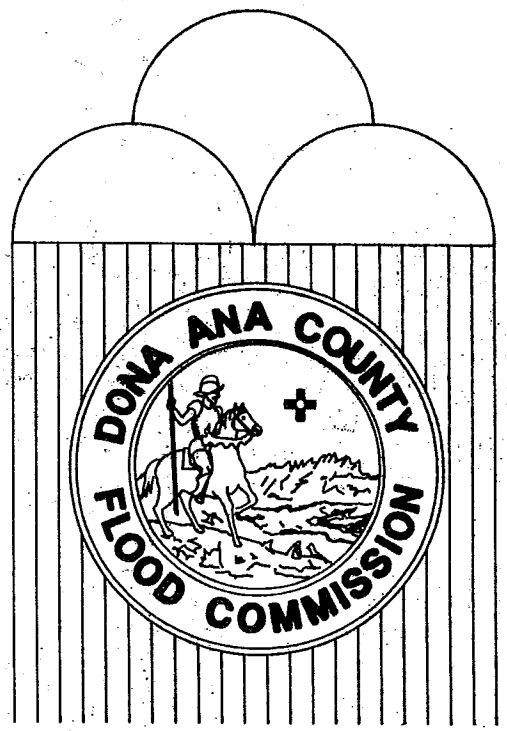
JORNADA MASTER DRAINAGE PLAN
VOLUME 1 OF 2

DONA ANA COUNTY, NEW MEXICO



MARCH 1992

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March 10, 1992

Cesar Ramos, P.E.
Director, Dona Ana County Flood Commission
430 South Main St.
Las Cruces, NM 88001

RE: DONA ANA COUNTY FLOOD COMMISSION STUDY
JORNADA MASTER DRAINAGE PLAN

Transmitted herewith are six (6) copies of the final edition of the Preliminary Engineering Study for the referenced project.

Changes in the final edition of the report from the preliminary review copy submitted in November include the following:

1. Relocation of Blair/Baylor Dam to the location you requested.
2. Resizing of downstream detailed outfall channels.
3. Minimizing the discharge from each dam by detaining flood waters as long as possible.
4. Inclusion of your written comments into the report.

Leedshill-Herkenhoff has enjoyed working with the Flood Commission on the Jornada Master Drainage Plan, and would appreciate the opportunity to provide final design services for these flood control structures.

SUSAN M. ALVAREZ NEW MEXICO 11521 REGISTERED PROFESSIONAL ENGINEER
3-10-92

SUSAN ALVAREZ, P.E.
Project Manager

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Enc.

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EXECUTIVE SUMMARY

INTRODUCTION

On December 20, 1990, the Dona Ana County Flood Commission authorized the preliminary engineering studies of the drainage facilities located in the 56 square mile Jornada watershed of the East Mesa area near Las Cruces, New Mexico. These studies included the analysis of existing watershed conditions, a sedimentation and erosion analysis, and the development and preliminary design of a system of drainage improvements to ameliorate historical flooding and sedimentation problems within the watershed.

ANALYSES

The hydrologic and hydraulic analyses were conducted by utilizing computer modeling techniques developed by the U.S. Army Corps of Engineers and other recognized engineering and analytical procedures. Aerial and field site surveys were used to augment the Flood Commission's orthophotographic mapping of the area. An analysis was made for existing and proposed watershed conditions occurring from the 10- and 100-year 24-hour frequency rainfall events.

Three basin-wide systems of drainage improvements were developed and analyzed for flood control effectiveness, costs, and sediment control. These consisted of a five dam option, a three dam option and a linear detention option. Each dam was optimized for embankment costs versus spillway type and length to obtain the most cost effective facility. All detention facilities were designed in general compliance with the New Mexico State Engineer's Office Design Criteria and the recommendations of the geotechnical report prepared for this project.

A sedimentation analysis was completed in order to quantify the sediment load from the arroyos to determine a reasonable area maintenance budget and to determine the

amount of additional storage required in the detention facilities to accommodate the sediment volume resulting from the 100-year frequency flood event.

The collection channels were also optimized by slope and type of erosion protection. Back water analyses and the resulting water surface profiles were included in this report.

FINDINGS AND CONCLUSIONS

a. The existing arroyos within the Jornada watershed do not have adequate capacity to accommodate either the 10-year and the 100-year frequency rainfall events.

b. With the exception of the roadway drainage structures located within U.S. Highway 70 right-of-way, most of the existing roadway crossing structures do not have adequate capacity to carry the existing 10- or 100-year frequency rainfall runoffs.

c. There is significant sediment loading stemming from the east and southern most areas of the watershed.

d. The linear detention pond configuration is not feasible for implementation in the East Mesa because of the terrain and because of the heavy sediment bed load from the arroyos served by the ponds.

e. The three dam alternative which consists of a detention facilities located at Brahman Road, Blair/Baylor Canyon Arroyos and Mine House Spring Arroyo provides significant cost savings over the five dam alternative. The five dam alternative utilizes smaller dams on the San Augustin, Owl's Nest and Organ Arroyos in lieu of the Brahman Road facility.

f. The stepped soil cement spillway provides significant savings over the stepped gabion spillway and the concrete baffle block spillway.

g. For channels requiring erosion protection, rock riprap is the most cost effective channel protection.

h. The project has minimal impact on Isaack Lake.

RECOMMENDED IMPROVEMENTS

We recommend the following improvements:

a. Construction of detention ponds and embankments of Brahman Road, Blair/Baylor Canyon Arroyos and Mine House Spring Arroyo.

b. Construction of the Brahman Road Channel to intercept runoff from the San Augustin, Owl's Nest and Organ Arroyos and convey it to the Brahman Road Detention Facility.

c. Construction of the Rincon Road Channel, Baylor Canyon Channel, Jornada Channel and Arroyo Road Channels to provide runoff conveyance to Isaack Lake.

d. As development occurs, the construction of the Isaack lake Channels and the neighborhood collector channel network.

COST OF RECOMMENDED FACILITIES

The preliminary cost estimates for construction and right-of-way for recommended improvements are as follows and have been prioritized into phases as described in the

report. These costs include contingencies at 15 percent and legal, administrative costs at 10 percent of construction costs with contingencies.

Phase 1	
Brahman Road Detention Facility	$1,783,330
Brahman Road Channel	$1,508,960
Rincon Road Channel	$4,094,390
Phase 2	
Mine House Spring Detention Facility	$2,500,810
Baylor Channel	$2,594,950
Jornada Road Channel	$2,307,590
Phase 3	
Blair/Baylor Detention Facility	$3,463,500
Arroyo Road Channel	$1,810,570
Phase 4	
Isaack Lake System Channels	$388,690
Local Collector Channels	$1,402,000
TOTAL PRELIMINARY COST ESTIMATE	$21,854,680

CHAPTER I
INTRODUCTION

A. AUTHORIZATION

Authorization for this study was provided in A/E services agreement No. FC90-91-002 between Dona Ana County Flood Commission and Leedshill-Herkenhoff, Inc., dated December 11, 1990. This authorization provided notice to proceed with engineering services for a total of three area drainage projects: Vado Arroyo, Donaldson Arroyo, and the Jornada Watershed pre-design studies. This report summarizes the analysis, results, and conclusions reached on the Jornada Watershed study; reports summarizing the Vado and Donaldson Arroyo studies have been provided under separate cover.

B. OBJECTIVE AND SCOPE

The primary objectives of this study are to quantify the existing flood potential and to investigate design alternatives to provide sediment control and mitigate flood damages in the developing East Mesa area of Las Cruces, New Mexico. This report summarizes the results of the hydrologic and hydraulic analyses of the basins forming the Jornada watershed within the East Mesa.

The scope of the pre-design services covered in this report includes the following:

1) Determine the existing flood potential within the East Mesa area resulting from the 24-hour, 10-year and 100-year storm events. The analysis will include determination of the peak rainfall runoff rates and volumes impacting the project area under existing development conditions and with limited development assuming the proposed project alternatives are in place.

2) Develop a system of flood control alternatives to economically mitigate the effects of the design flood on the Jornada watershed and to provide sediment control. Investigation will include sizing and location of

regional detention facilities, analysis of various types of detention, spillway, and channel configurations and evaluation of overall flood control effectiveness.

3) Generate water surface profiles to evaluate channel conveyance for existing flow conditions and for the proposed alternative under developed conditions.

4) Conduct a sediment transport analysis for each of the basin design alternatives to determine the probable annual sediment load, upstream erosion potential and estimated annual maintenance costs. Provide estimates of the impact of the basins on existing erosion and sedimentation rates.

5) Identify requirements for drainage easements and/or right-of-way acquisition necessary to construct the recommended flood control improvements.

6) Provide preliminary estimates of probable cost for the project components to enable economic comparison of the proposed alternatives and a preliminary project budget.

7) Provide a plan for construction implementation of the recommended improvements, including prioritization by immediate need, available budget and maximal flood and sediment control benefits.

8) Prepare a report summarizing the analyses, results and recommended system of improvements.

C. DATA ACQUISITION

The Dona Ana Flood Commission provided 1:200 foot orthophotographic mapping of the project area for use in this analysis.

Identification of current property boundaries was obtained from Section and Subsection mapping provided by the Dona Ana County Assessor's Office. This information was supplemented by the U.S. Bureau of Land Management (BLM) mapping of the area.

As-built plans for U.S. Highway 70 were obtained from the New Mexico State Highway and Transportation Department (NMSHTD).

Identification of soil types used for the hydrologic analysis was derived from the SCS publication "Soil Survey of Dona Ana County, New Mexico", August 1980.

Sampling of soils in the Jornada basin and subsurface soil borings at proposed detention dam locations was performed by Precision Engineering of Las Cruces, under contract with Leedshill-Herkenhoff, Inc. (LH). A geotechnical report containing findings and recommendations has been prepared by Precision, and is included in appendix B of this report. Other non-site specific references utilized in the Jornada Basin analyses are included in Chapter XI, Reference for this report.

D. INTER-AGENCY COORDINATION AND PERMITTING

The flow paths for both the existing and proposed East Mesa watershed conditions traverse land holdings of the United States Military, the United States Bureau of Land Management, the State of New Mexico, the New Mexico State Highway and Transportation Department, and numerous private individuals and corporations. In addition, the East Mesa watershed lies within the Extra-Territorial Zone (ETZ) of the City of Las Cruces. Coordination with each of these entities will be required to complete construction of the recommended flood control facilities in a timely manner. A brief summary of each agency's potential project involvement is included below.

The upper end of the watershed lies within the boundaries of the White Sands Missile Range in U.S. Military Reserves. However, since the proposed project does not impact the area located within the Military Reserves and construction of improvements is not recommended in this area, coordination with this entity is on a courtesy basis only.

Construction of the proposed improvements in the optimum economic and hydrologic locations may require land acquisition from the BLM. Typically, an environmental assessment is required by the BLM for all property acquisition. Because of the limited scope of the project, it is possible that a "Categorical Exclusion" may be acceptable rather than a full environmental assessment. In the event that an environmental assessment is required, a scoping workshop with BLM personnel and the Flood Commission will be necessary. The scoping workshop will establish the necessary information for archeological and biological surveys, and the level of effort required for further investigations.

In accordance with Chapter 72 of the New Mexico State Acts of 1978,the New Mexico State Engineer's Office has jurisdiction over the construction of all non-federal dams within the State of New Mexico. As such, a permit from the State Engineer is required for construction of dams which are more than 10 feet in height or provide more than 10 acre-feet of storage. This regulation includes dams intended for sediment,erosion and flood control but excludes those dams constructed for the sole purpose of sediment and flood control constructed under the supervision of officers of the U.S. Army Corps of Engineers (COE). For the dams proposed in the Jornada Master Plan, the State Engineer will be involved in the project from the review and approval of construction plans and specifications, issuing the construction permit, and monitoring the documentation of construction compliance testing. The State Engineer will require that a New Mexico Registered Professional Engineer be placed in responsible charge of dam construction.

Construction of some of the proposed improvements may traverse tracts currently owned by the State of New Mexico. Acquisition of rights-of-way for arroyos crossing State lands is recommended. In addition,the ultimate outfall for the Jornada basin is

Isaack Lake, which under normal conditions, encompasses approximately 139 acres. A portion of Isaack Lake comes under the jurisdiction of the State of New Mexico. As such, the planning and construction for the entire project and its various components will need to be coordinated and approved by the State Commissioner of Public Lands. The State Land Commission will require survey data on all potential rights-of-way requested, along with the submittal of all pertinent hydrological data and design documents.

U.S. Highway 70 crosses the Jornada watershed in a northeasterly manner. There are currently 24 culvert crossings of this roadway by arroyos within the study area. Review and approval of construction plans and specifications will be required by the NMSHTD prior to commencing construction operations within U.S. Highway rights-of-way.

The ETZ for the City of Las Cruces extends from five miles outside the city limits eastward to the Organ Mountains. As the entire project lies within this area, all construction plans and activities will need to be coordinated with the Engineer for the City of Las Cruces.

Some portions of the project traverse parcels which are under private ownership. As constituents of the project area who would be directly impacted by the project, a public awareness effort should be made to keep these individuals informed of project status. Drainage easements should be acquired by the Flood Control Commission to ensure access by maintenance personnel, and to prevent future construction in a potential flood zone. Further discussion of right-of-way acquisition is included in Chapter VIII of this report.

CHAPTER II

GENERAL BASIN DESCRIPTION

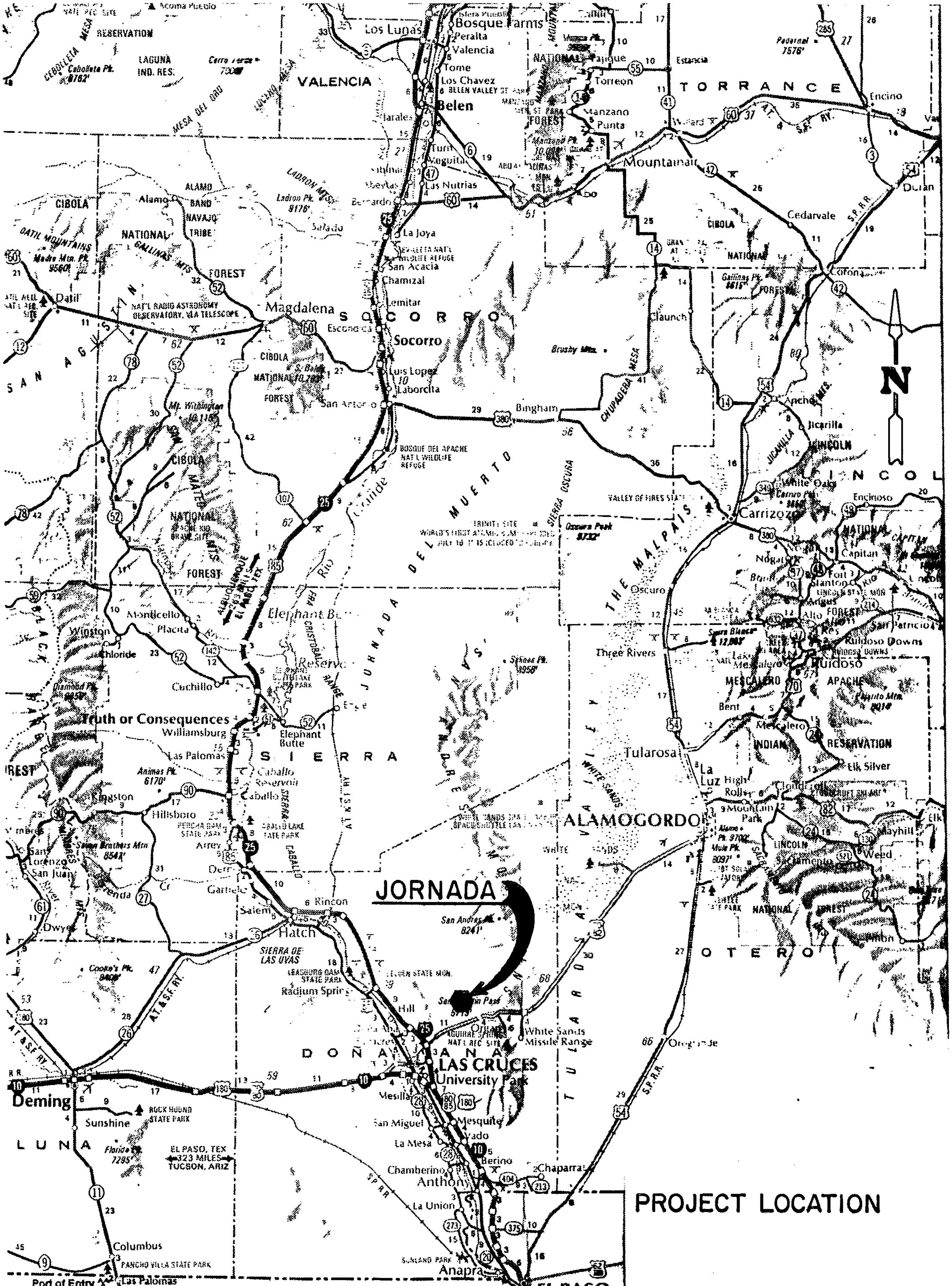
A. LOCATION

The Jornada watershed is located approximately 10 miles northeast of the central business district of Las Cruces, New Mexico and includes the communities of Jornada, Organ, Hangar Lake, Moongate, Hacienda Acres and Butterfield Park, as indicated in Figure II-1. The watershed encompasses approximately 56 square miles and is located within the East Mesa area of the Rio Grande Valley. The study limits extend from the crest of the Organ Mountains on the east westward to Isaack Lake; the project is bounded by the Sandhill Arroyo on the south and by Rincon Road on the north. However, the hydrologic study area was extended north of Rincon Road to ensure that there were no adverse offsite impacts.

B. HISTORICAL INFORMATION

Historically, the East Mesa has been inundated by widespread flooding from rainfall runoff emanating from the Organ Mountains east of Las Cruces, New Mexico. The variable topography, soil and ground cover all contribute to area flooding problems.

The Jornada watershed in the East Mesa is comprised of nine major waterways: the Organ Arroyos (North and South forks),Clark and Brown Arroyo, Hawkeye Arroyo, Owls Nest Arroyo, San Augustin Arroyo, Blair Canyon Arroyo, Baylor Canyon Arroyo and Mine House Spring Arroyo. These waterways originate in the Organ Mountains where the channels are fairly well defined, with a steep gradient. The mountains are characterized by steep, rock faces so that the runoff is neither attenuated nor absorbed as it travels along the drainage paths. As the arroyos traverse the foothills, the topography flattens, channel velocities decrease, deposition of waterborne sediment occurs. The well defined channels become braided and choked with sediment, thus losing necessary drainage capacity; flooding occurs. During significant rainfall events, these arroyos discharge



PROJECT LOCATION

LEEDSHILL-HERKENHOFF, INC.

FIGURE II-1

sediment laden runoff onto the communities of Butterfield Park, Hacienda Acres, Moongate, Hangar Lake and Jornada.

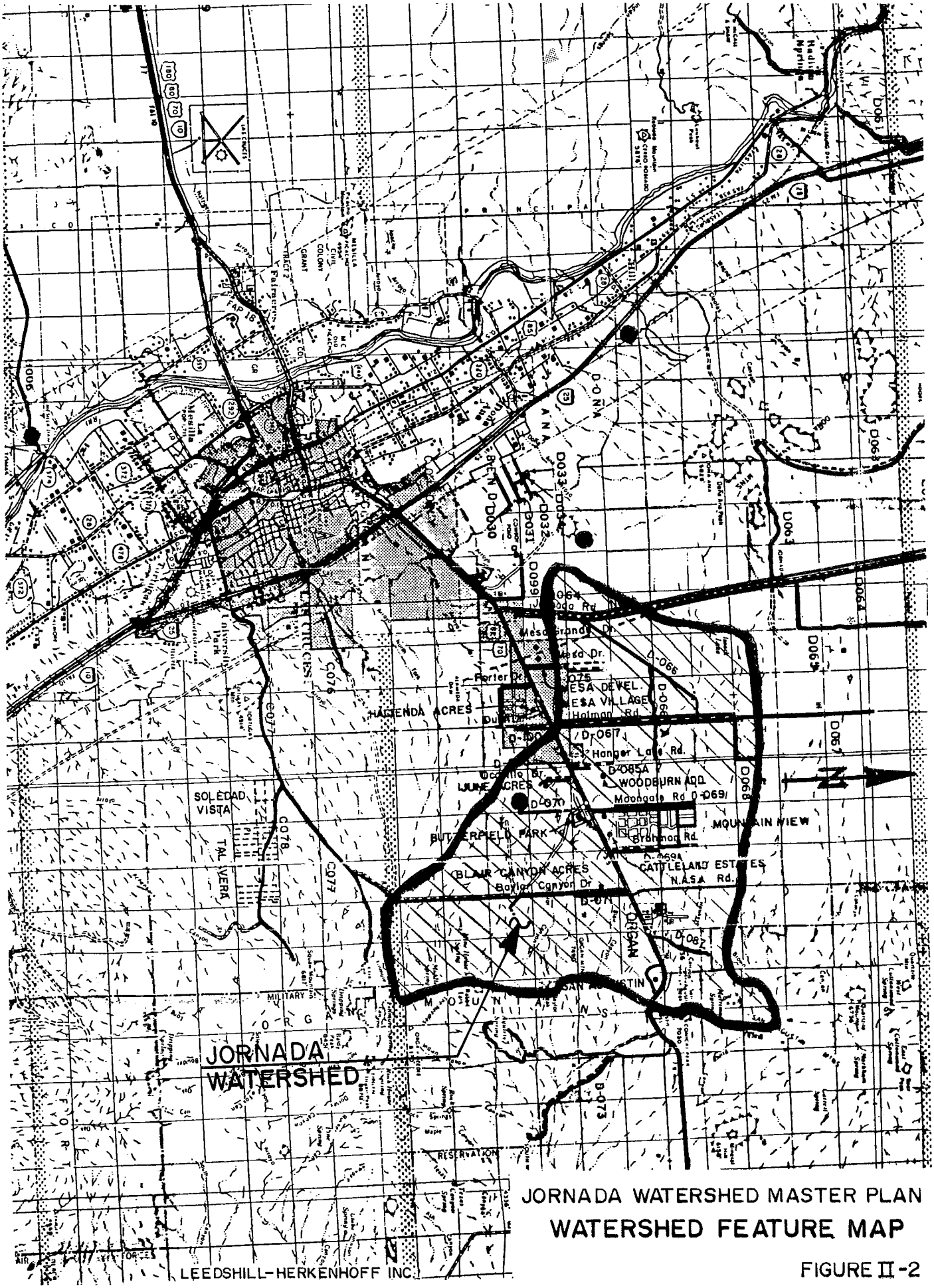
The present situation presents obvious public safety hazards, and damage to private property as well as the considerable costs incurred by Dona Ana County maintenance crews in the periodic sediment removal and roadway repairs required by intermittent flooding. In addition, these areas are exhibiting potential for residential and commercial growth which will lead to increased local runoff, thus aggravating a problematic situation.

The Dona Ana Flood Commission has realized the gravity of the situation and has recommended that a drainage system be implemented in order to reduce the peak flows from these arroyos, thereby increasing the protection of downstream water courses, public roadways, lives and properties.

C. PHYSICAL CHARACTERISTICS

The primary physical characteristics defining the Jornada watershed are the Organ Mountains, the arroyo systems, Isaack Lake, and the roads and highways transversing the project. These features are indicated on Figure II-2 and are described briefly as follows.

The major roadways providing access and drainage area definition are: U.S. Highway 70, and local roads including Rincon Road, NASA Road, Jornada Road, Brahman Road, Moongate Road, Hangar Lake Road and Holman Road. U.S. Highway 70 is a four-lane paved, heavy-duty highway and serves as the primary access route for the neighboring White Sands Missile Range. The highway transects the project area in a northeasterly manner and forms the divide between the north and south portions of the study. ~~Rincon~~ Dragon Fly Road is a two-lane unpaved road which forms the northern boundary of the project study area. NASA Road is a two lane paved roadway located along the


JORNADA WATERSHED
HACIENDA ACRES
SOLEDAD VISTA
TAL VERA
BUTTERFIELD PARK
BLAIR CANYON ACRES
CATTLELAND ESTATES
MOUNTAIN VIEW
WOODBURN ADD
LUNA ACRES
MESA DEVEL.
MESA VILLAGE
Mesa Dr.
Porter Rd.
Holman Rd.
Hanger Lane Rd.
Moongate Rd
Brahman Rd.
Bayless Canyon Dr.
N.A.S.A. Rd.
Mesilla Park
La Mesilla
MILITARY
RESERVATION
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north-south section line and provides a logical divide between the steep mountainous terrain in the eastern portion of the watershed, versus the flatter downstream alluvial plains in the western study area. The arroyo crossings at NASA Road concentrate the flows for all runoff generated east of NASA Road. Brahman Road provides area access to U.S. Highway 70 and is a two-lane unpaved roadway. This road is located 1 mile west of NASA Road. Moongate Road is a two-lane paved roadway loacted one mile west of Brahman Road. Hangar Lake and Holman Roads are both two-lane unpaved, roads which are located at one mile intervals westward and paralleling Brahman Road. Jornada Road is a two-lane road, which is located south and west of Isaack Lake and runs north towards the U.S. Military Jornada Experimental Station, located north of the project area.

The San Augustin Mountains of the Organ Mountain system form the eastern boundary of the project and comprise approximately 25 percent of the project's contributing drainage area. These mountains rise from an average elevation of 5300 feet at the base, to a maximum elevation of 8150 feet at the crest near Rabbit Ears Peak. Named for the jagged peaks which resemble a pipe organ, the Organ Mountains are formed from a quartz monzonite composition that precludes significant rainfall infiltration.

There are nine major arroyo systems serving the Jornada basin. In general,these arroyos originate in the Organ Mountains and run from east to west to a low-lying plain which eventually drains to Isaack Lake. The most northerly of these drainage ways is the Clark and Brown Canyon Arroyo. This system drains a total of 5.38 square miles of undeveloped land. Adjacent to this arroyo is the 11.51 square mile drainage basin served by the Hawkeye Canyon Arroyo. Both of these systems are located north of Rincon Road and are not located in the project study limits. However, as some of the proposed improvements under investigation may indirectly impact these watersheds, they are included in this study.

There are three drainage systems located between Rincon Road and U.S. Highway 70 which outfall directly into Isaack Lake. The San Augustin Arroyo is located adjacent to the south right-of-way of Rincon Road and drains a total of 4.61 square miles. This

arroyo starts in the mountains, crosses NASA Road in three 72" x 48" CMP arch culverts and flows through the Butterfield area in a northeasterly manner. Upon crossing Rincon Road, this arroyo currently joins Hawkeye Arroyo and outfalls to Isaack Lake. Due south of this system, the Owl's Nest Arroyo serves an area of approximately 4.73 square miles. This drainage system originates near the San Augustin Pass and crosses NASA Road in a dip in the road. The Owl's Nest Arroyo travels through the Butterfield community, joins the North Fork of the Organ Arroyo and outfalls directly to Isaack Lake. The North Fork of the Organ Arroyo begins at U.S. Highway 70 near the settlement of Organ and drains an area of 1.77 square miles. This channel crosses NASA Road in a roadway dip and flows westerly through the Butterfield Park community to its outfall.

South of U.S. Highway 70, the South Fork of the Organ Arroyo also originates near Organ and drains a .25 square mile area. The runoff crosses U.S. 70 in a 6' x 6' concrete box and joins the Organ North Fork east of this crossing. Blair Canyon Arroyo serves an area of 3.56 square miles; this channel also begins near the crest of the Organ Mountains and flows westerly towards NASA Road. Downstream of NASA Road,this arroyo joins with the Baylor Canyon Arroyo system. The Baylor Canyon Arroyo Serves a 4.29 square mile area which originates in the Organ Mountains. The Baylor Canyon Arroyo crosses U.S. Highway 70 in seven 8' x 5' concrete box culverts near Moongate Road. West of U.S. Highway 70, this arroyo is known as the Moongate Arroyo. The Moongate Arroyo then spreads out onto a broad floodplain. The runoff drains to Isaack Lake by overland sheetflow through the Moongate and Hangar Lake communities. The southernmost watershed in the Jornada basin is the Mine House Spring Arroyo. This arroyo drains an area of 2.57 square miles and is the largest system in terms of area and resulting runoff. The channel begins in "The Needles" of the Organ Mountains and flows in a northwesterly manner to six 8' x 3' concrete box culverts crossing U.S.Highway 70. From this crossing west of Hangar Lake Road, the arroyo outfalls overland to Isaack Lake in a manner similar to the Moongate Arroyo.

Isaack Lake is a low lying depression located between the Organ Mountain system and the Rio Grande. The yearly average water level in the lake covers approximately 0.22

square miles. The lake (classified as a playa) does not have an outfall and collects runoff from an approximate 180 square mile area. The Jornada basin encompasses 55.96 square miles or 31 percent of the total area contributing runoff to the lake.

D. LAND USE

Land use determines in part the runoff behavior for a particular basin. For instance, as development occurs, the amount of impervious area increases, which increases the resulting runoff peaks and volumes. Planning for drainage improvements then must include an investigation of existing and reasonably expected future land use for an area. In the Jornada watershed, a large percentage of the area is located in BLM land and in the U.S. Military Reserves, in addition much of this property lies in the Organ and San Augustin Mountains. As such, this land will probably remain largely undeveloped. The area west of NASA Road and south of Rincon Road presently is sparsely developed with residential and limited commercial land uses. The communities of Organ, Butterfield Park,Hangar Lake, Jornada, Moongate and Hacienda Acres (total population approximately 3,000) are located in this area. At this time, approximately 15 percent of the area has been developed. With the projected growth in Dona Ana County, this area has the potential to become fully developed within the next five to ten years. As such, the drainage improvements described herein have been analyzed assuming full development with a 30 percent impervious cover in the area bounded by Rincon Road, Brahman Road and U.S. Highway 70. Table II-1 includes a summary of area development as used for existing and proposed watershed conditions.

E. CLIMATE AND PRECIPITATION

The climate in the East Mesa is characterized by arid fall, winter and spring seasons followed by rainy summers. The average ambient daily temperature is 60 degrees fahrenheit, with average daily highs and lows of 76 and 44, respectively. Summer precipitation is typified by late afternoon thunder showers of fairly high intensity and short duration. The area experiences annual averages of 2.5 inches of snow and 8.0 inches of rain.

TABLE II-1
SUMMARY OF AREA DEVELOPMENT

SUB BASIN	EXISTING CONDITIONS			PROPOSED CONDITIONS		
	% Developed	% Impervious	Weighted % Impervious	% Developed	% Impervious	Weighted % Impervious
12	10	20	2.0	10	20	2.0
19			0	100	30	30
20,21			0	100	30	30
26			0	100	30	30
27	25	20	5.0	100	30	30
28	10	20	2.0	100	30	30
29			0			0
30			0	100	30	30
31	25	20	5.0	100	30	30
32	30	20	6.0	100	30	30
33	10	20	2.0	100	30	30
34	10	20	2.0	100	30	30
35	5	20	1.0	100	30	30
36,37			0	100	30	30
38			0	180	30	24
39			0	100	30	30
40			0	180	30	24
41	60	25	15.0	100	30	30
42			0	100	30	30
43	40	25	10	100	30	30
44	10	25	2.5	a. 30 b. 35 c. 100	30 30 30	9 10.5 30
45	40	20	8.0	100	30	30
46	40	20	8.0	100	30	30
47,48,49			0	100	30	30

TABLE II-1 (Cont'd.)
SUMMARY OF AREA DEVELOPMENT

SUB BASIN	EXISTING CONDITIONS			PROPOSED CONDITIONS		
	% Developed	% Impervious	Weighted % Impervious	% Developed	% Impervious	Weighted % Impervious
50			0	80	30	24
51	10	20	2.0	a. 20 b. 100	30 30	6.0 30.0
52	50	20	10	100	30	30
53	20	20	4	100	30	30
54	10	25	2.5	55	30	16.5
55	30	25	7.5	100	30	30
56	5	25	1.3	100	30	30
57	15	30	4.5	100	30	30
58	5	30	1.5	100	30	30
59	40	30	12	100	30	30
60	10	25	2.5	80	30	24
1-11, 13-18, 22-25, 29			0			0
Total Basin			1.7			14.9

Point rainfall intensities were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 2, Volume IV, New Mexico 1973. The 24-hour, 100-year point precipitation for the project area was 3.8 inches. The 24-hour, 10-year point precipitation was 2.4 inches. Because of the overall drainage area size and the orographic effects of the mountains, an areal distribution for the storm from the NOAA point rainfall was assumed with the heaviest rainfall(3.8") occurring near the crest and a diminished rainfall amount (3.4") occurring in the lower watershed. Precipitation data used in this analysis may be found in Appendix A. Figure II-3 shows the 100 year Type II-60 rainfall distribution and cumulative unit rainfall.

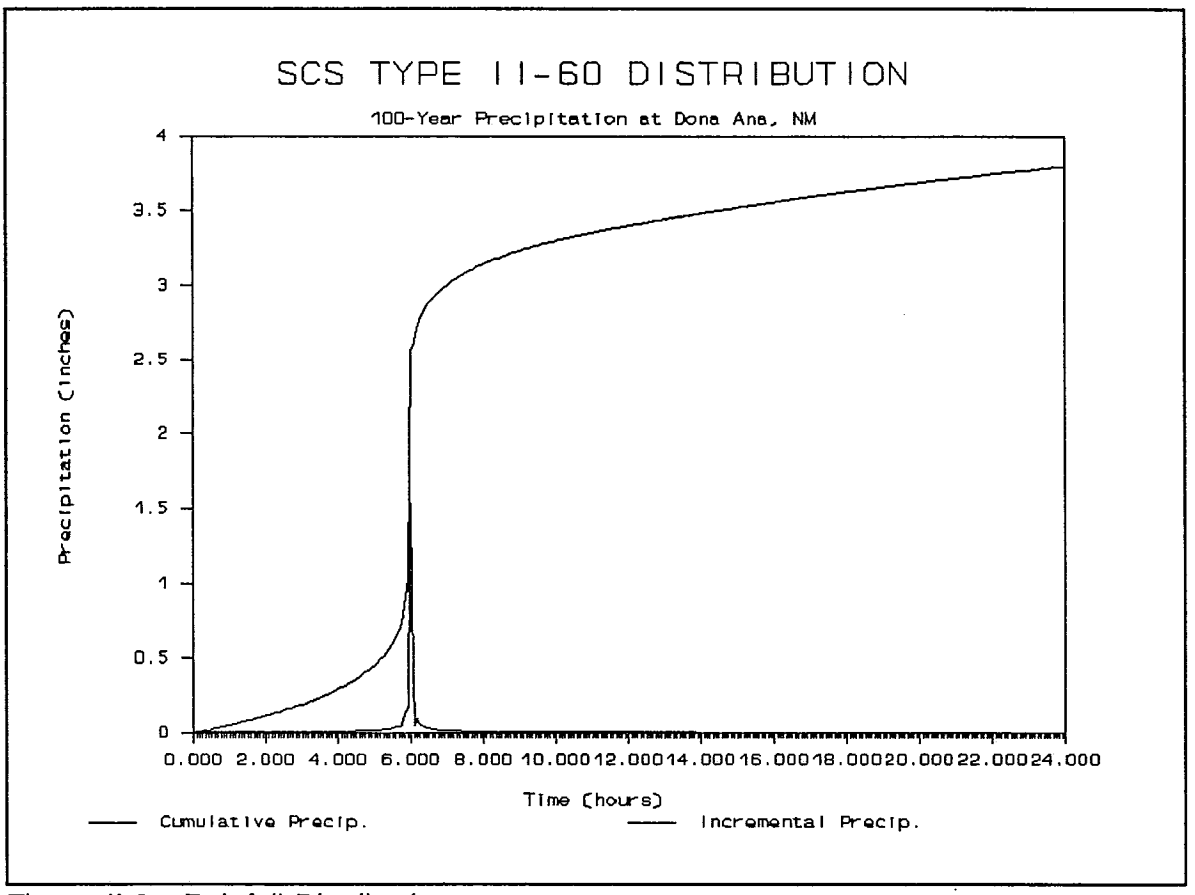


Figure II-3 - Rainfall Distribution

CHAPTER III

DESIGN CONSIDERATIONS AND METHODOLOGY

A. DESIGN CONSIDERATIONS

Based on discussions with the Dona Ana County Flood Commission staff, it was decided that the runoff associated with the 10 and 100 year 24-hour frequency storm events would be analyzed. The 100-year 24-hour storm will be used for design and the 10-year 24-hour storm will be analyzed to allow future storm sewer design in accordance with City of Las Cruces criteria. According to the State Engineer's criteria, all detention facilities will be designed to drain within 96-hours (4 days) of a rainfall event.

All improvements will be developed by optimizing costs for various alternative design solutions. The study goal is to produce a viable plan of drainage improvements attempting to maximum the benefits and minimize the costs.

B. HYDROLOGY

Hydrology is concerned with quantifying the transportation of water through the air, over the ground surface, and through the strata of the earth. It is the science that treats the various phases of the water cycle.

With respect to this study, the hydrologic effort deals with the transportation of water over the ground surface. Basically, it is the study of the responsiveness of a given area subjected to a given storm event. The responsiveness of an area is expressed in terms of the amount of rainfall absorbed into the ground (infiltration) versus the quantity of rainfall travelling over ground surfaces.

A hydrologic model was developed to study the rainfall/runoff response of the Jornada watershed in the East Mesa study area. Storm runoff is a function of watershed area, hydrologic soil type, ground cover, basin slope, flow length, and the amount and distribution of precipitation. Each of these physical parameters can be directly estimated using available topographic mapping, soil surveys, and meteorological data.

1. Storm Runoff

Runoff calculations were performed utilizing the U.S. Army Corps of Engineers (COE) HEC-1 Flood Hydrograph computer program. The Soil Conservation Service (SCS) Unit Hydrograph procedure was selected from the HEC-1 options for its particular applicability to undeveloped watersheds.

2. Basin Characteristics

Basin characteristics such as drainage areas, hydrologic soil groups, infiltration loss rates and the expected lag time are used as input to HEC-1. These basin parameters and their development are described below.

a. Drainage Areas

The drainage area defines the amount of land upstream of a specific reference point which is contributing runoff to the system under study. Runoff is conveyed through the contributing lands via overland sheet flow,storm sewers and culverts,and through ditches,arroyos, and open channels. The drainage areas defined for the East Mesa study were delineated from recent 1"= 200' scale orthophotographic maps as provided by the Dona Ana Flood Commission for use on this project. The maps were dated March 17,1990 and featured a two foot contour interval. This information was supplemented by United States Geological Survey (USGS) 7.5 minute quadrangle mapping of the area and by field verification. The drainage areas as defined for the Jornada basin study are shown on Figure III-1.

b. Time of Concentration and Basin Lag Time

The time of concentration, Tc, is defined as the length of time required for runoff to travel along the longest hydraulic length of the watershed. The mapping used for establishing the watershed's drainage areas was also used for determining the hydraulic length of the watershed and for estimating the overland cross slopes and channel slopes. The hydraulic length of a particular drainage area is defined as the length along the longest path that the runoff will follow in traversing from the upper watershed

ISAACK LAKE

RINCON ROAD

EL CENTRO ROAD

ARROYO ROAD

BUTTERFIELD PARK

HOLMAN ROAD

LAKE ROAD

HANGAR ROAD

MOONGATE ROAD

BRAHMAN ROAD

NASA ROAD

BAYLOR CANYON ROAD

CLARK AND GROTH CANYON ARROYO

HAWKEYE CANYON ARROYO

SAN AUGUSTIN ARROYO

OWL'S NEST ARROYO

ORGAN NORTH

ORGAN SOUTH

BLAIR CANYON ARROYO

BAYLOR CANYON ARROYO

MINE HOUSE SPRING ARROYO

Alameda Arroyo

LEGEND

22 — BASIN NUMBER

JORNADA WATERSHED MASTER PLAN

DRAINAGE AREA MAP

DRAWN BY

DATE FEB. 1992

SCALE 1"=2,000'

LEEDSHILL-HERKENHOFF, INC.

ENGINEERS ARCHITECTS

ALBUQUERQUE SANTA FE SAN DIEGO

BRUNING 44-242 71050

FIGURE NO. III-1

boundaries to the point of hydrograph calculation. This path includes overland flow, as well as flow in channels, roads and storm conveyance structures. Each basin's hydraulic length was divided into reaches to reflect major changes in slope, channel type, or channel roughness. The Tc was calculated as the sum of the reach lengths divided by the flow velocities for each reach. For this analysis, the velocities were estimated using the "Upland Method" slope nomographs found in the SCS Technical Release No. 55 (TR-55). The basin lag time was defined as 60 percent of the time of concentration (Tc) for each drainage basin.

c. Hydrologic Soil Types

The hydrologic soil types used in this report were obtained from the SCS Soil Survey of Dona Ana County Area, New Mexico, August 1980. The various soils within Dona Ana County were surveyed by the SCS and were assigned a hydrologic soil group designation (A,B,C,or D) depending on the soils' runoff potential during a longer duration storm. The designations range from an "A"- type soil, which exhibits a high permeability and subsequent low runoff potential,to the rocky "D"- type soil which exhibits little to no permeability and high runoff potential. The existing soils found in the Jornada Basin generally consist of three basic soil groups which form zones parallelling the mountains. The mountains themselves were mapped as Rock outcrops-Argid association (RG), with Tencee-Upton (TE) association, very gravelly sandy loams. These soils exhibit steep slopes, good drainage, low permeability and a very high runoff potential and carry a "D" designation. Immediately west of the mountains, a band of gravelly fine loams formed of alluvium and colluvium along the base of the piedmonts exists. This band consists of soils within the Aladdin-Coxwell (AM), Nickel-Upton (NU), and Dona Ana-Reagan (DR) associations. These soils are typified by undulating to rolling slopes,and consist of gravelly fine sandy loams of moderate permeability, medium runoff potential and moderate potential for water erosion. These soils carry the "B" designation. The last soil zone consists of the relatively flat area adjacent to Isaack Lake. The soils in this area consist of fine loamy sands of moderate permeability, moderate to slow surface runoff potential, and moderate potential for water erosion. These soils are also "B" type soils and have been identified as belonging to the Berino (BK,BJ,BL) and Onite-Pajarito

associations (OP). The SCS Dona Ana County Soils Survey provides more detailed information concerning the soils found in the study area.

d. Infiltration Loss Rates

The infiltration loss rate is the expected quantity of rainfall absorbed into the soil throughout the duration of a storm. The loss rates were calculated according to the Curve Number Method described in the Soils Conservation Service (SCS) Technical Release No. 55, "Urban Hydrology for Small Watersheds"(TR-55). This methodology relates infiltration to total rainfall for varying soils classifications, antecedent moisture conditions, vegetative ground cover and types of development. For existing watershed conditions, the ground cover for each area was determined from 1"=200' scale orthophotographic mapping and verified through field reconnaissance. With this information, the curve number (CN) for each drainage area was then obtained using tables from SCS TR-55. In cases where drainage areas had more than one land use or soil type, a weighted CN was calculated. Curve numbers for existing watershed conditions ranged from 63 to 84. For the design of proposed improvements, the area bounded by Rincon Road, Brahman Road, and U.S. Highway 70 was assumed to be fully developed. The CN's previously calculated for this area were adjusted by the HEC-1 model to reflect a 30 percent impervious condition, as would be expected under a typical fully developed scenario.

Total infiltration loss is divided into two components: an initial loss rate or abstraction, which is assumed to occur in the initial stages of the storm, and the constant loss rate, which is distributed at an hourly rate for the remainder of the storm. The difference between the total rainfall and the total infiltration loss is rainfall excess, or runoff.

3. Computation of Rainfall Runoff

The basin characteristics as defined above were used as input parameters for hydrologic modeling of the Jornada watershed. Table III-1 contains a summary of these parameters for each drainage subbasin. These hydrographs were then routed

TABLE III-1
SUMMARY OF HYDROLOGIC PARAMETERS

Subbasin	Area (sq.mi.)	Slope (%)	Length (feet)	Lagtime (hr.)	Soil Types (%)	CN
1	1.001	8.4	22,900	0.83	50D 50BC	83
2	0.5171	2.7	6,000	0.59	100BC	78
3	0.5500	1.8	6,000	0.77	90BA 10B	73
4	0.2594	1.7	5,700	0.73	60BA 40B	74
5	0.6062	1.3	6,000	0.83	100B	75
6	0.5953	1.1	5,600	0.85	90B 10BA	75
7	1.8516	0.5	8,000	2.67	100B	75
8	0.8906	12.6	14,700	0.46	95B 5D	79
9	0.3594	2.8	6,000	0.59	90BA 10BC	74
10	0.4812	2.1	5,800	0.64	100BA	73
11	0.5266	1.7	5,900	0.76	95BA 5B	73
12	0.5656	1.6	5,800	0.74	95BA 5B	74
13	0.4422	1.0	6,000	1.00	85BA 15B	74
14	1.4828	10.5	16,500	0.53	88BC 10D 2BA	81
15	0.4297	2.5	6,000	0.62	95BA 5BC	74
16	0.5094	1.7	5,800	0.74	95BA 5B	74
17	0.6078	2.0	5,500	0.65	80BA 20B	74
18	1.2203	5.8	18,400	0.69	90BC 10D	79
19	0.3500	2.8	3,400	0.43	60BA 40BC	75
20	0.7234	1.9	7,200	0.86	75BA 25B	74
21	0.5531	1.9	5,800	0.69	100B	75
22	0.6719	1.3	6,000	0.91	60BA 40B	74
23	0.7672	0.9	7,400	1.30	85B 15BA	75
24	0.7891	0.6	6,500	1.97	100B	75
25	0.8500	5.2	16,600	0.62	97B 3D	79
26	0.3641	3.1	4,200	0.39	85BC 15BA	77

TABLE III-1 (Cont'd.)
SUMMARY OF HYDROLOGIC PARAMETERS

Subbasin	Area (sq.mi)	Slope (%)	Length (feet)	Lagtime (hr.)	Soil Types (%)	CN
27	0.7094	2.0	6,800	0.81	90BA 10B	73
28	0.5953	1.9	5,300	0.63	100B	75
29	1.0984	8.6	18,500	0.61	50D 50BC	83
30	0.2547	3.1	4,200	0.39	95BC 5BA	78
31	0.3453	1.7	5,800	0.69	80BA 20B	74
32	0.4594	1.6	5,500	0.71	90B 10BA	75
33	0.6063	1.1	7,500	1.14	95B 5BA	75
34	0.5813	1.4	7,000	0.97	100B	75
35	0.3781	1.0	6,000	0.83	100B	75
36	0.5188	1.1	6,500	0.98	85B 15BA	75
37	0.7469	0.9	9,700	1.70	95B 5BA	75
38	0.9688	0.8	8,800	2.33	100B	75
39	1.0186	1.0	8,000	1.33	100B	75
40	1.2125	0.7	10,600	2.94	100B	75
41	0.3531	4.5	7,300	0.28	100BC	78
42	0.6094	2.9	5,800	0.54	55BC 45BA	76
43N	0.5094	2.0	7,500	0.89	80BA 20B	74
43S	0.3797	2.0	6,000	0.71	60B 40BA	74
44A	0.3188	10.7	4,500	0.27	50D 50B	83
44B	3.8000	10.7	28,600	1.42	50D 35BC 10B 5BA	82
44C	0.3438	1.5	7,500	1.04	60BA 40B	74
45N	0.5156	1.1	7,000	1.06	90B 10BA	75
45S	0.2297	1.0	5,000	0.83	100B	75
46	0.4000	1.3	7,300	1.01	100B	75
47	0.6531	0.9	6,200	1.32	100B	75

TABLE III-1 (Cont'd.) SUMMARY OF HYDROLOGIC PARAMETERS						
Subbasin	Area (sq mi.)	Slope (%)	Length (feet)	Lagtime (hr.)	Soil Types (%)	CN
48	0.4406	0.7	6,000	1.67	100B	75
49	0.3758	1.0	4,000	0.67	100B	75
50	1.2125	0.6	8,500	2.58	100B	75
51A	4.4125	12.1	22,000	0.71	65D 30B 5BA	83
51B	0.3594	1.3	6,000	0.83	65B 35 BA	74
51C	0.4000	1.1	3,000	0.45	65B 35 BA	74
52	0.2391	1.0	4,300	0.72	100B	75
53	0.3594	1,1	4,700	0.71	100B	75
54A	7.5719	11.5	30,300	1.64	45D 40BA 15B	80
54B	0.8594	1.3	8,000	1.11	100B	75
55	0.3484	1.0	4,000	0.67	100B	75
56	0.6781	0.7	6,200	1.72	100B	75
57	0.6641	0.8	7,800	2.06	100B	75
58A	0.2690	0.7	4,500	1.25	100B	75
58	1.0328	0.9	11,200	2.83	100B	75
59	0.3156	0.8	7,600	2.01	100B	75
60	1.2625	0.3	9,800	3.27	100B	75

downstream through the next subbasin and added to the hydrograph of the downstream subbasin. This process is repeated until all of the hydrographs were routed and combined into Isaack Lake. Because of the lack of downstream channel definition and steep overall basin slope, the kinematic wave method of routing hydrographs was utilized for this study. This method utilizes the Continuity Equations to translate but not attenuate the flood wave through a specific reach. This is a good method for fairly short reaches with little discernable difference between channel and overbank flow characteristics.

4. Floodwater Detention Facilities

Floodwater detention facilities reduce the downstream flood impacts by utilizing storage to diminish the peak runoff rate entering the facility. To design such a facility, the peak runoff entering the pond needs to be calculated, along with the total runoff volume. The amount of runoff stored, and thus the amount of flood attenuation, is a function of allowable downstream capacity versus available detention facility storage volume. Because the proposed detention ponds are intended to be used to trap sediment, the estimated sediment volume resulting from the 100-year rainfall event was included in the total volume requirement. In addition, because of New Mexico State Engineer Design Criteria, each detention facility was designed to completely drain in 96-hours (4 days).

Storage information was developed for incremental detention depths using the 1" = 200' scale orthophotographic mapping. For the principal spillways, culvert capacities were calculated for various upstream water elevations and for various culvert diameters. This information was used with the HEC-1 computer model to optimize the outlet design to allow minimal discharge and maintain the 96-hour maximum drain time.

The locations for the proposed detention facilities were determined by: 1) the need to maximize interception of runoff from the Jornada watershed, thereby minimizing the downstream peak discharge; 2) the need to balance earthwork; and 3) the need to minimize potential land acquisition costs.

5. Emergency Spillways

While the detention dams proposed for the East Mesa were designed using the 100-year frequency rainfall event, prudent engineering and the requirements of the New Mexico State Engineer's Office dictate the provision of an emergency spillway designed to pass even larger flows in order to prevent breaching of the embankment and possible catastrophic dam failure.

The magnitude of this spillway design flow is specified by the State Engineer and is directly related to the size and hazard classification of the dam. The proposed dams in this study would be classified as "small" according to State Engineer design criteria due to the fact that they are all under 40 feet in height and do not store more than 1000 acre-feet of runoff. The existing hazard potential of these dams under current development conditions would be considered "significant", i.e. under catastrophic conditions there would be few lives lost and minimal property damage. Under future development conditions, the hazard category could be considered "high", with more than a few lives lost and excessive economic losses.

The Spillway Design Flow specified by the State Engineer for a "small" dam with a "significant" hazard is within the range of a 100-year to 1/2 PMF (or Probable Maximum Flood) event. When the hazard classification is raised to "high", the Spillway Design Flow is within the range of a 1/2 PMF to the PMF event. Thus, the 1/2 PMF has been selected as the appropriate design flow for these facilities.

The Spillway Design Flows for the East Mesa dam alternatives were calculated from envelope curves for the Standard Project Flood or 1/2 PMF, which were developed by the Albuquerque District of the U.S. Army Corps of Engineers. These curves are included in the New Mexico State Engineer's Office "Procedure on Design Criteria and Safety of Dams". These calculations are included in Appendix D of this report.

C. HYDRAULICS

The hydraulic analysis of a watershed focuses on quantifying how the water actually travels through the watershed. For the Jornada basin, it involved the analysis of the existing and proposed channels, as well as the preliminary hydraulic design for outlet structures, and emergency spillways. Physical data describing the flow characteristics of each drainage facility coupled with the flood flows obtained in the hydrologic analysis were utilized to compute the expected hydraulics for the system. The following sections describe the data required for this analysis.

1. Watershed Reconnaissance

Land use and vegetative cover were obtained from 1"=200' scale orthographic mapping provided by the Dona Ana County Flood Commission for use on this project. As-built plans for the U.S. Highway 70 culvert crossings were obtained from the New Mexico State Department of Highways and Public Transportation. In addition, the project team verified hydraulic features by aerial site reconnaissance and by several field excursions in order to ascertain condition, function and location of existing culverts, low water road crossings, arroyos, and areas of overland sheet flow.

2. Roughness Coefficients

One of the hydraulic conveyance features of a drainage channel is the surface roughness. Roughness coefficients (Manning's "n") for this project were estimated from information obtained during watershed reconnaissance. Roughness values for the channel areas varied from 0.025 to 0.035, while roughness values for overbank and sheetflow areas varied between 0.035 and 0.05. Pipe culverts were assigned a roughness coefficient of 0.013 for reinforced concrete pipe (RCP), 0.024 for corrugated metal pipe (CMP), and 0.013 for steel pipe.

3. Channel Cross-Section Data

Channel cross-sections used in developing hydraulic profiles for existing basin conditions were obtained from the 1"=200' scale orthographic mapping. These sections were taken at an approximate 200 feet spacing. Channel cross-sections for the proposed

channels were designed using the peak runoff rates from the HEC-1 model and the Dodson Hydraulic Library computer program. This program uses open channel theory (Manning's formula) to compute the ideal section for a particular location given flow, channel slope and roughness (Manning's "n"); the channel geometry may be varied to produce adequate hydraulic flow area and conveyance properties. Prior to final design, detailed survey cross-sections of this area should be obtained to verify this design.

4. Conveyance Calculations The flows from the HEC-1 model were used with the information assembled to perform the hydraulic analyses. This involved the calculation of conveyance for the channels, culverts, and spillways within the Jornada watershed.

a. Channels

The U.S. Army Corps of Engineers HEC-2 computer program was utilized to determine flow depths, average channel velocities, and water surface profiles for the major waterways of the Jornada basin. The HEC-2 program was developed to calculate water surface profiles for natural or man-made channels. The program has tremendous flexibility and can simulate many different flow regimes. The computational procedure in the model is based on the solution of the one-dimensional energy equation with energy loss due to friction (evaluated by Manning's Equation) and known as the Standard Step Method.

The initial hydraulic analysis involved the investigation of the Owl's Nest, San Augustin, Organ, Blair Canyon and Baylor Canyon Arroyos under existing conditions. This established baseline conditions to enable comparison of arroyo and detention improvements and provided velocity profiles for use in the sediment analyses. Figure III-2 of this report indicates the arroyos under hydraulic investigation as well as the approximate cross-section locations.

The final design cross-sections for proposed channel improvements were also input into the HEC-2 model to verify improved hydraulic conditions and to calculate flood profiles for the proposed channel system.

b. Culverts

Using data compiled through field reconnaissance and the NMSHTD as-built plans for U.S. Highway 70, an analysis of the existing culverts was completed to determine capacity and to compare actual capacity with computed 10- and 100-year frequency peak flood flows. These culverts are indicated on Figure III-3. This analysis provided information on the existing structures and their adequacy with respect to existing and future hydrologic conditions.

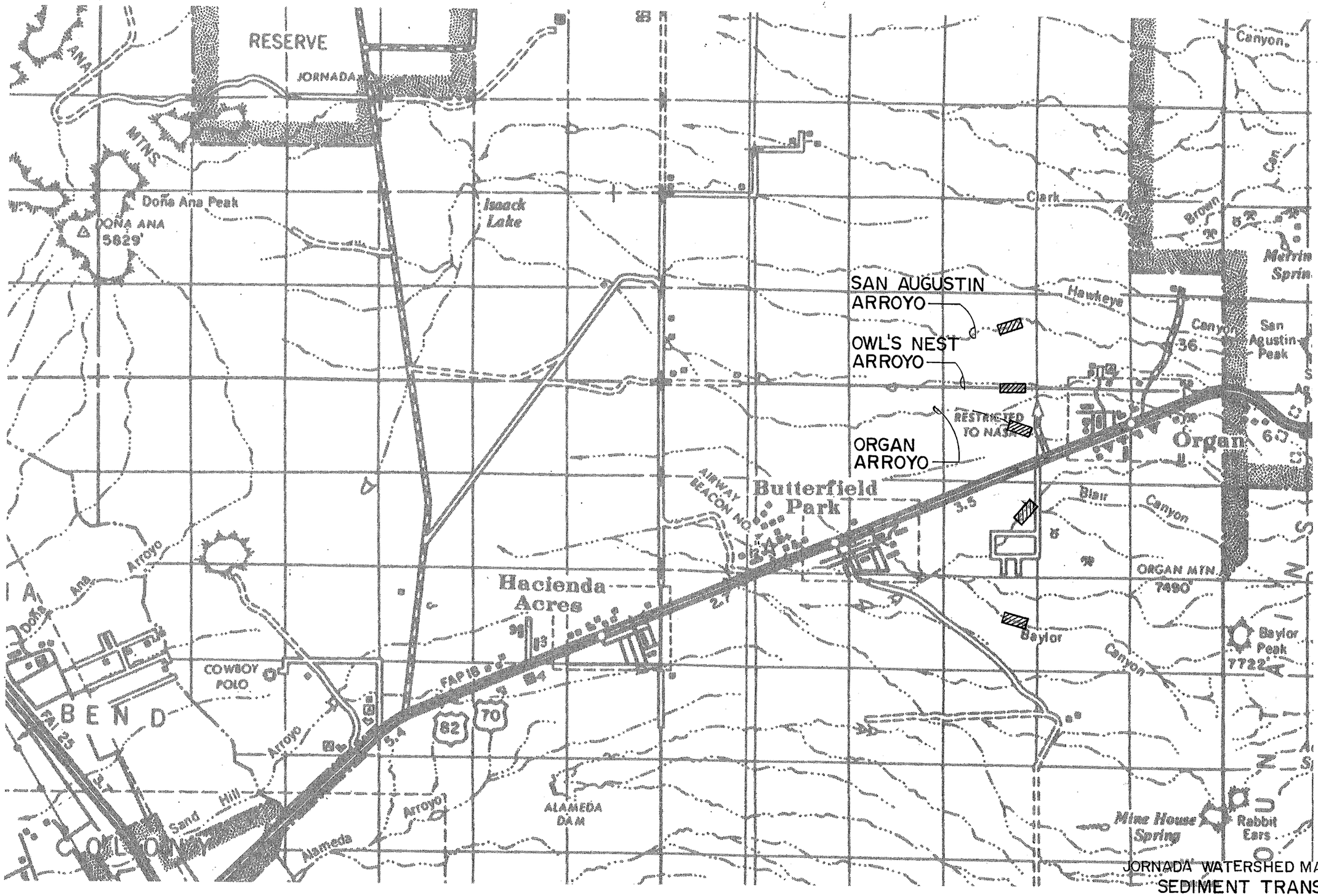
The Dodson Hydraulic Library computer software package was used for the hydraulic analysis of existing culverts and for the preliminary sizing for detention outlet structures.

This program utilizes Manning's formula to calculate pipe-full capacity and Bernoulli's theorem to calculate headloss through the culvert. More information on these formulas can be obtained in Brater & King's "Handbook of Hydraulics". The program was used to calculate the culvert's capacity for various channel conditions up and downstream of the culvert. Because of the programs versatility, it is possible to quickly analyze several outlet alternatives for various hydraulic conditions. The results of this analysis are included in Chapter IV of this report.

c. Spillways

The proposed spillway alternatives for this study were designed in accordance with criteria set forth in the U.S. Bureau of Reclamation Technical document,"Design of Small Dams".

Through hydraulic calculations and hydrologic analysis, many different spillway configurations were found to adequately pass the SDF. Very wide spillway



LEGEND

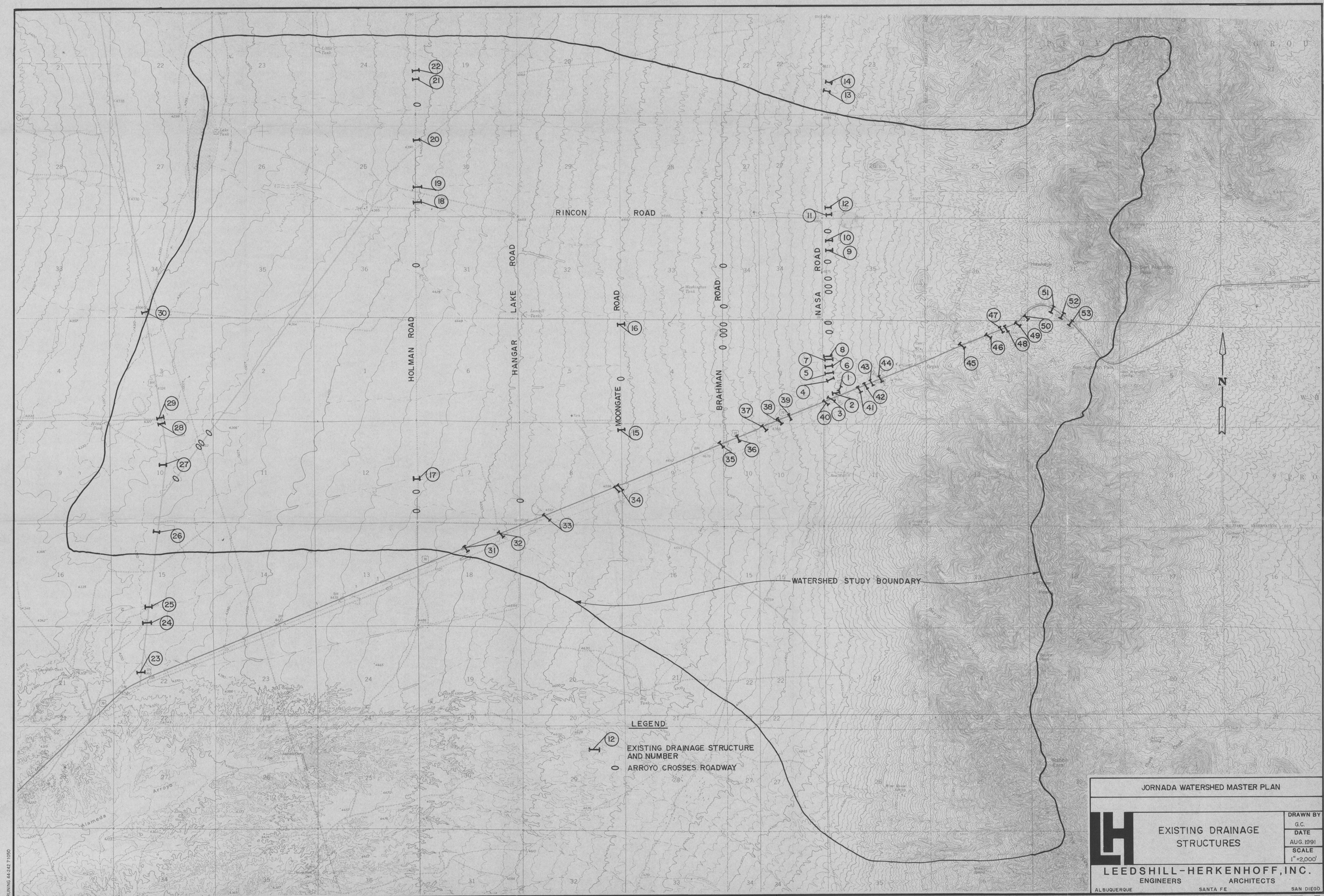
▨ LOCATION OF SEDIMENT TRANSPORT CROSS SECTIONS

JORNADA WATERSHED MASTER PLAN

SEDIMENT TRANSPORT
CROSS SECTION LOCATIONS

LEEDSHILL-HERKENHOFF, INC.

FIGURE NO. III-2



JORNADA WATERSHED MASTER PLAN

EXISTING DRAINAGE STRUCTURES

DRAWN BY: G.C.
DATE: AUG. 1991
SCALE: 1" = 2,000'

LEEDSHILL-HERKENHOFF, INC.
ENGINEERS ARCHITECTS
ALBUQUERQUE SANTA FE SAN DIEGO

FIGURE NO. III-3

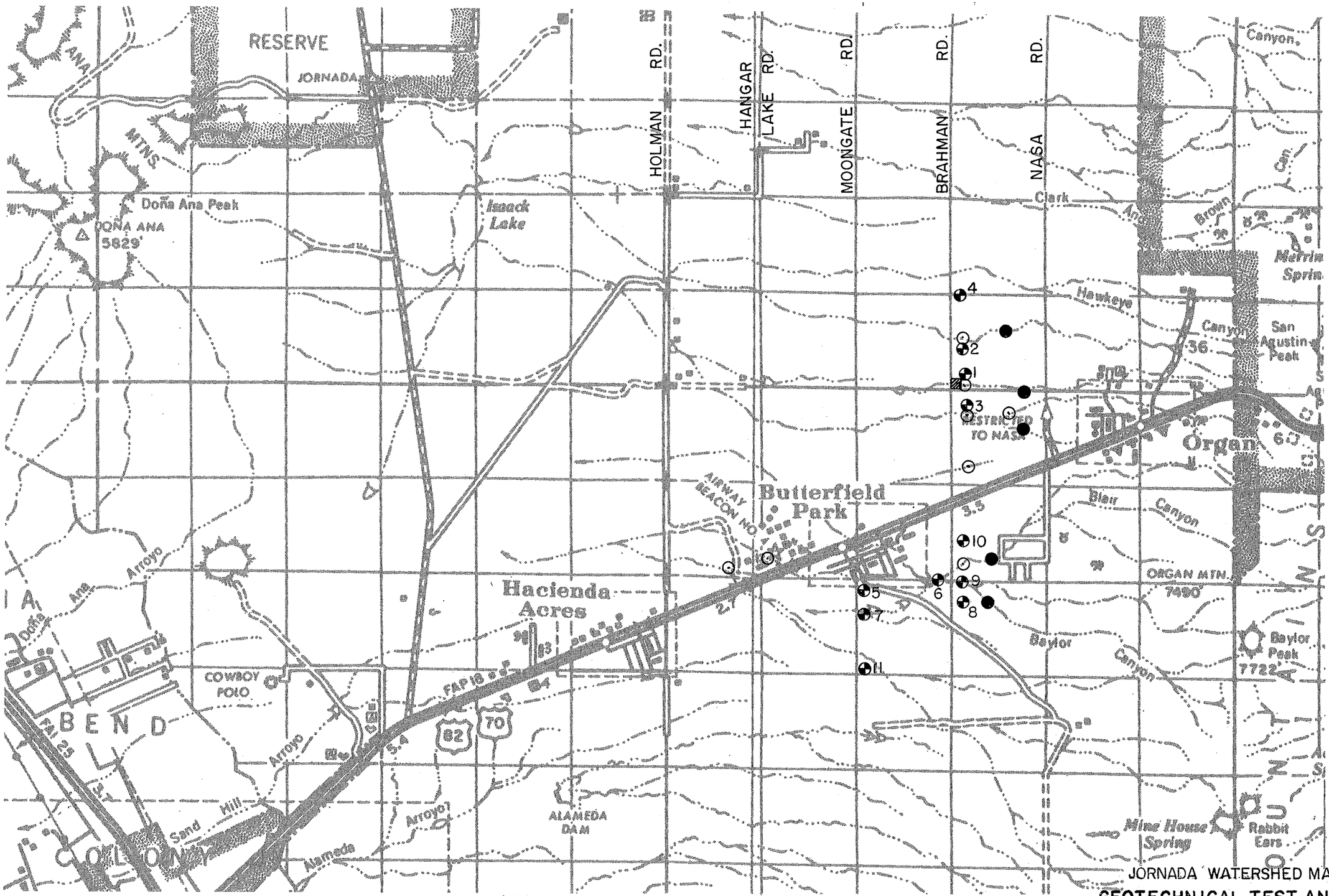
BRUNING 44-242 7105D

sections did not develop high velocities or depths but were not cost effective due to the spillway cost. Very narrow sections decreased the cost of the spillway but at the same time dramatically increased the required fill height of the dam and energy dissipation necessary, thus also becoming uneconomical. Therefore, an iterative method using numerous spreadsheet templates was developed to assess the most economical spillway as a function of the additional amount of fill material versus the width of spillway. The spreadsheets calculated the volume and cost of each major component of the dam for a range of spillway widths for each spillway type. The summation of the component costs represented the total preliminary dam cost as a function of spillway width. These results were then plotted to assess the most economical spillway width for each spillway type. These spreadsheets are included in Appendix G of this report.

D. GEOTECHNICAL INVESTIGATION

The geotechnical investigation for this project was provided by Precision Engineering,Inc. of Las Cruces, New Mexico and was completed on November 14, 1991. Their investigation consisted of obtaining two different types of information. Grab samples of surficial soils were taken at selected points throughout the watershed in order to obtain a grain-size distribution for use in the sediment transport analysis. (Section VI of this report). A grain size distribution was calculated for fourteen grab samples in accordance with ASTM D-2487.

In addition, eleven borings were made with a truck-mounted drill in accordance with methods set forth in ASTM D-1452,"Standard Methods for Soil Investigation and Sampling by Auger Methods." Testing on the bore material was completed for moisture content, particle size analysis, and direct shear; all testing was completed in compliance with procedures outlined in the ASTM Standard Methods. The information from this analysis was used for determining the recommended embankment sections for the detention dam alternatives. Figure III-4 indicates the locations used for geotechnical testing. Appendix B contains the complete Geotechnical Report for the Jornada Watershed, as provided by Precision Engineering, Inc.



LEGEND

- ● SURFACE SOIL SAMPLE SITE USED IN SEDIMENT TRANSPORT ANALYSIS
- ⊙ SURFACE SOIL SAMPLE SITE
- ◓ GEOTECHNICAL BORING SITE
- ▧ ARCHEOLOGICAL SITE 15-1

JORNADA WATERSHED MASTER PLAN

GEOTECHNICAL TEST AND PRELIMINARY ARCHEOLOGICAL SURVEY LOCATIONS

LEEDSHILL-HERKENHOFF, INC.

FIGURE NO. III-4

E. ARCHEOLOGICAL INVESTIGATION

Due to the fact that many of the sites proposed for the drainage improvements are located on BLM and State of New Mexico property, an archeological assessment was required to ensure that there were no known sites of historic significance which could be destroyed or encroached upon during the construction of the project or in the event of the 100-year storm event. A preliminary archeological investigation of the project area was provided by the Dona Ana County Flood Commission. The study was completed in September 1990 and was performed under currently accepted survey criteria. The investigation located a find of significant historical impact immediately east of Brahman Road along the existing overbank area for the Owl's Nest Arroyo. A site approximately one acre in size containing an estimated 60 artifacts of various Mesilla Phase sherd and lithic scatter was found at this location. This site is indicated on Figure III-3 along with the geotechnical boring locations. The site perimeter has been flagged with surveyors tape. Future improvements have been located to avoid site disturbance; however, further archeological investigation and/or clearance of the area may be warranted prior to construction. Additional survey information for other areas not covered in the initial archeological survey may also be required prior to final construction planning. The archeological investigation as provided by the Flood Commission is contained in Appendix C.

