Wire-tied riprap is 1.5 FT thick

Barcelona Ridge Arroyo Pond 2 (Pond B2)

Concrete: 6875 cu ft
260 cy or 1530 sq. yd. ✓

Riprap: 22,500 cu ft
840 cy ✓

Barcelona Ridge Arroyo Pond 3 (Pond B3)

Concrete: 5500 cu ft
210 cy or 1230 sq. yd ✓

Riprap: 18,000 cu ft
670 cy ✓

Barcelona Ridge Arroyo Pond 56 (Pond B56)

Concrete: None

Riprap: 33000 cu ft
1,230 cy ✓

Bohannan Huston INC.

PROJECT NAME Picacho Hills SHEET 1 OF 10
PROJECT NO. 090126 BY KJohnson DATE 3/11/2009
SUBJECT Emergency Spillway Quantities CH'D [illegible] DATE 3/12/09

ENGINEERING
SPATIAL DATA
ADVANCED TECHNOLOGIES

Golf Course Arroyo Pond 2 (Pond C2)

Concrete: 225 cy or 1350 sq. yd ✓

Riprap: 1050 cy ✓

Golf Course Arroyo Pond 3 (Pond C3)

Concrete: 140 cy or 800 sq. yd. ✓

Riprap: 550 cy ✓

Golf Course Arroyo Pond 4 (Pond C4)

Concrete: None

Riprap: 975 cy ✓

Fairway Village Pond (Pond C5)

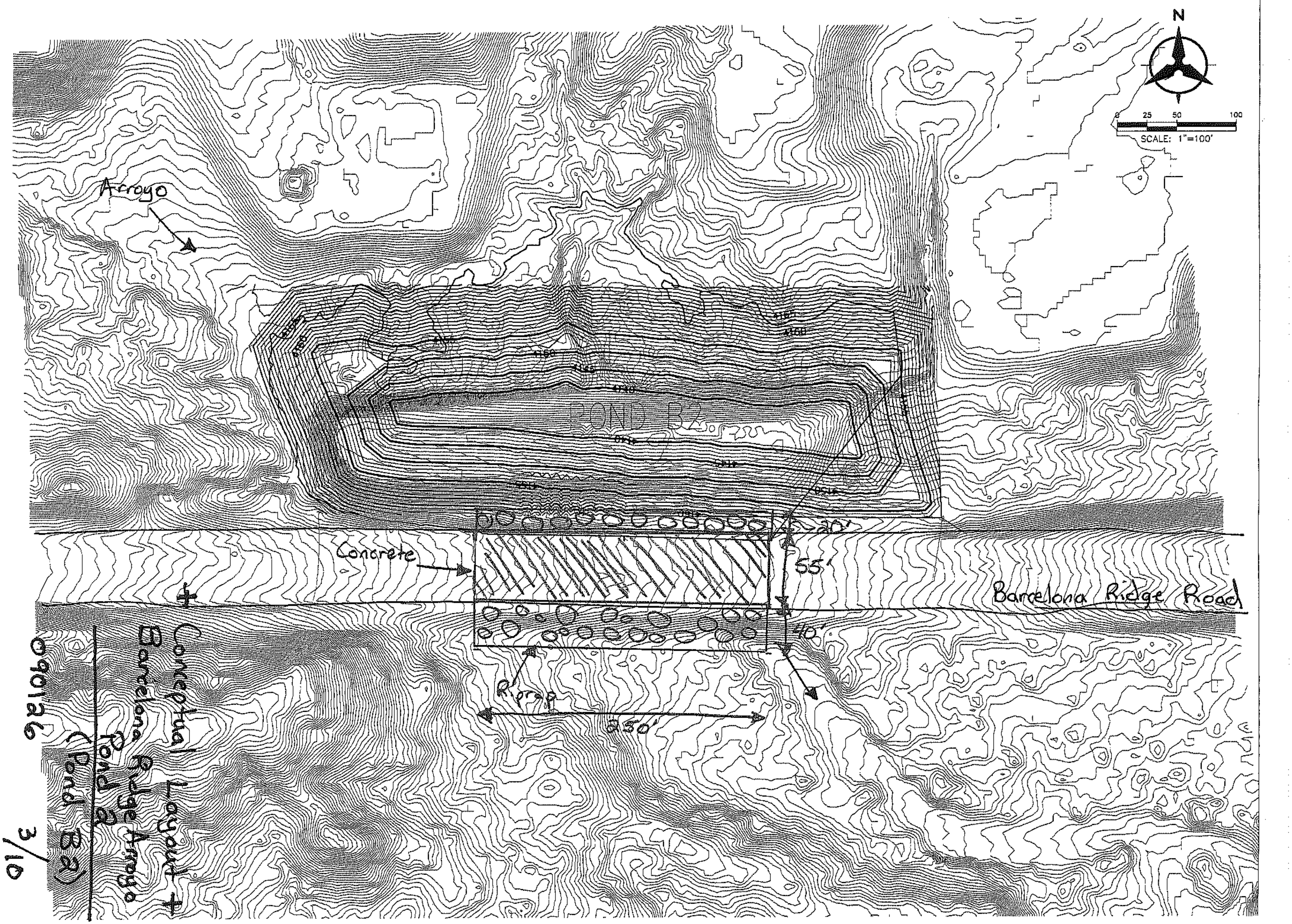
Concrete: None

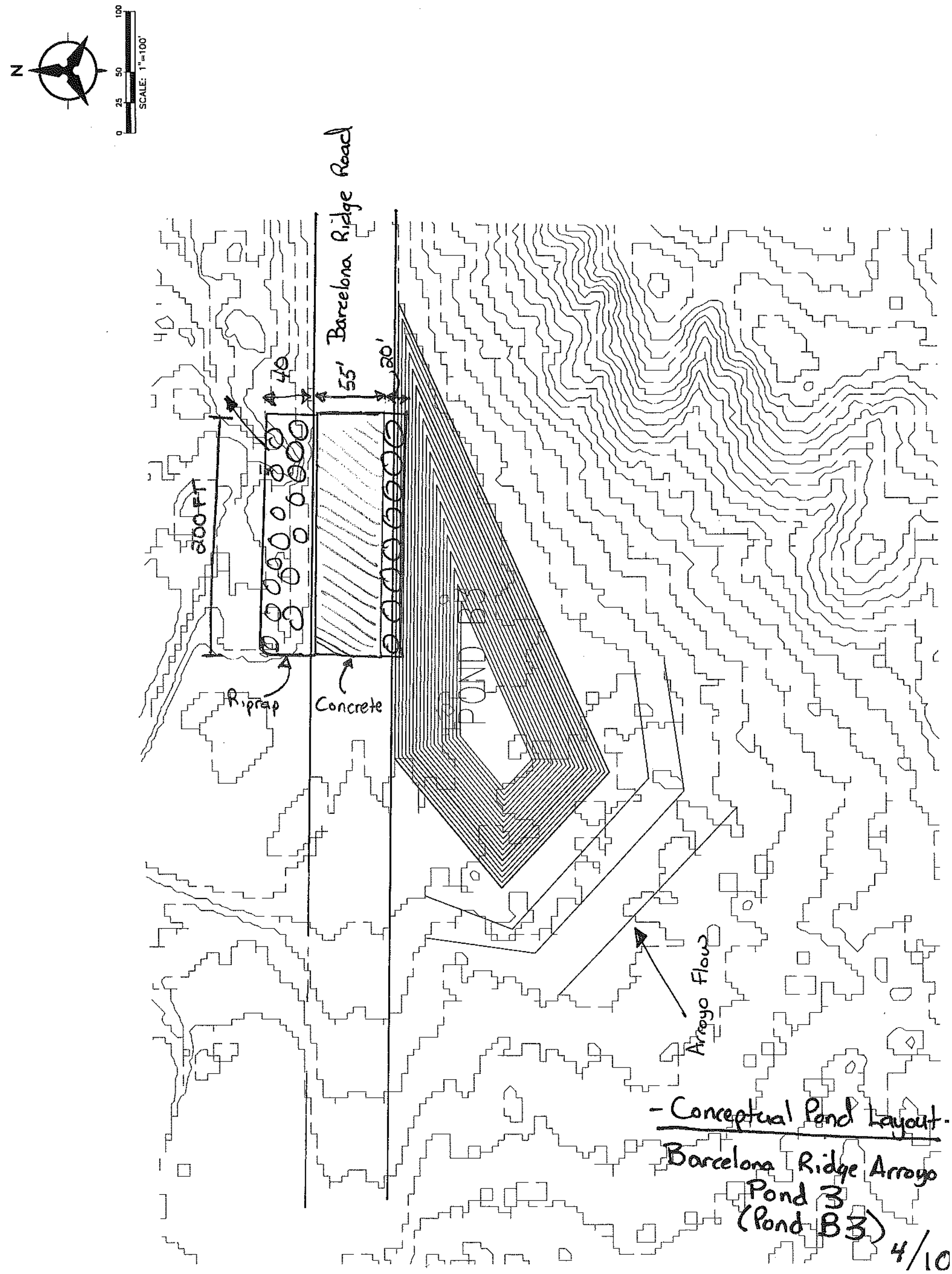
Riprap: 140 cy ✓

Nofzinger Arroyo Pond (Pond E2)

Concrete: 190 cy or 1120 sq. yd ✓

Riprap: 560 cy ✓

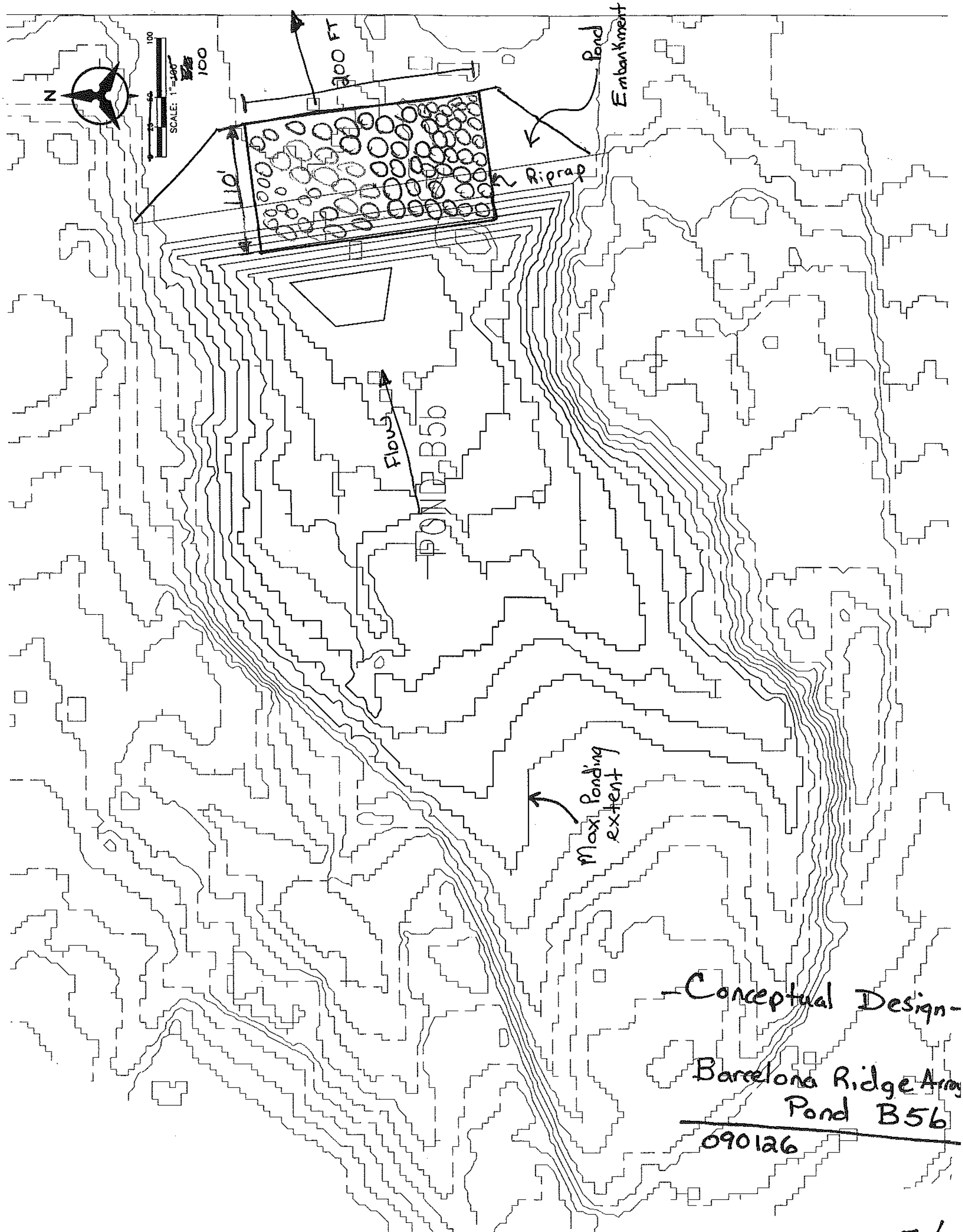

N
0 25 50 100
SCALE: 1"=100'
Arroyo
POND B2
Concrete
Riprap
20'
55'
40'
250'
Barcelona Ridge Road
+ Conceptual Layout +
Barcelona Ridge Arroyo
Pond 2
(Pond B2)
090126
3/10

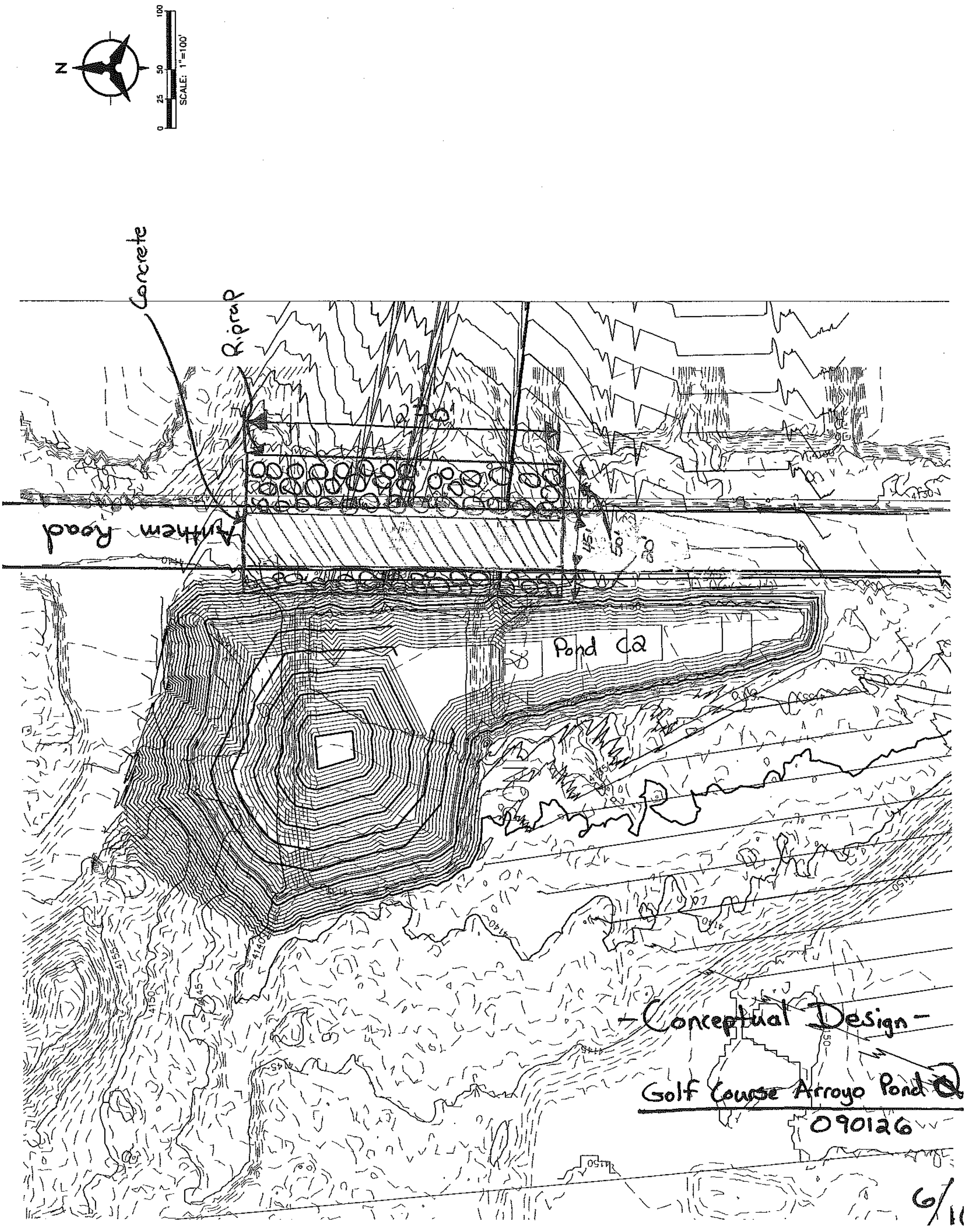


- Conceptual Pond Layout -

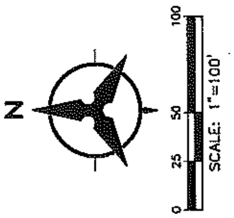
Barcelona Ridge Arroyo
Pond 3
(Pond B3)

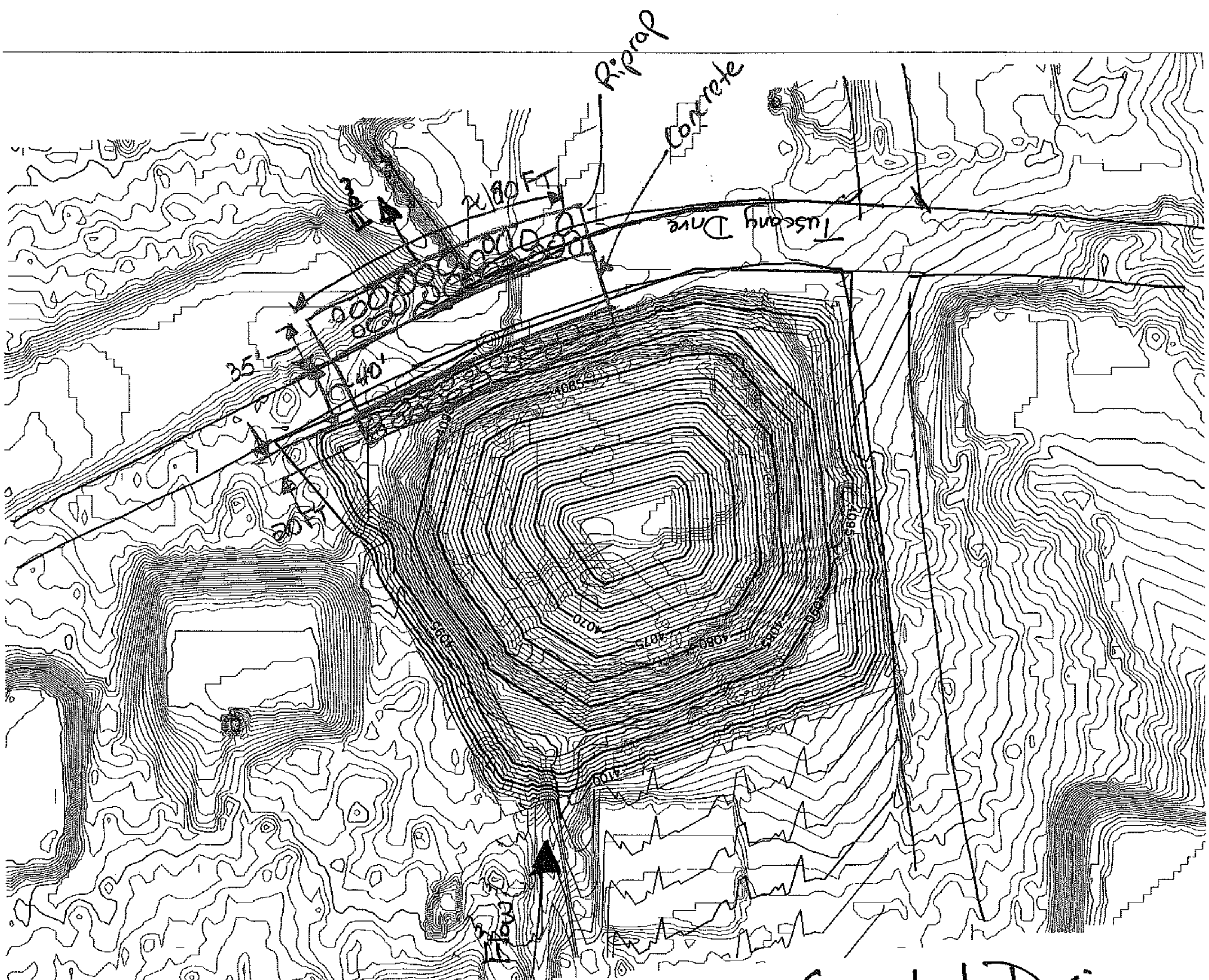
4/10


N
SCALE: 1" = 100'
100
200 FT
110'
Pond Embankment
Riprap
Flow
POND B5b
Max Ponding extent
-Conceptual Design-
Barcelona Ridge Array
Pond B56
090126



N
0
25
50
100
SCALE: 1"=100'
Concrete
Riprap
270'
Anthem Road
45'
50'
20'
Pond C2
4140
4145
4150
4155
- Conceptual Design -
Golf Course Arroyo Pond
090126
6/11





- Conceptual Design -

Golf Course Arroyo Pond 3

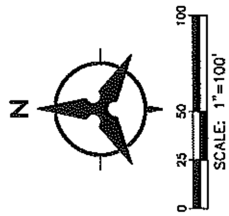
090126

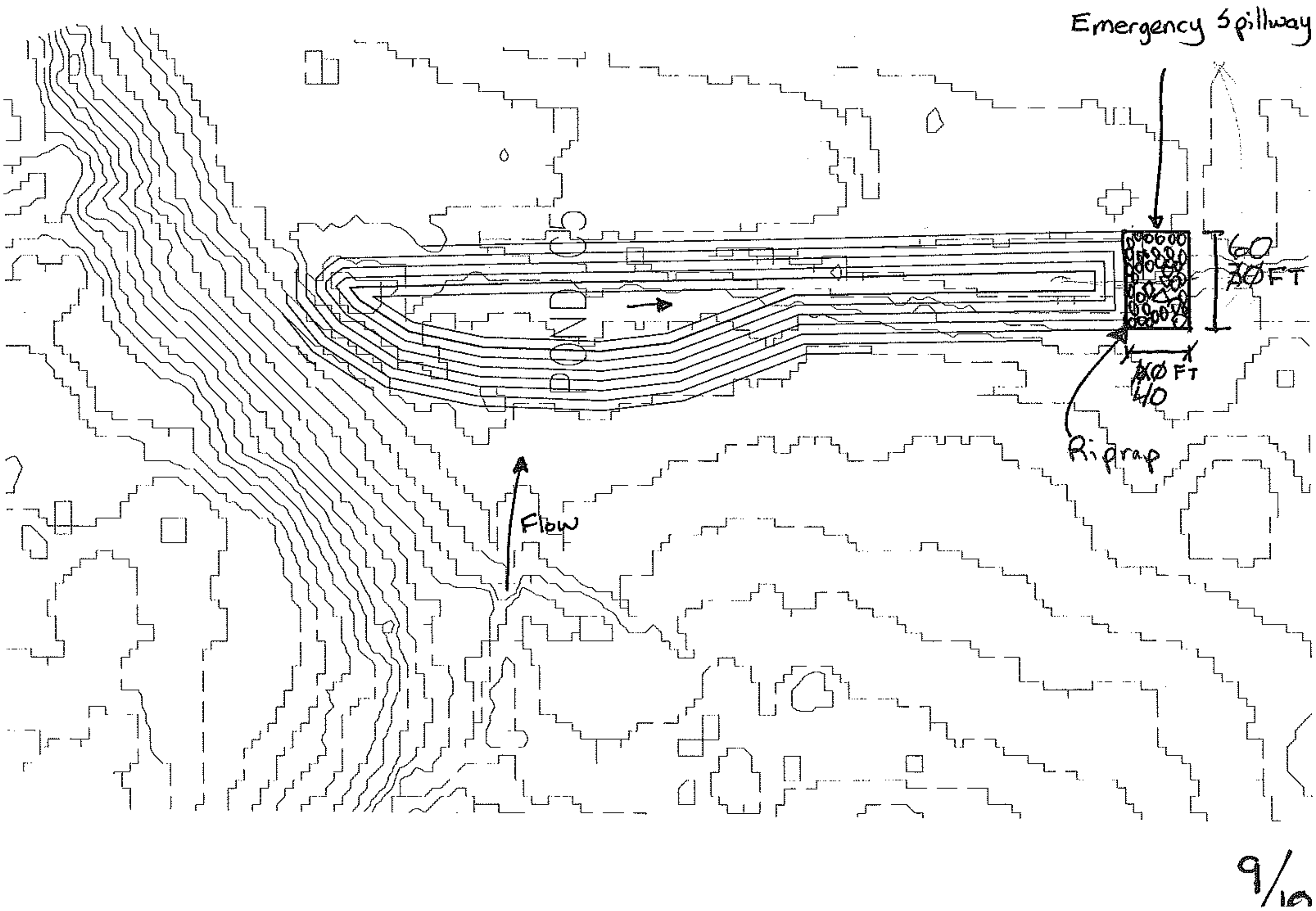
7/1C

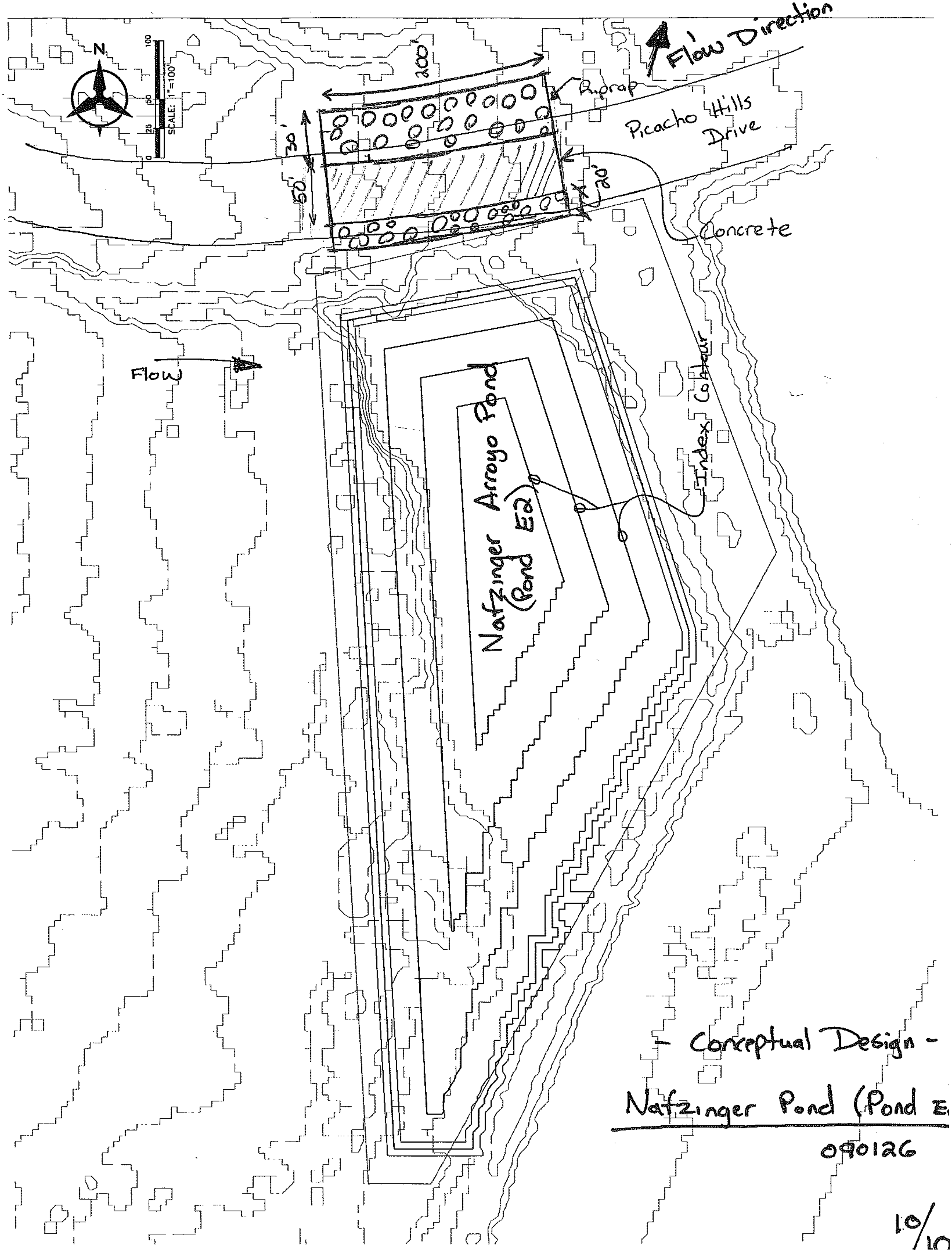

N
SCALE 1"=100'
0
25
50
100
130 FT
135 FT
Riprap
POND C4
- Conceptual Design -
Golf Course
Arroyo Pond 4 (Pond C4)
090126

Fairway Village Pond

Conceptual layout
090126







Flow Direction
N
SCALE: 1"=100'
0
25
50
100
200'
Riprap
Picacho Hills Drive
30'
50'
20'
Concrete
Flow
Nafzinger Arroyo Pond (Pond E2)
Index Contour
- Conceptual Design -
Nafzinger Pond (Pond E
090126
10/10

Nafzinger Arroyo Pond (Pond E2)

- new Pond -

Pond storage Volume = Earthwork

54.47 acre-ft = Earthwork

$$\text{Earthwork} = (54.47\ \text{acre-ft})\left(\frac{43560\ ft^2}{1\ \text{acre}}\right)\cdot\frac{1\ cy}{27\ ft^3}$$

▲ **Earthwork = 87,880 cy** ✓

Barcelona Ridge Arroyo Pond 2 (Pond B2)

- Improved pond -

[Proposed Pond Volume] − [Existing Pond Storage] = Earthwork

[15.65 ac-ft] − [1.48 ac-ft] = 14.17 ac-ft

▲ **Earthwork = 22,860 cy** ✓

Barcelona Ridge Arroyo Pond 3 (Pond B3)

- New Pond -

Pond storage Volume = Earthwork

8.33 ac-ft = Earthwork

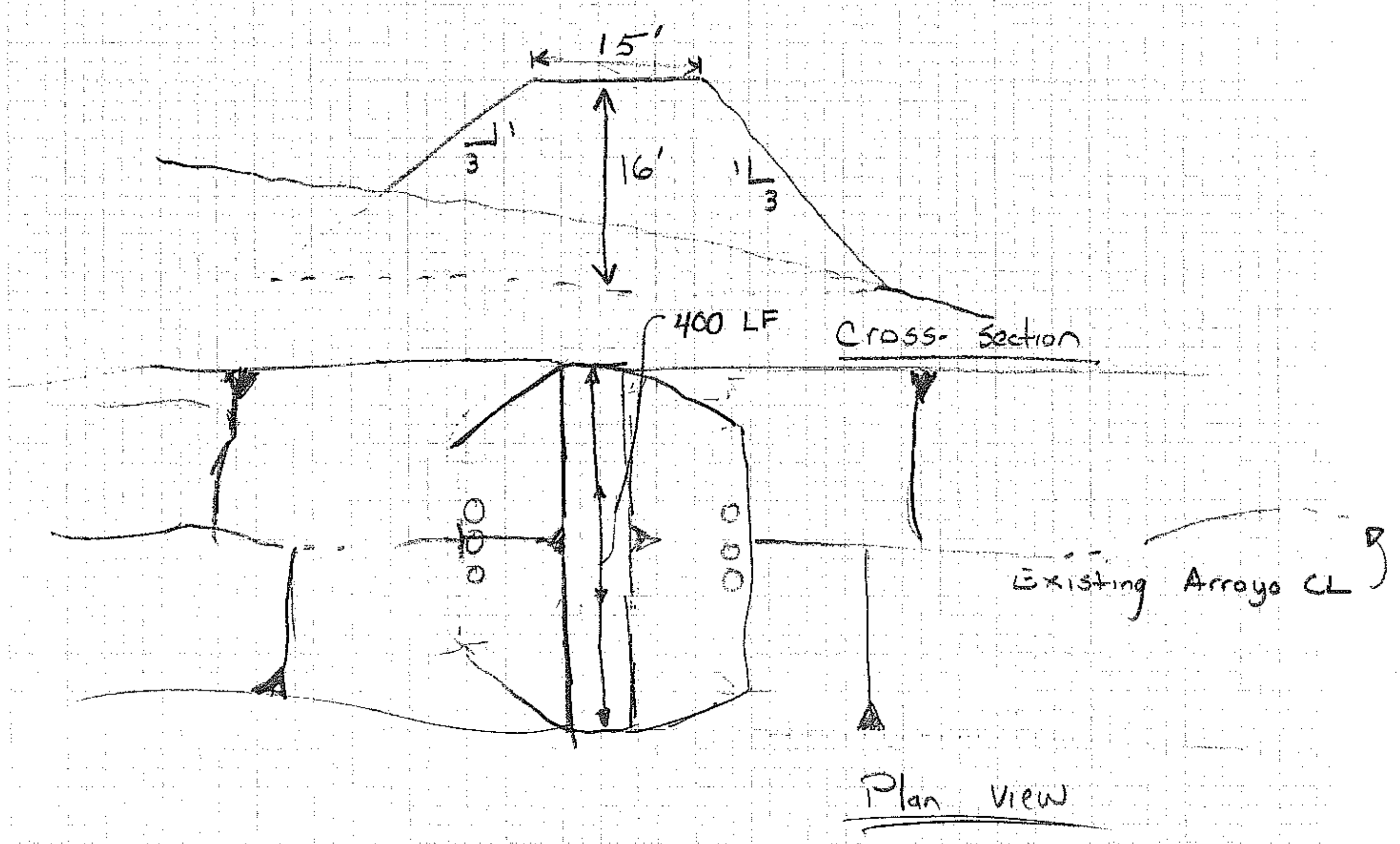
▲ **Earthwork = 13,340 ✓ cy**

General Assumptions for All Ponding Areas

- All improved ponding areas will include only excavation and will not include construction of an embankment.
- New Pond Construction Types:
  - Total excavation w/ NO embankment construction
  - Embankment pond w/no excavation.

Barcelona Ridge Pond 5b (Pond B5b)

Embankment ONLY. Requires no flood pool excavation.



Volume of Embankment

$$\forall = \frac{\left[3(16)(16) + (16)(15)\right] 400}{27}$$

$\forall = 14,930$ cy ✓

Bohannan Huston Inc.

PROJECT NAME Picacho Hills SHEET 2 OF 4

PROJECT NO. 090126 BY K Johnson DATE 3/10/2009

SUBJECT Pond Earthwork Quantities CH'D [signature] DATE 3/11/09

ENGINEERING
SPATIAL DATA
ADVANCED TECHNOLOGIES

Golf Course Pond 2 (Pond C2)

- Existing Pond Improvements -

[Proposed Pond Storage Volume] - [EXISTING Pond Storage Volume] = Earthwork

20.27 ac-ft - 3.24 ac-ft =

▲ Earthwork = $(17.03 \text{ ac-ft})\left(\frac{43560 \text{ ft}^2}{\text{ac}}\right)\frac{1 \text{ cy}}{27 \text{ ft}^3}$
= 27,480 cy

Golf Course Pond 3 (Pond C3)

- Existing Pond Improvement -

[Prop. Pond storage Volume] - [Existing Pond Storage] = Earthwork

(26.22 ac-ft) - (6.29 ac-ft) = Earthwork

▲ Earthwork = (19.93 ac-ft)
= 32,150 cy

Fairway Village Pond (Pond C5)

- New Pond -

[Proposed Pond Volume] = Earthwork

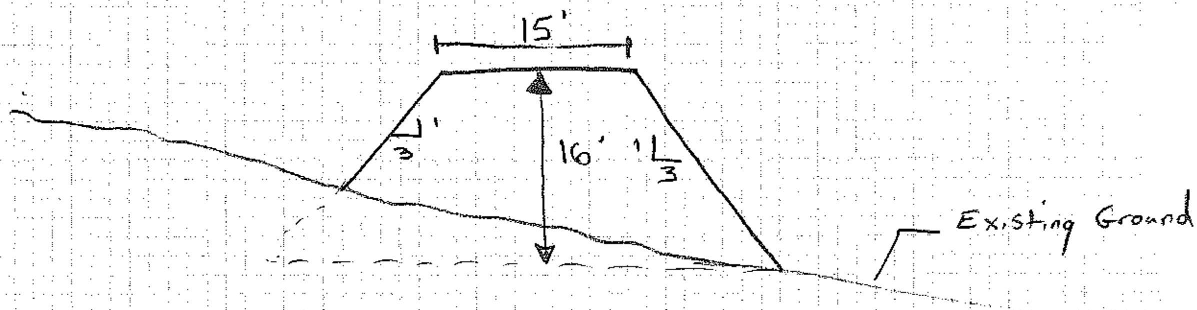
3.02 ac-ft = Earthwork

Earthwork = 4,872 cy

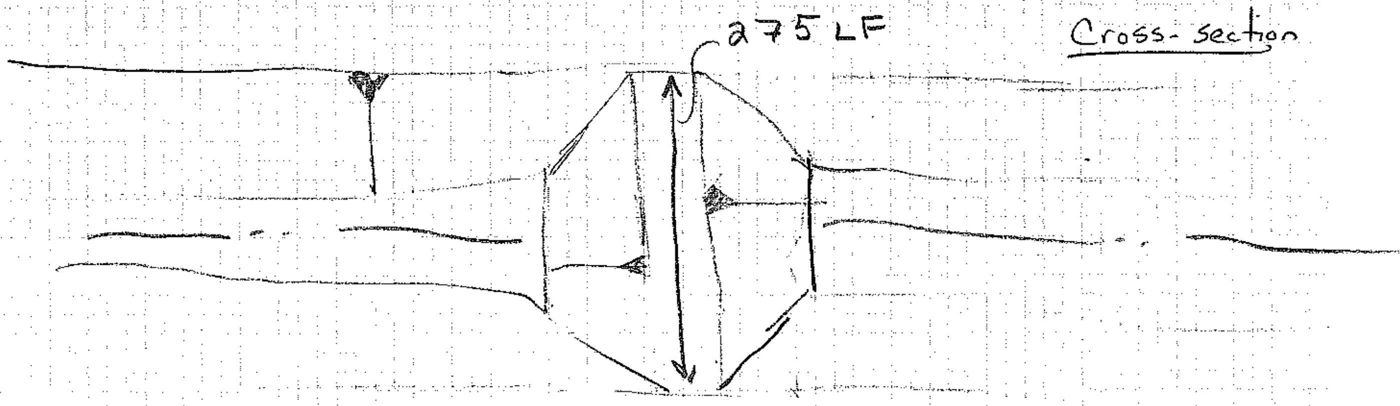
Golf Course Arroyo Pond 4 (Pond C4)

- New Pond -

Embankment ONLY. Requires no flood pool excavation



Cross-section



Plan View

Volume of Embankment

$$\forall = \frac{[3(16)(16) + 16(15)]\,275}{27}$$

$$\forall = 10{,}270 \text{ cy}$$

Bohannan Huston Inc.

ENGINEERING
SPATIAL DATA
ADVANCED TECHNOLOGIES

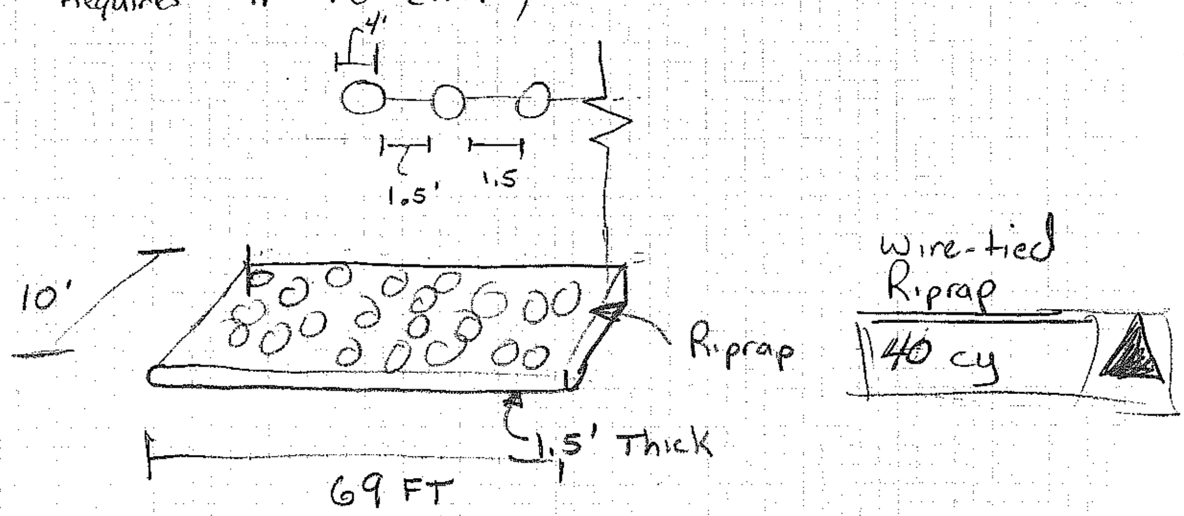
PROJECT NAME Picacho Hills SHEET 4 OF 4
PROJECT NO. 090126 BY K Johnson DATE 3/10/09
SUBJECT Pond Earthwork Quantities CH'D [signature] DATE 3/11/09

Assume

- ☐ Wire-tied riprap erosion control pad downstream of culverts
- ☐ Extends 10 Ft DS of Pipes
- ☐ Extends entire width of culverts + 10 FT

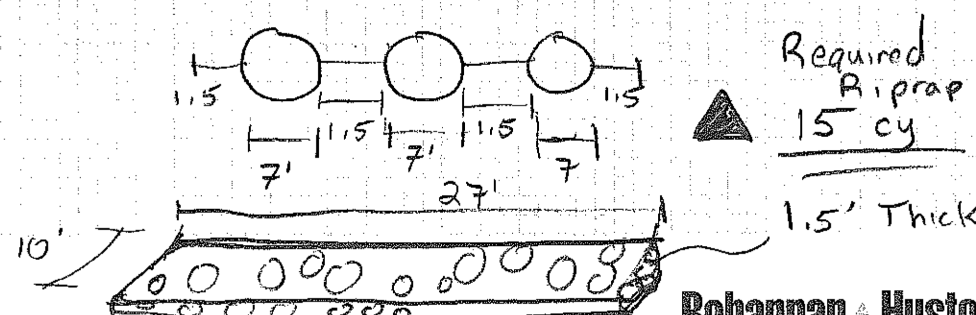
Barcelona Ridge Arroyo @
Picacho Hills Crossing

Requires 11 - 48" cmP,



Golf Course Arroyo Crossing
@
Via Norte

Requires 3 - 84" cmp



Bohannan Huston Inc.