CHAPTER IV
EXISTING CONDITIONS

A. GENERAL

Hydrologic and hydraulic analyses were completed for existing conditions in the Jornada watershed. These analyses verified areas with potential drainage problems, quantified the magnitudes of flow rate and volume affecting the watershed and served as a baseline for the development of design alternatives. A discussion of the results of this investigation follows.

B. HYDROLOGY

The U.S. Army Corps of Engineers HEC-1 computer model was utilized to develop flood-flow hydrographs for the 10- and 100-year 24-hour frequency rainfall events for the Jornada watershed. Table IV-1 indicates the 100-year and 10-year peak flows and runoff volumes at various key locations throughout the watershed. Figure IV-1 also provides this information.

The Hawkeye and Clark and Brown Arroyos north of Rincon Road have a combined peak flow of 7070 cubic feet per second (cfs). These basins contribute 1339 acre-foot of runoff volume to Isaack Lake. The combined peak flow from the San Augustin Arroyo, Owl's Nest Arroyo and North Fork of the Organ Arroyo crossing NASA Road is 2885 cfs. The drainage area upstream of NASA Road is approximately 3.52 square miles, with an average runoff rate of 1.28 cfs per acre.

The peak flow at U.S. Highway 70 from Organ Arroyo South Fork, Blair Canyon Arroyo, Baylor Canyon Arroyo and Mine House Spring Arroyo is 4973 cfs. The total area is 18.07 square miles and yields an average runoff rate of 0.43 cfs per acre.

The area bounded by Rincon, Jornada and NASA Roads and U.S. Highway 70 has a peak runoff of 7858 cfs from offsite drainage areas. This explains, in part, the current flooding problems experienced by the communities located in this area.

TABLE IV-1
HYDROLOGIC SUMMARY FOR EXISTING CONDITIONS

NODE	LOCATION	PEAK FLOW (cfs)		PEAK VOLUME (Ac.Ft.)	
		100 Yr.	10 Yr.	100 Yr.	10 Yr.
1	Clark & Brown Arroyo at NASA Rd.	695	350	113	60
2	Arroyo 1150' N. of US 70 at NASA Rd.	800	365	86	43
3	Hawkeye Arroyo at NASA Rd.	1326	637	154	80
4	San Augustin Arroyo at NASA Rd.	805	369	117	59
5	Owl's Nest Arroyo at NASA Rd.	610	279	82	41
6	Organ Arroyo (N) at NASA Rd.	972	489	124	66
7	Organ Arroyo (S) at NASA Rd.	498	251	38	21
8	San Augustin Arroyo at Brahman Rd.	1070	472	156	77
9	Owl's Nest Arroyo at Brahman Rd.	916	401	122	60
10	Organ Arroyo at Brahman Rd.	1178	568	150	79
11	Moongate Arroyo at Brahman Rd.	406	170	51	24
12	Blair Canyon Arroyo at US 70	1524	756	469	246
13	Clark and Brown Arroyo at Hangar Lake Rd.	1288	588	215	108
14	Arroyo 21,000' N. of US 70 at Hangar Lake Rd.	1360	602	182	87
15	Hawkeye Arroyo at Hangar Lake Rd.	2001	892	267	131
16	San Augustin Arroyo at Hangar Lake Rd.	1569	662	240	115
17	Owl's Nest Arroyo at Hangar Lake Rd.	1511	654	215	104

TABLE IV-1 (Cont'd.)
HYDROLOGIC SUMMARY FOR EXISTING CONDITIONS

NODE	LOCATION	PEAK FLOW (cfs)		PEAK VOLUME (Ac.Ft.)	
		100 Yr.	10 Yr.	100 Yr.	10 Yr.
18	Organ Arroyo at Hangar Lake Rd.	1878	917	254	132
19	Blair Canyon Arroyo at Hangar Lake Rd.	1952	966	657	339
20	Baylor Canyon Arroyo at US 70	1525	756	538	282
21	Mine House Arroyo at US 70	1924	945	840	434
22	Clark and Brown Arroyo at 2 mi.W. of Hangar Lake Rd	1694	753	301	147
23	Hawkeye Arroyo (N) 2 mi. W. of Hangar Lake Rd.	1713	740	252	118
24	Hawkeye Arroyo (S) 2 mi. W. of Hangar Lake Rd.	5542	2395	855	407
25	Blair Canyon Arroyo 2 mi. W. of Hangar Lake Rd.	2336	1130	762	388
26	Mine House Arroyo 2 mi. W. of Hangar Lake Rd.	3547	1732	1495	769
27	Blair Canyon Arroyo 14,300' W. of Hangar Lake Rd. & 13,000' S. of US 70	2383	1149	786	398
28	Baylor Canyon Arroyo 16,200' W. of Hangar Lake Rd. & 11,200' S. of US 70	157	67	74	34
29	Mine House Arroyo 17,700' W. of Hangar Lake Rd. & 9,600' S. of US 70	3660	1780	1536	787
30	Isaack Lake Arroyo 20,400' W. of Hangar Lake Rd. & 15,700' S. of US 70	4025	1939	1705	863
31	Isaack Lake Arroyo 17,900' W. of Hangar Lake Rd. & 20,700' S. of US 70	5992	2858	2546	1278

TABLE IV-1 (Cont'd.) HYDROLOGIC SUMMARY FOR EXISTING CONDITIONS					
NODE	LOCATION	PEAK FLOW (cfs)		PEAK VOLUME (Ac.Ft.)	
		100 Yr.	10 Yr.	100 Yr.	10 Yr.
32	Owl's Nest and Organ Arroyos 15,800' W. of Hangar Lake Rd. & 25,200' N of US 70 at Isaack Lake	3874	1619	715	346
33	Hawkeye Arroyo at Isaack Lake 15,800' W. of Hangar Lake Rd. & 28,000' N. of US 70 at Isaack Lake	7070	2819	1339	627
34	Total Inflow at Isaack Lake	11160	4473	4729	2305

ISAACK LAKE
RINCON ROAD
MOUNTAIN VIEW ROAD
EL CENTRO ROAD
ARROYO ROAD
MOON GATE
HANGAR LAKE
BUTTERFIELD PARK
HOLMAN ROAD
HANGAR LAKE ROAD
MOONGATE ROAD
BRAHMAN ROAD
NASA ROAD
BAYLOR CANYON ROAD
ORGAN
Alameda Arroyo

1	695 / 350
2	800 / 365
3	1326 / 637
4	805 / 369
5	610 / 279
6	972 / 489
7	498 / 251
8	1070 / 472
9	916 / 401
10	1178 / 568
11	406 / 170
12	1524 / 756
13	1288 / 588
14	1360 / 602
15	2001 / 892
16	1569 / 662
17	1311 / 654
18	1878 / 917
19	952 / 966
20	1525 / 756
21	1924 / 945
22	1694 / 753
23	1713 / 740
24	5542 / 2396
25	2336 / 1130
26	3547 / 1732
27	2383 / 1149
28	157 / 67
29	3660 / 1780
30	4025 / 1939
31	5992 / 2858
32	3874 / 1619
33	7070 / 2819
34	11160 / 4473

LEGEND
22 — BASIN NUMBER
NODE NUMBER
Q 100 YEAR
Q 10 YEAR

JORNADA WATERSHED MASTER PLAN

EXISTING HYDROLOGIC CONDITIONS - 10 AND 100 YEAR RETURN FREQUENCY

DRAWN BY G.C.
DATE AUG. 1991
SCALE 1"=2,000'

LEEDSHILL-HERKENHOFF, INC.
ENGINEERS ARCHITECTS
ALBUQUERQUE SANTA FE SAN DIEGO

FIGURE NO. IV-1

BRUNING 44-242 71050

The total contributing runoff volume from Jornada watershed to Isaack Lake under existing conditions is 4729 acre-feet. The combined peak runoff rate to Isaack Lake for the 100-year rainfall event is 11160 cfs.

The peak flow rates were used to identify areas with limited hydraulic capacities, excessive velocities and excessive sediment scour or deposition. This information was used for the hydraulic analyses and for the development of design alternatives. The HEC-1 runs used in this analysis are contained in Appendix D.

C. HYDRAULICS

Using the peak flow rates as developed above, a hydraulic analysis of the existing watershed conditions was made. This analysis procedure is described below and includes analyzing the existing channels and existing roadway crossing structures.

1. Existing Channels

The U.S. Army Corps of Engineer's HEC-2 backwater computer model was used to determine water surface profiles for the San Augustin, Owl's Nest, Organ, Blair Canyon and Baylor Canyon Arroyos. These arroyos were modeled for the portion of the channels located east of NASA Road and South of U.S. Highway 70. Because the downstream channels fan out, are undefined and are significantly under capacity, modeling was done only for the 5, 10, 25, 50 and 100 year flows for the channels entering the upstream detention facilities. This information was used in the sediment transport analysis. The HEC-2 analyses are included in Appendix E.

2. Existing Culverts

An inventory of all existing roadside drainage structures was made using as-built construction plans and field reconnaissance. Figure III-2 indicates the structures identified during this exercise. A culvert hydraulics computer program (The Dodson Hydraulic Library) was utilized to determined maximum culvert capacity for these structures. This analysis assumed inlet control and maximum head equaling the top of

road. Table IV-2 includes a comparison of the existing 10- and 100-year peak discharges reaching these facilities along with their maximum capacity. As indicated in this table, approximately 69 percent of the area's culverts are operating at or below capacity. This situation exacerbates the drainage problems caused by upstream runoff volumes. Upstream system improvements can rectify this situation in most cases. The calculations from this analysis are included in Appendix E.

TABLE IV-2
EXISTING DRAINAGE STRUCTURES

Structure No.	Description	10-Year Storm (cfs)	100-Year Storm (cfs)	Maximum Culvert Capacity (cfs)
1	1 - 24" CMP	10	20	23
2	1 - 24" CMP	10	20	23
3	1 - 24" CMP	10	20	23
4	1 - 72" CMP	50.2	99.6	255
5	1 - 72" CMP	50.2	99.6	252
6	1 - 60" CMP	50.2	99.6	170
7	1 - 60"X 78" CMP	50.2	99.6	123
8	1 - 60"X 48" CMP	50.2	99.6	123
9	3 - 72"X 48" CMP	184.5	402.5	435
10	3 - 72"X 48" CMP	184.5	402.5	435
11	2 - 72" CMP	318.5	663.0	506
12	2 - 72" CMP	318.5	663.0	506
13	3 - 60" CMP	Not in Study	Not in Study	510
14	3 - 60" CMP	Not in Study	Not in Study	510
15	1 - 36" CMP	393	906	62
16	1 - 30" CMP	532	958	37
17	1 - 36" CMP	780	1576	55
18	1 - 36" CMP	789	1839	55
19	1 - 30" CMP	789	1839	37
20	1 - 36" CMP	342	786	55
21	1 - 24" CMP	337	739	23
22	1 - 24" CMP	337	739	23
23	1 - 24" CMP	Not in Study	Not in Study	23
24	3 - 32" METAL PIPE	Not in Study	Not in Study	129
25	3 - 32" METAL PIPE	Not in Study	Not in Study	129
26	2 - 32" METAL PIPE	34	70	85

TABLE IV-2 (Cont'd.)
EXISTING DRAINAGE STRUCTURES

Structure No.	Description	10-Year Storm (cfs)	100-Year Storm (cfs)	Maximum Culvert Capacity (cfs)
27	2 - 32" METAL PIPE	1780	3660	85
28	3 - 32" METAL PIPE	34	79	127.5
29	3 - 32" METAL PIPE	34	79	127.5
30	6 - 32" METAL PIPE	1939	4025	255
31	2 - 30" RCP	50	100	100
32	6 - 8'X 3' CBC	945	1924	1572
33	4 - 10'X 3' CBC	756	1525	1308
34	7 - 8'X 5' CBC	396	812	3479
35	16 - 30" RCP	116	238	800
36	3 - 30" RCP	21	43	150
37	1 - 6'X 6' CBC	53	108	304
38	1 - 30" RCP	8	16	30
39	2 - 30" RCP	16	33	50
40	7 - 30" RCP	50	103	287
41	1 - 30" RCP	6	13	50
42	1 - 30" RCP	6	13	50
43	1 - 30" RCP	6	13	41
44	1 6'X 6' CBC	46	93	304
45	4 - 76"X 57" CBC	302	600	644
46	1 - 30" RCP	16	31	30
47	1 - 24" RCP	10	20	33
48	1 - 24" RCP	10	20	33
49	1 - 120" CMP	55	119	725
50	1 - 24" RCP	2	5	28
51	1 - 42" RCP	7	15	87
52	1 - 30" RCP	3	7	31
53	1 - 30" RCP	3	7	31

CHAPTER V
DEVELOPMENT OF DESIGN ALTERNATIVES

A. EVALUATION OF WATERSHED MASTER PLAN

The basin-wide master drainage plan for the Jornada watershed evolved through an intensive design optimization process. This process was initialized by the quantification of the magnitude, source and extent of the area's existing flooding conditions. It was then possible to develop a program of improvements designed to mitigate the area's flood potential.

The investigation began by defining overall regional storm management precepts to be used for this basin. There are generally two schools-of-thought in use today which relate to effective stormwater management. These are channelization and detention.

Channelization relies on the use, and if necessary, construction, of well defined drainage channels which convey the runoff quickly through the watershed to an appropriate outfall. This method of runoff management mitigates localized flooding by concentrating runoff to specifically designed outlet channels and by the rapid transfer of runoff out of the watershed. In drainage areas exhibiting rapid and/or high runoff peaks, the resulting conveyance channel may need to be extremely large and therefore can be quite costly.

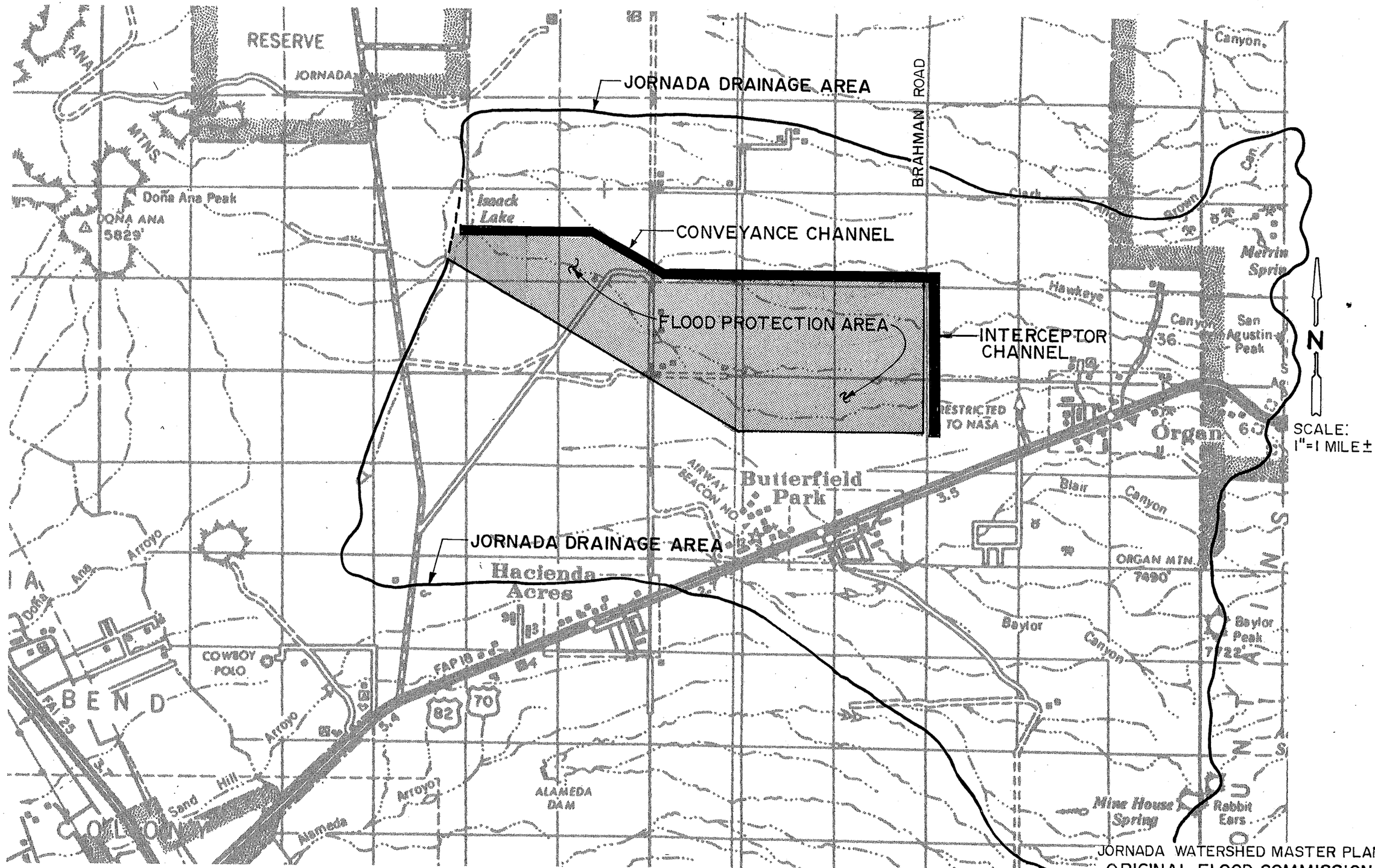
Mitigation of flooding through detention is accomplished by a controlled outlet and available upstream storage volume. The outlet from the detention facility serves to control the outflow to a rate compatible with downstream conveyance capacities. This method is, in many cases, generally more cost effective, in that downstream channels can be of a smaller size, and thus require less right-of-way and construction costs.

While both methods are generally effective in mitigating flooding, most regional systems employ elements of both channelization and detention to complete an overall stormwater management plan.

In addition to regional planning, the investigation also looked at the design details for various components of the plan. In other words, within each alternative, several other alternatives were also investigated. For channel design, options for earth-lined channels with drop structures were compared with rock riprap and concrete lined channels. For detention basins, options for multiple large versus fewer smaller detention dams were investigated. Within the detention dam alternative, various types of spillway alternatives were also investigated including: gabion drop spillways, concrete baffle block spillways and stepped soil-cement spillways. The design for each alternative was optimized and then evaluated for flood mitigation effectiveness, right-of-way requirements, and cost effectiveness. Upon completion of this investigation, a master plan for the entire watershed was developed which utilized the best combination of these components. These alternatives are described in further detail in the sections to follow.

B. CHANNEL ALTERNATIVE

At the time of the East Mesa project inception, the Dona Ana County Flood Control Commission had completed some conceptual design on a relief channel to serve the project area. The project initially consisted of an 8,000 foot long trapezoidal channel located east of and adjacent to Brahman Road. The Brahman Road Channel intercepted San Augustin, Owl's Nest and Organ North Fork Arroyos and conveyed runoff to Isaack Lake. This channel drains northward and connects to the Rincon Road Channel, a six mile long trapezoidal channel north of and adjacent to Rincon Road. Together, the Rincon Road and Brahman Road Channels passes an estimated peak of 3,878 cfs to Isaack Lake. A channel capable of transporting this runoff at an approximate 3 percent bed slope would need to be a rock riprap lined channel with a 30 foot bottom width, a minimum depth of 4.7 feet and 3:1 sideslopes. The channel would require a minimum 100 foot right-of-way. This channel system has a contributing area of approximately 4.81 square miles and provides flood protection for an area of approximately 14 square miles downstream. As shown on Figure V-1, the channel alternative provides protection for approximately 25 percent of the project area and does not mitigate the runoff from the large drainage areas crossing U.S. Highway 70 from the south. Because a small area of



JORNADA WATERSHED MASTER PLAN
ORIGINAL FLOOD COMMISSION
INTERCEPTOR CHANNEL PLAN

LEEDSHILL-HERKENHOFF, INC.

FIGURE NO. V-1

V-1

the whole drainage basin is served by the channel plan, other alternatives were investigated for providing regional flood protection.

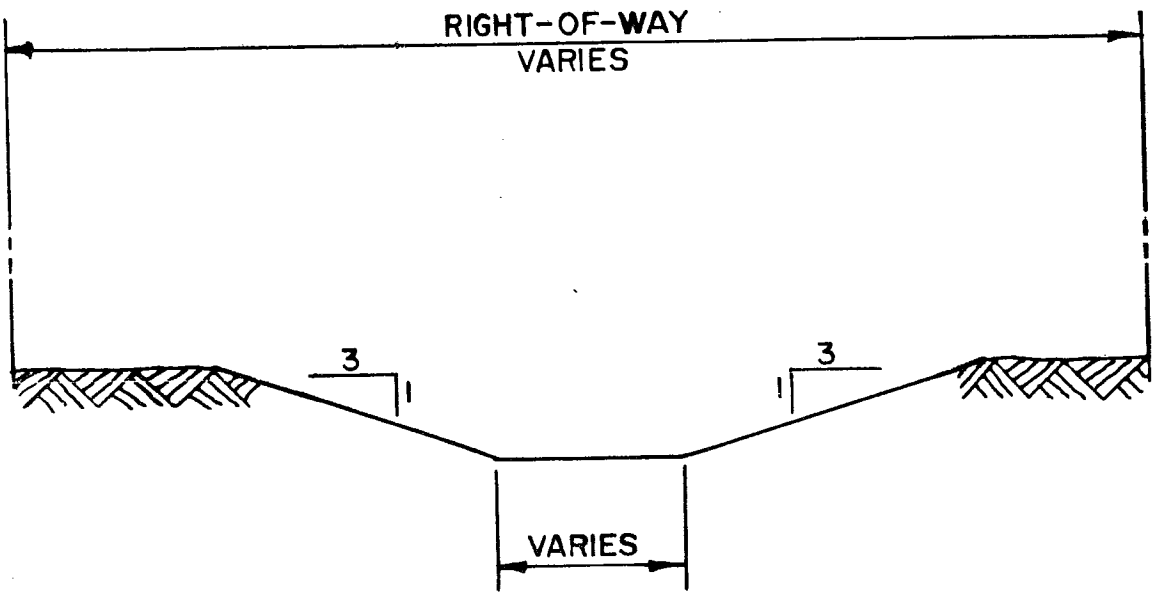
C. CHANNEL CROSS-SECTION OPTIONS

For each channel segment within the Master Drainage Plan, several options were identified and evaluated for technical viability, and overall feasibility considering construction costs, right-of-way requirements and anticipated maintenance requirements. Due to the lower cost versus other cross-section types, the trapezoidal cross-section was solely used for the channel cross-section options investigated. The geometry and surface treatments were varied to optimize hydraulic benefits versus channel and right-of-way costs.

The Jornada basin as a whole slopes from east to west at an approximate 3 percent slope; this cross slope determines the need for channel surface treatment. Channels flowing east to west, or perpendicular to the topography, will need to accommodate the basin slope and it's effects on channel velocity and subsequent hydraulic regime. From previous analysis on similar existing channels in the watershed, a supercritical flow regime should be expected for these channels; this type flow is characterized by low water depth, high velocities, and a high erosion potential.

The channels flowing north-south, or paralleling the basin slope, are allowed a higher degree of design freedom in that the channel bottom slope may be determined by necessary hydraulic capacity rather than the prevailing topography.

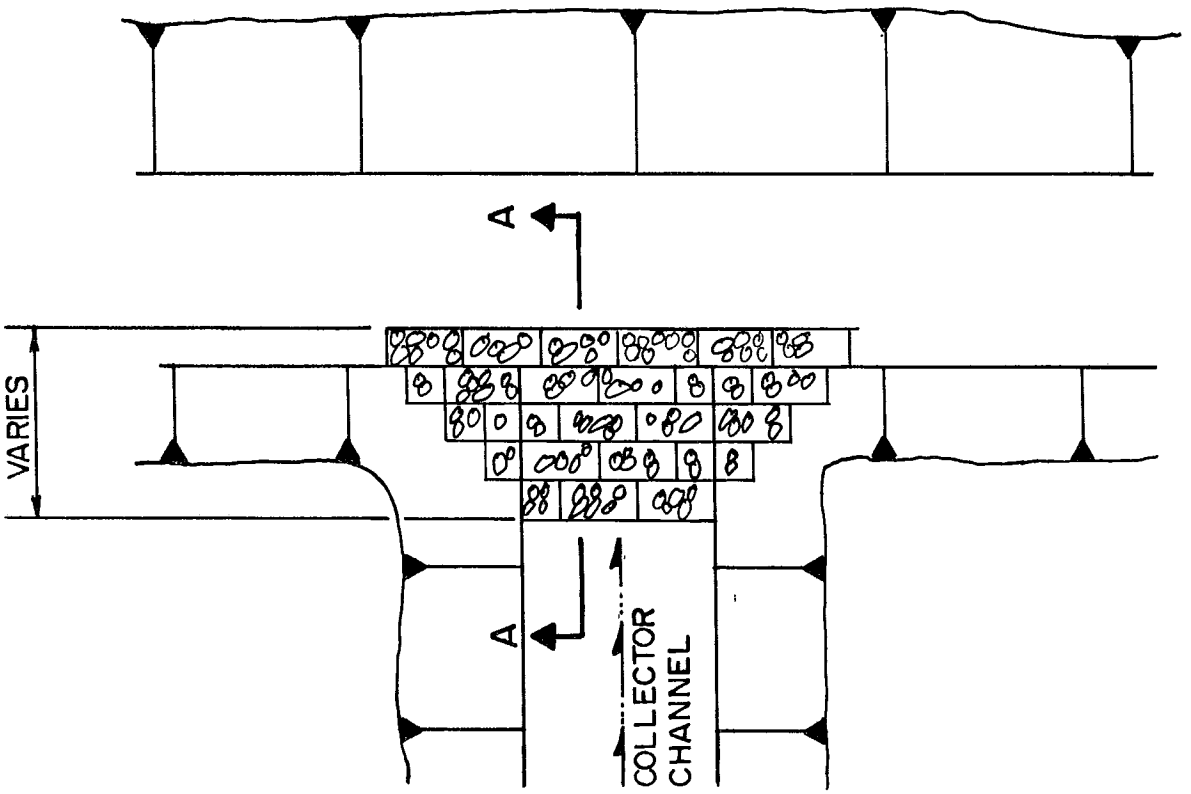
The following options were investigated for these channels: earth-lined with drop structures, rock riprap lined and concrete lined. Typical cross-sections for these options, as developed for the proposed Rincon Road Channel, are discussed in the paragraphs to follow and illustrated in Figures V-2 through V-5. Sections designed for similar hydraulic conditions were used to allow an easier comparison of the cross-section options. All channels included freeboard allowances to account for bulking and splash. Freeboard was calculated as a function of velocity.



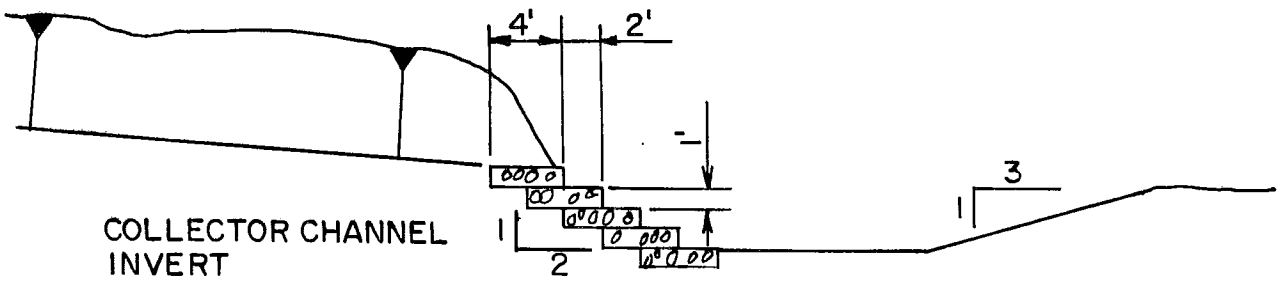
JORNADA WATERSHED MASTER PLAN

TYPICAL EARTH LINED
CHANNEL SECTION

FIGURE V-2



GABION DROP STRUCTURE LAYOUT
SCALE: 1" = 10'

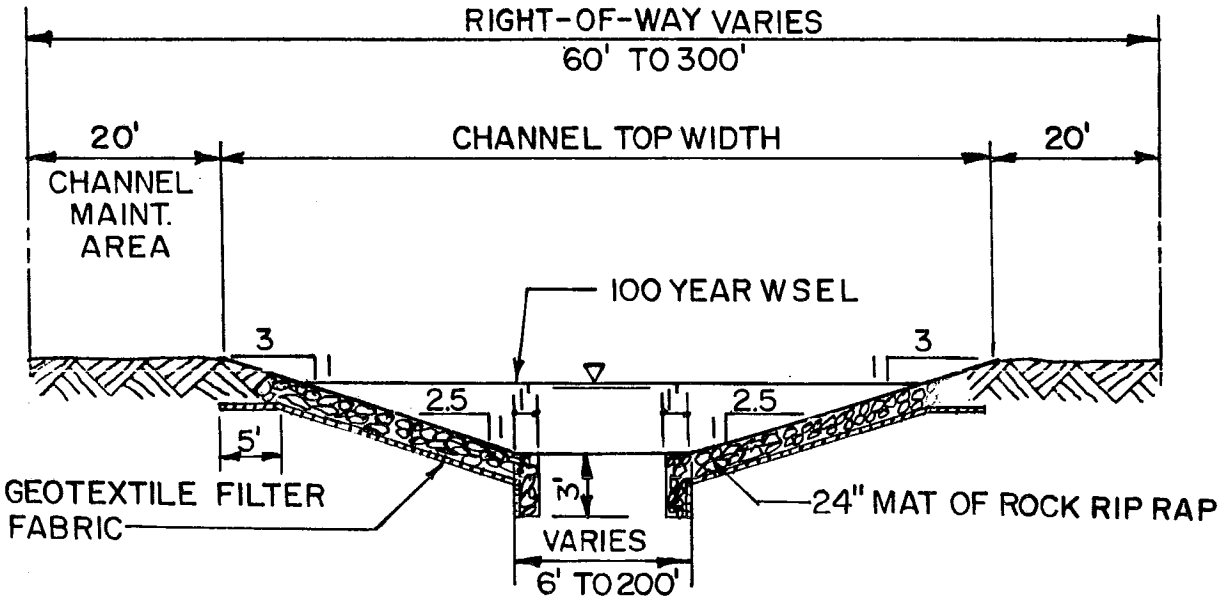


SECTION A-A
SCALE: 1" = 10'

JORNADA WATERSHED MASTER PLAN
TYPICAL CHANNEL WITH
GABION DROP STRUCTURE

LEEDSHILL-HERKENHOFF INC.

FIGURE V-3



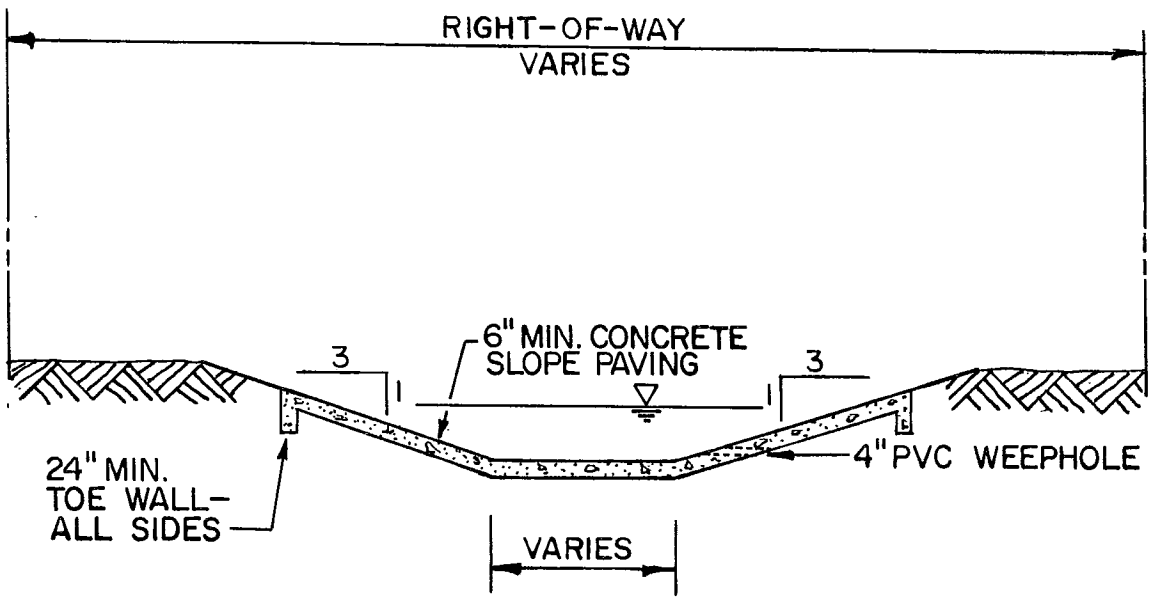
JORNADA WATERSHED MASTER PLAN

ROCK RIPRAP

CHANNEL SECTION

LEEDSHILL-HERKENHOFF INC.

FIGURE V-4



JORNADA WATERSHED MASTER PLAN

CONCRETE LINED
CHANNEL SECTION

1. Earth-lined Channels

An earth-lined channel is the most cost effective channel to construct because it involves simple excavation and shaping operations. However, because the local soils consist of non-cohesive sandy soils with a high erosion potential, the limits for this type design are channel velocity and allowable sideslopes. Ongoing maintenance requirements for this type channel would include bi-annual sediment removal, and annual grubbing of vegetation and removal of extraneous debris (tires, shopping carts, refrigerators, etc).

The earth-lined channel design must incorporate limiting channel velocities and allowable side-slope geometry. The recommended sideslopes which would prevent bank failure for an earth-lined channel should be no steeper than a 3:1 ratio.

Channel velocity is a function of channel roughness, cross sectional area and bottom slope. Channel bottom slopes were determined to allow an average velocity of 3± feet per second (fps); higher slopes increase the likelihood of scour and erosion problems, lower slopes encourage sediment deposition. As the bottom slope decreases, typically a larger cross-sectional area is required to maintain sub-critical type flows. This in turn increases the construction costs and right-of-way requirements; as the earth-lined channels increase in size, other channel cross-section designs are optimized for cost effectiveness for the particular reach under investigation. A typical cross-section for this design option is included in Figure V-2.

2. Earth Lined with Drop Structures

In order to mitigate construction costs for those channels located perpendicular to the basin slope, an option of using flatter sloped earth-lined channels with intermittent gabion drop structures was investigated. The channel sections were designed as discussed as above with 3:1 sideslopes, a fairly flat bottom slope and a variable cross-section area. Gabion-type drop structures were spaced at a 100 foot interval along the channel to provide a controlled drop in grade to compensate for the difference between the existing basin slopes and allowable channel slopes. These structures consisted of

rock-lined baskets which were inserted into the channel to allow a 3 foot drop with scour protection at the foot of each drop. A sketch of this option is included in Figure V-3.

Depending on the channel cross-sectional area required for the reaches on flatter grades, and on the total number of drop structures required, gabion drops can be a cost effective solution for some channels. However, for larger flows, a lined and thus a smaller channel is usually more cost effective and less right-of way intensive than its earthen counterpart. Because of the local availability of rock, gabion drop structures can be a cost effective solution for steep channels depending on the total number of drops required. However, because of the labor required in constructing these structures, if the channel requires a large number of drops to counteract the basin slope, the construction costs for this option can eliminate its feasibility.

The anticipated maintenance requirements for this type channel would be bi-annual sediment removal and the annual grubbing of vegetation and removal of extraneous debris.

3. Rock Riprap Lined Channels

By providing physical channel protection, it is possible to allow higher average velocities in the channel. This allows a steeper channel bottom slope, steeper allowable side-slopes (2.5:1) and a smaller resulting channel cross-section. In addition, lined channels can inhibit an arroyos' natural tendency to meander along its alignment by preventing erosion of the channel section. The rock riprap lined channel is slope protected by the placement of an 24-inch thick mat of dense, heavy blocks of rock. This mat is typically placed along the bottom and sideslopes up to 2 feet above the anticipated maximum water surface in the channel. However, in order to provide an economic cross-section for use in this area, the side slopes only are rocklined with the bottom remaining as an earthlined section. This section features a 2.5:1 sideslope for the rocklined section of channel and a flatter 3:1 sideslope for the earthen portion of the slope. This section provides protection from scour and channel meandering. Junctions with tributary channels should incorporate lining along the bottom as well as the sides. A typical cross-

section for this type of channel is shown on Figure V-4. Because of the abundance of rock material in the vicinity of the project and the smaller cross section required for the channel; this is a very cost effective option from both construction costing and right-of-way requirements.

Annual maintenance for this option would be anticipated as the annual clearing of miscellaneous vegetation sediment and debris.

4. Concrete Lined Channels

A concrete lined channel is usually the most hydraulically efficient conveyance method available and one of the more expensive. The concrete lining provides continuous impermeable slope protection which allows higher channel velocities, up to vertical sideslopes, and the smallest design cross-section of the four options. This is due to the fact that concrete has a low roughness factor and a trapezoid is a hydraulically efficient shape. With improved channel hydraulics, more runoff can be conveyed by a smaller cross-section.

The concrete lined channel section used for this study features 6-inch minimum thick reinforced concrete channel lining along the bottom and 2:1 (horizontal) sideslopes with two feet of lined freeboard. Toe walls along the edges of the concrete channel lining are recommended to prevent underwash and subsequent erosion. Figure V-5 indicates a typical channel cross section for this option.

Anticipated maintenance activities associated with this type of channel section would be the annual removal of extraneous debris and some limited sediment removal near structure locations.

The labor and material costs associated with the construction of concrete channel linings are quite a bit higher than the other design options. However, some savings may be realized on an annualized basis due to limited maintenance requirements.

D. DETENTION ALTERNATIVES

As a direct result of the analysis of existing conditions for the Jornada Basin, it became apparent that channelization alone was insufficient to solve the areas drainage problems. Several alternative solutions for detention storage facilities combined with smaller conveyance channels were investigated.

In general,detention basins present the most economical solution for the management of the large peak flow rates associated with the larger infrequent rainfall events. The channel outfall systems associated with the proposed detention basins can provide improved drainage conditions for the design storm through downstream basins.

Several locations were selected as potential sites for floodwater detention facilities. The prime consideration for site selection was to maximize flood peak attenuation, and as the highest peaks in the watershed occurred in the arroyos upstream of Brahman Road and south of U.S. Highway 70, tentative sites were located in these areas. These sites were finalized through consideration of minimizing earthwork requirements, and therefore probable project costs, and the consideration of minimizing right-of-way acquisition costs. In general, the sites were chosen to minimize the amount of right-of-way required of private landowners in the area.

Once the conceptual locations for the detention facilities were selected, several design alternatives for each of these facilities were investigated for hydrologic effectiveness, potential construction costs and right-of-way requirements. The alternatives investigated included the use of multiple dams, one per arroyo; the use of multiple dams, which would intercept the runoff from several arroyos; and the use of linear incised detention ponds with embankments. Descriptions of these alternatives are discussed in the sections following.

Through the investigation process, the final recommended design and location for each facility was determined for inclusion in the Jornada Master Drainage Plan.

1. Multiple Detention Dams (Five Dam Option)

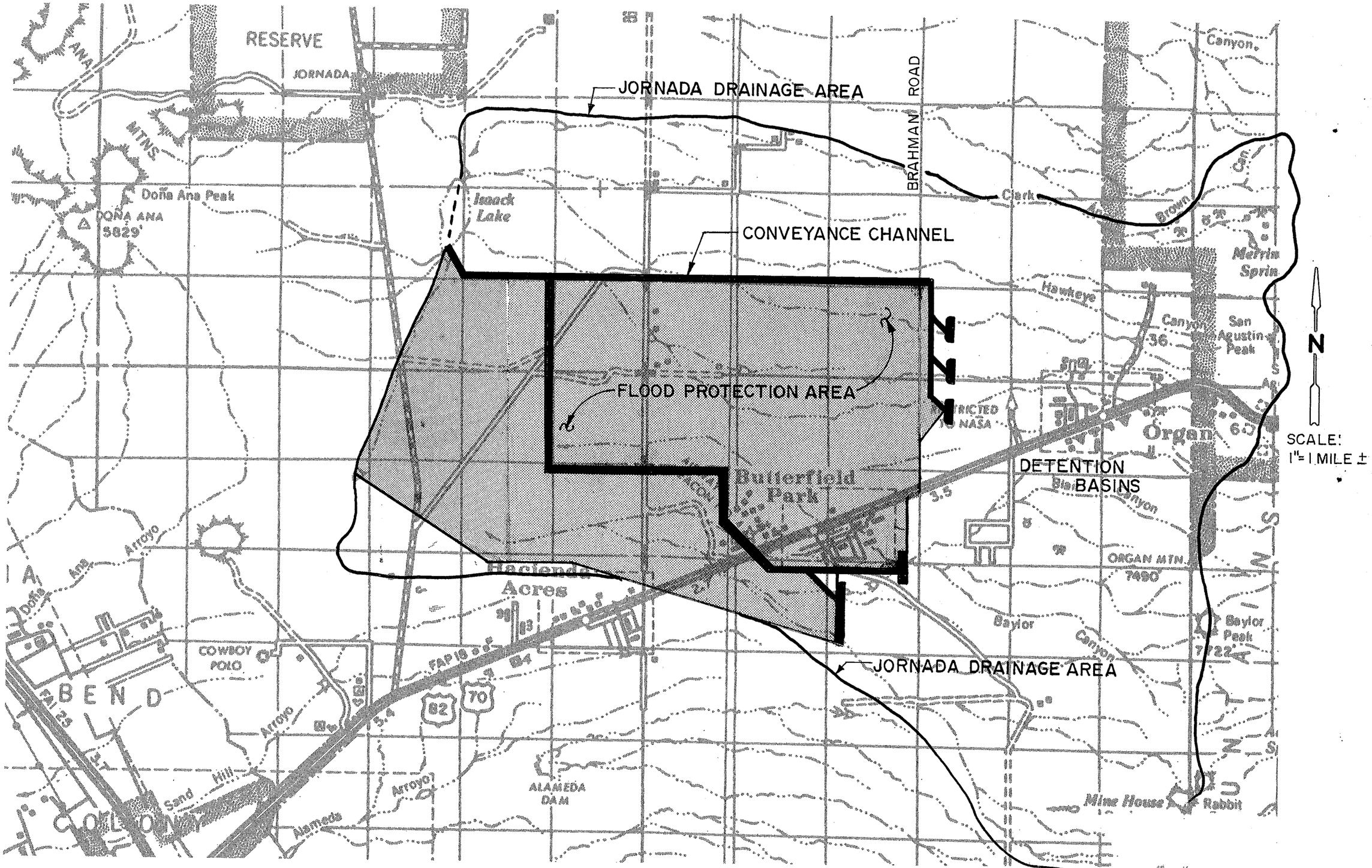
In previous work completed for similar watersheds in Dona Ana County, it was possible to locate the detention dams between well defined points of higher elevation and to utilize the arroyo channel for detention storage, thereby reducing the amount of excavation and embankment required, and thus reducing the construction cost. This approach seemed desirable for this watershed as well. The drawback to the direct application of this theory for the Jornada watershed, is that the sites where the topography allows this are located within the boundaries of the White Sands Missile Range; permission for construction within this area would be a time consuming endeavor. It was therefore assumed that construction of the proposed detention facilities would be located outside of the White Sands area. However, the topography outside this area dictates other types of detention facilities.

The concept of utilizing multiple smaller embankments, one per arroyo, with limited excavation of detention storage was investigated to determine its feasibility. The outfalls were assumed to discharge to common conveyance channels. A schematic for this plan is shown in Figure V-6 along with the area protected by these improvements. Approximately 80 percent of the watershed receives relief from flooding with this scenario.

This alternative proposes five individual dams and detention basins, all located in the upper most reaches of the drainage area. Dams would be provided for the San Augustin, Owl's Nest and Organ Arroyos located east of Brahman Road; for the Blair and Baylor Canyon Arroyos located south of Sallee Road; and for the Mine House Spring Arroyo located along the Moongate Road alignment. The details of this alternative are summarized in Table V-1, Summary of Detention Facilities.

2. Fewer Multiple Detention Dams (Three Dam Option)

In order to minimize construction costs and right-of-way acquisition, an alternative was investigated which consisted of one large dam, the Brahman Road Detention Dam, and a collector channel to be used in lieu of separate dams for the San Augustin, Owl's Nest and Organ Arroyos. Under this alternative, berming would be used



JORNADA WATERSHED MASTER PLAN

FIVE BASIN ALTERNATIVE

FIGURE NO. V-6

LEEDSHILL-HERKENHOFF, INC.

TABLE V-1
SUMMARY OF DETENTION FACILITIES

Detention Facility Parameters	Three Dam Alternative*			Five Dam Alternative*		
	Brahman Road	Mine House Spring	Blair/ Baylor	San Augustin	Owl's Nest	Organ Arroyo
Detention Basin Hydrology						
Drainage Area (sq.mi.)	4.81	7.57	8.21	1.57	1.21	2.03
100-yr Peak Inflow (cfs)	3938	2598	6715	506	918	2080
100-yr Peak Outflow (cfs)	108	137	212	30	29	62
100-yr Runoff Volume(ac-ft)	379.0	557.0	695.0	115.0	87.0	165.0
100-yr Sed. Volume(ac-ft)	84.0	103.0	107.0	9.0	27.0	47.0
Max. 100-yr Water Surface	4749.1	4624.6	4677.4	4777.4	4778.1	4768.1
1/2 PMF Peak Flow (cfs)	6975	9841	10,098	3140	2662	3654
Hydrograph Timing						
Peak Inflow (hr)	6.5	7.7	6.7	6.6	6.5	6.5
Peak 100-yr Outflow (hr)	14.1	18.7	13.0	15.7	12.5	11.3
Time to Drain Basin (hr)	79.0	95.7	81.3	78.7	64.0	63.0
Earthwork						
Maximum Dam Height (ft)	29.7	26.3	23.7	24.5	22.7	21.2
Crest Elevation (ft)	4757.7	4633.3	4685.7	4784.5	4784.7	4775.2
Crest Length (ft)	3322	4215	4460	2378	2085	2004
Embankment Slope (H:V)	3:1	3:1	3:1	3:1	3:1	3:1
Total Embankment Vol.(CY)	182,645	122,656	207,583	109,669	78,459	75,902
In-situ Material	136,984	91,962	155,687	82,252	58,844	56,926
Select Borrow Material	45,661	30,694	51,906	27,417	19,615	18,976
Excavated Volume	455,920	920,206	869,413	62,544	76,545	260,820
Spillways						
Service Spillway						
Class IV RCP	1-30" Dia.	1-36" Dia.	1-48" Dia.	1-18" Dia.	1-18" Dia.	1-24" Dia.
Emergency Spillway						
Type	Soil Cement	Soil Cement	Soil Cement	Soil Cement	Soil Cement	Soil Cement
Width (ft)	200	240	280	120	120	140
Height (ft)	8.1	8.7	8.2	7.1	6.6	7.1
Slope (H:V)	3:1	3:1	3:1	3:1	3:1	3:1
Drainage Easement (Ac)	9.43	8.12	12.1	6.12	5.05	4.60
Estimated Construction Cost	$1,390,852	$1,942,976	$2,094,989	$533,848	$468,193	$744,622

* Three Dam Alternative includes Brahman Road, Mine House Spring, Blair/Baylor facilities; Five Dam Alternative includes Mine House Spring, Blair/Baylor, San Augustin, Owl's Nest and Organ Arroyo Facilities

to direct these arroyos into the Brahman Road collector channel. This channel would then discharge into the Brahman Road Detention Facility located near the Brahman/Rincon Road intersection. The facilities serving runoff from the Blair, Baylor Canyonand Mine House Spring Arroyos would remain the same as for the five dam option. Figure V-7 provides a schematic for this alternative along with the protected area; this alternative provides similar benefits as the five dam alternative.

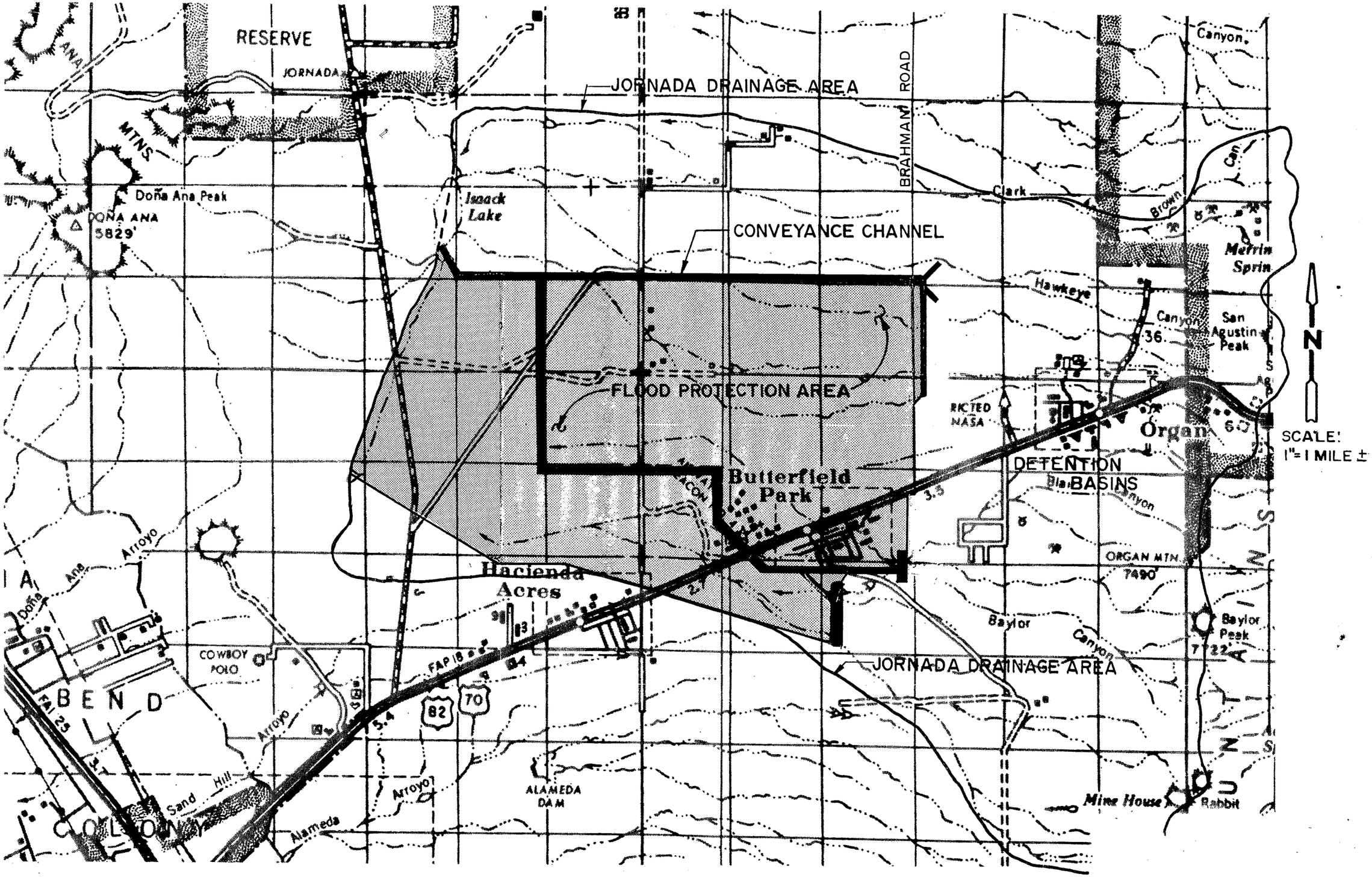
3. Linear Detention Ponds With Embankments.

In the development of the initial master plan, the concept of utilizing a combination channel and detention facility was investigated. This alternative consisted of utilizing a linear channel perpendicular to the arroyos and paralleling the contours for detention as well as conveyance. Figure V-8 indicates a schematic for this alternative. However, because the intent of the project was to provide detention ponds for sediment as well as flood control, upon completion of the sediment transport analyses, this alternative was eliminated from further consideration. The sediment transport analyses indicated the potential for substantial sediment loading to these facilities.

This sediment is carried at a fairly high velocity by the arroyos draining into the detention channels. The detention channels are designed at a much flatter slope than the arroyos in order to maximize storage volume. Because of this, the channel velocities are not high enough to continue to carry this sediment and it settles out near the arroyos junction. This causes the potential of plugging the channel near the arroyo junction locations. The channel loses its ability to function as a channel, and in severe cases, could cause overtopping upstream of the sediment plug.

E. DETENTION DAM AND SPILLWAY OPTIMIZATION

For each of the dams investigated in this study, further optimization of the primary and emergency spillway was made. Alternative spillways, embankment and excavation scenarios were optimized in order to balance flood control with project economics.

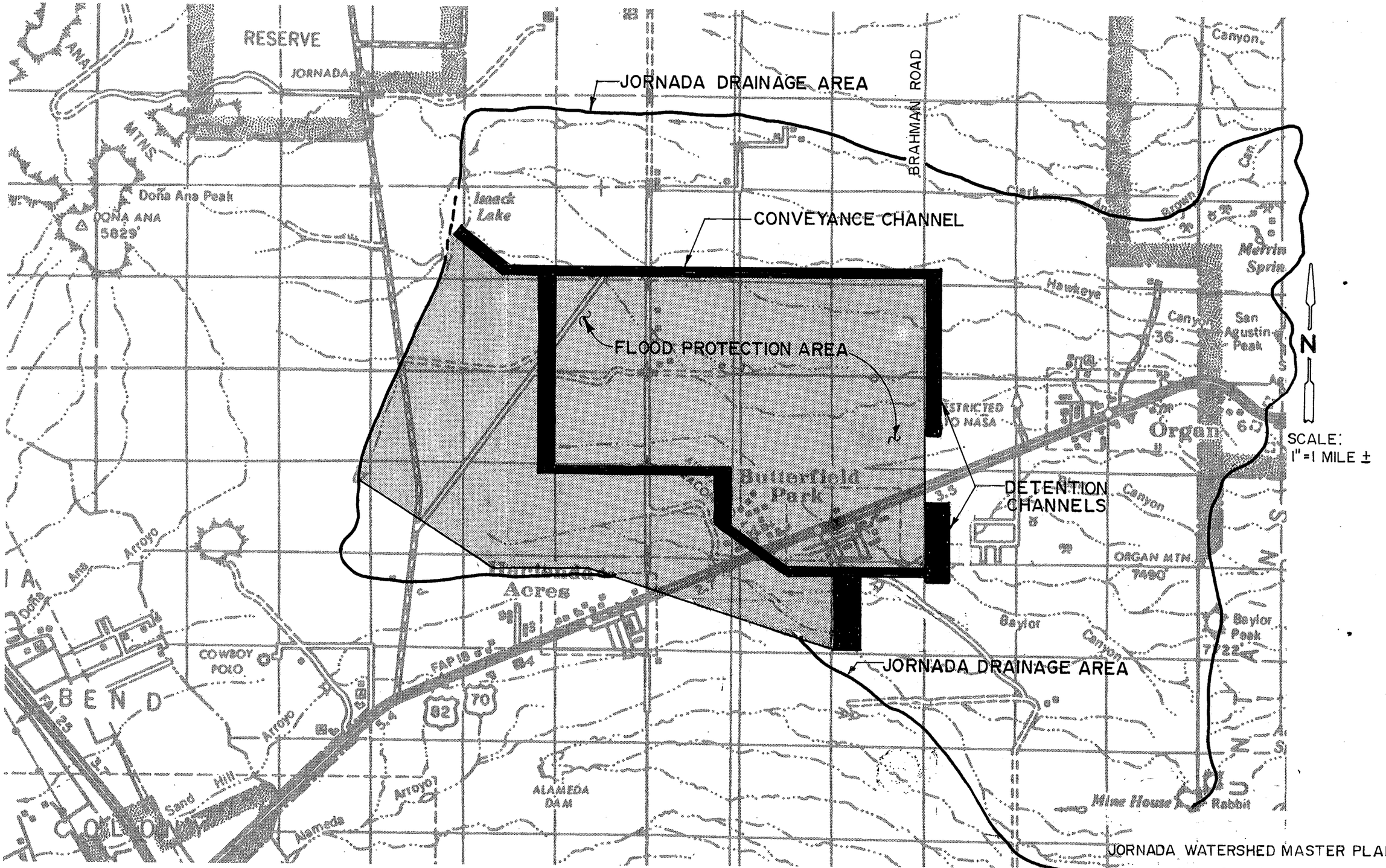


JORNADA WATERSHED MASTER PLAN

THREE BASIN ALTERNATIVE

FIGURE V-7

LEEDSHILL-HERKENHOFF, INC.



JORNADA WATERSHED MASTER PLAN

LINEAR DETENTION ALTERNATIVE

LEEDSHILL-HERKENHOFF, INC.

FIGURE NO. V-8

1. Primary and Emergency Spillway for Detention Dams

The primary spillway for a detention dam is usually the outlet pipe buried beneath the embankment. Outflow from the dam is regulated by the size of the discharge pipe. Due to the high potential for sediment deposition in the Jornada detention facilities, sediment resistant inlet towers are recommended. These towers are vertical cylinders with multiple inlet openings, providing inlet capacity further up the cylinder when lower orifices become plugged.

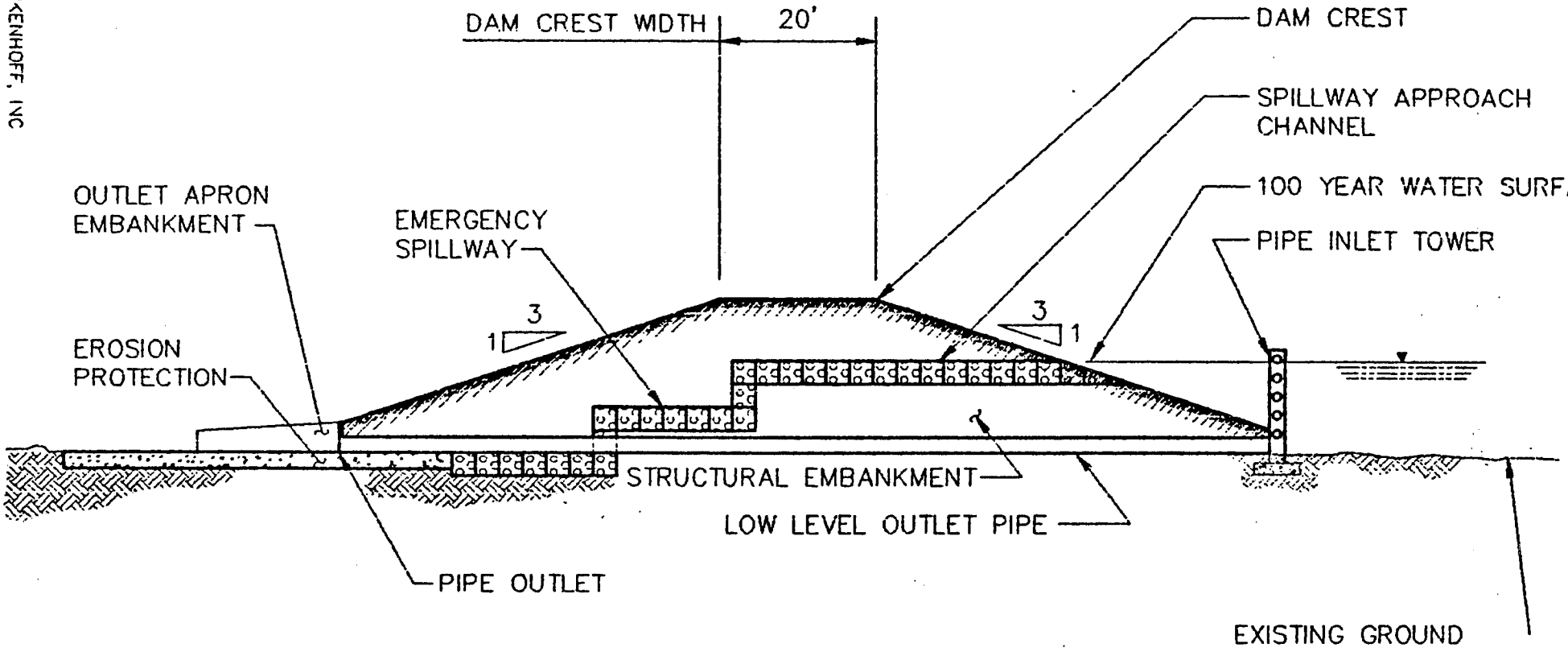
Each dam must also provide an emergency spillway which is designed for storms in excess of the 100-year rainfall event. This spillway is designed to protect the embankment from dam breach and subsequent downstream loss of life and property. Typically, the emergency spillway is constructed of concrete or other erosion resistant material. An approach channel is built across the top of the embankment and leads to a drop structure or other energy dissipation device located on the downstream face of the dam (see Figure V-9). The crest of the emergency spillway is located at an elevation equal to the maximum water surface elevation calculated for the 100-year storm event. Downstream of the pipe outlet and emergency spillway, additional erosion protection is usually provided (see Figure V-10).

2. Alternative Spillway Types

From previous work in the East Mesa area, three different spillway types were selected for evaluation in this report: a reinforced concrete baffle chute spillway, a stepped gabion spillway, and a stepped soil cement spillway. These three were chosen for their particular applicability for the project hydraulic conditions, the local availability of materials and their cost.

The baffle chute spillway consists of a concrete chute lined with trapezoidal blocks located perpendicular to the direction of flow as indicated in Figure V-11. This type of spillway was developed by the Soils Conservation Service and is very effective in energy dissipation over a wide range of flows.

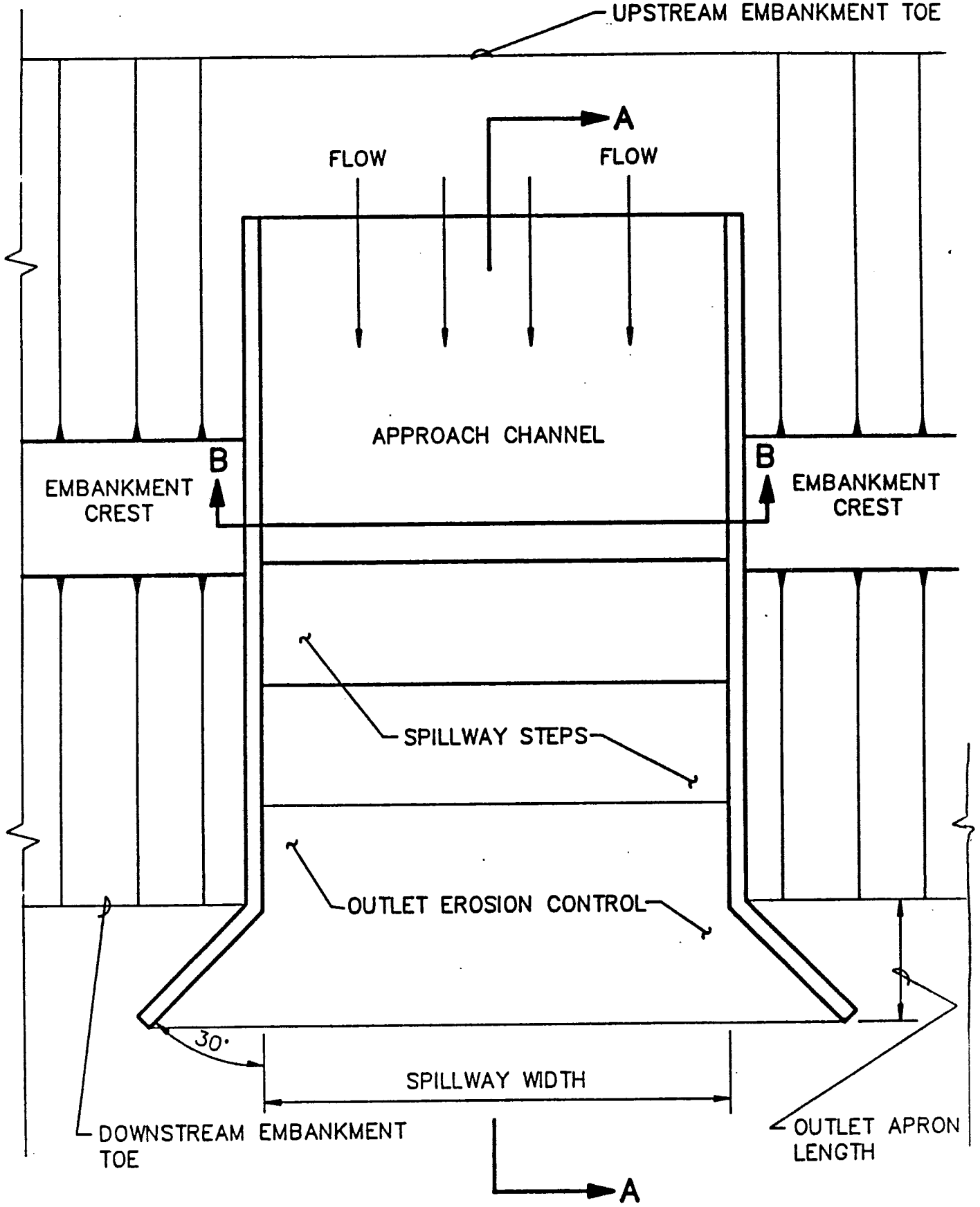
LEE SHILL-HERKENHOFF, INC



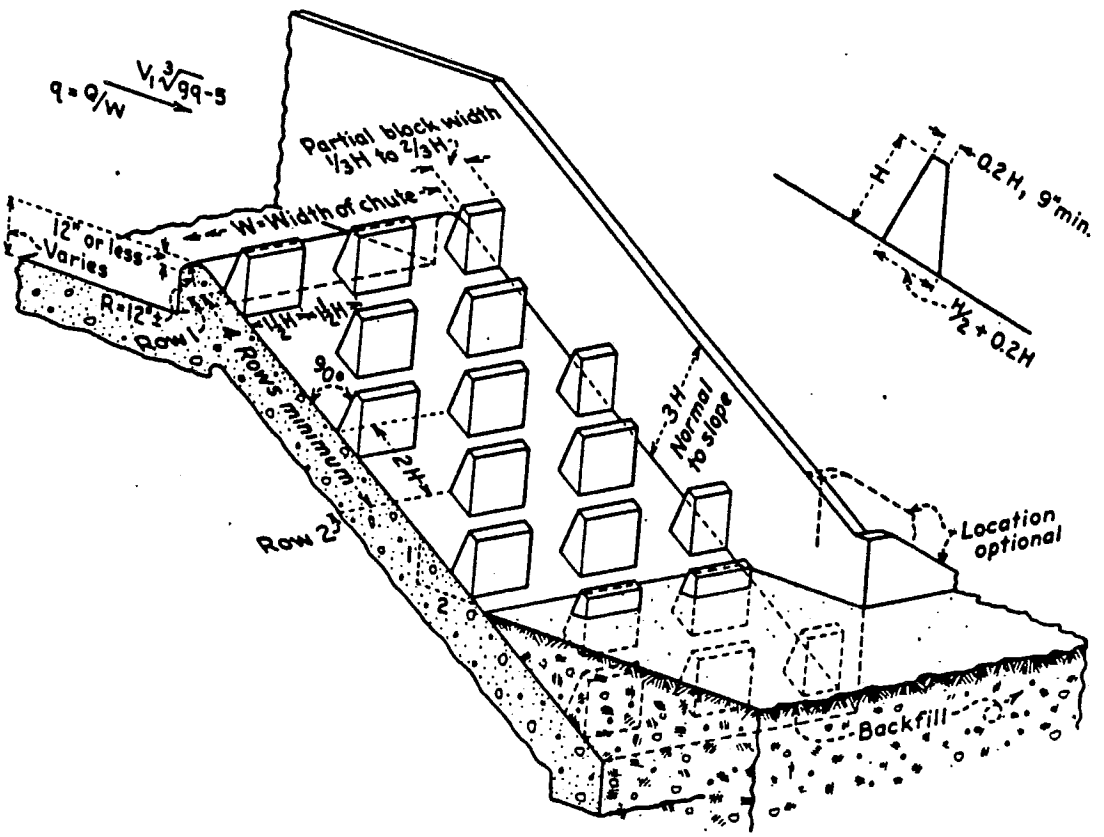
TYPICAL DAM SECTION

SCALE: 1"=20'

FIGURE V-9



EMERGENCY SPILLWAY PLAN
NOT TO SCALE



SOURCE: Progress Report V– Research Study on Stilling Basins, Energy Dissipators and Associated Appurtenances, Hyd-445, Bureau of Reclamation, April, 1961.

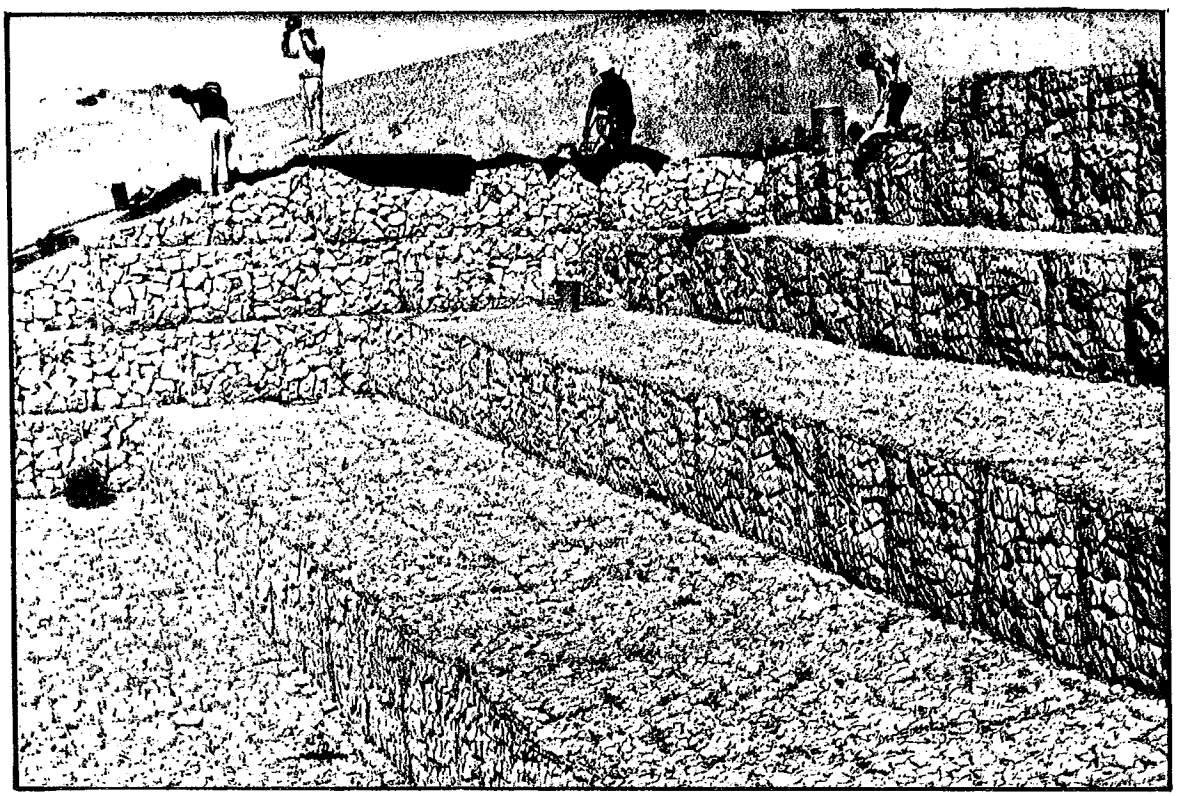
TYPICAL REINFORCED CONCRETE DROP STRUCTURE – ISOMETRIC

FIGURE V-11

The stepped gabion spillway has a certain aesthetic appeal which has led to its use on several COE flood control spillways in southern New Mexico. This type of drop structure consists of steps formed from galvanized steel wire mesh baskets filled with large cobbles, as indicated in Figures V-12 and V-13. The energy is dissipated through a series of hydraulic jumps created by the steps. Because of the ready supply of cobbles and rocks in the vicinity of the project, there are potential material cost savings with this type spillway.