PROJECT NAME Picacho Hills   SHEET 1 OF 1
PROJECT NO. 090126   BY KJohnson   DATE 3/12/09
SUBJECT Culvert Crossing Erosion Control Quantities   CH'D ____ DATE ____

ENGINEERING
SPATIAL DATA
ADVANCED TECHNOLOGIES

Assumption

- Storm Drain to extend the entire length of Via Campestre & out fall to the Golf Course arroyo.

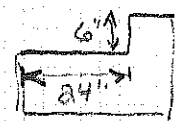
  Length = 1990 LF

- Required Dia: 36" RCP → chosen for maintenance purposes.
- Pipe will be Class III RCP
- Pipe will have cover of 2FT
- 9 Inlets are required → NMDOT CDI Type 1 B up to 4' Depth
- Normal crown roadway (2%)
- Wire Tied riprap utilized to armor Golf Course Arroyo @ SD outfall

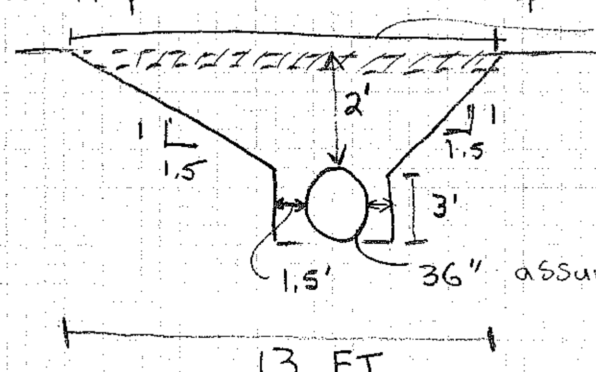
Pad 1.5" Thick

▲ 6 cy Wire tied riprap

- Curb and Gutter
  - No existing curb and gutter
  - Install equivelant to NMDOT Concrete barrier curb, type 3 6"x24" (6" ↑ tall, 24" ↑ pan) both sides of entire Street



- Asphalt Removal & Replacement



A = 13 • 1990/9

▲ Thus: Area = 2875 Sq. Yd

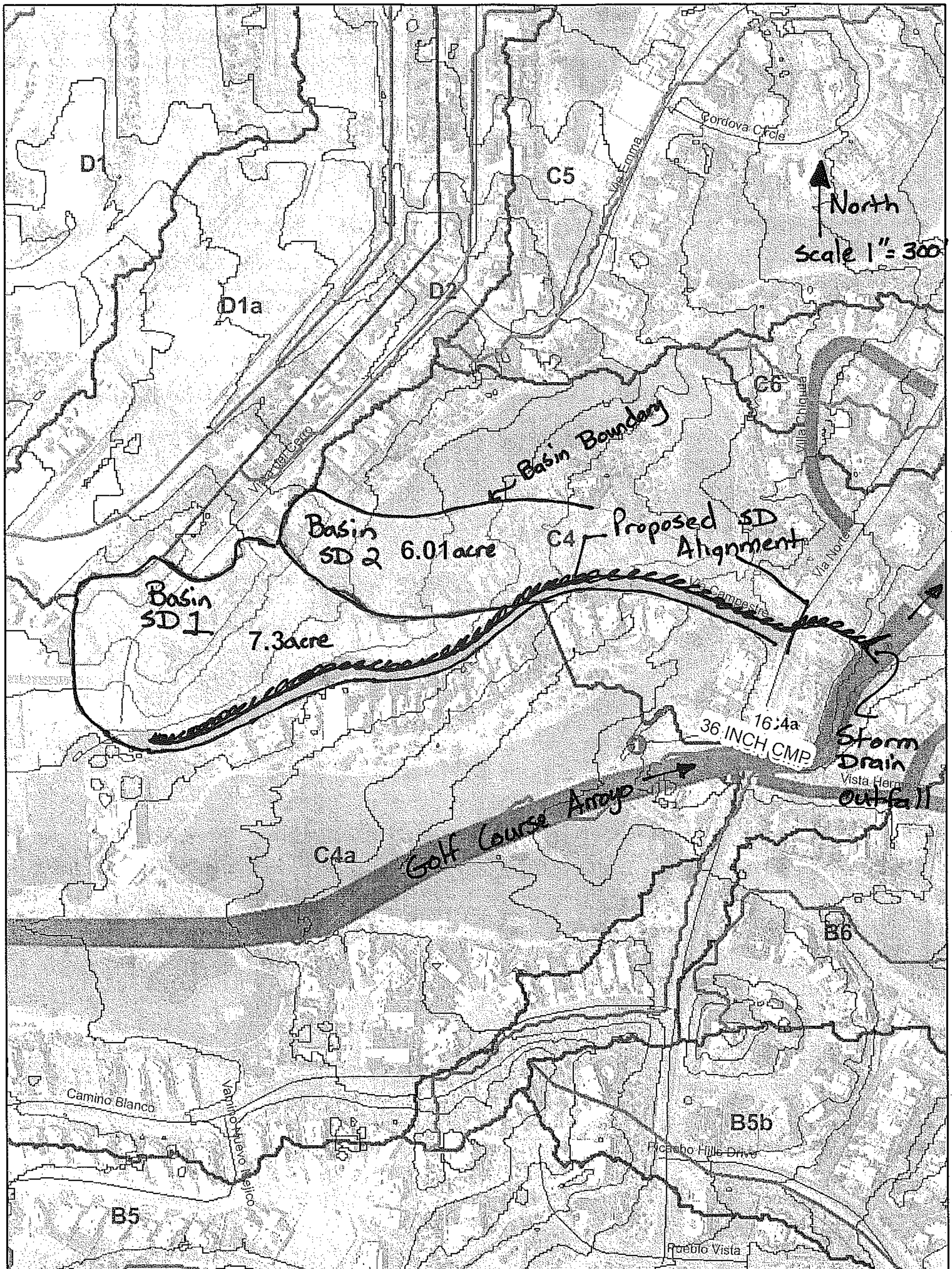
Bohannan ▲ Huston Inc.

ENGINEERING ▲
SPATIAL DATA ▲
ADVANCED TECHNOLOGIES ▲

PROJECT NAME Picacho Hills SHEET 1 OF 2

PROJECT NO. 090126 BY KJohnson DATE 3/11/2009

SUBJECT Via Campestre SD Quantities CH'D [signature] DATE 3/11/09



Via Campestre SD

Quantities

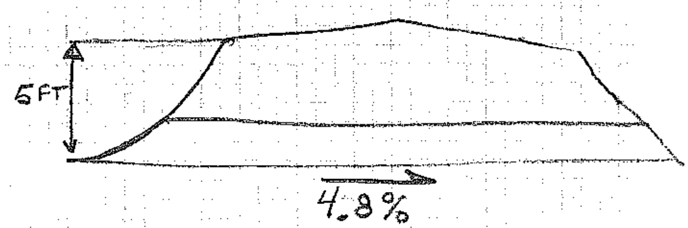
Picacho Hills Drive Crossing

Assumptions

- ☐ Use flow rate from Future Condition HEC-HMS model downstream of J-B5

$$Q_{100yr} = 999 \text{ cfs}$$

- ☐ Assume water is <u>NOT</u> allowed to cross overtop Picacho Hills Drive.
- ☐ See attached figure denoting proposed culvert crossing location
- ☐ Slope = $\frac{3978 - 3972}{125} = \underline{0.048 \frac{ft}{ft}}$
- ☐ Max headwater Depth · 5 FT
- ☐ Max culvert Dia. allowable 48"



▲ Requires 11 - 48" CMP culverts
→ see attached culvert design calculation

Via Norte Crossing

Assumptions

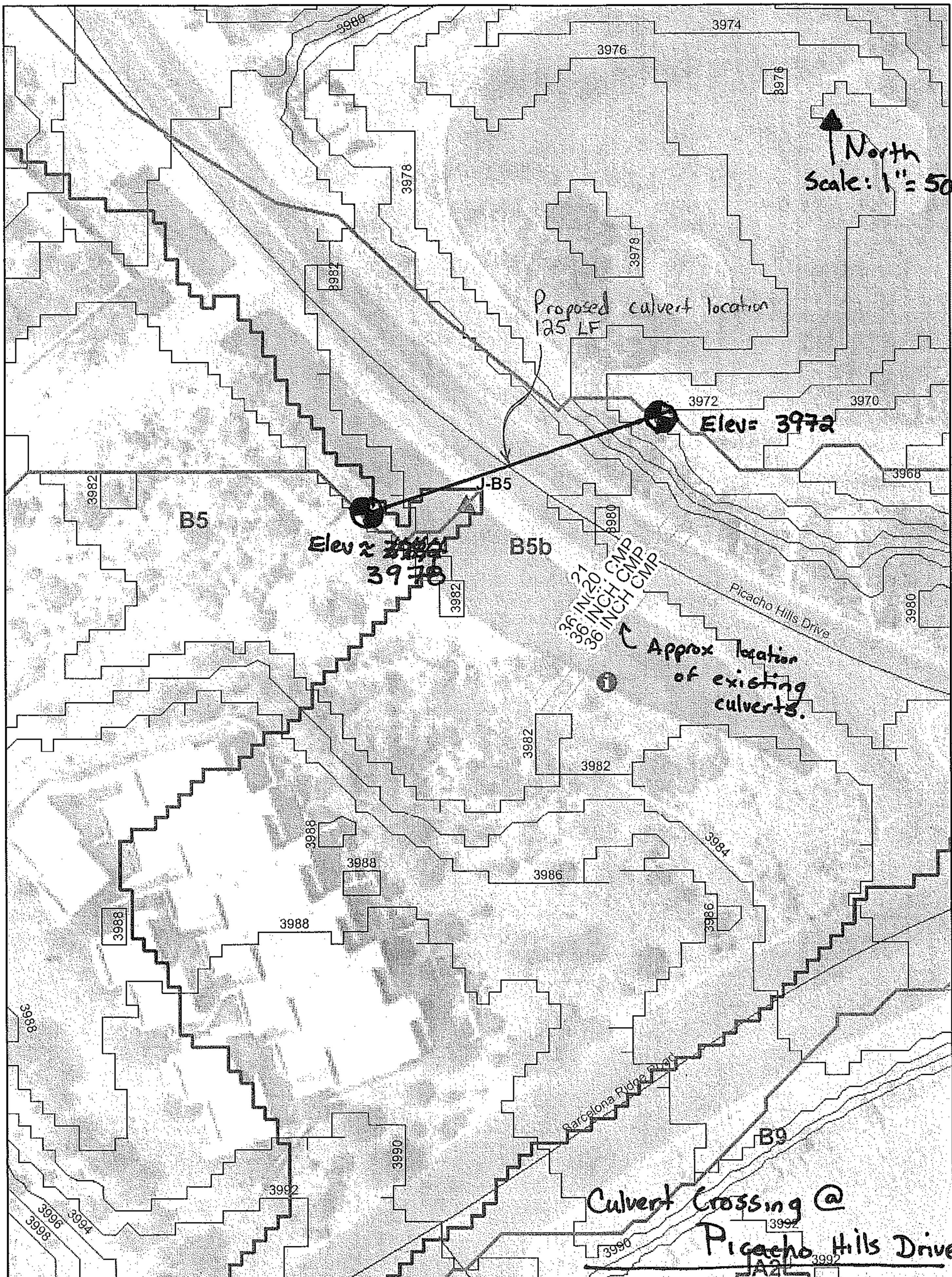
- ☐ Flows from HEC-HMS model @ J-C4a

$$Q_{100yr} = 1394 \text{ cfs}$$

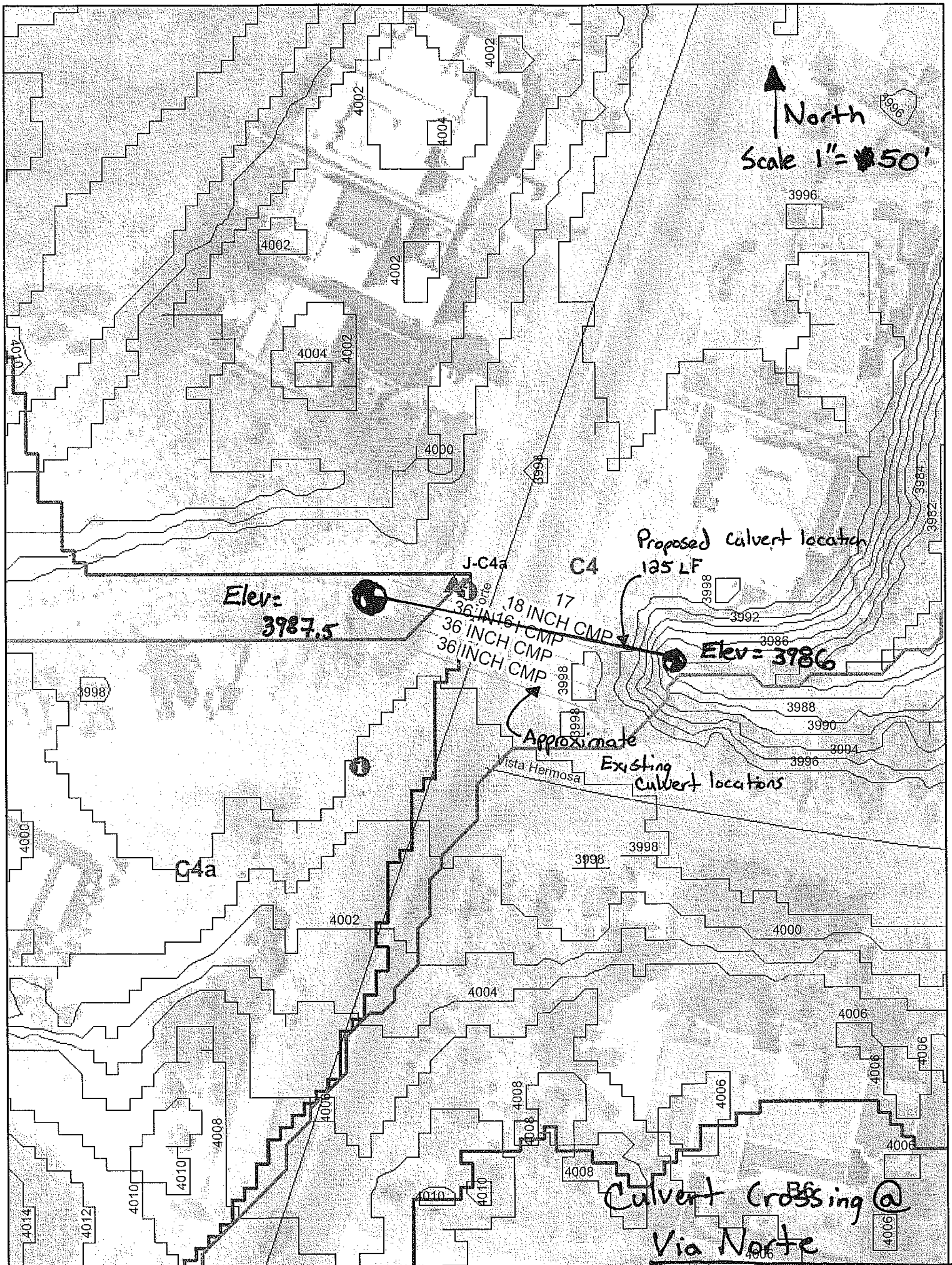
- ☐ No flow overtop roadway
- ☐ see attached figure for location & layout.
- ☐ Slope = $\frac{3987.5 - 3986}{125} = \underline{0.012 \frac{ft}{ft}}$
- ☐ Max Headwater: 10.5 FT
- ☐ Max culvert Dia allowable : 8 FT

▲ Required 3 - 84" CMP culverts → See attached culvert design calc.

Bohannan Huston Inc.


North
Scale: 1" = 50'
Proposed culvert location
125 LF
Elev= 3972
Elev ≈ 3978
J-B5
B5
B5b
B9
JA2
36 IN 21
36 INCH 20 CMP
36 INCH CMP
Approx location of existing culverts.
Picacho Hills Drive
Barcelona Ridge Road
3974
3976
3978
3980
3982
3984
3986
3988
3990
3992
3994
3996
3998
3972
3970
3968
Culvert Crossing @ Picacho Hills Drive

090126



Culvert Crossing @ Via Norte

090126

3/4

Culvert Crossing Design

Picacho Hills
BHI No. 090126
Prepared By: Kris Johnson
Path: P:\090126\WR\Calculations\Misc Calcs\090126 CulvertCapacity01.txt

Goal: Conceptual design of two culvert crossings within the Picacho Hills study area.

Assumptions: See hand calculations for discussion of assumptions.

Barcelona Ridge Arroyo Crossing @ Picacho Hills Drive

Analyzer Report
Drainage Structure Analyzer
Culvert Hydraulic Analysis
Date: Wednesday, March 11, 2009 13:15:34

Input Data

Shape	Circular
Material	CMP-12G
Roughness	0.022000
Entrance Edge	Headwall
Number of Barrels	11
Length	125.0000 ft
Slope	4.8000%
Tailwater	0.0000 ft
Inlet Control Equation	Entrance Loss
Size (W x T):	48.00 x 0.1090
Flow Rate	999.0000 cfs

Output Results

Flow Rate	999.0000 cfs
Control	Inlet
Capacity	2045.5933 cfs
Manning's Velocity	14.7069 ft/s
Headwater	4.5475 ft
Critical Depth	2.8800 ft
Normal Depth	1.9720 ft
Size (W x T):	48.00 x 0.1090

Golf Course Arroyo Crossing @ Via Norte

Analyzer Report
Drainage Structure Analyzer
Culvert Hydraulic Analysis
Date: Wednesday, March 11, 2009 13:46:07

Input Data

Shape	Circular
Material	CMP-12G
Roughness	0.022000
Entrance Edge	Headwall
Number of Barrels	3
Length	125.0000 ft
Slope	1.2000%
Tailwater	0.0000 ft
Inlet Control Equation	Entrance Loss
Size (W x T):	84.00 x 0.1090
Flow Rate	1394.0000 cfs

Output Results

Flow Rate	1394.0000 cfs
Control	Inlet
Capacity	1240.5645 cfs
Manning's Velocity	12.0741 ft/s
Headwater	10.3132 ft
Critical Depth	5.6500 ft
Normal Depth	7.0000 ft
Size (W x T):	84.00 x 0.1090

APPENDIX C - Digital Data

- HEC-HMS Model
- HEC-RAS Models

APPENDIX D – Hydraulic Calculations

090126 HEC-RAS models

3 HEC-RAS models Developed Along

① Nafzinger Arroyo

② Golf course Arroyo

③ Coronado

Previous Run Bulked Existing Conditions.

New Run Bulked Future Conditions.

Arroyo	Existing Bulked (cfs)	Future Bulked (cfs)	(AP) *
Nafzinger	4295.7	5360.3	J-A2
Coronado	1011.8	998.1	J-B4
Golf Course	1365.4	1417.7	J-C4

Note: the AP used for the HEC-RAS model Q's used the higher Q of the upstream or downstream AP point. The values were always within a few cfs

HEC-RAS models Assumed sub critical flow.

Bohannan Huston INC.

PROJECT NAME Pacacho Hills SHEET 1 OF 1

PROJECT NO. 090126 BY JTOB DATE 1/08/09

SUBJECT HEC-RAS models CH'D DATE

ENGINEERING
SPATIAL DATA
ADVANCED TECHNOLOGIES

Coronado Q100

HEC-RAS Plan: Plan 02 River: Coronado Reach: Reach

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	2909.021	Q100 Ex	1011.80	4098.00	4102.89	4100.34	4102.91	0.000162	1.40	974.57	396.02	0.14
Reach	2909.021	Q100 Fut	998.10	4098.00	4102.88	4100.33	4102.90	0.000160	1.38	970.71	395.76	0.13
Reach	2850		Culvert									
Reach	2726.672	Q100 Ex	1011.80	4091.00	4095.24	4095.24	4095.99	0.006848	7.48	188.56	140.94	0.83
Reach	2726.672	Q100 Fut	998.10	4091.00	4095.20	4095.20	4095.97	0.007033	7.56	183.16	138.94	0.84
Reach	2498.823	Q100 Ex	1011.80	4086.02	4088.49	4088.49	4089.15	0.011830	6.52	155.13	115.75	0.99
Reach	2498.823	Q100 Fut	998.10	4086.02	4088.47	4088.47	4089.13	0.011982	6.52	153.18	115.57	1.00
Reach	2296.742	Q100 Ex	1011.80	4081.26	4083.94	4083.94	4084.90	0.010971	7.85	128.88	68.49	1.01
Reach	2296.742	Q100 Fut	998.10	4081.26	4083.92	4083.92	4084.87	0.010983	7.82	127.69	68.37	1.01
Reach	2074.020	Q100 Ex	1011.80	4075.14	4077.32	4077.32	4078.03	0.012107	6.78	149.18	107.01	1.01
Reach	2074.020	Q100 Fut	998.10	4075.14	4077.30	4077.30	4078.01	0.012195	6.77	147.48	106.68	1.01
Reach	1726.314	Q100 Ex	1011.80	4066.55	4069.65	4069.65	4070.45	0.011820	7.17	141.18	91.40	1.01
Reach	1726.314	Q100 Fut	998.10	4066.55	4069.63	4069.63	4070.43	0.011890	7.15	139.67	91.02	1.02
Reach	1415.358	Q100 Ex	1011.80	4059.34	4062.49	4062.49	4063.57	0.010722	8.33	121.44	57.66	1.01
Reach	1415.358	Q100 Fut	998.10	4059.34	4062.47	4062.47	4063.54	0.010691	8.30	120.29	57.34	1.01
Reach	1173.282	Q100 Ex	1011.80	4053.55	4056.57	4056.57	4057.38	0.011347	7.19	140.68	88.01	1.00
Reach	1173.282	Q100 Fut	998.10	4053.55	4056.54	4056.54	4057.35	0.011692	7.23	138.02	87.60	1.02
Reach	983.3911	Q100 Ex	1011.80	4049.30	4052.69	4052.69	4053.61	0.010849	7.69	131.51	71.71	1.00
Reach	983.3911	Q100 Fut	998.10	4049.30	4052.67	4052.67	4053.58	0.010891	7.67	130.13	71.50	1.00
Reach	784.9563	Q100 Ex	1011.80	4045.27	4048.05	4048.05	4048.86	0.011444	7.22	140.18	87.76	1.01
Reach	784.9563	Q100 Fut	998.10	4045.27	4048.02	4048.02	4048.84	0.011596	7.26	137.55	86.28	1.01
Reach	508.7785	Q100 Ex	1011.80	4038.35	4041.40	4041.40	4042.28	0.007973	8.48	170.71	98.76	0.92
Reach	508.7785	Q100 Fut	998.10	4038.35	4041.37	4041.37	4042.26	0.008120	8.50	167.80	98.36	0.92
Reach	181.9140	Q100 Ex	1011.80	4030.75	4033.55	4033.55	4034.36	0.011330	7.25	139.49	86.03	1.00
Reach	181.9140	Q100 Fut	998.10	4030.75	4033.53	4033.53	4034.34	0.011379	7.23	138.02	85.79	1.00

HEC-RAS Plan: Plan 02 River: Coronado Reach: Reach (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	0.0000	Q100 Ex	1011.80	4016.31	4020.98	4018.99	4021.16	0.001001	3.42	296.07	90.67	0.33
Reach	0.0000	Q100 Fut	998.10	4016.31	4020.95	4018.98	4021.13	0.001001	3.40	293.33	90.42	0.33

Golf Course Arroyo .
Q100

HEC-RAS Plan: Plan 02 River: Stream Reach: Reach

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	2783.750	Q100 Ex	1365.40	4061.16	4063.78	4063.78	4064.50	0.013618	8.52	236.92	157.12	1.12
Reach	2783.750	Q100 Fut	1417.70	4061.16	4063.84	4063.84	4064.56	0.013316	8.53	245.29	158.67	1.11
Reach	2459.028	Q100 Ex	1365.40	4051.42	4055.16	4055.16	4056.14	0.008232	8.33	199.47	111.46	0.92
Reach	2459.028	Q100 Fut	1417.70	4051.42	4055.22	4055.22	4056.21	0.008265	8.42	205.63	112.97	0.92
Reach	2255.911	Q100 Ex	1365.40	4045.89	4049.74	4049.74	4050.80	0.008517	8.31	175.15	106.66	0.93
Reach	2255.911	Q100 Fut	1417.70	4045.89	4049.80	4049.80	4050.88	0.008384	8.38	181.96	108.57	0.93
Reach	1984.251	Q100 Ex	1365.40	4038.58	4042.86	4042.86	4044.26	0.009666	9.50	143.65	51.62	1.00
Reach	1984.251	Q100 Fut	1417.70	4038.58	4042.94	4042.94	4044.37	0.009667	9.60	147.63	52.23	1.01
Reach	1783.310	Q100 Ex	1365.40	4031.11	4034.41	4034.41	4035.24	0.011873	7.29	187.22	117.92	1.02
Reach	1783.310	Q100 Fut	1417.70	4031.11	4034.47	4034.47	4035.30	0.011484	7.31	193.90	118.98	1.01
Reach	1448.316	Q100 Ex	1365.40	4020.33	4024.05	4024.05	4025.15	0.010272	8.39	162.79	74.95	1.00
Reach	1448.316	Q100 Fut	1417.70	4020.33	4024.11	4024.11	4025.23	0.010385	8.49	166.90	76.02	1.01
Reach	1236.258	Q100 Ex	1365.40	4017.06	4019.08	4019.08	4019.75	0.012138	6.54	208.71	158.84	1.01
Reach	1236.258	Q100 Fut	1417.70	4017.06	4019.12	4019.12	4019.80	0.012201	6.60	214.78	161.91	1.01
Reach	936.4020	Q100 Ex	1365.40	4004.85	4007.14	4007.14	4007.96	0.011296	7.27	187.91	115.44	1.00
Reach	936.4020	Q100 Fut	1417.70	4004.85	4007.19	4007.19	4008.02	0.011244	7.33	193.41	116.87	1.00
Reach	753.7728	Q100 Ex	1365.40	3999.63	4004.81		4004.85	0.000179	1.71	843.26	217.05	0.15
Reach	753.7728	Q100 Fut	1417.70	3999.63	4004.84		4004.89	0.000188	1.76	850.47	217.22	0.15
Reach	536.3858	Q100 Ex	1365.40	3988.46	4004.81	3993.78	4004.83	0.000031	1.62	2054.62	454.13	0.07
Reach	536.3858	Q100 Fut	1417.70	3988.46	4004.84	3993.90	4004.86	0.000033	1.67	2069.55	454.73	0.08
Reach	500		Culvert									
Reach	398.4861	Q100 Ex	1365.40	3985.81	3992.22	3992.22	3994.18	0.008599	11.48	129.38	34.95	0.98
Reach	398.4861	Q100 Fut	1417.70	3985.81	3992.34	3992.34	3994.33	0.008490	11.57	133.65	35.36	0.98
Reach	245.2667	Q100 Ex	1365.40	3980.38	3985.53	3985.53	3987.05	0.008952	9.93	140.62	47.30	0.98
Reach	245.2667	Q100 Fut	1417.70	3980.38	3985.61	3985.61	3987.16	0.009238	10.03	144.79	51.40	0.99

HEC-RAS Plan: Plan 02 River: Stream Reach: Reach (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	37.3317	Q100 Ex	1365.40	3975.50	3980.56	3980.56	3982.00	0.009361	9.64	143.36	53.06	0.99
Reach	37.3317	Q100 Fut	1417.70	3975.50	3980.69	3980.69	3982.11	0.008932	9.59	150.06	54.39	0.98

Nafzinger Q100
Existing & Future

HEC-RAS Plan: Plan 03 River: Nafzinger Reach: Reach

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	5502.854	Q100 Ex	4295.70	4033.36	4036.60	4036.60	4037.73	0.009855	8.65	523.52	241.33	1.00
Reach	5502.854	Q100 Fut	5360.30	4033.36	4036.97	4036.97	4038.26	0.009387	9.30	611.54	244.74	1.00
Reach	5258.660	Q100 Ex	4295.70	4028.07	4031.70	4031.70	4033.03	0.009570	9.27	469.36	183.20	1.00
Reach	5258.660	Q100 Fut	5360.30	4028.07	4032.15	4032.15	4033.65	0.009084	9.88	552.37	189.16	0.99
Reach	4994.007	Q100 Ex	4295.70	4022.60	4026.17	4026.17	4027.49	0.009854	9.22	465.96	179.68	1.01
Reach	4994.007	Q100 Fut	5360.30	4022.60	4026.60	4026.60	4028.11	0.009354	9.86	543.60	182.09	1.01
Reach	4749.720	Q100 Ex	4295.70	4017.42	4022.00	4022.00	4023.59	0.008006	10.20	450.08	168.79	0.96
Reach	4749.720	Q100 Fut	5360.30	4017.42	4022.54	4022.54	4024.31	0.007482	10.84	543.67	176.72	0.95
Reach	4505.677	Q100 Ex	4295.70	4013.21	4016.68	4016.68	4018.13	0.009014	9.71	453.26	164.27	0.99
Reach	4505.677	Q100 Fut	5360.30	4013.21	4017.16	4017.16	4018.81	0.008484	10.40	533.55	176.33	0.99
Reach	4252.805	Q100 Ex	4295.70	4007.34	4011.11	4011.11	4012.36	0.009965	8.95	480.26	198.17	1.01
Reach	4252.805	Q100 Fut	5360.30	4007.34	4011.50	4011.50	4012.94	0.009496	9.62	558.67	200.95	1.01
Reach	3941.083	Q100 Ex	4295.70	4001.25	4005.30	4005.30	4006.87	0.008901	10.07	432.24	143.83	0.99
Reach	3941.083	Q100 Fut	5360.30	4001.25	4005.81	4005.81	4007.61	0.008411	10.81	507.63	152.87	0.99
Reach	3725.874	Q100 Ex	4295.70	3996.77	4000.71	4000.71	4002.31	0.008958	10.17	426.37	137.40	1.00
Reach	3725.874	Q100 Fut	5360.30	3996.77	4001.23	4001.23	4003.07	0.008393	10.89	498.93	139.32	0.99
Reach	3505.281	Q100 Ex	4295.70	3992.46	3995.90	3995.90	3997.08	0.009920	8.72	495.51	223.15	1.00
Reach	3505.281	Q100 Fut	5360.30	3992.46	3996.28	3996.28	3997.63	0.009376	9.36	580.08	224.96	1.00
Reach	3158.319	Q100 Ex	4295.70	3985.92	3988.90	3988.90	3989.85	0.010622	7.79	553.66	296.64	1.00
Reach	3158.319	Q100 Fut	5360.30	3985.92	3989.21	3989.21	3990.29	0.010397	8.36	645.05	306.50	1.01
Reach	2954.761	Q100 Ex	4295.70	3981.67	3984.70	3984.70	3985.58	0.009012	7.87	639.66	378.43	0.94
Reach	2954.761	Q100 Fut	5360.30	3981.67	3984.99	3984.99	3985.99	0.008758	8.44	752.00	382.10	0.95
Reach	2661.178	Q100 Ex	4295.70	3975.74	3978.34	3978.34	3979.18	0.011430	7.38	581.73	352.31	1.01
Reach	2661.178	Q100 Fut	5360.30	3975.74	3978.62	3978.62	3979.58	0.010658	7.83	684.42	361.38	1.00
Reach	2500.255	Q100 Ex	4295.70	3971.25	3974.61	3974.61	3975.41	0.011292	7.17	598.97	376.89	1.00
Reach	2500.255	Q100 Fut	5360.30	3971.25	3974.85	3974.85	3975.78	0.011001	7.74	692.98	382.68	1.01

HEC-RAS Plan: Plan 03 River: Nafzinger Reach: Reach (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	2245.374	Q100 Ex	4295.70	3966.69	3969.75	3969.75	3970.67	0.011098	7.70	558.09	310.49	1.01
Reach	2245.374	Q100 Fut	5360.30	3966.69	3970.06	3970.06	3971.10	0.010338	8.20	653.76	314.23	1.00
Reach	1988.599	Q100 Ex	4295.70	3962.99	3965.67	3965.67	3966.55	0.010892	7.53	572.05	327.57	1.00
Reach	1988.599	Q100 Fut	5360.30	3962.99	3965.94	3965.94	3966.97	0.010502	8.14	661.35	329.14	1.01
Reach	1736.662	Q100 Ex	4295.70	3958.06	3961.27	3961.27	3962.20	0.010757	7.74	554.81	299.00	1.00
Reach	1736.662	Q100 Fut	5360.30	3958.06	3961.59	3961.59	3962.63	0.010324	8.21	653.08	312.58	1.00
Reach	1498.480	Q100 Ex	4295.70	3952.80	3956.16	3956.16	3957.22	0.010355	8.26	519.85	245.95	1.00
Reach	1498.480	Q100 Fut	5360.30	3952.80	3956.50	3956.50	3957.72	0.010118	8.88	603.88	252.59	1.01
Reach	1214.655	Q100 Ex	4295.70	3946.60	3951.08	3951.08	3952.32	0.008718	9.57	548.52	229.07	0.98
Reach	1214.655	Q100 Fut	5360.30	3946.60	3951.47	3951.47	3952.90	0.008604	10.33	639.99	233.62	0.99
Reach	949.1599	Q100 Ex	4295.70	3939.34	3943.50	3943.50	3944.34	0.011221	7.38	582.14	345.35	1.00
Reach	949.1599	Q100 Fut	5360.30	3939.34	3943.80	3943.80	3944.73	0.010990	7.74	692.63	376.81	1.01
Reach	721.3156	Q100 Ex	4295.70	3933.32	3938.81	3938.81	3939.61	0.009090	7.47	674.67	468.84	0.93
Reach	721.3156	Q100 Fut	5360.30	3933.32	3939.08	3939.08	3939.98	0.008755	7.98	804.48	480.61	0.93

Weighted Mannings Roughness
Picacho Hills
BHI No. 090126
Date: 01/07/2009
Prepared By: Kris Johnson
Path: P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126 Channel Roughness_PH.xlsx

Goal:
Determine approximate mannings roughness for use in modeling channels

Assumptions:
3:1 Side Slopes

Earthen Channel Bottom roughness	0.023	per NMDOT Drainage Manual - Volume 2 Hydraulics, Table 2-3
Riprap side roughness	0.045	value chosen to be between value for d50= 2-inch rock and 6-inch as defined by NMDOT Drainage Manual - Volume 2 Hydraulics, Table 2-3

Results:

Channel Section No.	Bottom Width	Depth	Slope Leng	Weighted 'n'
1	40	4.9	15.5	0.033
2	60	4.9	15.5	0.031
3	240	5	15.81	0.026

Proposed Channel Section 1
Picacho Hills
BHI No. 090126
Date: 01/07/2009
Prepared By: Kris Johnson
Path: P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126_Channel Section01_PH.txt

Goal: Design channel section to convey the peak flow rate resulting from
Basins C, D.

Assumption: Required flow capacity: 1592 cfs (Flow rate obtained from Future_Ph01.hms)
Roughness calculated by the following spreadsheet:
P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126 Channel Roughness_PH.xlsx

MANNING'S N = 0.033 SLOPE = 0.003

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1.0	0.0	10.0	3.0	70.0	0.0			
2.0	30.0	0.0	4.0	100.0	10.0			

WSEL FT.	DEPTH INC	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID PLUS OBSTRUCTIONS	TOTAL ENERGY (FT)
1.000	1.000	43.000	100.919	46.325	2.347	46.000	1.086
2.000	2.000	92.000	329.193	52.649	3.578	52.000	2.199
3.000	3.000	147.000	666.534	58.974	4.534	58.000	3.320
4.000	4.000	208.000	1110.632	65.298	5.340	64.000	4.443
4.100	4.100	214.430	1160.958	65.931	5.414	64.600	4.556
4.200	4.200	220.920	1212.369	66.563	5.488	65.200	4.668
4.300	4.300	227.470	1264.868	67.196	5.561	65.800	4.781
4.400	4.400	234.080	1318.459	67.828	5.633	66.400	4.893
4.500	4.500	240.750	1373.144	68.460	5.704	67.000	5.006
4.600	4.600	247.480	1428.926	69.093	5.774	67.600	5.119
4.700	4.700	254.270	1485.810	69.725	5.843	68.200	5.231
4.800	4.800	261.120	1543.799	70.358	5.912	68.800	5.344
Flow depth required to convey flow.							
4.900	4.900	268.030	1602.895	70.990	5.980	69.400	5.456
5.000	5.000	275.000	1663.103	71.623	6.048	70.000	5.569
6.000	6.000	348.000	2327.180	77.947	6.687	76.000	6.696

Proposed Channel Section 2
Picacho Hills
BHI No. 090126
Date: 01/07/2009
Prepared By: Kris Johnson
Path: P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126_Channel Section02_PH.txt

Goal: Design channel section to convey the peak flow rate resulting from
Basin B combined with the flow from Basin C, D.

Assumption: Design flow rate = 2218 cfs
Roughness calculated by the following spreadsheet:
P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126 Channel Roughness_PH.xlsx

MANNING'S N = 0.031 SLOPE = 0.002

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1.0	0.0	10.0	3.0	100.0	0.0			
2.0	30.0	0.0	4.0	130.0	10.0			

WSEL FT.	DEPTH INC	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID PLUS OBSTRUCTIONS	TOTAL ENERGY (FT)
1.000	1.000	73.000	151.915	76.325	2.081	76.000	1.067
2.000	2.000	152.000	489.124	82.649	3.218	82.000	2.161
3.000	3.000	237.000	976.289	88.974	4.119	88.000	3.264
4.000	4.000	328.000	1602.896	95.298	4.887	94.000	4.371
4.100	4.100	337.430	1673.041	95.931	4.958	94.600	4.482
4.200	4.200	346.920	1744.537	96.563	5.029	95.200	4.593
4.300	4.300	356.470	1817.381	97.196	5.098	95.800	4.704
4.400	4.400	366.080	1891.573	97.828	5.167	96.400	4.815
4.500	4.500	375.750	1967.112	98.460	5.235	97.000	4.926
4.600	4.600	385.480	2043.996	99.093	5.302	97.600	5.037
4.700	4.700	395.270	2122.224	99.725	5.369	98.200	5.148
4.800	4.800	405.120	2201.797	100.358	5.435	98.800	5.259
Flow depth required to convey flow.							
4.900	4.900	415.030	2282.714	100.990	5.500	99.400	5.371
5.000	5.000	425.000	2364.974	101.623	5.565	100.000	5.482
6.000	6.000	528.000	3261.525	107.947	6.177	106.000	6.593
7.000	7.000	637.000	4293.171	114.272	6.740	112.000	7.707
8.000	8.000	752.000	5461.503	120.596	7.263	118.000	8.820
9.000	9.000	873.000	6768.725	126.921	7.753	124.000	9.935
10.000	10.000	1000.000	8217.448	133.246	8.217	130.000	11.050

Proposed Channel Section 3
Picacho Hills
BHI No. 090126
Date: 01/07/2009
Prepared By: Kris Johnson
Path: P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126_Channel Section03_PH.txt

Goal: Design channel section to convey the peak flow rate resulting from
Basins A, B, C and D.