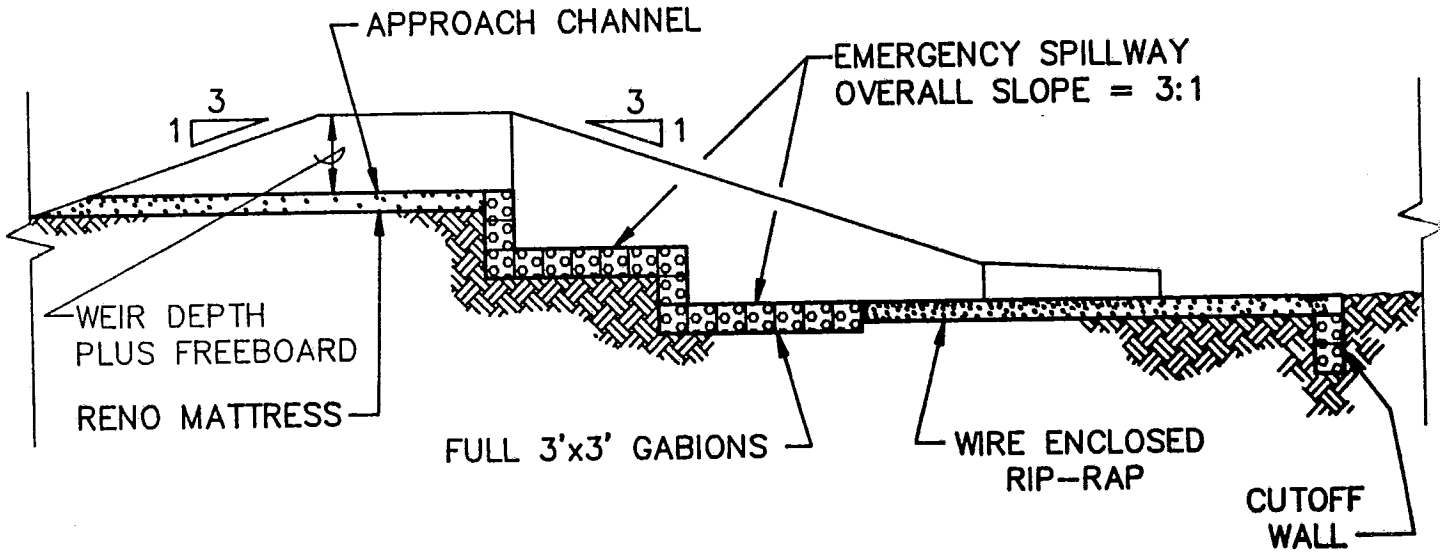
Aerial site reconnaissance of several existing dam and spillway locations in the East Mesa area indicated the use of cement stabilized earth spillways. Further research with the Portland Cement Institute and the U.S. Bureau of Reclamation indicates that this type of spillway may provide considerable cost savings. The stepped soil cement spillway has recently evolved as a relatively new element in flood control design. Utilizing site soils, a mixture of soil, cement and water is placed in one foot thick layers with road construction equipment and densified with roller compactors (see Figure V-14).

At this point in time, there is considerable literature available concerning the actual construction of the stepped cement stabilized spillway; however, most of the information available concerning hydraulic design recommendations has been based on empirical studies and physical modeling of the designs prior to construction. The Albuquerque Metropolitan Area Flood Control Authority (AMAFCA) has recently commissioned several hydraulic model studies of this type spillway through the University of New Mexico (UNM) Civil Engineering Department. Energy dissipation in the range of 65%-75% has been reported, with the greatest dissipation occurring when the entire flow of water must land on each spillway step. Model studies indicate that this occurs when the unit flow rate "q" (cfs/ft of spillway width) is less than approximately 60 cfs/ft. When q is greater than 100 cfs/ft, the majority of flow ignores the stepped configuration underneath and simply jets on past without tangible energy dissipation. For this reason "q" is for spillway design were selected with 60 cfs/foot as a maximum allowable unit flow rate.



TYPICAL STEPPED GABION
DROP STRUCTURE - ISOMETRIC

FIGURE V-12



GABION SPILLWAY SECTION

SCALE: 1"=20'

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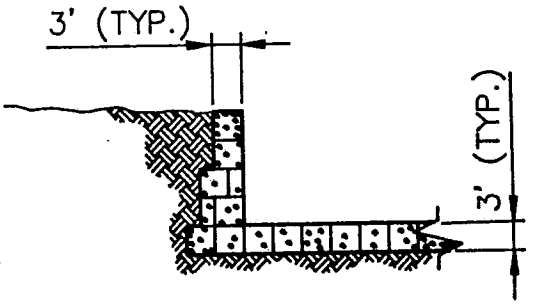
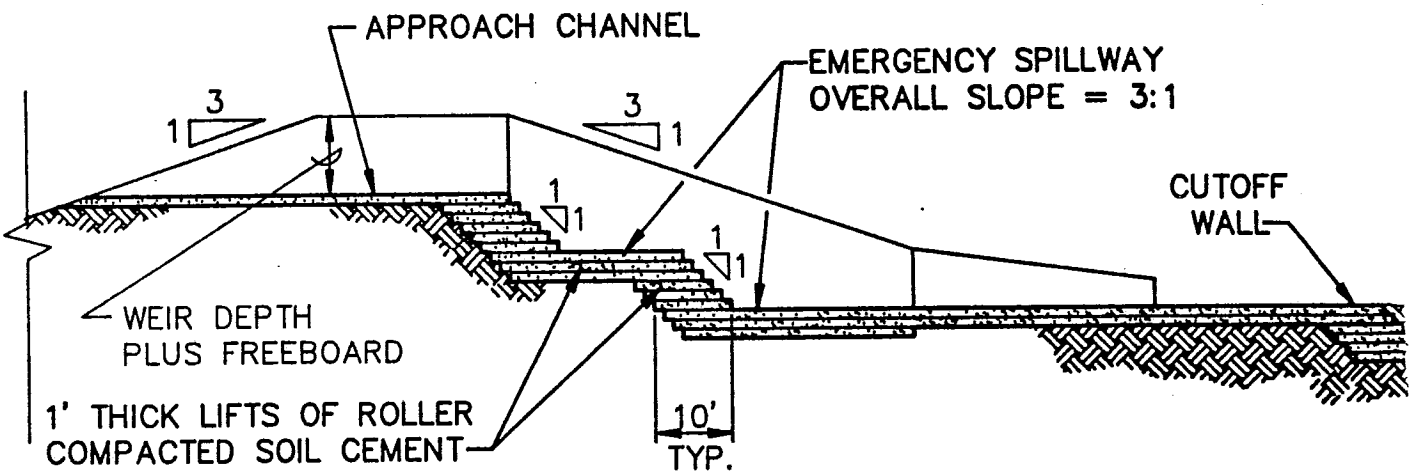


STACKED GABIONS

APPROACH CHANNEL CROSS SECTION

SCALE: 1"=20'



SOIL CEMENT SPILLWAY SECTION

SCALE: 1"=20'

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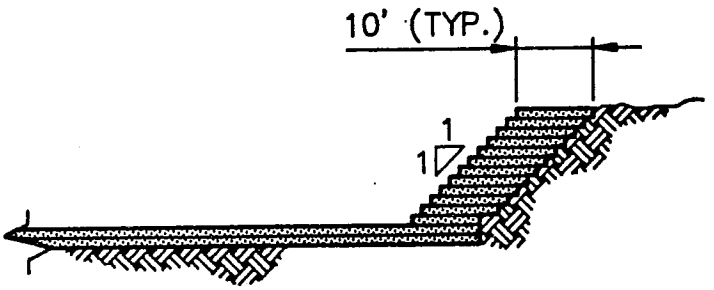


ROLLER COMPACTED SOIL CEMENT

APPROACH CHANNEL CROSS SECTION

SCALE: 1"=20'

Should a stepped spillway (gabion or soil-cement) configuration be selected, physical laboratory testing of the final design configuration should be utilized during the final design effort in order to fine tune the spillway for the particular site conditions. This procedure has been successfully utilized in the design and construction of many spillway facilities similar to those proposed for the East Mesa.

3. Optimizing Spillway and Embankments

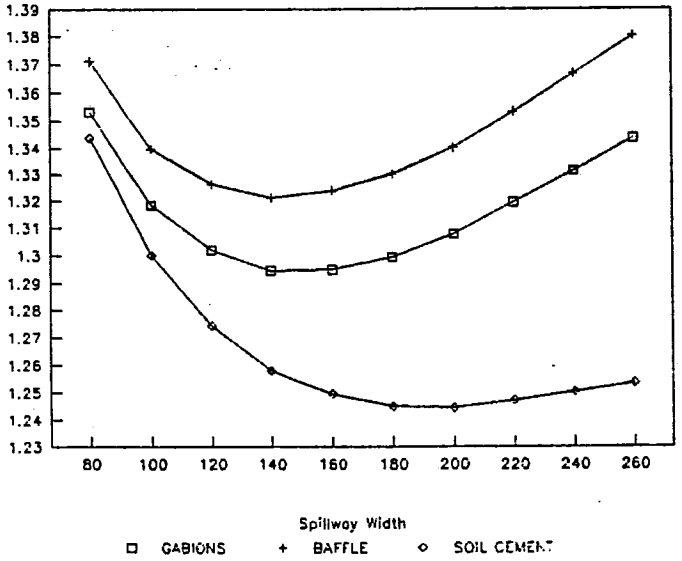
A computer spreadsheet was developed to compare each of the three spillway types considered. Included in this analysis is a computation of embankment fill volume, excavation quantities for ponding area, spillway construction materials and quantities, outlet pipe quantities and other cost factors. A compilation of these spreadsheets is included in Appendix G. Calculation of total cost was compiled for a range of spillway widths and resulting embankment heights, in order to determine the optimum spillway width for each spillway type. Figure V-15 indicated plots of the optimization curves for the six dams analyzed for this study. Table V-2 provides a comparison of the results of this analysis. As indicated by this table, in general, the concrete baffle block and gabion type spillways were fairly similar in construction geometrics and resulting costs. In all cases, the stepped soil cement spillway provided considerable cost savings.

4. Finalization of Master Plan Concept

The master plan for the Jornada watershed was finalized based on the examination of the hydrologic results of the three and five dam alternatives and on the optimization of the spillways and embankments. The hydrologic results did not vary significantly between the two alternatives; therefore, the driving force behind this decision was one of economics. As the three dam alternative was more cost effective, it was selected as the basis for the Jornada Master Drainage Plan.

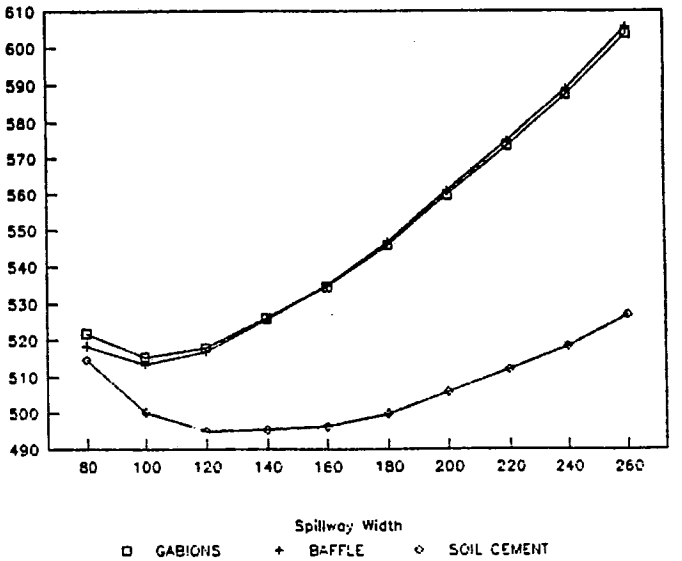
BRAHMAN ROAD DETENTION BASIN

Combined Dam Spillway Optimization



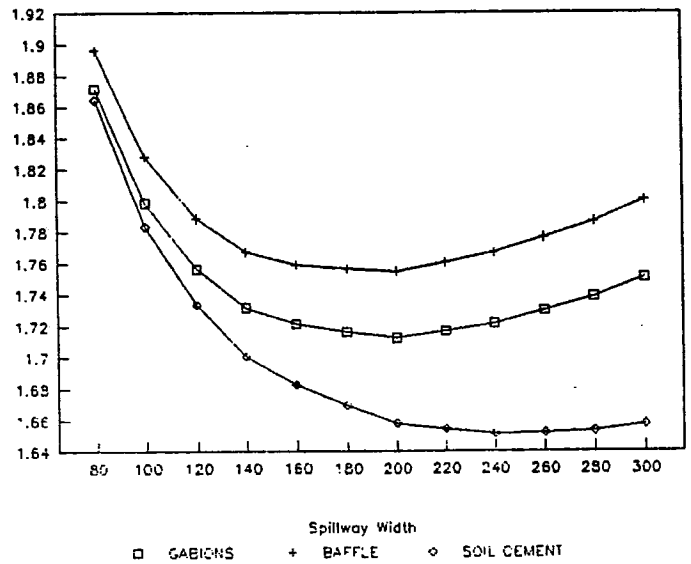
SAN AUGUSTIN ARROYO DETENTION BASIN

Combined Dam Spillway Optimization



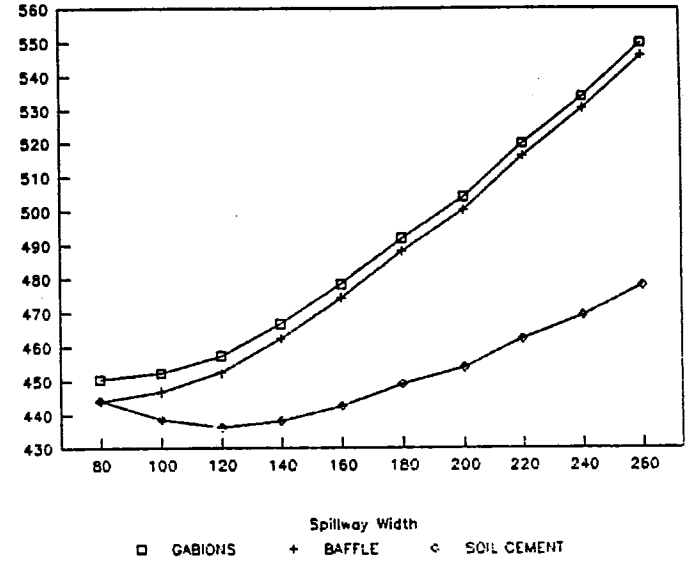
MINEHOUSE SPRING DETENTION BASIN

Combined Dam Spillway Optimization



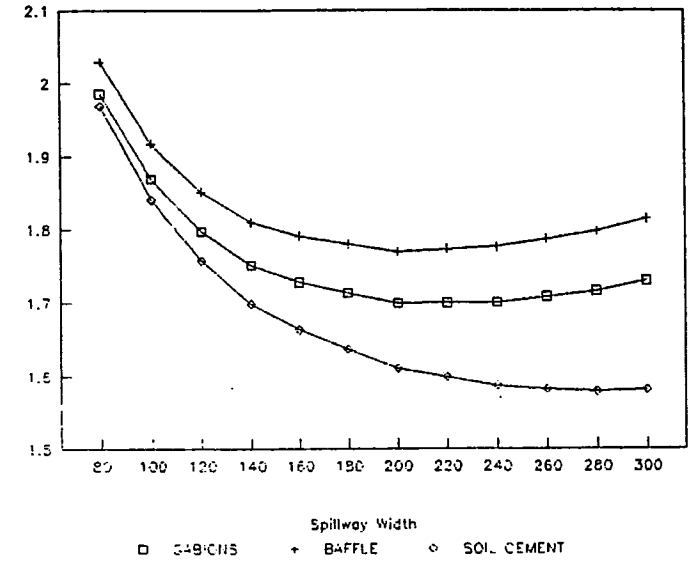
OWL'S NEST ARROYO DETENTION BASIN

Combined Dam Spillway Optimization



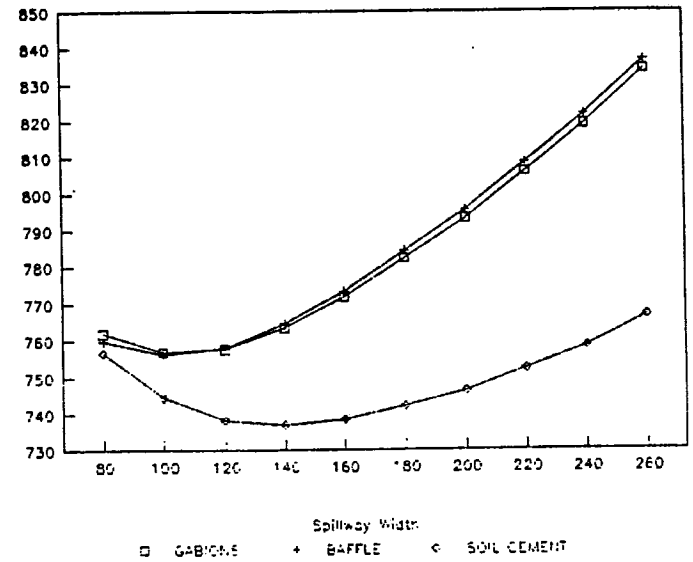
BLAIR/BAYLOR CANYON DETENTION BASIN

Combined Dam Spillway Optimization



ORGAN ARROYO DETENTION BASIN

Combined Dam Spillway Optimization



SPILLWAY OPTIMIZATION

FIGURE V-15

TABLE V-2
DETENTION DAM OPTIMIZATION SUMMARY

Detention Facility	Spillway Type (Width)		
	Gabion	Concrete	Soil Cement
** Brahman Road	$1,451,444 (160 feet)	$1,483,454 (160 feet)	$1,390,852 (200 feet)
* San Augustin	$555,824 (100 feet)	$554,362 (100 feet)	$533,848 (120 feet)
* Owl's Nest	$484,000 (80 feet)	$477,881 (80 feet)	$468,193 (120 feet)
* Organ Detention	$764,722 (100 feet)	$764,135 (100 feet)	$744,622 (140 feet)
*, ** Blair/Baylor	$2,171,555 (240 feet)	$2,216,169 (240 feet)	$2,094,989 (280 feet)
*, ** Mine House Spring	$2,009,174 (200 feet)	$2,054,149 (200 feet)	$1,942,976 (240 feet)
*Total Five Dam Option	$5,985,275	$6,066,696	$5,784,628
**Total Three Dam Option	$5,632,173	$5,753,772	$5,428,817

NOTE: Costs reflect total construction costs as calculated for the dam and detention basin only and do not include contingencies, engineering, rights-of-way or channel costs.

CHAPTER VI
MASTER PLAN DESCRIPTION

A. DRAINAGE IMPROVEMENTS

The drainage master plan for the Jornada watershed evolved through an iterative design process which involved cost estimating, right-of-way evaluation, and hydrologic and hydraulic analyses for the various alternative components. The final design for the East Mesa does not adhere to any one of the design concepts discussed above but includes elements from all; this provides the most advantageous combination of flood control benefits for the watershed. Figure VI-1 (A-D) provides a complete layout of the detention and channel facilities which form the Jornada Master Drainage Plan. Figure VI-1, due to its size, is included as a separate appendix (Appendix H) to this report.

Detention is provided in the upper reaches of the watershed by the construction of the Brahman Road Detention Facility, the Blair/Baylor Canyon Detention Facility and the Mine House Spring Detention Facility. These facilities provide flood attenuation and sediment control for the runoff stemming from the Organ Mountains. The outfall from these basins is directed to Isaack Lake by the Rincon Road, Baylor Canyon Road, and the Jornada Channels. The Brahman Road Channel intercepts runoff from the Owl's Nest, Organ and San Augustin Arroyos and conveys it to the Brahman Road Detention Facility. The Arroyo Road Channel has been included as a major collector channel to collect area drainage and convey it to the Baylor Canyon Road Channel. Several local collector channels have been included to provide runoff conveyance to the larger channel facilities. A detailed description of these facilities follows.

1. Brahman Road Detention Facility

The Brahman Road Detention Facility is a 463 acre-foot detention pond and dam located approximately 650 feet east of Brahman Road near the intersection with Rincon Road. This facility receives drainage from the Brahman Road Collector Channel which serves a 4.81 square mile drainage area. The Brahman Road Detention Facility serves the San Augustin, Owl's Nest and the North Fork of the Organ Arroyo watersheds.

This detention facility is designed to store 379.0 acre-feet of stormwater and an additional 84.0 acre-feet of sediment from the 100-year storm. The primary spillway for this facility consists of one 30-inch diameter RC pipe with an inlet tower to prevent plugging due to sediment or debris. With this spillway and storage configuration, it is possible to achieve an approximate 97 percent reduction in the 100-year peak flow from 3938 cfs to 108 cfs. The 100-year storm will completely drain through the pond in 84 hours.

The emergency spillway design flow (SDF) is 6975 cfs; this represents the 1/2 PMF storm event from the COE envelope curves. Spillway optimization yielded a 200 foot wide stepped soil cement spillway and a maximum 29.7 foot tall embankment. A 20 foot top width is provided on the embankment along with 3:1 sideslopes in conformance with the recommendations of the geotechnical report (Appendix B). Figure VI-1B includes the conceptual layout for the Brahman Road Detention Facility.

2. Blair/Baylor Canyon Detention Facility

The Blair/Baylor Canyon Detention Facility is a 805 acre-foot detention pond and dam located south of U.S. Highway 70, immediately east of Brahman Road. The facility intercepts flow from the 8.21 square mile drainage area served by the Baylor Canyon, Blair Canyon and South Fork of the Organ Arroyos.

The detention facility is designed to store 695 acre-feet of stormwater and 107.0 acre-feet of sediment from the 100-year storm. The primary spillway for this facility consists of one 48-inch diameter RC pipe equipped with an inlet tower to prevent plugging from sediment or debris. With this spillway and storage configuration, it is possible to achieve an approximate 97 percent reduction in 100-year peak flows from 6715 cfs to 212 cfs. The runoff from 100-year storm will completely drain through this facility in 81 hours.

The emergency spillway design flow (SDF) is 10,098 cfs; this represents the 1/2 PMF storm event from the COE envelope curves. Spillway optimization yielded a 280 foot wide stepped soil-cement spillway and a maximum 23.7 foot tall embankment. The

maximum height occurs at the centerline of the existing Baylor Canyon Arroyo and the average embankment height is 22.0 feet. The embankment consists of a 20 foot top width with 3:1 side slopes in conformance with the recommendations of the geotechnical report (Appendix B). Figure VI-1C includes the layout for the Blair/Baylor Canyon Detention Facility.

3. Mine House Spring Detention Facility

The Mine House Spring Detention Facility is a 660.0 acre-foot detention pond and dam located approximately one-half mile south of U.S. Highway 70 in line with Moongate Road. This facility receives runoff solely from the 7.57 square mile drainage area from the Mine House Spring Arroyo.

The detention facility is designed to store 557.0 acre-feet of stormwater runoff and 103 acre-feet of sediment from a 100-year storm. The primary spillway for this facility consists of one 36-inch diameter RC pipe with an inlet tower to prevent plugging due to sediment or wind driven debris. With this spillway and storage configuration, it is possible to achieve an approximate 95 percent reduction in the 100-year peak flow rates from 2598 cfs to 137 cfs. The runoff from the 100-year rainfall event will completely pass through this facility in 36 hours.

The emergency spillway design flow (SDF) is 9841 cfs; this represents the 1/2 PMF storm event as calculated from the COE envelope curves. Optimization for the spillway yielded a 200 foot wide stepped soil-cement spillway with a maximum embankment height of 26.3 feet. The embankment features a 20 foot top width and 3:1 sideslopes in conformance with the recommendations of the geotechnical report in Appendix B. Figure VI-1C includes the conceptual layout for the Mine House Spring Detention Facility.

4. Brahman Road Channel

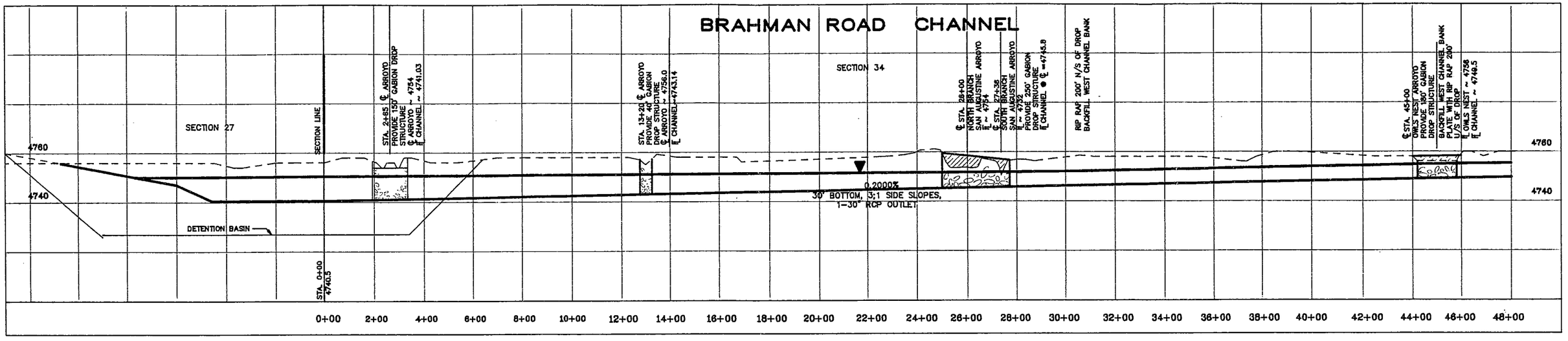
The Brahman Road Channel is a 7,100 foot long trapezoidal channel located approximately 1500 feet east of Brahman Road, as shown on Figure VI-1B. The channel extends from the Brahman Road Detention Facility southward to intercept runoff from the San Augustin, Owl's Nest and Organ Arroyos. This channel serves a contributing area of 4.81 square miles and conveys a maximum peak 100-year flow of 3938 cfs. The channel section consists of a 30 foot bottom width with 3:1 sideslopes and a bed slope of 0.20 percent. The channel varies in depth from 4 to 12 feet. The 100-year water surface profile for this channel is shown in Figure VI-2. The channel water surface profile shows the 100-year water depth ranging from 3 to 11 feet.

5. Rincon Road Channel

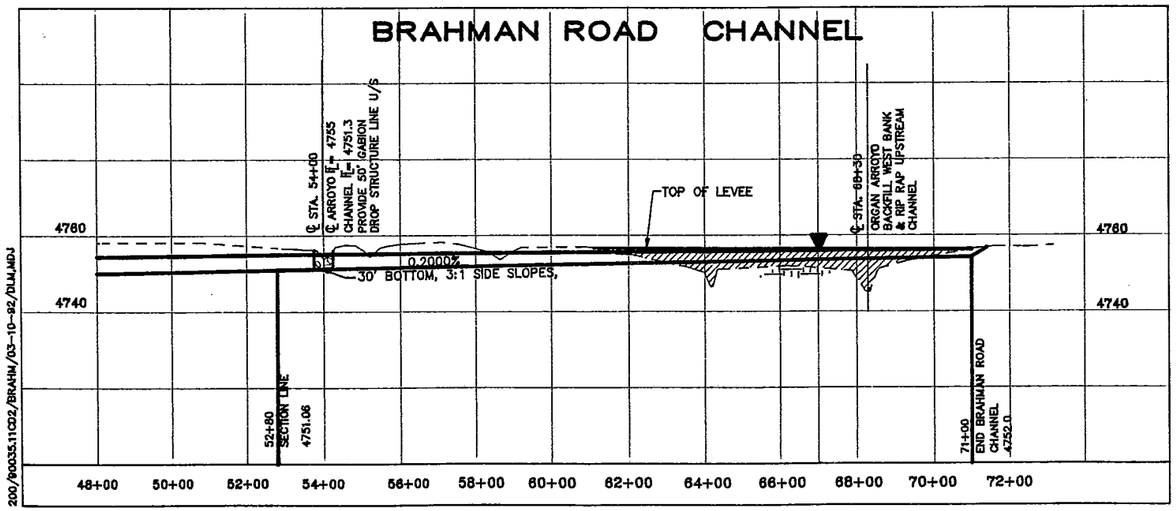
The Rincon Road Channel is a 28,506 foot long trapezoidal channel located immediately north of Rincon Road, as indicated in Figures VI-1A and B. The channel drains from east to west from the Brahman Road Detention Facility located 1500 feet east of Brahman Road to the system outfall in Isaack Lake. This channel is the primary conveyance channel for the Jornada watershed and intercepts flow from the 36.05 square mile drainage area served by the Brahman Road, Blair/Baylor Canyon, and Mine House Spring Detention Facilities as well as the various neighborhood collection channels.

Because the channel serves such a large area, the channel geometry varies from reach to reach. The channel reaches are as follows: Isaack Lake to the Jornada Road Channel, from Jornada Road Channel upstream to Moongate Road,and from Moongate Road upstream to the Brahman Road Detention Facility.

From the Jornada Road Channel to the outfall into Isaack Lake, the Rincon Road Channel serves a contributing area of 36.05 square miles. For the initial 3000 feet, the channel travels through a flat area with very little slope. The channel through this area is four feet deep with a 200 foot bottom width. The channel through the next reach consists of a 40 foot bottom width with a 0.52 percent bed slope. The channel varies in depth from 0' to 17'. The 100-year water surface profile for this channel is



SCALE H: 1"=400'
V: 1"=40'



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LEGEND

- CHANNEL INVERT
- NATURAL GRADE ● ℄
- 100 YEAR WATER SURFACE ELEVATION
- FILL
- GABION DROP STRUCTURE

JORNADA MASTER DRAINAGE PLAN
FIGURE VI-2

shown in Figure VI-3. The 100-year water surface profile along this channel averages approximately 10 feet in depth.

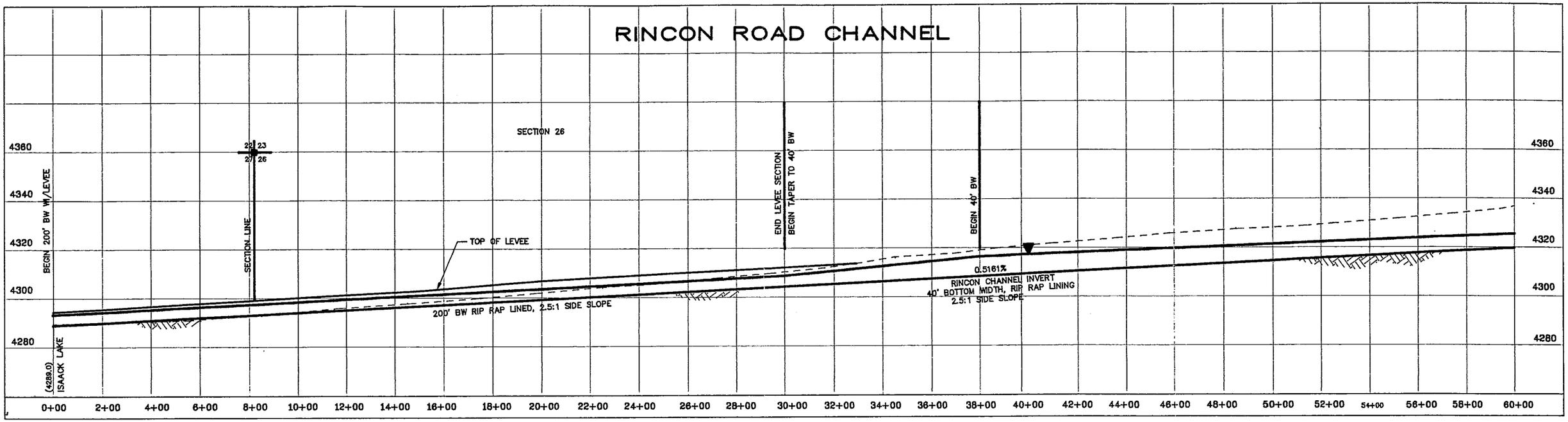
Upstream of the confluence with the Jornada Road Channel, the Rincon Road Channel serves a smaller contributing area of 9.21 square miles. This channel reach has a 10-foot bottom width, with an average channel slope of 1.07 percent. At this slope, the velocities remain above the limiting velocities for sediment transport; rock riprap is recommended along the channels wetted surface as indicated in Figure V-4. The channel varies in depth from 10.1' to 17'. The 10-year and 100-year water surface profiles for this channel are shown in Figure VI-3. The 100-year water surface profile along this channel ranges from 8 to 10 feet in depth.

Upstream of Moongate Road,the Rincon Road Channel serves a smaller contributing area of 6.24 square miles. This channel reach consists of a 6 foot bottom width channel, with an average bottom slope of 2.58 percent. At this slope, the velocities remain above the limiting velocities for sediment transport; rock riprap is recommended along the channels wetted surface as indicated in Figure V-4. The channel varies in depth from 12' to 15'. The 10- and 100-year water surface profiles for this channel are shown in Figure VI-3. The water surface profile along this channel indicates an average 100-year water surface of approximately 8 feet.

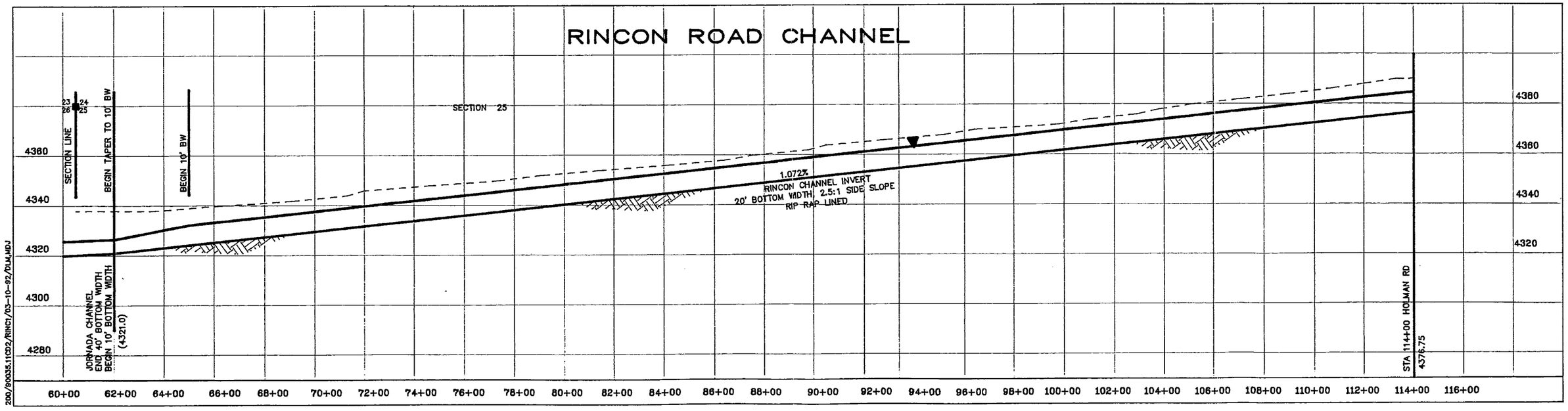
6. Jornada Road Channel

Initial analysis for the Jornada Road Channel defined a 12,000 foot long reach of the Baylor Canyon Road Channel as a detention channel to provide additional attenuation of the inflow into the system. The channel is located north of U.S. Highway 70, approximately one mile west of Hangar Lake Road. This channel segment connects the Baylor Canyon Road Channel with the Rincon Road Channel at Rincon Road. The channel used for detention consisted of a 100 foot bottom width channel, with a bottom slope of 0.10 percent to provide positive drainage northward to the outfall and to

RINCON ROAD CHANNEL



RINCON ROAD CHANNEL



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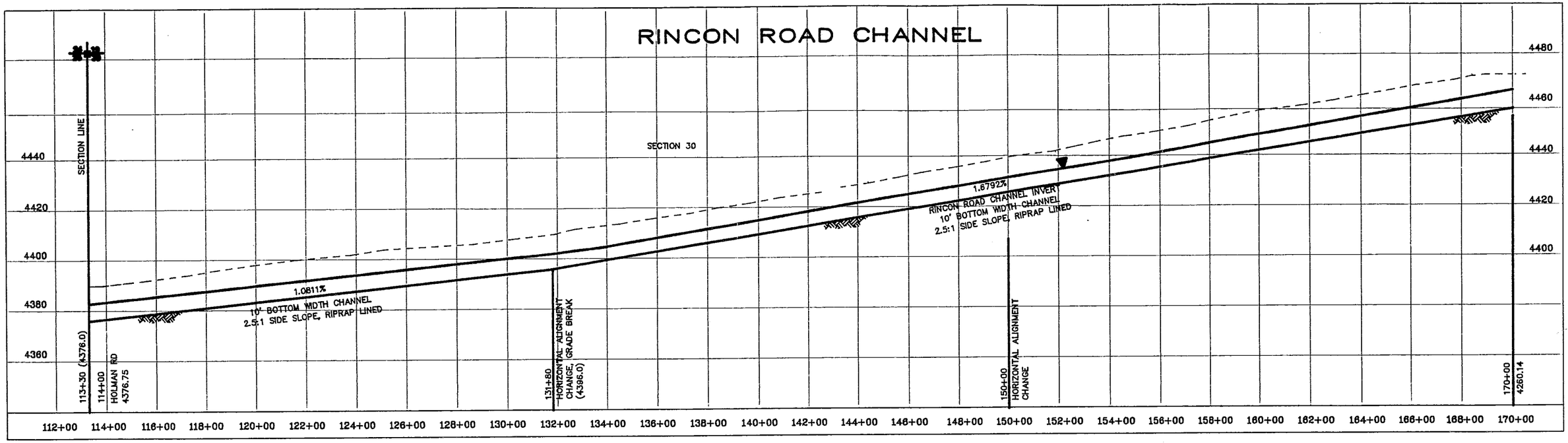
SCALE H: 1"=400'
V: 1"=40'

LEGEND

- CHANNEL INVERT
- TOP OF CHANNEL BANK
- 100 YEAR WATER SURFACE ELEVATION

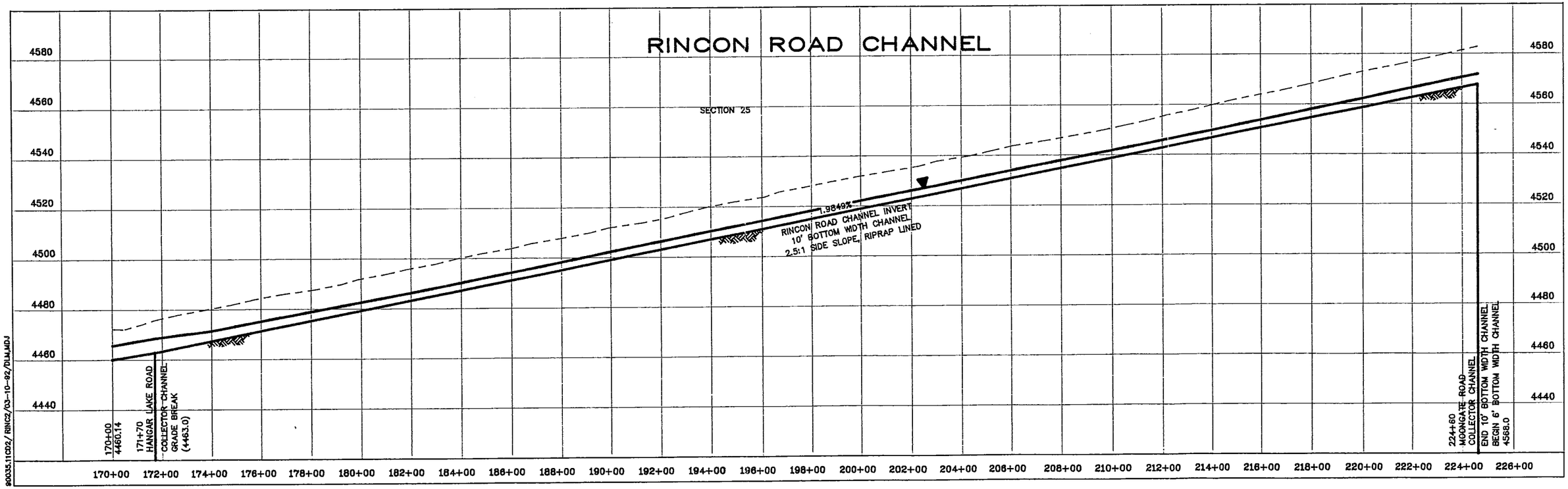
JORNADA MASTER DRAINAGE PLAN
FIGURE VI-3

RINCON ROAD CHANNEL



SCALE: H 1"=400'
V: 1"=40'

RINCON ROAD CHANNEL



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LEGEND

- CHANNEL INVERT
- TOP OF CHANNEL BANK
- 100 YEAR WATER SURFACE ELEVATION

JORNADA MASTER DRAINAGE PLAN
FIGURE VI-3A

RINCON ROAD CHANNEL

SECTION 28
SECTION 33

2.71%
RINCON ROAD CHANNEL INVERT
6' BOTTOM WIDTH CHANNEL
2.5:1 SIDE SLOPE, RIPRAP LINED

224+60 MOONGATE ROAD COLLECTOR CHANNEL 4568.0

BEGIN TAPER TO 6' BW STA. 225+00 BEGIN 8' BW

277+80 BRAHMAN ROAD 4707.5

4700 4680 4660 4640 4620 4600 4580 4560

222+00 224+00 226+00 228+00 230+00 232+00 234+00 236+00 238+00 240+00 242+00 244+00 246+00 248+00 250+00 252+00 254+00 256+00 258+00 260+00 262+00 264+00 266+00 268+00 270+00 272+00 274+00 276+00 278+00

RINCON ROAD CHANNEL

SECTION 27
SECTION 34

CREST = 4757.2

WSEL = 4749.1

2.71%
RINCON ROAD CHANNEL INVERT
6' BOTTOM WIDTH CHANNEL
2.5:1 SIDE SLOPE

277+80 BRAHMAN ROAD SECTION LINE 4699.07

285+00 ℄ DAM FL = 4727.0

294+50 BEGIN BRAHMAN ROAD CHANNEL 4743.5

4760 4740 4720 4700

276+00 278+00 280+00 282+00 284+00 286+00 288+00 290+00 292+00 294+00

90035.11\D02/RINC3/03-10-92/DLM,MDJ

SCALE: H: 1"=400'
V: 1"=40'

LEGEND

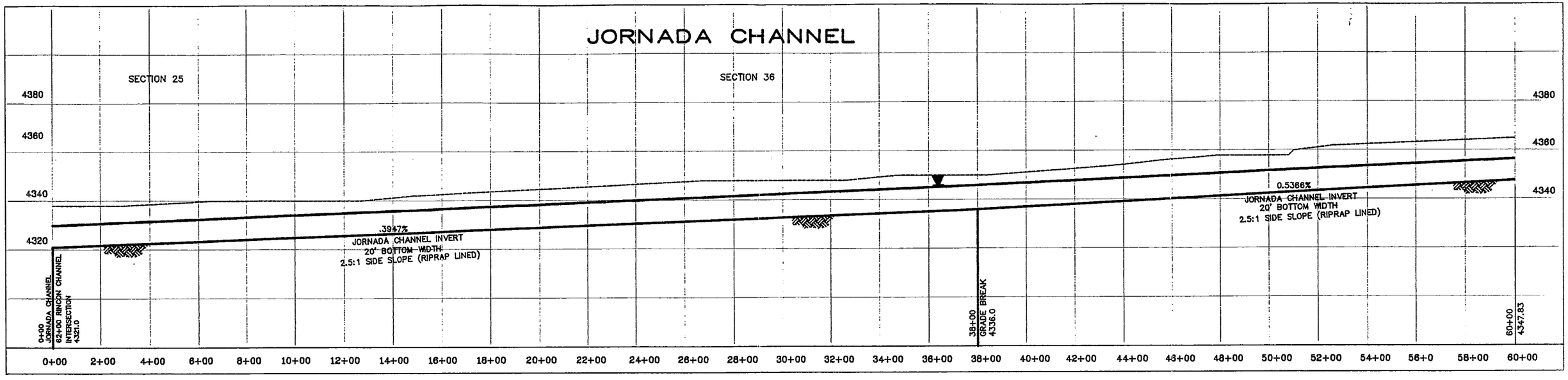
- CHANNEL INVERT
- TOP OF CHANNEL BANK
- 100 YEAR WATER SURFACE ELEVATION

maximize storage. Because of the natural grade through this reach, the channel varied in depth from approximately 15 to 60 feet. In order to minimize the right-of-way required for this facility, three - 5x5 reinforced concrete boxes were provided for the outfall. This facility provided a 61 percent reduction in the peak flow from the Jornada Detention Basin. However, because of the timing of this peak flow with respect to the peak in the Rincon Road Channel downstream, the Jornada Road Detention Channel did not provide significant reduction in the peak flow for this reach.

A second analysis was made using the Jornada Channel strictly as a conveyance channel. The channel used solely for conveyance consisted of a 20 foot bottom width channel which transitions to 10 foot south of El Centro Road, with a bottom slope of 0.54 percent to provide positive drainage northward to the outfall. This slope produced a channel depth ranging from 10 to 15 feet. Using this channel in lieu of in-line detention did not significantly affect the peak flow rate or the required channel geometry for the downstream portion of the Rincon Road Channel.

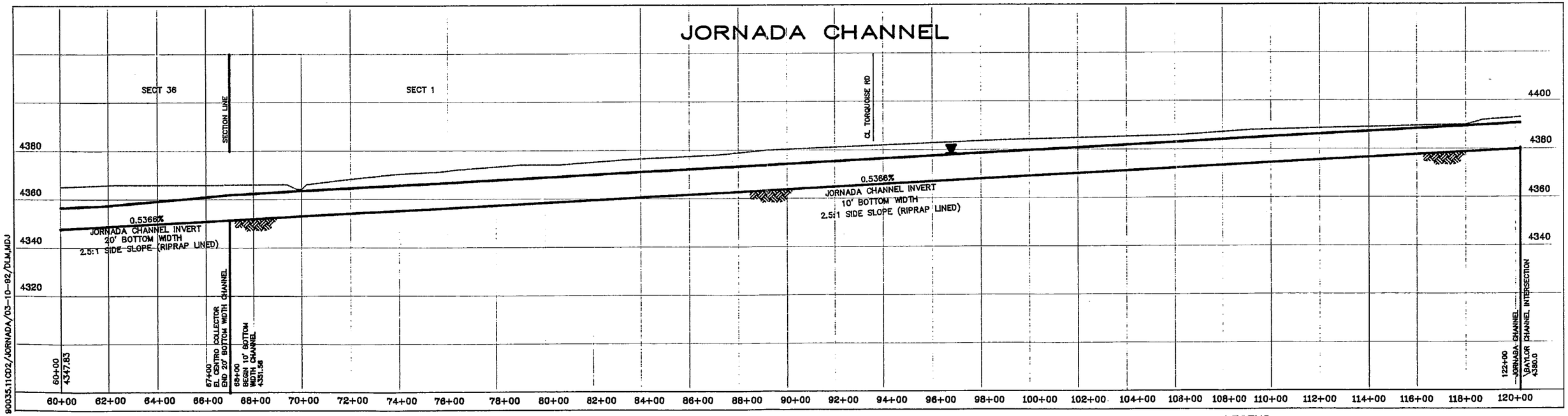
Table VI-1 contains a comparison of these two alternatives for this portion of the drainage system. Because of the costs incurred by the extra depth and right-of-way for this alternative and the negligible associated benefits, it was determined that the Jornada Channel would function most economically as a channel. Figure VI-1D includes a conceptual layout for the Jornada Road Channel. The 100-year water surface depth averages 10 feet; the profile for this channel is included in Figure VI-4.

JORNADA CHANNEL



SCALE: H: 1"=400'
V: 1"=40'

JORNADA CHANNEL



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LEGEND

- CHANNEL INVERT
- TOP OF CHANNEL BANK
- 100 YEAR WATER SURFACE ELEVATION

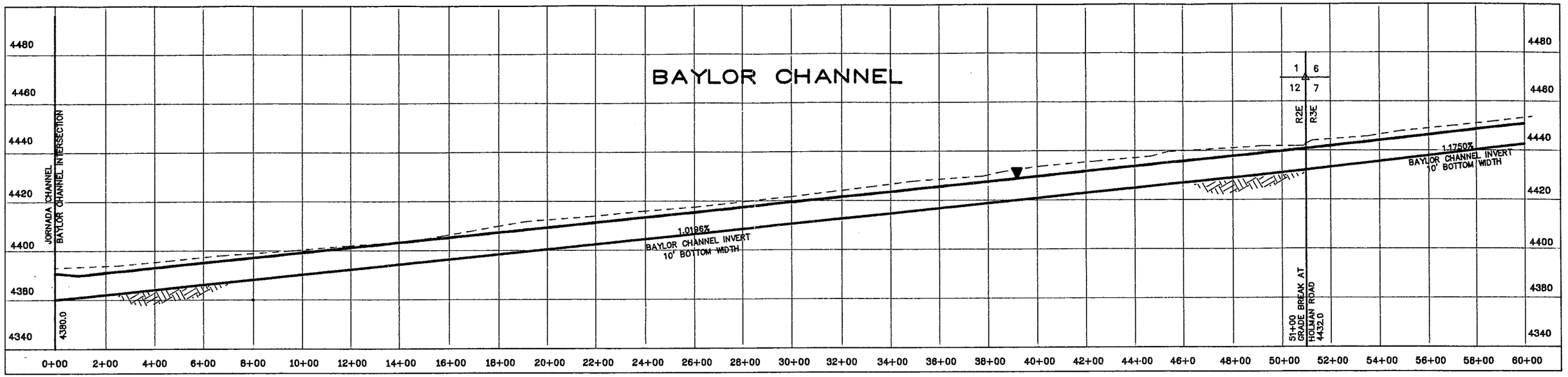
JORNADA MASTER DRAINAGE PLAN
FIGURE VI-4

TABLE VI-1 Comparison of Jornada Channel Alternatives		
Item	Channel	Detention Channel
1. Channel Geometry	10-20'BW, 3:1 SS, 2.0%	100'BW 3:1 SS, 0.1%
2. Excavation (CY)	385,732	3,811,447
3. ROW Requirements	38.65 acres	250' to 500'-- 109.84 acres
4. Peak Flow & Time a. Into Jornada b. From Jornada c. Upstream Rincon d. Combined Down stream	cfs/hrs 4386/7.17 4386/7.17 3007/6.92 7262/7.08	cfs/hrs 4342/7.25 1704/9.42 3007/6.92 3862/7.17
5. Normal depth Rincon and Jornada Combined	8.23'	9.11'

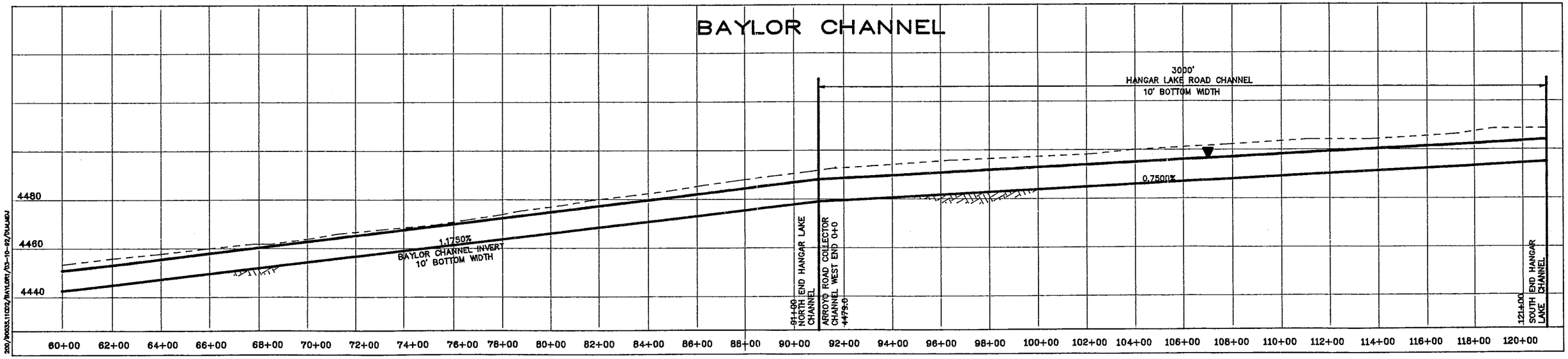
7. Baylor Canyon Road Channel.

The Baylor Canyon Road Channel is a 22,700 foot long trapezoidal channel located between the Jornada Channel one-mile west of Hangar Lake Road, and the confluence with the Blair/Baylor Canyon Detention Facility near Brahman Road and south of U.S. Highway 70, as indicated in Figure VI-1C. The channel drains from east to west from Brahman Road to the Jornada Channel and serves primarily as a conveyance system, draining the southern 26.06 square mile portion of the watershed which includes: the Blair/Baylor Canyon Detention Facility, the Mine House Spring Detention Facility, the Arroyo Road Channel and the various local collection channels.

This channel reach consists of a 6 foot bottom width, with an average channel slope of 1.75 percent. At this slope, the velocities remain above the limiting velocities for sediment transport; rock riprap is recommended along the channels wetted surface as indicated in Figure V-4. The channel varies in depth from 4 to 10 feet. The 100-year water surface profile for this channel is shown in Figure VI-5. The 100-year water surface profile along this channel is approximately 8 feet deep downstream of Hangar Lake Road and 4 feet deep in the upper reaches of this channel.



SCALE: H: 1"=400'
V: 1"=40'



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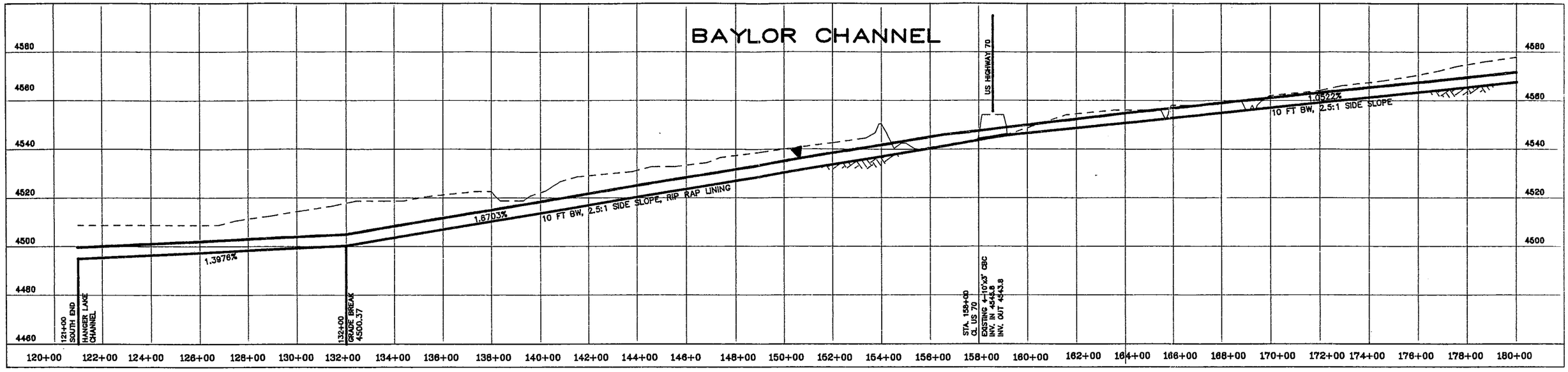
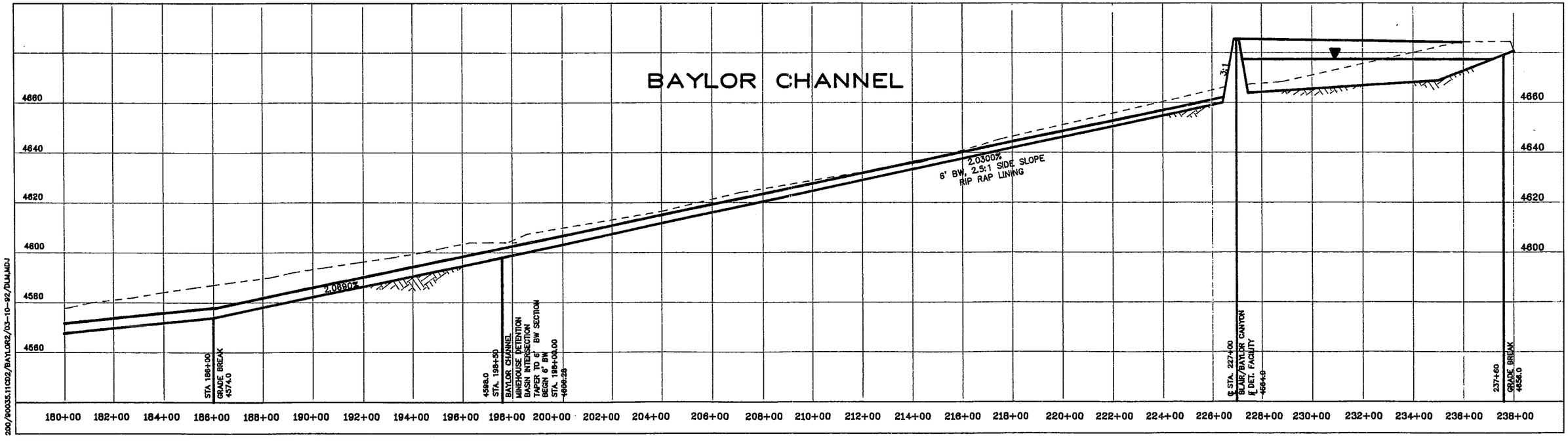
LEGEND

- CHANNEL INVERT
- TOP OF CHANNEL BANK
- 100 YEAR WATER SURFACE ELEVATION

JORNADA MASTER DRAINAGE PLAN
FIGURE VI-5





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LEGEND

- CHANNEL INVERT
- TOP OF CHANNEL BANK
- 100 YEAR WATER SURFACE ELEVATION

SCALE H: 1"=400'
V: 1"=40'

JORNADA MASTER DRAINAGE PLAN
FIGURE VI-5A

8. Arroyo Road Channel.

The Arroyo Road Channel is a 11,880 foot long trapezoidal channel located immediately north of Arroyo Road, as indicated in Figure VI-1C. The channel serves as a collector channel and drains from west to east from Brahman Road to the Baylor Channel. This channel intercepts flow from the 3.65 square mile drainage area served by the various neighborhood collection channels.

This channel reach consists of a 10 foot bottom width, with an average bed slope of 1.79 percent. At this slope, the velocities remain above the limiting velocities for sediment transport; rock riprap is recommended along the channels wetted surface as indicated in Figure V-4. The channel varies in depth from 10 to 13 feet. The 100-year water surface profile for this channel is approximately 4.5 feet deep and is shown in Figure VI-6.

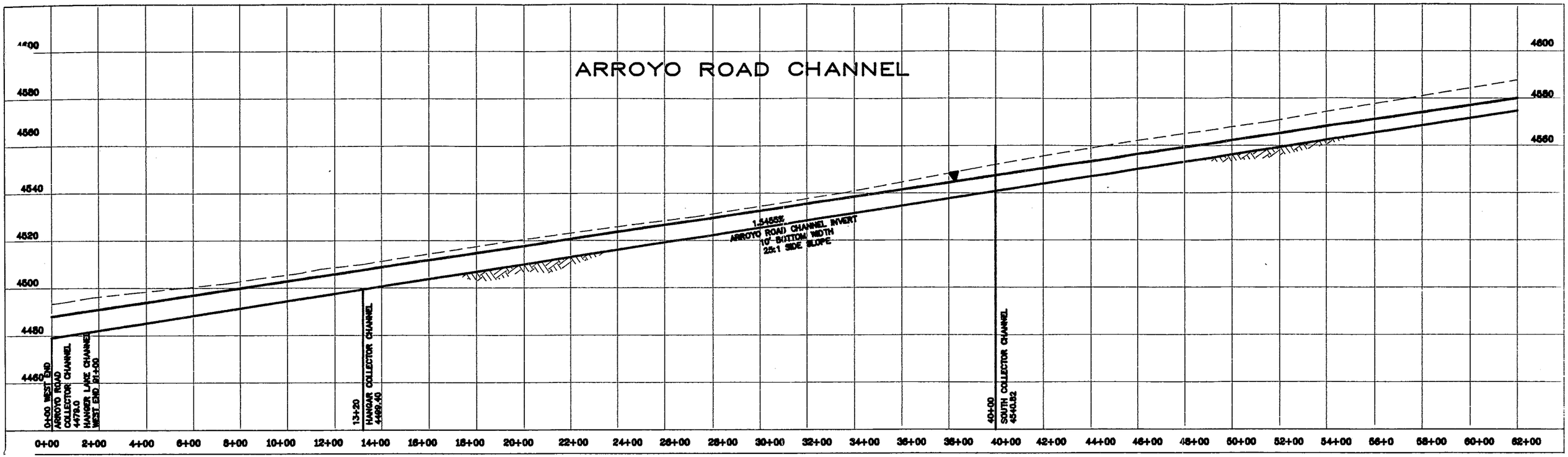
9. Isaack Lake Collector System

As the western areas within the East Mesa develop, the Isaack lake Collector System should be implemented in order to provide a well-defined drainage system to convey local runoff to the Lake. As indicated in Figure VI-1D, the Isaack Lake system consists of approximately six and one-half miles of channel, all with a 10 foot bottom width and 3:1 side slopes. As this is a flatter area within the watershed, the channel bottom slopes will be at a minimum of 0.20 percent. Channel depth varies from 0 to 10 feet. Channel velocities are well below the limiting velocities so earthen channels will function well in this area.

10. Neighborhood Collector Channels.

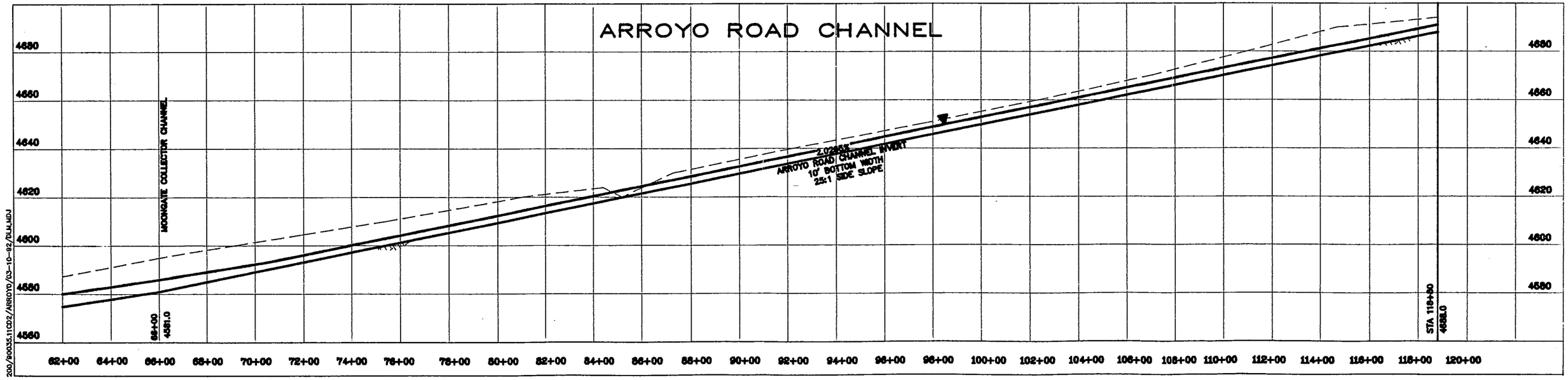
As the areas within the East Mesa develop, there will be a need for an organized system of local collector channels to convey local runoff to the conveyance channel system. For this reason, several smaller channels have been proposed to be constructed along the existing roadways at an approximate one mile interval. These channels are also indicated on Figure VI-1. These channels generally consist of 6 and

ARROYO ROAD CHANNEL



SCALE H: 1"=400'
V: 1"=40'

ARROYO ROAD CHANNEL



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LEGEND

- CHANNEL INVERT
- TOP OF CHANNEL BANK
- 100 YEAR WATER SURFACE ELEVATION

JORNADA MASTER DRAINAGE PLAN
FIGURE VI-6

10 foot bottom width channels, with a bottom slope of 0.25 percent. At this slope, the channel velocities are within the limiting velocities for sediment transport; therefore rock rip-rap is not necessary, and an earth-lined channel is adequate. These channels vary in depth from 3 to 8 feet. The average 100-year water surface depth in these channels is 3 feet. Table VI-2 summarizes the physical properties of these channels.

TABLE VI-2
Summary of Channel Characteristics

Channel	Length (ft)	Bottom Width (ft)	Slope (%)	Depth (ft)
Brahman Channel	7,100	30	0.20	4.0 to 14.8
Rincon Road Channel	3,000 3,200 16,300 6,000	200 40 10 6	0.52 0.52 1.75 2.71	4.0 to 9.9 9.9 to 17.0 17.0 to 15.0 15.0 to 3.0
Jornada Channel	6,700 5,300	20 10	0.54 to 0.39 0.54	14 to 18 11 to 16
Baylor Canyon Road Channel	19,850 2,850	10 6	2.07,1.18,0.75 2.03	15 to 4 4 to 8
Arroyo Road Channel	11,880	10	2.03 & 1.55	4 to 14
Isaack Lake System Channels	34,100	10	0.61 to 0.2	1.0 to 7.0
System Collector Channels	37,150	6	0.20 to 1.37	0 to 17

11. Confluence Protection

All junctions between channels should receive slope protection for the wetted portions of channel bottoms and sideslopes. This slope protection can be rock riprap soil cement and/or concrete as determined by final design and should extend a minimum distance equal to the channel top width up and downstream of the confluence. Gabion drop structures would be recommended for differences in the channel flowlines of more than a foot. In these situations, a gabion drop structure as described above and indicated in Figure V-3 is recommended to outfall these collector channels to the main conveyance channels.

B. FLOOD CONTROL BENEFITS

The feasibility of most construction projects depends on the identification and in many cases, quantification of the project's benefits: both tangible and intangible. As the Jornada Master Drainage Plan is intended to provide area flood control improvements, a quantification of flood control benefits is appropriate. The following sections quantify the flood control benefits from the results of hydrologic and hydraulic analyses of the proposed improvements. A discussion of the projects' possible impacts on Isaack Lake is also included.

1. Hydrology.

Review of the results from the hydrologic analyses of the proposed system provides the most direct and comprehensive indication of the available benefits. The U.S. Army Corps of Engineers HEC-1 Computer model was used as described in the preceding sections to model the proposed flood control system for the Jornada watershed for the 10- and 100-year frequency rainfall events for a developed watershed condition. These models are included in Appendix D.

Figure VI-7 indicates the 100 year peak flows, and contributing areas for future conditions at various key locations throughout the watershed. Table VI-3 contains runoff peak flows for the 10-year and 100-year frequency event for the three and five dam alternatives.

CLARK AND BROWN CANYON ARROYO

BRAHMAN ROAD DETENTION BASIN

HAWKEYE CANYON ARROYO

SAN AUGUSTIN ARROYO

OWL'S NEST ARROYO

ORGAN NORTH

ORGAN SOUTH

BLAIR CANYON ARROYO

BLAIR/BAYLOR CANYON DETENTION BASIN

BAYLOR CANYON ARROYO

MINE HOUSE ARROYO DETENTION BASIN

MINE HOUSE SPRING ARROYO

ISAACK LAKE

RINGON ROAD

EL CENTRO ROAD

MOUNTAIN VIEW ROAD

BRAHMAN ROAD

NASA ROAD

MOONGATE ROAD

HOLMAN ROAD

HANGAR LAKE

BUTTERFIELD PARK

ARROYO ROAD

BAYLOR CANYON ROAD

1	2078 / 1064
2	5600 / 3014
3	106 / 85
4	2949 / 1498
5	2080 / 1055
6	1240 / 685
7	3938 / 1959
8	106 / 85
9	106 / 85
10	875 / 516
11	947 / 577
12	1213 / 656
13	617 / 341
14	2141 / 1196
15	2721 / 1532
16	6116 / 3111
17	211 / 162
18	370 / 236
19	2598 / 1237
20	138 / 106
21	434 / 291
22	688 / 434
23	860 / 524
24	453 / 268
25	1197 / 715
26	591 / 329
27	582 / 327
28	314 / 164
29	1434 / 804
30	396 / 221
31	2223 / 1015
32	3403 / 1034
33	3392 / 1928
34	425 / 211
35	305 / 161
36	4702 / 2564
37	4982 / 2698
37A	7572 / 4199
38	7727 / 4283
39	1295 / 717
40	5498 / 8325
34A	402 / 2284
35A	3953 / 2195
36A	538 / 263
358	4192 / 2304

LEGEND

22 — BASIN NUMBER

NODE NUMBER
Q 100 YEAR
Q 10 YEAR

PROPOSED CHANNELS
PROPOSED DETENTION FACILITY

JORNADA WATERSHED MASTER PLAN

PROPOSED HYDROLOGIC CONDITIONS - 10 AND 100 YEAR RETURN FREQUENCY

DRAWN BY: G.C.
DATE: MAR. 9, 1992
SCALE: 1" = 2,000'

LEEDSHILL-HERKENHOFF, INC.
ENGINEERS ARCHITECTS
ALBUQUERQUE SANTA FE SAN DIEGO

FIGURE NO. VI-7

BRUNING 44-242-71050

TABLE VI-3 PROPOSED HYDROLOGIC CONDITIONS					
NODE	LOCATION	5 DAM ALTERNATIVE		3 DAM ALTERNATIVE	
		10 Yr. Peak (cfs)	100 Yr. Peak (cfs)	10 Yr. Peak (cfs)	100 Yr. Peak (cfs)
1	Clark & Brown Arroyo at Isaack Lake	1064	2078	1064	2078
2	Hawkeye Arroyo at Isaack Lake	3014	5600	3014	5600
3	San Augustin Arroyo at NASA Road	506	1047	1972	3947
4	Owl's Nest Arroyo at NASA Road	456	918	1498	2949
5	Organ Arroyo North at NASA Road	1055	2080	1055	2080
6	Organ Arroyo South at NASA Road	685	1240	685	1240
7	Brahman Road Detention Basin Total Inflow	---	---	1959	3938
8	Rincon Road Channel Downstream Brahman Road Detention Basin	100	120	85	106
9	Rincon Road Channel Upstream of Moongate Road Collector Channel	100	120	85	106
10	Moongate Road Collector Channel	516	875	516	875
11	Rincon Road Channel Upstream of Hangar Lake Road Channel	589	955	577	947
12	Hangar Lake Road Channel	656	1213	656	1213
13	Holman Road Channel	341	617	341	617
14	Rincon Road Channel Upstream of Holman Road Channel	1211	2150	1196	2141
15	Rincon Road Channel Upstream of Jornada Channel	1544	2730	1532	2721

TABLE VI-3 (Cont'd.)
PROPOSED HYDROLOGIC CONDITIONS

NODE	LOCATION	5 DAM ALTERNATIVE		3 DAM ALTERNATIVE	
		10 Yr. Peak (cfs)	100 Yr. Peak (cfs)	10 Yr. Peak (cfs)	100 Yr. Peak (cfs)
16	Blair and Baylor Arroyos Detention Basin Inflow	3111	6116	3111	6116
17	Baylor Channel Downstream Blair and Baylor Arroyos Detention Basin	141	211	162	211
18	Baylor Channel Upstream Minehouse Arroyo Detention Basin	246	377	236	377
19	Minehouse Arroyo Detention Basin Inflow	1237	2598	1237	2598
20	Minehouse Arroyo Detention Ba[illegible] Outflow	106	138	106	138
21	Baylor Channel Downstream Minehouse Arroyo Detention Basin	298	434	291	434
22	Baylor Channel Upstream US 70	439	688	434	688
23	Baylor Channel Upstream Hangar Lake Channel South	530	860	524	860
24	Hangar Lake Road Collector Channel South	268	453	268	453
25	Hangar Lake Road Collector Channel Up-stream Jornada Channel	725	1197	715	1197
26	Arroyo Road Channel Upstream Brahman Road	329	591	329	591
27	Arroyo Road Channel Up-stream Moongate Road Channel South	638	582	327	582
28	Moongate Road Channel South	164	314	164	314
29	Arroyo Road Channel Upstream South Collector	800	1434	804	1434

TABLE VI-3 (Cont'd.)
PROPOSED HYDROLOGIC CONDITIONS

NODE	LOCATION	5 DAM ALTERNATIVE		3 DAM ALTERNATIVE	
		10 Yr. Peak (cfs)	100 Yr. Peak (cfs)	10 Yr. Peak (cfs)	100 Yr. Peak (cfs)
30	South Collector	222	396	221	396
31	Arroyo Road Channel Upstream Hangar Lake Road Channel	1012	2224	1015	2223
32	Jornada Road Channel Downstream Hangar Lake Road Channel South	1931	3402	1934	3403
33	Jornada Road Channel Upstream Holman Road	1929	3391	1928	3392
34	Holman Road Collector Channel South	211	425	211	425
35	Basin 56 Collector Channel	161	305	161	305
36	Jornada Road Channel Downstream El Centro Channel	2563	4722	2564	4702
37	Jornada Road Channel at Rincon Road Channel	2699	4972	2698	4982
38	Rincon Road Channel Upstream of Isaack Lake	4299	7735	4283	7727
39	Isaack Lake Channels Inflow to Isaack Lake	736	1295	717	1295
40	Total Inflow to Isaack Lake	8352	15515	8328	15498
34A	Jornada Road Channel D/S Holman Collector	2194	3945	2195	3953
35A	Jornada Road Channel U/S Basin 56 Collector	2192	3938	2193	3947
35B	Jornada Road Channel D/S Basin 56 Collector	2304	4184	2304	4192
36A	El Centro Channel	263	538	263	538
37A	Rincon Road Channel D/S Jornada Road	4209	7599	4199	7572

Table VI-4 contains a comparison of peak flow results for the 100-year rainfall event for the existing and proposed watershed conditions at various points throughout the watershed.

TABLE VI-4
Comparison of 100-Year Results for Existing and Proposed Conditions

Location	Existing (cfs)	Proposed (cfs)
Clark & Brown Arroyo at Isaack Lake	1721	2078
Hawkeye Arroyo at Isaack Lake	5596	5600
Clark & Brown & Hawkeye Arroyos at Isaack Lake	7070	7262
San Augustin at Brahman Road	1070	287
Owl's Nest at Brahman Road	916	258
Organ Arroyo at Brahman Road	1510	143
San Augustin at Hangar Lake Road	1569	416
Owl's Nest at Hangar Lake Road	1511	482
Organ at Hangar lake Road	1878	339
Blair Canyon at U.S. 70	1524	211
Baylor Canyon at U.S. 70	1525	688
Mine House Springs at U.S. 70	1924	445
Mine House Springs at Jornada Road	3660	553
Blair Canyon at Jornada Road	2383	271
Owl's Nest & Organ at Jornada Road	3788	355
Total Peak to Isaack Lake	11160	15,498
Total Volume to Isaack Lake	4765 Ac/ft	5798 Ac/ft

As indicated by this table, there is a tangible decrease in flows along the existing arroyos in the developed areas of the watershed. This is due to the detention and diversion of this flow to the proposed channel system. The increases indicated in the

Clark & Brown and Hawkeye Arroyo peak runoff amounts are due to the effects of proposed development within those subbasins.

The 100-year peak flow entering Isaack lake through the Rincon Road Collection System for developed conditions is 7,727 cfs. This compares to an existing condition peak from the arroyos collected by this system of 5,977 cfs. The total 100-year developed conditions peak flow reaching Isaack lake from the entire study area is 15,498 cfs which is an increase over the existing conditions flow of 11,160 cfs. The total 100-year runoff volumes for proposed and existing are 5,798 and 4,765 acre-feet respectively, with a 22 percent increase.

The increases in peak flow rate and volume can be attributed to two things: development and channelization. As increase in development usually results in an increase in impervious area. Such an increase causes less area for runoff absorption resulting in an increase in runoff peak flow and volume. Channelization generally affects the peak flow rates in that the hydraulic travel times are decreased. Located upstream of the developed areas, the detention facilities only partially compensate for the increases due to development.

2. Hydraulics

Because of the lack of channel definition in the lower reaches of the watershed, the U.S. Army Corps of Engineer's HEC-2 backwater model was utilized to analyze only the upper portions of the San Augustin, Owl's Nest, Organ and Blair Canyon and Baylor Canyon Arroyos for existing conditions. Conveyance in the downstream channel sections was provided by overland sheetflow.

The HEC-2 model was used to generate backwater models for the proposed collector channels for the runoff from the 10- and 100-year frequency rainfall events. The output for these models is included in Appendix E. The resulting water surface profiles are indicated on Figures VI-2 through VI-6, on the appropriate channel profile. Water

surface profiles are provided to allow future hydraulic gradient calculations for storm sewer improvements and to calculate required channel freeboard.

A second hydraulic analysis was made for the area culverts to ascertain effects from implementation of the drainage improvements. Table VI-5 contains the results of this analysis. While there is a sizable decrease in flow at many of the culvert locations, many remain significantly under capacity. Additional culverts are recommended at these locations.

3. Impacts on Isaack Lake.

Isaack Lake is a low lying depression located between the Organ Mountain system and the Rio Grande River. As indicated on Figure VI-8, during average water levels in the lake, the wetted area covers approximately 138.88 acres or 0.22 square miles (based on U.S.G.S. quadrangle mapping). The lake does not have an outfall and collects runoff from an 180.03 square mile area. The Jornada basin consists of 55.96 square miles or 31 percent of the total area contributing runoff to the lake.

TABLE VI-5
Culvert Drainage Capacity Under Proposed Conditions

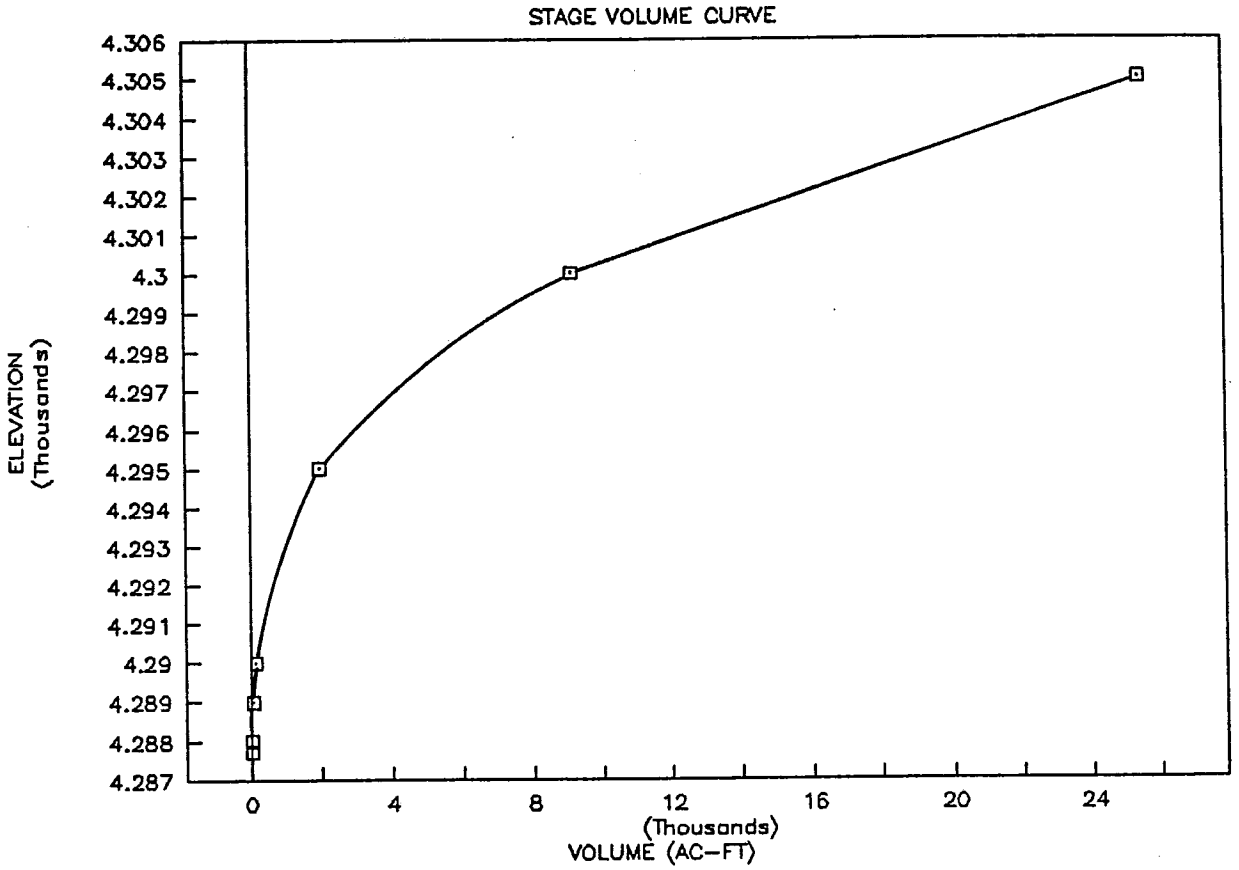
Structure No.	Description	10-Year Storm (cfs)	100-Year Storm (cfs)	Maximum Culvert Capacity (cfs)
1	1 - 24" CMP	10	20	23
2	1 - 24" CMP	10	20	23
3	1 - 24" CMP	10	20	23
4	1 - 72" CMP	50.2	99.6	255
5	1 - 72" CMP	50.2	99.6	252
6	1 - 60" CMP	50.2	99.6	170
7	1 - 60"X 78" CMP	50.2	99.6	123
8	1 - 60"X 48" CMP	50.2	99.6	123
9	3 - 72"X 48" CMP	184.5	402.5	435
10	3 - 72"X 48" CMP	184.5	402.5	435
11	2 - 72" CMP	318.5	663.0	506
12	2 - 72" CMP	318.5	663.0	506
13	3 - 60" CMP	Not in Study	Not in Study	510
14	3 - 60" CMP	Not in Study	Not in Study	510
15	1 - 36" CMP	175	314	62*
16	1 - 30" CMP	203	376	37*
17	1 - 36" CMP	77	186	55*
18	1 - 36" CMP	54	97	55
19	1 - 30" CMP	54	97	37*
20	1 - 36" CMP	342	786	55*
21	1 - 24" CMP	337	739	23*
22	1 - 24" CMP	337	739	23*
23	1 - 24" CMP	Not in Study	Not in Study	23
24	3 - 32" METAL PIPE	Not in Study	Not in Study	129
25	3 - 32" METAL PIPE	Not in Study	Not in Study	129
26	2 - 32" METAL PIPE	34	70	85

* Indicates culvert capacity not adequate for 10-year design flow.

TABLE VI-5 (Cont'd.)
Culvert Drainage Capacity Under Proposed Conditions

Structure No.	Description	10-Year Storm (cfs)	100-Year Storm (cfs)	Maximum Culvert Capacity (cfs)
27	2 - 32" METAL PIPE	32	58	85
28	3 - 32" METAL PIPE	34	79	127.5
29	3 - 32" METAL PIPE	34	79	127.5
30	6 - 32" METAL PIPE	10	20	255
31	2 - 30" RCP	10	20	100
32	6 - 8'X 3' CBC	264	445	1572
33	4 - 10'X 3' CBC	434	608	1308
34	7 - 8'X 5' CBC	184	330	3479
35	16 - 30" RCP	116	238	800
36	3 - 30" RCP	21	43	150
37	1 - 6'X 6' CBC	53	108	304
38	1 - 30" RCP	8	16	30
39	2 - 30" RCP	16	33	50
40	7 - 30" RCP	50	103	287
41	1 - 30" RCP	6	13	50
42	1 - 30" RCP	6	13	50
43	1 - 30" RCP	6	13	41
44	1 6'X 6' CBC	46	93	304
45	4 - 76"X 57" CBC	302	600	644
46	1 - 30" RCP	16	31	30
47	1 - 24" RCP	10	20	33
48	1 - 24" RCP	10	20	33
49	1 - 120" CMP	55	119	725
50	1 - 24" RCP	2	5	28
51	1 - 42" RCP	7	15	87
52	1 - 30" RCP	3	7	31
53	1 - 30" RCP	3	7	31

IMPACTS ON ISAACK LAKE



IMPACTS ON ISAACK LAKE

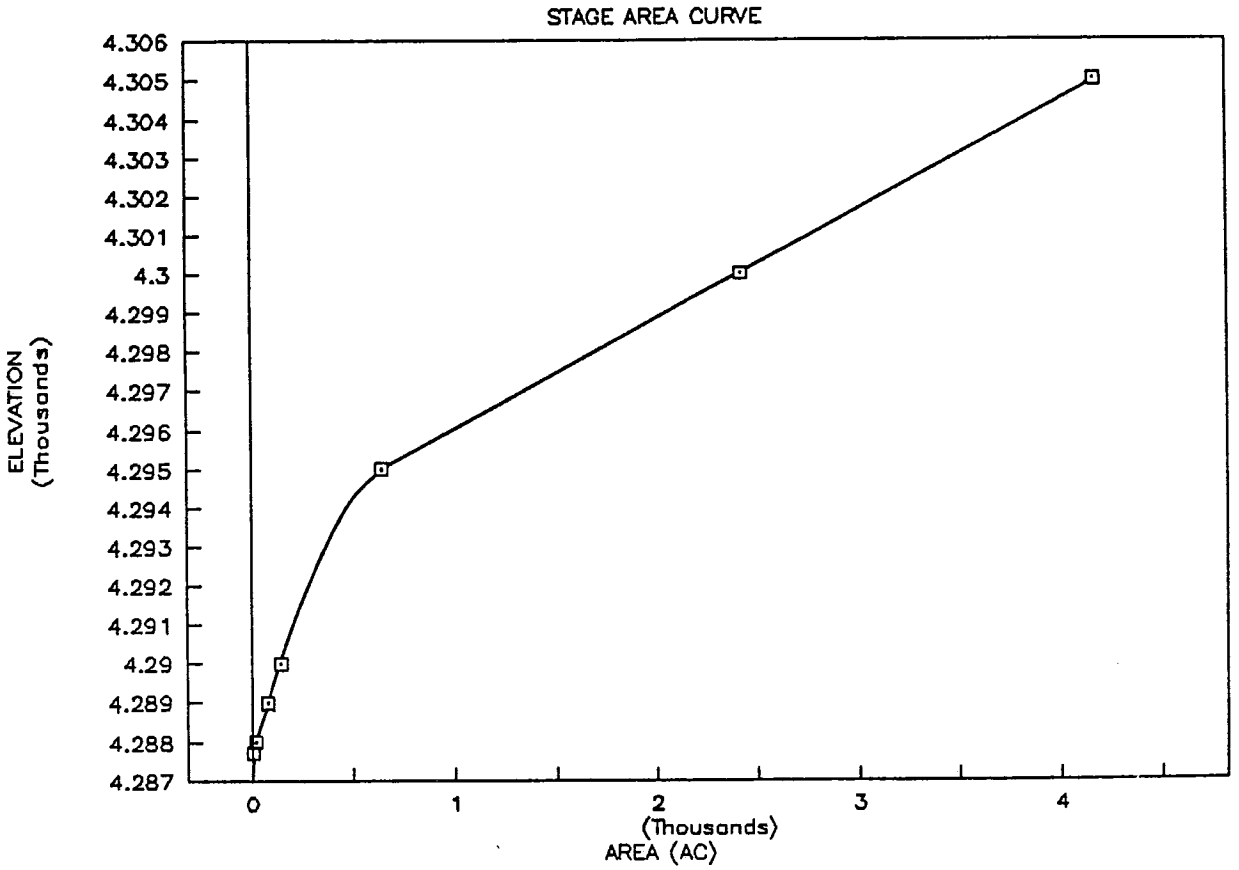


FIGURE VI-9

Two separate analyses were made regarding the potential impacts to Isaack Lake. The first simply provides a comparison of 100-year hydrologic and hydraulic results from the Jornada watershed. Table VI-6 contains this comparison.

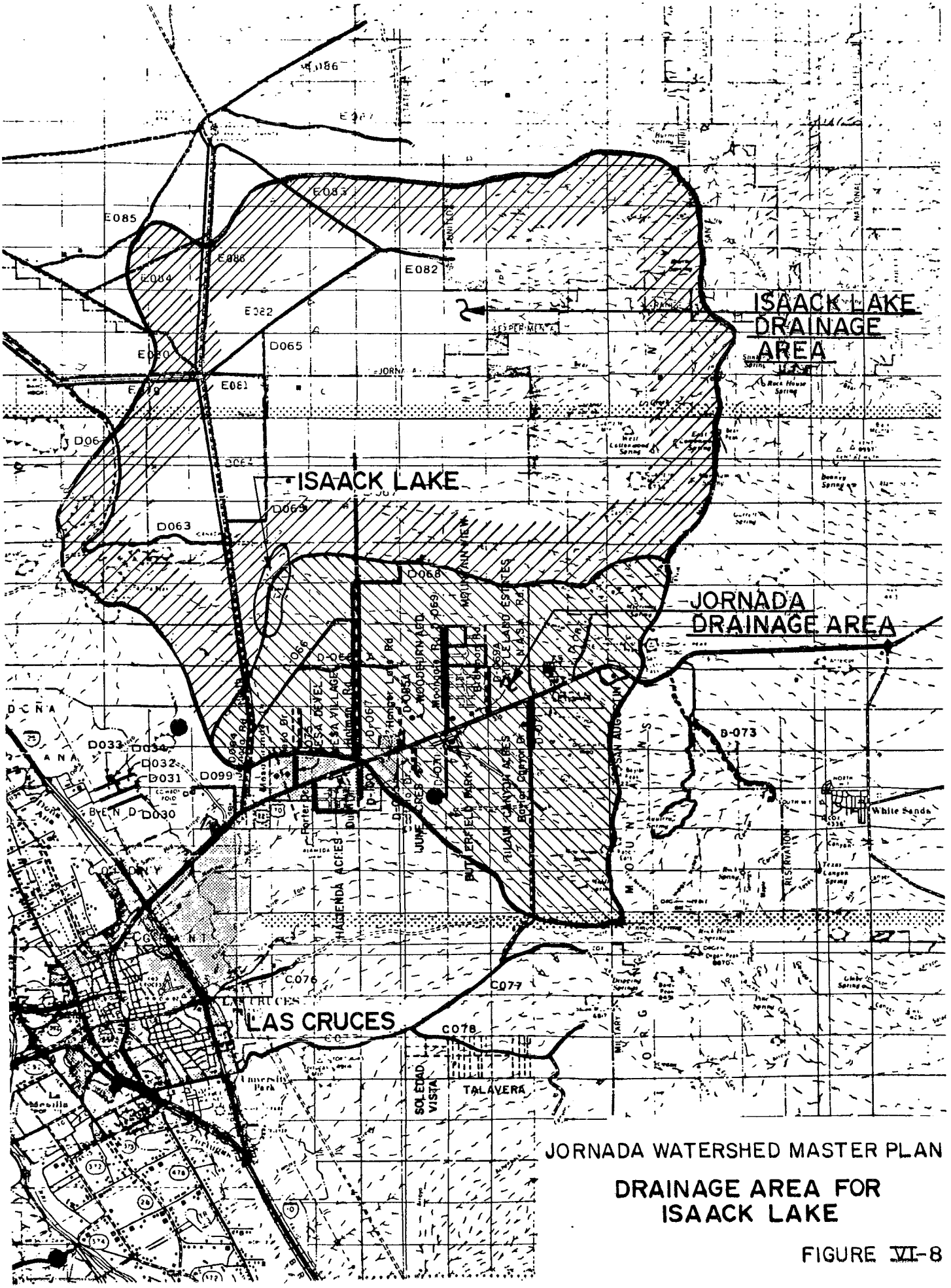
TABLE VI-6
Impacts on Isaack Lake from Jornada Watershed

	Existing	Proposed
Peak Flow	11160 cfs	15,498 cfs
Timing	7.25 hours	7.08 hours
Peak Volume	4729 Ac-ft	5798 Ac-ft
Estimated Lake Level	4298.0 ft	4298.1 ft
Estimated Wetted Acreage	1680 acres	1700 acres

This information indicates an increase over existing conditions and is due to the development assumed to occur in the Jornada watershed.

Because the Jornada watershed is a small portion of the entire area draining to Isaack Lake, a second analysis was made to determine the impacts to the lake with respect to the entire drainage area.

The U.S. Army Corps of Engineers HEC-1 computer model was used with a 100-year 24-hour storm for this analysis. The drainage areas, travel times and other hydrologic basin parameters were estimated for the remainder of the Isaack Lake drainage area using the U.S.G.S. 7.5 minute quadrangle mapping of the area and field reconnaissance. Figure VI-9 indicates the elevation-volume-area curves utilized for stationing pond elevations for Isaack lake. In order to separate the effects of local development from the effects of the project, additional HEC-1 analyses were completed



JORNADA WATERSHED MASTER PLAN

DRAINAGE AREA FOR ISAACK LAKE

FIGURE VI-8

for existing watershed conditions with the proposed project in place, and developed watershed conditions without the project. The HEC-1 runs used for these analyses are included in Appendix D. The results of these analyses are summarized in Table VI-7.

TABLE VI-7
Impacts on Isaack Lake

	Existing	Existing Conditions With Project	Developed Conditions With Project	Developed Conditions Without Project
Peak Flow (cfs)	14,660	15,491	16,854	16,485
Time (hrs)	15.75	15.75	7.17	7.25
Peak Volume (Ac-ft)	14,373	14,159	15,125	15,575
Lake Level (ft)	4301.60	4301.53	4301.80	4301.97
Wetted Acreage (Ac)	2980	2950	3010	3100

As indicated by the information in this table, there are minimal impacts to Isaack Lake resulting from the implementation of this project.

C. EMBANKMENT CONSTRUCTION

Earthen embankments have been evaluated in this report because of their low cost. To function properly they must be reasonably impermeable, preventing the ponded water from seeping through the toe of the dam. The suitability of using site soils for constructing an embankment dam was evaluated by Precision Engineering of Las Cruces (see the geotechnical report, Appendix B).

Soil borings were performed at each of the three proposed detention dam locations to evaluate soil types, gradations and subsurface stratigraphy. The results of the borings show sands predominating in all locations with varying densities and gradations. A few clay lenses and some gravely sands were also encountered. Borings were taken to 25 foot depths and neither rock nor groundwater was encountered.

Preliminary recommendations from the geotechnical report include utilizing site soils for the interior of the embankment and covering the sideslopes with a layer of low permeability fill. This low permeability material would have to be imported since no site soils satisfy the gradation requirements identified by Precision Engineering. Approximately 75% of the total embankment volume could come from site soils, with the remaining 25% imported clay type soils from a nearby borrow source. Exterior embankment side slopes of 3:1 are recommended as well as 5 feet of over-excavation below the dam and 10 feet of keyed embankment into the arroyo walls at the ends. Final recommendations for the embankment cross-section will be performed at the design stage. At that point a more sophisticated dynamic analysis will be performed to reflect the maximum detention time during the SDF.

In order to minimize the area needed for constructing the proposed detention facilities, the ponded area was excavated to provide additional storage. This will result in excess spoil material from the proposed construction. In order to dispose of this material and also to ensure that the arroyos could not, over time, meander around the dam, entrainment dikes are recommended along the arroyos upstream of the proposed facilities. These dikes are typically a trapezoidal section with a 6 foot top width 3:1 side slopes and a 2-3 foot height. The locations for these dikes are indicated on Figure VI-1.

CHAPTER VII

SEDIMENT TRANSPORT ANALYSIS

A. GENERAL

To accurately estimate bed load carrying capacities of the arroyos under existing and design flow conditions, a sediment transport analysis was conducted. This analysis was necessary to generate costs for maintenance of the existing arroyos and channel systems. It also illustrates the potential effects of the proposed detention facilities on the sediment deposition in downstream areas. A sediment transport analysis was performed for the Owl's Nest, Organ Arroyo North Fork, Blair Canyon, Baylor Canyon and San Augustin Arroyos. The results from this analysis were used to provide information for the Mine House Spring Arroyo.

Many sediment transport formulas have been developed to estimate bedload carrying capacities utilizing tractive force relations. The problem associated with the wide variety of formulas is their respective wide variety of calculated solutions for identical situations. The selection of the appropriate formula or formulas for each specific hydraulic reach is not straight-forward since it is not possible to determine which formula gives the most realistic results for the specific locale. For this reason, our analysis included computation of bedload capacity by several different equations, identification of those equations giving consistent results and the subsequent averaging of those results.

Geotechnical field investigations of the arroyos showed that the majority of the bed material was made up of coarse sands with some silt. There was also a large quantity of alluvium, with some cobbles ranging up to four inches, which had been transported by storm runoff and deposited in the bed of the arroyos. The gradation for each arroyo was plotted to estimate the median grain size (D-50) for input into the regression analysis for estimating the sediment loads. The D-50, and associated soil description for the arroyos studied is included in Table VII-1.

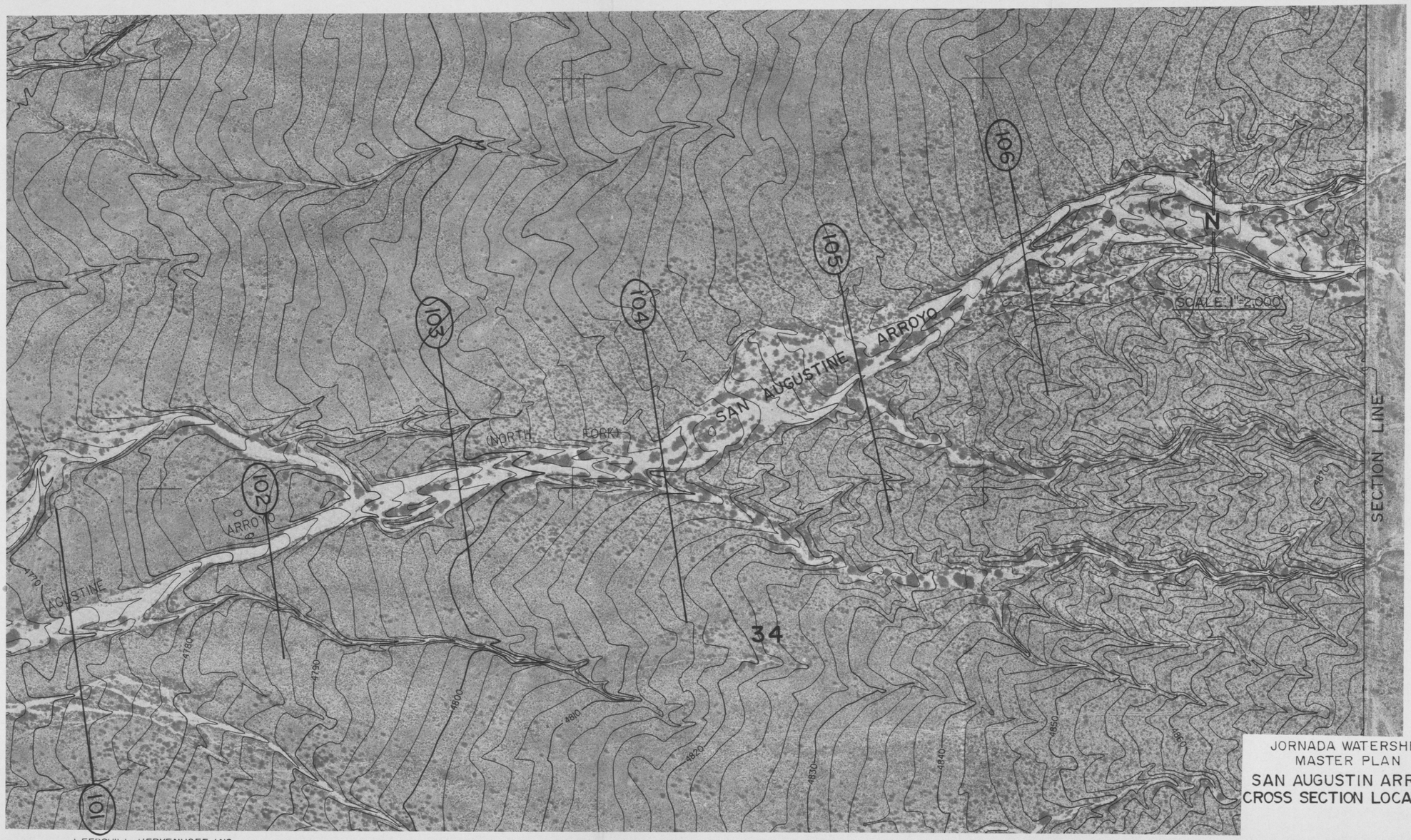
TABLE VII-1 - MEDIAN GRAIN SIZE (D-50)		
Arroyo	Grain Size	Soil Description
Organ Arroyo North Branch	0.55 mm	Medium Sand
Owl's Nest Arroyo	0.62 mm	Coarse Sand
Baylor Canyon Arroyo	1.30 mm	Very Coarse Sand
San Augustin Arroyo	1.30 mm	Very Coarse Sand
Blair Canyon Arroyo	1.40 mm	Very Coarse Sand

The required hydraulic input data for the sediment transport evaluation was based on the supercritical results of HEC-2 analyses upstream of each of the proposed detention basins. (Figures VII through VII-4 show the cross-sections used to evaluate the each arroyo. HEC-2 results can be found in Appendix E.

The HEC-2 output data for each cross section was compiled for a range of peak discharge rates from 500 cfs to 5000 cfs. The depth and the velocity calculated for each section was then plotted against the flow rates and averaged to obtain a typical hydraulic section for each arroyo. Flow depths and velocities for the typical hydraulic section were used as input for the sediment transport model. The graphical plots representing the typical hydraulic section for each arroyo and other pertinent sediment transport calculations can be found in Appendix F.

The sediment transport model uses regression analysis to fit an exponential equation to the sediment transport versus bed-discharge data. This equation has the following form:

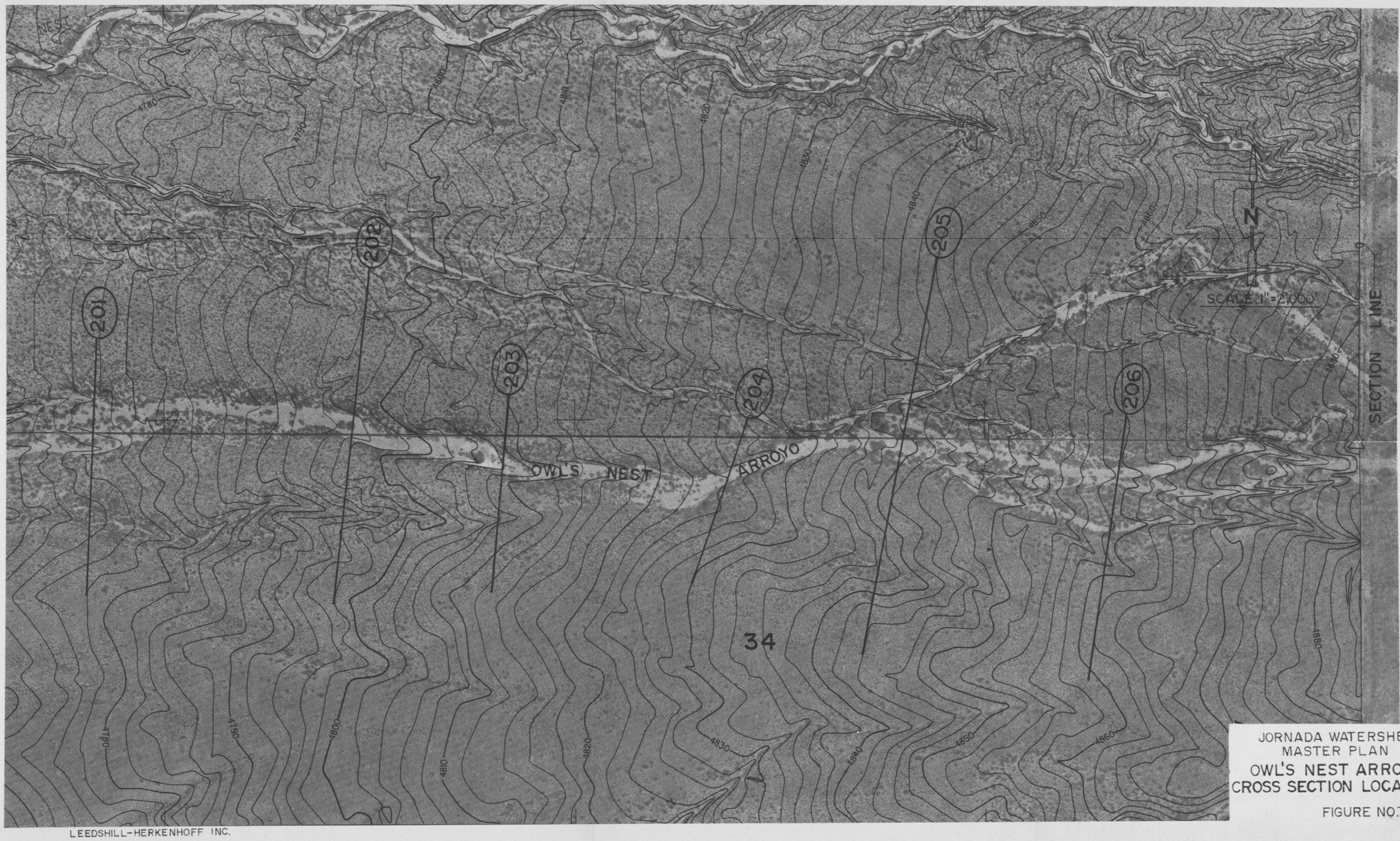
$$Qsed = a * (Qwater)^{b}$$



JORNADA WATERSHED
MASTER PLAN
SAN AUGUSTIN ARROYO
CROSS SECTION LOCATIONS

LEEDSHILL-HERKENHOFF INC.

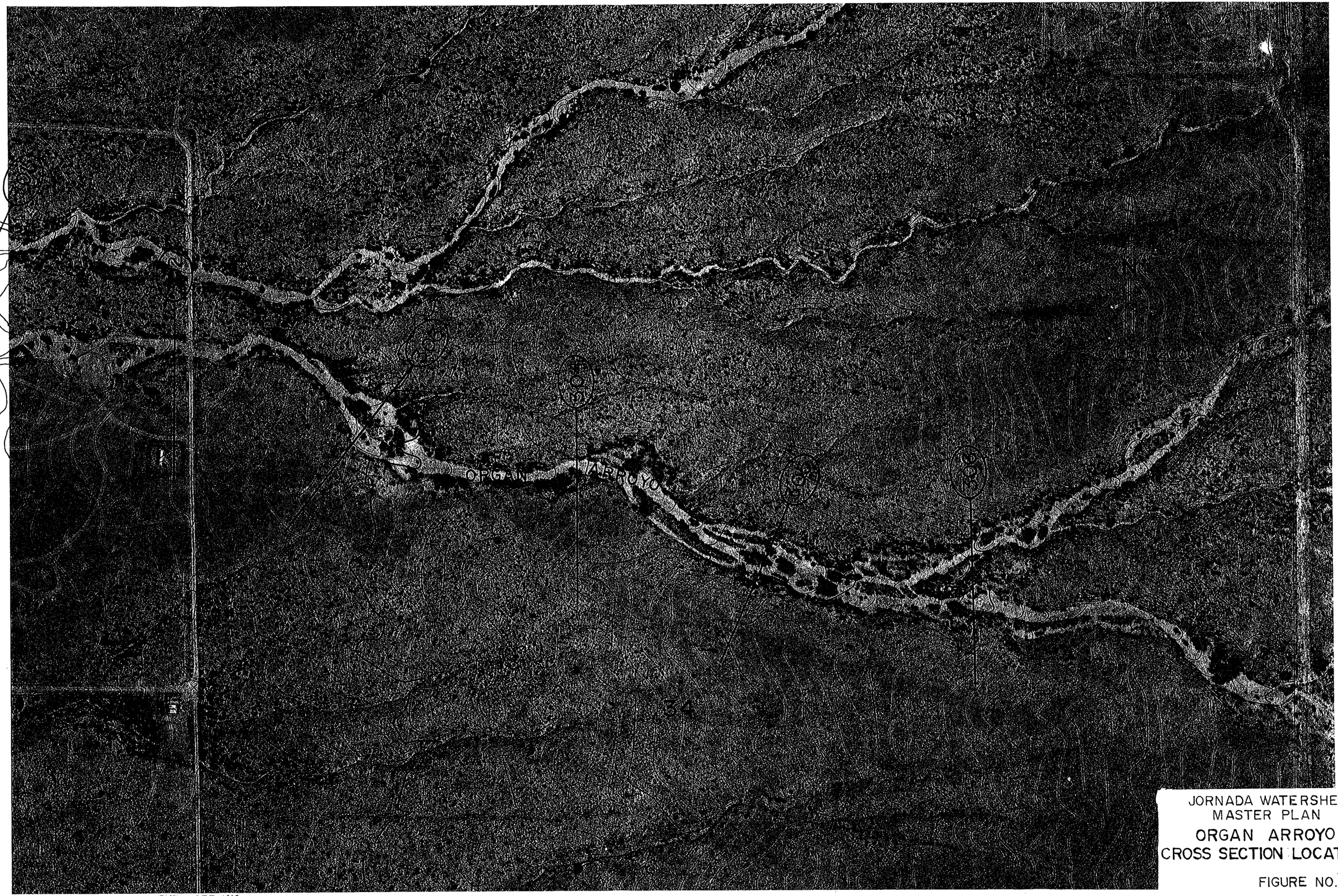
FIGURE NO. VII-1



JORNADA WATERSHED
MASTER PLAN
OWL'S NEST ARROYO
CROSS SECTION LOCATIONS

LEEDSHILL-HERKENHOFF INC.

FIGURE NO. VII-2



JORNADA WATERSHED
MASTER PLAN

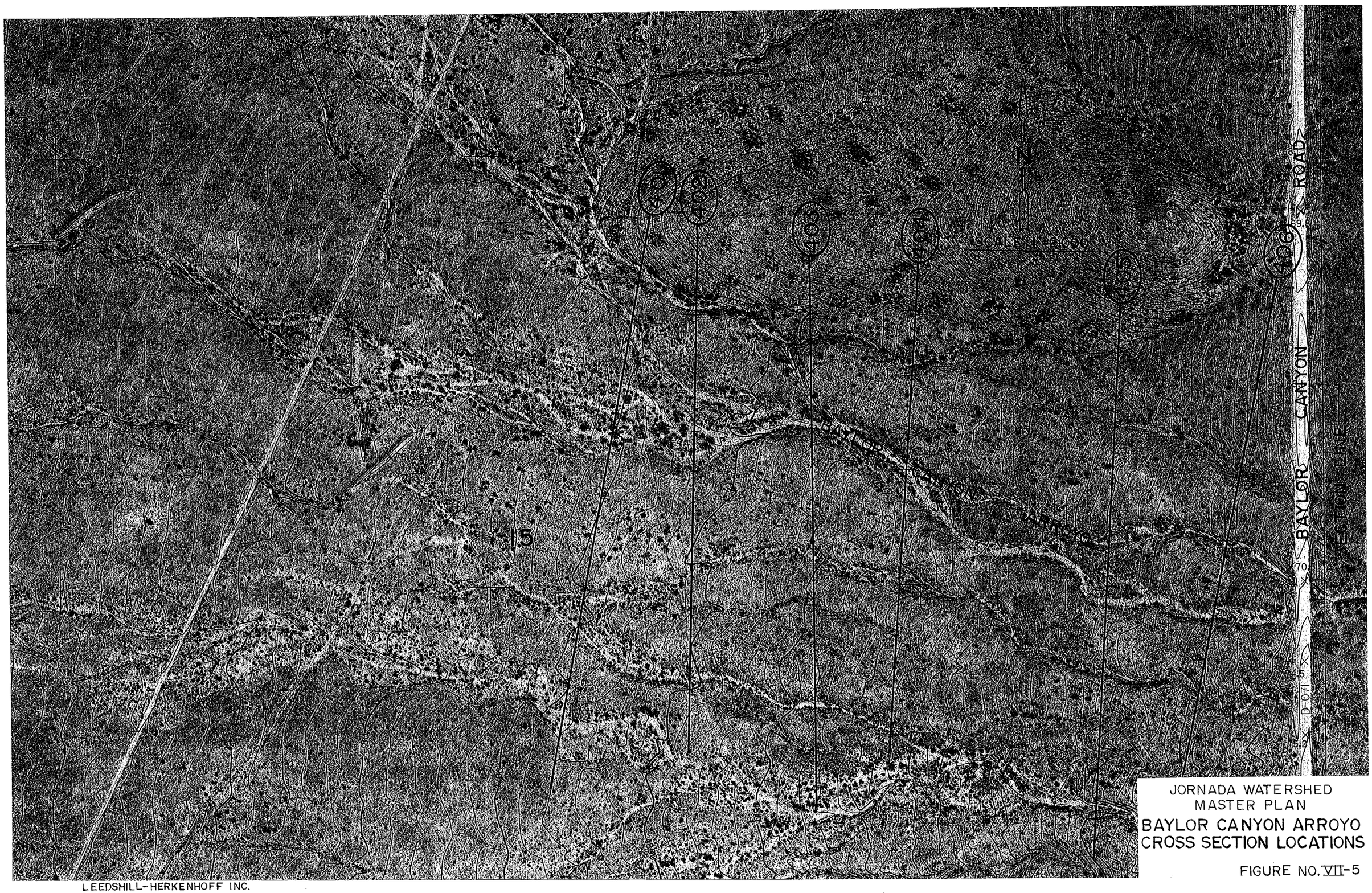
ORGAN ARROYO
CROSS SECTION LOCATIONS

FIGURE NO. VII-3

LEEDSHILL-HERKENHOFF INC.

JORNADA WATERSHED
MASTER PLAN
BLAIR CANYON ARROYO
CROSS SECTION LOCATIONS

FIGURE NO. VII-4



JORNADA WATERSHED
MASTER PLAN

BAYLOR CANYON ARROYO
CROSS SECTION LOCATIONS

FIGURE NO. VII-5

where **Qsed** is the bedload transport capacity in lbs./sec, **Qwater** is the bed-discharge in cfs and **a** and **b** are constants obtained from the regression analysis. The Qwater hydrograph for each arroyo was calculated using HEC-1 for the 5-year, 10-year, 50-year, and 100-year design storms.

For this analysis, nine of the most widely used formulas for estimating the a and b constants associated with the discharge of bedload sediment under conditions of uniform steady flow were used. Each formula was derived and evaluated by comparing observed sediment discharges in rivers with values calculated by the formulas. These evaluations established some limitations and ranges of use for each of the formulas. The limitations were based on the median grain size of sediment (D-50) in millimeters (mm) for each application. Table VII-2 lists the nine formulas available for use in the analysis, their respective applicable D-50 range, and the arroyos these formulas were applied to.

TABLE VII-2
SEDIMENT TRANSPORT FORMULA APPLICATIONS

Sediment Transport Formula	D-50 Range	Arroyo Use
1. Englund-Hansen (1966,1967)	0.20 mm to 1.00 mm	Owl's Nest & Organ North
2. Duboys (1879, 1950)	0.05 mm to 5.00 mm	All
3. Meyer-Peter Muller (1948)	0.40 mm to 30.0 mm	All
4. Einstein-Brown (1950)	0.30 mm to 7.00 mm	All
5. Inglis-Lacy (1968)	0.01 mm to 1.00 mm	Owl's Nest & Organ North
6. Meyer-Peter (1948)	3.00 mm to 30.0 mm	None
7. Schoklitsch (1935)	0.30 mm to 5.00 mm	All
8. Laursen (1958)	0.01 mm to 4.00 mm	All
9. Shields (1936)	1.70 mm to 2.50 mm	None

For the Jornada watershed sediment transport analyses, the grain size limitations usually eliminated two or three of the nine equations for each arroyo application. Bedload results of the remaining formulas were then plotted against a range of peak flow rates to graphically assess their compatibility. Usually one or two of the formulas were eliminated due to their excessive nonconformance with the remaining equations. The equations that produced similar trends were averaged to determine the required bedload factors **a** and **b**. The graphical results of the bedload vs. discharge equations used can be found in Appendix F.

A spreadsheet was developed to assess each of the nine bedload equations and the design hydrographs to ascertain the cumulative volume for each design storm. The peak sediment volume for each design storm was plotted against its probability of occurrence to find the annual sediment transport for each arroyo.

B. GEOTECHNICAL GRADATION ANALYSIS

The gradation analysis of the surface soils in the arroyo streambeds as performed by Precision Engineering,Inc., Las Cruces, showed a well graded sand with few silts and very little clay material. This soil gradation is typical of discharge channels from alluvial fans. These arroyo bed soils lack finer grained soils which are important for obtaining cohesion and low permeability. Sediment deposited in the detention facilities should remain loose and uncemented, allowing ease in maintenance. Surface soil gradation curves are presented in Appendix F.

C. AVERAGE ANNUAL SEDIMENT TRANSPORT

Runoff hydrographs for storms of various return frequencies were developed for the Owl's Nest, Organ North Branch, Blair Canyon, Baylor Canyon and San Augustin Arroyos as previously described. These hydrographs include the 5-year, 10-year, 25-year, 50-year, and 100-year storm events. A spreadsheet was developed to assess each of the applicable bedload equations with the design hydrographs to ascertain the cumulative

sediment volume resulting from each storm. The sediment transport capacity for each storm event was determined in tons at 165 lbs/cubic foot; this accounts for water filling the void space during storm events. The unit weight of the sediment itself was estimated at 100 lbs/cubic foot. The exponential bedload equations were applied to the hydrographs to obtain a relationship of sediment transport capacity versus time. The sediment transport capacity was integrated over the duration of each flood to give sediment volumes that could be transported in each arroyo during each storm event. (See Table VII-3). The peak sediment volume for each design storm was plotted against its probability of occurrence to find the estimated annual sediment transport for the arroyo. (See Figure VII-5). The area under the curve represents the maximum possible annual erosion volume. Table VII-4 presents the results of the annual sediment transport capacity analysis.

Because the Mine House Spring Detention Facility was added after the sampling and particle gradation analyses for the project had been completed, a different methodology was used for calculating the annual maximum possible annual erosion volumes for this facility. Based on the analyses completed on the other five arroyos, an investigation of the sediment transport volumes with respect to drainage was made. Table VII-4 indicates the results of this analysis. As this rate was fairly consistent, it was used with the drainage area for the Mine House Spring Detention Facility in order to provide maximum possible annual erosion volumes and the 100-year design storm sediment transport capacity.

An estimate of expected annual maintenance costs for sediment removal was made for each location assuming removal of the maximum annual erosion volume. A unit cost of $2.00 per cubic yard (CY) was utilized for sediment removal. The annual maximum bedload transport volumes for each location and the expected resulting annual maintenance costs are summarized in Table VII-5.

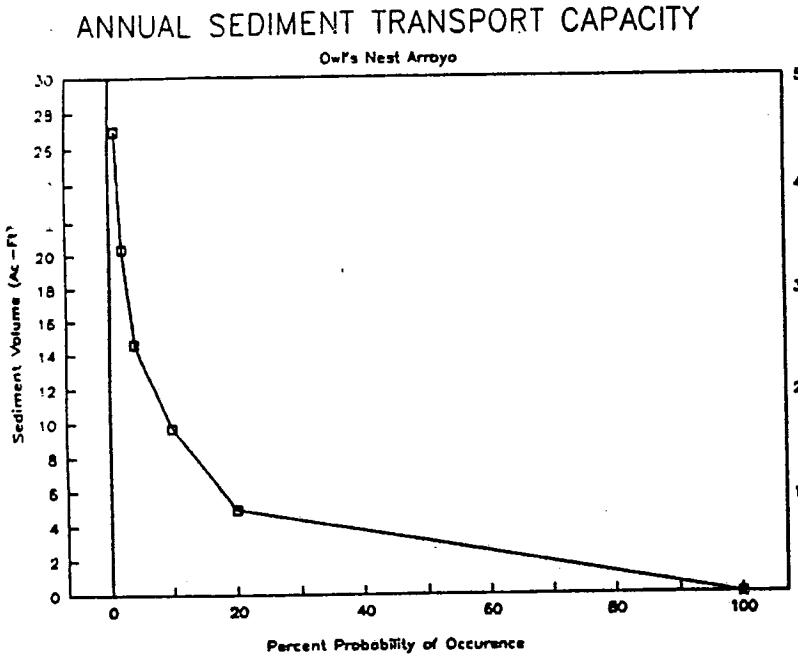
TABLE VII-3
ANNUAL SEDIMENT TRANSPORT CAPACITY

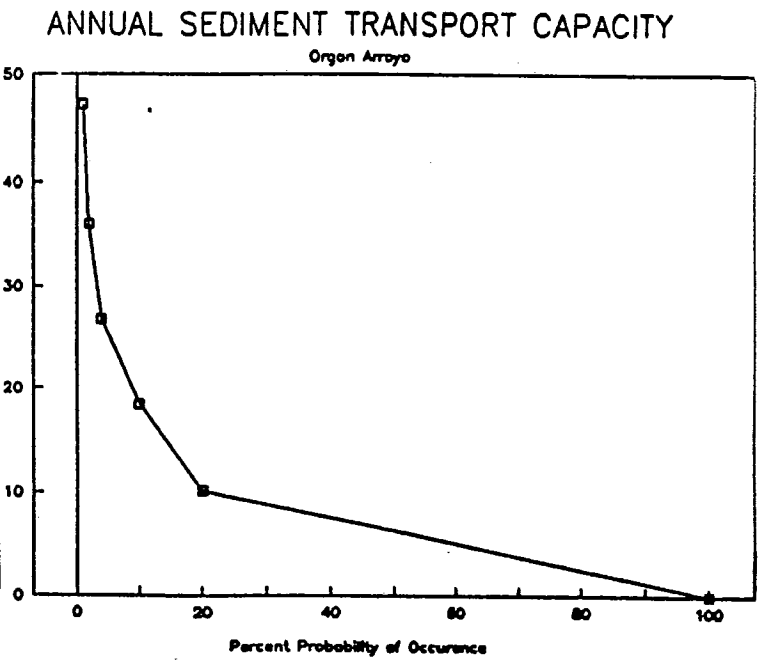
STORM RETURN PERIOD	PERCENT PROBABILITY OCCURRENCE	SEDIMENT TRANSPORT CAPACITY (ac. ft.)	INCREMENTED AREA UNDER CURVE	TRANSPORT/ DRAINAGE AREA
ORGAN ARROYO (dA = 2.03 mi^2)				
100-Year	1	48.0	0.480	23.65
50-Year	2	36.5	0.423	17.98
25-Year	4	27.0	0.635	13.30
10-Year	10	18.5	1.365	9.11
5-Year	20	10.0	1.425	4.93
1-Year	100	0	4.000	0
OWL'S NEST ARROYO (dA = 1.21 mi^2)				
100-Year	1	29.0	0.290	23.97
50-Year	2	21.8	0.254	18.02
25-Year	4	15.7	0.375	12.98
10-Year	10	9.3	0.750	7.69
5-Year	20	5.4	0.735	4.46
1-Year	100	0	2.160	0
BLAIR CANYON ARROYO (dA = 3.56)				
100-Year	1	59.5	0.595	16.71
50-Year	2	48.0	0.538	13.48
25-Year	4	37.0	0.850	10.39
10-Year	10	28.0	1.950	7.87
5-Year	20	17.5	2.275	4.92
1-Year	100	0	7.000	0

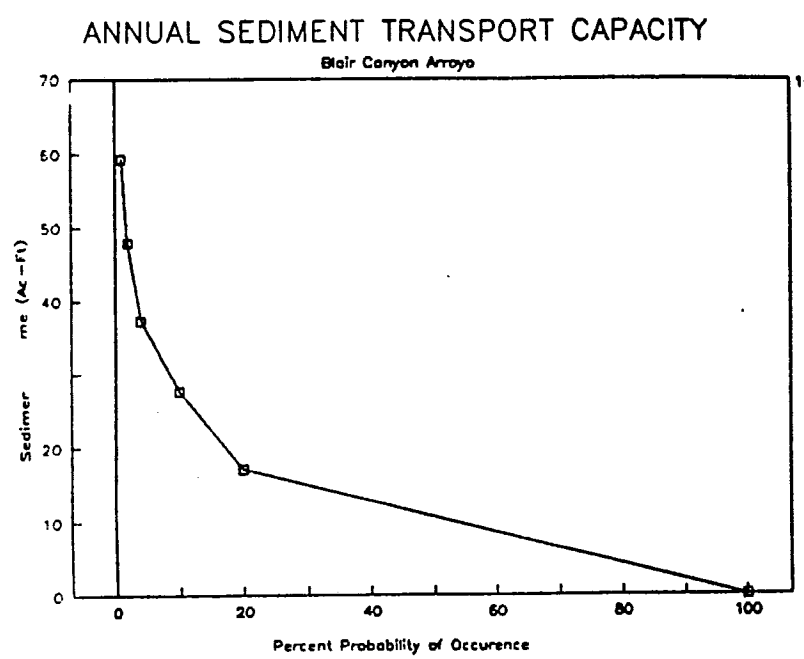
TABLE VII-3 (Cont'd.)
ANNUAL SEDIMENT TRANSPORT CAPACITY

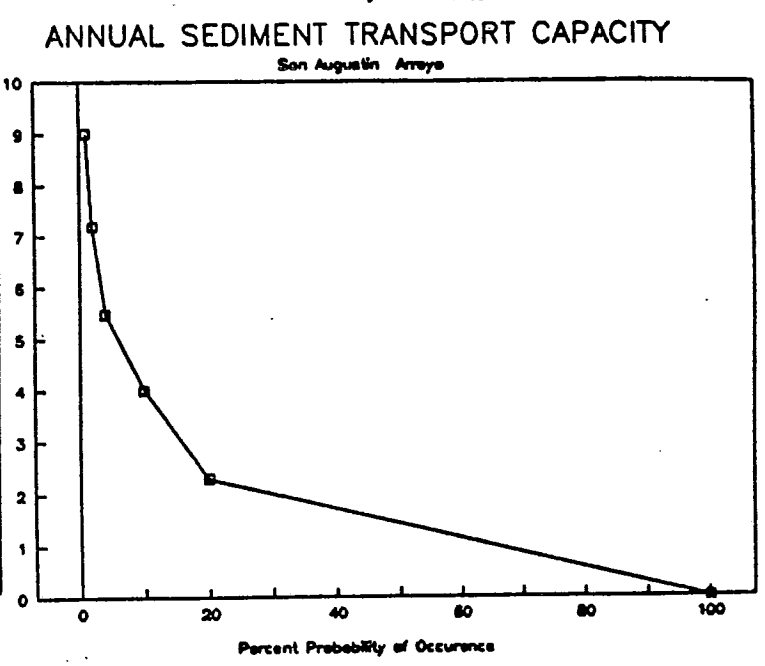
STORM RETURN PERIOD	PERCENT PROBABILITY OCCURRENCE	SEDIMENT TRANSPORT CAPACITY (ac. ft.)	INCREMENTED AREA UNDER CURVE	TRANSPORT/ DRAINAGE AREA
BAYLOR CANYON ARROYO (dA = 4.29)				
100-Year	1	49.0	0.490	11.42
50-Year	2	40.0	0.445	9.32
25-Year	4	32.0	0.720	7.46
10-Year	10	24.0	1.680	5.59
5-Year	20	16.5	2.025	3.85
1-Year	100	0	6.600	0
SAN AUGUSTIN ARROYO (dA = 1.57 mi^2)				
100-Year	1	9.0	.090	5.73
50-Year	2	7.2	.081	4.59
25-Year	4	5.5	0.127	3.50
10-Year	10	4.0	0.285	2.55
5-Year	20	2.5	0.325	1.59
1-Year	100	0	1.00	0
MINE HOUSE ARROYO (dA = 7.57 mi^2)				
100-Year	1	103.0	1.03	13.61
50-Year	2	84.9	0.94	11.21
25-Year	4	66.5	1.51	8.79
10-Year	10	50.2	3.50	6.62
5-Year	20	32.8	4.15	4.33
1-Year	100	0	13.12	0

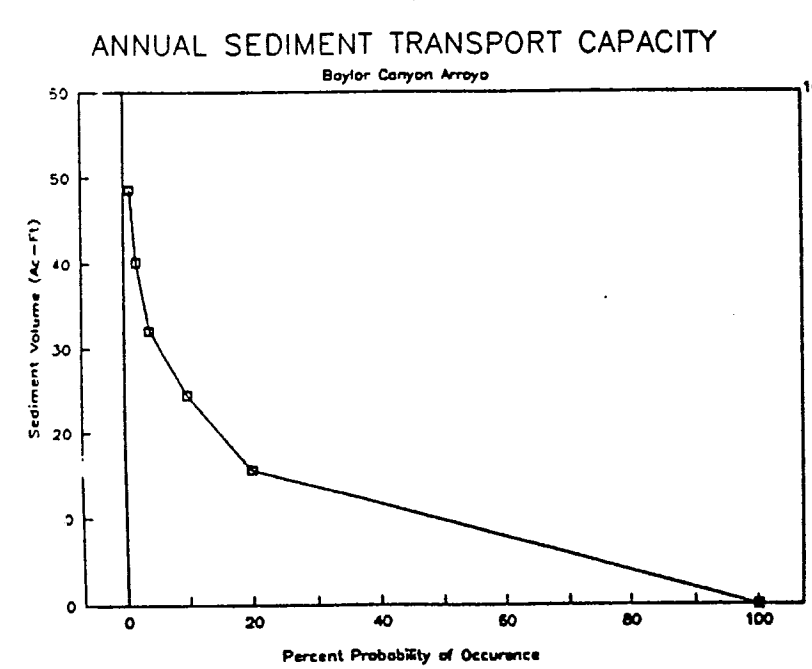
Figure VII-5

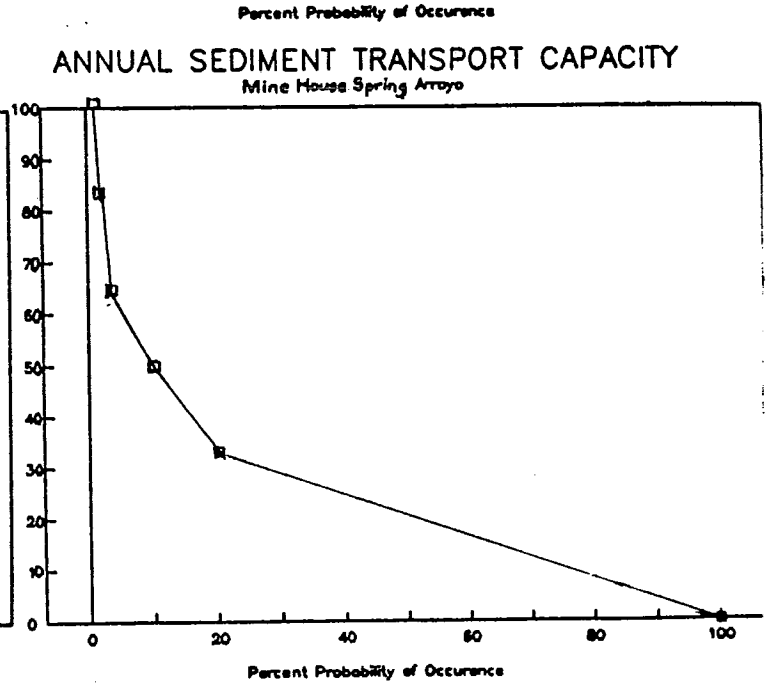












SEDIMENT PROBABILITY CURVES

FIGURE VII-6

TABLE VII-4
SUMMARY OF ANNUAL SEDIMENT TRANSPORT

TOTAL INCREMENTED AREA UNDER CURVE*	ANNUAL TRANSPORT*	TRANSPORT/SQUARE MILE
SAN AUGUSTIN		
1.91 ac. ft.	4,156 (tons) 3,078 (cy)	1.21 ac. ft./sq. mi.
OWL'S NEST		
4.56 ac. ft.	9,940 (tons) 7,363 (cy)	3.77 ac. ft./sq. mi.
ORGAN ARROYO		
8.33 ac. ft.	18,143 (tons) 13,440 (cy)	4.16 ac. ft./sq. mi.
BLAIR CANYON		
13.21 ac. ft.	28,767 (tons) 21,309 (cy)	3.71 ac. ft./sq. mi.
BAYLOR CANYON		
11.96 ac. ft.	26,049 (tons) 19,295 (cy)	2.78 ac. ft./sq. mi.
MINE HOUSE SPRING		
24.25 ac. ft.	52,817 (tons) 39,125 (cy)	3.20 ac. ft./sq. mi.

* Based on 100 square foot/cubic yard

TABLE VII-5 Annual Sediment Maintenance Costs		
Detention Facility	**Annual Transport**	**Annual Cost****
Brahman Road*	23,881 CY	$47,762
Baylor/Blair	40,604 CY	$81,208
Mine House Spring	39,125 CY	$78,250
* Drains San Augustin, Owl's Nest and Organ Arroyos ** Based on $2.00/CY Handling and Disposal Cost		

D. 100-YEAR DESIGN STORM SEDIMENT TRANSPORT

The 100-year design storm sediment transport volume was used to calculate the additional storage volume required for the detention facilities in order to provide some sediment storage in addition to flood control volume capacity. While this is not specifically required by the State Engineer, it is recommended for dual use facilities with probable heavy sediment loading, such as those proposed in this study.

The 100-year runoff hydrographs were calculated for each of the arroyos being analyzed using the HEC-1 computer model.The sediment transport capacity for each storm event was determined as described in the previous section. The 100-year design storm sediment transport potential, as calculated for the Jornada watershed, is included in Table VII-6. The detention facilities were designed to include this volume as additional storage behind the dams.

TABLE VII-6 100-YEAR SEDIMENT TRANSPORT POTENTIAL	
Arroyo	100-Year Sediment Transport Potential
San Augustin	9 Acre Feet
Owl's Nest	29 Acre Feet
Organ North Branch	48 Acre Feet
Blair Canyon	59 Acre Feet
Baylor Canyon	48 Acre Feet
Mine House Spring	103 Acre Feet

CHAPTER VIII

RIGHT-OF WAY REQUIREMENTS

In order to ensure legal access during construction,for maintenance operations and to enable construction of appropriate public safety appurtenances, it is critical that the Dona Ana County Flood Control obtain rights-of-way for the proposed improvements. Rights-of-way may be obtained through several mechanisms depending in part on the current land use and ownership.

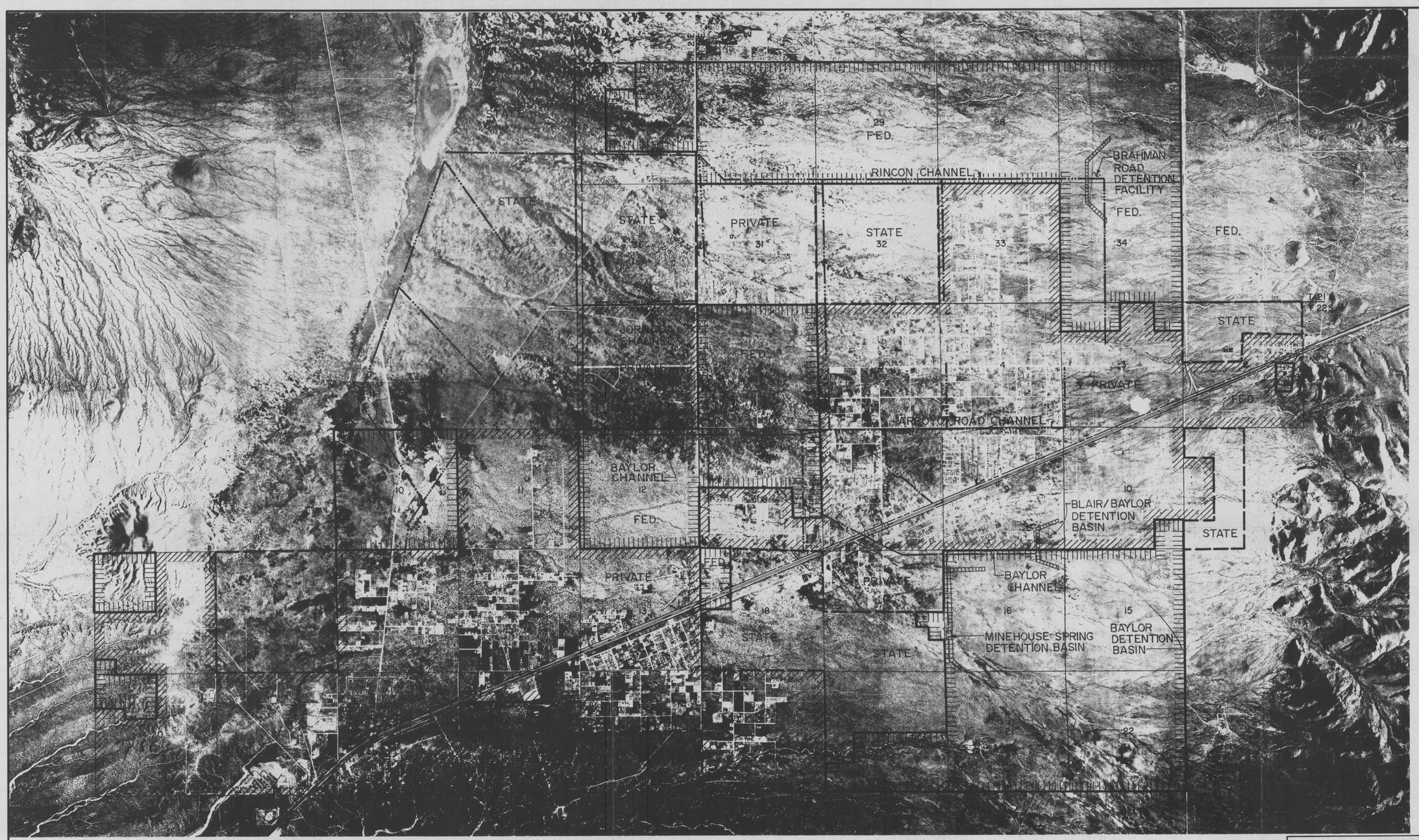
Right-of-way requirements determined many of the project alignments and enabled decisions regarding the various design alternatives. A discussion of the assumptions made in determining the right-of-way requirements, the actual project rights-of-way to be obtained, the methods and sources of rights-of way, and associated costs for such are discussed in the following sections. The rights-of-way for the various components of the Jornada Master Drainage Plan are indicated on the plan layout on Figure VIII-1.

A. RIGHT-OF-WAY REQUIREMENTS

Right-of-way requirements were estimated for the various project components based on the area required to construct the particular improvement plus adequate space for future roadway maintenance construction.

For channels, the construction area was calculated as the channel topwidth plus 20 feet minimum on each side for a regular maintenance area and backslope drains as indicated on Figure V-4. Backslope drains ensure the integrity of the channel sideslope by intercepting overland sheetflow and providing a controlled entrance into the channel.

Right-of-way for the detention facilities was determined as the area wetted by the SDF, plus the area required for the structural embankment from crest to 20 foot outside of the toe of slope. The emergency spillway with a twenty foot perimeter maintenance area was also included.



LEGEND

- FEDERAL LAND
- STATE LAND
- PRIVATE LAND
- ℄ PROPOSED DRAINAGE WORKS

JORNADA WATERSHED MASTER PLAN

LAND OWNERSHIP MAP

DRAWN BY: EAC
DATE: AUG. 1991
SCALE: 1" = 2000'

LEEDSHILL-HERKENHOFF, INC.
ENGINEERS ARCHITECTS
ALBUQUERQUE SANTA FE SAN DIEGO

FIGURE NO. VIII-1

BRUNING 44-242 7 1050

In general, once the minimum area was defined and mapped, the rights-of-way were then squared off to enable future description by section dimensions and easier calculation of acreage requirements.

B. TRACT OWNERSHIP

Tax maps for the project area were provided by the Dona Ana County Assessor's Office for the purpose of identifying potential tract ownership. This information was utilized along with the orthophotographic and Bureau of Land Management mapping of the area in order to determine whether the proposed improvements traversed properties which were under U.S., State of New Mexico, and private ownership. In general, the improvements were located to maximize the acreage required from lands currently under public ownership. Prior to final right-of-way acquisition, a formal boundary survey and title search for the affected tracts should be obtained.

The project was plotted along with the property boundaries on Figure VIII-1. Upon identification of the right-of-way required for the project components, Table VIII-1 was prepared as a summary of tracts impacted by the project, the acreage required, and the probable tract owner. These tracts were organized by project component to allow comparison of total right-of-way requirements per item.