Assumpation: Required flow capacity = 6331 cfs (Flow rate obtained from Future_Ph01.hms model)
Roughness calculated by the following spreadsheet:
P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126 Channel Roughness_PH.xlsx

MANNING'S N = 0.026   SLOPE = 0.001

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1.0	0.0	10.0	3.0	270.0	0.0			
2.0	30.0	0.0	4.0	300.0	10.0			

WSEL FT.	DEPTH INC	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID PLUS OBSTRUCTIONS	TOTAL ENERGY (FT)
1.000	1.000	243.000	435.229	246.325	1.791	246.000	1.050
2.000	2.000	492.000	1386.677	252.649	2.818	252.000	2.124
3.000	3.000	747.000	2735.748	258.974	3.662	258.000	3.209
4.000	4.000	1008.000	4435.986	265.298	4.401	264.000	4.301
4.100	4.100	1034.430	4624.183	265.931	4.470	264.600	4.411
4.200	4.200	1060.920	4815.593	266.563	4.539	265.200	4.520
4.300	4.300	1087.470	5010.196	267.196	4.607	265.800	4.630
4.400	4.400	1114.080	5207.973	267.828	4.675	266.400	4.740
4.500	4.500	1140.750	5408.905	268.460	4.742	267.000	4.850
4.600	4.600	1167.480	5612.974	269.093	4.808	267.600	4.960
4.700	4.700	1194.270	5820.162	269.725	4.873	268.200	5.069
4.800	4.800	1221.120	6030.454	270.358	4.938	268.800	5.179
4.900	4.900	1248.030	6243.834	270.990	5.003	269.400	5.289
Flow depth required to convey flow.							
5.000	5.000	1275.000	6460.285	271.623	5.067	270.000	5.399
5.100	5.100	1302.030	6679.792	272.255	5.130	270.600	5.509
5.200	5.200	1329.120	6902.342	272.888	5.193	271.200	5.619
5.300	5.300	1356.270	7127.920	273.520	5.256	271.800	5.730
5.400	5.400	1383.480	7356.513	274.153	5.317	272.400	5.840
5.500	5.500	1410.750	7588.108	274.785	5.379	273.000	5.950
5.600	5.600	1438.080	7822.691	275.418	5.440	273.600	6.060
5.700	5.700	1465.470	8060.251	276.050	5.500	274.200	6.171
5.800	5.800	1492.920	8300.775	276.682	5.560	274.800	6.281
5.900	5.900	1520.430	8544.252	277.315	5.620	275.400	6.391
6.000	6.000	1548.000	8790.671	277.947	5.679	276.000	6.502
7.000	7.000	1827.000	11414.418	284.272	6.248	282.000	7.607
8.000	8.000	2112.000	14322.158	290.596	6.781	288.000	8.715
9.000	9.000	2403.000	17506.842	296.921	7.285	294.000	9.826
10.000	10.000	2700.000	20963.097	303.246	7.764	300.000	10.938

Weighted Mannings Roughness

Picacho Hills

BHI No. 090126

Date: 01/07/2009

Prepared By: Kris Johnson

Path: P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126 Channel Roughness_PH.xlsx

Goal:

Determine approximate mannings roughness for use in modeling channels

Assumptions:

3:1 Side Slopes

Earthen Channel Bottom roughness	0.023	per NMDOT Drainage Manual - Volume 2 Hydraulics, Table 2-3
Riprap side roughness	0.045	value chosen to be between value for d50= 2-inch rock and 6-inch as defined by NMDOT Drainage Manual - Volume 2 Hydraulics, Table 2-3

Results:

Channel Section No.	Bottom Width	Depth	Slope Leng	Weighted 'n'
1	40	4.9	15.5	0.033
2	60	4.9	15.5	0.031
3	240	5	15.81	0.026

Proposed Channel Section 1
Picacho Hills
BHI No. 090126
Date: 01/07/2009
Prepared By: Kris Johnson
Path: P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126_Channel Section01_PH.txt

Goal: Design channel section to convey the peak flow rate resulting from
Basins C, D.

Assumption: Required flow capacity: 1592 cfs (Flow rate obtained from Future_Ph01.hms)
Roughness calculated by the following spreadsheet:
P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126 Channel Roughness_PH.xlsx

MANNING'S N = 0.033 SLOPE = 0.003

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1.0	0.0	10.0	3.0	70.0	0.0			
2.0	30.0	0.0	4.0	100.0	10.0			

WSEL FT.	DEPTH INC	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID PLUS OBSTRUCTIONS	TOTAL ENERGY (FT)
1.000	1.000	43.000	100.919	46.325	2.347	46.000	1.086
2.000	2.000	92.000	329.193	52.649	3.578	52.000	2.199
3.000	3.000	147.000	666.534	58.974	4.534	58.000	3.320
4.000	4.000	208.000	1110.632	65.298	5.340	64.000	4.443
4.100	4.100	214.430	1160.958	65.931	5.414	64.600	4.556
4.200	4.200	220.920	1212.369	66.563	5.488	65.200	4.668
4.300	4.300	227.470	1264.868	67.196	5.561	65.800	4.781
4.400	4.400	234.080	1318.459	67.828	5.633	66.400	4.893
4.500	4.500	240.750	1373.144	68.460	5.704	67.000	5.006
4.600	4.600	247.480	1428.926	69.093	5.774	67.600	5.119
4.700	4.700	254.270	1485.810	69.725	5.843	68.200	5.231
4.800	4.800	261.120	1543.799	70.358	5.912	68.800	5.344
Flow depth required to convey flow.							
4.900	4.900	268.030	1602.895	70.990	5.980	69.400	5.456
5.000	5.000	275.000	1663.103	71.623	6.048	70.000	5.569
6.000	6.000	348.000	2327.180	77.947	6.687	76.000	6.696

Proposed Channel Section 2
Picacho Hills
BHI No. 090126
Date: 01/07/2009
Prepared By: Kris Johnson
Path: P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126_Channel Section02_PH.txt

Goal: Design channel section to convey the peak flow rate resulting from
Basin B combined with the flow from Basin C, D.

Assumption: Design flow rate = 2218 cfs
Roughness calculated by the following spreadsheet:
P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126 Channel Roughness_PH.xlsx

MANNING'S N = 0.031 SLOPE = 0.002

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1.0	0.0	10.0	3.0	100.0	0.0			
2.0	30.0	0.0	4.0	130.0	10.0			

WSEL FT.	DEPTH INC	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID PLUS OBSTRUCTIONS	TOTAL ENERGY (FT)
1.000	1.000	73.000	151.915	76.325	2.081	76.000	1.067
2.000	2.000	152.000	489.124	82.649	3.218	82.000	2.161
3.000	3.000	237.000	976.289	88.974	4.119	88.000	3.264
4.000	4.000	328.000	1602.896	95.298	4.887	94.000	4.371
4.100	4.100	337.430	1673.041	95.931	4.958	94.600	4.482
4.200	4.200	346.920	1744.537	96.563	5.029	95.200	4.593
4.300	4.300	356.470	1817.381	97.196	5.098	95.800	4.704
4.400	4.400	366.080	1891.573	97.828	5.167	96.400	4.815
4.500	4.500	375.750	1967.112	98.460	5.235	97.000	4.926
4.600	4.600	385.480	2043.996	99.093	5.302	97.600	5.037
4.700	4.700	395.270	2122.224	99.725	5.369	98.200	5.148
4.800	4.800	405.120	2201.797	100.358	5.435	98.800	5.259
Flow depth required to convey flow.							
4.900	4.900	415.030	2282.714	100.990	5.500	99.400	5.371
5.000	5.000	425.000	2364.974	101.623	5.565	100.000	5.482
6.000	6.000	528.000	3261.525	107.947	6.177	106.000	6.593
7.000	7.000	637.000	4293.171	114.272	6.740	112.000	7.707
8.000	8.000	752.000	5461.503	120.596	7.263	118.000	8.820
9.000	9.000	873.000	6768.725	126.921	7.753	124.000	9.935
10.000	10.000	1000.000	8217.448	133.246	8.217	130.000	11.050

Proposed Channel Section 3
Picacho Hills
BHI No. 090126
Date: 01/07/2009
Prepared By: Kris Johnson
Path: P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126_Channel Section03_PH.txt

Goal: Design channel section to convey the peak flow rate resulting from
Basins A, B, C and D.

Assumpation: Required flow capacity = 6331 cfs (Flow rate obtained from Future_Ph01.hms model)
Roughness calculated by the following spreadsheet:
P:\090126\WR\Calculations\Misc Calcs\Proposed Channel Outfalls\090126 Channel Roughness_PH.xlsx

MANNING'S N = 0.026 SLOPE = 0.001

POINT	DIST	ELEV	POINT	DIST	ELEV	POINT	DIST	ELEV
1.0	0.0	10.0	3.0	270.0	0.0			
2.0	30.0	0.0	4.0	300.0	10.0			

WSEL FT.	DEPTH INC	FLOW AREA SQ.FT.	FLOW RATE (CFS)	WETTED PER (FT)	FLOW VEL (FPS)	TOPWID PLUS OBSTRUCTIONS	TOTAL ENERGY (FT)
1.000	1.000	243.000	435.229	246.325	1.791	246.000	1.050
2.000	2.000	492.000	1386.677	252.649	2.818	252.000	2.124
3.000	3.000	747.000	2735.748	258.974	3.662	258.000	3.209
4.000	4.000	1008.000	4435.986	265.298	4.401	264.000	4.301
4.100	4.100	1034.430	4624.183	265.931	4.470	264.600	4.411
4.200	4.200	1060.920	4815.593	266.563	4.539	265.200	4.520
4.300	4.300	1087.470	5010.196	267.196	4.607	265.800	4.630
4.400	4.400	1114.080	5207.973	267.828	4.675	266.400	4.740
4.500	4.500	1140.750	5408.905	268.460	4.742	267.000	4.850
4.600	4.600	1167.480	5612.974	269.093	4.808	267.600	4.960
4.700	4.700	1194.270	5820.162	269.725	4.873	268.200	5.069
4.800	4.800	1221.120	6030.454	270.358	4.938	268.800	5.179
4.900	4.900	1248.030	6243.834	270.990	5.003	269.400	5.289
Flow depth required to convey flow.							
5.000	5.000	1275.000	6460.285	271.623	5.067	270.000	5.399
5.100	5.100	1302.030	6679.792	272.255	5.130	270.600	5.509
5.200	5.200	1329.120	6902.342	272.888	5.193	271.200	5.619
5.300	5.300	1356.270	7127.920	273.520	5.256	271.800	5.730
5.400	5.400	1383.480	7356.513	274.153	5.317	272.400	5.840
5.500	5.500	1410.750	7588.108	274.785	5.379	273.000	5.950
5.600	5.600	1438.080	7822.691	275.418	5.440	273.600	6.060
5.700	5.700	1465.470	8060.251	276.050	5.500	274.200	6.171
5.800	5.800	1492.920	8300.775	276.682	5.560	274.800	6.281
5.900	5.900	1520.430	8544.252	277.315	5.620	275.400	6.391
6.000	6.000	1548.000	8790.671	277.947	5.679	276.000	6.502
7.000	7.000	1827.000	11414.418	284.272	6.248	282.000	7.607
8.000	8.000	2112.000	14322.158	290.596	6.781	288.000	8.715
9.000	9.000	2403.000	17506.842	296.921	7.285	294.000	9.826
10.000	10.000	2700.000	20963.097	303.246	7.764	300.000	10.938

```
Constructible Nafzinger Arroyo Pond (Pond E2) Principle Spillway
Picacho Hills
BHI No. 090126
Prepared By: Kris Johnson
Path:  P:\090126\WR\Calculations\Misc Calcs\Proposed Pond\090126_Pond E2 Outfall Culvert Analysis.txt

Goal: Analyze a constructible solution for the proposed
      Nafzinger Arroyo Pond principle spillway.  HEC-HMS limits the number
      of culvert pipes that can be analyzed as an outfall to a pond, to 10.
      Using HEC-HMS for the future conditions model, 10 culverts, each 3' (H) x 29' (W)
      recommended.  Verify that 48 culverts each, 3' (H) x 6' (W) will convey
      an equivalent flow.

Analyzer Report
====================================================================
Drainage Structure Analyzer
Culvert Hydraulic Analysis
Date:  Wednesday, March 11, 2009 14:00:16
====================================================================

Input Data
----------
Shape                                                  Box
Material                                           RC C789
Roughness                                         0.013000
Entrance Edge        90 and 15 deg wingwall flares
Number of Barrels                                       48
Length                                         100.0000 ft
Slope                                             0.5000%
Tailwater                                        0.0000 ft
Inlet Control Equation                      Entrance Loss
Size (W x H x T):               72.00 x 36.00 x 7.5000
Flow Rate                                     5358.2000 cfs

Output Results
--------------
Flow Rate                                     5358.2000 cfs
Control                                              Inlet
Capacity                                      6983.5171 cfs
Manning's Velocity                               9.1740 ft/s
Headwater                                        3.7802 ft
Critical Depth                                   2.2076 ft
Normal Depth                                     2.0270 ft
Size (W x H x T):               72.00 x 36.00 x 7.5000
```

Hydrologic Analysis

Surrounding Basin Information

Basin ID	Area Acre	Future 100-YR Flow Rate cfs	Flow per Acre cfs/ac
C4a	98.12	275.7	2.81
C4	163.4	41.8	3.91

Assumptions

- Sub-basin delineation of basins which Contribute to the SD attached.
- Linework describing sub-basins is found in the following shape file:

  P:\090126\WR\Calculations\Programs\ArcView\HEC GeoHMS\N_Picacho\Via Campestre SD.Shp

- Basin SD1 is a part of overall Basin C4a
- Basin SD2 is a part of the overall Basin C4

Design Flow Rates

Basin SD1 — 7.1 acre

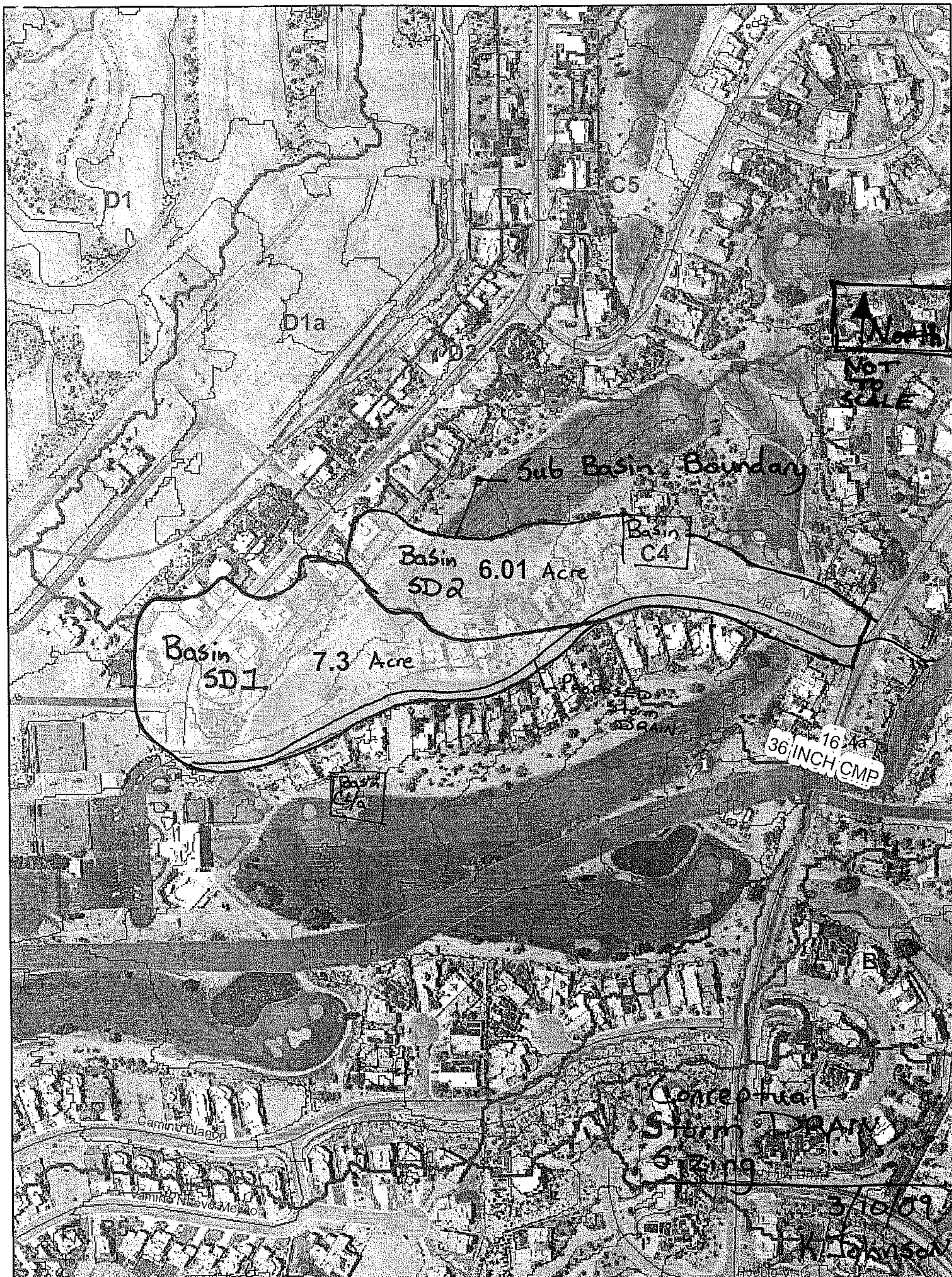
$$Q_{100} = \begin{bmatrix}\text{Basin} \\ \text{C4a} \\ \text{cfs/ac}\end{bmatrix}\begin{bmatrix}\text{Basin} \\ \text{SD1} \\ \text{ac}\end{bmatrix}$$

▲ $Q_{100} = 20.0$ cfs

Basin SD2 — 6.01 acre

$$Q_{100} = \begin{bmatrix}\text{Basin} \\ \text{C4} \\ \text{cfs/ac}\end{bmatrix}\begin{bmatrix}\text{Basin} \\ \text{SD2} \\ \text{Ac}\end{bmatrix}$$

▲ $Q_{100} = 23.5$ cfs



D1
D1a
D2
C5
North
NOT TO SCALE
Sub Basin Boundary
Basin C4
Basin SD2
6.01 Acre
Via Campestre
Basin SD1
7.3 Acre
Proposed Storm DRAIN
16.4a
36 INCH CMP
B
Camino Blanco
Conceptual Storm DRAIN Sizing
3/10/09
K. Johnson

Hydraulic Design

Storm Drain Trunkline

Assumptions:

- [Average SD slope] = [Slope from top of Via Campestre Rd to Proposed SD outfall into the Golf Course Arroyo]

$$S = \frac{4060 - 3980}{1990} = 4\%$$

- Storm Drain total length = 1990 LF
- Use RCP for SD
  Roughness coefficient = 0.013
- Use mannings equation to approx. flow capacity of SD flowing full, not under pressure.
  – Steady flow –

Calculation:

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$$

$$43.45 = \frac{1.49}{0.013} (\pi r^2)\left(\frac{1}{4}(2r)\right)^{2/3} (0.04)^{1/2}$$

△ r = 0.98 FT

★ See computer calculation attached

▲ Requires storm drain dia 24" RCP

Inlets

Assumption

- min spacing: 50 FT
- Assume each inlet can collect 5 cfs.
  ↳ Thus 9 inlets are required.

Bohannan Huston INC.

PROJECT NAME Picacho Hills	SHEET 3	OF	ENGINEERING
PROJECT NO.	BY KJohnson	DATE 3/11/09	SPATIAL DATA
SUBJECT Storm Drain Design – Conceptual –	CH'D [signature]	DATE 3/11/09	ADVANCED TECHNOLOGIES

Conceptual Via Campestre Storm Drain Sizing

Picacho Hills
BHI No. 090126
Date: 03/11/2009
Prepared By: Kris Johnson

Path: P:\090126\WR\ Calculations\ Misc Calculations\090126 SD Capacity01.txt

24.000 INCH DIAMETER PIPE

MANNING'S N = 0.013 SLOPE = 0.040

FLOW DEPTH INCHES	FLOW AREA SQ FT	DISCHARGE CFS	VELOCITY FPS
1.000	0.045	0.147	3.285
2.000	0.125	0.643	5.145
3.000	0.227	1.507	6.648
4.000	0.344	2.732	7.938
5.000	0.474	4.303	9.075
6.000	0.614	6.198	10.091
7.000	0.762	8.389	11.006
8.000	0.917	10.847	11.832
9.000	1.076	13.537	12.580
10.000	1.239	16.422	13.254
11.000	1.404	19.465	13.861
12.000	1.571	22.622	14.402
13.000	1.737	25.850	14.880
14.000	1.903	29.102	15.296
15.000	2.066	32.325	15.650
16.000	2.225	35.467	15.941
17.000	2.379	38.466	16.167
18.000	2.527	41.258	16.324
19.000	2.667	43.765	16.407
→ 20.000	2.797	45.899	16.407
21.000	2.915	47.540	16.309
22.000	3.017	48.518	16.084
23.000	3.097	48.505	15.663
24.000	3.142	45.245	14.402

36.000 INCH DIAMETER PIPE

MANNING'S N = 0.013 SLOPE = 0.040

FLOW DEPTH INCHES	FLOW AREA SQ FT	DISCHARGE CFS	VELOCITY FPS
1.000	0.055	0.182	3.300
2.000	0.154	0.802	5.191
3.000	0.281	1.897	6.741
4.000	0.429	3.474	8.091
5.000	0.595	5.530	9.301
6.000	0.774	8.055	10.402
7.000	0.967	11.033	11.414
8.000	1.170	14.446	12.351
9.000	1.382	18.273	13.223
10.000	1.602	22.488	14.036
11.000	1.829	27.067	14.795
12.000	2.063	31.979	15.505
13.000	2.301	37.197	16.169
14.000	2.543	42.688	16.789
→ 15.000	2.788	48.419	17.368
16.000	3.035	54.355	17.907
17.000	3.284	60.461	18.408
18.000	3.534	66.698	18.872
19.000	3.784	73.029	19.298
20.000	4.033	79.410	19.689
21.000	4.281	85.801	20.043
22.000	4.526	92.156	20.361
23.000	4.768	98.428	20.643
24.000	5.006	104.567	20.888
25.000	5.239	110.521	21.095
26.000	5.466	116.233	21.263
27.000	5.687	121.642	21.391
28.000	5.899	126.679	21.475
29.000	6.102	131.269	21.513
30.000	6.294	135.324	21.500
31.000	6.474	138.738	21.430
32.000	6.639	141.376	21.294
33.000	6.787	143.048	21.076
34.000	6.914	143.452	20.748
35.000	7.013	141.944	20.239
36.000	7.069	133.397	18.872

STREET CAPACITY

32' Street, 50' ROW, 2% Crown
6" Curb

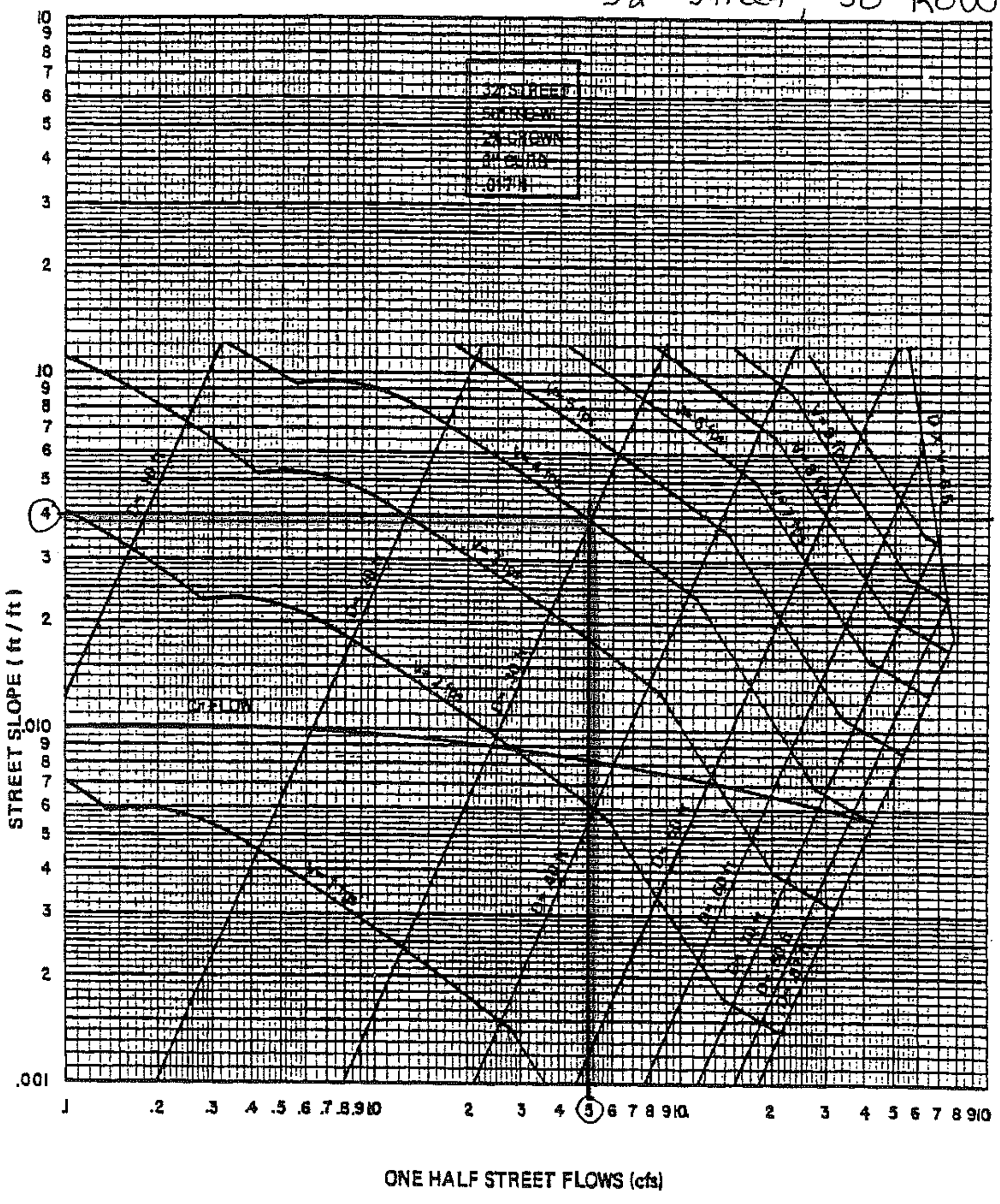


PLATE 22.3 D-1

City of Albuquerque
Development Process Manual
Volume II
Chpt 22, Section 3

APPENDIX E – Public Input

Public Meeting Notice

Picacho Hills and Old Picacho Drainage Management Plan

Date: August 20, 2008

Time: 6:00 – 7:30 PM

Location: Doña Ana County Complex
845 N. Motel Blvd
Room 111
Las Cruces, NM

For information contact: Tish Segovia, P.E.
Doña Ana Flood Commission
Phone: 575 525-5554

This will be the initial public meeting to gather information regarding drainage and storm water system improvements for Old Picacho and Picacho Hills areas.

Public Meeting Notice

Picacho Hills and Old Picacho Drainage Master Plan

Date: November 19, 2008

Time: 5:30 PM – 7:00 PM

Location: Doña Ana County Complex
845 N. Motel Blvd
Room 111
Las Cruces, NM

For information contact: Tish Segovia, P.E.
Doña Ana Flood Commission
Phone: 575-525-5554

This will be the second public meeting to present preliminary findings regarding the drainage and storm water system improvements for Old Picacho and Picacho Hills areas.

Diana Gomez

From: Mota, Adolph [amota@lcsun-news.com]
Sent: Wednesday, November 12, 2008 2:02 PM
To: Diana Gomez
Subject: RE: Picacho Hill DMP

Just wanted to let you that I have Schedule the notice in the paper for November 16
Ad # 1001110256
Pub No 41204
Cost $ 30.67

From: Diana Gomez [mailto:dgomez@bhinc.com]
Sent: Wednesday, November 12, 2008 12:45 PM
To: Mota, Adolph
Cc: Brad Sumrall; Andrew Guerra
Subject: FW: Picacho Hill DMP

Hi Adolph,
Please run the attached public meeting notice on Sunday, November 16, 2008 paper in the Community Brief section.
Please charge it to the Bohannan Huston account; and send me the tear sheet with the price on it as proof that it will run.
If you have any questions please let me know.

Thank you,

Diana Gomez
Administrative Assistant
Las Cruces Office
Bohannan Huston, Inc.
425 South Telshor Blvd., Suite C-103
Las Cruces, NM 88011-7237
www.bhinc.com
voice: 575.532.8670 facsimile: 575.532.8680

From: Andrew Guerra
Sent: Wednesday, November 12, 2008 11:16 AM
To: Diana Gomez
Subject: Picacho Hill DMP

Diana,

I made a few changes to the advertisement concerning Picacho Hills DMP. Tish agrees to use this one. Can you find it somewhere in your heart to help me get it to the papers today.
I'll buy you another Banana Nut!

Andrew Guerra, E.I.
Bohannan Huston Inc.
425 South Telshor Boulevard, Suite C-103

Name (Primary) :

Company (Primary) : BOHANNAN HUSTON

Ad # : 1001054572

Width : 1

Depth : 51

Surface : 51.00

Ad Sales Rep. : 315 - Adolph Mota

Class Code : 0114 - Public/Special Notices

Ad Type :

Account # : 1147794

Start Date : 08/18/08

Stop Date : 08/18/08

Rate : LCCOMSKIP - LC COMMERCIAL SKIP

Box Number : 0 - (None)

Ad Rated Cost : $130.18

Extra : $9.61

Total : $139.79

Run Status : I

DOÑA ANA COUNTY NEW MEXICO

Public Meeting Notice

Picacho Hills and Old Picacho Drainage Management Plan

Date: August 20, 2008
Time: 6:00 - 7:30pm

Location: Doña Ana County Complex 845 N. Motel Blvd Room 111 Las Cruces, NM

For information contact: Tish Segovia, P.E. Doña Ana Flood Commission Phone: 575 525-5554

This will be the initial public meeting to gather information regarding drainage and storm water system improvements for Old Picacho and Picacho Hills areas.

www.lcsun-news.com

LAS CRUCES SUN-NEWS

256 W. Las Cruces Ave. P.O. Box 1749 Las Cruces, NM. 88005
(505) 541-5400

Date: 12/04/08

BOHANNAN HUSTON
425 S. TELSHOR SUITE C-103
LAS CRUCES, NM 88011
(505) 532-8670

Ad#	Publication	Class	Start	Stop	Times	AS/400 Acct
1001110256	LAS CRUCES	0152 - Legal Notices	11/16/2008	11/16/2008	1	720420
1001110256	LAS CRUCES	0152 - Legal Notices	11/16/2008	11/16/2008	1	720420

Total Cost:	$30.67
Payment:	$0.00
Balance Due:	$30.67

TEXT:

Public Meeting NoticePicacho Hills and Old Picacho Drainage Mast

090126 | 009 | 02 | ENGLCS | 12/9/08

DESCRIPTION: Public Mtg. Notice Adv.

ENTERED DATE: 12/11/08

VOUCHER #: 63334

ENTERED BY: Diana G.

Name (Primary) :

Company (Primary) : BOHANNAN HUSTON

Ad # : 1001110256

Width : 1

Depth : 44

Surface : 44.00

Ad Sales Rep. : 315 - Adolph Mota

Class Code : 0152 - Legal Notices

Ad Type :

Account # : 1147794

Start Date : 11/16/08

Stop Date : 11/16/08

Rate : LCLEGAL - LC REG LEGAL 11/28/05 NEW RATE

Box Number : 0 - (None)

Ad Rated Cost : $28.64

Extra : $2.03

Total : $30.67

Run Status : I

Public Meeting Notice

Picacho Hills and Old Picacho Drainage Master Plan

Date:
November 19, 2008

Time:
5:30 PM - 7:00 PM

Location: Doña Ana County Complex
845 N. Motel Blvd
Room 111
Las Cruces, NM

For information contact: Tish Segovia, P.E.
Doña Ana Flood Commission
Phone: 575-525-5554

This will be the second public meeting to present preliminary findings regarding the drainage and storm water system improvements for Old Picacho and Picacho Hills areas.

Pub No. 41204
Pub Date. Nov 16,2008

www.lcsun-news.com

LAS CRUCES SUN-NEWS

PROOF OF PUBLICATION

Lou Hendren, being duly sworn, deposes and says that he is the Classified Manager of the Las Cruces Sun-News, a newspaper published daily in the county of Dona Ana, State of New Mexico; that the notice __41204_is an exact duplicate of the notice that was published once a week/day in regular and entire issue of said newspaper and not in any supplement thereof for 1 _consecutive week(s)/day(s), the first publication was in the issue dated ___November 16,2008_and the last publication was November 16,2008 .

Despondent further states this newspaper is duly qualified to publish legal notice or advertisements within the meaning of Sec. Chapter 167, Laws of 1937.

Signed [signature]

Classified Manager
Official Position

STATE OF NEW MEXICO
ss.
County of Dona Ana
Subscribed and sworn before me this 2 day of December 2008

[signature]

Notary Public in and for

Dona Ana County, New Mexico
September 22, 2012
My Term Expires

OFFICIAL SEAL
ERIN N. OWENS
Notary Public
State of New Mexico
My Comm. Expires 9-22-12

Public Meeting Notice

Picacho Hills and Old Picacho Drainage Master Plan

Date:
November 19, 2008

Time:
5:30 PM - 7:00 PM

Location: Doña Ana County Complex
845 N. Motel Blvd
Room 111
Las Cruces, NM

For information contact:
Tish Segovia, P.E.

Doña Ana Flood Commission

Phone: 575-525-5554

This will be the second public meeting to present preliminary findings regarding the drainage and storm water system improvements for Old Picacho and Picacho Hills areas.

Pub No. 41204
Pub Date. Nov 16,2008

8/20/08

STREET ADDRESS ~~COMPANY~~	NAME	TELEPHONE NUMBER	email address ~~FACSIMILE NUMBER~~
1600 Via Turquesa	Bernie Kute	647-8970	bgkute@comcast.net
ETZ	LEON BLUESTONE	624-6294	[illegible]
Alto Estates 3	Scott Hoffman	526-3451	—
1606 VIA DIAMANTE	LARRY GOFORTH	527-1707	—
6065 Linda Vista Dr	Michelle Archuleta	526-3303	—
1211 Vintage Ct	JILL JOHNSON	635-2490	jaj1130@msn.com
10022 Catalonia Ct	Sylvia Bizzell	524 9273	sbizzell2@msn.com
2214 Pepper RD	LOU BIAD	523 4857	APRILBIAD@AOL.com
6620 Butterfield Ridge Dr	ROBERT POTTER	523-5254	VETTE@2POTTERS.NET
10 1072 La Quinta St	MARY ALVRMINGHURZ	647-9590	
6440 Vista Valley Dr.	Julie Nagy	525-0253	jnagy@zianet.com
7010 BARCELONA RIDGE RD	JOHN R. WILLIAMS	525-0575	DICKWILLIAMS1@VET2010.com
10600 SAN MARCOS CT	Cliff Terry	523 5568	TerryALCK@AOL.com
6676 Vista Hermosa	Mary Bruegger	523-1712	Jimmery@mac.com
4167 Calle del Centro	Manuel Maggiulli	526-8929	
2225 Pepper Road	Cristan Brood	526-0803	Cristan14@MSN
1212 Titania Court	Kelly Dickson	525 0805	kellydickson@earthlink.net
6750 Bright View RD	ED RUZYLOWICZ	647-5834	RUZYLOWICZ@Q.com
1310 Picacho Hills Drive Ste 1	Tommy Etterling	523-2500	Tommy@Picachomountain.com
20 10070 Tuscany Dr.	Jacqueline Rosch	526-1261	
" "	Robert Rosch	526-1261	
21 Las Casitas	Rosemary Chaffee	525-4694	
6796 Via Campestre	Rebecca McNair	526-9369	vaepm9@yahoo
6843 Via Campestre	Oliver Mizes	527-6609	oliver@cybermesa.com
6715 Bright View Road	[illegible]	524-[illegible]	[illegible]@aol.com
1378 Vista Del Oro			
5245 Tricha	Rivera Vicente	527-2023	Vicentemartin@msn.com
1436 Fairway Village Dr.	Kathy Rodam	523-6411	Krodam@comcast.net
	DIANA ALBA, SUN-NEWS	541-5443	dalba@lcsun-news.com
6751 Via Campestre	Juliana Porter	541-1521	
31 1236 Regency Ct	David Zeend	523-0913	phpaala@yahoo.com

8/20/08

~~COMPANY~~ STREET ADDRESS	NAME	TELEPHONE NUMBER	~~FACSIMILE NUMBER~~ email address
SELF	STEVE SEARS	C. 575 405 7419	SSEARS @ DA.STATE.NM.US
6780 Bright View	Chuck Mueller	575 647-4045	chuck_wagon4u@hotmail.com
6704 Camino Blanco	Chad Dunn	575 496-3100	chadcdunn@hotmail.com
1380 Via Norte	Franklin McKay	644-1762	mmcmckay@zianet.com
6861 Via Campestre	Tom Geter PHCC	312-1332	
1390 Via Norte	Mike Quigley	647-9203	mquigley3@aol.com
8140 Constitution	Jan/Lamar Harrison	5419984	harrison134@msn.com
1229 Academy Ct.	David + Verona Wright	626-6122	gr8scape@comcast.net
2280 Pepper Rd	Vicky Schneider	523-1692	
1200 Titania Ct	Tim Henderson	649 5771	TimHenderson@Remaxg.net
6807 Via Campestre	Bill/Lorita Cline	523-4501	
10088 Catalonia Ct	Barry Swenson	202-6243	BSWENS@msn.com
10040 San Marcos Ct	Jim Haynoe	524-9399	jimhaynoe3@msn.com
2935 San Lorenzo Ct	Ruben Aguirre	523-2500	ruben@organmountain.com
6795 Via Campestre	Charles Mullis	523-0655	chad.mullis@us.army.mil
10072 San Savino Ct	David Sachs	526-6410	dasachs@msn.com
4400 Cresta Trl. Rd	Albert T. Carrillo	525-3453	
6814 Via Campestre	Sally Schutte	6887352	schuttejands@msn.com
6 "	Jeff Schutte	9080077	" "
6799 Desert Blossom Rd	Gary Roverman	523-4003	forn6tech@yahoo.com

D

8/20/08

STREET ADDRESS ~~COMPANY~~	NAME	TELEPHONE NUMBER	~~FACSIMILE NUMBER~~ emailaddress
6620 Butterfield Ridge	Martha Potter	523-5254	JEEP@ZPOTTERS.NET
1390 Via Norte	Mo Quigley	647-9203	mquigley3@aol.com
CLARE + HARVEY KAPLER	10000 TUSCANY	525-1382	CEK10000@HOTMAIL
1200 Regency Ct.	Larry Falhauer	526-2715	LRFEL01@msn.com
4321 Ladera	Lynn Smith	525 3970	lkindsmith@yahoo.com
10080 TUSCANY DR.	DON MILLER	526-9607	DEEKAYMILLER@HOTMAIL
39 Las Casitas,	Cheryl Fox-Nelson	647-1631	cfngolfgo@comcast.net
4300 Ladera	Veronica Moran	541-0691	mjvmoran@aol.com
4300 Ladera	Juan Moran	541-0699	" "
1310 Picacho Hills	Kenny Tameso	523-2500	kenny@picachomountain.com
6819 Via Campestre	J.P. Scoggin	650-7070	Patrick.Scoggin@gmail.com
1519 Fairway Village Dr	R. H Cehee	525-8760	
3100 Peralta Lane	Jim Pauna	526-8991	N/A
2801 W Picacho SP 6	Rebecca Najera	5267748	N/A
2801 W. Picacho Sp 25	Graciela [illegible]	541 1570	

5)

STREET ADDRESS (printed: ~~COMPANY~~)	NAME	TELEPHONE NUMBER	email address (printed: ~~FACSIMILE NUMBER~~)
6796 Via Campestre	Ed McNair	526-9369	raepm@yahoo.com
4321 Ladera	Geoffrey Smith	525-3970	gsmith@nmsu.edu
1536 Fairway Village	T. Leighton	526-6256	

3

8/20/08

STREET ADDRESS ~~COMPANY~~	NAME	TELEPHONE NUMBER	~~FACSIMILE NUMBER~~ email address
6789 VIA CAMPESTRE	JACK FRETER	(575) 524-2104	JFRETER@NETZERO.NET
	Jason Moberly		moberly@nmsu.edu
3081 Puerta Lane	Mandie Brandon	526-5517	mcbrandon@yahoo.com

3

Picacho Hills Drainage Master Plan

Public Meeting #1

August 20, 2008

Agenda

---

1. Introduction, Doña Aña County Flood Commission (6:00 pm – 6:10 pm)
    a. Presenters
    b. History
    c. Funding

2. Project Overview, Brad Sumrall, P.E. Bohannan Huston, Inc. (6:10 pm – 6:15 pm)
    a. Intent of Project
    b. Project and Meeting Schedule

3. Community Participation (6:15 pm – 7:25 pm)
    a. Review of Aerial Photos
    b. Comment Form

4. Conclusion of Public Meeting #1 (7:25 pm – 7:30 pm)

Drainage Ordinance

Erosion

SCS 1D Program

TR20 II-75 rainfall distribution

Barcelona Rd - culverts & DI

Picacho Hills Drainage Master Plan

Public Meeting #2
Sign In Sheet

November 19, 2008

Name:	Physical Address:	Phone #:	Email:
Scott Holtzhausen	1618 Via Norte	526-3451	
ROD BLASCHE			
MARTY "	1595 VISTA DEL CERRO	524-2989	
DAN CARR	2301 El Camino Real #201	647-0016	

Picacho Hills Drainage Master Plan

Public Meeting #2
Sign In Sheet

November 19, 2008

Name:	Physical Address:	Phone #:	Email:
John Kutney	5613 Mira Montes	525-8470	John.Kutney@Hotmail.com
Tom Clark	1600 Via Diamante	647-1959	trclark13@Comcast.net
Dominic Scaringe	1232 Sonnet Ct	(602) 207-7378	
Robin & Diane Fovargue	1448 Fairway Village Dr	526-9510	robin.fovargue@sympatico.ca
David Rea	1232 Regency Ct.	647-9214	dmhrea@comcast.net
Jerry & Barbara Farber	8080 Constitution Rd.	526-1702	geraldfarber@hotmail.com
Danny Suggs	6745 Bright View rd.	647-2672	dksuggs@zianet.com
A Z Walch	6865 Via Emma	639-2083	

Picacho Hills Drainage Master Plan

Public Meeting #2
Sign In Sheet

November 19, 2008

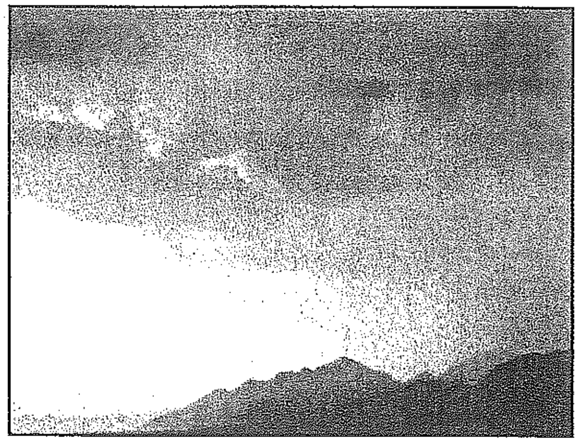
Name:	Physical Address:	Phone #:	Email:
WILLIAM CLINE	6807 VIA CAMPESTRE	523-4501	
STEVE RAMIREZ	256 W. LAS CRUCES AVE.	541-5452	sramirez@lcsun-news.com
STEVEN R. SEARS	1513 FAIRWAY VILLAGE DRIVE	647 2764	SSEARS@DA.STATE.NM.US

Flood Task Force Central Area

Cliff Terry PE, Facilitator

Leo Paz, Alternate

11/21/06 1



Precipitation Frequency Data Server   Page 1 of 5

POINT PRECIPITATION
FREQUENCY ESTIMATES
FROM NOAA ATLAS 14

New Mexico 32.211 N 106.791 W 3874 feet

Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | Docs | U.S. Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.22	0.33	0.41	0.55	0.69	0.78	0.83	0.94	1.03	1.13	1.22	1.38	1.57	1.72	2.19	2.60	3.14	3.60
2	0.28	0.43	0.53	0.72	0.89	1.02	1.07	1.20	1.34	1.44	1.55	1.76	2.00	2.21	2.80	3.32	4.00	4.58
5	0.38	0.58	0.72	0.97	1.20	1.37	1.43	1.58	1.71	1.88	2.07	2.31	2.62	2.91	3.64	4.27	5.10	5.83
10	0.46	0.69	0.86	1.16	1.44	1.65	1.70	1.86	2.00	2.25	2.40	2.73	3.10	3.46	4.25	4.99	5.90	6.72
25	0.56	0.85	1.05	1.43	1.76	2.03	2.07	2.26	2.40	2.73	2.94	3.31	3.77	4.22	5.13	5.94	6.93	7.84
50	0.64	0.98	1.21	1.63	2.02	2.34	2.40	2.56	2.70	3.15	3.38	3.77	4.31	4.82	5.79	6.66	7.68	8.65
100	0.73	1.11	1.37	1.85	2.29	2.66	2.72	2.88	3.01	3.59	3.86	4.25	4.86	5.45	6.45	7.38	8.42	9.44
200	0.82	1.24	1.51	2.07	2.50	2.99	3.06	3.21	3.33	4.07	[illegible]	4.75	5.45	6.10	7.11	8.09	9.14	10.19
500	0.91	1.43	1.77	2.38	2.95	3.45	3.51	3.66	3.75	4.75	5.11	5.57	6.25	7.00	8.03	9.04	10.06	11.14
1000	1.04	1.56	1.96	2.61	3.27	3.82	3.90	4.02	4.07	5.33	5.76	6.16	6.90	7.22	8.74	9.79	10.73	11.82