TABLE VIII-1 Summary of Right-of-Way Requirements				
Project	BLM (AC)	STATE (Ac)	PRIVATE (Ac)	TOTAL R-O-W (Ac)
Brahman Road Channel	20.49	0.00	0.41	20.90
Brahman Road Detention Facility	47.80	0.00	0.00	47.80
Mine House Spring Detention Channel	85.90	0.00	0.00	85.90
Blair/Baylor Detention Facility	30.68	0.00	79.80	110.48
Rincon Road Channel	80.46	36.27	0.00	116.73
Jornada Road Channel	0.00	5.87	32.78	38.65
Baylor Canyon Road Channel	44.27	0.00	13.84	58.11
Arroyo Road Channel	3.33	0.00	19.39	22.72
Isaack Lake System Channels	0.00	75.76	0.00	75.76
System Collector Channels	22.62	37.84	30.68	91.14
TOTAL R-O-W	335.55	155.74	176.90	668.19

C. PARCEL ACQUISITION

Parcel acquisition is dependent upon the current land ownership and use. The mechanism for obtaining the required acreage varies depending on whether the Flood Commission is dealing with the BLM, the State of New Mexico, or private individual land owners and developers.

The parcels located on BLM land will require acquisition of this property by the Flood Commission. As indicated on Figure VIII-1, there are 5 parcels located on BLM land, totalling 336 acres, which would be necessary for this project.

Federal law requires that an archaeological site investigation be performed on federal lands affected by a changing land use. Therefore, identification of archaeological sites in the BLM land portion of this project will be required before preceding with final design. Should an archaeological site be discovered which will be disturbed by the proposed construction, then a separate analysis will be required to determine whether the site's historical significance is worthy of maintaining the site intact. Most of the improvements located within BLM land can be relocated during final design in order to mitigate and or avoid site disturbance.

Approximately 156 acres from 4 parcels are required from land holdings of the State of New Mexico Land Office. It is thought that the State Land Office will approve a land transfer and or grant easements where more appropriate, when such an action will benefit State residents, and since the project provides needed flood and sedimentation protection to a large area, a clear benefit can be demonstrated.

The remaining 6 parcels, or 177 acres are located on several privately held land parcels. This private land is currently subject to recurrent flooding over a widespread area. At this time there is sporadic residential development in the area; however, a majority of these parcels are not under a specific land use and there is no evidence of agricultural activity in the project area. It is recommended that the Flood Commission seek to obtain drainage easements in these areas, as easements are generally less expensive than outright property acquisition. Given the low level of current land use of these parcels,a reasonable cost should be negotiable. In addition, it may be possible to require drainage easement dedication as part of the development plat process.

Dona Ana County Flood Commission is in the process of obtaining public rights-of-way from the State Land Office and from the United States Bureau of Land Management.

Table VIII-2 indicates the preliminary estimate of costs for required right-of-way parcels. These costs were estimated based on similar recent right-of-way acquisitions completed by the Flood Commission in the project area. A cost of $0.23 per square foot

($10,000 per acre) was utilized as the basis for estimating costs for private parcel acquisition. This cost was established without the benefit of appraised values for these parcels and should be verified by a certified land appraiser prior to parcel acquisition. An administrative cost of $0.01 per square foot ($500 per acre) was assumed for estimating costs for public parcel acquisition. This cost should cover all necessary boundary surveys, and administrative effort related to obtain parcel acquisition under public ownership.

TABLE VIII-2
Summary of Right-of-Way Costs

Project	BLM ($)	STATE ($)	PRIVATE ($)	TOTAL R-O-W ($)
Brahman Road Channel	10,245	0	4,100	14,345
Brahman Road Detention Facility	23,900	0	0	23,900
Mine House Spring Detention Channel	42,950	0	0	42,950
Blair/Baylor Detention Facility	15,340	0	798,000	813,340
Rincon Road Channel	40,230	18,135	0	58,365
Jornada Road Channel	0	2,935	327,800	330,735
Baylor Canyon Road Channel	22,135	0	138,400	160,535
Arroyo Road Channel	1,665	0	193,900	195,565
Isaack Lake System Channels	0	37,873	0	37,879
System Collector Channels	11,310	18,920	306,800	337,030
TOTAL R-O-W COSTS	$167,775	$77,869	$1,769,000	$2,014,644

CHAPTER IX
COST ESTIMATES

A. GENERAL

Construction costs were developed for the various design alternatives in order to provide economic comparison and to develop an overall plan for construction. The comparative cost estimates for the various dam and detention scenarios along with the costs for the various spillway and channel alternatives are included in Appendix G.

All construction costs were estimated in February 1992 dollars and are based upon prices currently bid for similar projects within the Dona Ana County area. The estimated construction costs are intended to illustrate relative magnitude of costs for planning and budgeting purposes only and do not reflect specific site conditions, inflation, the time value of money or the costs for land acquisition. The costs to include a fifteen percent allowance for contingencies and a cost for related administration, legal and engineering as ten percent of the construction costs with contingencies. Detailed cost estimates are recommended during the final design phase of the proposed improvements.

B. PROJECT COSTS

The estimated costs for the various components were evaluated along with the right-of-way requirements in order to develop the most cost effective improvements for the watershed. The estimated construction costs are itemized by component in Table IX-1.

TABLE IX-1 COST SUMMARY		
PROJECT	CONSTRUCTION	RIGHT-OF-WAY
PHASE 1		
Brahman Road Channel	$1,181,510	$14,345
Brahman Road Detention Facility	$1,390,852	$23,900
Rincon Road Channel	$3,190,530	$58,365
Subtotal Phase 1	$5,762,892	
Contingencies (15%)	$864,434	
Administrative, Legal & Engineering	$662,732	
Total Phase 1	$7,290,060	$96,610
Combined Total Phase 1	$7,386,670	
PHASE 2		
Mine House Spring Detention Facility	$1,942,976	$42,950
Baylor Channel	$1,924,438	$160,535
Jornada Road Channel	$1,562,731	$230,735
Subtotal Phase 2	$5,430,145	
Contingencies (15%)	$814,522	
Administrative, Legal & Engineering	$624,467	
Total Phase 2	$6,869,030	$534,220
Combined Total Phase 2	$7,403,354	
PHASE 3		
Blair/Baylor Detention Facility	$2,094,989	$813,340
Arroyo Road Channel	$1,276,683	$195,565
Subtotal Phase 3	$3,371,672	
Contingencies (15%)	$505,751	
Administrative, Legal & Engineering	$387,742	
Total Phase 3	$4,265,165	$1,008,905
Combined Total Phase 3	$5,274,070	
PHASE 4		
Isaack Lake System Channels	$277,322	$37,879
System Collector Channels	$841,870	$337,030
Subtotal Phase 4	$1,119,192	
Contingencies (15%)	$167,879	
Administrative, Legal & Engineering	$128,707	
Total Phase 4	$1,415,779	$374,909
Combined Total Phase 4	$1,790,687	
TOTAL PROJECT	$19,840,034	$2,014,644
COMBINED TOTAL PROJECT	$21,854,680	

C. CONSTRUCTION PRIORITIZATION.

Upon development of the total expected construction costs for the proposed system of improvements, it was apparent that a phased system of improvements would be necessary. Through discussions with Dona Ana County Flood Commission personnel, a prioritization for constructing these improvements was determined. Figure IX-1 indicates the overall plan of improvements and the optimal implementation for phased construction. Local funding constraints and projected development rates within the watershed were used along with evaluation of maximal project benefit in order to determine construction prioritization. This prioritization then determined the phased implementation of the Jornada Master Drainage Plan.

RINCON ROAD CHANNEL PHASE I

BRAHMAN ROAD DETENTION FACILITY PHASE I

RINCON ROAD

BRAHMAN ROAD CHANNEL PHASE I

PHASE IV

PHASE IV (TYP.)

JORNADA CHANNEL PHASE II

EL CENTRO ROAD

BRAHMAN ROAD

HANGAR LAKE ROAD

MOONGATE ROAD

ARROYO ROAD

JORNADA ROAD

BAYLOR CHANNEL PHASE II

BLAIR/ BAYLOR DETENTION FACILITY PHASE III

HANGAR LAKE CHANNEL PHASE II

HIGHWAY 70

MINEHOUSE SPRING DETENTION FACILITY PHASE II

WATERSHED STUDY BOUNDARY

N

LEGEND

- PHASE I CHANNEL CONSTRUCTION
- PHASE I DETENTION FACILITY CONSTRUCTION
- PHASE II CHANNEL CONSTRUCTION
- PHASE II DETENTION FACILITY CONSTRUCTION
- PHASE III CHANNEL CONSTRUCTION
- PHASE III DETENTION FACILITY CONSTRUCTION
- PHASE IV CONSTRUCTION

JORNADA WATERSHED MASTER PLAN

CONSTRUCTION PRIORITIZATION PLAN

DRAWN BY	M.C.
DATE	NOV 1991
SCALE	1"=2,000'

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BRUNING 44 242 71050

FIGURE NO. IX-1

CHAPTER X
CONCLUSIONS AND RECOMMENDATIONS

The existing arroyo system within the East Mesa area of Las Cruces does not have adequate conveyance capacity under either the 10-year or the 100-year frequency rainfall event. With the exception of the culverts crossing U.S. Highway 70, the area roadway drainage facilities are significantly under capacity and thus contribute to the area's drainage problems. The results of the sedimentation and erosion analyses identify heavy sediment volumes impacting the East Mesa area from contributing areas east and south of existing development. Additional development in this area will exacerbate the drainage and sediment problems.

A phased system of detention facilities and channels is recommended for the Jornada watershed to alleviate current problems caused by excessive runoff and sedimentation. The most cost effective drainage system for the area is the "three dam alternative" which consists of the detention facilities at Brahman Road, Blair/Baylor Canyon Arroyos and Mine House Spring Arroyos. Runoff from these facilities is directed to Isaack Lake by the Rincon Road, Baylor Canyon, Jornada Road, Arroyo Road collector channels. These facilities also convey runoff from the neighborhood collection system. These facilities provide local relief from the 100-year frequency storm and associated sediment loading, and were designed to allow additional development within the East Mesa. While the area wide drainage is vastly improved over existing conditions, additional culverts are recommended for the local roadway crossings which remain under capacity.

The detention facilities must be constructed in compliance with the State Engineer's Office criteria and with the recommendations of the geotechnical report. An inlet tower is recommended for the primary spillways to allow drainage in case of sediment plugging between regular maintenance activities. Sediment removal is recommended on an annual basis, or following a large storm. An emergency spillway designed to pass the 1/2 PMF is also recommended. Of the spillway options investigated, a stepped soil cement

spillway proved to be the most cost effective. It is recommended that physical testing of this type spillway be incorporated into the final design effort for these facilities.

This project will result in minimal impacts to Isaack Lake. Those impacts identified can be attributed to the projected increase in development rather than to the implementation of this project.

The total project cost is estimated at $21,854,680 and will require a total of 668.19 acres of rights-of-way. Phasing this project will allow a timely implementation of construction. It is recommended that the Dona Ana County Flood Commission move towards acquiring the right-of-way required to construct this project. In addition, the Flood Commission should be involved in the development process in order to ensure general compliance with the Master Plan, and to coordinate future construction activities in the area.

CHAPTER XI

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JORNADA WATERSHED

SCALE: 1"=1000'

DATE OF PHOTOGRAPHY: 4/8/1989

A	B
D	C

KOOGLE & POULS ENGINEERING, INC.

JORNADA MASTER DRAINAGE PLAN
MASTER DRAINAGE PLAN LAYOUT
FIGURE VI-1A

RINCON ROAD CHANNEL
10' B.W., 2.75:1 S.S., R.O.W.=140'

RINCON ROAD CHANNEL
6' B.W., 2.75:1 S.S., R.O.W.=100'

200' SOIL CEMENT
EMERGENCY SPILLWAY

BERMING TO DIRECT
ARROYO AROUND DAM
50' EASEMENT

CLARK AND BROWN ARROYO

HAWKEYE ARROYO

100 YEAR
PONDING AREA

STA. 285+00 ℄ BRAHMAN
ROAD DETENTION FACILITY

1-30" DIA. R.C.P PRIMARY
SPILLWAY WITH INLET

FILL BERMS

GABION DROP
STRUCTURE

CHANNEL
R.O.W.=200'

℄ STA. 233+80 RINCON ROAD CHANNEL*
STA. 0+00 BRAHMAN ROAD CHANNEL

SAN AUGUSTIN ARROYO

R.O.W.=180'
FILL BERMS

GABION DROP
STRUCTURES

FILL BERM

R.O.W.=160'
BRAHMAN ROAD
CHANNEL

FILL BERM

GABION DROP
STRUCTURES

OWL'S NEST ARROYO

FILL BERM

FILL BERMS
BRAHMAN ROAD CHANNEL
30' B.W., 3:1 S.S. R.O.W.=150'

FILL BERM

GABION DROP
STRUCTURES

R.O.W.=120'

FILL BERMS

R.O.W.=100'

STA. 71+00
END CHANNEL

ORGAN ARROYO

ORGAN

U.S. 70

R.O.W.=140'

10' B.W., 3:1 S.S.
R.O.W.=140'

N. HANGAR LAKE COLLECTOR
CHANNEL 10' B.W., 3:1 S.S.
R.O.W.=100'

R.O.W.=100'

N. MOONGATE ROAD
COLLECTOR CHANNEL
6' B.W., 3:1 S.S., R.O.W.=80'

6' B.W., 3:1 S.S.
R.O.W.=80'

EL CENTRO ROAD

MOUNTAIN VIEW

WOODBURN ADDITION

S. HANGAR ROAD
COLLECTOR CHANNEL
6' B.W., 3:1 S.S., R.O.W.=80'

ARROYO ROAD CHANNEL
10' B.W., 2.75:1 S.S., R.O.W.=110'

S. MOONGATE
COLLECTOR CHANNEL
6' B.W., 3:1 S.S., R.O.W.=80'

ARROYO ROAD CHANNEL
10' B.W., 2.75:1 S.S., R.O.W.=80'

BRAHMAN ROAD CHANNEL
6' B.W., 3:1 S.S., R.O.W.=80'

STA. 71+00 PAV. DR. CHANNEL*
STA. 0+00 ARROYO ROAD CHANNEL

STA. 66+60 ARROYO ROAD CHANNEL*
STA. 0+00 S. MOONGATE ROAD COLLECTOR CHANNEL

STA. 40+50 ARROYO ROAD CHANNEL*
STA. 0+00 COLLECTOR CHANNEL

HANGAR LAKE ROAD

MOONGATE ROAD

BRAHMAN ROAD

NASA ROAD

ROAD

CHANNEL

JORNADA WATERSHED

SCALE: 1"=1000'

DATE OF PHOTOGRAPHY: 4/8/1989

A	B
D	C

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JORNADA MASTER DRAINAGE PLAN
MASTER DRAINAGE PLAN LAYOUT

FIGURE VI-18

JORNADA WATERSHED

SCALE: 1"= 1000' DATE OF PHOTOGRAPHY: 4/8/1989

A	B
D	C

KOOGLE & POULS ENGINEERING, INC.

JORNADA MASTER DRAINAGE PLAN
MASTER DRAINAGE PLAN LAYOUT
FIGURE VI-1C

KOOGLE & POULS ENGINEERING, INC.

JORNADA WATERSHED

SCALE: 1"=1000'

DATE OF PHOTOGRAPHY: 4/8/1989

A	B
D	C

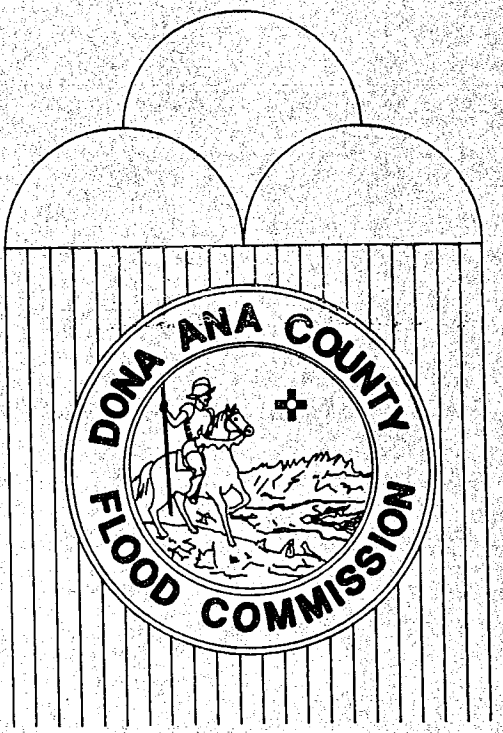
JORNADA MASTER DRAINAGE PLAN
MASTER DRAINAGE PLAN LAYOUT

FIGURE VI-1D

JORNADA MASTER DRAINAGE PLAN

VOLUME 2 OF 2

DONA ANA COUNTY, NEW MEXICO



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George P. Cressman, Director
Silver Spring, Maryland—1973

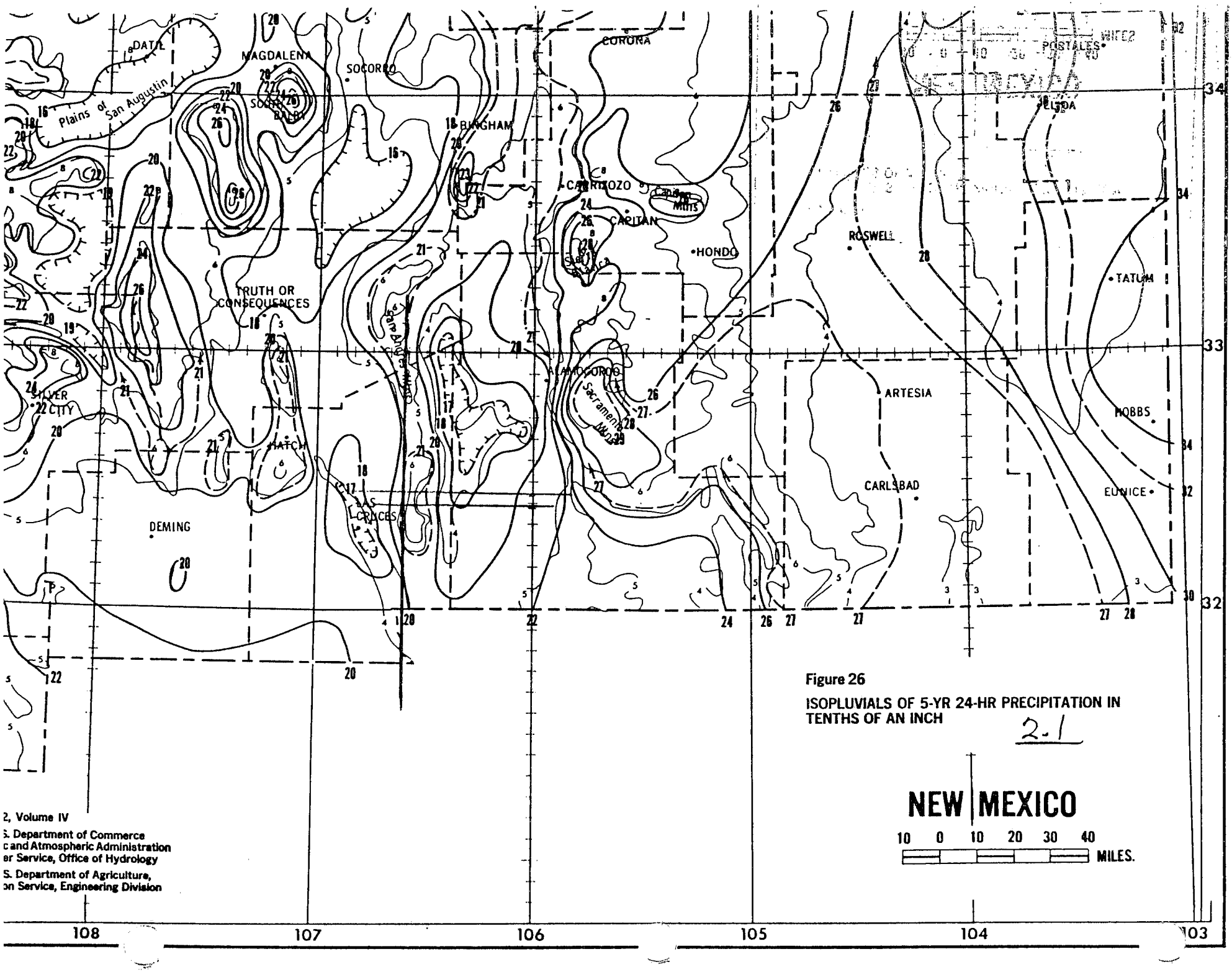


Figure 26

ISOPLUVIALS OF 5-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

2-1

NEW MEXICO

10 0 10 20 30 40 MILES.

2, Volume IV

S. Department of Commerce
c and Atmospheric Administration
er Service, Office of Hydrology

S. Department of Agriculture,
on Service, Engineering Division

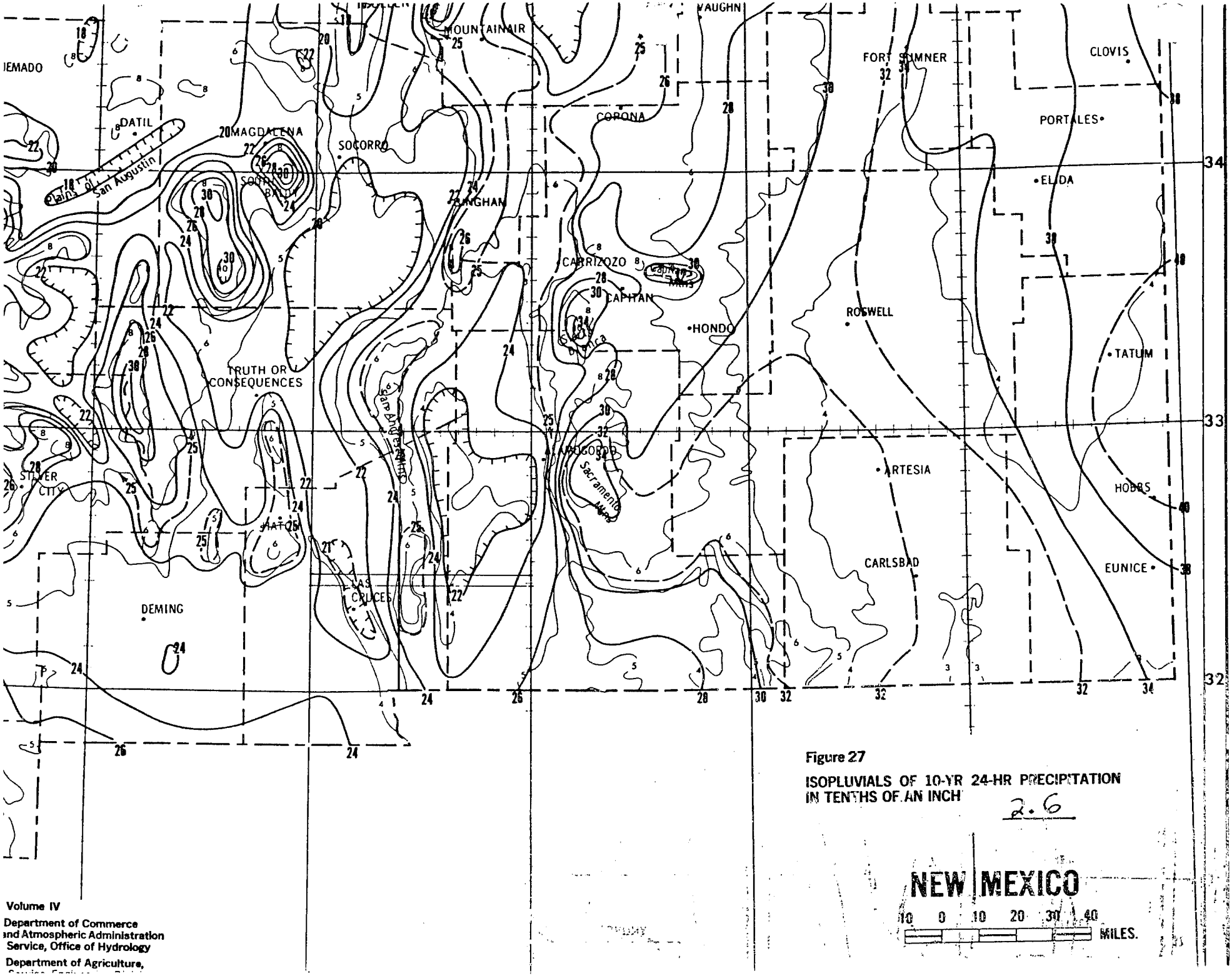


Figure 27

ISOPLUVIALS OF 10-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

2.6

Volume IV

Department of Commerce
and Atmospheric Administration
Service, Office of Hydrology

Department of Agriculture,

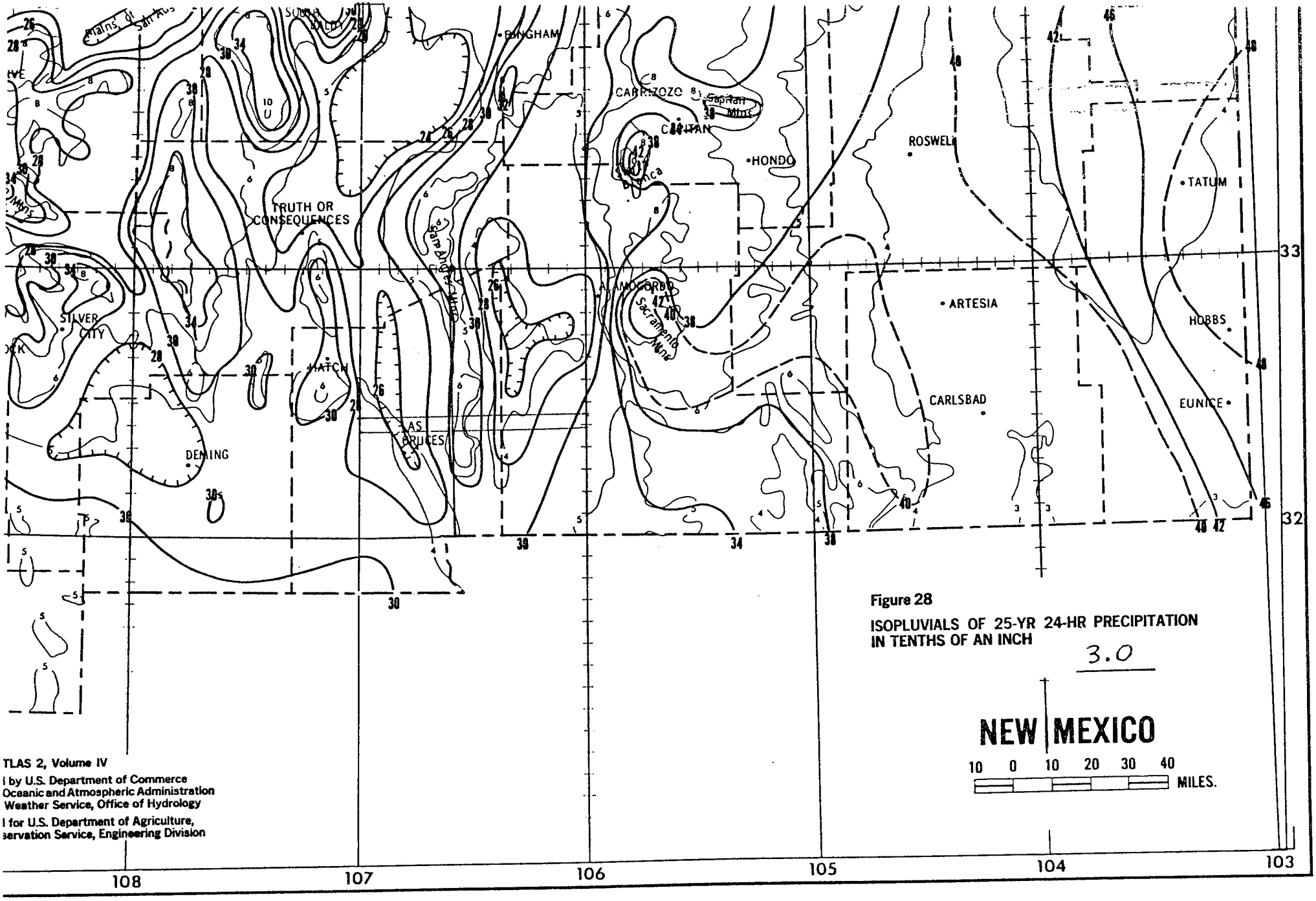


Figure 28

ISOPLUVIALS OF 25-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

3.0

NEW MEXICO

10 0 10 20 30 40 MILES.

TLAS 2, Volume IV

l by U.S. Department of Commerce
Oceanic and Atmospheric Administration
Weather Service, Office of Hydrology

l for U.S. Department of Agriculture,
servation Service, Engineering Division

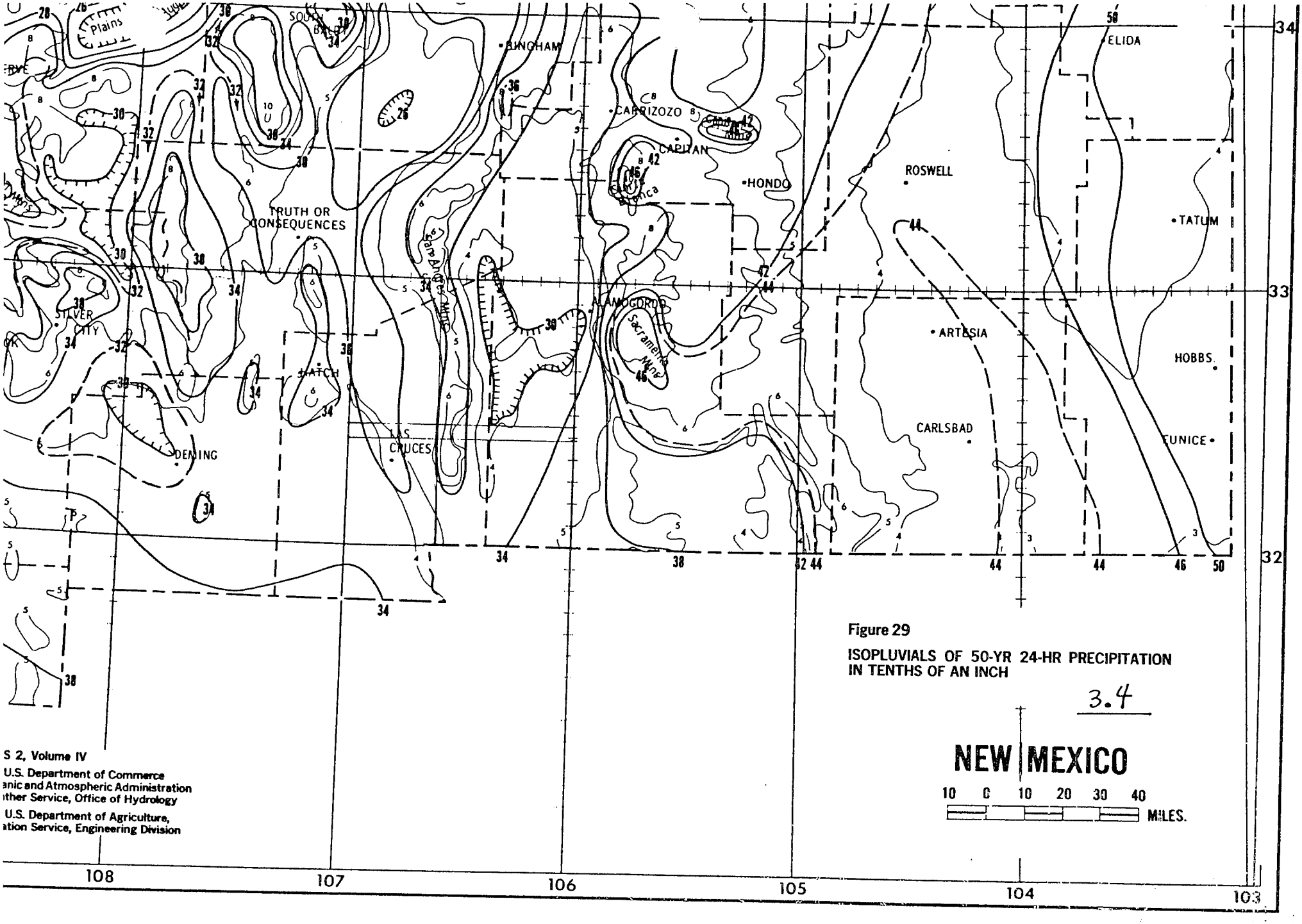


Figure 29

ISOPLUVIALS OF 50-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

3.4

NEW MEXICO

10 0 10 20 30 40 MILES.

S 2, Volume IV

U.S. Department of Commerce
anic and Atmospheric Administration
ther Service, Office of Hydrology

U.S. Department of Agriculture,
ation Service, Engineering Division

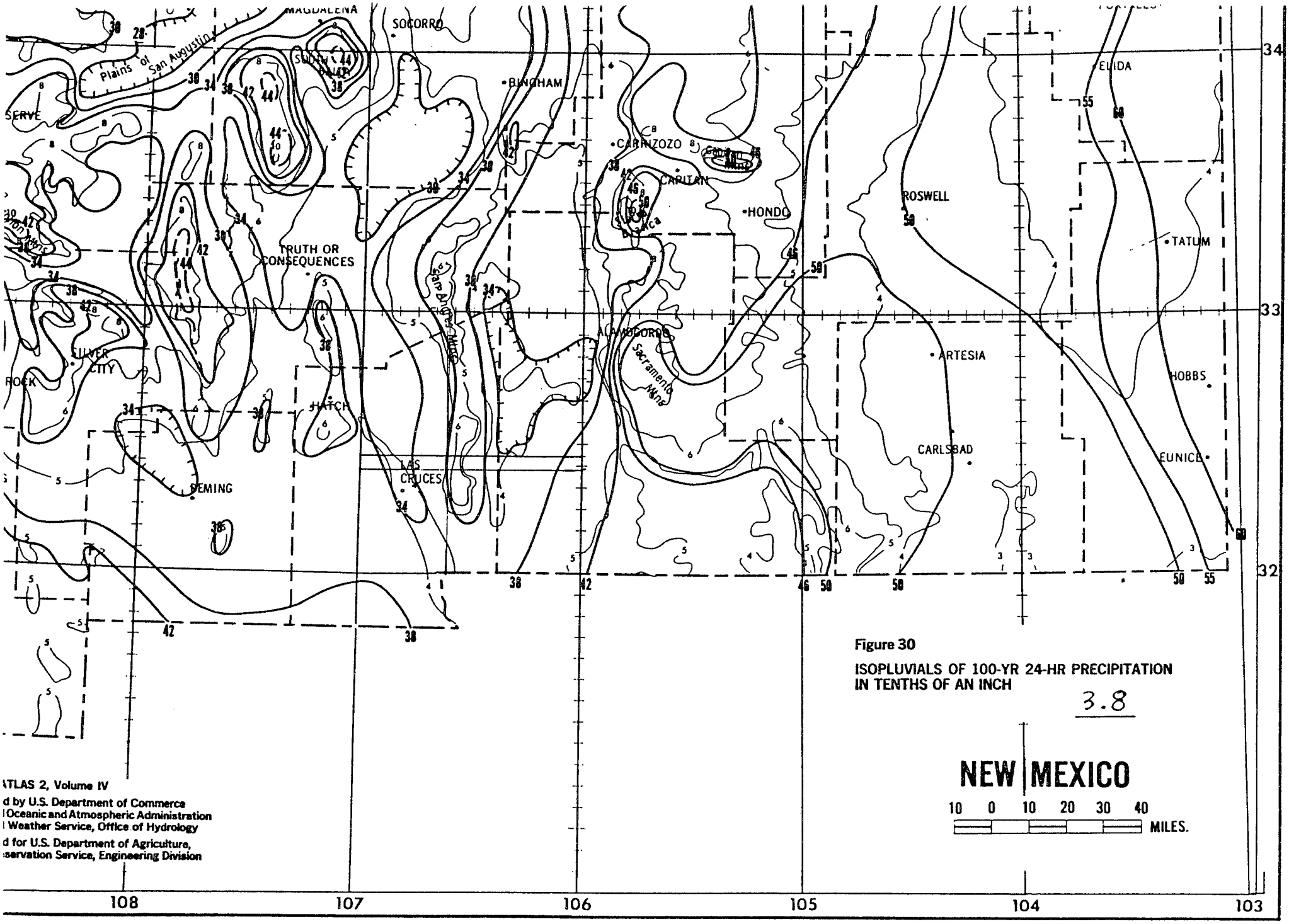


Figure 30

ISOPLUVIALS OF 100-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

3.8

NEW MEXICO

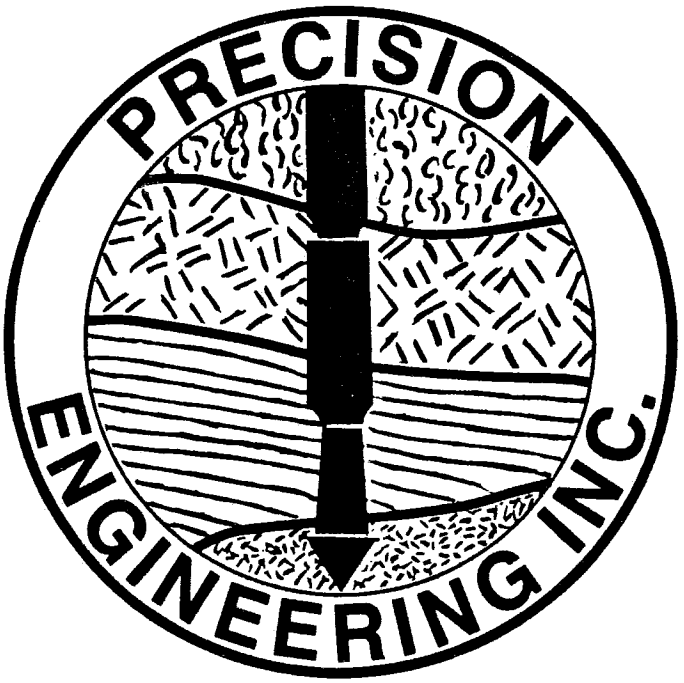
10 0 10 20 30 40 MILES.

ATLAS 2, Volume IV

d by U.S. Department of Commerce
l Oceanic and Atmospheric Administration
l Weather Service, Office of Hydrology

d for U.S. Department of Agriculture,
servation Service, Engineering Division

NOVEMBER 14, 1991



GEOTECHNICAL INVESTIGATION FOR THE EAST MESA DRAINAGE STUDY LAS CRUCES, NEW MEXICO

FILE NO.: 91-123

SUBMITTED TO:

LEEDSHILL HERKENHOFF
P.O. BOX 1217
ALBUQUERQUE, NEW MEXICO
87103

PRECISION ENGINEERING INC.

GEOTECHNICAL • MATERIALS • TESTING LABORATORY

Ph: (505) 523-7674 • FAX: (505) 523-7248

November 14, 1991

Mr. Chris Philips, E.I.
Leedshill Herkenhoff, Inc.
P.O. Box 1217
Albuquerque, New Mexico 87103

Re: Geotechnical Investigation for the East Mesa Drainage Study, Las Cruces, New Mexico

File No. 91-123

Dear Mr. Philips,

Enclosed please find our site investigation report for the above referenced project. This report describes our field and laboratory investigation, our findings, observations, and recommendations for site preparation, embankment construction, slopes, compaction, and inspection and testing for the project.

Once again it has been a pleasure working with you on this phase of your project. If you have any questions or require further services, please call us and we will be happy to discuss the matter to your satisfaction.

Sincerely,
PRECISION ENGINEERING, INC.

Philip L. Johnson

Philip L. Johnson, P.E.
PLJ/tm
Copies:(3) Above

GEOTECHNICAL INVESTIGATION FOR THE EAST MESA DRAINAGE STUDY LAS CRUCES, NEW MEXICO FILE NO: 91-123

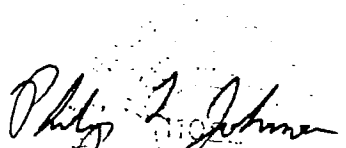
PREPARED BY

PRECISION ENGINEERING, INC.

P.O. BOX 422

LAS CRUCES, NEW MEXICO 88004

APPROVED BY



PHILIP L. JOHNSON, P.E.
P.E. NO. 11022
NOVEMBER 14, 1991

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General Site and Soil Conditions.....2
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1) Boring Plan
2) Boring Logs
3) Mechanical Grain Size Analysis
4) Key to Symbols and Classification
5) Soil Classification Chart

Field Investigation

A subsurface investigation for the proposed detention and channelization structures for numerous arroyo systems on the East Mesa east of Las Cruces was performed from the period from September 13, 1991 to October 22, 1991. Eleven (11) borings were advanced to depths generally ranging from twenty-one to twenty-nine feet. Boring locations are shown on the boring plan in the appendix of this report.

The borings were advanced using a truck-mounted drill with five and five-eighths (5-5/8) inch outside diameter, continuous flight, hollow stemmed auger. The borings were completed in accordance with ASTM D-1452: Standard Method for Soil Investigation and Sampling by Auger Methods.

As the auger was advanced, continuous visual inspection of cutting returns was maintained. Standard penetration testing samples were taken at five foot intervals throughout the total explored depths. Additional samples were taken at selected intervals from the auger cuttings.

Sampling and standard penetration resistance determinations were accomplished in accordance with ASTM D-1586: Standard Method for Penetration Test and Split-Barrel Sampling of Soils. Following field classification, the samples were identified and transported to the laboratory for further study.

The logs for the auger borings are provided in the appendix of this report.

Laboratory Investigation

Representative soil samples obtained from the field investigation were examined and classified based on the Unified Classification System (ASTM D-2487) and the AASHTO Classification System (AASHTO M-145). Atterberg limits were established on samples exhibiting a cohesive nature. Particle size analyses were conducted on representative samples. Moisture content determinations were made on representative samples. All of the above indicator tests were used to aid in defining soil stratification and general in situ soil conditions. The mechanical grain size analysis and soil classification results are provided in the appendix of this report.

All test procedures were conducted in general accordance with procedures outlined in the ASTM Standard Methods.

General Site and Soil Conditions

The site is located east of Las Cruces, New Mexico on what is commonly referred to as the East Mesa. The site is located both north and south of U.S. Highway 70 in Sections 9, 10, 15, and 16 of Township 22S, Range 3E, and Sections 27 and 34 of Township 21S, Range 3E. The project generally consists of channelization along a north-south orientation, such that the predominantly east-west arroyos are intercepted, diverted, and channelized upstream of developed areas to the west. The elevations in the investigated areas range from approximately 4600 to 4760 above mean sea level. The site is in the New Mexico Structural Unit known as the Las Cruces Basin.

The borings were performed at three detention facilities, the Brahman Detention facility north of US 70, and the Blair/Baylor and Minehouse Springs Detention facilities south of US 70. The locations of these facilities and the borings performed for them are indicated on the boring plan in the appendix of this report.

Borings one through four were performed for the Brahman Detention facility to a depth of twenty-one and one half feet. The soils encountered at this facility are a fine to medium sand with silt and/or clay fines. In addition, some scattered gravel was discovered below approximately eight feet at borings three and four. The soils vary somewhat along the facility alignment owing to the varied nature of deposits in an alluvial outwash system. The sand is dry to damp, typically medium dense to dense, and should provide suitable bearing materials for detention structures.

Borings five, seven, and eleven were performed at the proposed Minehouse Spring Detention facility. The borings were extended to a depth ranging from twenty-eight to twenty-nine feet. The soils varied appreciably between the three borings performed for this facility. The major soil type encountered is a fine to medium sand with varying amounts of clay, silt, and gravel. Some weak carbonate induration was also noted in these soils. The major soil variant at the Minehouse Spring Detention facility is a silty clay encountered in the upper five feet at boring eleven. The soils at the site vary from loose to very dense with medium dense to dense typical. The soils at this site should also provide suitable bearing materials for the proposed construction.

At the proposed Blair/Baylor Detention Facility four borings were advanced as requested, numbered six, eight, nine, and ten. The borings were advanced to an approximate depth of twenty-five feet. The soils at this proposed facility also varied somewhat ranging from a fine to medium sand to a sandy silt and silty clay. The soils at this site are predominantly a fine to medium sand with varying amounts of silt, clay, and gravel. The soils

are typically dry, light brown to light orange brown, and medium dense. The soils at the Blair/Baylor Detention facility should serve adequately for the proposed construction.

For all three facilities proposed the boring logs at each location should be consulted for the most accurate depiction of the soils to be encountered at those locations.

All three facility sites have substantial amounts of high permeability materials. In order to limit flow into structures an impermeable liner may be required.

Currently, the sites are moderately to heavily vegetated with mesquite bush, creosote bush, cacti and other semi-arid flora. Grubbing and clearing will be required prior to commencing the actual site grading. Excavation of the in-place soils should not be extremely difficult.

Groundwater was not encountered during the site investigation, nor, is it anticipated that it will become a problem in the future.

Analysis and Recommendations

Proposed Construction

We understand the project consists of the construction of three detention facilities in the approximate locations shown on the boring plan. The exact construction dimensions and approach for each facility are not known at the time of this report. We understand it is the intent of these facilities to catch runoff waters in either a detention basin or channel, such that water will be temporarily ponded or diverted to a controlled channel system. In addition, we understand the facilities may be a combination of cut and fill or entirely fill above grade. As such exact analyses and specific design recommendations are virtually impossible at this time, especially given the varying nature of the soil and the relatively limited subsurface data. In the following sections recommendations are given for general construction. Specific and detailed recommendations beyond those provided may require additional design input and field data.

We understand that the maximum berm heights for any facility will not exceed thirty (30) feet. In addition, we understand berms will be approximately twenty (20) feet in width at the crest. Structures are planned to be constructed from the materials at the site and other materials as required.

We request the opportunity to review the design plans and specifications prior to construction bidding to determine if the intent of the geotechnical design recommendations have been followed.

Site Preparation

All rubble, trash, vegetation and other deleterious material should be removed and disposed of off the site prior to commencing grading operations. Under no circumstances shall fill construction be allowed on surfaces which have not been cleared of vegetation and deleterious materials. Also, under no circumstances shall material containing vegetative debris or deleterious materials be allowed for use in the fill construction. Any holes created or encountered during the site preparation should be backfilled with compacted material.

General Embankment Construction

All fill used for embankment material should be keyed into the natural soil grade a minimum of five feet for the full width of the embankment base. Embankments should extend laterally a minimum of ten feet to key into the native soils at each end. Key trenches should be excavated in a manner such that the fill will be placed and compacted on horizontal native soil benches. To prevent significant stress concentrations at fill-native soil interfaces and to reduce the potential for piping avenues, it is recommended that the horizontal native soil benches be constructed in a manner such that they do not increase in elevation in greater than thirty-six (36) inch increments. The steps may be tapered somewhat so that compaction adjacent to the step can be achieved. It is recommended that the benching be accomplished in minimum bench widths of three (3) feet to allow for adequate stress distribution onto the native soil benches.

All fill for the general embankment construction should meet the following requirements:

Sieve	% Passing
4"	100
3/4"	70-100
#4	40-100
#200	0-35

It is recommended the plasticity index of the minus #40 sieve portion not exceed twelve (12). Many of the soils at the boring locations meet this requirement. Some native soils that do not meet these requirements may be blended with other soils such that an approved material is manufactured.

Once excavated and properly benched, the exposed natural soil surface should be scarified to a minimum of twelve (12) inches, the moisture content brought as close as practical to optimum moisture content (+2% to -1%) and compacted.

Embankment or berm fill should then be placed in compacted lifts to the proper grades. Fill should be placed in lifts not to exceed eight (8) inches in compacted thickness. If the contractor can demonstrate by the use of spined compactors that he can achieve the required unit weight using thicker lifts, the thicker lifts may be allowed. It is recommended that the density of the thicker lifts be checked using direct transmission nuclear techniques or excavated to an elevation where the density through the bottom of the layer can be measured. In no case is it recommended that compacted lifts greater than twelve (12) inches be allowed.

Compaction of cohesive material should be achieved with a sheepsfoot, pad wheel, spined, or similar compaction equipment. Smooth wheeled compaction equipment should be avoided except for finish work. The footed compactors tend to make more homogeneous soil embankments, whereas smooth wheeled equipment tend to make a layered structure leaving potential seepage avenues for water.

Arroyos or large embankments within the proposed structures that are not cut out by initial grading should be backfilled with compacted materials using benches as described above. Backfilling of the arroyos is an important portion of the construction. Poor quality backfilling of the arroyos will cause stress concentrations below embankments. The stress concentrations will potentially lead to excessive settlements in the fill and possibly overstressing in the soil causing leakage and further embankment distress or failure.

Much of the surficial soils at the site are fine to medium grained and cohesionless. The soils will have a relatively high coefficient of permeability. Much of the soil is also uniform in grain size and will tend to have a relatively low resistance to piping type failures. In order to protect embankments from piping failure and erosional effects exterior low permeability slopes should be constructed.

For low permeability slopes it is recommended that the materials used be uniformly graded. It is recommended that the low permeability materials be classified as CL, SC or GC according to the Unified Soil Classification System. In addition these materials should meet the following requirements:

Sieve	% Passing
4"	100
3/4"	70-100
#4	40-85
#200	25-60

The plasticity index of the minus #40 sieve portion should not be less than fifteen (15) and a liquid limit no greater than forty (40). Most all of the soils at the site do not meet these criteria.

Slopes

Several slopes have been analyzed for stability against shear failure using materials from the site. For the analysis it has been assumed the low permeability imported materials have a cohesion of 4.0 psi and phi angle of 12 degrees. The cohesionless and relatively high permeability material of the core has a cohesion of 0 psi and an apparent angle of internal friction (phi) of 30 degrees. The slopes discussed following are referenced by their horizontal to vertical ratio (i.e. a slope with 2 feet horizontal to 1 foot vertical is 2:1).

Bishop's analysis was performed on the proposed detention facilities for numerous slope angles. It was determined that upstream and downstream external slopes at 3:1 will provide a structurally stable configuration to support the proposed structures. The analysis assumed a maximum internal core slope of 2:1.

The slopes should be protected from degradation by means of vegetation, terracing, rock plating, or other suitable means of erosion protection.

The materials used for slope construction should be tested during construction to insure the design properties for phi angle and cohesion are valid.

Compaction Requirements

As mentioned previously, compaction of cohesive material should be accomplished with heavy sheepsfoot rolling equipment. Although, smooth wheel rollers can stratify the cohesive materials, it will most likely be the equipment of choice for noncohesive fill materials. Scarification between lifts should be maintained when using smooth wheeled equipment to reduce the possibility of developing significant stratification. The stratification provides seepage paths for water, reducing the fill strength and increasing the possibility for water intrusion.

It is recommended that the fill materials used in construction of granular berms and any low permeability exterior berms be compacted at or slightly above optimum moisture content. Although density requirements can be met when the soil is compacted below optimum moisture, the soil slightly wet of optimum, when compacted, provides a slightly more flexible structure which allows for settlement without significant damage to berms. The dryer soil has a more rigid, brittle structure and can crack when deformed. It is recommended that the moisture content during compaction not exceed two (2) percentage points above optimum moisture content, nor one (1) percentage point below.

Excellent moisture control and mixing of the soil will be the key to efficient fill placement.

All materials used to construct embankments should be compacted to a minimum of 90% of modified proctor density (ASTM D-1557). Materials within twenty-four inches of any associated structure should be compacted to a minimum of 95% of modified proctor density (ASTM D-1557).

Inspection and Testing

We recommend that all site grading and fill operations be inspected by a responsible geotechnical engineering firm. The inspecting engineer shall be a licensed professional engineer in the state of New Mexico and be able to provide continuous on site inspection by qualified personnel during all phases of construction. The inspecting engineer shall be responsible for immediately reporting any site or soil conditions encountered which appear to significantly vary from this report.

We strongly recommend the inspecting engineer be retained in the owner's behalf and, therefore, be directly responsible to the owner or owner's representative. We do not recommend these engineering services be made part of the bidding process.

Tests of materials should be made at the following rates:

A) One (1) in-place soil density per 5,000 square feet, but a minimum of two (2) per lift of compacted material per ASTM D-1556, ASTM D-2167, or ASTM D-2922 and D-3017.

B) One (1) moisture-density curve for each type of material used according to ASTM D-1557.

C) One sieve analysis and plasticity index per material used according to ASTM D-422, and D-4318.

Limitations

The methods utilized in this investigation and the recommendations made in this report are in accordance with generally accepted civil and geotechnical engineering practices and principles. The conclusions reached in this report are based on the data derived from eleven (11) borings and a general surface investigation.

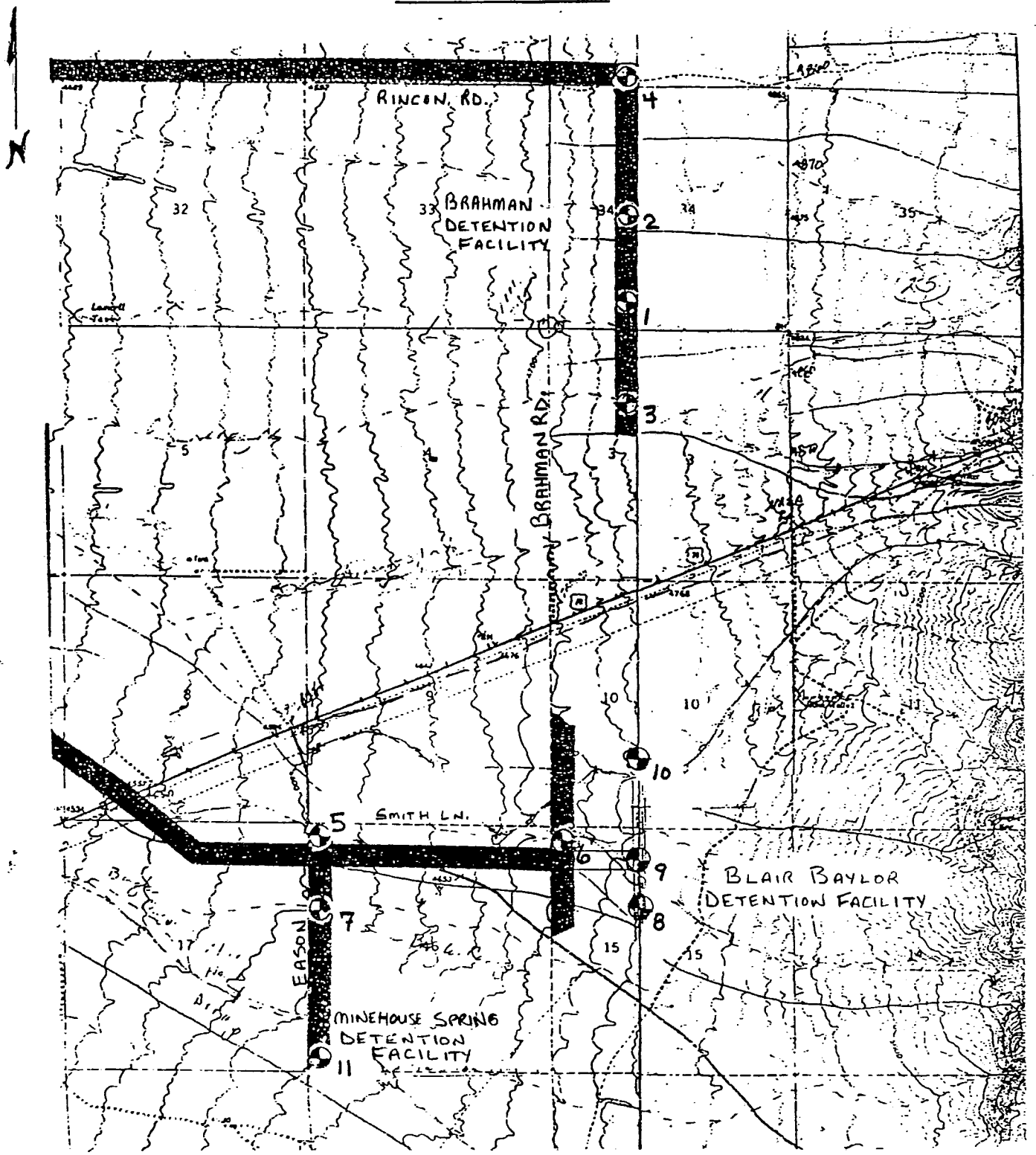
The recommendations made herein have been prepared for the most likely subsurface conditions that will be encountered at this site. Additionally, the recommendations have been tailored to fit our understanding of the proposed construction type and may not be suitable for other types of construction. The recommendations made in this report should not be used for the design of other structures outside the scope of this project.

A hazardous materials investigation is not within the scope of this geotechnical investigation. Therefore, the presence or absence of any hazardous materials on or near the site cannot be determined or inferred from this geotechnical investigation. In addition, any future conditions involving hazardous materials on site cannot be determined or inferred from this report.

If the subsurface conditions are observed to differ significantly from those described in this report, we request immediate notification to determine the effect, if any, of the newly discovered condition on the performance of the foundation before proceeding with construction.

APPENDIX

BORING PLAN



◒ = BORING NUMBER & LOCATION

NTS

PROJECT EAST MESA DRAINGE STUDY DRAWN BY JF DATE 10-4-91 FILE NO. 91-123

SHEET 1 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING PLAN | LOG OF TEST BORINGS | Location LAS CRUCES, NM

Elevation APPROX. 4760

Boring Number: ONE | Water Level NONE ENCOUNT. Date: 09/13/91

LAB #	DEPTH	BLOWS/N	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
17873	0.0 - 2.5	GRAB	*-**-*		G	SAND, FINE, SILTY, DRY, BROWN, LOOSE				
			*-**-*		G					
			*-**-*		G					
			*-**-*		G					
			*-**-*	2.5	G					
17874	2.5 - 4.0	GRAB	*-**-*		G					
			*-**-*		G					
	4.0		*-**-*		G					
			*/**/*			SAND, CLAYEY, SILTY, BROWN, DAMP, VERY DENSE				
			*/**/*	5						
17875	5.0 - 6.5	19-24-35	*/**/*		S		4.4	22	10	SC/A-2-4
			*/**/*		S					
			*/**/*		S					
	7.0		*/**/*							
17876	7.0 - 10.0	GRAB	*-**-*	7.5	G	SAND, FINE, SILTY, DRY, LIGHT BROWN, VERY				
			*-**-*		G	DENSE				
			*-**-*		G					
			*-**-*		G					
			*-**-*		G					
			*-**-*	10	G					
17877	10.0 - 11.5	15-34-27	*-**-*		S	GRADES LESS SILTY				
			*-**-*		S					
			*-**-*		S					
			*-**-*							
			*-**-*							
			*-**-*							
			*-**-*							
			*-**-*							
			*-**-*							
			*-**-*	15						
17878	15.0 - 16.5	12-9-9	*-**-*		S	MEDIUM DENSE	3.0	--	NP	SM/A-1-b
			*-**-*		S					
			*-**-*		S					
			*-**-*							
			*-**-*							
			*-**-*							
			*-**-*							
			*-**-*							
			*-**-*							
			*-**-*	20						
	20.0 - 20.5	24-	*-**-*		S	DENSE				
	20.5 - 21.5	-36-50	*/**/*		S	SAND, CLAYEY, SILTY, BROWN, DAMP, VERY DENSE				
	21.5		*/**/*		S					
	TOTAL DEPTH									

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: JFF

SHEET 2 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING PLAN | LOG OF TEST BORINGS | Location LAS CRUCES, NM

Elevation APPROX. 4760

Boring Number: TWO | Water Level NONE ENCOUNT. Date: 09/13/91

LAB #	DEPTH	BLOWS/N	POCKET TYPE	SAMPLE	SAMPLE TYPE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
17879	0.0 - 2.5	GRAB	***-**		G	SAND, MEDIUM TO COARSE, SLIGHTLY SILTY, LOOSE,				
			***-**		G	DRY, LIGHT BROWN				
			***-**		G					
			***-**		G					
			***-**	2.5	G					
17880	2.5 - 5.0	GRAB	***-**		G					
			***-**		G					
			***-**		G					
			***-**		G					
			***-**	5	G					
17881	5.0 - 6.5	6-5-3	***-**		S		3.2	--	NP	SP-SM/
			***-**		S					A-1-b
			***-**		S					
			***-**							
17882	7.0 - 10.0	GRAB	***-**	7.5	G					
			***-**		G					
			***-**		G					
			***-**		G					
			***-**		G					
	10.0		***-**	10	G					
17883	10.0 - 11.5	4-4-5	*-**-*		S	SAND, FINE, SILTY, DAMP, LIGHT BROWN, LOOSE	5.7	--	NP	SM/A-2-4
			*-**-*		S					
			*-**-*		S					
			*-**-*							
			*-**-*							
	13.0		*-**-*							
			******			SAND, MEDIUM TO COARSE, DRY TO DAMP, LIGHT				
			******			BROWN, DENSE				
			******							
			******	15						
17884	15.0 - 15.7	15-	******		S					
17885	15.7 - 16.5	-20-15	*/**-*		S	SAND, CLAYEY, SILTY, DAMP, LIGHT BROWN, DENSE				
			*/**-*		S					
			*/**-*							
			*/**-*							
			*/**-*			GRADES LESS SANDY				
			*/**-*							
			*/**-*							
			*/**-*							
			*/**-*	20						
17886	20.0 - 21.5	14-15-4	*/**-*		S	MEDIUM DENSE				
			*/**-*		S					
	21.5		*/**-*		S					
	TOTAL DEPTH									

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: JFF

SHEET 3 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING PLAN | LOG OF TEST BORINGS | Location LAS CRUCES, NM

Elevation APPROX. 4760

Boring Number: THREE | Water Level NONE ENCOUNT. Date: 09/13/91

LAB #	DEPTH	BLOWS/N	PLOT	SAMPLE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
17887	0.0 - 2.5	GRAB	******		G	SAND, MEDIUM TO COARSE, DAMP, BROWN, LOOSE				
			******		G					
			******		G					
			******		G					
	2.5		******	2.5	G					
17888	2.5 - 4.5	GRAB	*-**-*		G	SAND, MEDIUM TO COARSE, SILTY, BROWN, LOOSE				
			*-**-*		G					
			*-**-*		G					
	4.5		*-**-*		G					
			*/**/*	5		SAND, CLAYEY, LIGHT BROWN, DAMP, MEDIUM DENSE				
17889	5.0 - 6.5	9-10-11	*/**/*		S		6.7	23	10	SC/A-2-4
			*/**/*		S					
			*/**/*		S					
			*/**/*							
17890	7.0 - 10.0	GRAB	*/00/*	7.5		SCATTERED GRAVEL				
			/00/		G					
			/00/		G					
			/00/		G					
			/00/		G					
			/00/	10	G					
17891	10.0 - 11.5	25-12-11	*/00/*		S	SAND GRADES COARSER				
			/00/		S					
			/00/		S					
			/00/							
			/00/							
			/00/							
			/00/							
			/00/							
			/00/							
			/00/							
			/00/	15						
17892	15.0 - 16.5	23-50(5.5")	*/00/*		S	VERY DENSE	4.5	25	9	SC/A-2-4
			/00/		S					
			/00/							
			/00/							
			/00/							
			/00/							
			/00/							
			/00/							
			/00/							
			/00/							
			/00/	20						
17893	20.0 - 21.5	12-14-18	*/00/*		S					
			/00/		S					
			/00/		S					
	TOTAL DEPTH									

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: JFF

SHEET 4 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING | LOG OF TEST BORINGS | Location LAS CRUCES, NM

PLAN | Elevation APPROX. 4760

Boring Number: FOUR | Water Level NONE ENCOUNT. Date: 09/19/91

LAB #	DEPTH	BLOWS/N	PLOT	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
17929	0.0 - 2.5	GRAB	*-**-*	G	SAND, FINE TO COARSE, SILTY, LIGHT ORANGE				
			*-**-*	G	BROWN, DAMP 0.0 - 0.2' THEN DRY, LOOSE				
			*-**-*	G					
			*-**-*	G					
			*-**-* 2.5	G					
17930	2.5 - 5.0	GRAB	*-**-*	G	MODERATELY DENSE		--	NP	SM/A-2-4
			*-**-*	G					
			*-**-*	G					
			*-**-*	G					
			*-**-* 5	G					
17931	5.0 - 6.5	16-24-25	*-**-*	S	DENSE, LIGHT BROWN				
			*-**-*	S					
			*-**-*	S					
			*-**-*						
17932	7.0 - 9.0	GRAB	*-**-* 7.5						
			*-**-*	G					
			*-**-*	G					
			*-**-*	G					
			-0		SAND, FINE, SILTY, SCATTERED GRAVEL, DRY,				
			-0 10		LIGHT BROWN, MEDIUM DENSE				
17933	10.0 - 11.5	12-13-14	**-0**	S			--	NP	SM/A-1-b
			-0	S					
			-0	S					
			-0						
			-0						
			-0						
			-0						
			-0						
			-0						
			-0 15						
17934	15.0 - 16.4	9-29-50(5")	**-0**	S	COARSER SAND, VERY DENSE				
			-0	S					
			-0	S					
			-0						
			-0						
			-0						
			-0						
			-0						
			-0						
			-0						
			-0 20						
17935	20.0 - 21.5	22-20-20	**-0**	S	LESS SILT, DENSE		--	NP	SP-SM/
			-0	S					A-1-b
	21.5		**-0**	S					
	TOTAL DEPTH								

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: JFF

PRECISION ENGINEERING, INC.