Text version of table

3.59

```
******************************     SCSHYDRO     ******************************
******************************   Version 1.60   ******************************
*****************   COMPUTER-AIDED HYDROLOGY & HYDRAULICS   *****************

 PROJECT: CORONADO RIDGE SUBDIVISION PHASE 2
    User: DVT
    Date: 05/12/2003     Monday
    Time: 09:48:32
   Input: C:\CORONADO\SCSPOST.TXT
  Output: C:\CORONADO\SCSPOST.100

=====================   RAINFALL HYETOGRAPH INFORMATION   =====================

        RAINFALL HYETOGRAPH: SCS TYPE II
        RAINFALL DURATION:     24.00 Hours
        RAINFALL DEPTH:         3.40 Inches

RAINFALL HYETOGRAPH,
SCS TYPE II
Time (Hours), Total Depth (Inches):

     .000,   .00      2.000,   07      4.000,   .16      5.000,   .27
    7.000,   .33      8.000,   .41     8.500,   .45      9.000,   .50
    9.500,   .55      9.750,   .58    10.000,   .62     10.500,   .69
   11.000,   .80     11.500,   .96    11.750,  1.21     12.000,  2.25
   12.500,  2.50     13.000,  2.62    13.500,  2.72     14.000,  2.79
   16.000,  2.99     20.000,  3.24    24.000,  3.40
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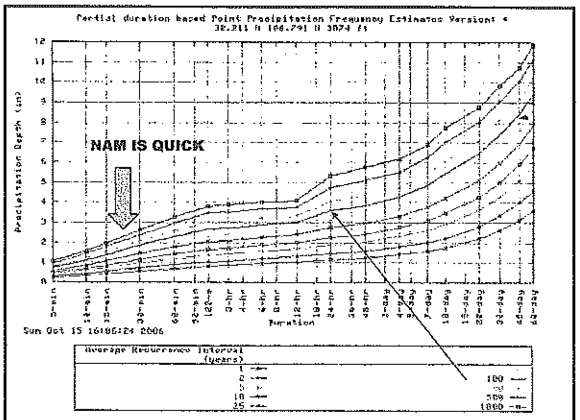

Estimating Runoff

- Computer Software Program Centers
- Soil Conservation Service (SCS)
- Hydrologic Engineering Center
  U S Army Corps of Engineers
  River Analysis System (HEC-RAS)

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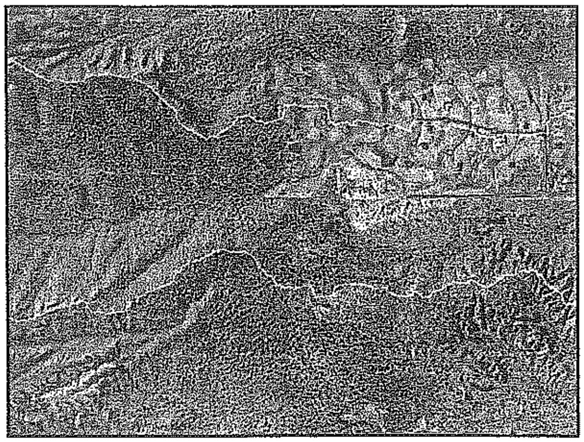


3.2.2 Arroyo:

390.2

TABLE 4-1 and TABLE 4-2 summarize the drainage resulting from storm events within the arroyo. The arroyo watershed was originally 390.2 acres of natural desert mesa terrain. Prior to development, this watershed developed 19.83 acre-feet of runoff from a 100 year storm. The subdivision development removed 15.9 acres of this watershed and routed its runoff to community retention ponds. This removed approximately 2.55 acre-feet of runoff from reaching the arroyo. Basin 40 added 1.00 acre-feet of runoff. The net effect is a reduction in the total runoff generated of 1.55 acre-feet.

19.83 1.55=18.28 (24 hour)

3.2 Floodplain Analysis:

X 43560 = 796,277/1440 = 553 cfs

The existing arroyo was analyzed for the before and after-development conditions as part of the Drainage Study performed for Phase 2. No additional runoff is routed to the arroyo from Phase 3 development. A slight reduction in runoff is directed toward the arroyo and therefore there will be no adverse affect as a result of Phase 3 development.

SUMMARY AND CONCLUSIONS

[illegible]
Date: 09/13/2003 Monday
Input: [illegible]
Output: [illegible]

HYDROLOGIC SUMMARY
Volumes, Losses, and Discharges

APPLIED RAINFALL DEPTH (inches): [illegible]

	VOLUME OF RAINFALL APPLIED (ac-ft)	VOLUME OF RUNOFF (ac-ft)	RAINFALL LOSSES (percent)	PEAK DISCHARGE (cfs)	PEAK DISCHARGE (cfs/ac)
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	56.665	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	75.51	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
SUBAREA [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL WATERSHED	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TOTAL WATERSHED AREA (square miles): [illegible]
TOTAL VOLUME OF DISCHARGE LEAVING WATERSHED (ac-ft): [illegible]

11/21/08

9

P3S2POST.rep

HEC-RAS Version 3.0.1 Mar 2001
U.S. Army Corp of Engineers
Hydrologic Engineering Center
609 Second Street, Suite D
Davis, California 95616-4687
(916) 756-1104

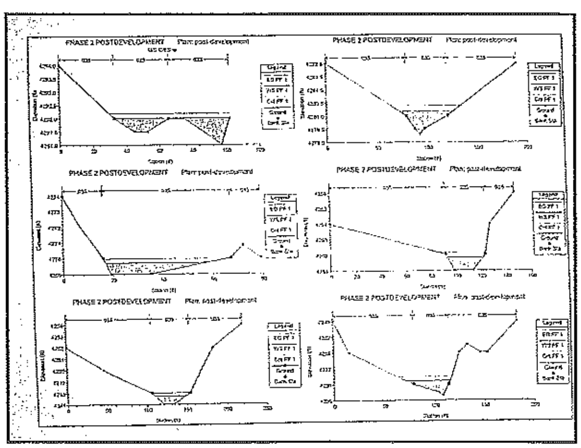
PROJECT DATA
Project Title: PHASE 2 POSTDEVELOPMENT
Project File : [illegible]
Run Date and Time: 10/28/2003 [illegible]

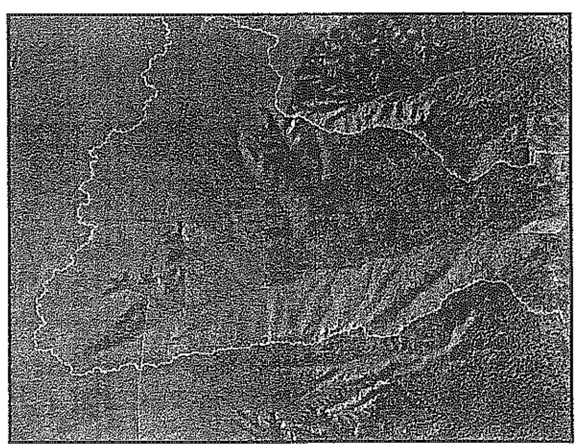
Project in English units

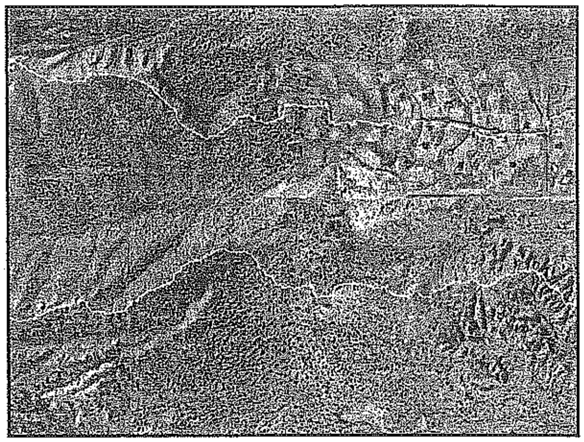
Profile Output Table - Standard Table 1

Reach	River Sta	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
821	150	31.40	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	69.31	0.93
821	140	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.95
821	130	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.01
821	120	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.00
821	110	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.00
821	100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.95
821	97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.02
821	95	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.01
821	93	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.00
821	87	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.01
821	83	Culvert									

Page 1







Location	Q10 (cfs)	Q100 (cfs)	Pipe Size	Pipe Slope	No. of Pipes	10-year HW Elev.	100-year HW Elev.
Pond B	8.6	92.39	36"	1.04%	2	4155.91	4158.95
Pond C	8.6	61.4	30"	3.75%	2	4218.90	4222.99

TABLE 4
CULVERT ANALYSIS SUMMARY

The HW / D ratios at both locations exceeded 2.0. However, since both culverts will back water entirely within their respective ponds, there will be no danger to private properties as a result.

The roadways were analyzed using FlowMaster (*v 5.13; 1994-95, Haestad Methods*) for overflow capacity in the event of 100% blockage of the culverts. In both cases, an 8-foot wide curb cut will be necessary to convey the flow across the roadway at a depth of less than 12 inches. Copies of the FlowMaster analysis are included in the Appendix.

3.4 Channels:

Historical runoff will continue to flow via natural sheet flow. Developed flows will travel via surface flow and / or street drainage. Since much of the runoff will be contained in on-lot ponds and community ponds, there is no need for large channels to convey runoff. Two small channels will be needed. The first will be located at the downstream

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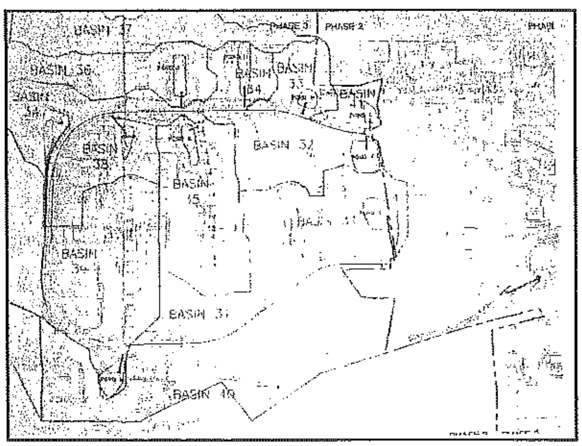
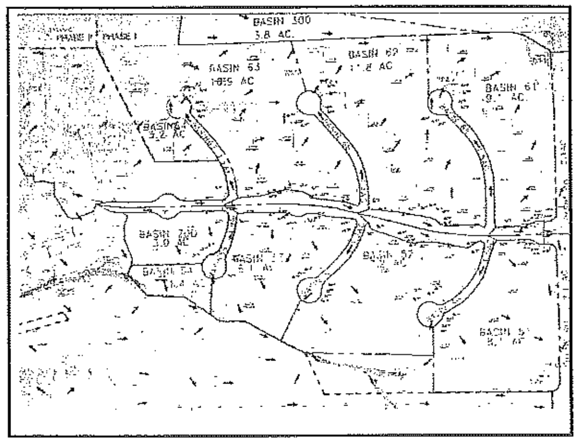
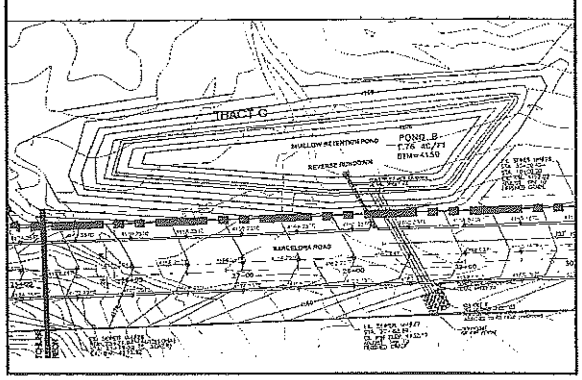
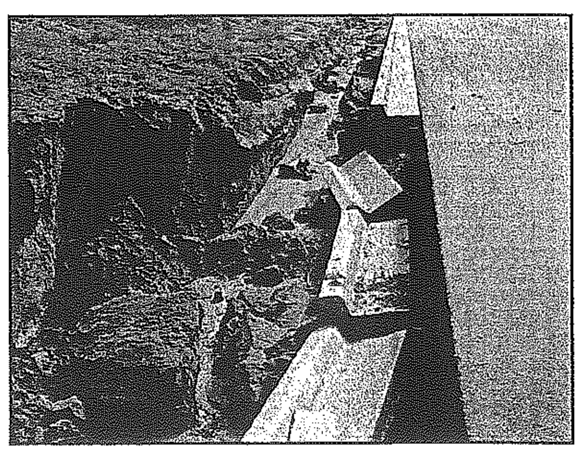
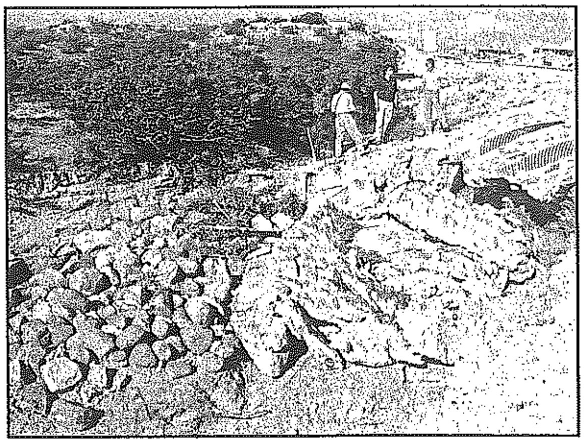




CORONADO RIDGE ESTATES
POND "C"
TWO 30" CULVERTS







Introduction

- Land use in hillside areas where arroyo's exist

Basic Rules

- Leave Historical Arroyos as open space
- Discontinue platting lots in them
- Do not redirect Arroyos or send them over roads
- Provide large area flow with bridges etc.

Community Input

- 120 issues Categorized into 5 priorities with 6 leading issues
- 70 solutions received and prioritized into 10 corrective action solutions

BRAINSTORM

⋆ HILLSIDE MANAGEMENT PLAN

BRAINSTORM

⋆ HILLSIDE MANAGEMENT PLAN

ARTICLE 14. DESIGN AND CONSTRUCTION STANDARDS
14.1.1 Flood Plain and Terrain Management Plan

- Change to: 14.1.1 Flood Plain, Terrain Management and Hillside Management Plan
- Also apply to : DEVELOPMENT DESIGN STANDARDS And other Documents

Key Issues

- Develop Regional Planning
- Establish Flood Control infrastructure
- Construction and Maintenance of Flood Control Structures

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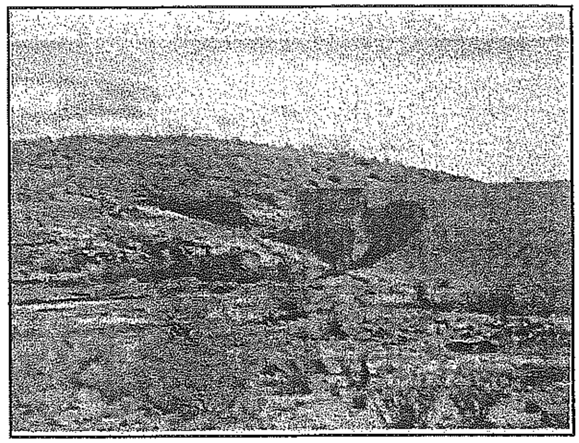
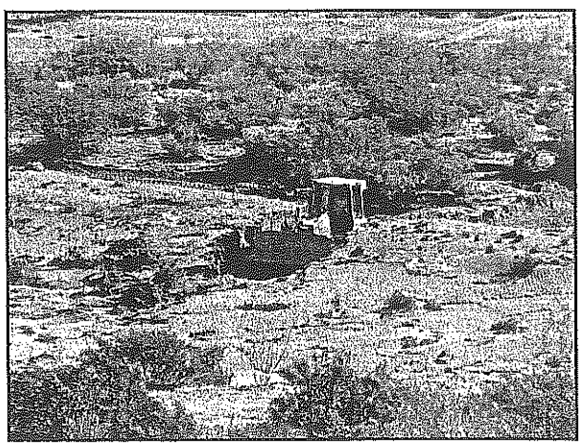
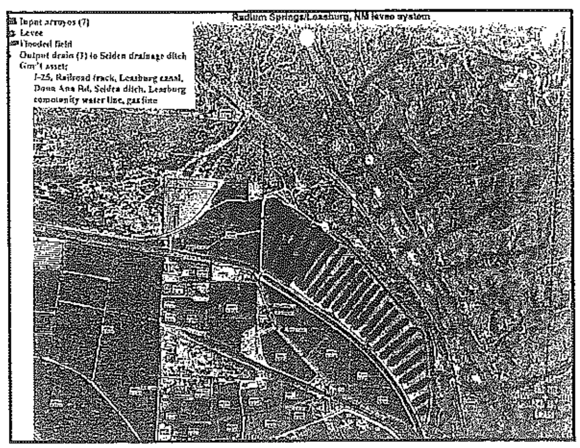
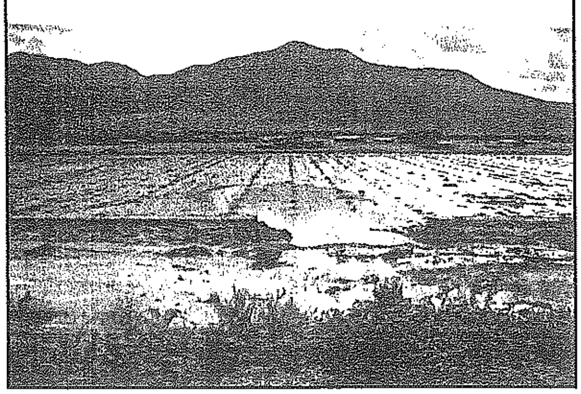


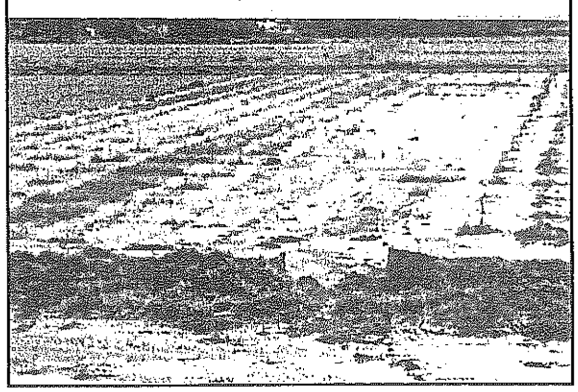


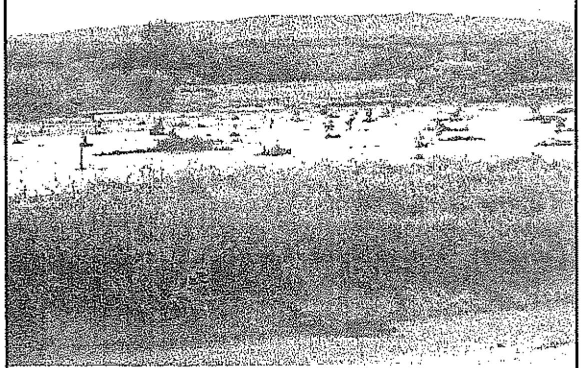


North break (100')



Middle break (20')





South break (100')

Key Issues

- Develop Regional Planning
- Establish Flood Control infrastructure
- Construction and Maintenance of Flood Control Structures
- Scrutinize Flood Plans by Qualified Engineers
- Develop plans for Reservoir and Recharge systems

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Strengthen Regulations

- Platting Outside Arroyos Only
- Provide Storm Drains and flood control systems
- Adequate ponds and Maintenance
- Provide Space for Migrating arroyos
- Bridges & box culverts at Road Crossings
- Use Landscaped Waterways
- Landscape Curbsides, Eliminating Erosion

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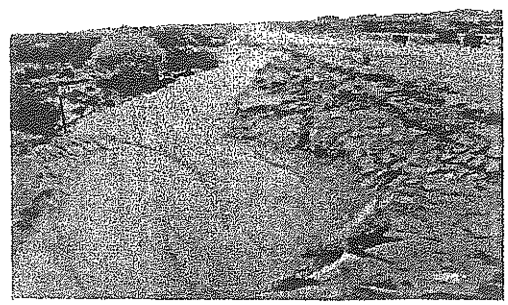
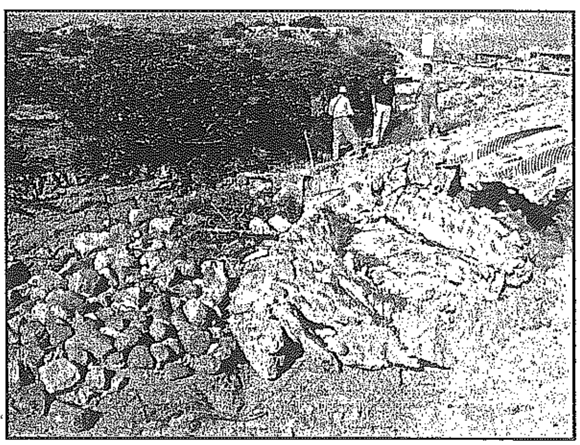


11

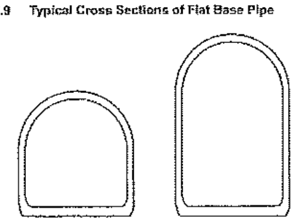
THE THREE CULVERTS ARE 38% FILLED WITH SEDIMENT AND DISTANCE FROM THE BOTTOM TO THE CURB IS 5 FEET (THIS SUMP IS FAR TOO SMALL)



Flat Base Pipe. Flat base pipe as shown in Illustration 5.9 has been used as cattle passes, pedestrian underpasses and utility tunnels. It is normally furnished with joints designed for use with mortar or mastic fillers and may be installed by the conventional open trenching method or by jacking.

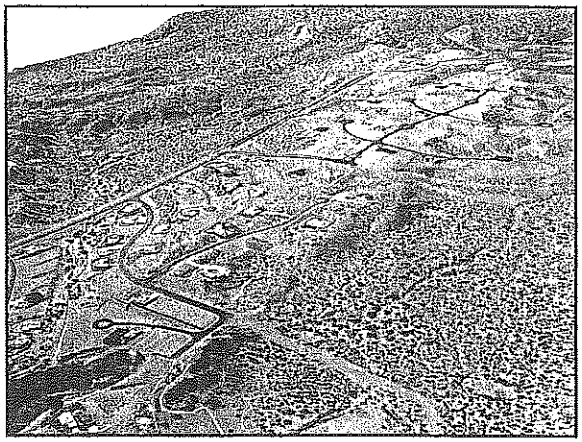
Although not covered by any existing national specification, standard designs have been developed by various manufacturers which are appropriate for a wide range of loading conditions.

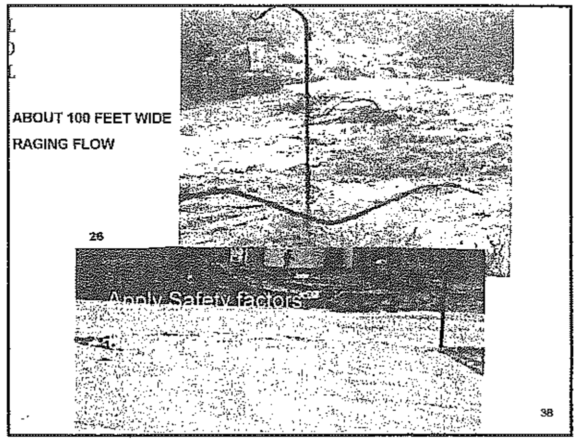
Illustration 5.9 Typical Cross Sections of Flat Base Pipe

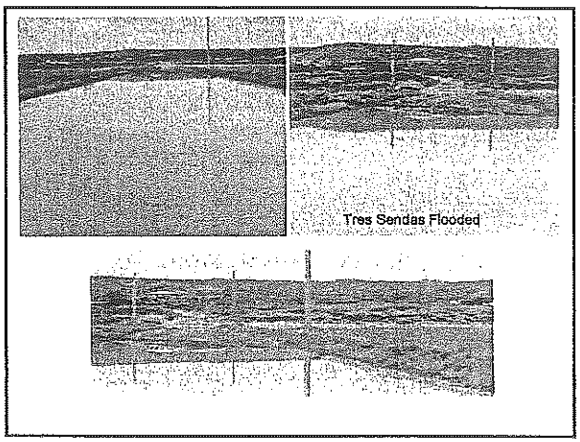


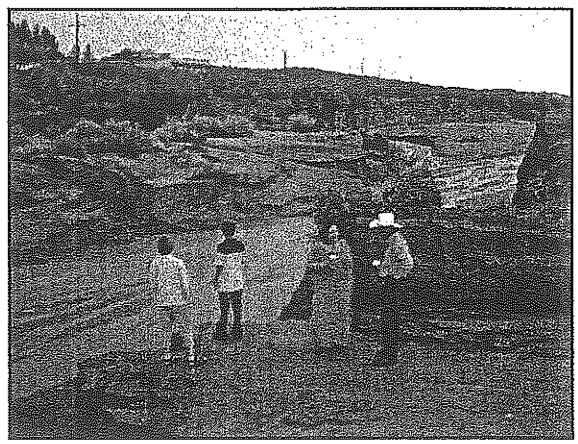
STANDARD SPECIFICATIONS FOR CONCRETE PIPE

Nationally accepted specifications covering concrete pipe along with the









Hillside Management Plan Safety Factors

STANDARD	WEIGHTED
000 – 200 cfs - 33%	133 – 260
200 – 250 cfs – 50%	270 - 390
250 – 300 cfs – 75%	400 - 525
300 – 400 cfs – 100%	530 - 800
400 – 500 cfs – 150%	810 -1250

Over 1250 Consult Army Corps of Engrs.

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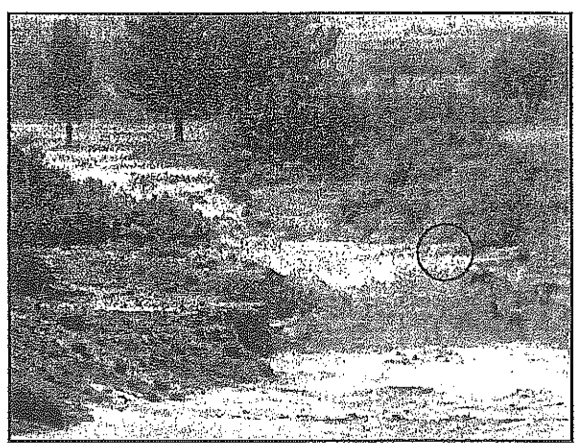

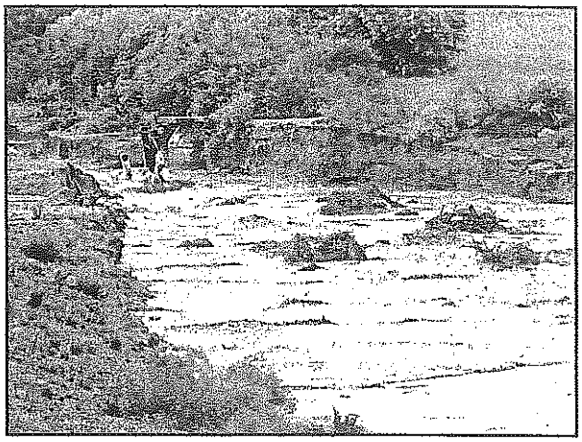

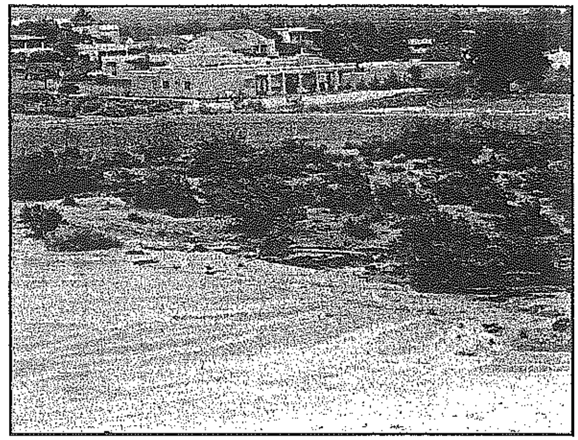

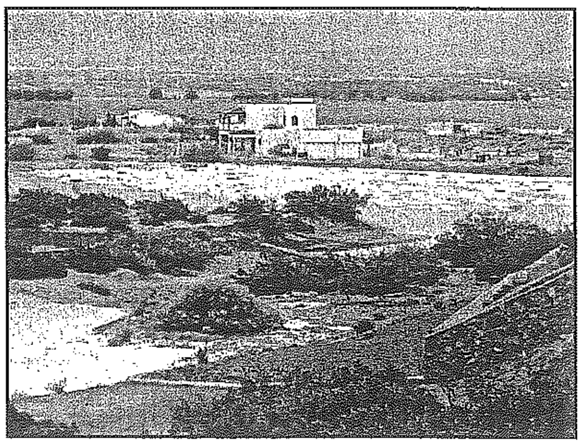

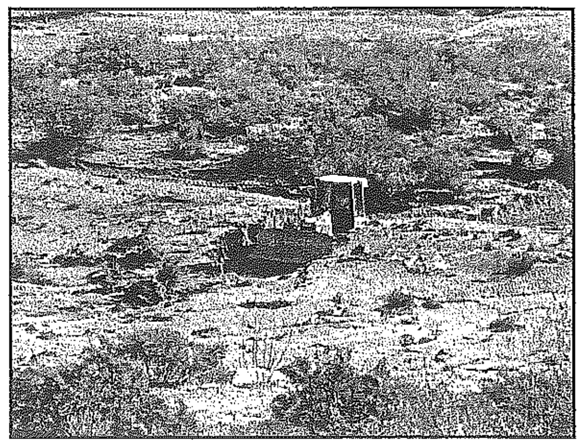

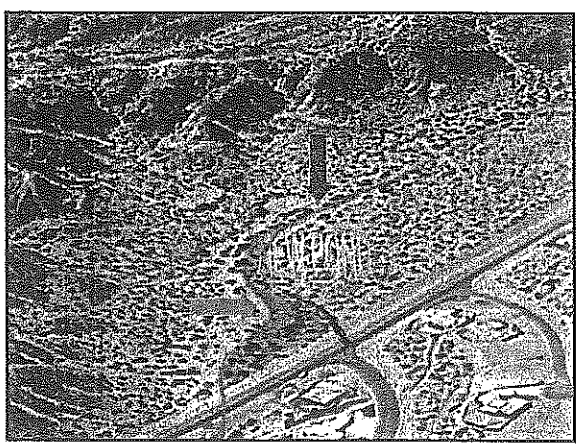

Hillside Management Plan

- Allows for Density of homes to be fit into the lay of the land
- Provides for historical arroyo to be an open space area - undisturbed

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Density Standards

cfs	GRADE	
100 - 200	3 - 5%	Clustered homes 1 home per ¾ acre 20 ft. open space
200 - 250	5 -10%	Clustered homes 1 home per acre & 30 ft. open area to arroyo
250 - 300	10 -15%	Clustered homes 1 home per 1.5 acres & 40 ft. open area
300 - 400	15 - 20%	1 home per 2 acres & 50 ft. open area
400 - 500	20 - 25%	1 home per 3 acres & 75 ft.
500 - 600	over 25%	1 home per 5 acres & 100 ft.

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Density Standards

cfs	GRADE	
150 - 200	3 - 5%	Clustered homes 1 home per ¾ acre 20 ft. open space
200 - 250	5 -10%	Clustered homes 1 home per acre & 30 ft. open area to arroyo
250 - 300	10 -15%	Clustered homes 1 home per 1.5 acres & 40 ft. open area
300 - 400	15 - 20%	1 home per 2 acres & 50 ft. open area
400 - 500	20 - 25%	1 home per 5 acres & 75 ft.
500 - 600	over 25%	1 home per 5 acres & 100 ft.

11/21/06 50

Density Standards

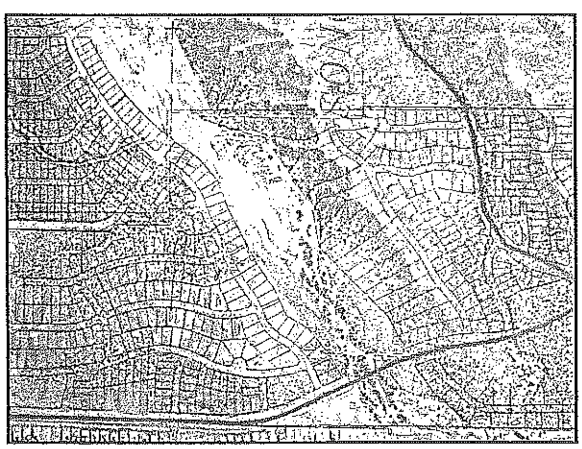
- Over 1250 cu. ft. / sec. Flow
- None allowed unless an Army Corps of Engineers Reservoir is included in the project.

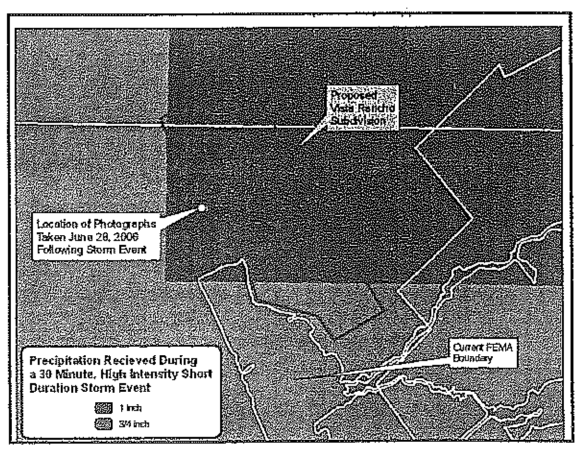
11/21/06 51

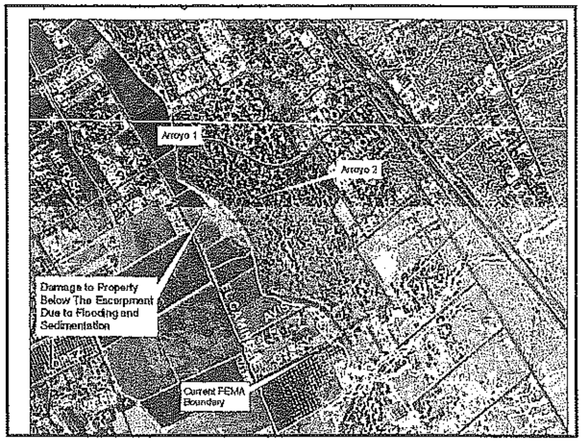
Key Elements

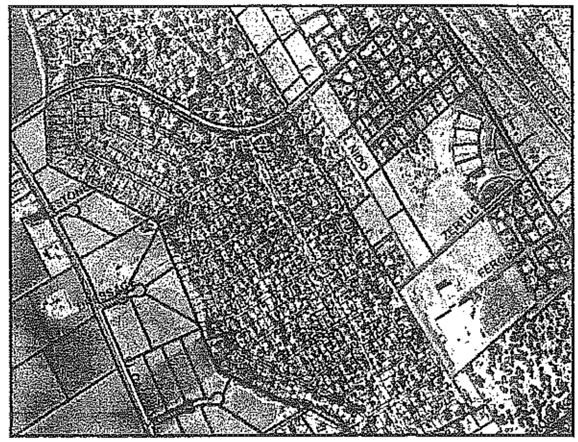
- No properties as an easement

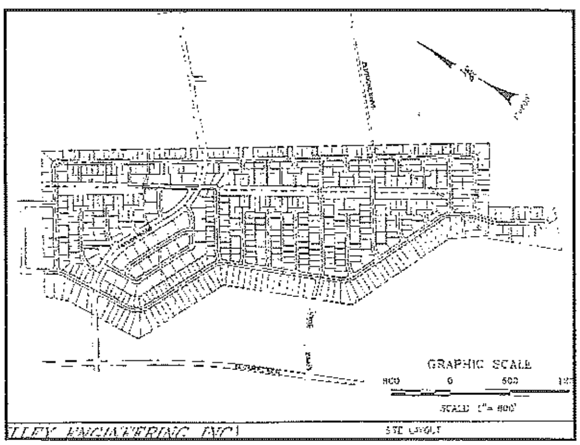
11/21/06 52

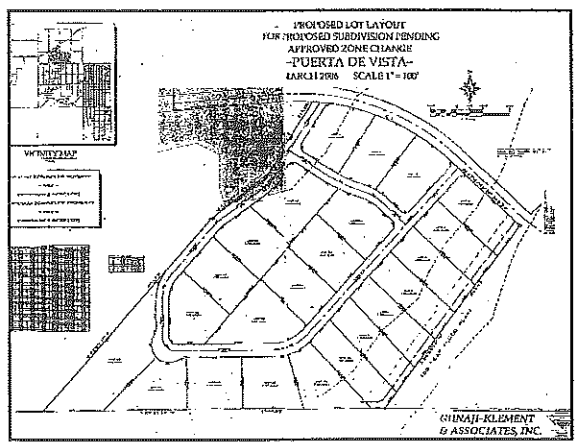


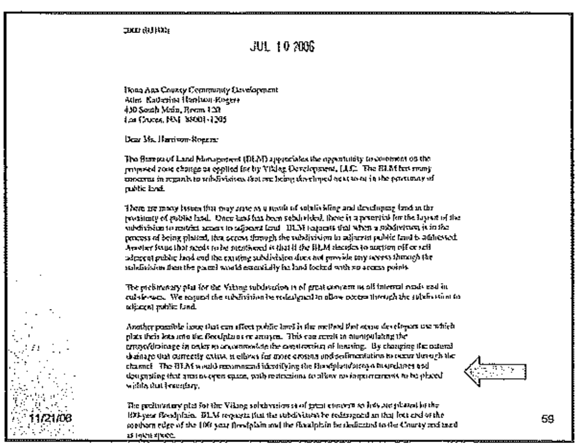











JUL 10 2006

Dona Ana County Community Development
Attn: Katherine Harrison-Rogers
430 South Main, Room 120
Las Cruces, NM 88001-1205

Dear Ms. Harrison-Rogers:

The Bureau of Land Management (BLM) appreciates the opportunity to comment on the proposed zone change as applied for by Viking Development, LLC. The BLM has many concerns in regards to subdivisions that are being developed next to or in the proximity of public land.

There are many issues that may arise as a result of subdividing and developing land in the proximity of public land. Once land has been subdivided, there is a potential for the layout of the subdivision to restrict access to adjacent land. BLM requests that when a subdivision is in the process of being platted, that access through the subdivision to adjacent public land is addressed. Another issue that needs to be mentioned is that if the BLM decides to auction off or sell adjacent public land and the existing subdivision does not provide any access through the subdivision then the parcel would essentially be land locked with no access points.

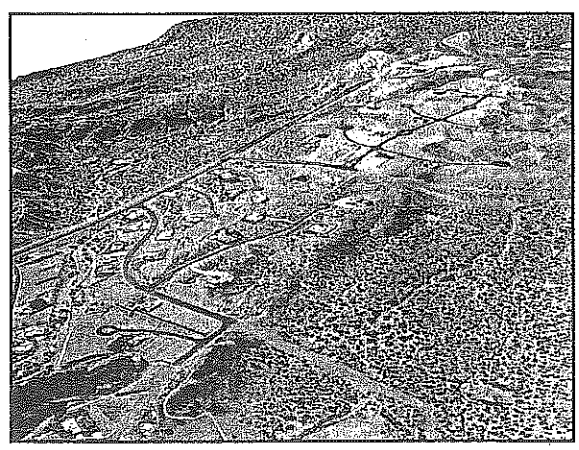
The preliminary plat for the Viking subdivision is of great concern as all internal roads end in cul-de-sacs. We request the subdivision be redesigned to allow access through the subdivision to adjacent public land.

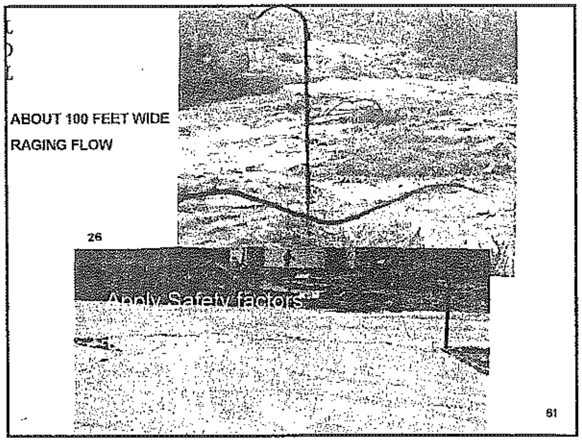
Another possible issue that can affect public land is the method that some developers use which plats their lots into the floodplains or arroyos. This can result in manipulating the arroyo/drainage in order to accommodate the construction of housing. By changing the natural drainage that currently exists, it allows for more erosion and sedimentation to occur through the channel. The BLM would recommend identifying the floodplain/arroyo boundaries and designating that area as open space, with restrictions to allow no improvements to be placed within that boundary.

The preliminary plat for the Viking subdivision is of great concern as lots are platted in the 100-year floodplain. BLM requests that the subdivision be redesigned so that lots end at the southern edge of the 100 year floodplain and the floodplain be dedicated to the County and used as open space.

11/21/08

59

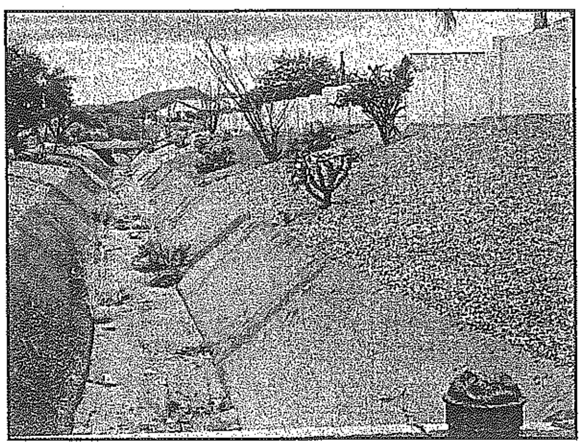




Key Elements

- Use concrete walled or lined channels, interim ponds with concrete weirs, followed by concrete channels or washes to the main dam

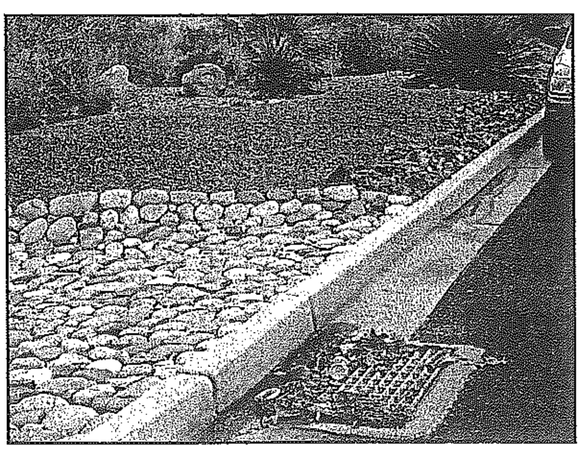
11/21/06 62



Key Elements

- Provide 6 inch curbs at all streets
- Eliminate sand, silting and sediment in residential streets apply drop down storm drains into precast
- Landscape open areas

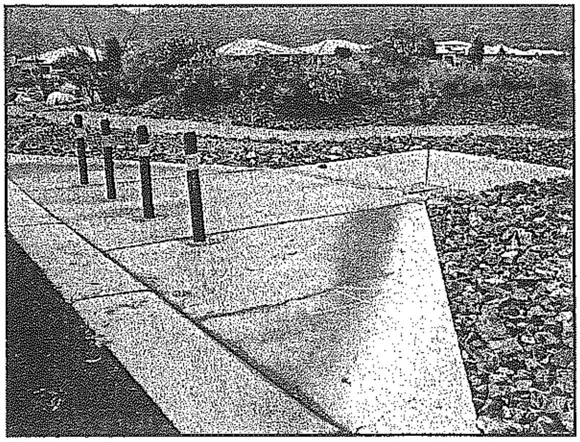
11/21/06 64



Key Elements

- Adopt off road sump design used in Arizona
- They handle larger theoretical capacity with more available area at 70% minimum
- They may be used at existing road swales

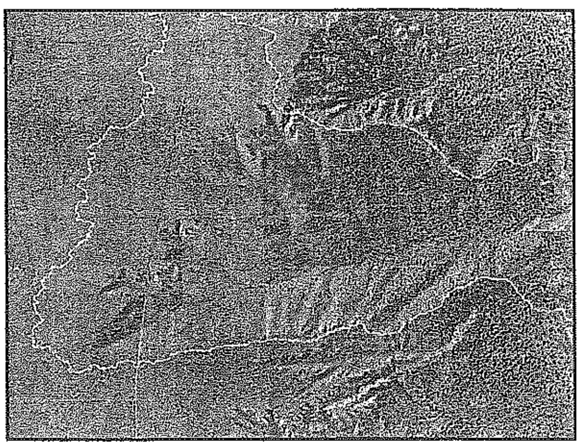
11/21/06 66

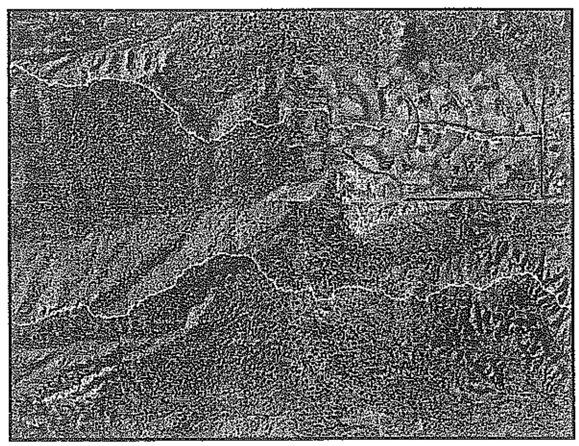


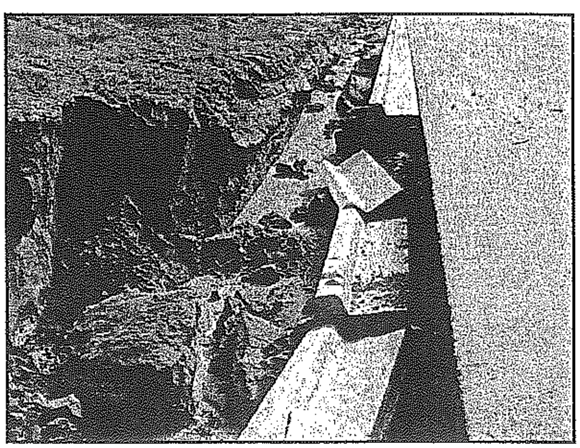
Developer Responsibility

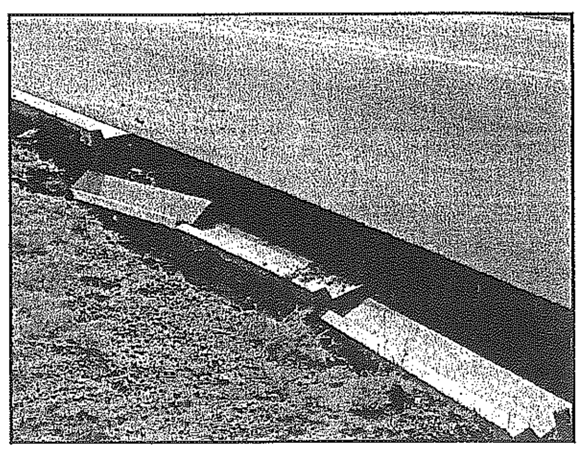
- Realistic designs
- Drainage systems
- Apply safety factors
- NO marginal conditions

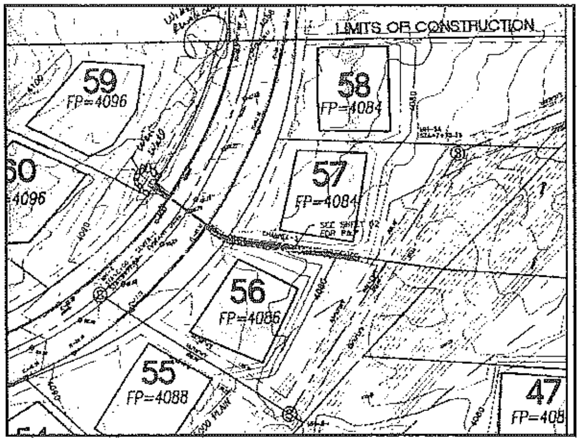
11/21/06 68

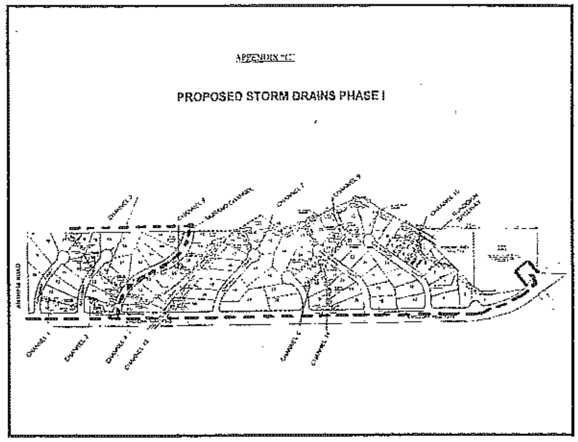








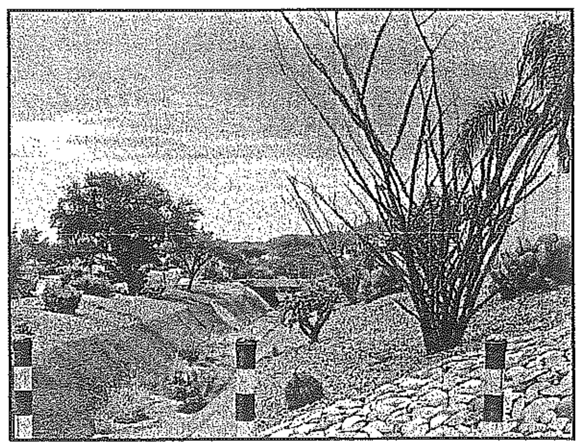




Developer Responsibility

- Landscape and Maintain all open space, ponds etc., annually for 5 years.
- Establish maintenance procedures.
- Organize or contract maintenance team and required equipment.
- Provide records of maintenance cost at dedication.

11/21/06 75



Developer Responsibility

- Developer provides warranty to County for one year

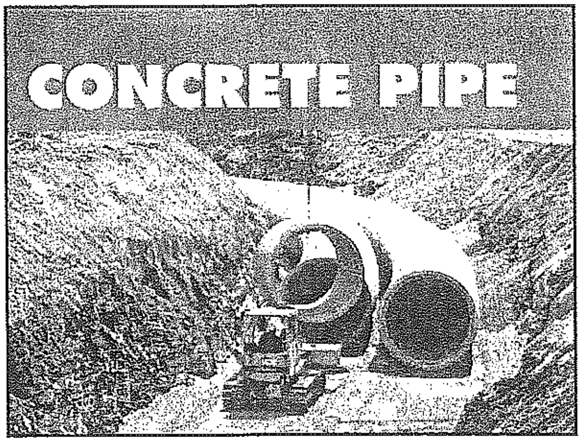
11/21/06 77

Regional Authority

Infrastructure needs - street water Storm Drains

- Large reservoir
- Pumping systems
- Large precast culverts to carry storm water
- Keep water from entering the River during storms
- Treatment plant to re-use water after storms

11/21/06 78

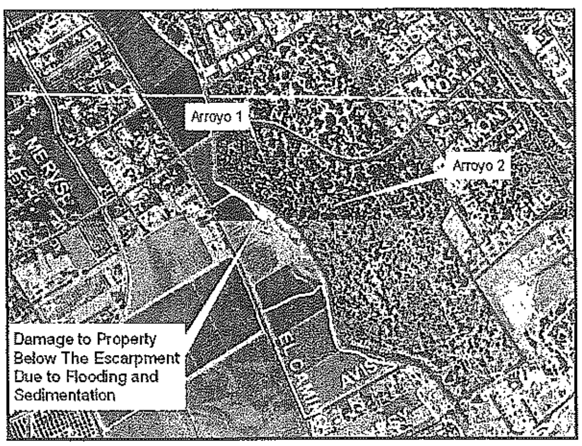


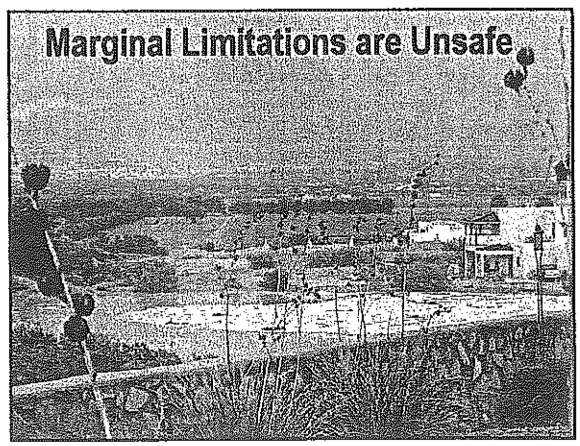
Regional Authority

Infrastructure Needs – Arroyo Water

- Build artificial re-charge systems to carry good arroyo water to underground storage for later use.
- Build Canals to transport water to wells
- Pumping systems to bring water back to use

11/21/06 80





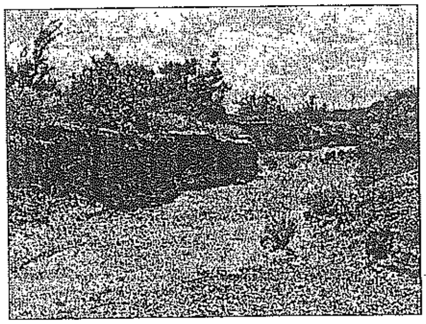
Dona Ana County Flood Task Force Central Area Community Input

- Thank you for this opportunity of expression

11/21/06 83

21ST AUGUST
REGIONALIZED DRAFT - PUPLIC 4MO., 1YR
P&D 2-4

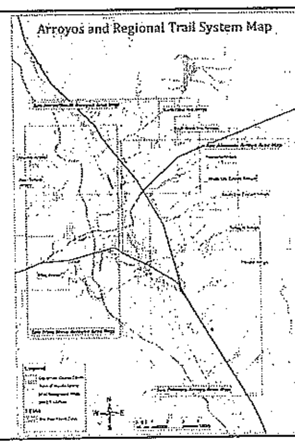
Arroyo Preservation Plan



ARROY & BUFFER
proportional to flow

- **Primary purpose of Plan**
  - Systematic arroyo protection (thru individual master plans)
  - Ensure primacy of drain & flood control function
  - Protect wildlife habitat & connectivity
- **Secondary purpose**
  - Increase trails & trail connectivity
  - Provide additional recreational opportunities
  - Increase protected open space

Policies
Density of homes
regulated
Hillside management



ARROYO DEFINITION
MAJOR ARROYO

Q.

Environment

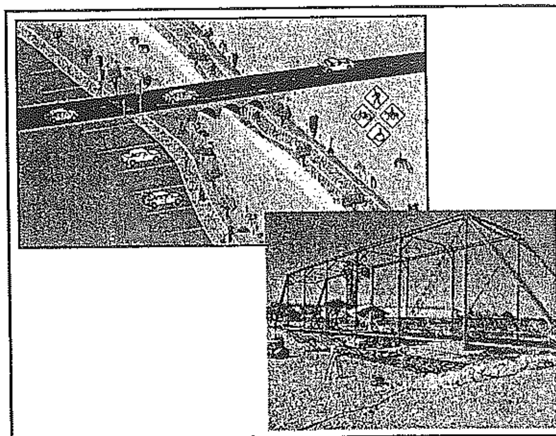
- **Goal 1: Protect and maintain the natural habitat & wildlife connectivity within arroyo systems to the greatest extent possible and mitigate damage that may result from development.**
  - Objective 1: Create a Master Plan for each major arroyo that will preserve local vegetation, wildlife and natural resources to maintain the biological diversity and long-term sustainability of the arroyo ecology.

Design

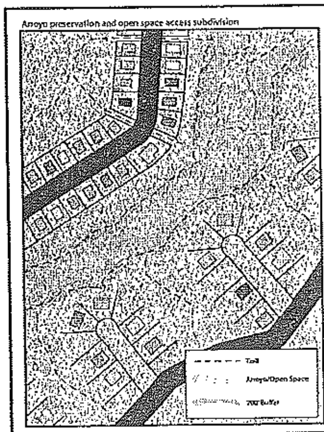
- **Goal 2: Create safe and effective engineering standards for flood control and conveyance while achieving visual harmony and maintaining the natural character of the arroyo.**
  - Objective 1: Trails, flood control structures, amenities and landscaping should be carefully integrated to blend visually into each other.
  - Objective 2: Major arroyos are to remain in a natural or semi-natural condition with native vegetation and channel stabilization consisting primarily of naturalistic treatments.

Land Use

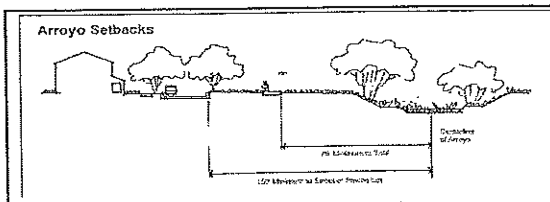
- **Goal 3: Minimize impacts created by development and human activities to realize the full potential of arroyo systems as a community asset**
  - Objective 1: Provide guidelines for development adjacent to arroyos that will preserve their natural character to the greatest extent possible.
  - Objective 2: Subdivision and PUD proposals shall incorporate arroyos and buffers into their larger park or open space plans to the greatest extent possible.



60 · 5 · 300 · 10 = 3K CFS



- Access points to arroyos and trails should occur no further apart than ¼ mile

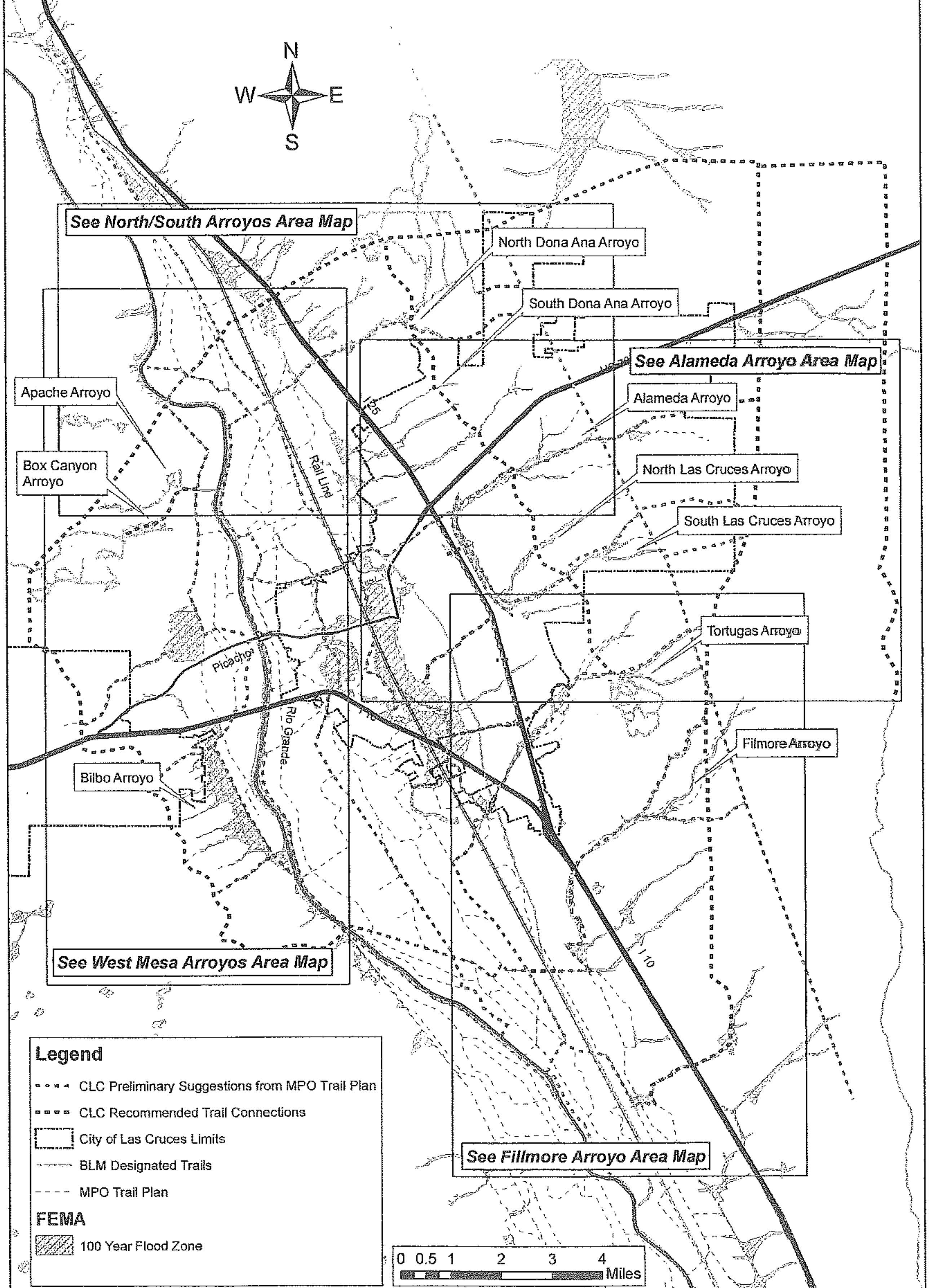


Volcano Heights Sector Plan (Open Space)

- Natural drainage function maintained
- Dynamic hydrology
- Naturalized features encouraged ; fenced-off features prohibited
- Hydrological study and design required of new development
- Development set back ≥150 feet from centerline
- This drainage corridor shall remain as undisturbed desert
- Minimal alternations permitted

NO PLATTING
PIPES
SEWERS

Arroyos and Regional Trail System Map



Coronado Ridge
Neighborhood Association, Inc.
PO Box 554
Fairacres, NM 88033

December 16, 2008

Mr. Jorge Granados
Dona Ana County
Director of Public Works
845 N. Motel Blvd.
Las Cruces, NM 88007

Ref: Underground culverts
West end of Barcelona Ridge Rd.

Dear Mr. Granados,

The Coronado Ridge Neighborhood Assn. has undertaken a large improvement project to preserve the size of our main drainage pond on Barcelona Ridge Rd. by restoring the elevation at the east end of the pond and constructing a concrete emergency spillway to best handle emergency overflow waters in an orderly fashion in the event of catastrophic flooding like we had in 2006.

We have also completed a smaller project at the pond to the east of this large one, at the corner of Barcelona Ridge and Anthem Rds. This was designed to utilize a simple system of underground pipes to carry the runoff into the pond, rather than down Anthem Rd. We hope that this will prevent the massive deposits of dirt on the streets at the bottom of Anthem Rd. and Saragossa Ct.

Part of the current project included pumping a considerable amount of water from the pond as a result of this season's rainfall. While attempting to remove the silt build up from the culverts going under Barcelona Ridge Rd., we have found that the pipes are pitched so flatly that the corrugations in the metal pipes are causing the silt to be deposited in the pipes, rather than carried through them to the outlet on the south side of Barcelona Ridge Rd. Furthermore, the size and length of the pipes make it extremely difficult to clean out the accumulated silt.

I am requesting that the county consider placing smooth plastic inserts into these pipes to allow the flow of water and sediment, and eliminate the silt deposition which will likely cause the whole system to fail.

I am enclosing some pictures of the work that has been done. Thank you for considering our request.

Sincerely yours,

Coronado Ridge Neighborhood Assn.

By:

David S. Zeemont, President

CC - Paul Dugie
Bohannan, Hueston Co. - Brad Sumrall
Tish Segovia

Coronado Ridge
Neighborhood Association, Inc.
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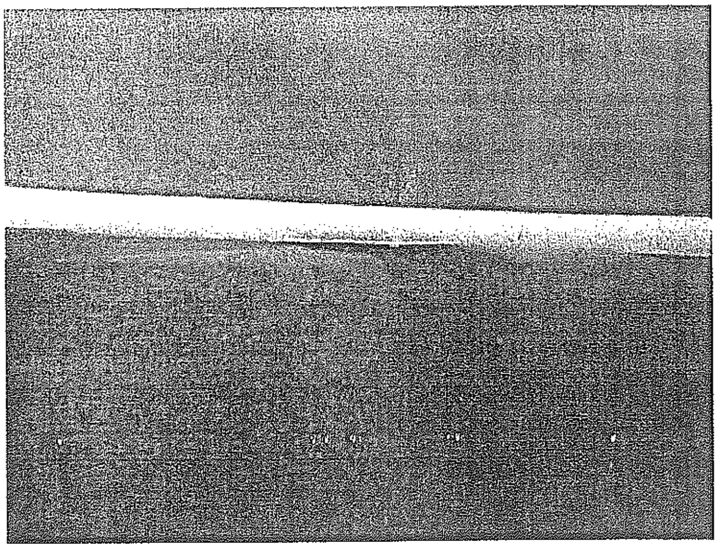

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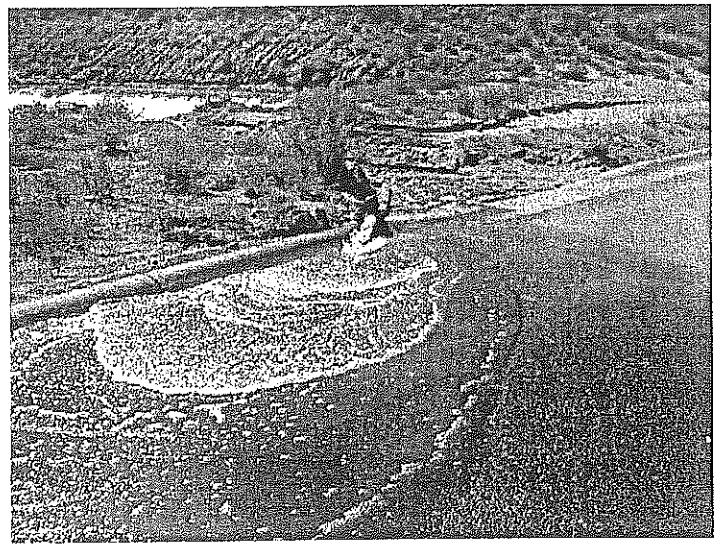

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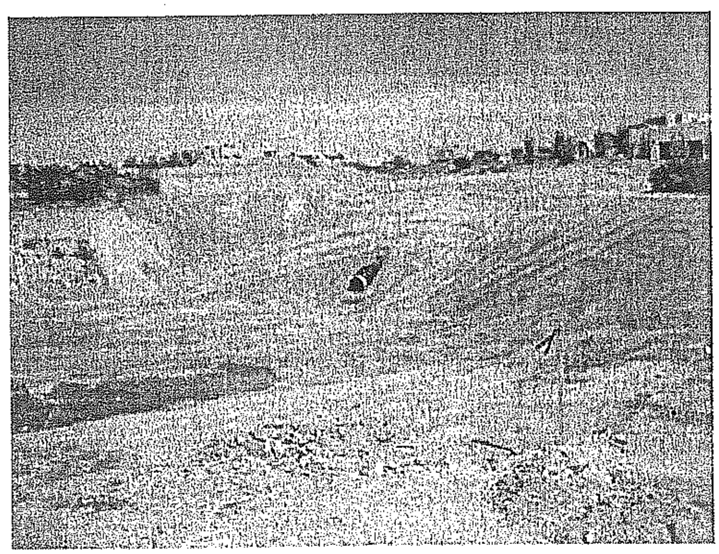

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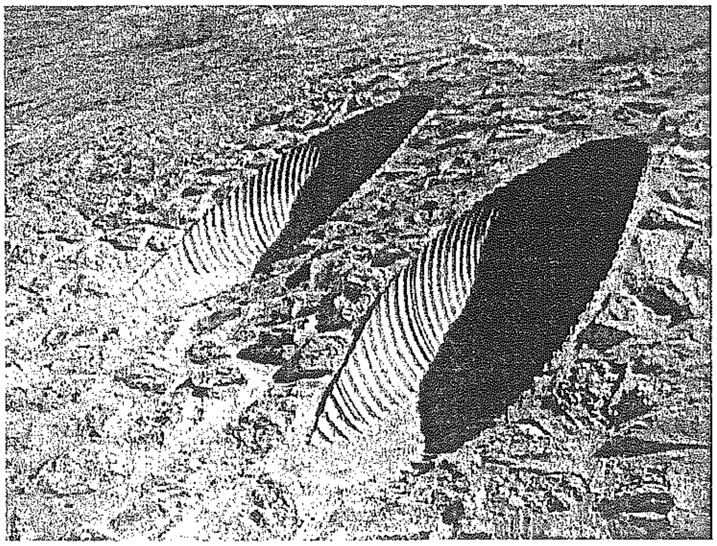

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Bill Terry Project Plan 9/16/08

Picacho Hills Master Plan
Barcelona Ridge Estates

1. Storm Drains on Barcelona Ridge road
2. Pond, lined Channel and Weirs on BLM at Tuscany
3. Round top concrete culverts at channel #15 size for 1000 cfs
4. Culvert under road at Catalonia
5. Storm drain at Murano Ct. to enlarged channel 5
6. Concrete weirs and lined channel rundown at pond "A" inlet
7. Hardscape ROW on Barcelona Re: erosion
8. Concrete rip-rap rundown at bollards

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

EXCESS WATER RUN OFF IN NORTH-SOUTH ARROYO SEPARATING FAIRWAY VILLAGE PROPERTIES AND THE PICACHO HILLS COUNTRY CLUB FOURTH FAIRWAY.

~ 20 TO 40 CUBIC YARDS OF SOIL + TURF COLLAPSED FROM THE ELEVATED FAIRWAY, FALLING INTO THE ARROYO, THUS RADICALLY INTERFERING WITH THE NATURAL NORTH-SOUTH RUNOFF FLOW.

THE DIVERTED WATER FLOW HAS SUCH ENERGY THAT IT IS CAUSING DANGEROUS EROSION - DISTURBING + WASHING AWAY ALL TURF SEPARATING THE ARROYO AND THE WEST WALL OF THE FAIRWAY VILLAGE PROPERTIES.

THE WATER FLOW IS MASSIVE DURING HEAVY RAINFALL

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	STEVE SEARS Name/ Nombre:	
	1513 FAIRWAY Address/ Direccion:	
	VILLAGE DRIVE	
	647-2764 Phone/ Telefono:	
	SSEARS@DA.STATE.NM.US E-mail/ Direccion Electronica:	

Our address also appears on the opposite side of this form, which if folded may be mailed to us directly. /Nuestra direccion aparece en el lado opuesto de esta forma, de tal manera que si la dobla y pega con cinta adhesiva, puede enviarnosla directamente..

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

WE ARE VERY CONCERNED
ABOUT THE WATER + SILT RUNOFF
PICACHO HILLS COUNTRY CLUB
INTO THE ARROYO ON THE WEST
SIDE (PHASE 3) OF FAIRWAY
VILLAGE. A ROCK WALL, WEIR
OR OTHER CONSTRUCTION NEED
TO BE BUILT TO CHANNEL THE
WATER AWAY FROM PROPERTY
OWNERS STONE WALLS

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	ROBIN COHEN
	Address/ Direccion:	1519 FAIRWAY VILLAGE DR LAS CRUCES, NM 88007
	Phone/ Telefono:	525-8760
	E-mail/ Direccion Electronica:	1rdc@comcast.net

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RECEIVED
NOV 10 2008
BOHANNAN HUSTON, INC.
LAS CRUCES OFFICE

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

I WISH WE COULD ALL AGREE TO A SPECIAL ASSESSMENT DERIVED FROM OBTAINING AN ESTIMATE TO LINE THE WEST-SIDE ARROYO(S) SEPARATING FAIRWAY VILLAGE DRIVE FROM THE GOLF COURSE.

WHATEVER THE LOWEST OF AT LEAST THREE (3) BIDS TO PLACE PROPER RIK-RAK ROCKS IN AND/OR ALONG THE LOWER SIDES OF THAT BIG ARROYO COULD CONCEIVABLY BE DIVVIED UP BY THE 67 OWNERS.

PERHAPS TO MAKE IT SEEM MORE EQUITABLE, THE WEST-SIDE PROPERTIES COULD BY ASSESSED 67% OF THE COST AND THE EAST-SIDE PROPERTIES COVERING THE REMAINING 33%.

JUST AS ILLUSTRATION: IF THE JOB COST $20K, THEN EACH OWNER'S SHARE WOULD AMOUNT TO ~$300. WEST-SIDE OWNERS WOULD PAY $450/LOT; EAST SIDE OWNER WOULD PAY $150/LOT

↓

OR SOME VARIATION OF THIS.

Mail to / Envie por correo a:		Please print clearly / Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	STEVE AND ANGIE SEARS — Name/ Nombre:	
	1513 FAIRWAY VILLAGE DRIVE — Address/ Direccion:	
	647-2764 — Phone/ Telefono:	
	SSEARS@DA.STATE.NM.US — E-mail/ Direccion Electronica:	[signature]

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H:\AdminLasCruces\Forms\Picacho Hills Comment Sheet.doc

NOTE: I DON'T KNOW IF I'VE SPELLED 'RIK RAK' PROPERLY.. IT IS MY UNDERSTANDING THAT THIS TERM DEFINES IRREGULARLY SHAPED GRANITE ROCK WEIGHING AT LEAST 20 lbs. EACH. (I PAID CARLOS OVER $700 FOR MY 51'-WIDE EDDY)

SPEAKING FOR MYSELF, I WOULD GLADLY PAY $400-$500 ONE TIME TO HAVE THE ARROYO PROPERLY FILLED WITH PROPER RIK RAK.

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

I know there are many issues with the drainage system, but my main concern is the building pad directly behind my house. The pad was basicly put in the middle of an arroyo, the water is eating away at the pad. If someone builds on this pad they will most likly rock or concrete the sides of the pad which will devert the water toward my wall. I think the pad could be moved south far enough to let the water flow on its original path.

If you have any questions or would like to set up a meeting please call me

Thank you

[signature]

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	Danny + Kara Suggs
	Address/ Direccion:	6745 Bright View rd.
	Phone/ Telefono:	575-647-2672 575-644-5330
	E-mail/ Direccion Electronica:	dksuggs@zianet.com

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Kris Johnson

From: Terryalcl@aol.com
Sent: Friday, September 26, 2008 10:34 AM
To: Kris Johnson
Subject: Fwd: Fw: Picacho Hills Community Comments
Attachments: Re: Fw: Picacho Hills Community Comments

In a message dated 9/26/2008 10:28:34 AM Mountain Daylight Time, Terryalcl writes:

> Dave,
> The following notes may be helpfull to Bohanan Houston.
>
> 1. The storm drains for Barcelona, (BH #7) need to include storm drains down Murano and across Tuscany as channe,l #5 and the inlet at Murano to a small trench into a culvert weir and under the road cannot take all the water that comes down Tuskany grade in a 90 degree turn. Houses across the street have been flooded out . Channel #5 is far too small and the sewers have been broken open in the arroyo at the foot of it.
>
> 2. Sediment deposits still ocurr with each rainfall at Saragosa because of water flow down Anthem bringing it to Barcelona channel #1 and a swale in the raod at the channel. Re: BH #* The inlet is as it was originally installed Too small and a positive grade which cannot take water from Anthem Re letter to J. Moscato 9/7/05 P. Dugie 8/22/05 and field trip with P. Dugie August 2005.
>
> 3. The East bank of Anthem still flows water into the back yards of two Barcelona properties bringing erosion over the bank
>
> 4. Dam at pond "A" Barcelona Ridge failed in 2006 and was not properly re-constructed. Pond was not dug deep enough at that time and not enough erosion was returned upstream Sewer Head #8 is again exposed due to erosion. re: BH #44
>
> 5. Excessive erosion at Goldeney Ct. due to steep banks not attended with landscape and vegetation.
>
> 6. When road was repaired at Barcelona due to being undermined with overflow from the pond "B" the erosion from the bank and local area was not re-built to original elevation 4160. The inlet of the two 36" culverts under the road is now two feet above the bank at the east and if water reaches the inlet level it will flow over the east bank which is now at elevation approx. 4155. Re: BH #9
>
> 7. Severe erosion in the 100 year flood plain has taken much land away from the golf course fairways and exposed several sewer heads including total exposure of #8. It has destroyed the original 14foot wide 157 foot long spillway the led water into pond "A" and some attention is required with drop down weirs to reduce velocity of flow and control further erosin.
>
> Sincerely,
>
> Cliff Terry P.E.

Butterfield Ridge I Neighborhood Council
6625 Butterfield Ridge
Las Cruces, NM 88007
October 5, 2008

Brad Sumrall, P.E.
Bohannan Huston, Inc
425 S. Telshor Blvd.
Las Cruces, NM 88011

Dear Mr. Sumrall:

As requested at the Picacho Hills Drainage Master Plan Public Meeting held August 20, 2008, we would like to bring our concerns to your attention.

Our neighborhood council owns the public lands surrounding the intersection at Vista del Reino and Vista del Cerro. We have attempted, given our resources, to manage the water at this intersection and maintain the ponding areas on our property, as well as to work with adjacent neighborhoods to minimize the problems. These efforts have not been completely successful; therefore the Master Drainage Plan and the solutions it suggests are of great interest to us.

By affixing our signatures, we are requesting you to carefully consider our petition. We will look forward to updates and a timely completion of the plan.

Sincerely,

Martha Potter

Martha Potter, Treasurer
Butterfield Ridge I Neighborhood Council

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

Problem: **Water AND sediment from Blanco's new development at the intersection of Vista del Reino and Vista del Cerro:**

1. The intersection floods and problems are caused along Vista del Reino, especially for homeowners on the south side.
2. The culverts under Vista del Cerro become blocked
3. Sediment builds up on the west side of the culverts as well as filling the drainage ditch along the north side of Vista del Reino.

Suggestions:

1. Develop solutions upstream (in Blanco's development) so that water is contained
2. Channel water into existing drainage ditch instead of allowing it to flow down Vista del Reino
3. Address problems at the culvert area – either KEEP CULVERTS CLEANED OUT – or – provide an alternative solution for water to cross Vista del Cerro

Important:

1. Blanco's development will not be built out for several years; Plan MUST address current issues as well as considerations once the development is complete.
2. If the culverts under Vista del Cerro are to be the final solution, AND in the interim, we need to have them on a schedule to be kept open!

We consider this to be one of the major water drainage problem areas in Picacho Hills and expect it to be high on the list of projects in the Drainage Master Plan.

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C- 103 LasCruces,NM88011 (575) 532-8680	Name/Nombre:	Butterfield Ridge I Neighborhood Council
	Address/Direccion:	6625 Butterfield Ridge Dr Las Cruces, NM 88007
	Phone/ Telefono:	(575) 523-5254
	E-mail/ Direccion Electronical	jeep@2potters.net

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H:\AdminLasCruces\Forms\Picacho Hills Comment Sheet.doc

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

Signature	Printed Name	Date
[signature]	PETER J PESSICO	10/5/08
Janice F. Peyton	Janice F. Peyton	10/5/08
Debra & Tom Komp	Debra & Tom Komp	10/5/08
[signature]	MEUNGHEE JOUNG	10/5/08
Jo Straniello	Jo STRANIELLO	10/5/08
[signature]	JOHN E CHRISTENSON	10/5/08
Carol Christenson	CAROL CHRISTENSON	10/5/08
Gerald Carson	GERALD CARSON	10/5/08
Vic Doran	Suki Doran	10-5-08
Jim Ayala	JiM Ayala	10/5/08
Nelson P. Ayala	NELSON P. AYALA	10/5/08
Marlene Cleis	MARLENE CLEIS	10/5/08
Annette M Hendrick	Annette M Hendrick	10/5/08
Edward J Hendrick	Edward J. HENdRICK, JR.	10/5/08

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Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C- 103 LasCruces,NM88011 (575) 532-8680	Name/Nombre:	Butterfield Ridge I Neighborhood Council
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Kris Johnson

From: Sequoia Zeemont [phpoa1@yahoo.com]
Sent: Monday, September 29, 2008 1:53 PM
To: Kris Johnson
Subject: Fw: Re: Fw: Picacho Hills Community Comments
Attachments: Fw: Picacho Hills Community Comments

Dear Kris,

Here are some more problem areas as reported by our residents. John Kutney was with me at our meeting on the 16th.

Thank you for sending me the map and key.

Dave Zeemont

--- On **Thu, 9/25/08, john.kutney@comcast.net** *<john.kutney@comcast.net>* wrote:

> From: john.kutney@comcast.net <john.kutney@comcast.net>
> Subject: Re: Fw: Picacho Hills Community Comments
> To: phpoa1@yahoo.com
> Date: Thursday, September 25, 2008, 4:00 PM
>
> Input for the Mira Montes Area:
>
> 1. Pooling of water and silt at the base of Mira montes (addresses 5613 &5615 Mira Montes) from run off from Barcelona Ridge and Mira Montes. Street crossover is not aligned with concrete culvert causeing water to pool and build up at base of Mira Montes. Flood of 2006 washed up onto the front yards of the homes.
>
> 2. Flood of 2006 caused severe erosion of the rock walls along concrete culvert behind Mira Montes running West to East. The concrete culvert over flowed and eroded ground.
>
> 3. Concrete culvert at the end of Mira Montes (between 5611 and 5613 Mira Montes) is eroding ground at its base leading into the dessert area located East of Mira Montes.
>
>> -------------- Original message --------------
>> From: Sequoia Zeemont <phpoa1@yahoo.com>
>
> Enclosed are pdf files, from Bohanan Huston indicating the drainage problem areas that they have received from the residents of Picacho Hills. You may need to expand the map to get the corresponding numbers to come up. I would appreciate your comments, especially if you think any areas have been left out. The areas are not displayed in any particular order of seriousness. I do not have permission to publish this information or distribute it widely as yet.
>
> Best,

Dave

--- On **Thu, 9/25/08, Kris Johnson** *<kjohnson@bhinc.com>* wrote:

> From: Kris Johnson <kjohnson@bhinc.com>
> Subject: Picacho Hills Community Comments
> To: phpoa1@yahoo.com
> Cc: "Dan Grochowski" <Dgrochow@bhinc.com>, "Brad Sumrall" <bsumrall@bhinc.com>
> Date: Thursday, September 25, 2008, 10:44 AM
>
> Greetings Mr. Dave Zeemont,
>
> Attached are PDF copies of the comments figure, and associated comments table for your review. Thank you for meeting with us a few weeks back to discuss the drainage issues in the area.
>
> Thanks again,
>
> ---
>
> Kris Johnson, E.I.
> Water Resources
> **direct line:** 505.798.7855
>
> **Bohannan Huston, Inc.**
> Courtyard I, 7500 Jefferson St. NE
> Albuquerque, NM 87109-4335
> www.bhinc.com
> **voice:** 505.823.1000 **facsimile:** 505.823.1234 **toll free:** 800.877.5332
>
>

Message

rezolex.com@zianet.com

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Message 2 of 2 (New)

From: "Janice Neaves" <jneaves@ebid-nm.org>
To: rezolex.com@zianet.com
Date: 15 Nov 2006, 11:38:33 AM
Subject: White paper for bingaman - nmdamsafetycrisis.doc

New Mexico?s Dam Safety Crisis

White Paper for Senator Jeff Bingaman

Gary Esslinger, Manager, Elephant Butte Irrigation District

Introduction:
The State of New Mexico faces an infrastructure crisis that compromises both the physical safety of the public and the potential for economic development in the state. In the middle of the last century, hundreds of flood control dams were built on arroyos in rural areas to protect downstream assets, primarily farm land. The dams were considered to be low risk, with minimal probability of loss of life if they failed. As a result, most were designed to withstand only a 50-year storm (the Flood that has a 2% chance of being equaled or exceeded in any given year), and built with a 50 year service life.

Now, 50 years later, the dams are at the end of their design life. Worse yet, residential and commercial development in the downstream areas protected by many of these dams has dramatically increased the potential for loss of life and high-dollar property damage. Although this changes hazard classification from low to high, the dams remain as they were, constructed for low hazard conditions.

Unfortunately, there is more than just hydrology facing this infrastructural issue. The financial arrangements associated with these dams are oriented toward low hazard maintenance, and the dams are in desperate need of comprehensive reevaluation and rehabilitation, far beyond the fiscal ability of local institutions. The reality of this threat became clear in March of 2006 when the Ka Loko dam, an aged, outdated structure in Hawaii breached killing several people.

Case Study: Elephant Butte Irrigation District
Elephant Butte Irrigation District (EBID) is charged with delivery of irrigation water from the Rio Grande Project to 90,640 acres in Do□na and Sierra Counties in Southern New Mexico. In the 1950s and 1960s, the federal government, through the Soil Conservation Service (now Natural Resources Conservation Service, NRCS) constructed 27 flood control dams along the edges of EBID?s service area primarily to protect the irrigation system and farms from flood damage. The dams are at or near the end of their design life, and in

need of rehabilitation. Now, these dams protect houses, businesses, highways and residential subdivisions.

The dams were turned over to EBID, who has maintained them since. EBID collects $5 per acre per annum from the farm lands protected from flood damage by each dam, a sum that has not increased for years. These areas assessed for flood protection are termed Local Improvement Districts, or LIDs. This is the only funding EBID has for maintenance of the dams.

EBID cannot assess based on the value of the protected lands downstream. EBID also is prohibited from assessing land protected by a dam which is not farm land, regardless of its value. Thus, a million dollar house would pay nothing to EBID for the flood protection afforded by one of these dams. These areas assessed for flood protection are termed Local Improvement Districts, or LIDs. This small amount of money from farmers is all that EBID by law can collect for maintenance of the dams.

Since the construction of the dams, the rural areas protected by the dams have developed into suburban or even urban areas, drastically increasing the consequences of failure of the dams. Rehabilitation to the previous rating of the dams would be inadequate for the current risk caused by downstream development. The dams will need to be upgraded significantly to meet the new regulatory requirements. As long as they protect primarily farm land, they do not require expensive overhaul.

The federal and state governments do offer significant cost sharing for dam rehabilitation and upgrading, but even that falls short of what is needed for the extensive work that needs to be done. For example, the NRCS estimates that rehabilitation and upgrading of the Do□na dam just east of the Village of Do□na would cost about $1.4 million. The federal government will cost-share 65 percent, and the state will cost share 25 percent, leaving EBID, the local sponsor, to contribute 10 percent, or $140,000. A cost higher than $1.4 million is likely, and EBID would be responsible for 10 percent of the final cost, whatever it may be. The LID for the Do□na dam only has $86,000 of funding (and this amount has been built up over many years of collecting farm land assessments) and only $5,000 per year can be collected. EBID has no other revenue sources for work on these dams. The state?s contribution of 25 percent is becoming less certain; losing that component would make rehabilitation even less of a possibility.

New Mexico?s soil and water conservation districts also lack the ability to raise the kind of local revenues needed to match federal and state funds for dam rehabilitation projects. There is little or no statutory authority for these districts to assess their members and other residents to pay for improvements. The county flood commissions are also limited in levying assessments in the amounts needed to raise the local matches. Frequently, the flood commissions have many more dams that they can feasibly maintain already and have no way of raising additional money to pay for rehabilitating other dams.

Federal and State regulatory standards will require the upgrading of many dams. If EBID cannot maintain a dam to an acceptable hazard rating because it lacks the funds to do so, its only alternative is to breach it. This will create new designated flood zones requiring flood insurance for hundreds or even thousands of homes and will cause a serious impediment to the economic development of the area.

The potential for intentionally breaching some of the dams will not even be a matter of choice for EBID. In memo dated June 6, 2006, the New Mexico Office of the State Engineer?s Dam Safety Bureau addressed a developer with a subdivision planned in the vicinity of Fillmore 1 Dam, one of the NRCS dams. In that memo, Dam Safety Bureau Chief Elaine Pacheco, P.E. states that there is no state funding currently available for the non-federal component of rehabilitation funding, and if the area of the dam develops without upgrading the dam, the Dam Safety Bureau may consider a safety order to breach the dam. The Dam Safety Bureau has no other authority to achieve compliance, yet they are required to ensure dam safety. Maintaining the dam in its current condition and design means that there can be no further residential, commercial or other development below it.

Significant acreage in Do□na and Sierra Counties is protected by EBID?s dams, and that area will effectively be off limits for residential or commercial development unless rehabilitation and improvement of the dams can be accomplished. Breaching the dams will place downstream areas in active flood plains, endangering residents and requiring prohibitively expensive flood insurance. Leaving the dams as they are is not possible, as the existing downstream residents face an even greater risk of harm if a dam should burst.

Solutions:
Elephant Butte Irrigation District in particular, and public and private dam owners in general, need more than just technical assistance to address this problem. A more comprehensive approach must be taken, to address the technical as well as the more complex institutional problems in an integrated way. EBID seeks the assistance of all those agencies involved in flood control to find new statutory and other methods of raising the revenues needed to fund the local match so that aging dams can be rehabilitated in order to protect the developing areas of our State. Without new funding sources, these dams cannot be upgraded, development below them will halt, and some dams may have to be breached. The means to assess and collect from those properties and persons benefited from future flood control measures needs to be developed as soon as possible.

##

Message 2 of 2 (New)

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Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

See attachment

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	4B Trust / Julie Diaz
	Address/ Direccion:	6440 Vista Valley
		Las Cruces, NM 88007
	Phone/ Telefono:	(575) 525-0253
	E-mail/ Direccion Electronica:	jogaz@zianet.com

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The Nofziger arroyo ends at our property which causes us serious problems because this is where the slope in Picacho Hills levels off.

Every time we get a hard rain the retention pond on the property gets filled, not just with water and sediment, but with debris such as road signs, road construction barrels, tree branches, fencing materials, construction materials, rocks, etc. Ultimately Picacho Hills rains drain into the valley farm land, sometimes doing much damage to crops.

Farmers have been assessed $5.00 per acre per year since the 1950's for flood protection. Our farm near Picacho, and other farms adjoining ours, has not received any protection at any time for this money that has been paid into the flood protection fund. We believe we are now entitled to serious consideration since more flooding is occurring due to wide scale development in this area.

Attached to this statement we have included a cost-effective proposal to, if not solve the flooding problem, mitigate it greatly. As you can tell from the dates on some of the documents we've been working on this proposal since after the flood of 2006. At that time not only was our property flooded (see attached photos), but some of the roads on the farm were completely destroyed, others seriously eroded. They had to be rebuilt, the farmland re-laser leveled, ditches dug out and repaired, and in some areas replaced. This was extremely costly to us.

So we began working with other farmers in the area, as well as residents, business owners, and developers in the Picacho Hills area. The proposed series of retention ponds and water channels have been very successful in the Tucson/Phoenix area. Not only does it stop the flooding for the most part, but EBID gets to keep the water. We farmers believe any flood water draining down into the valley should be diverted into the EBID irrigation system for the benefit of the farmers and community. Some drain pipes are already in place for this purpose, and complete hook up would be practical and inexpensive. Local contractors dig the holes, keep the dirt, and no money needs be exchanged. EBID, Dona Ana Flood Commission, area farmers, residents and business owners are all on board with this proposal (see petition). We hope you will consider it, as this recurring flooding has become a huge problem on our property.

Picacho – Nafzinger Arroyo
Flood/Drainage Plan

Prepared by
Tom Etterling
Picacho Mountain Development
CBI Holdings Ltd.
1310 Picacho Hills Drive, Ste. 1
Info@cbiholdings.com
505-523-2500

West Mesa – Nafzinger Arroyo
Flood Drainage Proposal

Introduction:

The following proposal is focused on addressing flooding from the Nafzinger Arroyo which runs east from the Airport to the valley and crosses Picacho Hills Drive, north of Picacho Avenue. (see attached drawings) Although this proposal addresses a specific area, it is intended to help develop a model for addressing similar problems in other locations in the county.

Stake Holders:

1. Valley Farmers and Land Owners
   Lou Biad
   Bud Hettinga, and others

2. Picacho Hills Residents (see signature list attached)

3. Business owners and residents on Picacho Avenue
   Dan Dolan – building owner 1310 Picacho Hills Drive
   Dave Gordon – building owner on Picacho Hills Drive
   Dan Karstofsky – land owner on Picacho Hills Drive

4. EBID
   Gary Eslinger

5. County Flood Commission
   John Allen
   Paul Dugie

6. BLM
   Tim Sanders – The BLM is the owner and manager of the majority of land in the Nafzinger Arroyo from the Vista Linda Subdivision to the Airport

7. Picacho Mountain Development and CBI Holdings – project facilitators

8. A.K. Khera – Developer of Vista Linda Subdivision. He has obtained a FEMA permit for crossing the Nafzinger Arroyo. His engineering report provided a study of the historic flows. Mr. Khera is also a registered professional engineer with Zia Engineering and is chairman of the local Society of Engineers.

9. Traveling public along Picacho Hills Drive

Proposal:

To build a series of ponding areas in the Nafzinger Arroyo totaling approximately 22.9 acres or 229.5 acre feet. (See attached exhibit) This would retain the historical flows in a series of small ponds that would provide timed release control of flows through the Arroyo to an existing 24" drainage structure at Picacho Avenue. The drainage structure currently runs to the Rio Grande River.

Proposal highlights:

1. BLM to provide land for ponding along the current arroyo in locations to be determined.
2. Local site work contractors or landowners in the flood plain would be allowed to remove dirt from ponding areas over a 24 month period.
3. EBID to assist agricultural owners in channeling water from Picacho Hills to Picacho Avenue.
4. EBID to assist with improvements to the existing 24" relief line that runs to the Rio Grande River.
5. City will be annexing this property in 2007 and would need to agree to provide maintenance of the ponds.
6. Funding would be required for overflow release pipes or structures from each pond.
7. County would need to assist in initiating this process with the City, FEMA and others.
8. A portion of the Nafzinger Arroyo will remain in the County after the annexations and will require long-term management and oversight by the County.

Benefits:

1. Preserve valley agricultural land from flooding.
2. Protection of current residents and landowners from future flood damage.
3. Protection of County-maintained roads from future flood damage. (Picacho Avenue, Picacho Hills Drive, Quesenberry Road)
4. Return of surface flows to the Rio Grande River.
5. Long term preservation of 1750 acre BLM site between Picacho Avenue and Barcelona Ridge Road.
6. Partnership between landowners, developers and government agencies to model economical solutions to local flood and drainage problems.

Conclusion:

This proposal allows natural percolation in ponding areas and arroyo bottoms, and provides a solution, at minimal cost, to a problem that could continue to cost thousands of dollars annually.

NAFZINGER ARROYO FLOWS

Figures taken from Zia Drainage Report dated August 17, 2006

Nafzinger 100 year flow at Linda Vista Crossing = 3031 CFS
Nafzinger 500 year flow at Linda Vista Crossing = 5153 CFS

3031 cu ft / sec = .06958 acre feet / sec ; Therefore:

10 minute frequency 100 year storm	= 600 sec = 41 acre feet
15 minute	= 900 sec = 62 acre feet
20 minute	= 1200 sec = 83 acre feet
25 minute	= 1500 sec = 104 acre feet
30 minute	= 1800 sec = 125 acre feet

5153 cu ft / sec = .118296 acre feet / sec ; Therefore:

10 minute frequency 500 year storm	= 600 sec = 71 acre feet
15 minute	= 900 sec = 106 acre feet
20 minute	= 1200 sec = 142 acre feet
25 minute	= 1500 sec = 177 acre feet
30 minute	= 1800 sec = 213 acre feet

An acre is 43,560 square feet or about 208.7' by 208.7' square
So a pond 208.7' by 208.7' square at 1 foot deep would be one acre feet and a pond 208.7' by 208.7' square at 2 feet deep would be two acre feet and so on.

A pond 1000' by 1000' by 10 feet deep would be 229.5 acre feet ((1000 x 1000)/43560)x10=229.5 (1000x1000 is about 22.9 acres of land) you can work the numbers in any direction: 500x500 x 40 foot deep would also be about 230 acre feet (500x500=5.74 acres).

Picacho Hills Area
Flood & Storm Drain Strategy

Recent rainstorms have identified drainage problems that currently exist in the Picacho Hills area. Residences and agricultural properties alike have been severely damaged in recent flooding, requiring considerable investment in the repairs and removal of silt and debris from both public roads and private properties. It is evident that a regional drainage solution is imperative to protect all Picacho Hills area landowners and residents from future flooding, erosion and maintenance challenges.

The problems of the Nafzinger wash and the heavy flows of storm water flowing down the mesa, through the valley and into the river have existed for years. This problem has been amplified by ongoing development and record-breaking rainfalls this year. In order to implement solutions before more damage occurs, we are proposing a partnership between landowners, residents and government agencies to develop and implement a plan to address the current flood problems.

Petition

We the undersigned residents of Dona Ana County, New Mexico:

1. Acknowledge the need for a solution to the drainage problems in the Picacho Hills area and support the development of a comprehensive plan for the area.

2. Acknowledge that private investment, as well as public support from the county, state and federal government, is necessary to solve the current drainage problems.

3. Acknowledge that a plan similar to the Albuquerque regional flood plan may need to be implemented.

4. Petition the participation of the County Flood Commission, the State Engineer, FEMA, EBID, and the BLM in developing and implementing a long-term solution to storm drainage and flooding.

Signed,

Signature	Print Name	Address	Farmer/Resident
[signature]	Robert Pfirrhl	#17 Las Cusitas	Resident
[signature]	Tiffany Sterling	1113 Fairway Village	Resident

Signature	Print Name	Address	Farmer/Resident
[signature]	GREGG PERFECT	#12 LAS CASITAS	RESIDENT
[signature]	Richard K. Dickson	1212 Titania Ct.	Resident
[signature]	BILL RAWLINS	2085 CORDOBELLA	RESIDENT
[signature]	Linda Trainer-Miller	1330 Vista del Cerro	Resident
[signature]	DAN Dolan	6565 Vista de Oro	Resident
[signature]	Alan Briley	5207 Imperial Dr.	Residential
[signature]	Ruben Aguirre	1310 Picacho Hills Dr	Landowner
[signature]	Martin Pillar	PO Box 131 Mesilla Park	Resident
[signature]	EDWARD J PILLAR	6844 CAMINO BLANCO	RESIDENT.
[signature]	ROBERT OHEIM	10010 SAN MARCOS CT.	RESIDENT
[signature]	JG HOYNE	10090 SAN MARCOS CT	RESIDENT
[signature]	PAUL GRADWOHL	6510 VISTA DE ORO	RESIDENT
[signature]	Brendan Donnelly	10170 TUSCANY Dr.	RESIDENT
[signature]	Mike Wilson	1400 V [illegible]	Res
[signature]	PETE BRANDT	6884 ALHAMBRA CT	RES
[signature]	ROHAN KLINKHAMMER	6715 DESERT BLOSSOM RD	RES.
[signature]	R. NELSON	1480 VISTA DEL VALLE	RES
[signature]	S. Davis	10100 Tuscany Dr.	RES
[signature]	DM Donnelly	6856 Alhambra	Res
[signature]	KG HETTINGA	4406 [illegible] Campo	Resident [illegible]
[signature]	HOWARD H DUKES	6408 VISTA HERMOSA	RESIDENT
[signature]	GEORGE EVANS	4748 Calle de Nubes	Res

Signature	Print Name	Address	Farmer/Resident
[illegible]	John Johnson	141 Villa Chiquita	R.
[illegible]	Barry Burton	130 Villa Chiquita	R
[illegible]	C. A. Cruz	6814 Via Campestre	R
EPHarvey	EPHarvey Jr	3750 Villa Grande	R-F
[illegible]	Robert Resch	10070 Tuscany Dr	R
[illegible]	[illegible]	1240 City Lots Pl	R
[illegible]	Puneet Ghei	6825 Bright View Rd	R
Sandra Resch	Sandra Resch	10070 Tuscany Dr.	R
Anna Leuenberger	Anna M Leuenberger	8128 Constitution Rd	R
Joyce DeAso	Joyce DeAso	1357 Vista del Cerro	R
Lonnie Wilson	LONNIE WILSON	6815 ALHAMBRA CT	R
[illegible]	Victoria [illegible]	6611 Vista Hermosa	R
Martha M. Capling	Martha M. Capling	1369 Fairway Village Dr	R
[illegible]	Dianne Sage	3205 El Camino Real	R
Chuck Wilson	CHUCK WILSON	6815 ALHAMBRA CT	R
Noel D. Rooney	Noel Rooney	10044 Cantabria CT	R
Edwin Benjamin	EDWIN BENJAMIN	6620 VISTA HERMOSA	R
Stephen Butler	Stephen Butler	8022 Renoir Loop	R
Bruce Shackelton	Bruce Shackelton	6716 CAMINO BLANCO, LC, NM	R
[illegible]	DAVE HANSEN	6610 VISTA DEL REINO	R
Wil Lamarre	WIL LAMARRE	1330 Fairway Village	R
[illegible]	D. M. JAMISON	1501 FAIRWAY VILLAGE DR	R

Signature	Print Name	Address	Farmer/Resident
[signature]	Blake Swanson	4532 Gerald	Resident
[signature]	Gary Jefferes	PO Box 1607 Deming 88031	"
[signature]	Barry McClure	PO Box ~~286~~ 1205	YES
[signature]	Gregg G. Martin	6652 Vista Del Reino	Resident
[signature]	Charlie Blanchard	3205 Arrowhead	Resident
[signature]	R. Logefeil	1622 Via Turquesa	"
[signature]	CJ Pierce	3585 Lucky Lindy Ln.	Resident
[signature]	Jason Clark	6490 Vista Valley Dr.	Resident Architect
[signature]	Vicente Rivera	PO Box 4141 Las Cruces NM	Resident
[signature]	Lee Cunningham	8015 Constitution	Resident
[signature]	Mark St. Paul		" Builder
[signature]	Jeff Branigan	11180 Windflyer Ln	"

Signature	Print Name	Address	Farmer/Resident
[signature]	Jack McIntyre	27 Las Casitas	Resident
[signature]	Dan Spence	28 Las Casitas	Resident
[signature]	Charla Spence	28 Las Casitas	Resident
[signature]	John Lavender	13 Las Casitas	"
[signature]	Leonard Elting	4 Las Casitas	Resident
[signature]	Barbara Elting	4 Las Casitas	Resident
[signature]	Rosemary Chaffee	21 Las Casitas	Resident
[signature]	Linda Kruger	29 Las Casitas	resident
[signature]	Charles Kruger		
[signature]	Donald Kinkel	#22 Las Casitas	resident
[signature]	Dick Apodaca	34 Las Casitas	Resident
[signature]	Joe Kane	#9 Las Casitas	Resident
[signature]	Doris M Nalls	31 Las Casitas	Resident
[signature]	N.H. Nalls	31 Las Casitas	Resident
[signature]	Florence McIntyre	27 Las Casitas	Resident
[signature]	Annette Hendrick	6645 Butterfield Rdg	Resident
[signature]	Ieva Rasmussen	1390 Vista del Cerro	Resident
[signature]	Andrew F. Walch	6865 Via Emma	"
[signature]	Robert N. Potter	6620 Butterfield Ridge Dr	Resident
[signature]	Cheryl Nom-Nelson	39 Las Casitas	Resident
[signature]	Stan Vick	38 Las Casitas	Resident
[signature]	Sabrina Payne	1425 Fairway Village	Resident

Signature	Print Name	Address	Farmer/Resident
[signature]	William Wilburn	30 Las Casitas	Resident
[signature]	AB Fiorin	29 Las Casitas	Resident
[signature]	J H Gardiner	18 Las Casitas	Resident
[signature]	Warren Boozer	1220 Vista Del Monte	Resident
[signature]	V. David Rodgers	1466 Fairway Village Dr.	Resident
[signature]	James W. McHale	1406 Fairway Village Dr	Resident
[signature]	MIKE IZON	1306 FAIRWAY VILLAGE DR, LAS CRUCES	RESIDENT
[signature]	Katharine K. Rodgers	1466 Fairway Village Dr.	Resident
[signature]	Michael Burke	1518 Fairway Village Dr.	Resident
[signature]	IRENE WHARTON	1400 Fairway Village Dr	Resident
[signature]	Thomas Etterley	1413 Fairway Village Drive	Resident
[signature]	Robin Cohen	1519 Fairway Village Dr	Resident

Signature	Print Name	Address	Farmer/Resident
Rose Marie Levasseur	Rose Marie Levasseur	1330 Fairway Village Dr	R
James B. O'Leary	JAMES B. O'LEARY	2136 Stone Pine Dr.	R

Picacho Hills Area
Flood & Storm Drain Strategy

Recent rainstorms have identified drainage problems that currently exist in the Picacho Hills area. Residences and agricultural properties alike have been severely damaged in recent flooding, requiring considerable investment in the repairs and removal of silt and debris from both public roads and private properties. It is evident that a regional drainage solution is imperative to protect all Picacho Hills area landowners and residents from future flooding, erosion and maintenance challenges.

The problems of the Nafzinger wash and the heavy flows of storm water flowing down the mesa, through the valley and into the river have existed for years. This problem has been amplified by ongoing development and record-breaking rainfalls this year. In order to implement solutions before more damage occurs, we are proposing a partnership between landowners, residents and government agencies to develop and implement a plan to address the current flood problems.

Petition

We the undersigned residents of Dona Ana County, New Mexico:

1. Acknowledge the need for a solution to the drainage problems in the Picacho Hills area and support the development of a comprehensive plan for the area.
2. Acknowledge that private investment, as well as public support from the county, state and federal government, is necessary to solve the current drainage problems.
3. Acknowledge that a plan similar to the Albuquerque regional flood plan may need to be implemented.
4. Petition the participation of the County Flood Commission, the State Engineer, FEMA, EBID, and the BLM in developing and implementing a long-term solution to storm drainage and flooding.

Signed,

Signature	Print Name	Address	Farmer/Resident
[signature]	BOB HETTINGER	2205 Shalem Colony Trail	Farmer & Resident
[signature]	JAMES NEWMAN	1815 SHALEM COLONY TRAIL	RESIDENT

Signature	Print Name	Address	Farmer/Resident
[signature]	Louis B Biad	6861 Via Campestre	Business/Land owner/PHCC
[signature]	Don Biad	2290 Pepper Rd	Business/PHCC
Cristan B Ismond	Cristan B Ismond	2225 Pepper Rd	Farmowner
Julie B. Ozaz	Julie B. Ozaz	6440 Vista Valley	Farm Owner

Signature	Print Name	Address	Farmer/Resident
[signature]	Louis B Biad	6861 Via Campestre	Business/Land owner/PHCC
[signature]	Don Bird	2290 Pepper Rd	Business/PHCC
Cristan B Ismond	Cristan B Ismond	2225 Pepper Rd	Farmowner
Julie B. Orgiz	Julie B. Orgoz	6440 Vista Valley	Farm Owner

Picacho Hills Area
Flood & Storm Drain Strategy

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Signed,

Signature	Print Name	Address	Farmer/Resident
Steven Lyles	Steven Lyles	1100 Shalom Colony Tr L.C. 88007	Farmer and Resident
Maxine Tucker	MAXINE TUCKER	5204 SUNASH CT	RESIDENT

Picacho Hills Area
Flood & Storm Drain Strategy

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Signed,

Signature	Print Name	Address	Farmer/Resident
Jovonna B. Hanlon	Jovonna B. Hanlon	1212 Verona Ct	Resident / Business
VB Schneider	Vicky B Schneider	2280 Pepper Rd	farmer/land owner

Signature	Print Name	Address	Farmer/Resident
[illegible]	Wayne Hunter	7000 Camino Suerte La Mesa	Farmer
[illegible]	DONNIE HAGWE	5140 W. Picacho	Farmer/Resident
Virginia Richards	VIRGINIA RICHARDS	425 Spanish Becom Rd Anthony NM 88021	Resident

Signature	Print Name	Address	Farmer/Resident
David H. Thompson	DAVID H. Thompson	PO Box 225 FAIRACRES NM	Resident / Farmer
Eula Fern Thompson	Eula Fern Thompson	P.O. Box 225 Fairacres NM	Resident/ Farmer
Mark Hettinga	MARK HETTINGA	PO Box 449 Fairacres NM 88044	Resident / Farmer
Eula Fern Thompson Trustee	McElyea Generation Skipping	PO Box 225 Fairacres NM 88033	Farmer/Resident

To: Bohannan Houston, Inc.
From: Alto Estates III Neighborhood Council, Board of Directors
Date: September 4, 2008
Subject: Picacho Hills Drainage Master Plan Review

This comment is offered on behalf of the homeowners of the Alto Estates III subdivision of Picacho Hills (hereafter called "AE3"). Over the years there has been considerable flood damage to a number of properties in AE3 resulting from water runoff during significant rainstorms. For the most part the property damage has involved landscaping and driveway erosion and deposited mud and debris. Several landowners have spent in excess of $10,000 restoring and cleaning their properties following flood incidents. Further, others have taken corrective actions such as building/replacing walls and rip wrapping drainage arroyos to keep floodwater from overrunning their property. Despite the efforts that have been taken, AE3 continues to suffer damage from floodwater during most major storms.

Our analysis of the current, unremediated flood problems in our subdivision shows that nearly all of them are the result of excessive water runoff that is channeled through the intersection of Vista del Cerro and Vista del Reino, (hereafter called "CR intersection") and down Vista del Reino, particularly along the south side of the road where the water then overflows adjoining properties. Substantial quantities of runoff water enter the CR intersection from the west, south and north and then flow eastward on Vista del Reino. Although there are two drainage arroyos, one parallel to Vista del Reino ("arroyo R") and one about 100-200 yards south of the CR intersection (perpendicular to Vista del Cerro running west to east; "arroyo C"), very little of the problematic floodwater ever enters either of these arroyos. If this water were effectively diverted into the two drainage arroyos most of the problems would be alleviated.

About 80 - 90% of the water entering the CR intersection is flowing <u>eastward</u> from the adjoining developed but uninhabited subdivision (Blanco Development Co.). Little of this water currently enters the existing drainage "arroyo R" which originates at the CR intersection even though drainage access is provided in the curbing and three culverts cross under Vista del Cerro at this location. The drainage access to this arroyo does not and never will work well as built. A means of effectively diverting water from the CR intersection into the "arroyo R" is badly needed.

The water flowing <u>southward</u> on Vista del Cerro primarily enters holding ponds maintained by the Butterfield subdivisions. During significant storms there is some overflow from these ponds into the CR intersection and into "arroyo R". Overflow that avoids the arroyo joins other water running eastward down the street (Vista del Reino).

The remaining 10 - 20 % of the water entering the CR intersection is flowing northward on Vista del Cerro. Before reaching the CR intersection this water passes over "arroyo C". Drainage access into "arroyo C" is provided in the curbing at this location and some of the water does enter the arroyo as intended. Under higher flows, however, much of the water on both sides of Vista del Cerro crosses the access points into "arroyo C" and continues northward into the CR intersection. Just before reaching the intersection the water flowing along the west side of Vista del Cerro crosses to the east side of the street. At the CR intersection this water flow joins with water coming from the west and north and turns east onto Vista del Reino flowing along the south side of the street. This is exactly the location of the water that is causing the most damage to our development.