File No. 91-123

Boring Location SEE BORING PLAN

LOG OF TEST BORINGS

Location LAS CRUCES, NM

Elevation APPROX. 4600

Boring Number: FIVE

Water Level NONE ENCOUNT. Date: 09/19/91

LAB #	DEPTH	BLOWS/N	PLOT	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
17936	0.0 - 2.0	GRAB	**/-**	G	SAND, FINE, CLAYEY, SILTY, REDDISH BROWN, DAMP		41	24	SC/A-7-6
			/-	G	LOOSE				
			/-	G					
	2.0		**/-**	G					
17937	2.0 - 5.0	GRAB	**0-**	2.5 G	SAND, MEDIUM TO COARSE, GRAVELLY, SLIGHTLY				
			0-	G	SILTY, LIGHT BROWN, DRY, MODERATELY DENSE				
			0-	G					
			0-	G					
			0-	G					
			0-	5 G					
17938	5.0 - 6.5	13-50	**0-**	S	VERY DENSE				
			0-	S					
			0-						
			0-						
17939	7.0 - 10.0	GRAB	**0-**	7.5					
			0-	G					
			0-	G					
			0-	G					
			0-	G					
			0-	10 G					
17940	10.0 - 11.5	24-32-50	**0-**	S			--	NP	SP-SM/
			0-	S					A-1-b
			0-	S					
			0-						
			0-						
			0-						
			0-						
			0-						
			0-						
			0-						
			0-	15					
17941	15.0 - 15.5	50(5.5")	**0-**	S					
			0-						
			0-						
			0-						
			0-						
			0-						
			0-						
			0-						
			0-						
			0-						
			0-	20					
	20.0 - 20.5	45-	**0-**	S			--	NP	SP-SM/
17942	20.5 - 21.5	-34-45	**/-**	S	SAND, FINE, CLAYEY, SILTY, LIGHT BROWN, DAMP,				A-1-b
			/-	S	VERY DENSE				
			/-						
			/-						
			/-						
			/-						
			/-	24					
			/-		CONTINUED ON NEXT PAGE				

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger

Logged By: JFP

SHEET 6 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING PLAN | LOG OF TEST BORINGS | Location LAS CRUCES, NM | Elevation APPROX. 4600

Boring Number: FIVE CONT. | Water Level NONE ENCOUNT. Date: 09/19/91

LAB #	DEPTH	BLOWS/N	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
			/-			SAND, FINE, CLAYEY, SILTY, LIGHT BROWN, DAMP,				
			/-	25		VERY DENSE				
17943	25.0 - 26.5	35-40-40	**/-**		S			25	12	SC/A-2-6
			/-		S					
			/-		S					
			/-							
			/-							
	28.0		**/-**							
	TOTAL DEPTH									
				30						
				35						
				40						
				45						

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: JFF

SHEET 7 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING PLAN | LOG OF TEST BORINGS | Location LAS CRUCES, NM | Elevation APPROX. 4700

Boring Number: SIX | Water Level NONE ENCOUNT. Date: 09/19/91

LAB #	DEPTH	BLOWS/N	PLOT	SAMPLE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	%M	LL	PI	CLASS.
17944	0.0 - 5.0	GRAB	******		G	SAND, FINE TO COARSE, DAMP, REDDISH BROWN,				
			******		G	LOOSE				
			******		G					
			******		G					
			******	2.5	G					
			******		G					
			******		G					
			******		G					
			******		G					
			******		G					
			******	5	G					
	5.0 - 5.5	12-	******		S					
17945	5.5 - 6.5	-19-30	/*-/*-		S	CLAY, SANDY, SILTY, DAMP, BROWN, HARD		24	11	CL/A-6
	6.5		/*-/*-		S					
			-/			SAND, SILTY, CLAYEY, DAMP, REDDISH BROWN,				
18236	7.0 - 8.5	GRAB	**-/**	7.5	G	MEDIUM DENSE				
			-/		G					
			-/		G					
	9.0		**-/**							
			-0			SAND, FINE TO MEDIUM, SILTY, SCATTERED GRAVEL,				
			-0	10		LIGHT BROWN, DRY, MEDIUM DENSE				
18237	10.0 - 11.5	12-7-10	**-0**		S		2.3	--	NP	SM/A-1-b
			-0		S					
			-0		S					
			-0							
			-0							
			-0							
			-0							
			-0							
			-0							
			-0							
			-0	15						
18238	15.0 - 16.5	11-15-13	**-0**		S					
			-0		S					
			-0		S					
			-0							
			-0							
	18.0		**-0**							
			*-**-*			SAND, FINE TO MEDIUM, SLIGHTLY SILTY, DRY,				
			*-**-*			LIGHT BROWN, MEDIUM DENSE				
			*-**-*							
			*-**-*	20						
18239	20.0 -21.5	5-6-12	*-**-*		S		2.3	--	NP	SP-SM/
			*-**-*		S					A-1-b
			*-**-*		S					
			*-**-*							
			*-**-*							
			*-**-*							
			*-**-*	25						
	25.0 - 25.2	50(2")	*-**-*		S	NO RECOVERY				
	TOTAL DEPTH									

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: JFF

SHEET 8 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING PLAN | LOG OF TEST BORINGS | Location LAS CRUCES, NM | Elevation APPROX. 4600

Boring Number: SEVEN | Water Level NONE ENCOUNT. Date: 10/21/91

LAB #	DEPTH	BLOWS/N	POCKET TORVANE	SAMPLE CORE	SAMPLE TYPE	MATERIAL CHARACTERISTICS (MOISTURE, CONDITION, COLOR, GRAINSIZE, ETC.)	%M	LL	PI	CLASS.
18240	0.0 - 4.0	GRAB	**--**		G	SAND, FINE, SILTY, REDDISH BROWN, DRY,				
			--		G	MODERATELY DENSE				
			--		G					
			--		G					
			--	2.5	G					
			--		G					
			--		G					
	4.0		**--**		G					
			-+			SAND, FINE, SILTY, CARBONATE INDURATED CCI 1,				
			-+	5		DAMP, WHITISH BROWN, DENSE				
18241	5.0 - 6.5	10-12-24	**-+**		S		5.6	--	NP	SM/A-2-4
			-+		S					
			-+		S					
			-+							
			-+	7.5		SCATTERED FINE GRAVEL @ 7.0'				
18242	7.5 - 10.0	GRAB	**-+0*		G					
			**-+0*		G					
			**-+0*		G					
			**-+0*		G					
			**-+0*	10	G					
18243	10.0 - 11.5	18-12-13	**-+0*		S	MEDIUM DENSE, DRY	2.8	--	NP	SM/A-1-b
			**-+0*		S					
			**-+0*		S					
			**-+0*							
			**-+0*							
			**-+0*							
			**-+0*							
			**-+0*							
			**-+0*							
			**-+0*	15						
18244	15.0 - 16.5	25-22-14	**-+0*		S					
			**-+0*		S					
			**-+0*		S					
			**-+0*							
			**-+0*							
			**-+0*							
			**-+0*							
			**-+0*							
			**-+0*							
			**-+0*							
			**-+0*	20						
18245	20.0 - 20.5	50(6")	**-+0*		S	POOR RECOVERY, VERY DENSE				
			**-+0*							
			**-+0*							
	22.0		**-+0*							
			-/			SAND, SILTY, SLIGHTLY CLAYEY, REDDISH BROWN,				
			-/			DAMP, VERY DENSE				
			-/							
			-/	24						
			-/			CONTINUED ON NEXT PAGE				

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: JFF

SHEET 9 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING | LOG OF TEST BORINGS | Location LAS CRUCES, NM

PLAN | Elevation APPROX. 4600

Boring Number: SEVEN CONT. | Water Level NONE ENCOUNT. Date: 10/21/91

LAB #	DEPTH	BLOWS/N	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
			-/			SAND, SILTY, SLIGHTLY CLAYEY, REDDISH BROWN,				
			-/	25		DAMP, VERY DENSE				
18246	25.0 - 25.8	40-50(4")	**-/**		S		11.5	--	NP	SM/A-4
			-/		S					
			-/							
			-/							
			-/							
	28.0		**-/**							
	TOTAL DEPTH									
				30						
				35						
				40						
				45						

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: JFF

SHEET 10 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING | LOG OF TEST BORINGS | Location LAS CRUCES, NM

PLAN | Elevation APPROX. 4740

Boring Number: EIGHT | Water Level NONE ENCOUNT. Date: 10/22/91

LAB #	DEPTH	BLOWS/N	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
18247	0.0 - 4.5	GRAB	**//**		G	SAND, CLAYEY, ORANGE BROWN, DAMP, MODERATELY	4.5	23	7	SC/A-4
			//		G	DENSE				
			//		G					
			//		G					
			//	2.5	G					
			//		G					
			//		G					
			//		G					
	4.5		**//**		G					
			--	5		SAND, SILTY, SCATTERED MEDIUM SAND, DRY, DENSE				
18248	5.0 - 6.5	13-16-15	**--**		S	LIGHT ORANGE BROWN				
			--		S					
			--		S					
			--							
			--	7.5						
			--							
			--							
			--							
			--							
			--	10						
18249	10.0 - 11.5	9-12-15	*-**0*		S	MEDIUM DENSE, SCATTERED GRAVEL UP TO 1 1/2"	3.0	--	NP	SM/A-1-b
			*-**0*		S	@ 10'				
			*-**0*		S					
			*-**0*							
			*-**0*							
			*-**0*							
			*-**0*							
			*-**0*							
			*-**0*							
			*-**0*							
			*-**0*	15						
18250	15.0 - 16.5	13-13-13	*-**0*		S	SILTIER				
			*-**0*		S					
			*-**0*		S					
			*-**0*							
			*-**0*							
	18.0		*-**0*							
			-0			SAND, MEDIUM TO COARSE, SILTY, SCATTERED				
			-0			GRAVEL, LIGHT BROWN, DRY, DENSE				
			-0							
			-0	20						
18251	20.0 - 21.5	11-25-20	**-0**		S		1.6	--	NP	SP-SM/
			-0		S					A-1-b
			-0		S					
			-0							
			-0							
			-0							
			-0	25						
18252	25.0 - 26.5	18-19-36	**-0**		S	VERY DENSE				
	26.5		**-0**		S					
	TOTAL DEPTH									

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: TT/PLJ

SHEET 11 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING PLAN | LOG OF TEST BORINGS | Location LAS CRUCES, NM | Elevation APPROX. 4730

Boring Number: NINE | Water Level NONE ENCOUNT. Date: 10/22/91

LAB #	DEPTH	BLOWS/N	PLOT	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
18253	0.0 - 5.0	GRAB	**-/**	G	SAND, SILTY, SLIGHTLY CLAYEY, LIGHT ORANGE				
			-/	G	BROWN, DAMP, MODERATELY DENSE				
			-/	G					
			-/	G					
			-/ 2.5	G					
			-/	G					
			-/	G					
			-/	G					
			-/	G					
	5.0		**-/** 5	G					
18254	5.0 - 6.5	7-12-25	-/**-/	S	SILT-CLAY, SANDY, LIGHT ORANGE BROWN, DAMP,	5.9	24	7	ML-CL/A-4
			-/**-/	S	HARD				
			-/**-/	S					
			-/**-/						
			-/**-/ 7.5						
			-/**-/						
			-/**-/						
			-/**-/						
			-/**-/						
			-/**-/ 10						
18255	10.0 - 11.5	12-11-11	-/**-/	S	VERY STIFF				
			-/**-/	S					
			-/**-/	S					
			-/**-/						
			-/**-/						
			-/**-/						
			-/**-/						
			-/**-/						
			-/**-/						
			-/**-/ 15						
18256	15.0 - 16.5	24-16-12	-/**-/	S					
			-/**-/	S					
			-/**-/	S					
			-/**-/						
			-/**-/						
	18.0		-/**-/						
			--		SAND, FINE TO MEDIUM, SILTY, LIGHT ORANGE				
			--		BROWN, DRY, DENSE				
			--						
			-- 20						
18257	20.0 - 21.5	10-16-25	**--**	S		1.9	--	NP	SP-SM/
			--	S					A-1-b
			--	S					
			--						
			--						
			-- 25						
18258	25.0 - 25.5	50(5.5")	**-0**	S	VERY DENSE, GRAVELLY				
	TOTAL DEPTH								

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: TT/PLJ

SHEET 12 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING | LOG OF TEST BORINGS | Location LAS CRUCES, NM

PLAN | Elevation APPROX. 4740

Boring Number: TEN | Water Level NONE ENCOUNT. Date: 10/22/91

LAB #	DEPTH	BLOWS/N	POT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
18259	0.0 - 2.5	GRAB	**--**		G	SAND, SILTY, LIGHT BROWN, MODERATELY DENSE,				
			--		G	DRY				
			--		G					
			--		G					
	2.5		**--**	2.5	G					
			++*+			SAND, CARBONATE INDURATED CCI 3-4, WHITE, DRY,				
			++*+			VERY DENSE				
			++*+							
			++*+							
	5.0		*+*+*+	5						
			*-**+*			SAND, FINE TO MEDIUM, SILTY, WHITE BROWN, DRY,				
			*-**+*			VERY DENSE, SLIGHT CARBONATE INDURATION CCI 1				
			*-**+*							
			*-**+*							
			*-**+*	7.5						
18260	7.5 - 9.0	25-37-24	*-**+*		S		3.4	--	NP	SM/A-1-b
			*-**+*		S					
			*-**+*		S					
	9.5		*-**+*							
			/-+*	10		SAND, CLAYEY, SILTY, SLIGHT CARBONATE INDURA-				
18261	10.0 - 11.5	19-34-50	*/*-+*		S	TION CCI 1, VERY DENSE, DAMP, LIGHT BROWN	7.7	29	15	SC/A-6
			/-+*		S					
			/-+*		S					
			/-+*							
			/-+*							
			/-+*							
			/-+*							
			/-+*							
			/-+*							
			/-+*	15						
18262	15.0 - 16.5	15-17-19	**--**		S	NO CCI, DENSE, LESS CLAYEY				
			--		S					
			--		S					
			--							
			--							
			--							
			--							
			--							
			--							
			--	20						
18263	20.0 - 21.3	27-23-50(4")	**-+**		S	CCI 0-1, VERY DENSE, WHITE BROWN				
			-+		S	SCATTERED GRAVEL 21 - 25'				
			**-+0*		S					
			**-+0*							
			**-+0*							
			**-+0*	25						
18264	25.0 - 26.5	25-29-25	**-+0*		S		3.9	--	NP	SM/A-2-4
	26.5		**-+0*		S					
	TOTAL DEPTH									

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: TT/PLJ

SHEET 13 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING PLAN | LOG OF TEST BORINGS | Location LAS CRUCES, NM

Elevation APPROX. 4640

Boring Number: ELEVEN | Water Level NONE ENCOUNT. Date: 10/22/91

LAB #	DEPTH	BLOWS/N	POCKET TORVANE	SAMPLE CHANGE	SAMPLE TYPE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
18265	0.0 - 5.0	GRAB	//**//		G	CLAY, SANDY, LIGHT BROWN, DAMP, STIFF				
			//**//		G					
			//**//		G					
			//**//		G					
			//**//	2.5	G					
			//**//		G					
			//**//		G					
			//**//		G					
			//**//		G					
	5.0		//**//	5	G					
18266	5.0 - 6.5	20-30-36	**-0**		S	SAND, FINE TO MEDIUM, SILTY, SCATTERED GRAVEL,	3.5	--	NP	SM/A-4
			-0		S	DRY, VERY DENSE, LIGHT BROWN				
			-0		S					
			-0							
			-0	7.5						
			-0							
			-0							
			-0							
			-0							
			-0	10						
18267	10.0 - 11.5	11-12-12	**-0**		S	MEDIUM DENSE				
			-0		S					
			-0		S					
			-0							
			-0							
	13.0		**-0**							
			-/			SAND, SILTY, SLIGHTLY CLAYEY, WHITISH BROWN,				
			-/			DAMP, VERY DENSE				
			-/							
			-/	15						
18268	15.0 - 16.5	20-30-30	**-/**		S					
			-/		S					
			-/		S					
			-/							
			-/							
			-/							
			-/							
			-/							
			-/							
			-/	20						
18269	20.0 - 21.5	16-17-18	**-/**		S	DENSE	3.4	--	NP	SM/A-2-4
			-/		S					
			-/		S					
			-/							
			-/							
			-/							
			-/							
			-/	24						
			-/			CONTINUED ON NEXT PAGE				

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: TT/PLJ

SHEET 14 OF 14 | PRECISION ENGINEERING, INC. | File No. 91-123

Boring Location SEE BORING PLAN | LOG OF TEST BORINGS | Location LAS CRUCES, NM | Elevation APPROX. 4640

Boring Number: ELEVEN CONT. | Water Level NONE ENCOUNT. Date: 10/22/91

LAB #	DEPTH	BLOWS/N	PLOT	SCALE	SAMPLE	MATERIAL CHARACTERISTICS (MOISTURE,CONDITION,COLOR,GRAINSIZE,ETC.)	%M	LL	PI	CLASS.
			-/			SAND, SILTY, SLIGHTLY CLAYEY, WHITISH BROWN,				
			-/	25		DAMP, DENSE				
18270	25.0 - 26.5	27-30-34	**-/**		S	VERY DENSE				
			-/		S					
			-/		S					
			-/							
			-/							
			-/							
			-/							
	29.0		**-/**							
	TOTAL DEPTH									
				30						
				35						
				40						
				45						

Size & Type of Boring: 5-5/8" OD Hollow Stemmed Auger | Logged By: TT/PLJ

PRECISION ENGINEERING, INC.
Civil & Technical Consultants
P.O. Box 4 Las Cruces, NM 88004
(505) 523-7674

MECHANICAL GRAIN SIZE ANALYSIS SUMMARY

PROJECT: East Mesa Drainage Study

LOCATION: Las Cruces, NM

FILE NO: 91-123

DATE : October 29, 1991

Boring #	Lab #	Depth	Sieve Analysis % Passing														Atterberg Limits		USCS Class.	AASHTO Class.
			3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#140	#200	LL	PI		
1	17875	5.0 - 6.5					100	96	95	93	83	67	55	49	38	34.1	22	10	SC	A-2-4
1	17878	15.0 - 16.5					100	98	93	86	64	40	29	23	15	12.5	--	NP	SM	A-1-b
2	17881	5.0 - 6.5							100	95	71	43	26	16	7	6.2	--	NP	SP-SM	A-1-b
2	17883	10.0 - 11.5								100	99	95	88	71	32	21.4	--	NP	SM	A-2-4
3	17889	5.0 - 6.5				100	90	90	90	87	75	60	50	42	32	29.2	23	10	SC	A-2-4
3	17892	15.0 - 16.5						100	99	93	68	48	38	30	20	16.3	25	9	SC	A-2-4
4	17930	2.5 - 5.0						100	98	94	80	66	56	48	34	29.1	--	NP	SM	A-2-4
4	17933	10.0 - 11.5		100	86	86	86	83	82	77	63	46	37	30	21	18.4	--	NP	SM	A-1-b
4	17935	20.0 - 21.5					100	98	97	92	66	36	22	16	9	7.7	--	NP	SP-SM	A-1-b
5	17936	0.0 - 2.0						100	97	92	82	71	65	60	49	45.4	41	24	SC	A-7-6
5	17940	10.0 - 11.5					100	98	97	84	59	32	19	13	8	7.4	--	NP	SP-SM	A-1-b
5	17943	25.0 - 26.5							100	97	86	71	61	53	40	35.1	25	12	SC	A-2-6
6	17945	5.5 - 6.0							100	98	93	84	75	69	58	53.8	24	11	CL	A-6
6	18237	10.0 - 11.5				100	98	94	94	88	73	53	41	32	22	14.6	--	NP	SM	A-1-b
6	18239	20.0 - 21.5							100	96	78	48	29	20	11	9.1	--	NP	SP-SM	A-1-b

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MECHANICAL GRAIN SIZE ANALYSIS SUMMARY

PROJECT: East Mesa Drainage Study

LOCATION: Las Cruces, NM

FILE NO: 91-123

DATE : October 29, 1991

Boring #	Lab #	Depth	Sieve Analysis % Passing														Atterberg Limits		USCS Class.	AASHTO Class.
			3"	2"	1 1/2"	1"	3/4"	1/2"	3/8"	#4	#10	#20	#40	#60	#140	#200	LL	PI		
7	18241	5.0 - 6.5					100	94	93	91	84	77	71	64	42	35.0	--	NP	SM	A-2-4
7	18243	10.0 - 11.5				100	94	87	83	74	60	46	36	30	22	14.5	--	NP	SM	A-1-b
7	18246	25.0 - 26.0								100	94	83	75	68	49	42.0	--	NP	SM	A-4
8	18247	0.0 - 4.5					100	97	97	91	80	67	59	54	46	38.0	23	7	SC	A-4
8	18249	10.0 - 11.5			100	92	92	90	90	82	65	45	34	28	20	16.5	--	NP	SM	A-1-b
8	18251	20.0 - 21.5			100	93	93	91	88	80	59	32	19	13	11	5.6	--	NP	SP-SM	A-1-b
9	18254	5.0 - 6.5							100	98	93	83	74	68	58	53.0	24	7	ML-CL	A-4
9	18257	20.0 - 21.5					100	95	95	87	64	30	17	13	11	7.9	--	NP	SP-SM	A-1-b
10	18260	7.5 - 9.0				100	93	88	87	82	73	57	46	37	24	19.2	--	NP	SM	A-1-b
10	18261	10.0 - 11.5							100	98	93	82	70	62	49	38.8	29	15	SC	A-6
10	18264	25.0 - 26.5							100	97	88	72	59	49	33	27.6	--	NP	SM	A-2-4
11	18266	5.0 - 6.5						100	98	96	89	79	72	66	50	37.3	--	NP	SM	A-4
11	18269	20.0 - 21.5							100	98	89	79	71	55	23	18.5	--	NP	SM	A-2-4

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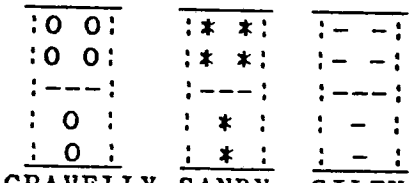
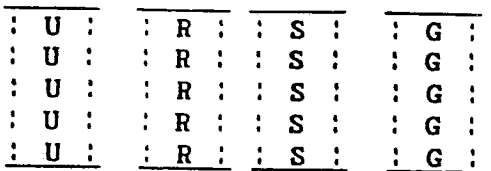
KEY TO SOIL CLASSIFICATION AND SYMBOLS

SOIL TYPE



SAMPLE TYPE



TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOIL

(major portion retained on #200 sieve)

Includes (1) clean gravels and sands described as fine, medium, or coarse, depending on grain size distribution and (2) silty or clayey gravels or sands.

Penetration Resistance**	Descriptive Term
0 - 5	Very Loose
6 - 10	Loose
11 - 15	Moderately Dense
16 - 30	Medium Dense
31 - 50	Dense
over 50	Very Dense

FINE GRAINED SOILS

(major portion passing a #200 sieve)

Includes (1) inorganic and inorganic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency rated according to shear strength.

Penetration Resistance**	Descriptive Term
1 - 3	Very Soft
4 - 6	Soft
7 - 11	Firm
12 - 19	Stiff
20 - 30	Very Stiff
over 30	Hard

Descriptive Term (in terms of % moisture)

Dry 0-4%, Damp 4-8%, Moist 8-20%, Wet >20%, Water Bearing is below water table

** Measured in blows/foot by a 140# hammer falling 30".

PRECISION ENGINEERING INC.

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CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES

ASTM Designation: D 2487 – 69 AND D 2488 – 69

(Unified Soil Classification System)

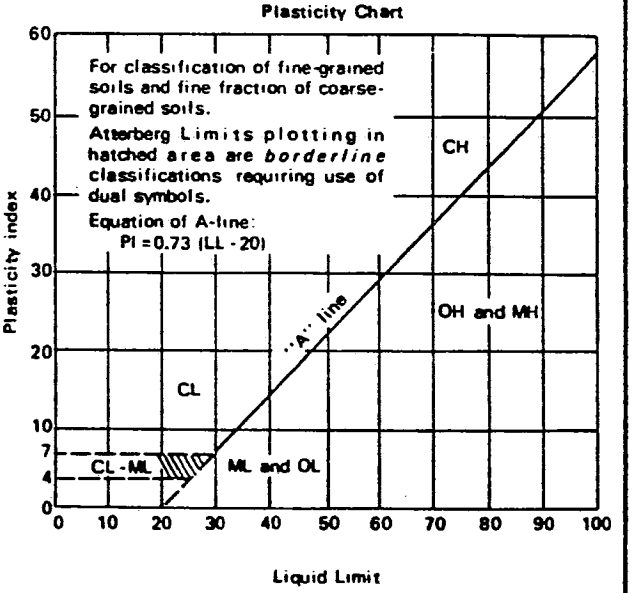
Major divisions			Group symbols	Typical names	Classification criteria
Coarse-grained soils: More than 50% retained on No. 200 sieve*	Gravels: 50% or more of coarse fraction retained on No. 4 sieve	Clean gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_Z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines	Not meeting both criteria for GW
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
	Sands: More than 50% of coarse fraction passes No. 4 sieve	Clean sands	SW	Well-graded sands and gravelly sands, little or no fines	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_Z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3
			SP	Poorly graded sands and gravelly sands, little or no fines	Not meeting both criteria for SW
		Sands with fines	SM	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4
			SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with P.I. greater than 7
Fine-grained soils: 50% or more passes No. 200 sieve*	Silts and clays: Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
			OL	Organic silts and organic silty clays of low plasticity	
	Silts and clays: Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts	
			CH	Inorganic clays of high plasticity, fat clays	
			OH	Organic clays of medium to high plasticity	
	Highly organic soils		Pt	Peat, muck and other highly organic soils	

Classification on basis of percentage of fines
Less than 5% pass No. 200 sieve . . . . . GW, GP, SW, SP
More than 12% pass No. 200 sieve . . . . . GM, GC, SM, SC
5 to 12% pass No. 200 sieve . . . . . *Borderline* classifications requiring use of dual symbols

Atterberg limits plotting in hatched area are *borderline* classifications requiring use of dual symbols

Atterberg limits plotting in hatched area are *borderline* classifications requiring use of dual symbols

Plasticity Chart



*Based on the material passing the 3 in. (76 mm) sieve.

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CARBONATE CEMENTATION INDEX (CCI) RATING SCALE

GENERAL PROPERTIES:

1. N ESSENTIALLY TOTALLY DEPENDENT ON PARENT MATERIAL. SOIL SHOWS SLIGHT ACCUMULATION OF CARBONATE. OFTEN SMALL WHITE NODULES OR THIN WHITE FILAMENTS WITHIN SOIL MATRIX, MAY HAVE MOTTLED APPEARANCE. CARBONATES TEND TO PLUG OR ACT AS A WEAK BONDING AGENT RATHER THAN REPLACING SOIL CONSTITUENTS. ALL PROPERTIES OF THE SOIL ARE BASED ON THE PARENT MATERIAL. CONCENTRATION OF CARBONATE IS ONLY VISUALLY APPARENT. EXCAVATION EFFORTS ESSENTIALLY UNAFFECTED BY PRESENCE OF CARBONATES WITHIN SOIL MATRIX. BASICALLY SOIL WITH WHITE STAINING.

2. N VALUES PRIMARILY DEPENDENT ON PARENT MATERIALS, GENERALLY SLIGHTLY ELEVATED. READILY DISTINGUISHABLE PARENT MATERIAL. COLOR GENERALLY SLIGHTLY LIGHTER THAN PARENT MATERIAL AUGERING EFFORTS DEPENDENT ON CONDITIONS OF PARENT MATERIALS. EXCAVATION EFFORTS REQUIRED LITTLE TO NO INCREASE FROM PARENT MATERIAL EXCAVATION EFFORTS. TYPICAL CARBONATE REPLACEMENT RANGES FROM 25 TO 75% BY VISUAL OBSERVATION. CONCENTRATIONS OFTEN SEEN IN SMALL TO MEDIUM SIZED NODULES, MAY HAVE A BEDDED APPEARANCE. ALWAYS SOME PARENT MATERIAL READILY DINSTINGUISABLE. CARBONATE CONCENTRATIONS EASILY BROKEN DOWN BY HAND. HAND EXCAVATION POSSIBLE IF PARENT MATERIAL EXCAVATABLE BY HAND. SOIL MATRIX GENERALLY PLUGGED BY CARBONATES. BASICALLY SOIL HAS SIGNIFICANT STAINING AND IS SLIGHTLY TO MODERATELY ALTERED FROM ORIGINAL PARENT MATERIAL NATURE.

3. GENERALLY N LESS THAN 50. N IS INCREASED SIGNIFICANTLY BY CARBONATE PRESENCE. STRENGTH PROPERTIES PRIMARILY DEPENDENT ON CARBONATE CEMENTATION. TYPICALLY READILY DRILLABLE BY AUGER METHODS, BUT AGAIN PARTIALLY DEPENDENT ON PARENT MATERIAL. NON-LAMINAR TO MOSTLY HOMOGENEOUS. TRANSITIONAL STATE BETWEEN SOIL AND ROCKLIKE CARBONATES. READILY PENETRATED WITH A KNIFE. HAND SPECIMENS TYPICALLY CRUSHED BY HAND. SOME MATERIAL WILL BREAK DOWN IN WATER, BUT TENDS TO LEAVE LUMPS. DIFFICULT TO BREAK WITH TWO HANDS. "POKER CHIP" SAMPLES FROM SPT SAMPLING. GENERALLY WHITE TO BUFF, MAY BE PINK. READILY EXCAVATABLE WITH MODERATE TO HEAVY EQUIPMENT. 75 TO 100% REPLACEMENT. PARENT MATERIAL MAY BE IDENTIFIABLE (I.E. GRAVELS, SAND).

4 N > 30. MAY HAVE PEBBLE GHOSTS, REMNANTS OF PARENT MATERIALS, CUPPED PEBBLES. AUGER DRILLING WITH DIFFICULTY. ROCKLIKE. SCRATCH WITH A KNIFE WITH DIFFICULTY. GENERALLY VARIES IN HARDNESS, INDURATION. MAY APPEAR THIN WAVY BEDDED. "POKER CHIP" PIECES AND BROKEN DOWN, WELL INDURATED PIECES IN SPT SAMPLER. WHITE, PINK, TO TAN, MAY WEATHER DARK GREY TO BLACK. RARELY MASSIVE. EXCAVATION EFFORTS TYPICALLY REQUIRE RIPPING. GENERALLY DOZER EXCAVATIONS POSSIBLE WITH PLATY BLOCKS RESULTING. BACKHOE EXCAVATION MAY BE POSSIBLE BUT WITH DIFFICULTY. 100% REPLACEMENT OF SOIL CONSTITUENTS. GENERALLY SHOWS LITTLE TO NO BREAKDOWN IN WATER.

5. N > 50 ALWAYS, GENERALLY >100. EXTREMELY DIFFICULT TO AUGER, OFTEN AUGER REFUSAL. ROCKLIKE, LIGHT COLORED, WHITE, PINK, GREY, TO TAN. WEATHERS GREY TO BLACK. COMPLETE SOIL CONSTITUENT REPLACEMENT. PARENT MATERIAL INDISTINGUISHABLE. OFTEN REFERRED TO AS BIRDSEYE, PISOLITIC, CAPROCK, ROCKHOUSE, LAMINAR, OOLITIC. EXCAVATIONS REQUIRE HEAVY RIPPING, CHISELING, OCCASIONALLY BLASTING. MASSIVE TO BLOCKY. CANNOT BE SCRATCHED WITH A KNIFE. DOES NOT BREAK DOWN IN WATER.

SURVEY RESULTS

During the survey an archaeological site was found and recorded. Other than recent refuse no other cultural resources were found. Site 15-1 is a Mesilla Phase sherd and lithic scatter that is located in the SW1/4, SW1/4, SW1/4, Section 34, T21W, R3E (Figure 2). The site is on the edge of a west trending arroyo and covers an area of 80 x 50 meters (Figure 4). An estimated 60 artifacts were observed within the site but many more are probably present. Artifacts noted include a single sherd of a Mimbres Black-on-white bowl sherd, numerous El Paso Brownware sherds, flakes of limestone, chert and basalt. In a 10m diameter area adjacent to the arroyo 20 artifacts were observed. Much of the surface of the site is obscured by grass cover and the banks of the arroyo are overgrown with vegetation. There may be subsurface cultural remains present.

The perimeter of the site was marked with red, white, and blue suveyors tape tied to shrubs.

RECOMMENDATIONS

The site is significant and should be avoided by the proposed project. This may be accomplished by deleting the remainder of Area 1 to the south from construction plans. It is probably not feasible to reroute the flood control channel. Archaeological clearance is recommended with the stipulation that the site be avoided. If avoidance is not feasible, data recovery procedures should be instituted for the site.

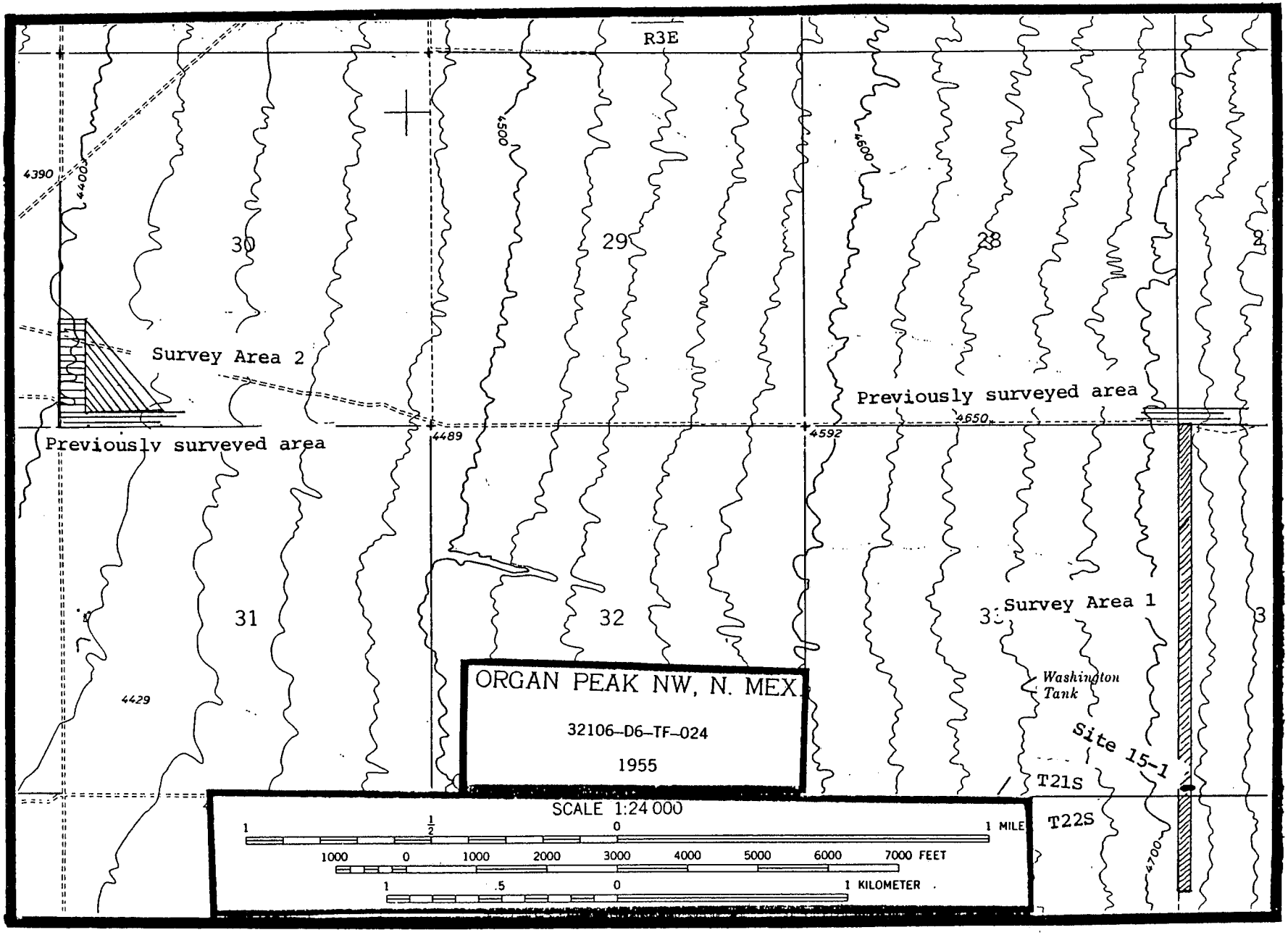

Figure 2. Project Map

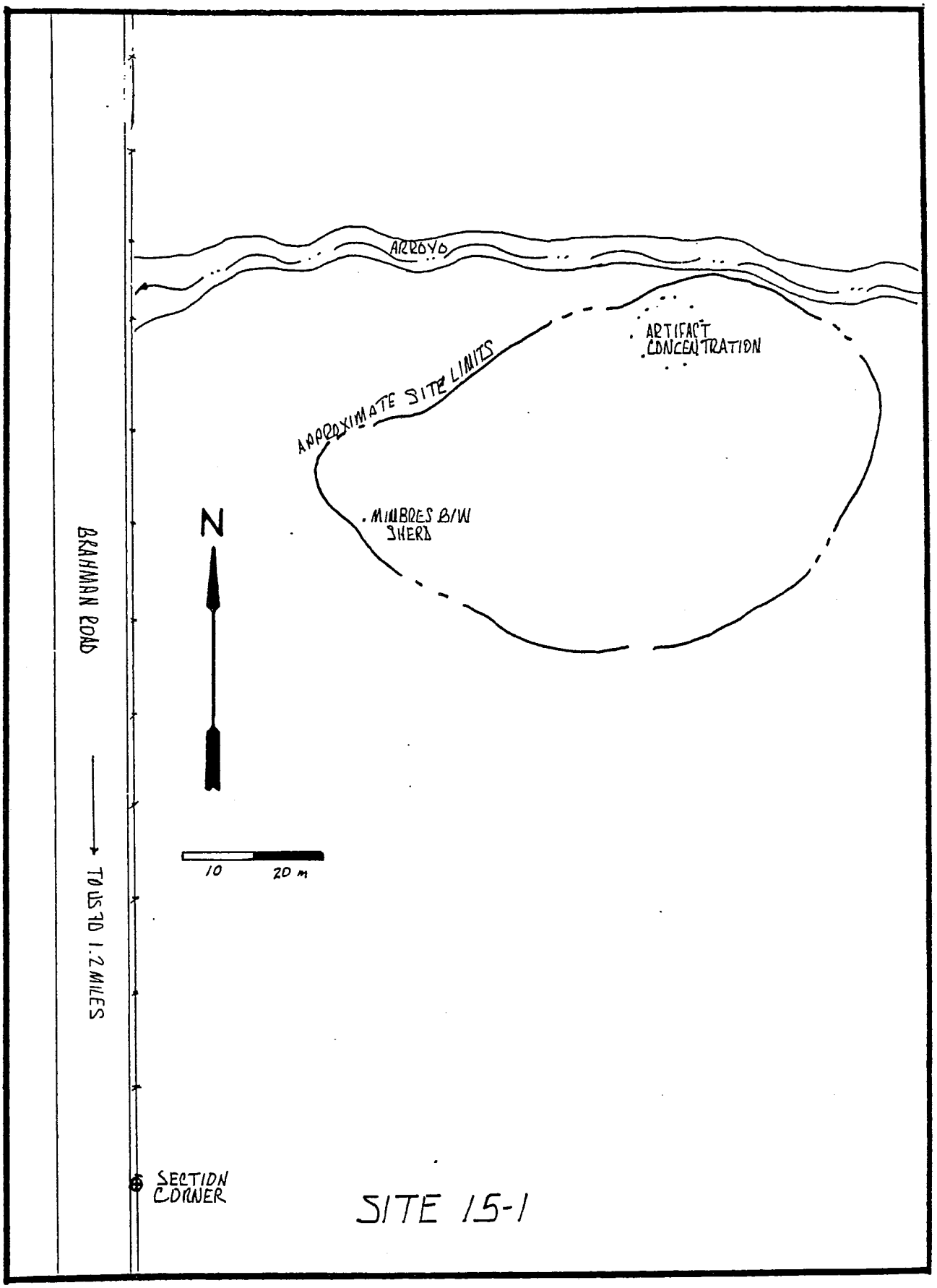

Figure 3. Archaeological Site 15-1

2.1. Classification of Dams. Dams should be classified in accordance with size and hazard potential in order to formulate a priority basis for selecting dams to be included in the inspection program and also to provide compatibility between guideline requirements and involved risks. When possible the initial classifications should be based upon information listed in the National Inventory of Dams with respect to size, impoundment capacity and hazard potential. It may be necessary to reclassify dams when additional information becomes available.

2.1.1. Size. The classification for size based on the height of the dam and storage capacity should be in accordance with Table 1. The height of the dam is established with respect to the maximum storage potential measured from the natural bed of the stream or watercourse at the downstream toe of the barrier, or if it is not across a stream or watercourse, the height from the lowest elevation of the outside limit of the barrier, to the maximum water storage elevation. For the purpose of determining project size, the maximum storage elevation may be considered equal to the top of dam elevation. Size classification may be determined by either storage or height, whichever gives the larger size category.

TABLE 1

SIZE CLASSIFICATION BLAIR/BAYLOR CANYON

Category	Impoundment Storage (Ac-Ft)	Impoundment Height (Ft)
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and $< 50,000$	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

2.1.2. Hazard Potential. The classification for potential hazards should be in accordance with Table 2. The hazards pertain to potential loss of human life or property damage in the area downstream of the dam in event of failure or misoperation of the dam or appurtenant facilities. Dams conforming to criteria for the low hazard potential category generally will be located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or township and country roads. Significant hazard potential category structures will be those located in predominantly rural or agricultural areas where failure may damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities. Dams in the high hazard potential category will be those located where failure may cause serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads.

TABLE 2

HAZARD POTENTIAL CLASSIFICATION
BLAIR / BAYLOR CANYON

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture) *existing*
Significant	Few (No urban developments and no more than a small number of *existing* inhabitable structures)	Appreciable (Notable agriculture, industry or structures) *future*
High	More than few *future*	Excessive (Extensive community, industry or agriculture)

TABLE 3 *BLAIR/BAYLOR CANYON*

HYDROLOGIC EVALUATION GUIDELINES

RECOMMENDED SPILLWAY DESIGN FLOODS

Hazard	Size	*Spillway Design Flood (SDF)
Low	Small	50 to 100-yr freq
	Intermediate	100-yr to 1/2 PMF
	Large	1/2 PMF to PMF
Significant	Small	100-yr to 1/2 PMF
	Intermediate	1/2 PMF to PMF
	Large	PMF
High	Small	1/2 PMF to PMF
	Intermediate	PMF
	Large	PMF

*The recommended design floods in this column represent the magnitude of the spillway design flood (SDF), which is intended to represent the largest flood that need be considered in the evaluation of a given project, regardless of whether a spillway is provided; i.e., a given project should be capable of safely passing the appropriate SDF. Where a range of SDF is indicated, the magnitude that most closely relates to the involved risk should be selected.

100-yr = 100-Year Exceedence Interval. The flood magnitude expected to be exceeded, on the average, of once in 100 years. It may also be expressed as an exceedence frequency with a one-percent chance of being exceeded in any given year.

PMF = Probable Maximum Flood. The flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The PMF is derived from probable maximum precipitation (PMP), which information is generally available from the National Weather Service, NOAA. Most Federal agencies apply reduction factors to the PMP when appropriate. Reductions may be applied because rainfall isohyetals are unlikely to conform to the exact shape of the drainage basin and/or the storm is not likely to center exactly over the drainage basin. In some cases local topography will cause changes from the generalized PMP values, therefore, it may be advisable to contact Federal construction agencies to obtain the prevailing practice in specific areas.

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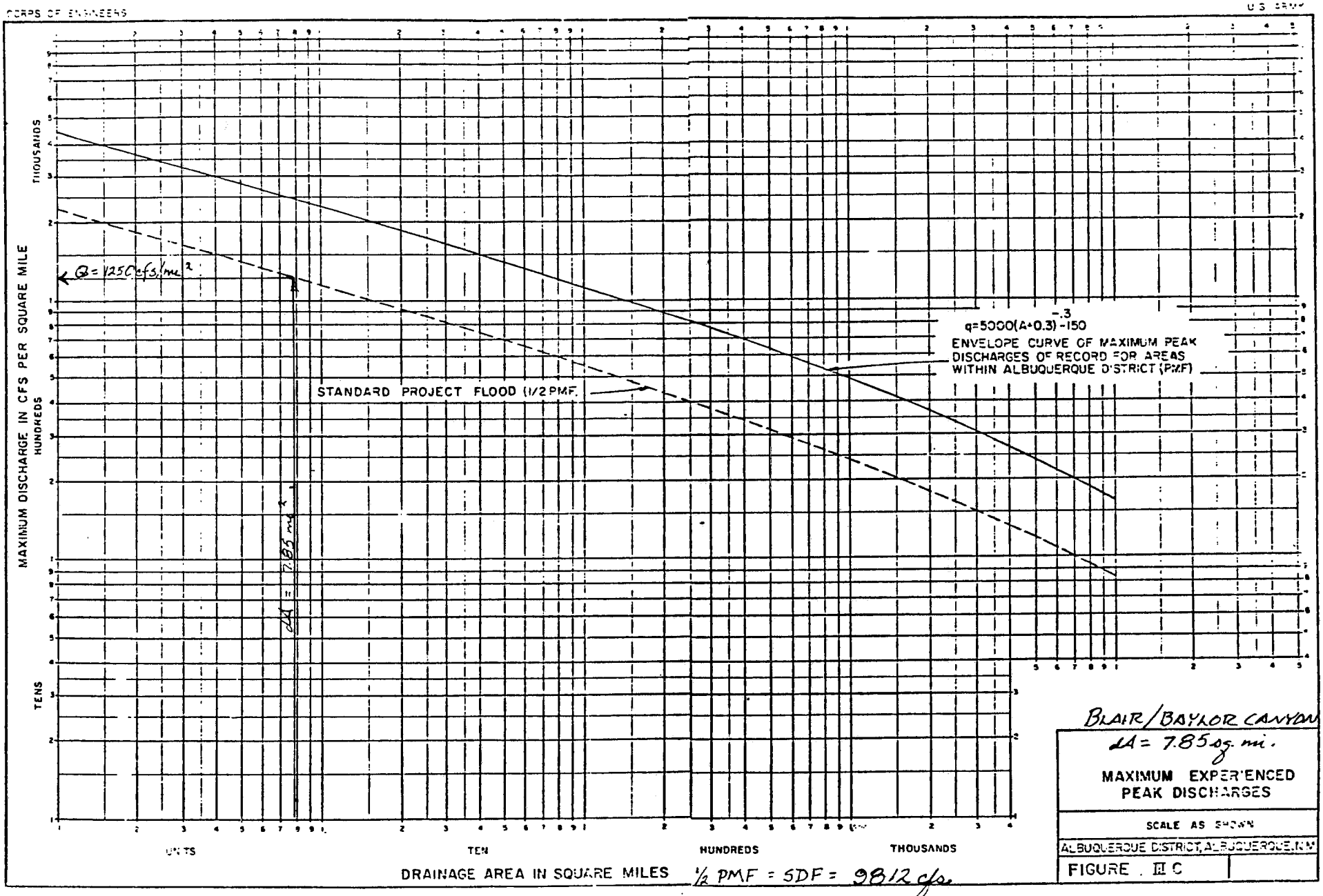

½ PMF = SDF = 9812 cfs

BLAIR/BAYLOR CANYON

DA = 7.85 sq. mi.

MAXIMUM EXPERIENCED PEAK DISCHARGES

SCALE AS SHOWN

ALBUQUERQUE DISTRICT, ALBUQUERQUE, N.M.

FIGURE III C

Attachment 4

2.1. Classification of Dams. Dams should be classified in accordance with size and hazard potential in order to formulate a priority basis for selecting dams to be included in the inspection program and also to provide compatibility between guideline requirements and involved risks. When possible the initial classifications should be based upon information listed in the National Inventory of Dams with respect to size, impoundment capacity and hazard potential. It may be necessary to reclassify dams when additional information becomes available.

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TABLE 1 MINE HOUSE SPRING

SIZE CLASSIFICATION

Category	Impoundment Storage (Ac-Ft)	Impoundment Height (Ft)
Small	< 1000 and ≥ 50	< 40 and ≥ 25 (< 25 !)
Intermediate	≥ 1000 and < 50,000	≥ 40 and < 100
Large	≥ 50,000	≥ 100

2.1.2. Hazard Potential. The classification for potential hazards should be in accordance with Table 2. The hazards pertain to potential loss of human life or property damage in the area downstream of the dam in event of failure or misoperation of the dam or appurtenant facilities. Dams conforming to criteria for the low hazard potential category generally will be located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or township and country roads. Significant hazard potential category structures will be those located in predominantly rural or agricultural areas where failure may damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities. Dams in the high hazard potential category will be those located where failure may cause serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads.

TABLE 2 MINE HOUSE SPRING

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture) existing
Significant	Few (No urban developments and no more than a small number of ex. inhabitable structures)	Appreciable (Notable agriculture, industry or structures) FUTURE
High	More than few FUTURE	Excessive (Extensive community, industry or agriculture)

TABLE 3

HYDROLOGIC EVALUATION GUIDELINES *MINEHOUSE SPRING*

RECOMMENDED SPILLWAY DESIGN FLOODS

Hazard	Size	*Spillway Design Flood (SDF)
Low	Small	50 to 100-yr freq
	Intermediate	100-yr to 1/2 PMF
	Large	1/2 PMF to PMF
Significant	Small	100-yr to 1/2 PMF ←
	Intermediate	1/2 PMF to PMF
	Large	PMF
High	Small	1/2 PMF to PMF
	Intermediate	PMF
	Large	PMF

*The recommended design floods in this column represent the magnitude of the spillway design flood (SDF), which is intended to represent the largest flood that need be considered in the evaluation of a given project, regardless of whether a spillway is provided; i.e., a given project should be capable of safely passing the appropriate SDF. Where a range of SDF is indicated, the magnitude that most closely relates to the involved risk should be selected.

100-yr = 100-Year Exceedence Interval. The flood magnitude expected to be exceeded, on the average, of once in 100 years. It may also be expressed as an exceedence frequency with a one-percent chance of being exceeded in any given year.

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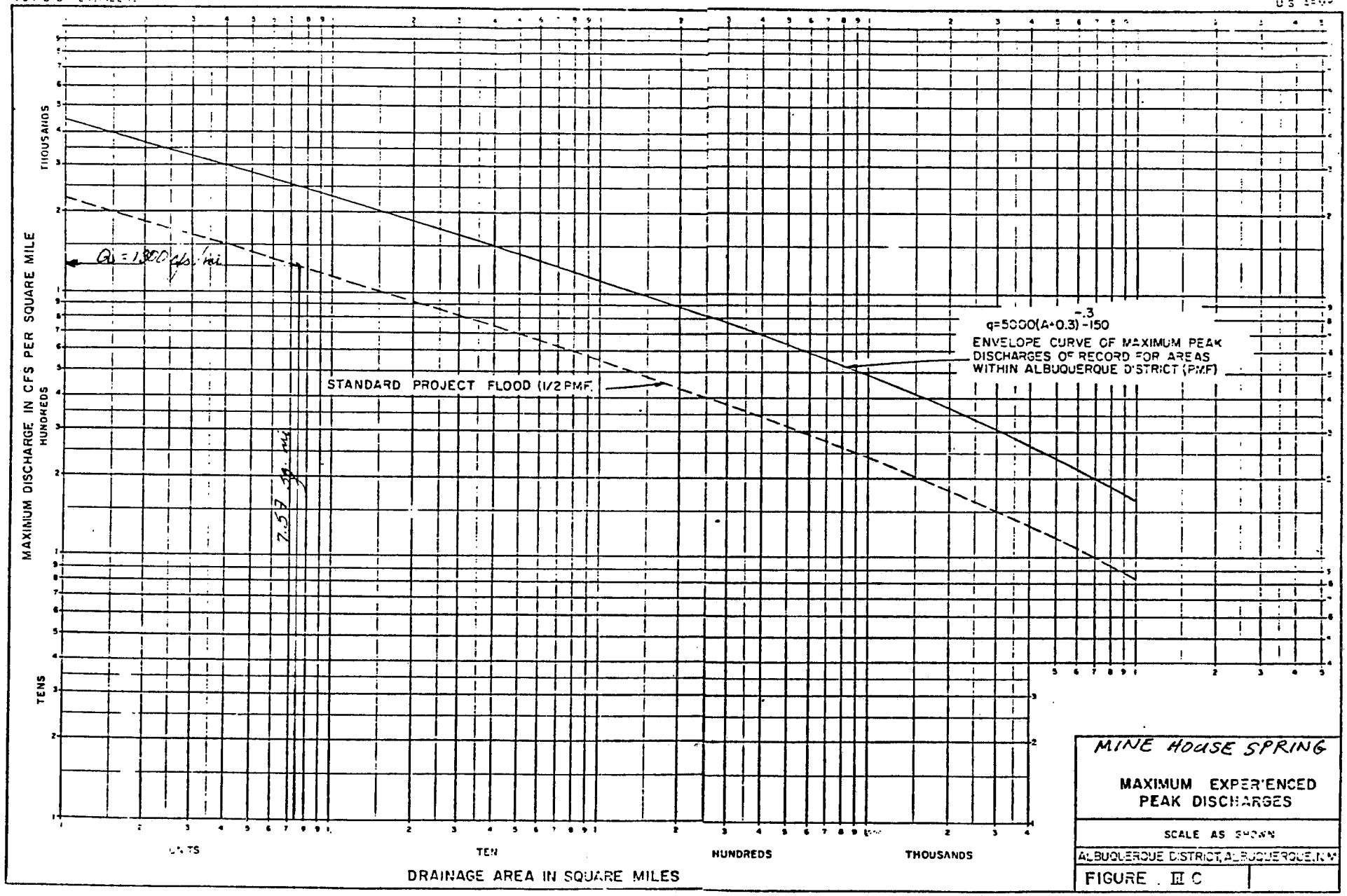
CORPS OF ENGINEERS

U.S. ARMY



MINE HOUSE SPRING

MAXIMUM EXPERIENCED PEAK DISCHARGES

SCALE AS SHOWN

ALBUQUERQUE DISTRICT, ALBUQUERQUE, N.M.

FIGURE III C

$Q_{1/2\ PMF} = 9841$ cfs

2.1. Classification of Dams. Dams should be classified in accordance with size and hazard potential in order to formulate a priority basis for selecting dams to be included in the inspection program and also to provide compatibility between guideline requirements and involved risks. When possible the initial classifications should be based upon information listed in the National Inventory of Dams with respect to size, impoundment capacity and hazard potential. It may be necessary to reclassify dams when additional information becomes available.

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BRAHMAN ROAD (LARGE)

TABLE 1

SIZE CLASSIFICATION

Category	Impoundment	
	Storage (Ac-Ft)	Height (Ft)
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and $< 50,000$	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

2.1.2. Hazard Potential. The classification for potential hazards should be in accordance with Table 2. The hazards pertain to potential loss of human life or property damage in the area downstream of the dam in event of failure or misoperation of the dam or appurtenant facilities. Dams conforming to criteria for the low hazard potential category generally will be located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or township and country roads. Significant hazard potential category structures will be those located in predominantly rural or agricultural areas where failure may damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities. Dams in the high hazard potential category will be those located where failure may cause serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads.

TABLE 2 BRAHMAN ROAD (LARGE)

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture) existing
Significant	Few (No urban developments and no more than a small number of inhabitable structures) ex	Appreciable (Notable agriculture, industry or structures) future
High	More than few future	Excessive (Extensive community, industry or agriculture)

BRAHMAN ROAD/LARGE

TABLE 3

HYDROLOGIC EVALUATION GUIDELINES

RECOMMENDED SPILLWAY DESIGN FLOODS

Hazard	Size	*Spillway Design Flood (SDF)
Low	Small	50 to 100-yr freq
	Intermediate	100-yr to 1/2 PMF
	Large	1/2 PMF to PMF
Significant	Small	100-yr to 1/2 PMF
	Intermediate	1/2 PMF to PMF
	Large	PMF
High	Small	1/2 PMF to PMF
	Intermediate	PMF
	Large	PMF

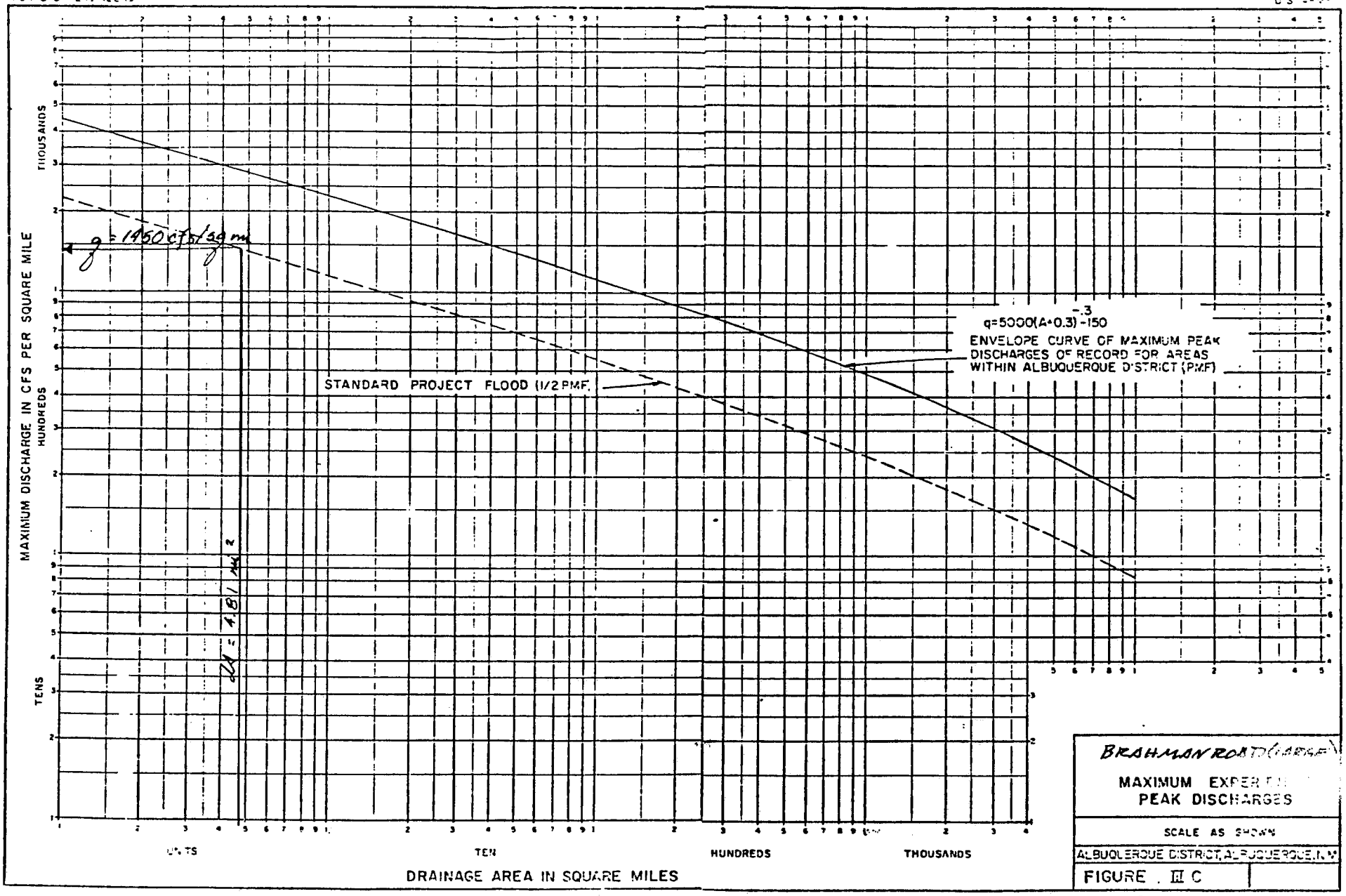
*The recommended design floods in this column represent the magnitude of the spillway design flood (SDF), which is intended to represent the largest flood that need be considered in the evaluation of a given project, regardless of whether a spillway is provided; i.e., a given project should be capable of safely passing the appropriate SDF. Where a range of SDF is indicated, the magnitude that most closely relates to the involved risk should be selected.

100-yr = 100-Year Exceedence Interval. The flood magnitude expected to be exceeded, on the average, of once in 100 years. It may also be expressed as an exceedence frequency with a one-percent chance of being exceeded in any given year.

PMF = Probable Maximum Flood. The flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The PMF is derived from probable maximum precipitation (PMP), which information is generally available from the National Weather Service, NOAA. Most Federal agencies apply reduction factors to the PMP when appropriate. Reductions may be applied because rainfall isohyetals are unlikely to conform to the exact shape of the drainage basin and/or the storm is not likely to center exactly over the drainage basin. In some cases local topography will cause changes from the generalized PMP values, therefore, it may be advisable to contact Federal construction agencies to obtain the prevailing practice in specific areas.

CORPS OF ENGINEERS

U.S. ARMY



BRAHMAN ROAD (LARGE)

MAXIMUM EXPERIENCED PEAK DISCHARGES

SCALE AS SHOWN

ALBUQUERQUE DISTRICT, ALBUQUERQUE, N.M.

FIGURE . III C

$Q_{1/2PMF} = 6975$ cfs

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TABLE 1 ORGAN ARROYO DETENTION BASIN

SIZE CLASSIFICATION

Category	Impoundment Storage (Ac-Ft)	Impoundment Height (Ft)
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and $< 50,000$	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

2.1.2. Hazard Potential. The classification for potential hazards should be in accordance with Table 2. The hazards pertain to potential loss of human life or property damage in the area downstream of the dam in event of failure or misoperation of the dam or appurtenant facilities. Dams conforming to criteria for the low hazard potential category generally will be located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or township and country roads. Significant hazard potential category structures will be those located in predominantly rural or agricultural areas where failure may damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities. Dams in the high hazard potential category will be those located where failure may cause serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads.

TABLE 2

HAZARD POTENTIAL CLASSIFICATION
ORGAN ARROYO DETENTION BASIN

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture) existing
Significant use	Few (No urban developments and no more than a small number of existing inhabitable structures)	Appreciable (Notable agriculture, industry or structures) future
High	More than few future	Excessive (Extensive community, industry or agriculture)

TABLE 3 ORGAN ARROYO DETENTION BASIN

HYDROLOGIC EVALUATION GUIDELINES

RECOMMENDED SPILLWAY DESIGN FLOODS

Hazard	Size	*Spillway Design Flood (SDF)
Low	Small	50 to 100-yr freq
	Intermediate	100-yr to 1/2 PMF
	Large	1/2 PMF to PMF
Significant	Small	100-yr to 1/2 PMF USE
	Intermediate	1/2 PMF to PMF
	Large	PMF
High	Small	1/2 PMF to PMF
	Intermediate	PMF
	Large	PMF

*The recommended design floods in this column represent the magnitude of the spillway design flood (SDF), which is intended to represent the largest flood that need be considered in the evaluation of a given project, regardless of whether a spillway is provided; i.e., a given project should be capable of safely passing the appropriate SDF. Where a range of SDF is indicated, the magnitude that most closely relates to the involved risk should be selected.

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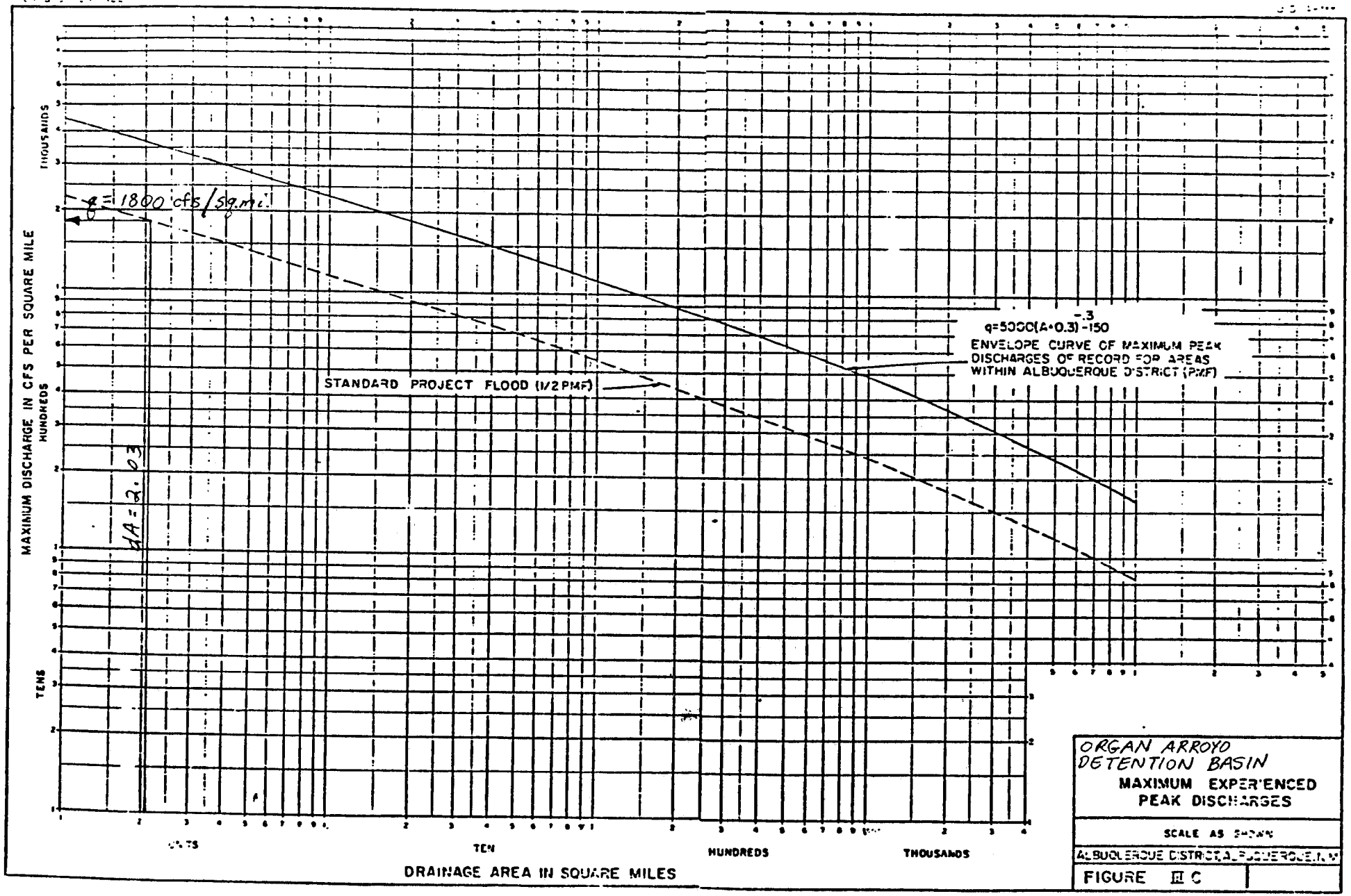

$Q_{1/2\,PMF} = 3654$ cfs

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TABLE 1 OWL'S NEST DETENTION BASIN

SIZE CLASSIFICATION

Category	Impoundment	
	Storage (Ac-Ft)	Height (Ft)
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and $< 50,000$	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

2.1.2. Hazard Potential. The classification for potential hazards should be in accordance with Table 2. The hazards pertain to potential loss of human life or property damage in the area downstream of the dam in event of failure or misoperation of the dam or appurtenant facilities. Dams conforming to criteria for the low hazard potential category generally will be located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or township and country roads. Significant hazard potential category structures will be those located in predominantly rural or agricultural areas where failure may damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities. Dams in the high hazard potential category will be those located where failure may cause serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads.

TABLE 2 OWL'S NEST DETENTION BASIN

HAZARD POTENTIAL CLASSIFICATION

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture) existing
Significant USE	Few (No urban developments and no more than a small number of existing inhabitable structures)	Appreciable (Notable agriculture, industry or structures) future
High	More than few Future	Excessive (Extensive community, industry or agriculture)

TABLE 3 OWL'S NEST DETENTION BASIN

HYDROLOGIC EVALUATION GUIDELINES

RECOMMENDED SPILLWAY DESIGN FLOODS

Hazard	Size	*Spillway Design Flood (SDF)
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	Intermediate	100-yr to 1/2 PMF
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	Intermediate	1/2 PMF to PMF
	Large	PMF
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	Large	PMF

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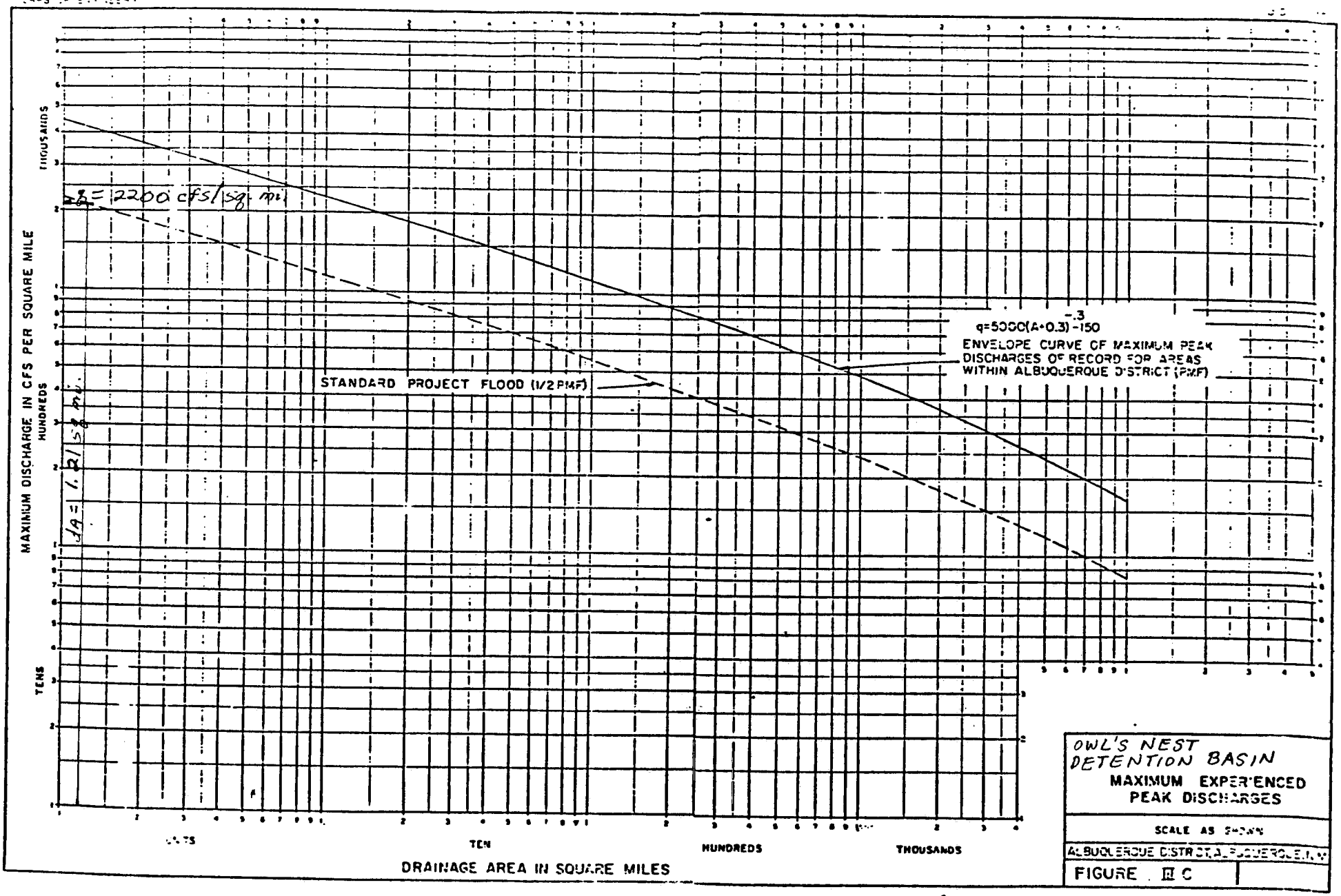

$Q_{1/2\,PMF} = 2662$ cfs

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TABLE 1 SAN AUGUSTIN DETENTION BASIN

SIZE CLASSIFICATION

Category	Impoundment Storage (Ac-Ft)	Impoundment Height (Ft)
Small	< 1000 and ≥ 50	< 40 and ≥ 25
Intermediate	≥ 1000 and $< 50,000$	≥ 40 and < 100
Large	$\geq 50,000$	≥ 100

2.1.2. Hazard Potential. The classification for potential hazards should be in accordance with Table 2. The hazards pertain to potential loss of human life or property damage in the area downstream of the dam in event of failure or misoperation of the dam or appurtenant facilities. Dams conforming to criteria for the low hazard potential category generally will be located in rural or agricultural areas where failure may damage farm buildings, limited agricultural land, or township and country roads. Significant hazard potential category structures will be those located in predominantly rural or agricultural areas where failure may damage isolated homes, secondary highways or minor railroads or cause interruption of use or service of relatively important public utilities. Dams in the high hazard potential category will be those located where failure may cause serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads.