As you proceed with the drainage review we request that the flood water problems affecting AE3, described in this comment, be given serious attention and that a solution to effectively channel these waters into the two available arroyos and out of the street be given high priority. If effective correction is not provided, this will continue to be one of the more serious floodwater problem areas in Picacho Hills.

If we can be of further assistance, or show you in the field what we are talking about, please contact us.

Larry Goforth - 575-527-1707
Scott Holzhauser - 575-526-3451
Tom Clark - 575-647-1959

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	
	Address/ Direccion:	
	Phone/ Telefono:	
	E-mail/ Direccion Electronica:	

Our address also appears on the opposite side of this form, which if folded may be mailed to us directly. /Nuestra direccion aparece en el lado opuesto de esta forma, de tal manera que si la dobla y pega con cinta adhesiva, puede enviarnosla directamente..

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Date: September 4, 2008
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MARYCE M. JACOBS, PH.D.
5611 MIRA MONTES
LAS CRUCES, NM 88007-8966
Phone 575 524-0606 • Fax 575 524-2117 • hsieduc@aol.com

Date: August 25,2008

To: Dona Ana County Flood Commission

Location of Concern: 5611 Mira Montes watershed in Picacho Hills

Dear Mr. Dugie,

I am a concerned resident who requests that you include the watershed area behind my house in your flood plan. Please do not allow building of any type in this watershed.

My house is at 5611 Mira Montes. The back of my house faces the Organ Mountains. The watershed area is directly behind my house.

The watershed area is East of Mira Montes and West of Picacho Hills Drive. This area of land is bordered by the houses on the East ridge of Mira Montes and Picacho Hills Dr. where the Irish Pub is located.

This watershed area is a natural river with a basin that fills with water each time it rains. Photographs labeled "Mira Montes 1" and "Mira Montes 2" are attached. These show the flow of the water in the recent August 2008 rain.

My request is that this area be designated a flood area in your flood plan and prohibit any residential or commercial building.

Thank you for your attention to this matter.

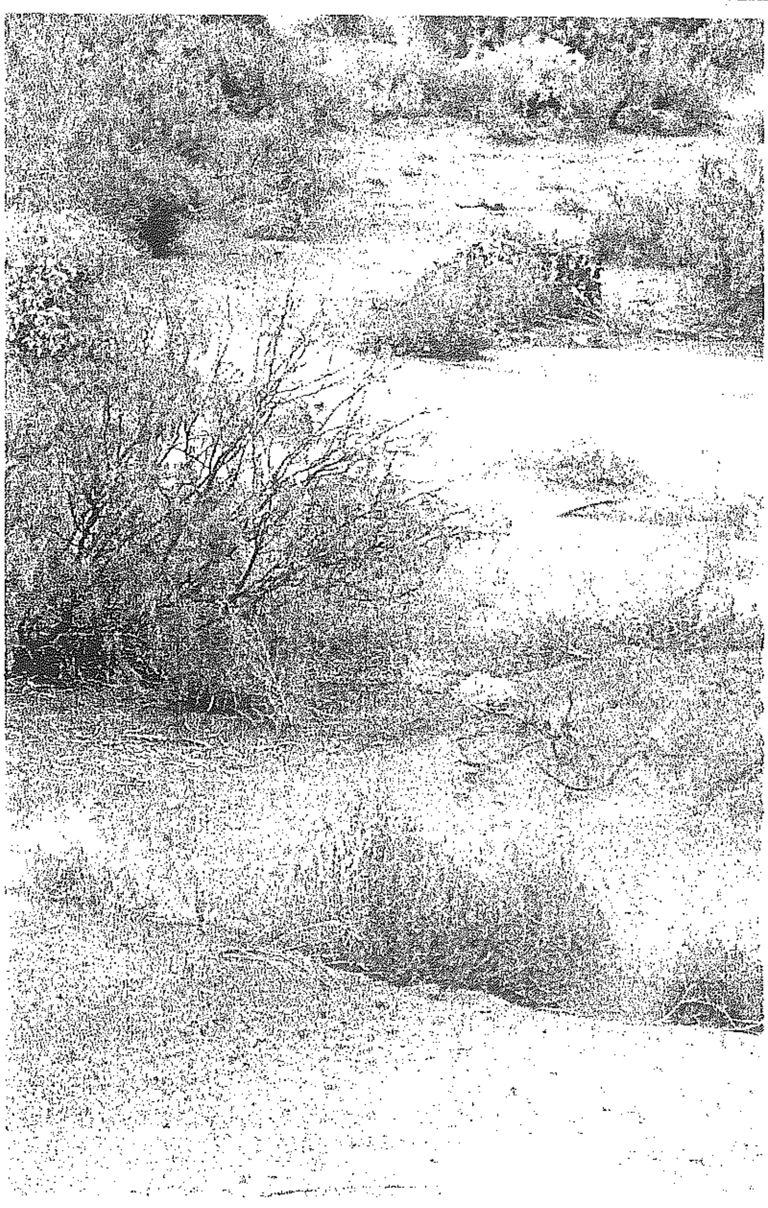
Sincerely,

Maryce Jacobs, PhD

RECEIVED

AUG 27 2008

BY: FLOOD COMMISSION OFFICE



9

Miramontes 1

Miramontes 2

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

APPROXIMATELY ~~THREE~~ TWO YEARS AGO, WE HAD A SEVERE RAIN STORM IN PICACHO HILLS THAT ENLARGED EXISTING ARROYOS, ETC. THAT WERE IN NO WAY ABLE TO REDIRECT WATER FLOWS WE EXPERIENCED. LESSER RAIN STORMS, ETC. HAVE FURTHER ENLARGED THE SMALL ARROYO ADJACENT TO OUR HOME.

IT IS EXTREMELY UNCERTAIN THAT THE CURRENT ARROYO WOULD HAVE MUCH EFFECT IN DIRECTING WATER FLOW.

THE STORM REFERENCED ABOVE ENLARGED THE ARROYO IN TERMS OF WIDTH AND DEPTH THAT CAUSE US TO ONLY WONDER WHAT DAMAGE MIGHT BE DONE IN THE FUTURE.

AS AN EXAMPLE, THE STORM OF 2 YRS AGO INCREASED THE DEPTH OF THE ARROYO AS MUCH AS 5 FEET IN THE AREA OF THE CULVERTS THAT PASS UNDER PICACHO HILLS DRIVE. (three dots on DIAGRAM) ALSO THE ARROYO WAS MADE WIDER BY THREE TO TEN FEET. ALSO, UNDERGROUND LINES (ELECTRIC, TELEPHONE, TELEVISION) WERE EXPOSED OVER A DISTANCE OF 20-25 FEET.

LUCKILY, NO SEVERE DAMAGE WAS INCURRED AND THE COUNTY DID REPAIR MUCH OF THE SURFACE DAMAGE. HOWEVER, IF A SIMILAR STORM SHOULD OCCUR IT IS PROBABLE HOUSES, ETC. COULD BECOME FLOODED.

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	DR. JACK PHILLIPS
	Address/ Direccion:	6940 BARCELONA RIDGE RD.
		LAS CRUCES NM 88007-8956
	Phone/ Telefono:	575-532-5490
	E-mail/ Direccion Electronica:	NA

Our address also appears on the opposite side of this form, which if folded may be mailed to us directly. /Nuestra direccion aparece en el lado opuesto de esta forma, de tal manera que si la dobla y pega con cinta adhesiva, puede enviarnosla directamente..

SEE OVER

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

The current slope of the land in the BLM area south of Barcelona Ridge and the Barcelona Ridge, Coronado Ridge and Morano subdivisions along with the slope and contours of Barcelona Ridge Road and Tuscany Drive, cause extremely large amounts of water to need to exit Tuscany Drive between properties at 10070 and 10060 Tuscany drive during heavy rainfalls. In the past 3.5 years, water coming from Tuscany Drive has damaged properties at 10070, 10080 and 10060 at least 4 times. Twice, damage was quite severe. Property owners along Tuscany Drive have modified the landscaping in front of the lots to prevent in intrusion of the damaging water onto their properties. This causes even larger amounts of water to continue down Tuscany (from Barcelona Ridge Road, as well) and use the exit to the arroyo between 10070 and 10060 Tuscany Drive.

The intersection of Tuscany Drive and Barcelona Ridge Road should have been structured in such a fashion that the water coming down Barcelona Ridge Road and crossing from the BLM land remains on Barcelona Ridge Road and exit's further east at it's low point. This could be corrected easily.

There are several other outlets for the water to escape from Tuscany Drive. They don't readily accept water from the street. This should be changed to minimize the amount of water that must exit between 10060 and 10070 Tuscany Drive.

Thank you.

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
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Picacho Hills Drainage Master Plan
Dona Ana County

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There is an natural arroyo on the south side of Barcelona Ridge Rd. located within the BLM land, and which begins about 1 mile west, runs east and turns north, across the county right of way and crosses Barcelona Ridge heading northeast. This arroyo has migrated and widened and now threatens my property on the corner of Barcelona Ridge Rd and Tuscany Dr. The enclosed pictures show flooding which took place on Aug 16 and Sept 13, 2006. Except for a few J Barriers, the county has not taken any action to mitigate future damage. They did construct some dirt berms which have now been washed into the street and deposited about 6" of mud onto the south side of Barcelona Ridge Rd. **The county needs to contain the mud and water on their right of way to prevent damage to private property**

Also on the south side of Barcelona Ridge Road is a spillway which drains into a drainage pond which runs under the road. This spillway is only about 24" wide and cannot accommodate the flow of water coming east on Barcelona Ridge Rd. **This spillway needs to be at least 5 or 6' wide to accommodate the volume of water coming down the south side of the road.**

The water flowing down the north side of Barcelona Ridge Rd turns north at Tuscany Dr and flows down the west side of the street. /There is no spillway immediately available to collect this water. Several hundred yards on the east side of the road there is a spillway which is supposed to collect this water. By the time the water reaches this spillway it has increased in speed and volume, leaves the road and flows over private property. **If you examine the plat for Barcelona Ridge Estates. you will see that to accommodate a 100 yr storm, the road has been engineered to have water flow over lots 54 and 55. See Note 14 associated with the Plat for Barcelona Ridge Estates. This flow of water needs to be corrected. Nobody should expect their property to act as an arroyo for the rest of the neighborhood.**

Lastly, the roads should not be used as arroyos, especially with low, roll over curbs

Rainwater should be directed to storm drains & collected in cisterns for use.

Clare Kapner
10000 Tuscany Dr
Las Cruce NM 88007
575 525 1382
cek10000@hotmail.com

Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Nombre:	
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Picacho Hills Drainage Master Plan
Dona Ana County

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I am concerned about the silting in of The holding pond NE of San Marcos ct. in picacho hills. I is holding less and less water during a storm. The sewer line is real close to The west bank of this pond.

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	Jerry Stepro
	Address/ Direccion:	10038 San Marcos CT Las Cruces NM 88007
	Phone/ Telefono:	575-541-8922
	E-mail/ Direccion Electronica:	rhett@zianet.com

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Ms. Eileen R. Vela
7100 Purple Mtn
Las Cruces, NM 88007

USA FIRST-CLASS FOREVER

Bohannan Huston, Inc.
425 S. Telshor Blvd.
Suite C-103
Las Cruces, NM 88011

880119823? C047

RECEIVED
SEP - 4 2008
BOHANNAN HUSTON, INC.
LAS CRUCES OFFICE

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

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Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

SEE ATTACHMENT - THANK YOU

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Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	EILEEN & OCTAVIO VELA
	Address/ Direccion:	7100 PURPLE MOUNTAIN
		(LINDA VISTA ESTATES)
	Phone/ Telefono:	575-525-6655
	E-mail/ Direccion Electronica:	redspyder@comcast.net

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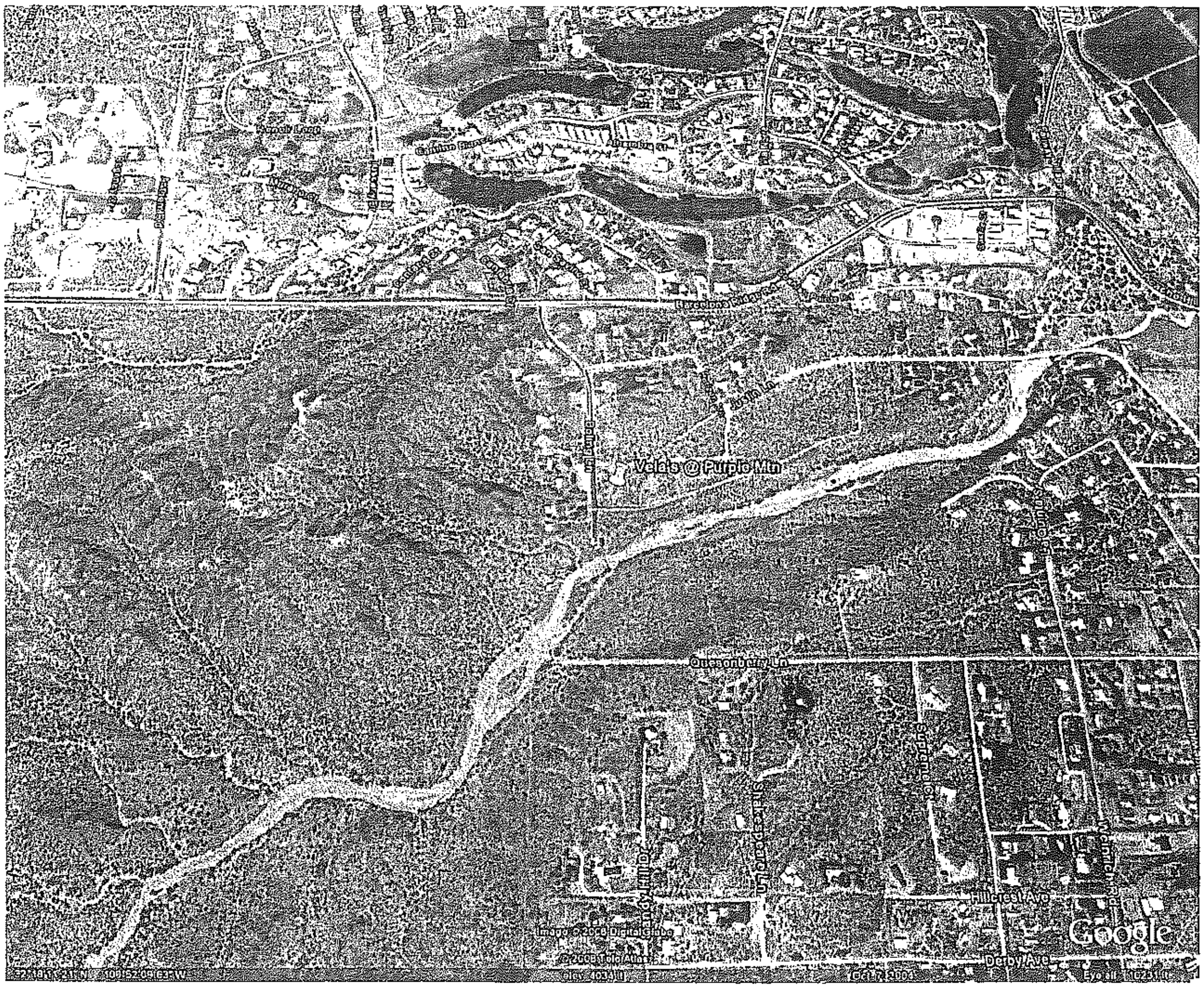
The Sun-News article regarding Picacho flooding indicated that a 4 square mile area was being studied for a comprehensive flood control program. No indication was given as to what area that covered. As residents of Linda Vista Estates, we are often left out of planning for the Picacho Hills area. Nevertheless, we have serious flooding concerns since a lot of the drainage cuts through Linda Vista. In particular, the arroyo parallel and south of Purple Mountain Avenue (off Boling Lane and Barcelona Ridge) must drain some significant area since it is always filled with rapidly flowing water after every heavy rain. Justin Lane (the dirt road portion east of Linda Vista Estates) has been completely severed by this arroyo. Any comprehensive flood control program must include this area since much of the area to the southwest drains through the arroyo mentioned above.



Picacho Hills Drainage Master Plan
Comment Sheet

Bohannan Huston, Inc.
425 S. Telshor Blvd
Las Cruces, Nm. 88011
575-532-8680

Water draining from the south down Vista Del Cerro, water and mud draining from Butterfield and water and mud coming from the westward continuation of Vista Del Reino are flowing west down Vista Del Reino and down the cul de sacs of Via Diamante, Via Turquesa, Via Rubi and thru channels between houses that were only designed to take runoff from the cul de sac. The mud is clogging these channels and the streets.

The water should have been channeled into the drain on the north side of Vista Del Reino.

It would seem that a grate placed on the west side of the intersection of Vista Del Cerro and Vista Del Reino to divert the water and mud into the channel on the north side of Vista Del Reino would alleviate the flooding occurring in the cul de sacs.

Another possible longer term problem could occur if the holding area on the west of Vista Del Cerro fills or overflows into the channel under Vista Del Cerro and down the channel between the golf course and the houses at the end of the cul de sacs. This channel is not designed to handle large water runoff.

Bernie Kute
1600 Via Turquesa
Las Cruces, Nm. 88007
575-647-8970
bgkute@comcast.net

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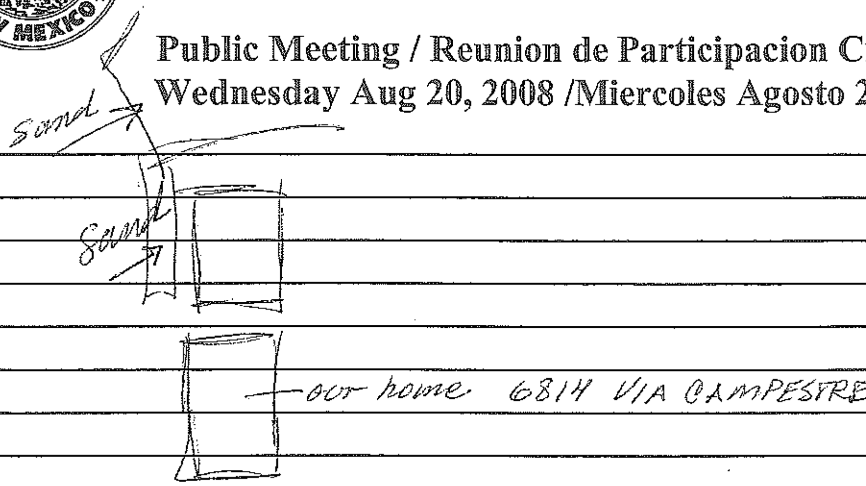
Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008



Sand/soil erosion flows in front of our home, sand stands at foot of drive and in road, our steep drive is even more challenging to navigate when we approach it and have to drive through sand.

road patches in front of our home are in need of repair. Road should be repaved as it is the main thorough fare to Country Club.

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	Jeff + Sally Schutte
	Address/ Direccion:	6814 VIA CAMPESTRE
	Phone/ Telefono:	688-7352 or 908-0077
	E-mail/ Direccion Electronica:	schuttejands@msn.com

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Problem: **Water AND sediment from Blanco's new development at the intersection of Vista del Reino and Vista del Cerro:**

1. The intersection floods and problems are caused along Vista del Reino, especially for homeowners on the south side.
2. The culverts under Vista del Cerro become blocked
3. Sediment builds up on the west side of the culverts as well as filling the drainage ditch along the north side of Vista del Reino.

Suggestions:

1. Develop solutions upstream (in Blanco's development) so that water is contained
2. Channel water into existing drainage ditch instead of allowing it to flow down Vista del Reino
3. Address problems at the culvert area – either KEEP CULVERTS CLEANED OUT – or – provide an alternative solution for water to cross Vista del Cerro

Important:

1. Blanco's development will not be built out for several years; Plan MUST address current issues as well as considerations once the development is complete.
2. If the culverts under Vista del Cerro are to be the final solution, AND in the interim, we need to have them on a schedule to be kept open!

We consider this to be one of the major water drainage problem areas in Picacho Hills and expect it to be high on the list of projects in the Drainage Master Plan.

Robert & Martha Potter

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C- 103 LasCruces,NM88011 (575) 532-8680	Name/ Nombre:	Robert & Martha Potter
	Address/ Direccion:	6620 Butterfield Ridge Dr
	Phone/ Telefono:	(575) 523-5254
	E-mail/ Direccion Electronical	jeep@2potters.net

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1. Erosion of arroyo behind homes sitting along 1300 block of Via Norte.
2. Water abatement needed at end of Via Compestre & Via Norte intersection
3 Cement drainage alongside 1390 Via Norte... End is falling into arroyo.

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	Mor Mike Quigley
	Address/ Direccion:	1390 Via Norte
	Phone/ Telefono:	647-9203
	E-mail/ Direccion Electronica:	mquigley3@AOL.COM

Our address also appears on the opposite side of this form, which if folded may be mailed to us directly. /Nuestra direccion aparece en el lado opuesto de esta forma, de tal manera que si la dobla y pega con cinta adhesiva, puede enviarnosla directamente..

Picacho Hills Area
Flood & Storm Drain Strategy

Recent rainstorms have identified drainage problems that currently exist in the Picacho Hills area. Residences and agricultural properties alike have been severely damaged in recent flooding, requiring considerable investment in the repairs and removal of silt and debris from both public roads and private properties. It is evident that a regional drainage solution is imperative to protect all Picacho Hills area landowners and residents from future flooding, erosion and maintenance challenges.

The problems of the Nafzinger wash and the heavy flows of storm water flowing down the mesa, through the valley and into the river have existed for years. This problem has been amplified by ongoing development and record-breaking rainfalls this year. In order to implement solutions before more damage occurs, we are proposing a partnership between landowners, residents and government agencies to develop and implement a plan to address the current flood problems.

Petition

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3. Acknowledge that a plan similar to the Albuquerque regional flood plan may need to be implemented.
4. Petition the participation of the County Flood Commission, the State Engineer, FEMA, EBID, and the BLM in developing and implementing a long-term solution to storm drainage and flooding.

Signed,

Signature	Print Name	Address	Farmer/Resident
Jovonna B. Hanlon	Jovonna B. Hanlon	1212 Verona Ct	Resident / Business
VB Schneider	Vicky B Schneider	2280 Pepper Rd	farmer/landowner

Signature	Print Name	Address	Farmer/Resident
[signature]	Louis B. Biad	6861 Via Campestre	Business/Land owner/PHCC
[signature]	Don Bird	2290 Pepper Rd	Business/PHCC
Cristan B Ismond	Cristan B Ismond	2225 Pepper Rd	Farm owner
Julie B. Ozgoz	Julie B. Ozgoz	6440 Vista Valley	Farm Owner

Signature	Print Name	Address	Farmer/Resident
Jack McIntyre	Jack McIntyre	27 Las Casitas	Resident
Dan Spence	DAN SPENCE	28 LAS CASITAS	Resident
Charla Spence	CHARLA SPENCE	28 Las Casitas	Resident
John Lavender	JOHN LAVENDER	13 LAS CASITAS	"
Leonard Elting	LEONARD ELTING	4 LAS CASITAS	RESIDENT
Barbara Elting	Barbara Elting	4 Las Casitas	RESIDENT
Rosemary Chaffee	Rosemary Chaffee	21 Las Casitas	Resident
Linda Kruger	Linda KRUGER	29 Las Casitas	resident
Charles Kruger	CHARLES KRUGER		
Donald Kunkel	Donald Kunkel	#22 Las Casitas	resident
Dick Apodaca	DICK APODACA	34 Las Casitas	Resident
Joe Kane	Joe Kane	#9 Las Casitas	Resident
Doris M Nalls	DORIS M NALLS	31 LAS CASITAS	RESIDENT
N.A. Nalls	N.A. NALLS	31 LAS CASITAS	Resident
Florence McIntyre	FLORENCE McIntyre	27 Las Casitas	Resident
Annette Hendrick	Annette Hendrick	6645 Butterfield Rdg	Resident
Ieva Rasmussen	Ieva Rasmussen	1390 Vista del Cerro	Resident
A. F. Walch	ANDREW F. WALCH	6865 Via Emma	"
Robert N. Potter	ROBERT N. POTTER	6620 BUTTERFIELD RIDGE DR	RESIDENT
Cheryl Vom-Nelson	Cheryl Vom-Nelson	39 Las Casitas	Resident
[illegible]	Sean Vick	38 Las Casitas	Resident
Sabrina Payne	SABRINA PAYNE	1425 FAIRWAY Village	Resident

Signature	Print Name	Address	Farmer/Resident
[illegible signature]	William Wilburn	30 Las Casitas	Resident
[illegible signature]	AB Estein	24 Las Casitas	Resident
J H Gardiner	J H Gardiner	18 Los Casitas	Resident
W. Boozer	Warren Boozer	1220 Vista Del Monte	Resident.
V. David Rodger	V. David Rodger	1466 Fairway Village Dr.	Resident
James W. McHale	James W. McHale	1406 Fairway Village Dr	Resident
Mike Izon	MIKE IZON	1306 FAIRWAY VILLAGE DR, LAS CRUCES	RESIDENT.
Kathy Rodger	Kathrine K. Rodger	1466 Fairway Village Dr.	Resident
[illegible signature]	Michael Burke	1518 Fairway Village Dr.	Resident
Irene Wharton	IRENE WHARTON	1400 Fairway Village Dr	Resident
Tom [illegible]	Thomas Etterly	1413 Fairway Village Dr	RESIDENT
Robin Cohen	Robin Cohen	1519 Fairway Village Dr	Resident

Signature	Print Name	Address	Farmer/Resident
Rose Marie Levasseur	Rose Marie Levasseur	1330 Fairway Village Dr	R
James P. O'Leary	JAMES P. O'LEARY	2136 Stone Pine Dr.	R

Signature	Print Name	Address	Farmer/Resident
[illegible]	Wayne Hunter	7000 Camrey Suerte [illegible]	Farmer
Donnie Hagne	DONNIE HAGNE	5140 W. Picacho	Farmer / Resident
Virginia Richards	Virginia RICHARDS	425 Spanish Becou Rd Anthony NM 88021	Resident

Signature	Print Name	Address	Farmer/Resident
[signature]	David A. Thompson	PO Box 225 FAIRACRES NM	Resident / Farmer
[signature]	Eula Fern Thompson	P.O. Box 225 Fairacres NM	Resident / Farmer
[signature]	Mark Hettinga	PO Box 449 Fairacres, NM 88044	Resident / Farmer
[signature] Trustee	McElyea Generation Skipping	PO Box 225 Fairacres NM 88033	Farmer/Resident

Picacho Hills Area
Flood & Storm Drain Strategy

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4. Petition the participation of the County Flood Commission, the State Engineer, FEMA, EBID, and the BLM in developing and implementing a long-term solution to storm drainage and flooding.

Signed,

Signature	Print Name	Address	Farmer/Resident
[illegible]	Robert Pfahl	#17 Las Cuestas	Resident
Tiffany Sth	Tiffany Sterling	1413 Fairway Village	Resident

Signature	Print Name	Address	Farmer/Resident
[illegible]	[illegible]	#12 Las Casitas	Resident
[illegible]	Richard K. Dickson	1212 Titania Ct.	Resident
[illegible]	Bill Laughlin	[illegible]	Resident
[illegible]	Linda Timmer Ashe	9530 Vista del Cerro	Resident
[illegible]	DAN Dolan	6565 Vista de Oro	Resident
	Alan Bailey	5207 Imperial Dr.	Residential
[illegible]	[illegible]	1910 Rancho Hills Dr	Resident
[illegible]	Martin Pillay	PO Box 131 [illegible] Park	Resident
[illegible]	Edward T. [illegible]	6844 Camito Blanco	Resident
[illegible]	Robert [illegible]	10010 San Marcos Ct.	Resident
[illegible]	JE Hayter	10040 San Marcos Ct	Resident
[illegible]	Paul Gerdwich	6510 Vista de Oro	Resident
[illegible]	Brendan Donnelly	10770 Tuscany Dr	Resident
[illegible]	[illegible]	[illegible]	Res
[illegible]	[illegible]	6884 Alhambra Ct	Res
[illegible]	[illegible]	6715 Desert Blossom Ln	RES.
[illegible]	R. NELSON	4480 [illegible]	RES
	S. DAVIS	10100 Tuscany Dr.	RES
[illegible]	DM Donnelly	6858 Alhambra	Res
[illegible]	KG HETTINGER	[illegible] Canyon	Resident Commercial
[illegible]	Howard H [illegible]	6608 Vista Hermosa	Resident
[illegible]	George Evans	4748 Calle de Nubes	Res

Signature	Print Name	Address	Farmer/Resident
[illegible]	JOHN JOHNSON*	141 VILLA CHIQUITA	R.
[illegible]	Garry Burton	130 Villa Chiquita	R
[illegible]	C.A. CRUZ	6814 Via Campestre	R
[illegible]	EP Harvey Jr	2750 Valle Grande	R-F
[illegible]	Robert Resch	10070 Tuscany Dr	R
[illegible]	[illegible]	1240 City Lots Pl	R
[illegible]	Puneet Ghei	6825 Bright View Rd	R
Sandra Resch	Sandra Resch	10070 Tuscany Dr.	R
Anna Leuenberger	Anna M Leuenberger	8128 Constitution Rd	R
Joyce DeAsso	Joyce DeASSO	1356 Vista del Cerro	R
Lonnie Wilson	LONNIE WILSON	6815 ALHAMBRA CT	R
[illegible]	VICTORIA TRAN	6611 VISTA HERMOSA	R
Martha M. Capling	Martha M. Capling	1369 Fairway Village Dr.	R
[illegible]	Dianne Sage	~~[illegible]~~ 3205 El Camino Real	R
Chuck Wilson	CHUCK WILSON	6815 ALHAMBRA CT	R
Noel D. Rooney	Noel Rooney	10044 Cantabria CT	R
Edwin Benjamin	EDWIN BENJAMIN*	6620 VISTA HERMOSA	R
Stephen Butler	Stephen Butler	8022 Renoir Loop	R
Bruce Shackelton	Bruce Shackelton	6716 CAMINO BLANCO, LC, NM	R
[illegible]	DAVE HANSEN	6610 VISTA DEL REINO	R
W. Lamarre	WIL LAMARRE	1330 FAIRWAY Village	R
[illegible]	D.M. JAMISON	1501 FAIRWAY VILLAGE DR	R

Signature	Print Name	Address	Farmer/Resident
[signature]	Blake Simmons	4532 Candle	Resident
[signature]	GARY JEFFERGIS	PO Box 1607 Dominguez 88021	"
[signature]	GARY McClure	PO Box 281205	YES
[signature]	Greg G. Martin	6652 Vista Del Rosa	Resident
[signature]	Christa Blanchard	3205 Arrowhead	Resident
[signature]	R. LOSEFEIL	1622 VIA TURQUESA	"
[signature]	C J Pierce	3525 Luckyhorse	Resident
[signature]	JASON CLARK	6490 VISTA VALLEY DR.	Resident realtor
[signature]	Vicente Rivera	[illegible]	Resident
[signature]	Lee Cunningham	8645 Constitution	Resident
[signature]	MARK STROUD		" Builder

Picacho Hills Area
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Signed,

Signature	Print Name	Address	Farmer/Resident
[signature]	Steven Lyles	1100 Shalom Colony Tr L.C. 88007	Farmer and Resident
[signature]	MAYNE TUCKER	5204 SUNSHINE CT	RESIDENT

Signature	Print Name	Address	Farmer/Resident
[illegible signature]	Wayne Hunter	7000 Camino Suerte [illegible]	Farmer
[illegible signature]	DONNIE HAGWE	5140 W. Picacho	Farmer / Resident
Virginia Richards	VIRGINIA RICHARDS	425 Spanish Bedroom Rd Anthony NM 88021	Resident

Message

rezolex.com@zianet.com

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Message 2 of 2 (New)

From: "Janice Neaves" <jneaves@ebid-nm.org>
To: rezolex.com@zianet.com
Date: 15 Nov 2006, 11:38:33 AM
Subject: White paper for bingaman - nmdamsafetycrisis.doc

New Mexico?s Dam Safety Crisis

White Paper for Senator Jeff Bingaman

Gary Esslinger, Manager, Elephant Butte Irrigation District

Introduction:
The State of New Mexico faces an infrastructure crisis that compromises both the physical safety of the public and the potential for economic development in the state. In the middle of the last century, hundreds of flood control dams were built on arroyos in rural areas to protect downstream assets, primarily farm land. The dams were considered to be low risk, with minimal probability of loss of life if they failed. As a result, most were designed to withstand only a 50-year storm (the Flood that has a 2% chance of being equaled or exceeded in any given year), and built with a 50 year service life.

Now, 50 years later, the dams are at the end of their design life. Worse yet, residential and commercial development in the downstream areas protected by many of these dams has dramatically increased the potential for loss of life and high-dollar property damage. Although this changes hazard classification from low to high, the dams remain as they were, constructed for low hazard conditions.

Unfortunately, there is more than just hydrology facing this infrastructural issue. The financial arrangements associated with these dams are oriented toward low hazard maintenance, and the dams are in desperate need of comprehensive reevaluation and rehabilitation, far beyond the fiscal ability of local institutions. The reality of this threat became clear in March of 2006 when the Ka Loko dam, an aged, outdated structure in Hawaii breached killing several people.

Case Study: Elephant Butte Irrigation District
Elephant Butte Irrigation District (EBID) is charged with delivery of irrigation water from the Rio Grande Project to 90,640 acres in Do□na and Sierra Counties in Southern New Mexico. In the 1950s and 1960s, the federal government, through the Soil Conservation Service (now Natural Resources Conservation Service, NRCS) constructed 27 flood control dams along the edges of EBID?s service area primarily to protect the irrigation system and farms from flood damage. The dams are at or near the end of their design life, and in

need of rehabilitation. Now, these dams protect houses, businesses, highways and residential subdivisions.

The dams were turned over to EBID, who has maintained them since. EBID collects $5 per acre per annum from the farm lands protected from flood damage by each dam, a sum that has not increased for years. These areas assessed for flood protection are termed Local Improvement Districts, or LIDs. This is the only funding EBID has for maintenance of the dams.

EBID cannot assess based on the value of the protected lands downstream. EBID also is prohibited from assessing land protected by a dam which is not farm land, regardless of its value. Thus, a million dollar house would pay nothing to EBID for the flood protection afforded by one of these dams. These areas assessed for flood protection are termed Local Improvement Districts, or LIDs. This small amount of money from farmers is all that EBID by law can collect for maintenance of the dams.

Since the construction of the dams, the rural areas protected by the dams have developed into suburban or even urban areas, drastically increasing the consequences of failure of the dams. Rehabilitation to the previous rating of the dams would be inadequate for the current risk caused by downstream development. The dams will need to be upgraded significantly to meet the new regulatory requirements. As long as they protect primarily farm land, they do not require expensive overhaul.

The federal and state governments do offer significant cost sharing for dam rehabilitation and upgrading, but even that falls short of what is needed for the extensive work that needs to be done. For example, the NRCS estimates that rehabilitation and upgrading of the Do□na dam just east of the Village of Do□na would cost about $1.4 million. The federal government will cost-share 65 percent, and the state will cost share 25 percent, leaving EBID, the local sponsor, to contribute 10 percent, or $140,000. A cost higher than $1.4 million is likely, and EBID would be responsible for 10 percent of the final cost, whatever it may be. The LID for the Do□na dam only has $86,000 of funding (and this amount has been built up over many years of collecting farm land assessments) and only $5,000 per year can be collected. EBID has no other revenue sources for work on these dams. The state?s contribution of 25 percent is becoming less certain; losing that component would make rehabilitation even less of a possibility.

New Mexico?s soil and water conservation districts also lack the ability to raise the kind of local revenues needed to match federål and state funds for dam rehabilitation projects. There is little or no statutory authority for these districts to assess their members and other residents to pay for improvements. The county flood commissions are also limited in levying assessments in the amounts needed to raise the local matches. Frequently, the flood commissions have many more dams that they can feasibly maintain already and have no way of raising additional money to pay for rehabilitating other dams.

Federal and State regulatory standards will require the upgrading of many dams. If EBID cannot maintain a dam to an acceptable hazard rating because it lacks the funds to do so, its only alternative is to breach it. This will create new designated flood zones requiring flood insurance for hundreds or even thousands of homes and will cause a serious impediment to the economic development of the area.

The potential for intentionally breaching some of the dams will not even be a matter of choice for EBID. In memo dated June 6, 2006, the New Mexico Office of the State Engineer?s Dam Safety Bureau addressed a developer with a subdivision planned in the vicinity of Fillmore 1 Dam, one of the NRCS dams. In that memo, Dam Safety Bureau Chief Elaine Pacheco, P.E. states that there is no state funding currently available for the non-federal component of rehabilitation funding, and if the area of the dam develops without upgrading the dam, the Dam Safety Bureau may consider a safety order to breach the dam. The Dam Safety Bureau has no other authority to achieve compliance, yet they are required to ensure dam safety. Maintaining the dam in its current condition and design means that there can be no further residential, commercial or other development below it.

Significant acreage in Do□na and Sierra Counties is protected by EBID?s dams, and that area will effectively be off limits for residential or commercial development unless rehabilitation and improvement of the dams can be accomplished. Breaching the dams will place downstream areas in active flood plains, endangering residents and requiring prohibitively expensive flood insurance. Leaving the dams as they are is not possible, as the existing downstream residents face an even greater risk of harm if a dam should burst.

Solutions:
Elephant Butte Irrigation District in particular, and public and private dam owners in general, need more than just technical assistance to address this problem. A more comprehensive approach must be taken, to address the technical as well as the more complex institutional problems in an integrated way. EBID seeks the assistance of all those agencies involved in flood control to find new statutory and other methods of raising the revenues needed to fund the local match so that aging dams can be rehabilitated in order to protect the developing areas of our State. Without new funding sources, these dams cannot be upgraded, development below them will halt, and some dams may have to be breached. The means to assess and collect from those properties and persons benefited from future flood control measures needs to be developed as soon as possible.

##

Message 2 of 2 (New)

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1. STORM DRAINS ON BARCELONA RD
2. INLET TO POND ON ANTHEM IS UPHILL NEEDS TO BE DREDGED
3. POND AT BARCELONA NEEDS BUILD UP FOR 40 FEET TO AVOID ROAD DAMAGE
4, BLM ARROYO AT TUSCANY HAS ERODED BERMS AND HAS ERODED THE ROAD.
5. POND AND WEAR FLOW OVER CATALONIA DOES NOT MEET WITH DOWNSTREAM POND CULVERT