TABLE 2

HAZARD POTENTIAL CLASSIFICATION
SAN AUGUSTIN DETENTION BASIN

Category	Loss of Life (Extent of Development)	Economic Loss (Extent of Development)
Low	None expected (No permanent structures for human habitation)	Minimal (Undeveloped to occasional structures or agriculture) *existing*
Significant *USE*	Few (No urban developments and no more than a small number of *existing* inhabitable structures)	Appreciable (Notable agriculture, industry or structures) *future*
High	More than few *future*	Excessive (Extensive community, industry or agriculture)

TABLE 3 SAN AUGUSTIN DETENTION BASIN

HYDROLOGIC EVALUATION GUIDELINES

RECOMMENDED SPILLWAY DESIGN FLOODS

Hazard	Size	*Spillway Design Flood (SDF)
Low	Small	50 to 100-yr freq
	Intermediate	100-yr to 1/2 PMF
	Large	1/2 PMF to PMF
Significant	Small	100-yr to 1/2 PMF USE
	Intermediate	1/2 PMF to PMF
	Large	PMF
High	Small	1/2 PMF to PMF
	Intermediate	PMF
	Large	PMF

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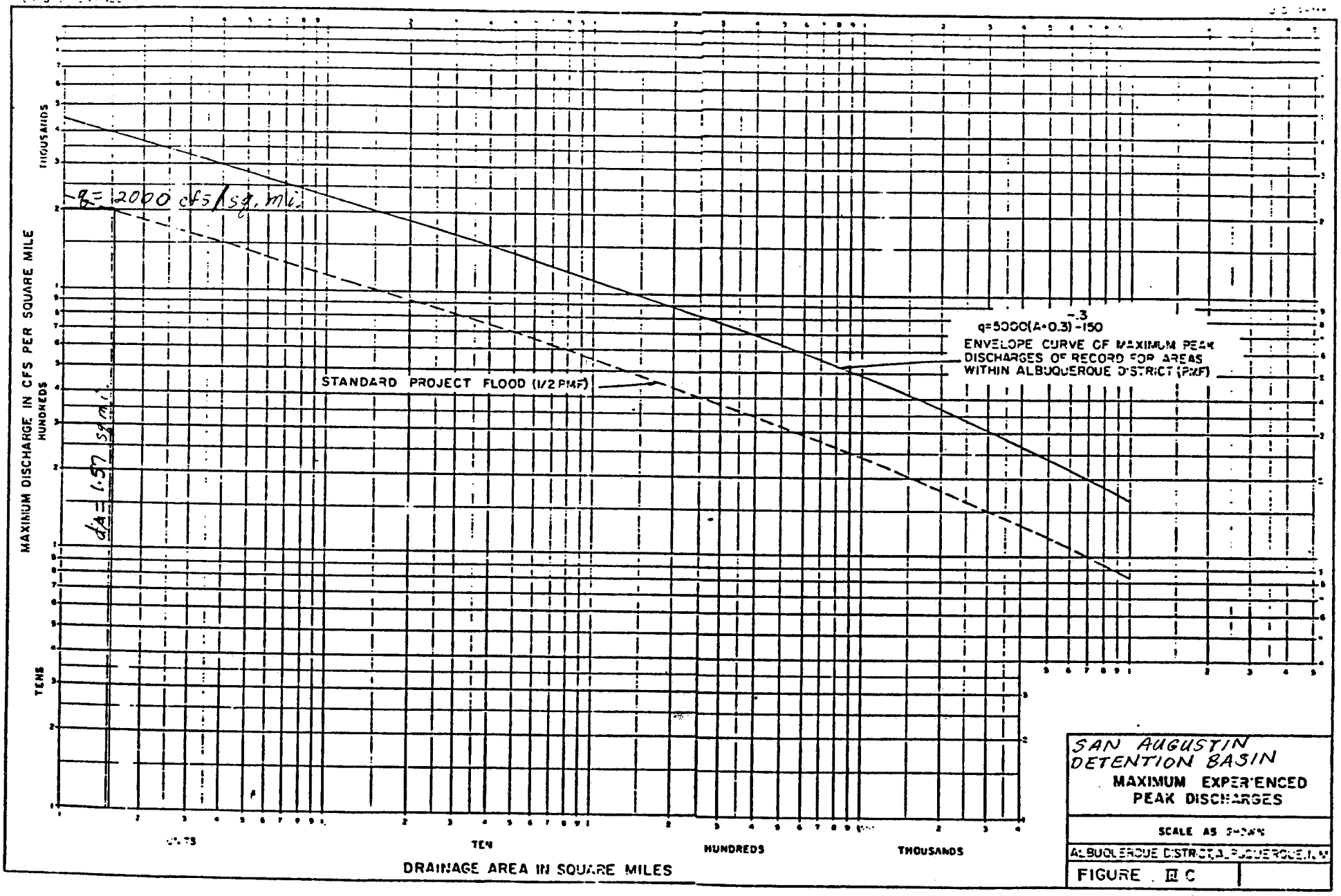

$Q_{1/2PMF} = 3140$ cfs

Attachment 4

```
*DIAGRAM
ID ************************************************************
ID * ..................................................... *
ID * :                EXISTING CONDITIONS                 : *
   :           JORNADA WATERSHED MASTER PLAN            : *
   :                DONA ANA COUNTY, NM                 : *
ID * :.....................................................: *
ID * :          STORM DURATION _______     24 HOUR       : *
ID * :          RETURN PERIOD _______      10 YEAR       : *
ID * :          DISTRIBUTION _________  TYPE II-60       : *
ID * :          PROJECT NO. __________     90035.11      : *
ID * :          FILENAME _____________     EX10.H1       : *
ID * :          DATE _________________     09-3-91       : *
ID * :.....................................................: *
ID ************************************************************
ID *   ALL SOIL COVER TYPES ARE CLASSIFIED AS NATURAL DESERT  *
ID *                                                          *
ID *   HSG A-SOIL ... CN = 63                                 *
ID *   HSG B-SOIL ... CN = 75                                 *
ID *   HSG C-SOIL ... CN = 85                                 *
ID *   HSG D-SOIL ... CN = 88                                 *
ID *                                                          *
IC *   HSG B/A-SOIL CONTAINS 15% A-SOIL ... CN = 73           *
ID *   HSG B/C-SOIL CONTAINS 30% C-SOIL ... CN = 78           *
ID ************************************************************
*FREE
IT 5 0 0 300
IN 15
IC 3
KK BASIN.1
KM     A.....(AC)... 641
KM LENGTH....(FT)... 2000 1500 5000 6400 8000
KM SLOPE.....(%).... 38.0 13.0  8.0  5.0  3.2
KM VELOCITY..(FPS).. 13.0  7.4  5.6  4.5  3.5  UPLAND GULLIES
KM LAG TIME..(HR)... 0.03 0.03 0.15 0.24 0.38
KM SOIL TYPE / CN... 50% D, 50% BC
BA 1.001
PB 2.60
PC .0000 .0031 .0063 .0096 .0131 .0167 .0205 .0245 .0287 .0331
PC .0377 .0426 .0479 .0536 .0597 .0664 .0737 .0819 .0912 .1019
PC .1147 .1308 .1527 .1888 .6690 .7256 .7527 .7712 .7854 .7971
PC .8070 .8157 .8234 .8304 .8368 .8427 .8482 .8533 .8581 .8626
PC .8669 .8710 .8749 .8786 .8821 .8855 .8880 .8919 .8949 .8979
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PC .9715 .9734 .9753 .9772 .9791 .9810 .9828 .9846 .9864 .9882
PC .9900 .9918 .9935 .9952 .9969 .9986 1.000
LS 0 83
UD 0.83
KK V
RY 6000 0.027 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.2
KM AREA......(AC)... 331
KM LENGTH....(FT)... 6000
KM     PE.....(%).... 2.7
KM VELOCITY..(FPS).. 1.7 ALLUVIAL FAN
KM LAG TIME..(HR)... 0.59
KM SOIL TYPE / CN... 100% BC
BA .5171
PB 2.58
LS 0 78
```

```
HC 2
KK V
RK 6000 0.018 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.3
KM AREA.....(AC)... 352
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.8
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.77
KM SOIL TYPE / CN... 90% BA, 10% B
BA .5500
PB 2.55
LS 0 73
UD .77
KK .
HC 2
KK V
RK 5700 0.017 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.4
KM AREA.....(AC)... 423
KM LENGTH....(FT)... 5700
KM SLOPE.....(%).... 1.7
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.73
KM SOIL TYPE / CN... 60% BA, 40% B
BA .2594
PB 2.51
LS 0 74
UD .73
KK .
HC 2
KK V
RK 6000 0.013 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.5
KM AREA.....(AC)... 388
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.3
KM VELOCITY..(FPS).. 1.2  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.83
KM SOIL TYPE / CN... 100% B
BA .6062
PB 2.48
LS 0 75
UD .83
KK .
HC 2
KK V
RK 5600 0.011 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.6
KM AREA.....(AC)... 381
KM LENGTH....(FT)... 5600
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.85
KM SOIL TYPE / CN... 90% B, 10% BA
BA .5953
PB 2.44
LS 0 75
UD .85
KK .
HC 2
```

```
KK V
RK 8000 0.005 0.03 0 TRAP 100 10
* ***************************************
KK BASIN.7
KM AREA.....(AC)... 466
KM LENGTH....(FT)... 8000
KM SLOPE.....(%).... 0.5
KM VELOCITY..(FPS).. 0.5  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.67
KM SOIL TYPE / CN... 100% B
BA 1.8516
PB 2.41
LS 0 75
UD 2.67
KK .
KM INPUT TO ISAACK LAKE
HC 2
* ***************************************
KK BASIN.8
KM AREA.....(AC)... 570
KM LENGTH....(FT)... 2100 2100 3200 7300
KM SLOPE.....(%).... 48.6 14.3  6.2  4.5
KM VELOCITY..(FPS).. 14.0  7.5  5.0  4.3   UPLAND GULLIES
KM LAG TIME..(HR)... 0.02 0.05 0.11 0.28
KM SOIL TYPE / CN... 95% BC, 5% D
BA .8906
PB 2.60
LS 0 79
UD .46
KK V
RK 6000 0.028 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.9
KM AREA.....(AC)... 230
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 2.8
KM VELOCITY..(FPS).. 1.7  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.59
KM SOIL TYPE / CN... 90% BA, 10% BC
BA .3594
PB 2.58
LS 0 74
UD .59
KK .
HC 2
KK V
RK 5800 0.021 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.10
KM AREA.....(AC)... 308
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 2.1
KM VELOCITY..(FPS).. 1.5  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.64
KM SOIL TYPE / CN... 100% BA
BA .4812
PB 2.54
LS 0 73

KK .
HC 2
KK V
RK 5900 0.017 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.11
```

```
KM SLOPE.....(%).... 1.7
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.76
KM SOIL TYPE / CN... 95% BA, 5% B
BA .5266
PB 2.51
LS 0 73
UD .76
KK .
HC 2
KK V
RK 5800 0.016 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.12
KM AREA......(AC)... 362
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.6
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.74
KM SOIL TYPE / CN... 95% BA, 5% B
BA .5656
PB 2.48
LS 0 74 2.0
UD .74
KK .
HC 2
KK V
RK 6000 0.01 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.13
KM AREA......(AC)... 283
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.0
KM VELOCITY..(FPS).. 1.0  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.00
KM SOIL TYPE / CN... 85% BA, 15% B
BA .4422
PB 2.44
LS 0 74
UD 1.00
KK .
HC 2
* ***************************************
KK BASIN.14
KM AREA......(AC)... 949
KM LENGTH....(FT)... 1500 2500 2800 3700 6000
KM SLOPE.....(%).... 46.7 16.0  7.1  5.4  4.0
KM VELOCITY..(FPS).. 14.5  8.0  5.5  4.7  4.0  UPLAND GULLIES
KM LAG TIME..(HR)... 0.02 0.05 0.08 0.13 0.25
KM SOIL TYPE / CN... 88% BC, 10% D, 5% BA
BA 1.4828
PB 2.60
LS 0 81
UD .53
KK V
RK 6000 0.025 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.15
KM AREA......(AC)... 275
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 2.5
KM VELOCITY..(FPS).. 1.6  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.62
KM SOIL TYPE / CN... 95% BA, 5% BC
```

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BA .4297
PB 2.58
LS 0 74
UD .62
KK .
HC 2
KK V
    100 0.017 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.16
KM AREA.....(AC)... 326
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.7
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.74
KM SOIL TYPE / CN... 95% BA, 5% B
BA .5094
PB 2.55
LS 0 74
UD .74
KK .
HC 2
KK V
RK 5500 0.02 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.17
KM AREA.....(AC)... 389
KM LENGTH....(FT)... 5500
KM SLOPE.....(%).... 2.0
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.65
KM SOIL TYPE / CN... 80% BA, 20% B
BA .5078
PB 2.51
LS 0 74
UD .65
KK .
HC 2
KM ROUTE TO BASIN.22
KK V
RK 6000 0.013 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.18
KM AREA.....(AC)... 781
KM LENGTH....(FT)... 1000 5100 6000 6300
KM SLOPE.....(%).... 24.0  5.9  5.0  3.6
KM VELOCITY..(FPS).. 10.0  4.8  4.5  3.9  UPLAND GULLIES
KM LAG TIME..(HR)... 0.02 0.18 0.22 0.27
KM SOIL TYPE / CN... 90% BC, 10% D
BA 1.2203
PB 2.60
LS 0 79
UD .69
KK V
RK 5700 0.028 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.19
KM AREA.....(AC)... 314
KM LENGTH....(FT)... 5700
KM SLOPE.....(%).... 2.8
KM VELOCITY..(FPS).. 1.7  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.56
KM SOIL TYPE / CN... 70% BA, 30% BC
BA .4906
PB 2.58
LS 0 75
```

```
UD .56
KK .
HC 2
KK V
RK 5900 0.019 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.20
KM AREA.....(AC)... 373
KM LENGTH....(FT)... 5900
KM SLOPE.....(%).... 1.9
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.70
KM SOIL TYPE / CN... 55% BA, 45% B
BA .5828
PB 2.55
LS 0 74
UD .70
KK .
HC 2
KK V
RK 5800 0.019 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.21
KM AREA.....(AC)... 354
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.9
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.69
KM SOIL TYPE / CN... 100% B
BA .5531
PB 2.51
LS 0 75
UD .69
KK .
HC 2
KK V
RK 6000 0.013 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.22
KM AREA.....(AC)... 430
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.3
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.91
KM SOIL TYPE / CN... 60% BA, 40% B
BA .6719
PB 2.48
LS 0 74
UD .91
KK .
KM COMBINE AREAS B-22
HC 3
KK V
KM ROUTE TO BASIN.23
RK 7400 0.009 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.23
KM AREA.....(AC)... 491
KM LENGTH....(FT)... 7400
KM SLOPE.....(%).... 0.9
KM VELOCITY..(FPS).. 0.95 ALLUVIAL FAN
KM LAG TIME..(HR)... 1.30
KM SOIL TYPE / CN... 85% B, 15% BA
BA .7672
PB 2.44
LS 0 75
```

```
UD 1.30
KK .
HC 2
KK .
HC 2
*  \
    500 0.006 0.03 0 TRAP 100 10
    ************************************
KK BASIN.24
KM AREA.....(AC)... 505
KM LENGTH....(FT)... 6500
KM SLOPE.....(%).... 0.6
KM VELOCITY..(FPS).. 0.55  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 1.97
KM SOIL TYPE / CN... 100% B
BA .7891
PB 2.41
LS 0 75
UD 1.97
KK .
HC 2
KK .
KM SAN AUGSTIN SYSTEM TO ISAACK LAKE
HC 2
* ************************************
KK BASIN.25
KM AREA.....(AC)... 544
KM LENGTH....(FT)... 3000 7600 6000
KM SLOPE.....(%).... 8.0  5.3  3.7
KM VELOCITY..(FPS).. 5.6  4.7  3.9  UPLAND GULLIES
KM LAG TIME..(HR)... 0.09 0.27 0.26
K    'L TYPE / CN... 97% BC, 3% D
(    500
Pb 2.60
LS 0 79
UD .62
KK V
RY 5500 0.031 0.03 0 TRAP 0 10
* ************************************
KK BASIN.26
KM AREA.....(AC)... 314
KM LENGTH....(FT)... 5500
KM SLOPE.....(%).... 3.1
KM VELOCITY..(FPS).. 1.8  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.51
KM SOIL TYPE / CN... 55% BC, 45% BA
BA .4906
PB 2.58
LS 0 76
UD .51
KK .
HC 2
KK V
RK 5500 0.02 0.03 0 TRAP 0 10
* ************************************
KK BASIN.27
KM AREA.....(AC)... 373
'     GTH....(FT)... 5500
    _OPE.....(%).... 2.0
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.65
KM SOIL TYPE / CN... 80% BA, 20% B
BA .5828
PB 2.55
```

```
KK .
HC 2
KK V
RK 5300 0.019 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.28
KM AREA.....(AC)... 381
KM LENGTH....(FT)... 5300
KM SLOPE.....(%).... 1.9
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.63
KM SOIL TYPE / CN... 100% B
BA .5953
PB 2.51
LS 0 75 2.0
UD .63
KK .
HC 2
KK V
KM ROUTE TO BASIN.33
RK 6500 0.012 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.29
KM AREA.....(AC)... 703
KM LENGTH....(FT)... 1500 9500 7500
KM SLOPE.....(%).... 38.0  7.4  4.3
KM VELOCITY..(FPS).. 13.0  5.5  4.2  UPLAND GULLIES
KM LAG TIME..(HR)... 0.02 0.29 0.30
KM SOIL TYPE / CN... 50% D, 50% BC
BA 1.0984
PB 2.60
LS 0 83
UD .61
KK V
RK 5500 0.031 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.30
KM AREA.....(AC)... 208
KM LENGTH....(FT)... 5500
KM SLOPE.....(%).... 3.1
KM VELOCITY..(FPS).. 1.8  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.51
KM SOIL TYPE / CN... 60% BC, 40% BA
BA .3250
PB 2.58
LS 0 76
UD .51
KK .
HC 2
* ***************************************
KK BASIN.41
KM AREA.....(AC)... 226
KM LENGTH....(FT)... 7300
KM SLOPE.....(%).... 4.5
KM VELOCITY..(FPS).. 4.3  UPLAND GULLIES
KM LAG TIME..(HR)... 0.28
KM SOIL TYPE / CN... 100% BC
BA .3531
PB 2.60
LS 0 78 15.0
UD .28
KK V
KM ROUTE TO BASIN.30
RK 5500 0.031 0.03 0 TRAP 0 10
KK .
```

```
KM COMBINE ORGAN ARROYO
HC 2
KK V
KM ROUTE TO BASIN.31
RK 5800 0.017 0.03 0 TRAP 0 10
* ************************************
KK BASIN.31
    :EA.....(AC)... 221
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.7
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.69
KM SOIL TYPE / CN... 80% BA, 20% B
BA .3453
PB 2.55
LS 0 74 5.0
UD .69
KK .
HC 2
KK V
KM ROUTE TO BASIN.32
RK 5500 0.016 0.03 0 TRAP 0 10
* ************************************
KK BASIN.32
KM AREA......(AC)... 294
KM LENGTH....(FT)... 5500
KM SLOPE.....(%).... 1.6
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.71
KM SOIL TYPE / CN... 90% B, 10% BA
BA .4594
PB 2.51
    75 6.0
    .
KK .
HC 2
KK V
KM ROUTE TO BASIN.33
RK 7500 0.011 0.03 0 TRAP 0 10
* ************************************
KK BASIN.33
KM AREA......(AC)... 388
KM LENGTH....(FT)... 7500
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.14
KM SOIL TYPE / CN... 95% B, 5% BA
BA .6063
PB 2.48
LS 0 75 2.0
UD 1.14
KK .
KM COMBINE OWL'S NEST & ORGAN ARROYOS
HC 3
KK V
KM ROUTE TO BASIN.35
RK 4000 0.014 0.03 0 TRAP 0 10
* ************************************
    `IN.34
K   :EA.....(AC)... 372
KM LENGTH....(FT)... 7000
KM SLOPE.....(%).... 1.4
KM VELOCITY..(FPS).. 1.2  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.97
KM SOIL TYPE / CN... 100% B
BA .5813
```

```
PB 2.46
LS 0 75 2.0
UD .97
KK V
RK 2500 0.012 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.35
KM AREA.....(AC)... 138
KM LENGTH....(FT)... 4000
KM SLOPE.....(%).... 1.4
KM VELOCITY..(FPS).. 1.2  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.56
KM SOIL TYPE / CN... 100% B
BA .2156
PB 2.46
LS 0 75 2.0
UD .56
KK .
HC 3
KK V
RK 8800 0.008 0.03 0 TRAP 100 10
* ***************************************
KK BASIN.36
KM AREA.....(AC)... 332
KM LENGTH....(FT)... 6500
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.98
KM SOIL TYPE / CN... 85% B, 15% BA
BA .5188
PB 2.48
LS 0 75
UD .98
KK V
RK 6700 0.009 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.37
KM AREA.....(AC)... 409
KM LENGTH....(FT)... 6700
KM SLOPE.....(%).... 0.9
KM VELOCITY..(FPS).. 0.95  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.18
KM SOIL TYPE / CN... 95% B, 5% BA
BA .6391
PB 2.44
LS 0 75
UD 1.18
KK .
HC 2
KK V
RK 8800 0.008 0.03 0 TRAP 100 10
*  ***************************************
KK BASIN.38
KM AREA.....(AC)... 620
KM LENGTH....(FT)... 8800
KM SLOPE.....(%).... 0.8
KM VELOCITY..(FPS).. 0.63  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.33
KM SOIL TYPE / CN... 100% B
BA .9688
PB 2.41
LS 0 75
UD 2.33
KK .
HC 2
KK
```

```
HC 2
* ***************************************
KK BASIN.39
KM AREA.....(AC)... 652
KM LENGTH....(FT)... 8000
KM SLOPE.....(%).... 1.0
    'LOCITY..(FPS).. 1.0  ALLUVIAL FAN
.. _AG TIME..(HR)... 1.33
KM SOIL TYPE / CN... 100% B
BA 1.0186
PB 2.44
LS 0 75
UD 1.33
KK V
RK 10600 0.007 0.03 0 TRAP 100 10
* ***************************************
KK BASIN.40
KM AREA.....(AC)... 776
KM LENGTH....(FT)... 10600
KM SLOPE.....(%)....  0.7
KM VELOCITY..(FPS)..  0.6  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.94
KM SOIL TYPE / CN... 100% B
BA 1.2125
PB 2.40
LS 0 75
UD 2.94
KK .
HC 3
KK .
HC 2
*****************************************
    IN.42
KM AREA.....(AC)... 390
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 2.9
KM VELOCITY..(FPS).. 1.8  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.54
KM SOIL TYPE / CN... 55% BC, 45% BA
BA .6094
PB 2.58
LS 0 76
UD .54
KK V
RK 5600 0.02 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.43
KM AREA.....(AC)... 569
KM LENGTH....(FT)... 5600
KM SLOPE.....(%).... 2.0
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.67
KM SOIL TYPE / CN... 60% BA, 40% B
BA .8891
PB 2.55
LS 0 74 10
UD .67

.
KK V
KM ROUTE TO BASIN.45
RK 7000 0.011 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.44
KM AREA.....(AC)... 2856
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KM SLOPE.....(%).... 48.6 14.3  8.3   3.0  1.5
KM VELOCITY..(FPS).. 14.5  7.7  5.6   3.5  1.2  UPLAND GULLIES/AF
KM LAG TIME..(HR)... 0.02 0.08 0.18  0.48 1.04
KM SOIL TYPE / CN... 40% D, 30% BC, 20% B, 10% BA
BA 4.4625
PB 2.60
LS 0 81 2.5
UD 1.80
KK V
KM ROUTE TO BASIN.45
RK 7000 0.011 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.45
KM AREA......(AC)... 477
KM LENGTH....(FT)... 7000
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.06
KM SOIL TYPE / CN... 95% B, 5% BA
BA .7453
PB 2.51
LS 0 75 8.0
UD 1.06
KK .
KM COMBINE BLAIR CANYON ARROYO
HC 3
KK V
KM ROUTE TO BASIN.47
RK 7500 0.009 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.46
KM AREA......(AC)... 211
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.2
KM VELOCITY..(FPS).. 1.2  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.83
KM SOIL TYPE / CN... 100% B
BA .3297
PB 2.50
LS 0 75 8.0
UD .83
KK V
KM ROUTE TO BASIN.47
RK 7500 0.009 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.47
KM AREA......(AC)... 463
KM LENGTH....(FT)... 7500
KM SLOPE.....(%).... 0.9
KM VELOCITY..(FPS).. 0.95  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.32
KM SOIL TYPE / CN... 100% B
BA .7234
PB 2.48
LS 0 75
UD 1.32
KK .
HC 3
KK V
KM ROUTE TO BASIN.48
RK 5300 0.008 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.48
KM AREA......(AC)... 335
KM LENGTH....(FT)... 6000
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KM SLOPE.....(%).... 0.7
KM VELOCITY..(FPS).. 0.85  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.78
KM SOIL TYPE / CN... 100% B
BA .4406
PB 2.44
     75
    .78
KK .
HC 2
KK V
KM ROUTE TO BASIN.49
RK 4000 0.01 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.49
KM AREA......(AC)... 240
KM LENGTH....(FT)... 4000
KM SLOPE.....(%).... 1.0
KM VELOCITY..(FPS).. 1.0  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.67
KM SOIL TYPE / CN... 100% B
BA .3750
PB 2.41
LS 0 75
UD .67
KK .
HC 2
KK V
KM ROUTE TO BASIN.50
RK 8500 0.006 0.03 0 TRAP 100 10
* ****************************************
KK BASIN.50
KM AREA......(AC)... 776
KM LENGTH....(FT)... 8500
KM SLOPE.....(%).... 0.6
KM VELOCITY..(FPS).. 0.55  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.58
KM SOIL TYPE / CN... 100% B
BA 1.2125
PB 2.39
LS 0 75
UD 2.58
KK .
HC 2
* ****************************************
KK BASIN.51
KM AREA......(AC)... 3310
KM LENGTH....(FT)... 2700 3000 5500 5000 4000 6500 4500
KM SLOPE.....(%).... 34.8 16.7 10.9  6.0  2.5  1.5  1.1
KM VELOCITY..(FPS).. 12.0  8.1  6.6  5.0  3.2  1.3  1.1  UG & AF
KM LAG TIME..(HR)... 0.04 0.06 0.14 0.17 0.21 0.83 0.68
KM SOIL TYPE / CN... 50% D, 30% B, 20% BA
BA 5.1719
PB 2.60
LS 0 81 2.0
UD 2.13
KK V
RK 10 0.01 0.03 0 TRAP 0 10
     ************************************
KK BASIN.52
KM AREA......(AC)... 108
KM LENGTH....(FT)... 3000
KM SLOPE.....(%).... 1.0
KM VELOCITY..(FPS).. 1.0  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.50
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```
BA .1688
PB 2.50
LS 0 75 10.0
UD .50
KK .
HC 2
KK V
RK 6000 0.011 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.53
KM AREA.....(AC)... 275
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.91
KM SOIL TYPE / CN... 100% B
BA .4297
PB 2.48
LS 0 75 4.0
UD .91
KK .
HC 2
KK V
RK 6200 0.007 0.03 0 TRAP 0 10
*  ***************************************
KK BASIN.54
KM AREA.....(AC)... 5396
KM LENGTH....(FT)... 2000 6300 4500 7500 5000 7000 6000
KM SLOPE.....(%).... 75.0 19.0  8.9  2.7  2.0  1.4  1.3
KM VELOCITY..(FPS).. 17.0  8.5  5.6  3.3  2.8  1.2  1.2
KM LAG TIME..(HR)... 0.02 0.12 0.13 0.38 0.30 0.97 0.83
KM SOIL TYPE / CN... 40% D, 30% BA, 30% B
BA 8.4313
PB 2.60
LS 0 80 2.5
UD 2.75
KK V
RK 5800 0.01 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.55
KM AREA.....(AC)... 257
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.0
KM VELOCITY..(FPS).. 1.0  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.97
KM SOIL TYPE / CN... 100% B
BA .4016
PB 2.47
LS 0 75 7.5
UD .97
KK .
HC 2
KK V
RK 6200 0.007 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.56
KM AREA.....(AC)... 434
KM LENGTH....(FT)... 6200
KM SLOPE.....(%).... 0.7
KM VELOCITY..(FPS).. 0.6  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 1.72
KM SOIL TYPE / CN... 100% B
BA .6781
PB 2.44
LS 0 75 1.3
UD 1.72
```

```
UD 1.72
KK .
HC 3
KK V
RK 7800 0.008 0.03 0 TRAP 0 10
* ****************************************
KM BASIN.57
KM AREA.....(AC)... 425
KM LENGTH....(FT)... 7800
KM SLOPE.....(%).... 0.8
KM VELOCITY..(FPS).. 0.63  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.06
KM SOIL TYPE / CN... 100% B
BA .6641
PB 2.41
LS 0 75 4.5
UD 2.06
KK .
HC 2
KK V
KM ROUTE TO BASIN.60
RK 6500 0.004 0.03 0 TRAP 100 10
* ****************************************
KK BASIN.58
KM AREA.....(AC)... 661
KM LENGTH....(FT)... 11200
KM SLOPE.....(%).... 0.9
KM VELOCITY..(FPS).. 0.66  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.83
KM SOIL TYPE / CN... 100% B
BA 1.0328
PB 2.44
LS 0 75 1.5
UD 2.83
KK V
KM ROUTE TO BASIN.60
RK 6000 0.004 0.03 0 TRAP 100 10
* ****************************************
KK BASIN.59
KM AREA.....(AC)... 202
KM LENGTH....(FT)... 7600
KM SLOPE.....(%).... 0.8
KM VELOCITY..(FPS).. 0.63  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.01
KM SOIL TYPE / CN... 100% B
BA .3156
PB 2.39
LS 0 75 12.0
UD 2.01
KK V
KM ROUTE TO BASIN.60
RK 9600 0.004 0.03 0 TRAP 100 10
* ****************************************
KK BASIN.60
KM AREA.....(AC)... 808
KM LENGTH....(FT)... 9800
KM SLOPE.....(%).... 0.3
KM VELOCITY..(FPS).. 0.5  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 3.27
KM SOIL TYPE / CN... 100% B
BA 1.2625
PB 2.37
LS 0 75 2.5
UD 3.27
KK .
KM SUM OF TAYLOR CANYON & MINE HOUSE APPROACH
```

```
KK V
KM ROUTE TO BASIN.50
RK 7000 0.002 0.03 0 TRAP 100 10
KK .
KM COMBINE WITH BLAIR CANYON ARROYO
HC 2
KK V
KM ROUTE TO BASIN.40
RK 6000 0.002 0.03 0 TRAP 100 10
KK .
KM COMBINE WITH ISAACK LAKE
HC 2
ZZ
```

CUMULATIVE AREA = 55.96 SQ MI

Existing 10yr.
9/3/91

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	BASIN.1	350.	6.83	97.	30.	29.	1.00		
ROUTED TO	V	346.	6.92	96.	30.	29.	1.00		
HYDROGRAPH AT	BASIN.2	160.	6.58	36.	12.	11.	.52		
2 COMBINED AT	.	470.	6.83	132.	42.	40.	1.52		
ROUTED TO	V	466.	6.92	131.	42.	40.	1.52		
HYDROGRAPH AT	BASIN.3	88.	6.83	26.	9.	8.	.55		
2 COMBINED AT	.	552.	6.92	157.	50.	49.	2.07		
ROUTED TO	V	548.	7.00	156.	50.	48.	2.07		
HYDROGRAPH AT	BASIN.4	45.	6.75	13.	4.	4.	.26		
2 COMBINED AT	.	588.	7.00	168.	54.	52.	2.33		
ROUTED TO	V	586.	7.08	167.	54.	52.	2.33		
HYDROGRAPH AT	BASIN.5	102.	6.83	31.	10.	10.	.61		
2 COMBINED AT	.	681.	7.08	197.	65.	62.	2.93		
ROUTED TO	V	674.	7.25	196.	64.	62.	2.93		
HYDROGRAPH AT	BASIN.6	94.	6.92	29.	10.	9.	.60		
2 COMBINED AT	.	753.	7.25	223.	74.	71.	3.53		
ROUTED TO	V	647.	7.67	218.	72.	70.	3.53		
HYDROGRAPH AT	BASIN.7	116.	8.92	77.	29.	28.	1.85		

2 COMBINED AT							
+	.	719.	7.67	295.	101.	97.	5.38
HYDROGRAPH AT							
+	BASIN.8	365.	6.42	68.	22.	21.	.89
ROUTED TO							
+	V	359.	6.50	67.	22.	21.	.89
HYDROGRAPH AT							
+	BASIN.9	79.	6.58	19.	6.	6.	.36
2 COMBINED AT							
+	.	437.	6.58	86.	28.	27.	1.25
ROUTED TO							
+	V	435.	6.67	86.	28.	27.	1.25
HYDROGRAPH AT							
+	BASIN.10	88.	6.67	22.	8.	7.	.48
2 COMBINED AT							
+	.	522.	6.67	108.	35.	34.	1.73
ROUTED TO							
+	V	521.	6.83	109.	36.	34.	1.73
HYDROGRAPH AT							
+	BASIN.11	81.	6.83	24.	8.	8.	.53
2 COMBINED AT							
+	.	602.	6.83	133.	44.	42.	2.26
ROUTED TO							
+	V	596.	6.92	132.	44.	42.	2.26
HYDROGRAPH AT							
+	BASIN.12	102.	6.75	29.	10.	9.	.57
2 COMBINED AT							
+	.	694.	6.92	159.	53.	51.	2.82
ROUTED TO							
+	V	684.	7.00	159.	53.	51.	2.82
HYDROGRAPH AT							
+	BASIN.13	56.	7.08	20.	7.	7.	.44
2 COMBINED AT							
-	.	740.	7.00	178.	60.	57.	3.27
HYDROGRAPH AT							
-	BASIN.14	637.	6.50	128.	40.	39.	1.48
ROUTED TO							
-	V	623.	6.58	127.	40.	39.	1.48
HYDROGRAPH AT							
-	BASIN.15	91.	6.67	23.	8.	7.	.43
2 COMBINED AT							
-	.	714.	6.58	150.	48.	46.	1.91
ROUTED TO							
-	V	705.	6.67	149.	48.	46.	1.91

	HYDROGRAPH AT						
+		BASIN.16	92.	6.75	26.	9.	8.	.51
	2 COMBINED AT						
		.	796.	6.75	174.	56.	54.	2.42
	ROUTED TO						
+		V	784.	6.83	174.	56.	54.	2.42
	HYDROGRAPH AT						
+		BASIN.17	116.	6.67	30.	10.	10.	.61
	2 COMBINED AT						
+		.	892.	6.83	202.	66.	64.	3.03
	ROUTED TO						
+		V	886.	6.92	202.	66.	63.	3.03
	HYDROGRAPH AT						
+		BASIN.18	369.	6.67	92.	30.	29.	1.22
	ROUTED TO						
+		V	362.	6.75	92.	30.	28.	1.22
	HYDROGRAPH AT						
+		BASIN.19	123.	6.58	28.	9.	9.	.49
	2 COMBINED AT						
+		.	472.	6.75	119.	39.	37.	1.71
	ROUTED TO						
+		V	468.	6.83	119.	39.	37.	1.71
	HYDROGRAPH AT						
+		BASIN.20	110.	6.75	30.	10.	10.	.58
	2 COMBINED AT						
+		.	575.	6.83	148.	48.	47.	2.29
	ROUTED TO						
+		V	561.	6.92	147.	48.	46.	2.29
	HYDROGRAPH AT						
+		BASIN.21	110.	6.75	29.	10.	9.	.55
	2 COMBINED AT						
+		.	662.	6.92	175.	58.	56.	2.85
	ROUTED TO						
+		V	653.	7.08	175.	58.	55.	2.85
	HYDROGRAPH AT						
+		BASIN.22	96.	7.00	32.	11.	10.	.67
	3 COMBINED AT						
		.	1606.	7.00	407.	134.	129.	6.55
	ROUTED TO						
+		V	1578.	7.08	405.	133.	128.	6.55
	HYDROGRAPH AT						
+		BASIN.23	87.	7.42	37.	13.	12.	.77

2 COMBINED AT							
+	.	1658.	7.08	440.	146.	140.	7.32
2 COMBINED AT							
+	.	2395.	7.08	618.	205.	198.	10.58
ROUTED TO							
+	V	2350.	7.25	612.	203.	195.	10.58
HYDROGRAPH AT							
+	BASIN.24	63.	8.17	35.	12.	12.	.79
2 COMBINED AT							
+	.	2391.	7.25	647.	215.	207.	11.37
2 COMBINED AT							
+	.	2819.	7.33	941.	316.	305.	16.75
HYDROGRAPH AT							
+	BASIN.25	279.	6.58	64.	21.	20.	.85
ROUTED TO							
+	V	273.	6.75	64.	21.	20.	.85
HYDROGRAPH AT							
+	BASIN.26	144.	6.50	30.	10.	9.	.49
2 COMBINED AT							
+	.	401.	6.67	94.	30.	29.	1.34
ROUTED TO							
+	V	399.	6.75	93.	30.	29.	1.34
HYDROGRAPH AT							
+	BASIN.27	138.	6.67	34.	11.	11.	.58
2 COMBINED AT							
+	.	533.	6.75	127.	42.	40.	1.92
ROUTED TO							
+	V	532.	6.83	127.	42.	40.	1.92
HYDROGRAPH AT							
+	BASIN.28	136.	6.67	33.	11.	11.	.60
2 COMBINED AT							
+	.	654.	6.83	159.	53.	51.	2.52
ROUTED TO							
+	V	649.	6.92	158.	52.	50.	2.52
HYDROGRAPH AT							
+	BASIN.29	489.	6.58	107.	33.	32.	1.10
ROUTED TO							
+	V	484.	6.67	106.	33.	32.	1.10
HYDROGRAPH AT							
+	BASIN.30	95.	6.50	20.	6.	6.	.32
2 COMBINED AT							
+	.	568.	6.67	126.	40.	38.	1.42

HYDROGRAPH AT							
+	BASIN.41	251.	6.17	33.	11.	10.	.35
ROUTED TO							
	V	250.	6.33	34.	11.	11.	.35
2 COMBINED AT							
+	.	736.	6.50	160.	51.	49.	1.78
ROUTED TO							
+	V	732.	6.67	159.	51.	49.	1.78
HYDROGRAPH AT							
+	BASIN.31	78.	6.67	20.	7.	7.	.35
2 COMBINED AT							
+	.	810.	6.67	179.	57.	55.	2.12
ROUTED TO							
+	V	809.	6.75	179.	57.	55.	2.12
HYDROGRAPH AT							
+	BASIN.32	109.	6.67	28.	9.	9.	.46
2 COMBINED AT							
+	.	917.	6.75	206.	67.	64.	2.58
ROUTED TO							
+	V	889.	6.92	206.	66.	64.	2.58
HYDROGRAPH AT							
+	BASIN.33	85.	7.17	32.	11.	11.	.61
3 COMBINED AT							
+	.	1615.	6.92	396.	129.	125.	5.71
ROUTED TO							
+	V	1593.	7.00	395.	129.	124.	5.71
HYDROGRAPH AT							
+	BASIN.34	93.	7.00	31.	10.	10.	.58
ROUTED TO							
+	V	93.	7.08	31.	10.	10.	.58
HYDROGRAPH AT							
+	BASIN.35	51.	6.58	12.	4.	4.	.22
3 COMBINED AT							
+	.	1715.	7.00	436.	143.	138.	6.50
ROUTED TO							
+	V	1570.	7.25	430.	141.	136.	6.50
HYDROGRAPH AT							
	BASIN.36	77.	7.00	26.	9.	9.	.52
ROUTED TO							
+	V	75.	7.33	26.	9.	8.	.52
HYDROGRAPH AT							
+	BASIN.37	78.	7.25	31.	10.	10.	.64

2 COMBINED AT							
+	.	153.	7.33	56.	19.	19.	1.16
ROUTED TO							
+	V	143.	7.92	54.	19.	18.	1.16
HYDROGRAPH AT							
+	BASIN.38	67.	8.58	42.	15.	15.	.97
2 COMBINED AT							
+	.	202.	8.00	96.	34.	32.	2.13
2 COMBINED AT							
+	.	1619.	7.25	525.	174.	168.	8.63
HYDROGRAPH AT							
+	BASIN.39	114.	7.42	49.	17.	16.	1.02
ROUTED TO							
+	V	106.	8.33	46.	16.	15.	1.02
HYDROGRAPH AT							
+	BASIN.40	69.	9.25	49.	18.	18.	1.21
3 COMBINED AT							
+	.	1641.	7.25	617.	209.	201.	10.86
2 COMBINED AT							
+	.	4431.	7.33	1557.	525.	506.	27.61
HYDROGRAPH AT							
+	BASIN.42	170.	6.50	37.	12.	12.	.61
ROUTED TO							
+	V	169.	6.67	37.	12.	12.	.61
HYDROGRAPH AT							
+	BASIN.43	240.	6.67	59.	20.	19.	.89
2 COMBINED AT							
+	.	409.	6.67	96.	32.	31.	1.50
ROUTED TO							
+	V	393.	6.83	95.	32.	30.	1.50
HYDROGRAPH AT							
+	BASIN.44	756.	7.92	377.	124.	120.	4.46
ROUTED TO							
+	V	755.	8.00	376.	123.	119.	4.46
HYDROGRAPH AT							
+	BASIN.45	138.	7.08	48.	16.	15.	.75
3 COMBINED AT							
+	.	966.	7.58	515.	171.	165.	6.71
ROUTED TO							
+	V	964.	7.75	513.	170.	164.	6.71
HYDROGRAPH AT							
+	BASIN.46	73.	6.83	21.	7.	7.	.33

ROUTED TO							
+	V	71.	7.17	21.	7.	7.	.33
HYDROGRAPH AT							
	BASIN.47	85.	7.42	36.	12.	12.	.72
3 COMBINED AT							
+	.	1095.	7.67	569.	189.	182.	7.76
ROUTED TO							
+	V	1092.	7.75	568.	188.	181.	7.76
HYDROGRAPH AT							
+	BASIN.48	39.	7.92	20.	7.	7.	.44
2 COMBINED AT							
+	.	1130.	7.75	588.	195.	188.	8.20
ROUTED TO							
+	V	1129.	7.83	587.	195.	188.	8.20
HYDROGRAPH AT							
+	BASIN.49	68.	6.67	18.	6.	6.	.38
2 COMBINED AT							
+	.	1149.	7.83	599.	201.	193.	8.57
ROUTED TO							
+	V	1137.	8.08	592.	198.	190.	8.57
HYDROGRAPH AT							
+	BASIN.50	76.	8.83	50.	18.	18.	1.21
2 COMBINED AT							
+	.	1202.	8.17	641.	216.	208.	9.79
HYDROGRAPH AT							
+	BASIN.51	756.	8.25	422.	142.	137.	5.17
ROUTED TO							
+	V	755.	8.33	422.	142.	136.	5.17
HYDROGRAPH AT							
+	BASIN.52	57.	6.50	11.	4.	4.	.17
2 COMBINED AT							
+	.	761.	8.33	429.	145.	140.	5.34
ROUTED TO							
+	V	760.	8.42	429.	145.	139.	5.34
HYDROGRAPH AT							
+	BASIN.53	77.	6.92	24.	8.	8.	.43
2 COMBINED AT							
	.	782.	8.42	450.	153.	147.	5.77
ROUTED TO							
+	V	780.	8.50	449.	152.	146.	5.77
HYDROGRAPH AT							
+	BASIN.54	945.	8.92	618.	219.	211.	8.43

	ROUTED TO						
+		V	943.	9.08	618.	218.	210.	8.43
	HYDROGRAPH AT						
+		BASIN.55	76.	7.00	25.	8.	8.	.40
	2 COMBINED AT						
+		.	957.	9.08	634.	226.	218.	8.83
	ROUTED TO						
+		V	956.	9.25	633.	224.	216.	8.83
	HYDROGRAPH AT						
+		BASIN.56	65.	7.83	33.	11.	11.	.68
	3 COMBINED AT						
+		.	1732.	8.83	1109.	388.	374.	15.28
	ROUTED TO						
+		V	1729.	9.00	1108.	385.	371.	15.28
	HYDROGRAPH AT						
+		BASIN.57	60.	8.25	34.	12.	11.	.66
	2 COMBINED AT						
+		.	1780.	9.00	1139.	397.	382.	15.95
	ROUTED TO						
+		V	1777.	9.17	1134.	393.	378.	15.95
	HYDROGRAPH AT						
+		BASIN.58	67.	9.08	46.	17.	16.	1.03
	ROUTED TO						
+		V	66.	9.75	45.	16.	16.	1.03
	HYDROGRAPH AT						
+		BASIN.59	36.	8.08	19.	7.	6.	.32
	ROUTED TO						
+		V	34.	9.50	18.	6.	6.	.32
	HYDROGRAPH AT						
+		BASIN.60	71.	9.58	52.	20.	19.	1.26
	4 COMBINED AT						
+		.	1939.	9.17	1247.	435.	419.	18.56
	ROUTED TO						
+		V	1930.	9.42	1234.	429.	413.	18.56
	2 COMBINED AT						
+		.	2858.	9.08	1820.	645.	621.	28.34
	ROUTED TO						
+		V	2852.	9.25	1812.	637.	614.	28.34
	2 COMBINED AT						
+		.	4473.	8.75	3255.	1162.	1119.	55.96

*** NORMAL END OF HEC-1 ***

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*DIAGRAM
*************************************************************
*.......................................................... *
*  :                EXISTING CONDITIONS                   : *
ID *  :           JORNADA WATERSHED MASTER PLAN            : *
ID *  :                DONA ANA COUNTY, NM                 : *
ID *  :...................................................: *
ID *  :          STORM DURATION _______     24 HOUR       : *
ID *  :          RETURN PERIOD _______      100 YEAR      : *
ID *  :          DISTRIBUTION _________   TYPE II-60      : *
ID *  :          PROJECT NO. __________     90035.11      : *
ID *  :          FILENAME _____________     EX100.H1      : *
ID *  :          DATE _________________     09-3-91       : *
ID *  :...................................................: *
ID *************************************************************
ID *   ALL SOIL COVER TYPES ARE CLASSIFIED AS NATURAL DESERT  *
ID *                                                          *
ID *   HSG A-SOIL ... CN = 63                                 *
ID *   HSG B-SOIL ... CN = 75                                 *
ID *   HSG C-SOIL ... CN = 85                                 *
ID *   HSG D-SOIL ... CN = 88                                 *
ID *                                                          *
ID *   HSG B/A-SOIL CONTAINS 15% A-SOIL ... CN = 73           *
ID *   HSG B/C-SOIL CONTAINS 30% C-SOIL ... CN = 78           *
ID *************************************************************
*FREE
IT 5 0 0 300

KK BASIN.1
KM AREA......(AC)... 641
KM LENGTH....(FT)... 2000 1500 5000 6400 8000
KM SLOPE.....(%).... 38.0 13.0  8.0  5.0  3.2
KM VELOCITY..(FPS).. 13.0  7.4  5.6  4.5  3.5  UPLAND GULLIES
KM LAG TIME..(HR)... 0.03 0.03 0.15 0.24 0.38
KM SOIL TYPE / CN... 50% D, 50% BC
BA 1.001
PB 3.80
PC .0000 .0031 .0063 .0096 .0131 .0167 .0205 .0245 .0287 .0331
PC .0377 .0426 .0479 .0536 .0597 .0664 .0737 .0819 .0912 .1019
PC .1147 .1308 .1527 .1888 .6690 .7256 .7527 .7712 .7854 .7971
PC .8070 .8157 .8234 .8304 .8368 .8427 .8482 .8533 .8581 .8626
PC .8669 .8710 .8749 .8786 .8821 .8855 .8880 .8919 .8949 .8979
PC .9008 .9037 .9065 .9093 .9120 .9147 .9174 .9200 .9226 .9251
PC .9276 .9301 .9325 .9349 .9373 .9396 .9419 .9442 .9465 .9487
PC .9509 .9531 .9552 .9573 .9594 .9615 .9635 .9655 .9675 .9695
PC .9715 .9734 .9753 .9772 .9791 .9810 .9828 .9846 .9864 .9882
PC .9900 .9918 .9935 .9952 .9969 .9986 1.000
LS 0 83
UD 0.83
KK V
RK 6000 0.027 0.03 0 TRAP 0 10
* ***************************************
      .N.2
KM AREA......(AC)... 331
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 2.7
KM VELOCITY..(FPS).. 1.7 ALLUVIAL FAN
KM LAG TIME..(HR)... 0.59
KM SOIL TYPE / CN... 100% BC
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PB 3.77
LS 0 78
UD 0.59
KK .
HC 2
KK V
RK 6000 0.018 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.3
KM AREA.....(AC)... 352
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.8
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.77
KM SOIL TYPE / CN... 90% BA, 10% B
BA .5500
PB 3.72
LS 0 73
UD .77
KK .
HC 2
KK V
RK 5700 0.017 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.4
KM AREA.....(AC)... 423
KM LENGTH....(FT)... 5700
KM SLOPE.....(%).... 1.7
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.73
KM SOIL TYPE / CN... 60% BA, 40% B
BA .2594
PB 3.67
LS 0 74
UD .73
KK .
HC 2
KK V
RK 6000 0.013 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.5
KM AREA.....(AC)... 388
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.3
KM VELOCITY..(FPS).. 1.2  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.83
KM SOIL TYPE / CN... 100% B
BA .6062
PB 3.62
LS 0 75
UD .83
KK .
HC 2
KK V
RK 5600 0.011 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.6
KM AREA.....(AC)... 381
KM LENGTH....(FT)... 5600
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.85
KM SOIL TYPE / CN... 90% B, 10% BA
BA .5953
PB 3.57
LS 0 75
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UD .85
KK .
HC 2
KK V
RK 8000 0.005 0.03 0 TRAP 100 10
* ************************************
     SIN.7
     EA......(AC)... 466
KM LENGTH....(FT)... 8000
KM SLOPE.....(%).... 0.5
KM VELOCITY..(FPS).. 0.5  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.67
KM SOIL TYPE / CN... 100% B
BA 1.8516
PB 3.52
LS 0 75
UD 2.67
KK .
KM INPUT TO ISAACK LAKE
HC 2
*  ************************************
KK BASIN.8
KM AREA......(AC)... 570
KM LENGTH....(FT)... 2100 2100 3200 7300
KM SLOPE.....(%).... 48.6 14.3  6.2  4.5
KM VELOCITY..(FPS).. 14.0  7.5  5.0  4.3   UPLAND GULLIES
KM LAG TIME..(HR)... 0.02 0.05 0.11 0.28
KM SOIL TYPE / CN... 95% BC, 5% D
BA .8906
PB 3.80
LS 0 79
UD  .5
(
RK 8000 0.028 0.03 0 TRAP 0 10
* ************************************
KK BASIN.9
KM AREA......(AC)... 230
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 2.8
KM VELOCITY..(FPS).. 1.7  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.59
KM SOIL TYPE / CN... 90% BA, 10% BC
BA .3594
PB 3.77
LS 0 74
UD .59
KK .
HC 2
KK V
RK 5800 0.021 0.03 0 TRAP 0 10
* ************************************
KK BASIN.10
KM AREA......(AC)... 308
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 2.1
KM VELOCITY..(FPS).. 1.5  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.64
K    . TYPE / CN... 100% BA
.    .12
PB 3.72
LS 0 73
UD .64
KK .
HC 2
KK V
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KK BASIN.11
KM AREA......(AC)... 337
KM LENGTH....(FT)... 5900
KM SLOPE.....(%).... 1.7
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.76
KM SOIL TYPE / CN... 95% BA, 5% B
BA .5266
PB 3.67
LS 0 73
UD .76
KK .
HC 2
KK V
RK 5800 0.016 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.12
KM AREA......(AC)... 362
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.6
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.74
KM SOIL TYPE / CN... 95% BA, 5% B
BA .5656
PB 3.62
LS 0 74 2.0
UD .74
KK .
HC 2
KK V
RK 6000 0.01 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.13
KM AREA......(AC)... 283
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.0
KM VELOCITY..(FPS).. 1.0  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.00
KM SOIL TYPE / CN... 85% BA, 15% B
BA .4422
PB 3.57
LS 0 74
UD 1.00
KK .
HC 2
* ***************************************
KK BASIN.14
KM AREA......(AC)... 949
KM LENGTH....(FT)... 1500 2500 2800 3700 6000
KM SLOPE.....(%).... 46.7 16.0  7.1  5.4  4.0
KM VELOCITY..(FPS).. 14.5  8.0  5.5  4.7  4.0  UPLAND GULLIES
KM LAG TIME..(HR)... 0.02 0.05 0.08 0.13 0.25
KM SOIL TYPE / CN... 88% BC, 10% D, 5% BA
BA 1.4828
PB 3.80
LS 0 81
UD .53
KK V
RK 6000 0.025 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.15
KM AREA......(AC)... 275
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 2.5
```

```
KM VELOCITY..(FPS).. 1.6  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.62
KM SOIL TYPE / CN... 95% BA, 5% BC
BA .4297
PB 3.77
LS 0 74
   52

KK V
RK 5800 0.017 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.16
KM AREA......(AC)... 326
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.7
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.74
KM SOIL TYPE / CN... 95% BA. 5% B
BA .5094
PB 3.72
LS 0 74
UD .74
KK .
HC 2
KK V
RK 5500 0.02 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.17
KM AREA......(AC)... 389
KM LENGTH....(FT)... 5500
KM SLOPE.....(%).... 2.0
    OCITY..(FPS).. 1.4  ALLUVIAL FAN
   G TIME..(HR)... 0.65
KM SOIL TYPE / CN... 80% BA, 20% B
BA .6078
PB 3.67
LS 0 74
UD .65
KK .
HC 2
KM ROUTE TO BASIN.22
KK V
RK 6000 0.013 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.18
KM AREA......(AC)... 781
KM LENGTH....(FT)... 1000 5100 6000 6300
KM SLOPE.....(%).... 24.0  5.9  5.0  3.6
KM VELOCITY..(FPS).. 10.0  4.8  4.5  3.9  UPLAND GULLIES
KM LAG TIME..(HR)... 0.02 0.18 0.22 0.27
KM SOIL TYPE / CN... 90% BC, 10% D
BA 1.2203
PB 3.80
LS 0 79
UD .69
KK V
RK 5700 0.028 0.03 0 TRAP 0 10
     ***************************************
KK BASIN.19
KM AREA......(AC)... 314
KM LENGTH....(FT)... 5700
KM SLOPE.....(%).... 2.8
KM VELOCITY..(FPS).. 1.7  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.56
```

```
BA .4906
PB 3.77
LS 0 75
UD .56
KK .
HC 2
KK V
RK 5900 0.019 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.20
KM AREA.....(AC)... 373
KM LENGTH....(FT)... 5900
KM SLOPE.....(%).... 1.9
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.70
KM SOIL TYPE / CN... 55% BA, 45% B
BA .5828
PB 3.72
LS 0 74
UD .70
KK .
HC 2
KK V
RK 5800 0.019 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.21
KM AREA.....(AC)... 354
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.9
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.69
KM SOIL TYPE / CN... 100% B
BA .5531
PB 3.67
LS 0 75
UD .69
KK .
HC 2
KK V
RK 6000 0.013 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.22
KM AREA.....(AC)... 430
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.3
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.91
KM SOIL TYPE / CN... 60% BA, 40% B
BA .6719
PB 3.62
LS 0 74
UD .91
KK .
KM COMBINE AREAS 8-22
HC 3
KK V
KM ROUTE TO BASIN.23
RK 7400 0.009 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.23
KM AREA.....(AC)... 491
KM LENGTH....(FT)... 7400
KM SLOPE.....(%).... 0.9
KM VELOCITY..(FPS).. 0.95 ALLUVIAL FAN
KM LAG TIME..(HR)... 1.30
KM SOIL TYPE / CN... 85% B, 15% BA
```

```
KM SOIL TYPE / CN... 85% B, 15% BA
BA .7672
PB 3.57
LS 0 75
UD 1.30
KK .
K[illegible]

[illegible]
KK V
RK 6500 0.006 0.03 0 TRAP 100 10
*  ***************************************
KK BASIN.24
KM AREA.....(AC)... 505
KM LENGTH....(FT)... 6500
KM SLOPE.....(%).... 0.6
KM VELOCITY..(FPS).. 0.55  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 1.97
KM SOIL TYPE / CN... 100% B
BA .7891
PB 3.52
LS 0 75
UD 1.97
KK .
HC 2
KK .
KM SAN AUGSTIN SYSTEM TO ISAACK LAKE
HC 2
* ***************************************
KK BASIN.25
KM AREA.....(AC)... 544
KM LENGTH....(FT)... 3000 7600 6000
K[illegible]  PE.....(%).... 8.0  5.3  3.7
[illegible]  LOCITY..(FPS).. 5.6  4.7  3.9  UPLAND GULLIES
KM LAG TIME..(HR)... 0.09 0.27 0.26
KM SOIL TYPE / CN... 97% BC, 3% D
BA .8500
PB 3.80
LS 0 79
UD .62
KK V
RK 5500 0.031 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.26
KM AREA.....(AC)... 314
KM LENGTH....(FT)... 5500
KM SLOPE.....(%).... 3.1
KM VELOCITY..(FPS).. 1.8  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.51
KM SOIL TYPE / CN... 55% BC, 45% BA
BA .4906
PB 3.77
LS 0 76
UD .51
KK .
HC 2
KK V
RK 5500 0.02 0.03 0 TRAP 0 10
      *********************************
K[illegible] BASIN.27
KM AREA.....(AC)... 373
KM LENGTH....(FT)... 5500
KM SLOPE.....(%).... 2.0
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.65
KM SOIL TYPE / CN... [illegible]
```

```
BA .3828
PB 3.72
LS 0 74 5.0
UD .65
KK .
HC 2
KK V
RK 5300 0.019 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.28
KM AREA.....(AC)... 381
KM LENGTH....(FT)... 5300
KM SLOPE.....(%).... 1.9
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.63
KM SOIL TYPE / CN... 100% B
BA .5953
PB 3.67
LS 0 75 2.0
UD .63
KK .
HC 2
KK V
KM ROUTE TO BASIN.33
RK 6500 0.012 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.29
KM AREA.....(AC)... 703
KM LENGTH....(FT)... 1500 9500 7500
KM SLOPE.....(%).... 38.0  7.4  4.3
KM VELOCITY..(FPS).. 13.0  5.5  4.2  UPLAND GULLIES
KM LAG TIME..(HR)... 0.02 0.29 0.30
KM SOIL TYPE / CN... 50% D, 50% BC
BA 1.0984
PB 3.80
LS 0 83
UD .61
KK V
RK 5500 0.031 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.30
KM AREA.....(AC)... 208
KM LENGTH....(FT)... 5500
KM SLOPE.....(%).... 3.1
KM VELOCITY..(FPS).. 1.8  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.51
KM SOIL TYPE / CN... 60% BC, 40% BA
BA .3250
PB 3.77
LS 0 76
UD .51
KK .
HC 2
* ****************************************
KK BASIN.41
KM AREA.....(AC)... 226
KM LENGTH....(FT)... 7300
KM SLOPE.....(%).... 4.5
KM VELOCITY..(FPS).. 4.3  UPLAND GULLIES
KM LAG TIME..(HR)... 0.28
KM SOIL TYPE / CN... 100% BC
BA .3531
PB 3.80
LS 0 78 15.0
UD .28
KK V
```

```
KM ROUTE TO BASIN.30
RK 5500 0.031 0.03 0 TRAP 0 10
KK .
KM COMBINE ORGAN ARROYO
HC 2
K  .
   UTE TO BASIN.31
.  00 0.017 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.31
KM AREA.....(AC)... 221
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.7
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.69
KM SOIL TYPE / CN... 80% BA, 20% B
BA .3453
PB 3.72
LS 0 74 5.0
UD .69
KK .
HC 2
KK V
KM ROUTE TO BASIN.32
RK 5500 0.016 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.32
KM AREA.....(AC)... 294
KM LENGTH....(FT)... 5500
KM SLOPE.....(%).... 1.6
KM VELOCITY..(FPS).. 1.3  ALLUVIAL FAN
K      TIME..(HR)... 0.71
(    .L TYPE / CN... 90% B, 10% BA
BA .4594
PB 3.67
LS 0 75 6.0
UD .71
KK .
HC 2
KK V
KM ROUTE TO BASIN.33
RK 7500 0.011 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.33
KM AREA.....(AC)... 388
KM LENGTH....(FT)... 7500
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.14
KM SOIL TYPE / CN... 95% B, 5% BA
BA .6063
PB 3.62
LS 0 75 2.0
UD 1.14
KK .
KM COMBINE OWL'S NEST & ORGAN ARROYOS
HC 2
K
K   UTE TO BASIN.35
RK 4000 0.014 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.34
KM AREA.....(AC)... 372
KM LENGTH....(FT)... 7000
```

KM SOIL TYPE / CN... 100% B
BA .5813
PB 3.62
LS 0 75 2.0
UD .97
KK V
RK 2500 0.012 0.03 0 TRAP 0 10
* **
KK BASIN.35
KM AREA.....(AC)... 138
KM LENGTH....(FT)... 4000
KM SLOPE.....(%).... 1.4
KM VELOCITY..(FPS).. 1.2 ALLUVIAL FAN
KM LAG TIME..(HR)... 0.56
KM SOIL TYPE / CN... 100% B
BA .2156
PB 3.59
LS 0 75 2.0
UD .56
KK .
HC 3
KK V
RK 8800 0.008 0.03 0 TRAP 100 10
* **
KK BASIN.36
KM AREA.....(AC)... 332
KM LENGTH....(FT)... 6500
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1 ALLUVIAL FAN
KM LAG TIME..(HR)... 0.98
KM SOIL TYPE / CN... 85% B, 15% BA
BA .5188
PB 3.62
LS 0 75
UD .98
KK V
RK 6700 0.009 0.03 0 TRAP 0 10
* **
KK BASIN.37
KM AREA.....(AC)... 409
KM LENGTH....(FT)... 6700
KM SLOPE.....(%).... 0.9
KM VELOCITY..(FPS).. 0.95 ALLUVIAL FAN
KM LAG TIME..(HR)... 1.18
KM SOIL TYPE / CN... 95% B, 5% BA
BA .6391
PB 3.57
LS 0 75
UD 1.18
KK .
HC 2
KK V
RK 8800 0.008 0.03 0 TRAP 100 10
* **
KK BASIN.38
KM AREA.....(AC)... 620
KM LENGTH....(FT)... 8800
KM SLOPE.....(%).... 0.8
KM VELOCITY..(FPS).. 0.63 SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.33
KM SOIL TYPE / CN... 100% B
BA .9688
PB 3.52
LS 0 75

```
UD 2.33
KK .
HC 2
KK .
HC 2
* ***************************************
KK BASIN.39
     :A.....(AC)... 652
K.. LENGTH....(FT)... 8000
KM SLOPE.....(%).... 1.0
KM VELOCITY..(FPS).. 1.0  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.33
KM SOIL TYPE / CN... 100% B
BA 1.0186
PB 3.56
LS 0 75
UD 1.33
KK V
RK 10600 0.007 0.03 0 TRAP 100 10
* ***************************************
KK BASIN.40
KM AREA.....(AC)... 776
KM LENGTH....(FT)... 10600
KM SLOPE.....(%)....  0.7
KM VELOCITY..(FPS)..  0.6  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.94
KM SOIL TYPE / CN... 100% B
BA 1.2125
PB 3.51
LS 0 75
UD 2.94
KK .
K
HC 2
* ***************************************
KK BASIN.42
KM AREA.....(AC)... 390
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 2.9
KM VELOCITY..(FPS).. 1.8  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.54
KM SOIL TYPE / CN... 55% BC, 45% BA
BA .6094
PB 3.77
LS 0 76
UD .54
KK V
RK 5600 0.02 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.43
KM AREA.....(AC)... 569
KM LENGTH....(FT)... 5600
KM SLOPE.....(%).... 2.0
KM VELOCITY..(FPS).. 1.4  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.67
KM SOIL TYPE / CN... 60% BA, 40% B
BA  8891

L     , 10
UD .67
KK .
HC 2
KK V
KM ROUTE TO BASIN.45
RK 7000 0.011 0.03 0 TRAP 0 10
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* ***************************************
KK BASIN.44
KM AREA......(AC)... 2856
KM LENGTH....(FT)... 2100 3500 6000 10000 7500
KM SLOPE.....(%).... 48.6 14.3  8.3   3.0  1.5
KM VELOCITY..(FPS).. 14.5  7.7  5.6   3.5  1.2  UPLAND GULLIES/AF
KM LAG TIME..(HR)... 0.02 0.08 0.18  0.48 1.04
KM SOIL TYPE / CN... 40% D, 30% BC, 20% B, 10% BA
BA 4.4625
PB 3.80
LS 0 81 2.5
UD 1.80
KK V
KM ROUTE TO BASIN.45
RK 7000 0.011 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.45
KM AREA......(AC)... 477
KM LENGTH....(FT)... 7000
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.06
KM SOIL TYPE / CN... 95% B, 5% BA
BA .7453
PB 3.67
LS 0 75 8.0
UD 1.06
KK .
KM COMBINE BLAIR CANYON ARROYO
HC 3
KK V
KM ROUTE TO BASIN.47
RK 7500 0.009 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.46
KM AREA......(AC)... 211
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.3
KM VELOCITY..(FPS).. 1.2  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.83
KM SOIL TYPE / CN... 100% B
BA .3297
PB 3.66
LS 0 75 8.0
UD .83
KK V
KM ROUTE TO BASIN.47
RK 7500 0.009 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.47
KM AREA......(AC)... 463
KM LENGTH....(FT)... 7500
KM SLOPE.....(%).... 0.9
KM VELOCITY..(FPS).. 0.95  ALLUVIAL FAN
KM LAG TIME..(HR)... 1.32
KM SOIL TYPE / CN... 100% B
BA .7234
PB 3.62
LS 0 75
UD 1.32
KK .
HC 3
KK V
KM ROUTE TO BASIN.48
RK 5300 0.008 0.03 0 TRAP 0 10
```

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* ****************************************
KK BASIN.48
KM AREA.....(AC)... 335
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 0.7
KM VELOCITY..(FPS).. 0.85  ALLUVIAL FAN
     G TIME..(HR)... 1.78
     IL TYPE / CN... 100% B
BA .4406
PB 3.57
LS 0 75
UD 1.78
KK .
HC 2
KK V
KM ROUTE TO BASIN.49
RK 4000 0.01 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.49
KM AREA.....(AC)... 240
KM LENGTH....(FT)... 4000
KM SLOPE.....(%).... 1.0
KM VELOCITY..(FPS).. 1.0  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.67
KM SOIL TYPE / CN... 100% B
BA .3750
PB 3.52
LS 0 75
UD .67
KK .
HC 2
KK V
(     TE TO BASIN.50
RK 3000 0.006 0.03 0 TRAP 100 10
* ****************************************
KK BASIN.50
KM AREA.....(AC)... 776
KM LENGTH....(FT)... 8500
KM SLOPE.....(%).... 0.6
KM VELOCITY..(FPS).. 0.55  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.58
KM SOIL TYPE / CN... 100% B
BA 1.2125
PB 3.50
LS 0 75
UD 2.58
KK .
HC 2
* ****************************************
KK BASIN.51
KM AREA.....(AC)... 3310
KM LENGTH....(FT)... 2700 3000 5500 5000 4000 6500 4500
KM SLOPE.....(%).... 34.8 16.7 10.9  6.0  2.5  1.5  1.1
KM VELOCITY..(FPS).. 12.0  8.1  6.6  5.0  3.2  1.3  1.1  UG & AF
KM LAG TIME..(HR)... 0.04 0.06 0.14 0.17 0.21 0.83 0.68
KM SOIL TYPE / CN... 50% D, 30% B, 20% BA
BA 5.1719
P  - 70
.      . 2.0
UD 2.13
KK V
RK 3000 0.01 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.52
KM AREA.....(AC)... 108
```

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KM VELOCITY..(FPS).. 1.0  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.50
KM SOIL TYPE / CN... 100% B
BA .1688
PB 3.66
LS 0 75 10.0
UD .50
KK .
HC 2
KK V
RK 6000 0.011 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.53
KM AREA......(AC)... 275
KM LENGTH....(FT)... 6000
KM SLOPE.....(%).... 1.1
KM VELOCITY..(FPS).. 1.1  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.91
KM SOIL TYPE / CN... 100% B
BA .4297
PB 3.62
LS 0 75 4.0
UD .91
KK .
HC 2
KK V
RK 6200 0.007 0.03 0 TRAP 0 10
*  ***************************************
KK BASIN.54
KM AREA......(AC)... 5396
KM LENGTH....(FT)... 2000 6300 4500 7500 5000 7000 6000
KM SLOPE.....(%).... 75.0 19.0  8.9  2.7  2.0  1.4  1.3
KM VELOCITY..(FPS).. 17.0  8.5  5.6  3.3  2.8  1.2  1.2
KM LAG TIME..(HR)... 0.02 0.12 0.13 0.38 0.30 0.97 0.83
KM SOIL TYPE / CN... 40% D, 30% BA, 30% B
BA 8.4313
PB 3.80
LS 0 80 2.5
UD 2.75
KK V
RK 5800 0.01 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.55
KM AREA......(AC)... 257
KM LENGTH....(FT)... 5800
KM SLOPE.....(%).... 1.0
KM VELOCITY..(FPS).. 1.0  ALLUVIAL FAN
KM LAG TIME..(HR)... 0.97
KM SOIL TYPE / CN... 100% B
BA .4016
PB 3.61
LS 0 75 7.5
UD .97
KK .
HC 2
KK V
RK 6200 0.007 0.03 0 TRAP 0 10
* ***************************************
KK BASIN.56
KM AREA......(AC)... 434
KM LENGTH....(FT)... 6200
KM SLOPE.....(%).... 0.7
KM VELOCITY..(FPS).. 0.6  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 1.72
KM SOIL TYPE / CN... 100% B
```

```
BA .6781
PB 3.57
LS 0 75 1.3
UD 1.72
KK .
HC 3
K
K    J0 0.008 0.03 0 TRAP 0 10
* ****************************************
KK BASIN.57
KM AREA.....(AC)... 425
KM LENGTH....(FT)... 7800
KM SLOPE.....(%).... 0.8
KM VELOCITY..(FPS).. 0.63  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.06
KM SOIL TYPE / CN... 100% B
BA .6641
PB 3.52
LS 0 75 4.5
UD 2.06
KK .
HC 2
KK V
KM ROUTE TO BASIN.60
RK 6500 0.004 0.03 0 TRAP 100 10
* ****************************************
KK BASIN.58
KM AREA.....(AC)... 661
KM LENGTH....(FT)... 11200
KM SLOPE.....(%).... 0.9
KM VELOCITY..(FPS).. 0.66  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.83
K       TYPE / CN... 100% B
BA 1.0328
PB 3.57
LS 0 75 1.5
UD 2.83
KK V
KM ROUTE TO BASIN.60
RK 6000 0.004 0.03 0 TRAP 100 10
* ****************************************
KK BASIN.59
KM AREA.....(AC)... 202
KM LENGTH....(FT)... 7600
KM SLOPE.....(%).... 0.8
KM VELOCITY..(FPS).. 0.63  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 2.01
KM SOIL TYPE / CN... 100% B
BA .3156
PB 3.50
LS 0 75 12.0
UD 2.01
KK V
KM ROUTE TO BASIN.60
RK 9800 0.004 0.03 0 TRAP 100 10
* ****************************************
KK BASIN.60
K       .....(AC)... 808
K      TH....(FT)... 9800
KM SLOPE.....(%).... 0.3
KM VELOCITY..(FPS).. 0.5  SHORT GRASS PASTURE
KM LAG TIME..(HR)... 3.27
KM SOIL TYPE / CN... 100% B
BA 1.2625
PB 3.46
```

```
UD 3.27
KK .
KM SUM OF BAYLOR CANYON & MINE HOUSE ARROYOS
HC 4
KK V
KM ROUTE TO BASIN.50
RK 7000 0.002 0.03 0 TRAP 100 10
KK .
KM COMBINE WITH BLAIR CANYON ARROYO
HC 2
KK V
KM ROUTE TO BASIN.40
RK 6000 0.002 0.03 0 TRAP 100 10
KK .
KM COMBINE WITH ISAACK LAKE
HC 2
ZZ
```

CUMULATIVE AREA = 55.96 SQ MI

Existing 100 yr.
9/3/91

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	BASIN.1	695.	6.75	185.	57.	55.	1.00		
ROUTED TO	V	690.	6.92	185.	57.	54.	1.00		
HYDROGRAPH AT	BASIN.2	359.	6.58	76.	24.	23.	.52		
2 COMBINED AT	.	982.	6.75	260.	80.	77.	1.52		
ROUTED TO	V	969.	6.83	259.	80.	77.	1.52		
HYDROGRAPH AT	BASIN.3	226.	6.75	61.	20.	19.	.55		
2 COMBINED AT	.	1194.	6.83	320.	100.	96.	2.07		
ROUTED TO	V	1182.	6.92	319.	99.	96.	2.07		
HYDROGRAPH AT	BASIN.4	115.	6.75	30.	9.	9.	.26		
2 COMBINED AT	.	1288.	6.92	347.	109.	105.	2.33		
ROUTED TO	V	1265.	7.00	346.	108.	104.	2.33		
HYDROGRAPH AT	BASIN.5	251.	6.83	71.	23.	22.	.61		
2 COMBINED AT	.	1503.	7.00	414.	131.	126.	2.93		
ROUTED TO	V	1478.	7.08	413.	130.	125.	2.93		
HYDROGRAPH AT	BASIN.6	234.	6.83	67.	22.	21.	.60		
2 COMBINED AT	.	1694.	7.08	478.	152.	146.	3.53		
ROUTED TO	V	1594.	7.33	470.	149.	144.	3.53		
HYDROGRAPH AT	BASIN.7	279.	8.92	180.	63.	61.	1.85		