IT NEEDS A CULVERT UNDER ROAD AND CULVERT WELL UPSTREAM
6- SEWER HEAD #8 IS AGAIN EXPOSED AT INLET OF POND "A" WE NEED MORE WIERS

Mail to / Envie por correo a:		Please print clearly / Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	
	Address/ Direccion:	
	Phone/ Telefono:	
C Terry PF	E-mail/ Direccion Electronica:	523-5568

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CORONADO RIDGE EROSION/DRAINAGE ISSUES

PINK – Arroyo stabilization and restoration

South Arroyo - Lack of stabilization structures within the arroyo beginning west of pond C and continuing downstream to Pond B has caused massive erosion to the arroyo leaving outlet elevations for street flumes continually unstable.

Street Flume outlets – South Regency
South Titania
South Academy
South Constitution (upstream and downstream)
Island Court

North Arroyo – Joint effort between Coronado Ridge and Picacho Mountain needed to create waterway the entire length of the shared boundary to facilitate the expulsion of excess runoff for that part of Coronado Ridge lying north of North Constitution and a similar portion of Picacho Mountain that presently inundates private property and improvements of both subdivisions.

ORANGE – Street drainage design improvements needed

Lot 119 street drainage flume – Street slope does not allow for water to enter flume and utilize Pond M.

Lot 117 street drainage flume – has been modified – previous design caused severe damage to private property and improvements.

Lot 91 street drainage culvert – Curb design and inlet do not allow for water to enter culvert and utilize Pond E.

BLUE - Ponds (19 total)

Zero emergency overflow provisions for 14 ponds.

Pond B emergency overflow is into Barcelona Ridge Road.

Pond C emergency overflow is into South Constitution.

Pond H emergency overflow is into Anthem Road.

Pond J emergency overflow is into private property.

15 of the 19 ponds do not wick or evaporate within 72 hours.

Pond P does not wick down at all and needs a design revision, perhaps a french drain system.

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See Att'd

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Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	Dave + Ronnie Wright
	Address/ Direccion:	1229 Academy Ct. LC 88007
	Phone/ Telefono:	(575) 526-6122
	E-mail/ Direccion Electronica:	gr8soap@comcast.net

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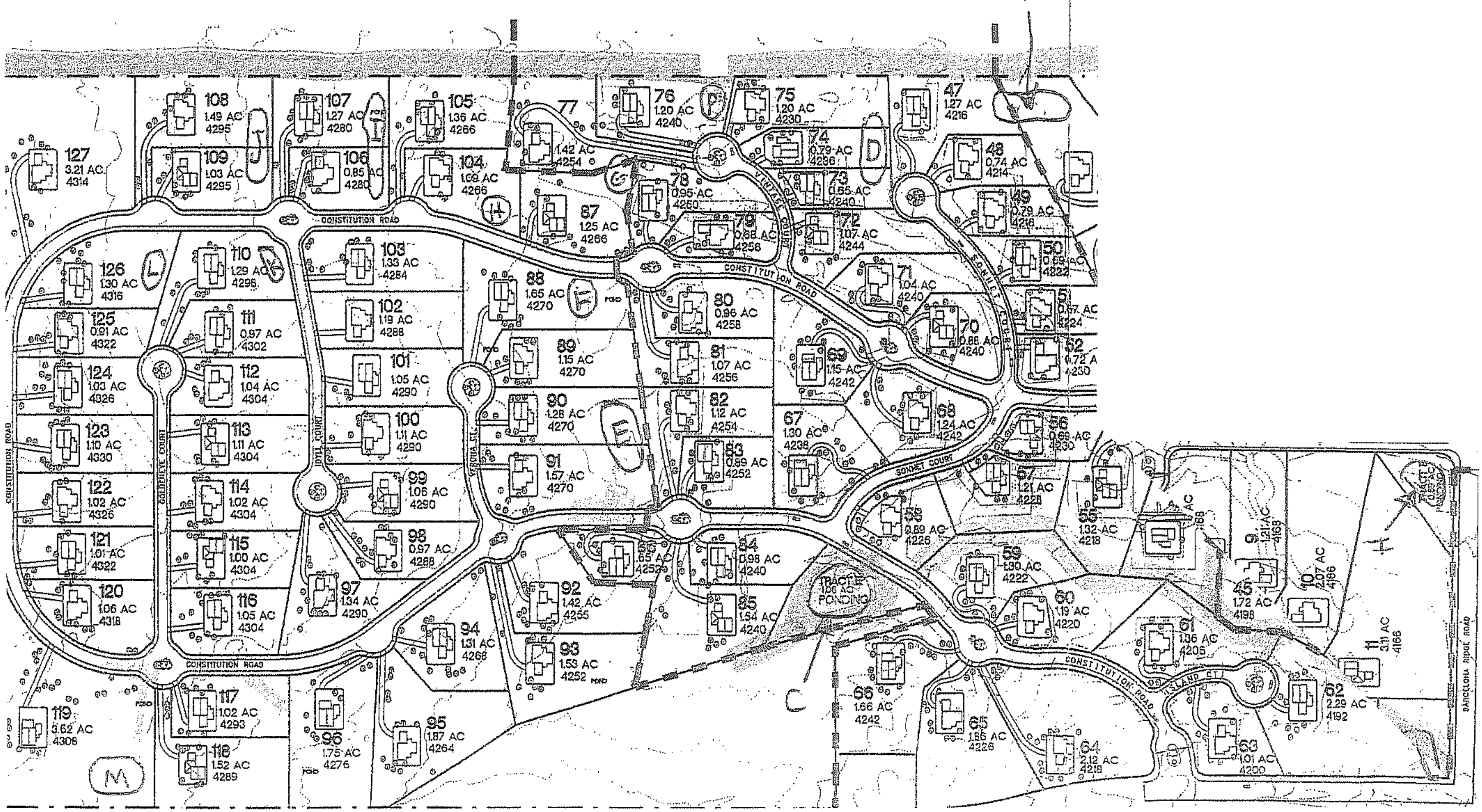
Coronado

FOR INFORMATION:

BRIGHT VIEW LAND

P.O. BOX 1050
FAIRACRES, NM 88
505-647-0123
www.brightviewland.



CORONADO RIDGE EROSION/DRAINAGE ISSUES

PINK – Arroyo stabilization and restoration

South Arroyo - Lack of stabilization structures within the arroyo beginning west of pond C and continuing downstream to Pond B has caused massive erosion to the arroyo leaving outlet elevations for street flumes continually unstable.

Street Flume outlets – South Regency
South Titania
South Academy
South Constitution (upstream and downstream)
Island Court

North Arroyo – Joint effort between Coronado Ridge and Picacho Mountain needed to create waterway the entire length of the shared boundary to facilitate the expulsion of excess runoff for that part of Coronado Ridge lying north of North Constitution and a similar portion of Picacho Mountain that presently inundates private property and improvements of both subdivisions.

ORANGE – Street drainage design improvements needed

Lot 119 street drainage flume – Street slope does not allow for water to enter flume and utilize Pond M.

Lot 117 street drainage flume – has been modified – previous design caused severe damage to private property and improvements.

Lot 91 street drainage culvert – Curb design and inlet do not allow for water to enter culvert and utilize Pond E.

BLUE - Ponds (19 total)

Zero emergency overflow provisions for 14 ponds.

Pond B emergency overflow is into Barcelona Ridge Road.

Pond C emergency overflow is into South Constitution.

Pond H emergency overflow is into Anthem Road.

Pond J emergency overflow is into private property.

15 of the 19 ponds do not wick or evaporate within 72 hours.

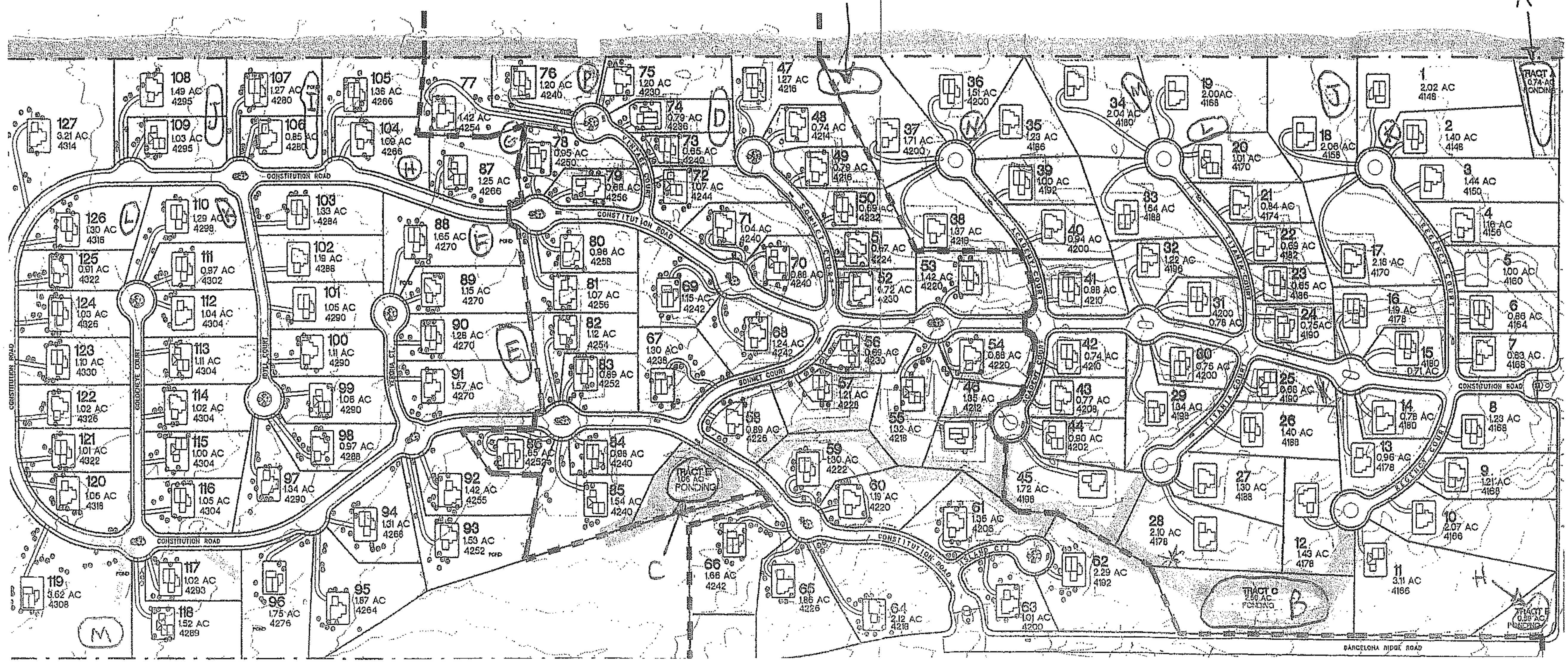
Pond P does not wick down at all and needs a design revision, perhaps a french drain system.

Coronado Ridge

FOR INFORMATION:

BRIGHT VIEW LAND COMPANY

P.O. BOX 1050
FAIRACRES, NM 88033
505-647-0123
www.brightviewland.com



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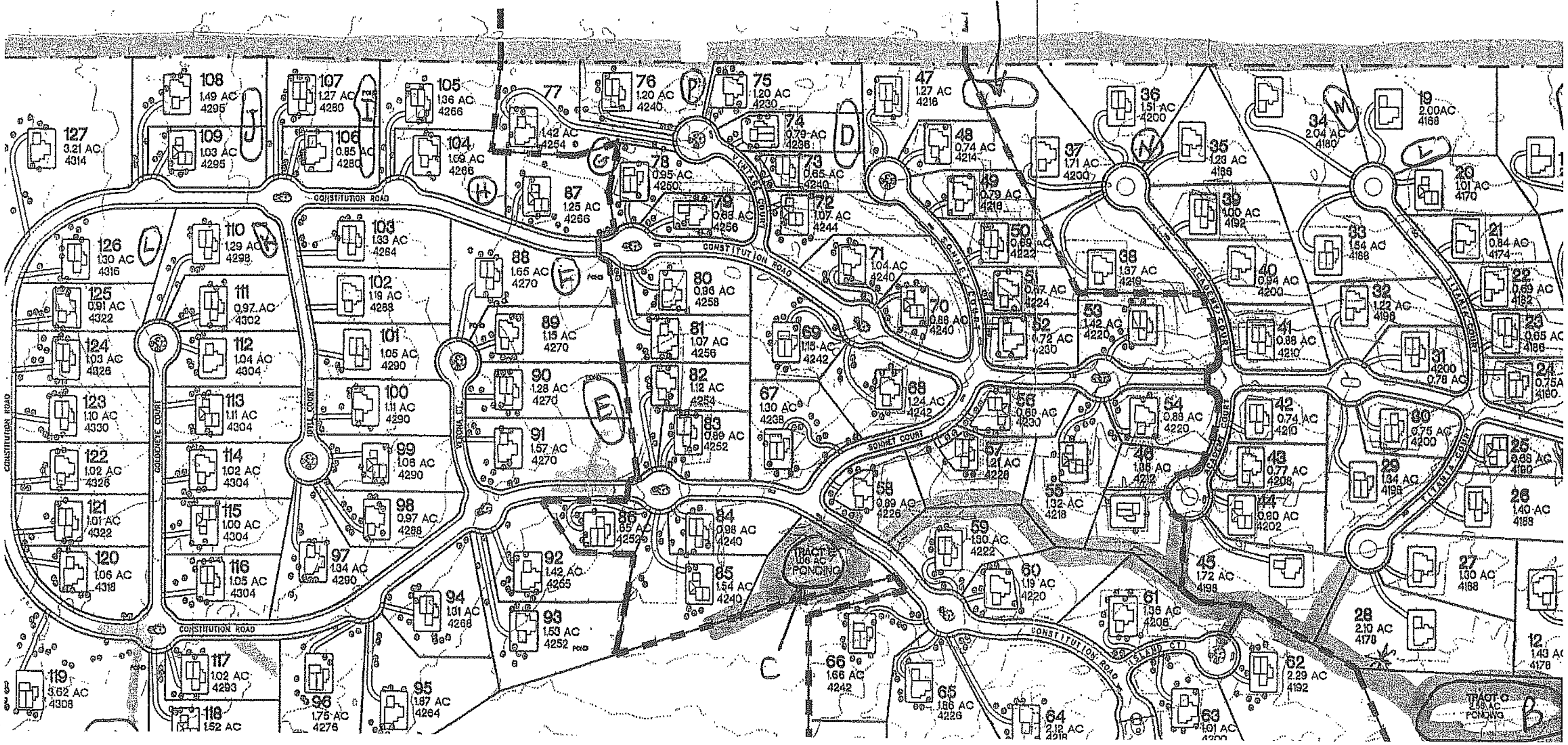

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

Steve Blanco (Vista del Reino) area is
A mess - how can county allow this
problems - errosion, violations of water flows
excavated large area and deserted
area causing erosion, ?
What can county do?

EBID - issues

Gary Roverman 523-4003 forn6tech@yahoo.com

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	
	Address/ Direccion:	
	Phone/ Telefono:	
	E-mail/ Direccion Electronica:	

Our address also appears on the opposite side of this form, which if folded may be mailed to us directly. /Nuestra direccion aparece en el lado opuesto de esta forma, de tal manera que si la dobla y pega con cinta adhesiva, puede enviarnosla directamente..

Picacho Hills Drainage Master Plan

Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

1. Contain drainage + gravel from coming off PHCC onto Via Campestre
2. Fix culvert under Via Norte. It appears that it is not able to adequately drain water from PHCC + neighboring homes + lots
3. Protect Fairway Village + other areas from being inundated with water, rock, + sand each time it rains.

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	Paul & Joan Sheehan
	Address/ Direccion:	6837 Via Campestre
		Las Cruces, NM 88007
	Phone/ Telefono:	525-8213
	E-mail/ Direccion Electronica:	sheehan@zianet.com

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Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

My main concern is the erosion on Via Campestre -
After every hard rain the road fills with dirt & debris creating hazardous condition for vehicles & pedestrians.

Mail to / Envie por correo a:	Oliver Miles	Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre: 6843 Via Campestre Address/ Direccion: Las Cruces, 88007 575-527-0609	
	Phone/ Telefono:	
	oliver@cybermesa.com E-mail/ Direccion Electronica:	

Our address also appears on the opposite side of this form, which if folded may be mailed to us directly. /Nuestra direccion aparece en el lado opuesto de esta forma, de tal manera que si la dobla y pega con cinta adhesiva, puede enviarnosla directamente..

Picacho Hills Drainage Master Plan
Dona Ana County

COMMENT SHEET / HOJA PARA COMENTARIOS

Public Meeting / Reunion de Participacion Ciudadana
Wednesday Aug 20, 2008 /Miercoles Agosto 20, 2008

(1) Timely removal of sand & debris from County Roads (Vista del Reino Vista del Cerro) ... Sand at intersections is a safety issue. Debris is from County arroyas and neglected

(2) Need microphone for speakers (hearing issue)

505 798 7819

(3) Speakers need to repeat questions from audience. (hearing issue)

(4) County needs arroya at Vista del Cerro / Vista del Reino intersection
this is reoccurring problem

Gary Loverman Road Committee
523-4003
forn6tech@yahoo.com

Mail to / Envie por correo a:		Please print clearly Por favor escriba claramente
Bohannan Huston, Inc 425 S. Telshor Blvd. Suite C-103 Las Cruces, NM 88011 (575) 532-8680	Name/ Nombre:	
	Address/ Direccion:	
	Phone/ Telefono:	
	E-mail/ Direccion Electronica:	

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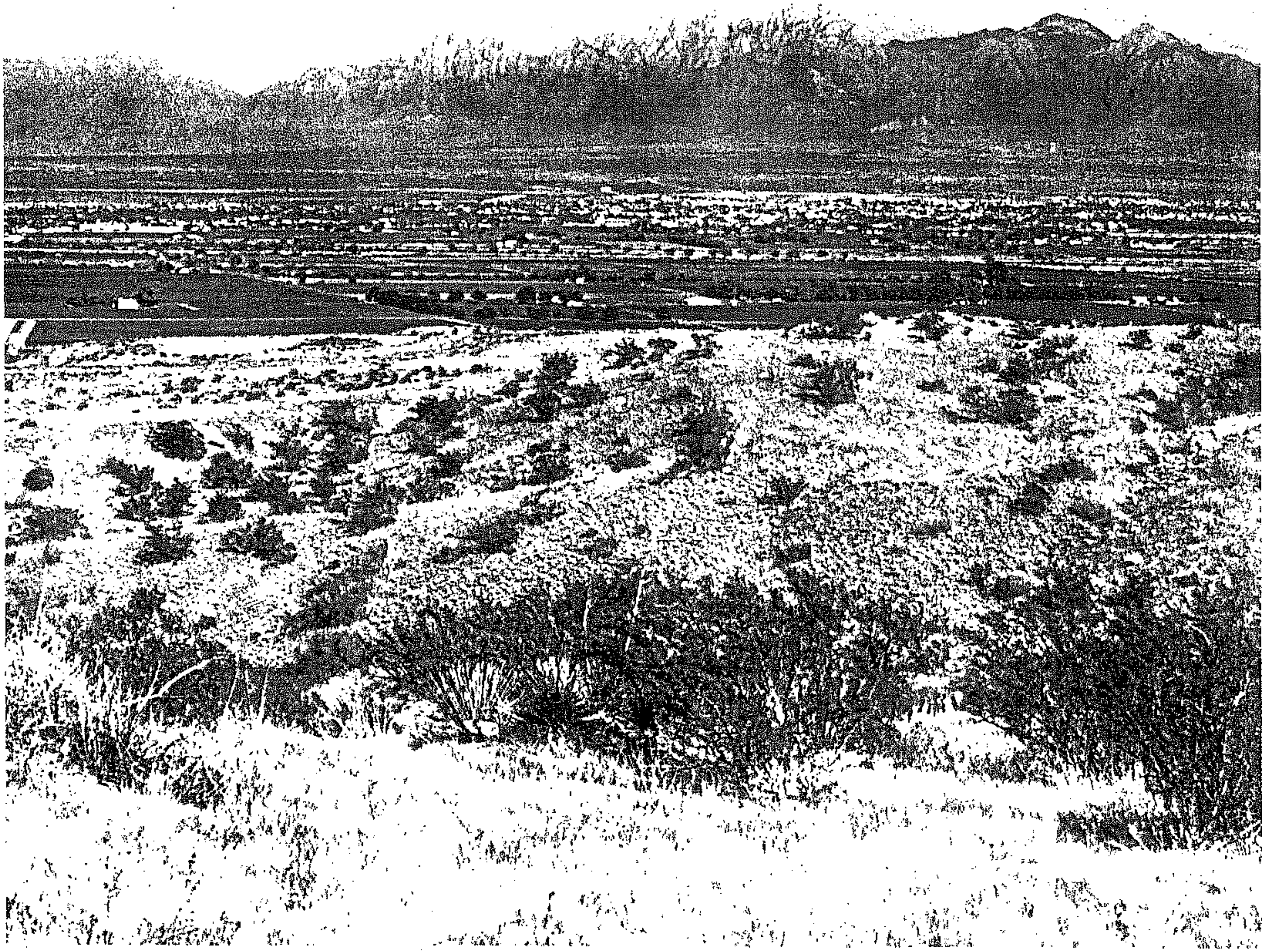
Appendix F – Soils Information

Soil Survey of

Doña Ana County Area New Mexico



ıd States Department of Agriculture, Soil Conservation Service
ıperation with
d States Department of the Interior, Bureau of Land Management
Mexico Agricultural Experiment Station

536

TABLE 13.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ad------------------ Adelino	0-10	Sandy clay loam	SC, CL	A-6	0	100	100	90-100	45-80	25-35	10-15
	10-28	Loam, sandy clay loam, clay loam.	SC, CL	A-6	0	100	100	90-100	35-75	25-35	10-15
	28-60	Sandy loam, sandy clay loam, loam.	SM, SM-SC	A-2, A-4	0	100	100	90-100	30-40	20-30	NP-10
Ae------------------ Adelino	0-5	Clay loam--------	SC, CL	A-6	0	100	100	90-100	45-80	25-35	10-15
	5-27	Loam, silty clay loam, clay loam.	SC, CL	A-6	0	100	100	90-100	35-75	25-35	10-15
	27-60	Sandy loam, sandy clay loam, loam.	SM, SM-SC	A-2, A-4	0	100	100	90-100	30-40	20-30	NP-10
AF*:											
Aftaden------------	0-2	Loamy sand-------	SM	A-1, A-2	0-35	90-100	85-95	40-70	15-25	---	NP
	2-18	Fine sandy loam, sandy loam, gravelly sandy loam.	SM-SC, SM	A-2, A-4	5-15	75-95	70-95	55-85	30-45	15-25	NP-10
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Onite--------------	0-5	Loamy sand-------	SM	A-2	0	100	100	50-95	15-35	---	NP
	5-18	Sandy loam, gravelly sandy loam.	SM	A-2	0	75-100	65-100	50-95	15-35	---	NP
	18-60	Loamy sand, gravelly sandy loam, sandy loam.	SM	A-1, A-2	0	65-100	60-100	45-85	10-35	---	NP
Ag------------------ Agua	0-12	Loam-------------	ML, SM	A-4	0	100	100	70-95	40-70	20-30	NP-5
	12-23	Loam, fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	100	70-95	40-70	20-30	NP-5
	23-60	Sand, fine sand	SP, SP-SM, SM	A-3, A-2	0	100	100	60-90	0-15	---	NP
Ah------------------ Agua	0-12	Clay loam--------	CL	A-6	0	100	100	90-100	70-80	30-40	10-20
	12-24	Loam, fine sandy loam, very fine sandy loam.	ML, SM	A-4	0	100	100	70-95	40-70	20-30	NP-5
	24-60	Sand, fine sand	SP, SP-SM, SM	A-3, A-2	0	100	100	60-90	0-15	---	NP
AJ*----------------- Agua Variant	0-11	Fine sandy loam	ML, SM	A-4	0	100	100	70-95	40-70	20-30	NP-5
	11-28	Very fine sandy loam, loam.	CL-ML, SM-SC, ML, SM	A-4	0	100	100	75-90	40-70	20-30	NP-10
	28-60	Sand, fine sand	SP, SP-SM, SM	A-3, A-2	0	100	100	60-90	0-15	---	NP

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
AK*:											
Agua Variant	0-13	Fine sandy loam	ML, SM	A-4	0	100	100	70-95	40-70	20-30	NP-5
	13-23	Very fine sandy loam, loam.	CL-ML, SM-SC, ML, SM	A-4	0	100	100	75-90	40-70	20-30	NP-10
	23-60	Sand, fine sand	SP, SP-SM, SM	A-3, A-2	0	100	100	60-90	0-15	---	NP
Belen Variant	0-4	Silty clay	CH, CL	A-7, A-6	0	100	100	95-100	85-100	30-70	15-40
	4-21	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	50-70	20-40
	21-38	Fine sandy loam, loam, very fine sandy loam.	CL-ML	A-4	0	100	100	75-95	50-75	20-30	5-10
	38-60	Very fine sand	SM, ML	A-4	0	100	100	75-90	35-55	---	NP
AL*:											
Akela	0-3	Gravelly sandy loam.	SM, GM	A-2, A-4, A-1	5-10	50-75	50-75	30-60	15-25	20-25	NP-5
	3-14	Very gravelly sandy loam, very gravelly loam.	SP-SM, GP-GM, SM, GM	A-1	5-10	40-60	30-50	20-40	5-15	15-20	NP-5
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Akela	0-3	Gravelly sandy loam.	SM, GM	A-2, A-4, A-1	5-10	50-75	50-75	30-60	15-25	20-25	NP-5
	3-14	Very gravelly sandy loam, very gravelly loam.	SP-SM, GP-GM, SM, GM	A-1	5-10	40-60	30-50	20-40	5-15	15-20	NP-5
	14	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
[illegible]											
Aladdin	0-2	Gravelly sandy loam.	SM	A-2, A-1	0-5	70-90	50-75	25-50	15-30	15-25	NP-5
	2-68	Gravelly sandy loam, gravelly fine sandy loam, gravelly loam.	SM, SM-SC, ML, CL-ML	A-1, A-2, A-4	0-5	70-90	50-75	25-65	15-55	20-30	NP-10
[illegible]well	0-3	Gravelly sandy loam.	SM-SC, SM	A-4, A-2	0-15	75-85	70-85	45-60	25-35	15-30	NP-10
	3-13	Gravelly sandy clay loam, gravelly clay loam.	SC, CL, SM-SC, CL-ML	A-6, A-2	0-15	60-75	60-75	60-75	30-55	25-40	5-20
	13-33	Very gravelly sandy clay loam, very gravelly clay loam.	GC, GP-GC	A-2	0	25-50	10-40	10-35	5-20	25-35	5-15
	33	Weathered bedrock.	---	---	---	---	---	---	---	---	---
[illegible]	0-16	Silt loam	CL	A-6,	0	100	100	90-100	60-85	25-35	10-15
	16-28	Silty clay loam, clay loam.	CL	A-6	0	100	100	85-100	75-90	25-35	10-15
	28-60	Fine sand, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	95-100	65-80	10-40	15-25	NP-10

* See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ao---------------- Anapra	0-28	Clay loam--------	CL	A-6, A-7	0	100	100	90-100	60-85	30-50	12-30
	28-60	Fine sand, loamy fine sand.	SM, SM-SC	A-2, A-4	0	100	95-100	65-80	10-40	<25	NP-7
Ap*:											
Anthony-----------	0-18	Fine sandy loam	SM, ML	A-4	0	95-100	90-100	55-85	35-65	20-30	NP-5
	18-38	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	95-100	90-100	50-85	30-50	20-30	NP-5
	38-60	Loamy very fine sand.	SM	A-4	0	95-100	90-100	50-85	35-50	20-30	NP-5
Vinton------------	0-12	Fine sandy loam	SM, ML	A-4	0	100	100	70-85	40-55	20-30	NP-5
	12-60	Loamy sand, loamy fine sand, fine sandy loam.	SM	A-2	0	95-100	90-100	55-80	15-30	---	NP
Ar*:											
Anthony-----------	0-13	Loam------------	CL-ML, CL	A-4, A-6	0	100	100	85-100	60-80	25-35	5-15
	13-60	Fine sandy loam, sandy loam, loamy very fine sand.	SM	A-2, A-4	0	95-100	90-100	50-85	30-50	20-30	NP-5
Vinton------------	0-16	Loam------------	CL-ML, CL	A-4, A-6	0	100	100	85-100	60-80	25-35	5-15
	16-60	Loamy sand, loamy fine sand, fine sand, loam.	SM	A-2	0	95-100	90-100	55-80	15-30	---	NP
As*:											
Anthony-----------	0-15	Clay loam--------	CL-ML, CL	A-4, A-6	0	100	100	85-100	60-80	25-35	5-15
	15-60	Fine sandy loam, sandy loam, loamy very fine sand.	SM	A-2, A-4	0	95-100	90-100	50-85	30-50	20-30	NP-5
Vinton------------	0-15	Clay loam--------	CL-ML, CL	A-4, A-6	0	100	100	85-100	60-80	25-35	5-15
	15-60	Loamy sand, loamy fine sand, fine sand.	SM	A-2	0	95-100	90-100	55-80	15-30	---	NP
At---------------- Armijo	0-10	Loam------------	CL, CL-ML	A-4, A-6	0	100	100	95-100	75-85	20-30	5-15
	10-52	Clay loam, clay, silty clay.	CH	A-7	0	100	100	95-100	50-100	50-75	25-50
	52-60	Stratified very fine sandy loam to loamy fine sand.	SM	A-2, A-4	0	100	100	60-85	25-50	---	NP-5
Aw---------------- Armijo	0-15	Clay loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	75-85	20-30	5-15
	15-42	Sandy clay, clay, silty clay.	CH	A-7	0	100	100	95-100	50-100	50-75	25-50
	42-60	Stratified very fine sandy loam to loamy fine sand.	SM	A-2, A-4	0	100	100	60-85	25-50	---	NP-5

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Ax------------------- Armijo	0-12	Clay--------------	CL, CH	A-7	0	100	100	95-100	85-95	45-70	25-45
	12-60	Sandy clay, clay, silty clay.	CH	A-7	0	100	100	95-100	50-100	50-75	25-50
	60-70	Stratified very fine sandy loam to loamy fine sand.	SM	A-2, A-4	0	100	100	60-85	25-50	---	NP-5
Be------------------ Belen	0-12	Loam-------------	CL, CL-ML	A-4, A-6	0	100	100	95-100	75-95	20-30	5-15
	12-24	Clay, silty clay, silty clay loam.	CH, MH	A-7	0	100	100	95-100	90-100	50-70	20-40
	24-60	Fine sandy loam, loam, silt loam.	CL, ML	A-4	0	100	100	75-95	50-85	20-30	5-10
Bf------------------ Belen	0-11	Clay loam--------	CL	A-6	0	100	100	95-100	85-95	30-40	15-25
	11-26	Clay, silty clay, silty clay loam.	CH, MH	A-7	0	100	100	95-100	90-100	50-70	20-40
	26-60	Loam, silt loam, very fine sandy loam.	CL, ML	A-4	0	100	100	75-95	50-85	20-30	5-10
Bg------------------ Belen	0-11	Clay-------------	CH, MH	A-7	0	100	100	95-100	90-100	50-70	20-40
	11-30	Clay, silty clay, silty clay loam.	CH, MH	A-7	0	100	100	95-100	90-100	50-70	20-40
	30-60	Fine sandy loam, loam, silt loam.	CL, ML	A-4	0	100	100	75-95	50-85	20-30	5-10
BH*----------------- Belen Variant	0-4	Silty clay-------	CH, CL	A-7, A-6	0	100	100	95-100	85-100	30-70	15-40
	4-21	Clay, silty clay	CH, MH	A-7	0	100	100	95-100	90-100	50-70	20-40
	21-38	Fine sandy loam, loam, very fine sandy loam.	CL-ML	A-4	0	100	100	75-95	50-75	20-30	5-10
	38-60	Very fine sand	SM, ML	A-4	0	100	100	75-90	35-55	---	NP
BJ*: Berino-------------	0-4	Loamy fine sand	SM, SP-SM	A-2	0	95-100	95-100	50-95	10-35	---	NP
	4-60	Sandy clay loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-6, A-4	0	95-100	95-100	65-80	35-55	20-35	5-15
Bucklebar----------	0-6	Sandy loam-------	SM, ML	A-2, A-4	0	95-100	95-100	60-85	30-55	15-25	NP-5
	6-25	Sandy clay loam, clay loam.	SM-SC, SC, CL-ML, CL	A-6, A-4	0-5	90-100	90-100	60-85	40-60	25-35	5-15
	25-38	Loam	ML, CL-ML	A-4	0-5	95-100	95-100	80-100	60-80	25-35	5-10
	38-60	Silty clay loam, loam.	CL-ML, CL	A-4, A-6	0-5	95-100	95-100	85-100	60-90	25-40	5-15
Dona Ana-----------	0-5	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	60-85	30-50	15-25	NP-5
	5-60	Sandy clay loam, sandy loam, loam.	SC, SM-SC	A-6, A-4	0	95-100	90-100	80-90	35-50	25-40	5-15
BK*: Berino-------------	0-5	Fine sandy loam	SM	A-2, A-4	0	95-100	95-100	60-95	30-50	---	NP
	5-60	Sandy clay loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-6, A-4	0	95-100	95-100	65-80	35-55	20-35	5-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
BK*:											
Dona Ana----------	0-6	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	60-85	30-50	15-25	NP-5
	6-60	Sandy clay loam, sandy loam, loam.	SC, SM-SC	A-6, A-4	0	95-100	90-100	80-90	35-50	25-40	5-15
BL*:											
Berino------------	0-8	Fine sandy loam	SM	A-2, A-4	0	95-100	95-100	60-95	30-50	---	NP
	8-60	Sandy clay loam, sandy loam.	SC, SM-SC, CL, CL-ML	A-6, A-4	0	95-100	95-100	65-80	35-55	20-35	5-15
Pintura-----------	0-60	Loamy fine sand	SP-SM, SM	A-3, A-2	0	100	100	70-95	5-25	---	NP
Bm---------------- Bluepoint	0-12	Loamy sand------	SM	A-2	0	90-100	90-100	75-85	20-35	---	NP
	12-60	Stratified loamy fine sand to loamy sand.	SM	A-2	0	90-100	90-100	70-80	15-25	---	NP
Bn---------------- Bluepoint	0-18	Loamy sand------	SM	A-2	0	90-100	90-100	75-85	20-35	---	NP
	18-60	Stratified loamy fine sand to loamy sand.	SM	A-2	0	90-100	90-100	70-80	15-25	---	NP
BO---------------- Bluepoint	0-17	Loamy sand------	SM	A-2	0	90-100	90-100	75-85	20-35	---	NP
	17-60	Stratified loamy fine sand to loamy sand.	SM	A-2	0	90-100	90-100	70-80	15-25	---	NP
BP*:											
Bluepoint---------	0-19	Loamy sand------	SM	A-2	0	90-100	90-100	75-85	20-35	---	NP
	19-60	Stratified loamy fine sand to loamy sand.	SM	A-2	0	90-100	90-100	70-80	15-25	---	NP
Caliza------------	0-22	Very gravelly sandy loam.	GP-GM, GM	A-1	0	30-50	25-45	15-35	5-20	20-30	NP-5
	22-60	Very gravelly loamy sand, very gravelly sand.	GP, GP-GM	A-1	0	25-50	20-40	10-30	0-10	---	NP
Yturbide----------	0-15	Loamy sand------	SM	A-1, A-2	0	80-95	75-90	40-70	15-30	---	NP
	15-26	Gravelly loamy sand.	SM, SP-SM	A-1, A-2	0	65-80	60-75	35-55	10-20	---	NP
	26-60	Gravelly sand, gravelly loamy sand, loamy sand.	SP-SM	A-1, A-2, A-3	0-5	60-80	55-75	30-60	5-10	---	NP
Br---------------- Brazito	0-5	Loamy fine sand	SM	A-2	0	95-100	95-100	70-85	15-30	---	NP
	5-60	Fine sand, sand	SP, SP-SM	A-3	0	95-100	95-100	65-85	0-10	---	NP
Bs---------------- Brazito	0-15	Very fine sandy loam.	ML, SM, CL-ML, SM-SC	A-4	0	95-100	95-100	75-90	35-55	20-30	NP-10
	15-60	Fine sand, sand	SP, SP-SM	A-3	0	95-100	95-100	65-85	0-10	---	NP
CA*:											
Cacique-----------	0-2	Loamy sand------	SM	A-2	0	100	100	50-80	15-35	---	NP
	2-25	Sandy clay loam, sandy loam.	SC	A-2, A-6	0	90-100	85-100	65-90	30-50	25-35	10-15
	25	Indurated--------	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
CA*:											
Cruces-------------	0-2	Loamy sand------	SM	A-2	0	90-100	90-100	70-90	15-35	---	NP
	2-14	Fine sandy loam, sandy clay loam.	CL-ML, SM-SC, SC, CL	A-2, A-4	0	90-100	80-100	80-90	30-60	20-30	5-10
	14	Indurated-------	---	---	---	---	---	---	---	---	---
Simona------------	0-7	Loamy sand------	SM	A-2	0	100	100	90-100	15-35	---	NP
	7-18	Fine sandy loam, sandy loam, gravelly fine sandy loam.	SM	A-2, A-4	0-5	70-100	65-100	50-100	20-50	---	NP
	18	Indurated-------	---	---	---	---	---	---	---	---	---
Cb*:											
Canutio-----------	0-10	Gravelly sandy loam.	SM-SC, SC	A-1, A-2	5-25	60-75	60-70	30-40	10-30	20-40	5-20
	10-60	Very gravelly sandy loam, very gravelly loamy sand, gravelly loamy sand.	GP-GC, SC, GC, SP-SC	A-2	10-20	45-75	45-70	25-40	5-20	20-40	5-20
Arizo-------------	0-15	Gravelly sandy loam.	GM	A-1, A-2	0-15	50-60	50-60	30-55	15-35	---	NP
	15-60	Stratified very gravelly sand to loamy sand.	GP-GM, GP	A-1	0-15	25-55	20-50	10-30	0-10	---	NP
CH*:											
Cave--------------	0-16	Gravelly sandy loam.	SM-SC	A-2, A-4	0-5	70-90	60-75	40-65	25-50	25-30	5-10
	16	Indurated-------	---	---	---	---	---	---	---	---	---
Harrisburg--------	0-3	Fine sandy loam	SM	A-4	0	95-100	90-100	70-85	40-50	20-30	NP-5
	3-24	Fine sandy loam, gravelly fine sandy loam.	SM	A-2, A-4	0	60-90	60-90	40-70	15-45	20-30	NP-5
	24	Indurated-------	---	---	---	---	---	---	---	---	---
DR*:											
Dona Ana----------	0-5	Fine sandy loam	SM	A-2, A-4	0	95-100	90-100	60-85	30-50	15-25	NP-5
	5-60	Sandy clay loam, sandy loam, loam.	SC, SM-SC	A-6, A-4	0	95-100	90-100	80-90	35-50	25-40	5-15
Reagan------------	0-23	Clay loam-------	CL	A-6, A-7	0	95-100	95-100	90-100	70-95	35-45	20-30
	23-71	Silty clay, silty clay loam, loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-95	35-50	20-30
DS. Dumps											
Ge----------------- Glendale	0-8	Loam------------	SM, ML	A-4	0	95-100	95-100	75-85	40-60	20-30	NP-5
	8-60	Clay loam, silty clay loam, very fine sandy loam.	CL	A-6	0	100	100	95-100	75-90	30-40	15-25
Gf----------------- Glendale	0-8	Clay loam-------	CL	A-6	0	100	100	95-100	75-90	30-40	15-25
	8-60	Clay loam, silty clay loam, very fine sandy loam.	CL	A-6	0	100	100	95-100	75-90	30-40	15-25

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Gg----------------- Glendale	0-12	Clay loam--------	CL	A-6	0	100	100	80-95	75-90	30-40	15-25
	12-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	80-95	75-90	30-40	15-25
HD*. Haplargids											
Hf----------------- Harkey	0-13	Fine sandy loam	SM	A-4	0	100	100	60-70	35-50	---	NP
	13-56	Very fine sandy loam, loam, silt loam.	ML	A-4	0	100	100	85-100	75-90	20-30	NP-5
	56-60	Fine sand	SP-SM, SM	A-3, A-4	0	100	100	70-95	5-25	---	NP
Hg----------------- Harkey	0-18	Loam-------------	ML	A-4	0	100	100	90-100	65-90	20-30	NP-5
	18-60	Very fine sandy loam, loam, silt loam.	ML	A-4	0	100	100	85-100	75-90	20-30	NP-5
Hh----------------- Harkey	0-10	Loam-------------	ML	A-4	0	100	100	90-100	65-90	20-30	NP-5
	10-47	Very fine sandy loam, loam, silt loam.	CL-ML, ML, CL	A-4	0	100	100	85-100	75-90	20-30	NP-10
	47-60	Loamy sand	SM	A-1, A-2	0	85-100	75-100	45-80	10-30	---	NP
Hk----------------- Harkey	0-12	Clay loam--------	CL	A-6	0	100	100	85-100	70-80	30-40	10-20
	12-60	Fine sandy loam, loam, silt loam.	ML	A-4	0	100	100	85-100	75-90	20-30	NP-5
MN*: Masonfort----------	0-3	Sandy loam-------	SM	A-2, A-4	0-5	85-100	80-100	50-70	25-40	20-30	NP-5
	3-18	Sandy loam, gravelly sandy loam.	SM, GM	A-1, A-2	0-10	60-100	55-95	35-65	15-35	20-30	NP-5
	18	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Nickel-------------	0-8	Gravelly sandy loam.	GM, SM	A-1, A-2	0-5	55-80	50-75	30-70	10-30	---	NP
	8-60	Very gravelly sandy loam, very gravelly fine sandy loam, gravelly sandy loam.	GP-GM, GM, SP-SM, SM	A-1	0-10	30-60	20-55	15-35	5-15	---	NP
Mo----------------- Mimbres	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	90-100	75-95	25-45	10-25
	10-60	Silty clay loam, silt loam, clay loam.	CL	A-6, A-7	0	100	100	90-100	75-95	25-45	10-25
MR*: Minlith------------	0-3	Loamy sand-------	SM, SP-SM	A-1, A-2	0-5	85-100	75-100	45-80	10-30	---	NP
	3-13	Very gravelly loamy sand, very gravelly loamy fine sand.	GP-GM, GM, SP-SM, SM	A-1	5-25	45-60	40-50	20-40	5-15	---	NP
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
MR*:											
Onite----------------	0-5	Loamy sand-------	SM	A-2	0	100	100	50-95	15-35	---	NP
	5-27	Sandy loam, gravelly sandy loam.	SM	A-2	0	75-100	65-100	50-95	15-35	---	NP
	27-60	Loamy sand, gravelly sandy loam, sandy loam.	SM	A-1, A-2	0	65-100	60-100	45-85	10-35	---	NP
MS*:											
Motoqua-------------	0-2	Cobbly loam------	GM-GC, GC	A-4, A-6	25-30	65-85	60-75	50-65	35-50	20-35	5-15
	2-20	Very cobbly silt loam, very cobbly loam.	GM-GC, GC	A-4, A-6	25-45	55-65	55-65	50-55	35-40	20-35	5-15
	20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
NB*:											
Nickel--------------	0-2	Very gravelly sandy loam.	GP-GM, GM,	A-1, A-2	0-5	25-55	20-50	15-45	5-35	---	NP
	2-60	Very gravelly sandy loam, very gravelly fine sandy loam, gravelly sandy loam.	GP-GM, GM, SP-SM, SM	A-1	0-10	30-60	20-55	15-35	5-15	---	NP
Badland.											
NU*:											
Nickel--------------	0-5	Very gravelly fine sandy loam.	GM, GP-GM	A-1, A-2	0-5	25-55	20-50	15-45	5-35	---	NP
	5-60	Very gravelly sandy loam, very gravelly fine sandy loam, gravelly sandy loam.	GP-GM, GM, SP-SM, SM	A-1	0-10	30-60	20-55	15-35	5-15	---	NP
Upton---------------	0-14	Gravelly sandy loam.	CL, GC, SC	A-4, A-6	0-5	65-85	60-75	51-70	35-55	25-38	10-15
	14-22	Cemented---------	---	---	0-50	---	---	---	---	---	---
	22-60	Variable---------	---	---	0-20	---	---	---	---	---	---
OP*:											
Onite---------------	0-5	Loamy sand-------	SM	A-2	0	100	100	50-95	15-35	---	NP
	5-18	Sandy loam, gravelly sandy loam.	SM	A-2	0	75-100	65-100	50-95	15-35	---	NP
	18-60	Loamy sand, gravelly sandy loam, sandy loam.	SM	A-1, A-2	0	65-100	60-100	45-85	10-35	---	NP
Pajarito-----------	0-8	Fine sandy loam	SM, SM-SC	A-2, A-4	0	100	100	85-100	30-45	10-20	NP-5
	8-25	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	90-100	85-100	60-100	25-45	10-20	NP-5
	25-60	Fine sandy loam, sandy loam, loam, fine sand.	SM, ML	A-4, A-2	0	90-100	85-100	60-95	20-55	20-30	NP-5

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
OP*:											
Pintura	0-60	Fine sand	SP-SM, SM	A-3, A-2	0	100	100	70-95	5-25	---	NP
OR*:											
Onite	0-5	Loamy fine sand	SM	A-2	0	100	100	50-95	15-35	---	NP
	5-20	Sandy loam, gravelly sandy loam.	SM	A-2	0	75-100	65-100	50-95	15-35	---	NP
	20-60	Loamy sand, gravelly sandy loam, sandy loam.	SM	A-1, A-2	0	65-100	60-100	45-85	10-35	---	NP
Pintura	0-60	Fine sand	SP-SM, SM	A-3, A-2	0	100	100	70-95	5-25	---	NP
Pa Pajarito	0-12	Fine sandy loam	SM, SM-SC	A-2, A-4	0	100	100	85-100	30-45	10-20	NP-5
	12-20	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	90-100	85-100	60-100	25-45	10-20	NP-5
	20-60	Fine sandy loam, sandy loam, loam.	SM, ML	A-4, A-2	0	90-100	85-100	60-95	20-55	20-30	NP-5
Pb*:											
Pajarito	0-14	Loamy fine sand	SM	A-2	0	100	100	85-100	25-35	---	NP
	14-28	Fine sandy loam, sandy loam.	SM, SM-SC	A-2, A-4	0	90-100	85-100	60-100	25-45	10-20	NP-5
	28-60	Fine sandy loam, sandy loam, loamy very fine sand.	SM, ML	A-4, A-2	0	90-100	85-100	60-95	20-55	20-30	NP-5
Pintura	0-10	Loamy fine sand	SP-SM, SM	A-3, A-2	0	100	100	70-95	5-25	---	NP
	10-60	Fine sand	SP-SM, SM	A-3, A-2	0	100	100	70-75	5-25	---	NP
PN*:											
Pinaleno	0-2	Very gravelly sandy loam.	GM	A-1	0-15	30-55	25-50	15-35	10-20	20-30	NP-5
	2-20	Very gravelly sandy loam, very gravelly sandy clay loam.	GM-GC	A-2	0-20	30-55	25-50	15-45	10-25	25-30	5-10
	20-37	Very gravelly sandy loam.	GM	A-1	0-20	30-55	25-50	15-35	10-20	20-30	NP-5
	37-60	Very gravelly loamy sand.	GP-GM, GM	A-1	0-20	30-55	25-50	15-35	5-15	---	NP
Nolam	0-2	Very gravelly fine sandy loam.	GM	A-1, A-2	0	35-50	35-50	25-40	15-30	---	NP
	2-17	Very gravelly sandy clay loam, very gravelly sandy loam.	GM-GC, GC, GP-GC	A-2	0	35-50	35-50	25-45	10-25	25-40	5-15
	17-40	Very gravelly sandy loam.	GM, GP-GM	A-1	0	35-50	35-50	20-35	10-20	---	NP
	40-71	Very gravelly sand, very gravelly loamy sand.	GM, GP-GM	A-1	0	35-50	35-50	20-35	5-15	---	NP
RE. Riverwash											

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
RF*: Riverwash.											
Arizo-------------	0-12	Gravelly loamy sand.	GM	A-1	0-15	50-75	50-75	20-45	15-25	---	NP
	12-60	Stratified very gravelly sand to very gravelly loamy sand.	GP-GM, GP	A-1	0-15	25-55	20-50	10-30	0-10	---	NP
RG*: Rock outcrop.											
Argids.											
RH*: Rock outcrop.											
Argids.											
RL*: Rock outcrop.											
Lozier------------	0-6	Stony loam------	GC, SC, CL	A-2, A-4, A-6	5-20	40-80	30-70	25-65	20-60	25-35	10-15
	6-11	Very stony loam	GC	A-2, A-4	35-70	35-65	30-60	30-50	20-40	25-35	10-15
	11	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
RT*: Rock outcrop.											
Torriorthents.											
SH*: Simona------------	0-2	Sandy loam------	SM	A-4	0	100	100	90-100	35-50	---	NP
	2-12	Fine sandy loam, sandy loam, gravelly fine sandy loam.	SM	A-2, A-4	0-5	70-100	65-100	50-100	20-50	---	NP
	12	Indurated-------	---	---	---	---	---	---	---	---	---
Harrisburg--------	0-8	Fine sandy loam	SM	A-4	0	95-100	90-100	70-85	40-50	20-30	NP-5
	8-24	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	95-100	90-100	55-85	30-50	20-30	NP-5
	24	Indurated-------	---	---	---	---	---	---	---	---	---
ST*: Stellar-----------	0-3	Clay loam-------	CL	A-6	0	100	100	90-100	70-95	30-40	10-20
	3-28	Clay, sandy clay, clay loam.	CH, CL, SC	A-7	0	100	100	80-95	45-90	40-60	15-30
	28-60	Clay loam, sandy clay loam, gravelly clay loam.	CL, GC, SC	A-6, A-7	0-5	65-100	60-100	55-100	45-70	30-50	10-25
Stellar, flooded--	0-5	Clay loam-------	CL	A-6	0	100	100	95-100	70-80	30-40	10-20
	5-31	Clay------------	CL, CH	A-7	0	100	100	90-100	70-90	40-55	15-30
	31-60	Sandy clay loam, clay loam.	SM-SC, SC, CL-ML, CL	A-4, A-6	0	95-100	90-100	80-95	40-75	25-40	5-15

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
TE*:											
Tencee	0-7	Very gravelly sandy loam.	GM, GP-GM	A-1	0-25	35-50	25-45	15-40	5-20	20-30	NP-5
	7	Indurated	---	---	---	---	---	---	---	---	---
Upton	0-16	Gravelly sandy loam.	CL, GC, SC	A-4, A-6	0-2	65-85	60-75	51-70	35-55	25-35	10-15
	16-22	Cemented	---	---	0-50	---	---	---	---	---	---
	22-60	Variable	---	---	0-20	---	---	---	---	---	---
TF*:											
Terino	0-2	Very gravelly sandy loam.	GP-GM, GM, SM, SP-SM	A-1, A-2, A-3	0-5	35-60	25-50	15-45	5-30	---	NP
	2-15	Very gravelly sandy clay loam, very gravelly sandy loam.	GM-GC, GM, GC, GP-GM	A-1, A-2	0-5	35-55	25-50	20-45	10-30	20-30	NP-10
	15-32	Indurated	---	---	---	---	---	---	---	---	---
	32-60	Very gravelly sandy loam, very gravelly loamy sand.	GP-GM, GM	A-1	0-10	35-55	25-50	15-40	5-20	---	NP
Casito	0-6	Very gravelly sandy loam.	GM, GP-GM	A-1	0-5	35-50	30-50	15-35	10-25	---	NP
	6-12	Very gravelly sandy clay loam.	GM-GC, GC, GP-GC	A-1, A-2	0-5	30-50	25-50	20-45	10-30	20-30	5-15
	12-28	Indurated	---	---	---	---	---	---	---	---	---
	28-60	Very gravelly sandy loam, very gravelly loamy sand.	GM, GP-GM	A-1	0-5	35-50	30-50	15-40	5-20	---	NP
Pinaleno	0-2	Very gravelly sandy loam.	GM	A-1	0-15	30-55	25-50	15-35	10-20	20-30	NP-5
	2-30	Very gravelly sandy loam, very gravelly sandy clay loam.	GM-GC	A-2	0-20	30-55	25-50	15-45	10-25	25-30	5-10
	30-40	Very gravelly sandy loam.	GM	A-1	0-20	30-55	25-50	15-35	10-20	20-30	NP-5
	40-60	Very gravelly loamy sand.	GP-GM, GM	A-1	0-20	30-55	25-50	15-35	5-15	---	NP
Vf Vinton Variant	0-14	Fine sandy loam	SM, ML	A-4	0	100	100	70-90	40-65	15-25	NP-5
	14-32	Loamy sand, loamy fine sand, fine sand.	SM	A-2	0	100	100	50-85	15-35	---	NP
	32-42	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	42-60	Sand	SP, SP-SM, SM	A-2, A-3	0	100	100	60-80	0-15	---	NP
Vg Vinton Variant	0-16	Sandy clay loam	SC, CL	A-6	0	100	100	80-95	35-75	30-40	10-15
	16-33	Loamy sand, loamy fine sand, fine sand.	SM	A-2	0	100	100	50-85	15-35	<20	NP
	33-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
WH*:											
Wink----------------	0-2	Fine sandy loam	SM,	A-2	0-5	90-100	90-100	80-100	15-35	15-25	NP-5
	2-26	Fine sandy loam, loam.	SM, SM-SC	A-2 A-4	0-5	90-100	90-100	80-100	25-45	15-25	NP-10
	26-60	Sandy loam-------	SM-ML	A-2, A-4	0	95-100	95-100	60-85	30-55	15-25	NP-5
Harrisburg---------	0-4	Loamy fine sand	SM	A-2	0	95-100	90-100	75-85	25-35	---	NP
	4-24	Fine sandy loam, sandy loam.	SM	A-2, A-4	0	95-100	90-100	55-85	30-50	20-30	NP-5
	24	Indurated--------	---	---	---	---	---	---	---	---	---
Simona-------------	0-2	Sandy loam-------	SM	A-4	0	100	100	90-100	35-50	---	NP
	2-7	Fine sandy loam, sandy loam, gravelly fine sandy loam.	SM	A-2, A-4	0-5	70-100	65-100	50-100	20-50	---	NP
	7	Indurated--------	---	---	---	---	---	---	---	---	---
WP*:											
Wink----------------	0-10	Loamy fine sand	SM, SM-SC	A-2	0-5	90-100	90-100	80-100	15-35	15-25	NP-5
	10-20	Fine sandy loam, loam.	SM, SM-SC	A-4	0-5	90-100	90-100	80-100	25-45	15-25	NP-10
	20-60	Sandy loam, loamy fine sand	SM	A-2, A-4	0	90-100	90-100	55-85	25-50	15-30	NP-5
Pintura-------------	0-60	Loamy fine sand	SP-SM, SM	A-3, A-2	0	100	100	70-95	5-25	---	NP

* See description of the map unit for composition and behavior characteristics of the map unit.

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