+	2 COMBINED AT .	1721.	7.33	649.	213.	205.	5.38
	HYDROGRAPH AT BASIN.8	800.	6.42	140.	43.	42.	.89
+	ROUTED TO V	785.	6.50	139.	43.	41.	.89
	HYDROGRAPH AT BASIN.9	199.	6.58	43.	14.	13.	.36
+	2 COMBINED AT .	981.	6.50	182.	57.	55.	1.25
	ROUTED TO V	959.	6.58	181.	57.	55.	1.25
+	HYDROGRAPH AT BASIN.10	228.	6.67	54.	17.	17.	.48
	2 COMBINED AT .	1187.	6.58	235.	74.	71.	1.73
+	ROUTED TO V	1151.	6.67	234.	74.	71.	1.73
	HYDROGRAPH AT BASIN.11	212.	6.75	57.	18.	18.	.53
+	2 COMBINED AT .	1360.	6.67	290.	92.	88.	2.26
	ROUTED TO V	1336.	6.83	289.	91.	88.	2.26
+	HYDROGRAPH AT BASIN.12	250.	6.75	65.	21.	20.	.57
	2 COMBINED AT .	1580.	6.83	352.	112.	108.	2.82
+	ROUTED TO V	1572.	6.92	351.	112.	108.	2.82
	HYDROGRAPH AT BASIN.13	144.	7.00	47.	15.	15.	.44
+	2 COMBINED AT .	1713.	6.92	397.	127.	122.	3.27
	HYDROGRAPH AT BASIN.14	1326.	6.50	254.	78.	75.	1.48
	ROUTED TO V	1306.	6.58	253.	78.	75.	1.48
	HYDROGRAPH AT BASIN.15	229.	6.58	52.	16.	16.	.43
	2 COMBINED AT .	1535.	6.58	305.	94.	91.	1.91
	ROUTED TO V	1512.	6.67	303.	94.	90.	1.91

HYDROGRAPH AT							
+	BASIN.16	230.	6.75	60.	19.	18.	.51
2 COMBINED AT							
	.	1740.	6.67	363.	113.	109.	2.42
ROUTED TO							
+	V	1717.	6.75	361.	113.	108.	2.42
HYDROGRAPH AT							
+	BASIN.17	294.	6.67	69.	22.	21.	.61
2 COMBINED AT							
+	.	2001.	6.67	429.	135.	130.	3.03
ROUTED TO							
+	V	1971.	6.83	428.	134.	129.	3.03
HYDROGRAPH AT							
+	BASIN.18	805.	6.67	190.	59.	57.	1.22
ROUTED TO							
+	V	799.	6.75	189.	59.	57.	1.22
HYDROGRAPH AT							
+	BASIN.19	299.	6.50	62.	20.	19.	.49
2 COMBINED AT							
+	.	1070.	6.67	251.	79.	76.	1.71
ROUTED TO							
+	V	1055.	6.75	250.	78.	75.	1.71
HYDROGRAPH AT							
+	BASIN.20	275.	6.67	68.	22.	21.	.58
2 COMBINED AT							
+	.	1328.	6.75	318.	100.	96.	2.29
ROUTED TO							
+	V	1313.	6.83	317.	100.	96.	2.29
HYDROGRAPH AT							
+	BASIN.21	272.	6.67	66.	21.	20.	.55
2 COMBINED AT							
+	.	1569.	6.83	382.	121.	116.	2.85
ROUTED TO							
+	V	1543.	6.92	381.	120.	116.	2.85
HYDROGRAPH AT							
+	BASIN.22	243.	6.92	74.	24.	23.	.67
3 COMBINED AT							
+	.	3705.	6.83	881.	278.	268.	6.55
ROUTED TO							
+	V	3678.	7.00	878.	277.	267.	6.55
HYDROGRAPH AT							
+	BASIN.23	215.	7.33	85.	28.	27.	.77

2 COMBINED AT							
+	.	3869.	7.00	962.	304.	293.	7.32
2 COMBINED AT							
+	.	5542.	7.00	1358.	431.	415.	10.58
ROUTED TO							
+	V	5509.	7.08	1379.	435.	419.	10.58
HYDROGRAPH AT							
+	BASIN.24	153.	8.08	82.	27.	26.	.79
2 COMBINED AT							
+	.	5596.	7.08	1460.	462.	445.	11.37
2 COMBINED AT							
+	.	7070.	7.17	2108.	675.	650.	16.75
HYDROGRAPH AT							
+	BASIN.25	610.	6.58	133.	41.	40.	.85
ROUTED TO							
+	V	604.	6.67	132.	41.	40.	.85
HYDROGRAPH AT							
+	BASIN.26	340.	6.50	66.	21.	20.	.49
2 COMBINED AT							
+	.	916.	6.58	198.	62.	59.	1.34
ROUTED TO							
+	V	902.	6.67	197.	61.	59.	1.34
HYDROGRAPH AT							
+	BASIN.27	317.	6.58	74.	24.	23.	.58
2 COMBINED AT							
+	.	1219.	6.67	270.	85.	82.	1.92
ROUTED TO							
+	V	1206.	6.75	269.	85.	82.	1.92
HYDROGRAPH AT							
+	BASIN.28	325.	6.58	74.	23.	23.	.60
2 COMBINED AT							
.	.	1511.	6.75	342.	108.	104.	2.52
ROUTED TO							
.	V	1503.	6.83	341.	108.	104.	2.52
HYDROGRAPH AT							
	BASIN.29	972.	6.58	204.	62.	60.	1.10
ROUTED TO							
	V	964.	6.58	204.	62.	60.	1.10
HYDROGRAPH AT							
	BASIN.30	225.	6.50	44.	14.	13.	.32
2 COMBINED AT							
	.	1178.	6.58	247.	76.	73.	1.42
HYDROGRAPH AT							
	BASIN.41	498.	6.17	61.	19.	19.	.35

ROUTED TO							
+	V	499.	6.25	63.	20.	19.	.35
2 COMBINED AT							
	.	1510.	6.50	310.	96.	92.	1.78
ROUTED TO							
+	V	1480.	6.58	309.	95.	92.	1.78
HYDROGRAPH AT							
+	BASIN.31	180.	6.67	44.	14.	13.	.35
2 COMBINED AT							
+	.	1657.	6.58	352.	109.	105.	2.12
ROUTED TO							
+	V	1634.	6.67	351.	109.	105.	2.12
HYDROGRAPH AT							
+	BASIN.32	245.	6.67	60.	19.	19.	.46
2 COMBINED AT							
+	.	1878.	6.67	411.	128.	123.	2.58
ROUTED TO							
+	V	1871.	6.75	409.	127.	123.	2.58
HYDROGRAPH AT							
+	BASIN.33	202.	7.17	72.	23.	22.	.61
3 COMBINED AT							
+	.	3511.	6.83	822.	258.	249.	5.71
ROUTED TO							
+	V	3496.	6.92	825.	259.	249.	5.71
HYDROGRAPH AT							
+	BASIN.34	220.	7.00	69.	22.	21.	.58
ROUTED TO							
+	V	219.	7.00	69.	22.	21.	.58
HYDROGRAPH AT							
+	BASIN.35	123.	6.50	26.	8.	8.	.22
3 COMBINED AT							
+	.	3788.	6.92	917.	289.	279.	6.50
ROUTED TO							
+	V	3735.	7.00	909.	286.	276.	6.50
HYDROGRAPH AT							
+	BASIN.36	188.	7.00	60.	19.	19.	.52
ROUTED TO							
	V	182.	7.25	59.	19.	18.	.52
HYDROGRAPH AT							
+	BASIN.37	194.	7.25	71.	23.	22.	.64
2 COMBINED AT							
+	.	375.	7.25	130.	42.	41.	1.16

+	V	358.	7.67	127.	41.	40.	1.16
HYDROGRAPH AT							
+ BASIN.38	163.	8.50	97.	33.	32.	.97	
2 COMBINED AT							
+ .	488.	7.75	224.	74.	72.	2.13	
2 COMBINED AT							
+ .	3874.	7.08	1132.	360.	347.	8.63	
HYDROGRAPH AT							
+ BASIN.39	278.	7.42	112.	36.	35.	1.02	
ROUTED TO							
+ V	257.	8.00	108.	35.	34.	1.02	
HYDROGRAPH AT							
+ BASIN.40	168.	9.17	114.	41.	40.	1.21	
3 COMBINED AT							
+ .	3947.	7.08	1349.	437.	421.	10.86	
2 COMBINED AT							
+ .	10946.	7.17	3455.	1112.	1071.	27.61	
HYDROGRAPH AT							
+ BASIN.42	406.	6.50	82.	26.	25.	.61	
ROUTED TO							
+ V	401.	6.58	81.	26.	25.	.61	
HYDROGRAPH AT							
+ BASIN.43	514.	6.67	121.	39.	37.	.89	
2 COMBINED AT							
+ .	912.	6.58	202.	64.	62.	1.50	
ROUTED TO							
+ V	906.	6.75	201.	64.	62.	1.50	
HYDROGRAPH AT							
+ BASIN.44	1524.	7.83	741.	236.	228.	4.46	
ROUTED TO							
+ V	1518.	8.00	738.	235.	226.	4.46	
HYDROGRAPH AT							
+ BASIN.45	298.	7.08	99.	32.	31.	.75	
3 COMBINED AT							
+ .	1952.	7.58	1032.	331.	319.	6.71	
ROUTED TO							
+ V	1948.	7.75	1029.	329.	317.	6.71	
HYDROGRAPH AT							
+ BASIN.46	159.	6.83	44.	14.	14.	.33	
ROUTED TO							
+ V	155.	7.08	44.	14.	13.	.33	
HYDROGRAPH AT							
+ BASIN.47	206.	7.42	82.	27.	26.	.72	

3 COMBINED AT							
+	.	2246.	7.58	1154.	370.	356.	7.76
ROUTED TO							
	V	2243.	7.67	1151.	369.	355.	7.76
HYDROGRAPH AT							
+	BASIN.48	95.	7.92	47.	16.	15.	.44
2 COMBINED AT							
+	.	2336.	7.67	1198.	384.	370.	8.20
ROUTED TO							
+	V	2335.	7.75	1197.	383.	369.	8.20
HYDROGRAPH AT							
+	BASIN.49	172.	6.67	42.	13.	13.	.38
2 COMBINED AT							
+	.	2383.	7.67	1227.	396.	382.	8.57
ROUTED TO							
+	V	2376.	7.83	1217.	392.	378.	8.57
HYDROGRAPH AT							
+	BASIN.50	185.	8.75	117.	41.	40.	1.21
2 COMBINED AT							
+	.	2526.	7.92	1335.	433.	417.	9.79
HYDROGRAPH AT							
+	BASIN.51	1525.	8.25	834.	271.	261.	5.17
ROUTED TO							
+	V	1524.	8.33	834.	271.	261.	5.17
HYDROGRAPH AT							
+	BASIN.52	124.	6.42	23.	7.	7.	.17
2 COMBINED AT							
+	.	1535.	8.33	850.	278.	268.	5.34
ROUTED TO							
+	V	1532.	8.42	849.	277.	267.	5.34
HYDROGRAPH AT							
+	BASIN.53	177.	6.92	53.	17.	16.	.43
2 COMBINED AT							
+	.	1578.	8.33	897.	294.	283.	5.77
ROUTED TO							
+	V	1576.	8.50	895.	293.	282.	5.77
HYDROGRAPH AT							
	BASIN.54	1924.	8.92	1237.	423.	408.	8.43
ROUTED TO							
+	V	1922.	9.00	1236.	422.	406.	8.43
HYDROGRAPH AT							
+	BASIN.55	166.	7.00	52.	17.	16.	.40

	2 COMBINED AT						
+		.	1951.	9.00	1272.	438.	422.	8.83
	ROUTED TO						
+		V	1947.	9.08	1271.	436.	420.	8.83
	HYDROGRAPH AT						
+		BASIN.56	155.	7.83	75.	25.	24.	.68
	3 COMBINED AT						
+		.	3547.	8.75	2230.	754.	726.	15.28
	ROUTED TO						
+		V	3541.	8.83	2225.	750.	722.	15.28
	HYDROGRAPH AT						
+		BASIN.57	135.	8.17	74.	25.	24.	.66
	2 COMBINED AT						
+		.	3660.	8.83	2296.	774.	746.	15.95
	ROUTED TO						
+		V	3651.	9.00	2287.	768.	740.	15.95
	HYDROGRAPH AT						
+		BASIN.58	157.	9.08	104.	37.	36.	1.03
	ROUTED TO						
+		V	155.	9.50	103.	36.	35.	1.03
	HYDROGRAPH AT						
+		BASIN.59	73.	8.08	39.	13.	13.	.32
	ROUTED TO						
+		V	70.	9.17	38.	12.	12.	.32
	HYDROGRAPH AT						
+		BASIN.60	164.	9.50	117.	43.	42.	1.26
	4 COMBINED AT						
+		.	4025.	9.00	2542.	860.	828.	18.56
	ROUTED TO						
+		V	4017.	9.17	2526.	850.	819.	18.56
	2 COMBINED AT						
+		.	5992.	8.83	3767.	1283.	1236.	28.34
	ROUTED TO						
+		V	5977.	9.00	3749.	1273.	1226.	28.34
	2 COMBINED AT						
+		.	11160.	7.25	7021.	2384.	2297.	55.96

*** NORMAL END OF HEC-1 ***

C:\HEC1>

PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 1
1-24" CMP, 60'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	60.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
5.0	1.00	1.16	0.95	0.89	0.79	0.89	3.70
10.0	1.00	1.82	1.60	1.37	1.13	1.37	4.35
20.0	1.00	3.32	3.74	2.00	1.61	1.61	7.40
25.0	1.00	4.58	5.24	2.00	1.76	1.76	8.53
23.0	1.00	4.04	4.60	2.00	1.71	1.71	8.06

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 2
1-24" CMP, 90'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	90.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
20.0	1.00	3.32	4.23	2.00	1.61	1.61	7.40
23.0	1.00	4.04	5.35	2.00	1.71	1.71	8.06

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 3
1-24" CMP, 90'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	90.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
20.0	1.00	3.32	4.23	2.00	1.61	1.61	7.40
23.0	1.00	4.04	5.35	2.00	1.71	1.71	8.06

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 4
1-72" CMP, 160'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	6.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	160.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
5.0	1.00	0.78	1.69	0.61	0.58	1.00	1.61
10.0	1.00	1.12	1.82	0.85	0.82	1.00	3.23
20.0	1.00	1.61	2.01	1.20	1.17	1.17	5.13
30.0	1.00	2.01	2.17	1.47	1.44	1.44	5.73
40.0	1.00	2.36	2.33	1.69	1.67	1.69	6.10
50.0	1.00	2.68	2.49	1.90	1.88	1.90	6.49
75.0	1.00	3.41	2.89	2.36	2.32	2.36	7.27
100.0	1.00	4.07	3.34	2.77	2.69	2.77	7.84
200.0	1.00	6.54	5.71	4.32	3.86	4.32	9.17
225.0	1.00	7.15	6.46	4.82	4.11	4.82	9.24
230.0	1.00	7.27	6.62	4.93	4.15	4.93	9.26
240.0	1.00	7.52	6.94	5.21	4.24	5.21	9.21
250.0	1.00	7.89	7.28	6.00	4.33	6.00	8.84
260.0	1.00	8.21	7.62	6.00	4.42	6.00	9.20
255.0	1.00	8.06	7.45	6.00	4.37	6.00	9.02

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 5
1-72" CMP, 130'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	6.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	130.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
75.0	1.00	3.41	3.16	2.36	2.32	2.36	7.27
100.0	1.00	4.07	3.58	2.77	2.69	2.77	7.84
125.0	1.00	4.71	4.05	3.16	3.02	3.16	8.30
200.0	1.00	6.54	5.78	4.32	3.86	4.32	9.17
250.0	1.00	7.89	7.22	6.00	4.33	6.00	8.84
255.0	1.00	8.06	7.38	6.00	4.37	6.00	9.02
252.0	1.00	7.96	7.28	6.00	4.35	6.00	8.91

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 6
1-60" CMP, 90'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	5.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	90.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
50.0	1.00	2.93	2.85	2.06	1.98	2.06	6.56
100.0	1.00	4.60	4.08	3.11	2.85	3.11	7.80
150.0	1.00	6.19	5.73	4.48	3.51	4.48	8.08
175.0	1.00	7.11	6.72	5.00	3.79	5.00	8.91
165.0	1.00	6.85	6.31	5.00	3.68	5.00	8.40
170.0	1.00	7.01	6.51	5.00	3.74	5.00	8.66

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 7
1-60"x48" CMP, 90', EQUIV. DIA.=54"

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	4.50
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	90.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	1.00	5.00	4.53	3.47	2.94	3.47	7.60
125.0	1.00	6.08	5.67	4.50	3.29	4.50	7.86
122.0	1.00	5.93	5.52	4.50	3.25	4.50	7.67
123.0	1.00	5.98	5.57	4.50	3.26	4.50	7.73

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 8
1-60"x48" CMP, 80' EQUIV. DIA.=54"

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	4.50
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	80.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	1.00	5.00	4.54	3.47	2.94	3.47	7.60
125.0	1.00	6.08	5.63	4.50	3.29	4.50	7.86
123.0	1.00	5.98	5.54	4.50	3.26	4.50	7.73

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 9
3-72"x48" CMP, 80' EQUIV. DIA.=60" Q=3x145=435

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	5.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	80.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	0.10	4.60	4.13	3.11	2.85	3.11	7.80
125.0	0.10	5.39	4.87	3.66	3.20	3.66	8.12
130.0	0.10	5.55	5.03	3.79	3.26	3.79	8.15
135.0	0.10	5.71	5.19	3.92	3.33	3.92	8.17
140.0	0.10	5.87	5.36	4.22	3.39	4.22	7.92
145.0	0.10	6.03	5.54	4.23	3.45	4.23	8.19

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 10
3-72"x48" CMP, 90' EQUIV. DIA.=60" Q=3x145=435

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	5.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	90.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
125.0	0.10	5.39	4.85	3.66	3.20	3.66	8.12
130.0	0.10	5.55	5.01	3.79	3.26	3.79	8.15
140.0	0.10	5.87	5.36	4.22	3.39	4.22	7.92
145.0	0.10	6.03	5.54	4.23	3.45	4.23	8.19

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 11
2-72" CMP, 80' Q=2x253=506

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	6.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	80.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	0.10	4.07	3.99	2.77	2.69	2.77	7.84
150.0	0.10	5.33	4.86	3.53	3.33	3.53	8.68
200.0	0.10	6.54	5.90	4.32	3.86	4.32	9.17
250.0	0.10	7.89	7.13	6.00	4.33	6.00	8.84
275.0	0.10	8.52	7.82	6.00	4.54	6.00	9.73
260.0	0.10	8.21	7.40	6.00	4.42	6.00	9.20
255.0	0.10	8.06	7.26	6.00	4.37	6.00	9.02
253.0	0.10	7.99	7.21	6.00	4.36	6.00	8.95

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 12
2-72" CMP, 80' Q=2x253=506

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	6.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	80.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
150.0	0.10	5.33	4.86	3.53	3.33	3.53	8.68
200.0	0.10	6.54	5.90	4.32	3.86	4.32	9.17
250.0	0.10	7.89	7.13	6.00	4.33	6.00	8.84
253.0	0.10	7.99	7.21	6.00	4.36	6.00	8.95

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 13
3-60" CMP, 105' Q=3x170=510

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	5.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	105.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	1.00	4.60	4.00	3.11	2.85	3.11	7.80
125.0	1.00	5.39	4.81	3.66	3.20	3.66	8.12
150.0	1.00	6.19	5.75	4.48	3.51	4.46	8.08
160.0	1.00	6.64	6.15	5.00	3.63	5.00	8.15
170.0	1.00	7.01	6.58	5.00	3.74	5.00	8.66

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 14
3-60" CMP, 90' Q=3x170=510

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	5.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	90.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
125.0	1.00	5.39	4.85	3.66	3.20	3.66	8.12
150.0	1.00	6.19	5.73	4.48	3.51	4.48	8.08
160.0	1.00	6.64	6.11	5.00	3.63	5.00	8.15
170.0	1.00	7.01	6.51	5.00	3.74	5.00	8.66

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 15
1-36" CMP, 50'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	3.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	1
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	50.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
50.0	1.00	3.97	4.27	3.00	2.30	2.30	8.59
75.0	1.00	6.34	7.12	3.00	2.72	2.72	11.14
60.0	1.00	4.80	5.30	3.00	2.50	2.50	9.53
65.0	1.00	5.27	5.87	3.00	2.59	2.59	10.03
62.0	1.00	4.99	5.52	3.00	2.54	2.54	9.73

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 16
1-30" CMP, 50'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	50.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
50.0	1.00	7.09	6.83	2.50	2.30	2.50	10.19
40.0	1.00	5.02	4.97	2.50	2.13	2.50	8.15
35.0	1.00	4.16	4.17	2.50	2.01	2.01	8.28
36.0	1.00	4.32	4.33	2.50	2.03	2.03	8.41
37.0	1.00	4.49	4.48	2.50	2.06	2.50	7.54

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 17
1-36" CMP, 80'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	3.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	80.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
50.0	1.00	4.39	4.54	3.00	2.30	2.30	8.59
55.0	1.00	4.97	5.16	3.00	2.41	2.41	9.05

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 18
1-36" CMP, 50'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	3.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	50.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
50.0	1.00	4.39	4.27	3.00	2.30	3.00	7.07
55.0	1.00	4.97	4.77	3.00	2.41	3.00	7.78

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 19
1-30" CMP, 36'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	36.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
50.0	1.00	7.09	6.27	2.50	2.30	2.50	10.19
25.0	1.00	2.96	2.80	2.50	1.70	2.50	5.09
30.0	1.00	3.50	3.35	2.50	1.87	2.50	6.11
35.0	1.00	4.16	3.97	2.50	2.01	2.50	7.13
40.0	1.00	5.02	4.66	2.50	2.13	2.50	8.15
37.0	1.00	4.49	4.24	2.50	2.06	2.50	7.54

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 20
1-36" CMP, 75'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	3.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	75.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
50.0	1.00	4.39	4.49	3.00	2.30	2.30	8.59
55.0	1.00	4.97	5.09	3.00	2.41	2.41	9.05

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 21
1-24" CMP, 30'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	30.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
40.0	1.00	10.04	8.63	2.00	1.95	2.00	12.73
20.0	1.00	3.32	3.24	2.00	1.61	2.00	6.37
25.0	1.00	4.58	4.30	2.00	1.76	2.00	7.96
22.0	1.00	3.79	3.64	2.00	1.67	2.00	7.00
23.0	1.00	4.04	3.85	2.00	1.71	2.00	7.32

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 22
1-24" CMP, 30'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	30.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
20.0	1.00	3.32	3.24	2.00	1.61	2.00	6.37
23.0	1.00	4.04	3.85	2.00	1.71	2.00	7.32

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 23
1-24" CMP,50'

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.00
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	50.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth at (ft)	Outlet Depth (ft)	Outlet Velocity (fps)
20.0	1.00	3.32	3.57	2.00	1.61	1.61	7.40
23.0	1.00	4.04	4.35	2.00	1.71	1.71	8.06

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 24
3-32" METAL PIPES, 50' Q=3x43=129

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.67
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	50.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
20.0	1.00	2.39	1.96	1.20	1.49	1.20	8.20
25.0	1.00	2.79	2.27	1.35	1.67	1.35	8.79
30.0	1.00	3.20	2.61	1.51	1.84	1.51	9.21
35.0	1.00	3.71	2.99	1.67	1.98	1.67	9.50
40.0	1.00	4.26	3.41	1.92	2.12	1.92	9.29
45.0	1.00	5.01	3.88	2.02	2.23	2.02	9.90
42.0	1.00	4.55	3.59	1.91	2.16	1.91	9.81
43.0	1.00	4.70	3.69	1.94	2.19	1.94	9.85

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 25
3-32" METAL PIPES, 50' Q=3x43=129

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.67
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	50.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
40.0	1.00	4.26	3.41	1.92	2.12	1.92	9.29
42.0	1.00	4.55	3.59	1.91	2.16	1.91	9.81
43.0	1.00	4.70	3.69	1.94	2.19	1.94	9.85

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 26
2-32" METAL PIPES, 45' Q=2x42.5=85

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.67
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	45.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
40.0	1.00	4.26	3.43	1.92	2.12	1.92	9.29
43.0	1.00	4.70	3.70	1.94	2.19	1.94	9.85
42.0	1.00	4.55	3.61	1.91	2.16	1.91	9.81
42.5	1.00	4.63	3.65	1.93	2.17	1.93	9.82

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 27
2-32" METAL PIPES, 45' Q=2x42.5=85

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.67
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	45.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
40.0	1.00	4.26	3.43	1.92	2.12	1.92	9.29
42.5	1.00	4.63	3.65	1.93	2.17	1.93	9.82

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 28
3-32" METAL PIPES, 45' Q=3x42.5=127.5

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.67
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	45.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth at Depth (ft)	Outlet Depth (ft)	Outlet Velocity (fps)
42.5	1.00	4.63	3.65	1.93	2.17	1.93	9.82

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 29
3-32" METAL PIPES, 45' Q=3x42.5=127.5

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.67
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	45.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
42.5	1.00	4.63	3.65	1.93	2.17	1.93	9.82

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 16, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATER SHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 30
6-32" METAL PIPES, 45' Q=6x42.5=255

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.67
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	45.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
42.5	1.00	4.63	3.65	1.93	2.17	1.93	9.82

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 31
2-30" RCP, 122', 2.5' TOTAL ALLOWABLE HEAD, Q=2x50=100

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	122.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
45.0	1.00	4.39	4.56	2.50	2.23	2.23	9.75
50.0	1.00	5.01	5.40	2.50	2.30	2.30	10.58

==========

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BOX CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 32
6-8'x3' CBC, 120', 4.0' TOTAL ALLOWABLE HEAD, Q=6x262=1572

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Span (Width of Opening) (feet).....	8.00
Culvert Rise (Height of Opening) (feet).....	3.00
FHWA Chart Number (8,9,10,11,12 or 13).....	8
Scale Number on Chart (Type of Culvert Entrance).....	1
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.35
Culvert Length (feet).....	120.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	1.00	2.73	1.65	1.17	1.69	1.17	10.70
200.0	1.00	5.10	3.66	1.86	2.69	1.86	13.41
300.0	1.00	8.45	6.35	2.47	3.00	2.47	15.16
250.0	1.00	6.61	4.96	2.18	3.00	2.18	14.37
260.0	1.00	6.95	5.21	2.24	3.00	2.24	14.54
262.0	1.00	7.02	5.27	2.25	3.00	2.25	14.57

==========

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BOX CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 33
4-10'x3' CBC, 101', 4.0' TOTAL ALLOWABLE HEAD, Q=4x327=1308

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Span (Width of Opening) (feet).....	10.00
Culvert Rise (Height of Opening) (feet).....	3.00
FHWA Chart Number (8,9,10,11,12 or 13).....	8
Scale Number on Chart (Type of Culvert Entrance).....	1
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.35
Culvert Length (feet).....	101.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	1.00	2.34	1.52	0.99	1.46	0.99	10.08
200.0	1.00	4.12	2.86	1.56	2.32	1.56	12.82
300.0	1.00	6.28	4.72	2.05	3.00	2.05	14.66
325.0	1.00	6.95	5.20	2.16	3.00	2.16	15.03
330.0	1.00	7.09	5.29	2.18	3.00	2.18	15.11
327.0	1.00	7.00	5.24	2.17	3.00	2.17	15.06

==========

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BOX CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 34
7-8'x5' CBC, 124', 5.0' TOTAL ALLOWABLE HEAD, Q=7x497=3479

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Span (Width of Opening) (feet).....	8.00
Culvert Rise (Height of Opening) (feet).....	5.00
FHWA Chart Number (8,9,10,11,12 or 13).....	8
Scale Number on Chart (Type of Culvert Entrance).....	1
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.35
Culvert Length (feet).....	124.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
200.0	1.00	4.32	3.26	1.86	2.69	1.86	13.42
500.0	1.00	10.07	7.87	3.58	5.00	3.58	17.46
490.0	1.00	9.83	7.65	3.53	4.88	3.53	17.37
498.0	1.00	10.02	7.83	3.57	5.00	3.57	17.45
496.0	1.00	9.97	7.80	3.56	5.00	3.56	17.43
497.0	1.00	9.99	7.82	3.56	5.00	3.56	17.44

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 35
16-30" RCP, 188', 2.5' TOATL ALLOWABLE HEAD, Q=16x50=800

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	188.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
45.0	1.00	4.39	4.69	2.50	2.23	2.23	9.75
50.0	1.00	5.01	5.71	2.50	2.30	2.30	10.58

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 36
3-30" RCP, 184', 2.5' TOTAL ALLOWABLE HEAD, Q=3x50=150

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	184.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
45.0	1.00	4.39	4.68	2.50	2.23	2.23	9.75
50.0	1.00	5.01	5.70	2.50	2.30	2.30	10.58

==========

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BOX CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 37
1-6'x6' CBC, 110', 1.0' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Span (Width of Opening) (feet).....	6.00
Culvert Rise (Height of Opening) (feet).....	6.00
FHWA Chart Number (8,9,10,11,12 or 13).....	8
Scale Number on Chart (Type of Culvert Entrance).....	1
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.35
Culvert Length (feet).....	110.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	1.00	3.25	3.12	1.47	2.05	1.47	11.33
200.0	1.00	5.24	4.33	2.41	3.26	2.41	13.86
300.0	1.00	6.93	5.83	3.25	4.27	3.25	15.38
305.0	1.00	7.01	5.91	3.29	4.31	3.29	15.44
304.0	1.00	6.99	5.89	3.28	4.30	3.28	15.42

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 38
1-30" RCP, 144', 0.5' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	144.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth at Outlet (ft)	Velocity (fps)
40.0	1.00	3.83	3.78	1.99	2.13	1.99	9.53
35.0	1.00	3.34	3.04	1.78	2.01	1.78	9.38
30.0	1.00	2.97	2.38	1.59	1.87	1.59	9.11

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 39
2-30" RCP, 124', 2.5' TOTAL ALLOWABLE HEAD, Q=2x50=100

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	124.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
45.0	1.00	4.39	4.56	2.50	2.23	2.23	9.75
50.0	1.00	5.01	5.41	2.50	2.30	2.30	10.58

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 40
7-30" RCP, 148', 1.5' TOTAL ALLOWABLE HEAD, Q=7x41=287

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	148.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
35.0	1.00	3.34	3.03	1.78	2.01	1.78	9.38
40.0	1.00	3.83	3.78	1.99	2.13	1.99	9.53
42.0	1.00	4.05	4.10	2.07	2.17	2.17	9.28
41.0	1.00	3.94	3.94	2.05	2.15	2.15	9.13

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 41
1-30" RCP, 130', 2.5' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	130.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Velocity (fps)
45.0	1.00	4.39	4.58	2.50	2.23	2.23	9.75
50.0	1.00	5.01	5.44	2.50	2.30	2.30	10.58

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 42
1-30" RCP, 136', 2.5' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	136.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
45.0	1.00	4.39	4.59	2.50	2.23	2.23	9.75
50.0	1.00	5.01	5.47	2.50	2.30	2.30	10.58

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 43
1-30" RCP, 152', 1.5' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	152.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
35.0	1.00	3.34	3.02	1.78	2.01	1.78	9.38
40.0	1.00	3.83	3.78	1.99	2.13	1.99	9.53
41.0	1.00	3.94	3.94	2.05	2.15	2.15	9.13

==========

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BOX CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 44
1-6'x6' CBC, 123', 1.0' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Span (Width of Opening) (feet).....	6.00
Culvert Rise (Height of Opening) (feet).....	6.00
FHWA Chart Number (8,9,10,11,12 or 13).....	8
Scale Number on Chart (Type of Culvert Entrance).....	1
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.35
Culvert Length (feet).....	123.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
200.0	1.00	5.24	4.21	2.41	3.26	2.41	13.86
300.0	1.00	6.93	5.74	3.25	4.27	3.25	15.38
304.0	1.00	6.99	5.81	3.28	4.30	3.28	15.42

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 45
4-76"x57" CMP, EQUIV. DIA.=66", 1' TOT. ALLOW. HEAD Q=4x161= 644

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	5.50
FHWA Chart Number (1,2 or 3).....	2
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0240
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	186.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	1.00	4.30	3.24	2.91	2.76	2.91	7.85
125.0	1.00	5.00	3.96	3.31	3.11	3.31	8.37
150.0	1.00	5.69	4.78	3.81	3.42	3.81	8.55
160.0	1.00	5.97	5.14	4.00	3.53	4.00	8.63
161.0	1.00	6.00	5.18	4.03	3.54	4.03	8.64

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 46
1-30" RCP, 164', 0.5' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	164.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
25.0	1.00	2.58	1.67	1.41	1.70	1.41	8.76
30.0	1.00	2.97	2.29	1.59	1.87	1.59	9.11

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 47
1-24" RCP, 100', 3' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.00
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	100.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
30.0	1.00	4.27	4.80	2.00	1.86	1.86	9.84
35.0	1.00	5.31	6.23	2.00	1.92	1.92	11.29
31.0	1.00	4.47	5.07	2.00	1.88	1.88	10.13
32.0	1.00	4.67	5.35	2.00	1.89	1.89	10.41
33.0	1.00	4.88	5.64	2.00	1.90	1.90	10.70
34.0	1.00	5.09	5.93	2.00	1.91	1.91	10.99

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 48
1-24" RCP, 148', 3.0' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.00
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	148.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
30.0	1.00	4.27	5.16	2.00	1.86	1.86	9.84
35.0	1.00	5.31	6.89	2.00	1.92	1.92	11.29
34.0	1.00	5.09	6.53	2.00	1.91	1.91	10.99
33.0	1.00	4.88	6.17	2.00	1.90	1.90	10.70

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 49
1-120" CMP, 168', 1.0' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet)	10.00
FHWA Chart Number (1,2 or 3)	2
Scale Number on Chart (Type of Culvert Entrance)	3
Manning's Roughness Coefficient (n-value)	0.0240
Entrance Loss Coefficient of Culvert Opening	0.50
Culvert Length (feet)	168.0
Culvert Slope (feet per foot)	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
100.0	1.00	3.22	4.54	2.26	2.32	2.32	7.25
200.0	1.00	4.76	5.21	3.21	3.31	3.31	8.81
500.0	1.00	8.44	7.45	5.34	5.34	5.34	11.73
600.0	1.00	9.58	8.36	5.99	5.87	5.99	12.22
700.0	1.00	10.71	9.37	6.66	6.36	6.66	12.61
750.0	1.00	11.27	9.91	7.00	6.59	7.00	12.78
725.0	1.00	10.99	9.64	6.82	6.48	6.82	12.70

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 50
1-24" RCP, 135', 2' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.00
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	135.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
25.0	1.00	3.39	3.65	2.00	1.76	1.76	8.53
30.0	1.00	4.27	5.07	2.00	1.86	1.86	9.84
27.0	1.00	3.72	4.19	2.00	1.81	1.81	9.04
28.0	1.00	3.90	4.47	2.00	1.83	1.83	9.30

==========

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 51
1-42" RCP, 188', 1.5' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	3.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	188.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
40.0	1.00	2.85	1.55	1.53	1.97	1.53	9.87
50.0	1.00	3.28	2.07	1.75	2.21	1.75	10.42
75.0	1.00	4.34	3.68	2.25	2.71	2.25	11.47
85.0	1.00	4.89	4.46	2.46	2.87	2.46	11.74
87.0	1.00	5.01	4.62	2.51	2.90	2.51	11.76

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 52
1-30" RCP, 120', 0.5' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	120.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Headwater (ft) Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
25.0	1.00	2.58	1.95	1.41	1.70	1.41	8.76
30.0	1.00	2.97	2.49	1.59	1.87	1.59	9.11
31.0	1.00	2.99	2.61	1.62	1.90	1.62	9.18

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PIPE CULVERT ANALYSIS
COMPUTATION OF CULVERT PERFORMANCE CURVE

August 19, 1991
DONA ANA FLOOD COMMISSION - JORNADA WATERSHED MASTER PLAN
EXISTING DRAINAGE STRUCTURE 53
1-30" RCP, 116', 0.5' TOTAL ALLOWABLE HEAD

==========

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Culvert Diameter (feet).....	2.50
FHWA Chart Number (1,2 or 3).....	1
Scale Number on Chart (Type of Culvert Entrance).....	3
Manning's Roughness Coefficient (n-value).....	0.0130
Entrance Loss Coefficient of Culvert Opening.....	0.50
Culvert Length (feet).....	116.0
Culvert Slope (feet per foot).....	0.0100

==========

PROGRAM RESULTS:

Flow Rate (cfs)	Tailwater Depth (ft)	Headwater (ft) Inlet Control	Outlet Control	Normal Depth (ft)	Critical Depth (ft)	Depth at Outlet (ft)	Outlet Velocity (fps)
30.0	1.00	2.97	2.51	1.59	1.87	1.59	9.11
31.0	1.00	2.99	2.63	1.62	1.90	1.62	9.18

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****
HEC2 RELEASE DATED SEPT 88

****

NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

ARROYO RD CH 10 & 100 YR

SUMMARY PRINTOUT

	SECNO	CWSEL	DEPTH	VCH
	11880.000	4690.34	2.34	8.24
	11880.000	4691.15	3.15	9.67
	11440.000	4681.43	2.33	8.32
	11440.000	4682.23	3.13	9.75
	11000.000	4672.55	2.35	8.24
	11000.000	4673.34	3.14	9.68
	10560.000	4663.52	2.32	8.36
	10560.000	4664.32	3.12	9.79
	.20.000	4654.65	2.32	8.07
	10120.000	4655.43	3.10	9.50
	9680.000	4645.72	2.32	8.31
	9680.000	4646.53	3.13	9.70
	9240.000	4636.85	2.35	8.21
	9240.000	4637.64	3.14	9.69
	8800.000	4627.93	2.33	8.35
	8800.000	4628.74	3.14	9.74
	8360.000	4619.12	2.45	8.43
	8360.000	4619.93	3.30	9.91
	7920.000	4609.99	2.29	8.53
	7920.000	4610.77	3.07	10.05
	7480.000	4601.19	2.39	8.02
	7480.000	4602.02	3.22	9.38

1

	SECNO	CWSEL	DEPTH	VCH
	7040.000	4592.19	2.29	8.49
	7040.000	4592.98	3.08	9.98
*	6600.000	4585.00	4.00	9.19
*	6600.000	4586.33	5.33	10.39

6080.000	4576.83	3.83	9.86
6080.000	4577.97	4.97	11.65
5560.000	4568.86	3.96	9.32
5560.000	4570.14	5.24	10.64
5040.000	4560.75	3.85	9.74
5040.000	4561.91	5.01	11.44
4520.000	4552.86	3.96	9.34
4520.000	4554.12	5.22	10.72
4000.000	4545.39	4.57	9.82
4000.000	4546.77	5.95	11.29
3464.000	4536.83	4.33	10.69
3464.000	4538.13	5.63	12.38
2928.000	4528.88	4.58	9.78
2928.000	4530.25	5.95	11.32
2392.000	4520.32	4.32	10.70
2392.000	4521.64	5.64	12.35
1856.000	4512.36	4.66	9.75
1856.000	4513.70	6.00	11.34
1320.000	4504.21	4.81	10.78
1320.000	4505.80	6.40	12.22
880.000	4497.45	4.85	10.73
880.000	4498.88	6.28	12.72
440.000	4490.62	4.82	10.82
440.000	4492.18	6.38	12.37
.000	4483.84	4.84	10.74
.000	4485.28	6.28	12.67

SUMMARY OF ERRORS AND SPECIAL NOTES

CAUTION SECNO= 6600.000 PROFILE= 1 CRITICAL DEPTH ASSUMED
CA

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HEC2 RELEASE DATED SEPT 88

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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

BAYLOR CH 10 & 100 YR

SUMMARY PRINTOUT

	SECNO	CWSEL	DEPTH	VCH
	26860.000	4723.44	2.44	8.62
	26860.000	4723.77	2.77	9.21
	26417.000	4714.13	2.43	8.62
	26417.000	4714.45	2.75	9.25
	25974.000	4704.83	2.43	8.59
	25974.000	4705.16	2.76	9.18
	25531.000	4695.55	2.45	8.63
	25531.000	4695.87	2.77	9.26
	25088.000	4686.23	2.43	8.65
	25088.000	4686.57	2.77	9.25
	24645.000	4677.05	2.45	8.55
	24645.000	4677.39	2.79	9.17
	24202.000	4667.73	2.43	8.70
	24202.000	4668.05	2.75	9.31
	23760.000	4658.45	2.45	8.58
	23760.000	4658.77	2.77	9.19
*	23322.000	4652.24	2.64	7.74
*	23322.000	4652.61	3.01	8.18
*	22884.000	4645.94	2.64	7.72
*	22884.000	4646.31	3.01	8.16
*	22446.000	4639.53	2.62	7.73
*	22446.000	4639.90	3.00	8.14

1

	SECNO	CWSEL	DEPTH	VCH
	22008.000	4633.24	2.64	7.71
*	22008.000	4633.62	3.02	8.15
*	21570.000	4626.83	2.63	7.71
*	21570.000	4627.20	3.00	8.17

*	21132.000	4620.53	2.63	7.72
*	21132.000	4620.90	3.00	8.14
*	20694.000	4614.14	2.64	7.71
*	20694.000	4614.51	3.01	8.15
*	20256.000	4607.83	2.63	7.71
*	20256.000	4608.21	3.01	8.15
*	19810.000	4601.33	2.63	7.72
*	19810.000	4601.71	3.01	8.14
*	19710.000	4600.35	3.35	8.56
*	19710.000	4600.95	3.95	9.15
	19356.000	4592.50	2.90	10.58
	19356.000	4593.00	3.40	11.55
	19002.000	4585.56	3.26	8.92
	19002.000	4586.10	3.81	9.70
	18650.000	4577.95	2.95	10.31
	18650.000	4578.45	3.45	11.19
*	18550.000	4576.87	3.37	8.50
*	18550.000	4577.46	3.96	9.10
*	18125.000	4572.35	3.35	8.55
*	18125.000	4572.95	3.95	9.14
*	17700.000	4567.86	3.36	8.54
*	17700.000	4568.45	3.95	9.15
*	17275.000	4563.47	3.37	8.54
*	17275.000	4564.06	3.96	9.15
*	16850.000	4558.97	3.37	8.56
*	16850.000	4559.56	3.96	9.17
*	16425.000	4554.47	3.37	8.54
*	16425.000	4555.06	3.96	9.18
	16000.000	4549.28	2.68	7.22
	16000.000	4549.35	2.75	8.29

1

	SECND	CWSEL	DEPTH	VCH
*	15860.000	4547.82	2.02	7.92
*	15860.000	4548.36	2.58	9.02
*	15859.000	4547.82	2.02	7.90
*	15859.000	4548.39	2.59	8.89
*	15740.000	4545.38	1.58	10.27
*	15740.000	4545.84	2.04	11.48
*	15739.000	4545.45	1.65	9.79
*	15739.000	4545.89	2.09	11.22

*	15650.000	4544.89	3.59	8.80
*	15650.000	4545.67	4.37	9.56
	15150.000	4536.25	3.35	9.76
	5150.000	4536.90	4.00	10.91
*	14650.000	4528.20	3.60	8.81
	14650.000	4528.95	4.35	9.64
	14150.000	4519.55	3.35	9.77
	14150.000	4520.22	4.02	10.87
	13650.000	4511.49	3.59	8.79
	13650.000	4512.22	4.32	9.69
	13150.000	4503.09	3.39	9.62
	13150.000	4503.77	4.07	10.66
*	12650.000	4496.30	3.60	8.78
*	12650.000	4497.06	4.36	9.56
*	12150.000	4489.29	3.59	8.79
	12150.000	4490.01	4.31	9.74
	12050.000	4487.70	2.80	9.12
*	12050.000	4488.66	3.76	9.79
*	11550.000	4486.79	2.89	8.80
*	11550.000	4487.66	3.76	9.79
	)50.000	4485.80	2.90	8.75
*	11050.000	4486.66	3.76	9.79
*	10550.000	4484.79	2.89	8.79
*	10550.000	4485.66	3.76	9.79
*	10050.000	4483.80	2.90	8.75
*	10050.000	4484.66	3.76	9.79

	SECNO	CWSEL	DEPTH	VCH
*	9550.000	4482.79	2.89	8.77
*	9550.000	4483.66	3.76	9.78
*	9150.000	4482.00	2.90	8.78
*	9150.000	4482.86	3.76	9.81
*	9050.000	4484.98	6.58	11.34
*	9050.000	4486.81	8.41	12.65
*	8550.000	4479.08	6.58	11.38
	8550.000	4480.79	8.29	13.00
*	8050.000	4473.25	6.55	11.34
*	8050.000	4475.09	8.39	12.57
*	7550.000	4467.40	6.60	11.35
	7550.000	4469.12	8.32	12.96

*	7050.000	4461.46	6.56	11.39
	7050.000	4463.25	8.35	12.79
*	6550.000	4455.59	6.59	11.35
	6550.000	4457.34	8.34	12.87
*	6050.000	4449.78	6.58	11.37
	6050.000	4451.61	8.41	12.67
*	5550.000	4443.90	6.60	11.36
	5550.000	4445.60	8.30	12.99
*	5100.000	4438.94	6.94	11.66
*	5100.000	4440.97	8.97	13.04
*	4595.000	4433.84	6.94	11.62
*	4595.000	4435.86	8.96	13.02
*	4090.000	4428.64	6.94	11.62
*	4090.000	4430.67	8.97	13.02
*	3585.000	4423.56	6.96	11.63
*	3585.000	4425.60	9.00	13.02
*	3080.000	4418.32	6.92	11.65
*	3080.000	4420.34	8.94	13.05
*	2575.000	4413.26	6.96	11.61
*	2575.000	4415.29	9.00	13.01
*	2070.000	4408.14	6.94	11.64
*	2070.000	4410.16	8.96	13.03

1

	SECNO	CWSEL	DEPTH	VCH
*	1565.000	4402.95	6.95	11.63
*	1565.000	4404.98	8.98	13.01
*	1060.000	4397.75	6.95	11.65
*	1060.000	4399.78	8.98	13.03
*	555.000	4392.64	6.94	11.63
*	555.000	4394.66	8.96	13.03
*	50.000	4388.18	7.58	12.10
*	50.000	4390.53	9.93	13.61

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HEC2 RELEASE DATED SEPT 88

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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

JORNADA CH 10 & 100 YR

SUMMARY PRINTOUT

	SECNO	CWSEL	DEPTH	VCH
*	12000.000	4385.15	5.15	11.14
*	12000.000	4387.03	7.03	12.70
*	11475.000	4382.34	5.14	11.17
*	11475.000	4384.21	7.01	12.73
*	10950.000	4379.53	5.13	11.17
*	10950.000	4381.41	7.01	12.71
*	10425.000	4376.64	5.14	11.18
*	10425.000	4378.52	7.02	12.73
	300.000	4373.84	5.14	11.17
*	9900.000	4375.71	7.01	12.72
*	9375.000	4371.03	5.13	11.18
*	9375.000	4372.91	7.01	12.71
*	8850.000	4368.25	5.15	11.16
*	8850.000	4370.13	7.03	12.72
*	8325.000	4365.44	5.14	11.18
*	8325.000	4367.32	7.02	12.73
*	7800.000	4362.63	5.13	11.19
*	7800.000	4364.51	7.01	12.73
*	7275.000	4359.74	5.14	11.18
*	7275.000	4361.63	7.02	12.73
*	6750.000	4356.94	5.14	11.17
*	6750.000	4358.82	7.02	12.73

	SECNO	CWSEL	DEPTH	VCH
	6650.000	4355.17	3.87	12.00
	6650.000	4356.66	5.36	14.38
*	6175.000	4352.96	4.26	10.71
*	6175.000	4354.73	6.03	12.44

*	5700.000	4350.45	4.25	10.72
*	5700.000	4352.22	6.02	12.43
*	5225.000	4347.85	4.25	10.73
*	5225.000	4349.63	6.03	12.43
*	4750.000	4345.35	4.25	10.73
*	4750.000	4347.12	6.02	12.44
*	4275.000	4342.75	4.25	10.71
*	4275.000	4344.52	6.02	12.44
*	3800.000	4340.25	4.25	10.73
*	3800.000	4342.02	6.02	12.44
*	3325.000	4338.35	4.25	10.72
*	3325.000	4340.12	6.02	12.45
*	2850.000	4336.55	4.25	10.72
*	2850.000	4338.32	6.02	12.45
*	2375.000	4334.65	4.25	10.71
*	2375.000	4336.42	6.02	12.43
*	1900.000	4332.75	4.25	10.72
*	1900.000	4334.52	6.02	12.43
*	1425.000	4330.85	4.25	10.72
*	1425.000	4332.62	6.02	12.45
*	950.000	4329.18	4.38	10.88
*	950.000	4330.99	6.19	12.62
*	475.000	4327.28	4.38	10.85
*	475.000	4329.10	6.20	12.59
*	.000	4325.38	4.38	10.87
*	.000	4327.20	6.20	12.59

THIS RUN EXECUTED 12/ 2/91 16:33:26

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C2 RELEASE DATED SEPT 88

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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

RINCON RD CH 10 & 100 YR

SUMMARY PRINTOUT

SECNO	CWSEL	DEPTH	VCH
29280.000	4738.02	2.42	9.69
29280.000	4738.43	2.83	10.57
28780.000	4725.93	2.53	9.07
28780.000	4726.36	2.96	9.88
28280.000	4713.63	2.43	9.61
28280.000	4714.04	2.84	10.46
27780.000	4701.63	2.53	9.10
27780.000	4702.06	2.96	9.92
27304.000	4689.93	2.43	9.60
27304.000	4690.35	2.85	10.45
26826.000	4678.41	2.51	9.14
26826.000	4678.84	2.94	9.96
26352.000	4666.74	2.44	9.55
26352.000	4667.16	2.86	10.39
25876.000	4655.21	2.51	9.19
25876.000	4655.63	2.93	10.04
25400.000	4643.43	2.31	9.16
25400.000	4643.81	2.69	9.97
24910.000	4631.41	2.51	9.14
24910.000	4631.85	2.95	9.92
24420.000	4619.23	2.43	9.63
24420.000	4619.64	2.84	10.51

1

SECNO	CWSEL	DEPTH	VCH
23930.000	4607.10	2.50	9.28
23930.000	4607.53	2.93	10.09

	SECNO	CWSEL	DEPTH	VCH
	23440.000	4594.83	2.43	9.59
	23440.000	4595.24	2.84	10.45
	22950.000	4582.69	2.49	9.29
	22950.000	4583.12	2.92	10.11
	22510.000	4571.63	2.43	9.59
	22510.000	4572.04	2.84	10.45
*	22410.000	4569.49	2.49	9.30
*	22410.000	4570.41	3.41	9.42
	21937.000	4560.01	2.41	9.69
	21937.000	4560.46	2.86	11.73
	21464.000	4550.67	2.47	9.34
	21464.000	4551.46	3.26	9.97
	20991.000	4541.33	2.43	9.58
	20991.000	4541.83	2.93	11.34
	20518.000	4531.95	2.45	9.44
	20518.000	4532.68	3.18	10.30
	20045.000	4523.32	2.52	9.05
	20045.000	4523.87	3.07	10.67
	19572.000	4512.97	2.27	10.15
	19572.000	4513.61	2.91	11.25
	19100.000	4503.73	2.73	8.92
	19100.000	4504.31	3.31	10.40
	18630.000	4494.36	2.35	9.87
	18630.000	4495.01	3.01	11.02
	18160.000	4485.11	2.51	9.20
	18160.000	4485.69	3.09	10.67
	17690.000	4475.70	2.40	9.75
	17690.000	4476.35	3.05	10.90
	17220.000	4466.50	2.50	9.25
	17220.000	4467.08	3.08	10.70
*	17120.000	4465.93	3.73	9.71
*	17120.000	4467.19	4.99	11.04

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	SECNO	CWSEL	DEPTH	VCH
	16627.000	4457.19	3.29	11.35
	16627.000	4458.22	4.32	13.30
	16134.000	4449.25	3.65	9.98
	16134.000	4450.42	4.82	11.57
	15641.000	4440.63	3.33	11.19
	15641.000	4441.70	4.40	13.01

	15148.000	4432.59	3.59	10.15
	15148.000	4433.73	4.73	11.85
	14655.000	4424.19	3.39	10.98
	14655.000	4425.28	4.48	12.74
	14162.000	4416.04	3.54	10.36
	14162.000	4417.15	4.65	12.12
	13669.000	4407.60	3.40	10.90
	13669.000	4408.70	4.50	12.64
	13230.000	4400.33	3.53	10.43
	13230.000	4401.42	4.62	12.21
*	13130.000	4399.21	3.71	9.76
*	13130.000	4400.48	4.98	11.05
*	12692.000	4394.41	3.71	9.76
*	12692.000	4395.69	4.98	11.04
*	12254.000	4389.72	3.72	9.75
*	12254.000	4390.99	4.99	11.04
*	11816.000	4385.01	3.71	9.77
*	11816.000	4386.29	4.99	11.04
*	11380.000	4380.21	3.71	9.76
*	11380.000	4381.49	4.99	11.04
*	11280.000	4379.21	3.71	9.76
	80.000	4380.49	4.99	11.05
*	10802.000	4374.02	3.72	9.75
*	10802.000	4375.29	4.99	11.05
*	10324.000	4369.36	4.16	10.21
*	10324.000	4370.79	5.59	11.56
*	9846.000	4364.26	4.16	10.23
*	9846.000	4365.70	5.60	11.59

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	SECNO	CWSEL	DEPTH	VCH
*	9368.000	4359.15	4.15	10.24
*	9368.000	4360.59	5.59	11.59
*	8890.000	4353.96	4.16	10.23
*	8890.000	4355.40	5.60	11.57
*	8412.000	4348.85	4.15	10.23
*	8412.000	4350.29	5.59	11.57
	7934.000	4343.76	4.16	10.23
*	7934.000	4345.20	5.60	11.57
*	7456.000	4338.65	4.15	10.24
*	7456.000	4340.09	5.59	11.58

*	6978.000	4333.46	4.16	10.21
*	6978.000	4334.89	5.59	11.58
*	6500.000	4328.39	4.17	10.22
*	6500.000	4329.82	5.60	11.58
*	6300.000	4327.87	5.80	12.21
*	6300.000	4330.07	8.00	13.98
*	6100.000	4326.25	5.77	12.21
*	6100.000	4328.44	7.96	13.99
*	5650.000	4324.00	5.80	12.23
*	5650.000	4326.20	8.00	14.00
*	5200.000	4321.59	5.79	12.26
*	5200.000	4323.80	8.00	14.03
*	4750.000	4319.30	5.80	12.23
*	4750.000	4321.50	8.00	14.01
*	4300.000	4316.99	5.79	12.25
*	4300.000	4319.19	7.99	14.02
*	3850.000	4314.69	5.79	12.23
*	3850.000	4316.89	7.99	14.00
*	3400.000	4312.30	5.80	12.23
*	3400.000	4314.49	7.99	14.02
*	2950.000	4309.99	5.79	12.23
*	2950.000	4312.19	7.99	14.01
*	2500.000	4307.69	5.79	12.24
*	2500.000	4309.89	7.99	14.00

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	SECNO	CWSEL	DEPTH	VCH
*	2000.000	4305.10	5.80	12.23
*	2000.000	4307.22	7.92	14.21
*	1500.000	4301.38	4.68	11.47
*	1500.000	4303.28	6.58	13.28
*	1000.000	4298.47	4.27	11.10
*	1000.000	4300.24	6.04	12.94
*	500.000	4295.54	3.96	10.78
*	500.000	4297.19	5.61	12.63
*	.000	4292.96	3.96	10.79
*	.000	4294.62	5.62	12.62

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Job Name..... SAN AUGUSTIN ARROYO
Job No..... 90035.11

Date..... AUGUST 1, 1991

SEDIMENT TRANSPORT BEDLOAD CALCULATIONS

These calculations determine the bedload transport capacity of a stream using the following bedload equations:

RECOMMENDED RANGES OF APPLICATION:

Bedload Equation:	Median Grain Size (mm)
1. Engelund-Hansen	0.20 mm to 1 mm
2. DuBoys	0.05 mm to 5 mm
3. Meyer-Peter Muller	0.40 mm to 30 mm
4. Einstein-Brown	0.30 mm to 7 mm
5. Inglis-Lacey	0.01 mm to 1 mm
6. Meyer-Peter	3.00 mm to 30 mm
7. Schoklitsch	0.30 mm to 5 mm
8. Laursen	0.01 mm to 4 mm
9. Shields	1.70 mm to 2.5 mm

LOOK-UP TABLES USED IN DUBOYS FORMULA:

d50	critical shearstress	DuBoys ft^3/
mm	lbs/ft^2	lb sec
0.01	0.017	1000
0.05	0.017	300
0.10	0.017	150
0.15	0.017	120
0.20	0.018	95
0.25	0.018	80
0.30	0.019	70
0.40	0.020	55
0.50	0.022	47
0.60	0.024	42
0.70	0.026	37
0.80	0.028	33
0.90	0.030	30
1.00	0.033	28
1.50	0.040	21
2.00	0.050	17
2.50	0.060	14
3.00	0.070	12
4.00	0.090	10
5.00	0.110	8
selected:	0.033	28

GENERAL PARAMETERS:

Acceleration of gravity	32.2 ft/sec^2
Kinematic viscosity of water	0.000012 ft^2/sec
Specific weight of water	62.4 lbs/ft^3
Specific weight of sediment	165 lbs/ft^3
Einstein-Brown and fall velocity factor:	0.00137

SEDIMENT PARAMETERS:

Median grain size (D-50)... 1.30 mm
90% passing (D-90)... 3.40 mm

(D-50)... 0.0043 ft
(for Eq.3 only) (D-90)... 0.0112 ft

HYDRAULIC PARAMETERS:

Hydraulic parameters for the sediment transport calculations must be estimated from the following sources:

1) HEC-2 analysis
2) Field measurements
3) Normal depth calculations
4) Other acceptable methods

Discharge (cfs)	Bed Width (ft)	Flow Depth (ft)	X-sect. Area (ft^2)	Flow Velocity (fps)	Hydr. Radius (ft)	Slope ( )
200	22	1.26	27.89	7.17	1.26	0.026
300	25	1.47	37.13	8.08	1.47	0.026
400	28	1.63	45.35	8.92	1.63	0.026
500	30	1.78	53.50	9.35	1.78	0.026
650	32	1.96	63.41	10.25	1.96	0.026
800	35	2.12	73.33	10.91	2.12	0.026

SAN AGUSTIN ARROYO 5 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4, 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	851	2549	64	913	2242	203	312	728	9218	1126
300 cfs	1554	3967	97	1654	3985	306	473	1123	16132	1804
400 cfs	2381	5380	131	2484	6136	408	634	1549	23851	2512
500 cfs	3296	6938	162	3495	8109	511	795	1927	32558	3289
650 cfs	4931	9065	216	5023	12578	664	1037	2640	46605	4441
800 cfs	6718	11347	267	6795	15984	818	1279	3206	62043	5682
Q(Bed)=a*Q(Water)^b										
a=	0.31634	8.49573	0.28118	0.42823	0.96665	0.99066	1.42460	2.23188	6.32426	2.31021
b=	1.49002	1.07715	1.02536	1.44733	1.46022	1.00484	1.01751	1.09126	1.37495	1.16775

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.310212 b= 1.167747

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	7	3.5
6.5	1800	204	105.5
6.75	900	253	228.5
7	900	225	239
7.25	900	166	195.5
7.5	900	123	144.5
7.75	900	93	108
8	900	72	82.5
8.25	900	58	65
8.5	900	48	53
9	1800	36	42
10	3600	24	30
11	3600	19	21.5
12	3600	16	17.5
13	3600	14	15
14	3600	13	13.5
17	10800	11	12
20	10800	10	10.5
24	14400	9	9.5
40	57600	0	4.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
10.0	0.1	4	0.9
532.5	3.2	479	1.6
1312.9	8.0	591	3.1
1383.6	8.4	623	3.7
1094.3	6.6	492	4.0
768.8	4.7	346	3.8
547.2	3.3	246	3.6
399.6	2.4	180	3.4
302.5	1.8	136	3.2
238.3	1.4	107	3.0
181.6	1.1	163	3.1
122.6	0.7	221	3.1
83.1	0.5	150	2.7
65.3	0.4	118	2.5
54.5	0.3	98	2.4
48.3	0.3	87	2.2
42.1	0.3	227	2.3
36.0	0.2	194	2.2
32.0	0.2	231	2.2
13.4	0.1	385	

Sediment Transport Capacity..... 5,079 tons

Wet Transport Capacity..... 2,280 cy @ 165 pcf..... 1.4 acre-feet

Dry Transport Capacity..... 3,762 cy @ 100 pcf..... 2.3 acre-feet

SAN AGUSTIN ARROYO 10 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4, 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	851	2549	64	913	2242	203	312	728	9218	1126
300 cfs	1554	3967	97	1654	3985	306	473	1123	16132	1804
400 cfs	2381	5380	131	2484	6136	408	634	1549	23851	2512
500 cfs	3296	6938	162	3495	8109	511	795	1927	32558	3289
650 cfs	4931	9065	216	5023	12578	664	1037	2640	46605	4441
800 cfs	6718	11347	267	6795	16984	818	1279	3306	62043	5682
Q(Bed)=a*Q(Water)^b										
a=	0.31634	8.49573	0.28118	0.42823	0.96665	0.99066	1.42460	2.23188	6.32426	2.31021
b=	1.49002	1.07715	1.02536	1.44733	1.46032	1.00484	1.01751	1.09126	1.37495	1.16775

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.310212 b= 1.167747

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	17	8.5
6.5	1800	382	199.5
6.75	900	431	406.5
7	900	364	397.5
7.25	900	260	312
7.5	900	189	224.5
7.75	900	141	165
8	900	108	124.5
8.25	900	86	97
8.5	900	71	78.5
9	1800	52	61.5
10	3600	35	43.5
11	3600	27	31
12	3600	23	25
13	3600	20	21.5
14	3600	19	19.5
17	10800	16	17.5
20	10800	14	15
24	14400	12	13
40	57600	0	6

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
28.1	0.2	13	1.0
1120.5	6.8	1008	1.8
2572.6	15.6	1158	3.6
2506.2	15.2	1128	4.2
1888.8	11.4	850	4.4
1296.1	7.8	579	4.1
897.7	5.4	404	3.9
646.1	3.9	291	3.6
482.7	2.9	217	3.4
377.0	2.3	170	3.2
283.5	1.7	255	3.3
189.2	1.1	341	3.3
127.4	0.8	229	2.9
99.1	0.6	178	2.6
83.1	0.5	150	2.5
74.1	0.4	133	2.4
65.3	0.4	353	2.5
54.6	0.3	295	2.4
46.2	0.3	332	2.3
18.7	0.1	529	

Sediment Transport Capacity..... 8,623 tons

Wet Transport Capacity..... 3,871 cy @ 165 pcf..... 2.4 acre-feet

Dry Transport Capacity..... 6,387 cy @ 100 pcf..... 4.0 acre-feet

SAN AGUSTIN ARROYO 25 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4, 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	851	2549	64	913	2242	203	312	728	9218	1129
300 cfs	1554	3967	97	1654	3985	306	473	1123	16132	1804
400 cfs	2381	5380	131	2484	6136	408	634	1549	23851	2512
500 cfs	3298	6938	162	3495	8109	511	795	1927	32558	3289
650 cfs	4921	9065	216	5023	12578	664	1037	2640	46605	4441
800 cfs	6718	11347	267	6795	16984	818	1279	3306	62043	5682
Q(Bed)=a*Q(Water)^b										
a=	0.31634	8.49573	0.28118	0.42823	0.96665	0.99066	1.42460	2.23188	6.32426	2.31021
b=	1.49002	1.07715	1.02536	1.44733	1.46032	1.00484	1.01751	1.09126	1.37495	1.16775

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.310212 b= 1.167747

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	28	14
6.5	1800	549	288.5
6.75	900	591	570
7	900	487	539
7.25	900	342	414.5
7.5	900	245	293.5
7.75	900	181	213
8	900	139	160
8.25	900	109	124
8.5	900	89	99
9	1800	66	77.5
10	3600	43	54.5
11	3600	34	38.5
12	3600	28	31
13	3600	25	26.5
14	3600	24	24.5
17	10800	20	22
20	10800	17	18.5
24	14400	15	16
40	57600	0	7.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
50.4	0.3	23	1.1
1723.8	10.4	1551	1.9
3817.8	23.1	1718	3.9
3576.5	21.7	1609	4.5
2631.8	16.0	1184	4.7
1758.7	10.7	791	4.4
1209.5	7.3	544	4.0
865.0	5.2	390	3.8
643.0	3.9	289	3.6
494.4	3.0	222	3.4
371.4	2.3	334	3.4
246.2	1.5	443	3.5
164.1	1.0	295	2.9
127.4	0.8	229	2.8
106.1	0.6	191	2.6
96.8	0.6	174	2.4
85.4	0.5	461	2.6
69.7	0.4	377	2.5
58.9	0.4	424	2.4
24.3	0.1	700	

Sediment Transport Capacity..... 11,951 tons

Wet Transport Capacity..... 5,365 cy @ 165 pcf..... 3.3 acre-feet

Dry Transport Capacity..... 8,853 cy @ 100 pcf..... 5.5 acre-feet

SAN AGUSTIN ARROYO 50 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4, 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	851	2549	64	913	2242	203	312	728	9218	1126
300 cfs	1554	3967	97	1654	3985	306	473	1123	16132	1804
400 cfs	2381	5380	131	2484	6136	408	634	1549	23851	2512
500 cfs	3296	6938	162	3495	8109	511	795	1927	32558	3289
650 cfs	4931	9065	216	5023	12578	664	1037	2640	46605	4441
800 cfs	6718	11347	267	6795	16984	818	1279	3306	62043	5682
Q(Bed)=a*Q(Water)^b										
a=	0.31634	8.49573	0.28118	0.42823	0.96665	0.99066	1.42460	2.23188	6.32426	2.31021
b=	1.49002	1.07715	1.02536	1.44733	1.46032	1.00484	1.01751	1.09126	1.37495	1.16775

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.310212 b= 1.167747

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	42	21
6.5	1800	733	387.5
6.75	900	763	748
7	900	616	689.5
7.25	900	427	521.5
7.5	900	305	366
7.75	900	224	264.5
8	900	170	197
8.25	900	133	151.5
8.5	900	109	121
9	1800	79	94
10	3600	52	65.5
11	3600	41	46.5
12	3600	34	37.5
13	3600	31	32.5
14	3600	29	30
17	10800	24	26.5
20	10800	21	22.5
24	14400	18	19.5
40	57600	0	9

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
80.8	0.5	35	1.2
2432.8	14.7	2189	2.0
5243.8	31.8	2360	4.2
4768.1	28.9	2146	4.7
3441.3	20.9	1549	4.9
2275.9	13.8	1024	4.5
1557.5	9.4	701	4.2
1104.1	6.7	497	3.9
812.5	4.9	366	3.7
624.9	3.8	281	3.5
465.3	2.8	419	3.6
305.2	1.8	549	3.6
204.6	1.2	368	3.0
159.1	1.0	286	2.8
134.6	0.8	242	2.6
122.6	0.7	221	2.6
106.1	0.6	573	2.7
87.6	0.5	473	2.5
74.1	0.4	534	2.5
30.1	0.2	866	

Sediment Transport Capacity..... 15,680 tons

Wet Transport Capacity..... 7,039 cy @ 165 pcf..... 4.4 acre-feet

Dry Transport Capacity..... 11,615 cy @ 100 pcf..... 7.2 acre-feet

SAN AUGUSTIN ARROYO 100 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4, 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	851	2549	64	913	2242	203	312	728	9218	1126
300 cfs	1554	3967	97	1654	3985	306	473	1123	16132	1804
400 cfs	2381	5380	131	2484	6136	408	634	1549	23851	2512
500 cfs	3296	6938	162	3495	8109	511	795	1927	32558	3289
650 cfs	4931	9065	216	5023	12578	664	1037	2640	46605	4441
800 cfs	6718	11347	267	6795	16984	818	1279	3306	62043	5682
Q(Bed)=a*Q(Water)^b										
a=	0.31634	8.49573	0.28118	0.42823	0.96665	0.99066	1.42460	2.23188	6.32426	2.31021
b=	1.49002	1.07715	1.02536	1.44733	1.46032	1.00484	1.01751	1.09126	1.37495	1.16775

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.310212 b= 1.167747

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	59	29.5
6.5	1800	929	494
6.75	900	944	936.5
7	900	751	847.5
7.25	900	515	633
7.5	900	366	440.5
7.75	900	267	316.5
8	900	202	234.5
8.25	900	158	180
8.5	900	128	143
9	1800	93	110.5
10	3600	61	77
11	3600	48	54.5
12	3600	40	44
13	3600	36	38
14	3600	33	34.5
17	10800	28	30.5
20	10800	24	26
24	14400	21	22.5
40	57600	0	10.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
120.2	0.7	54	1.2
3230.3	19.6	2907	2.1
6817.4	41.3	3068	4.4
6067.1	36.8	2730	4.9
4315.0	26.2	1942	5.1
2825.6	17.1	1272	4.7
1920.7	11.6	864	4.4
1353.3	8.2	609	4.1
993.7	6.0	447	3.8
759.5	4.6	342	3.6
562.1	3.4	506	3.7
368.6	2.2	664	3.7
246.2	1.5	443	3.1
191.8	1.2	345	2.9
161.6	1.0	291	2.7
144.4	0.9	260	2.7
125.0	0.8	675	2.7
103.7	0.6	560	2.6
87.6	0.5	631	2.5
36.0	0.2	1036	

Sediment Transport Capacity..... 19,646 tons

Wet Transport Capacity..... 8,820 cy @ 165 pcf..... 5.5 acre-feet

Dry Transport Capacity..... 14,553 cy @ 100 pcf..... 9.0 acre-feet

ANNUAL SEDIMENT TRANSPORT CAPACITY:

Storm Return Period	Percent Probability Of Occurence	Sediment Transport Capacity (ac-ft)	Incremental Areas Under Curve
100-year	1	9.0	0.090
50-year	2	7.2	0.081
25-year	4	5.5	0.127
10-year	10	4.0	0.285
5-year	20	2.3	0.315
	100	0.0	0.920

Volume under curve 1.82 ac-ft/yr based on 100#/cf

Annual Transport.. 3960 tons/yr based on 100#/cf 2933 cubic yards / year

Job Name..... BAYLOR CANYON ARROYO

Job No..... 90035.11

Date..... AUGUST 1, 1991

SEDIMENT TRANSPORT BEDLOAD CALCULATIONS

These calculations determine the bedload transport capacity of a stream using the following bedload equations:

RECOMMENDED RANGES OF APPLICATION:

Bedload Equation:	Median Grain Size (mm)
1. Engelund-Hansen	0.20 mm to 1 mm
2. DuBoys	0.05 mm to 5 mm
3. Meyer-Peter Muller	0.40 mm to 30 mm
4. Einstein-Brown	0.30 mm to 7 mm
5. Inglis-Lacey	0.01 mm to 1 mm
6. Meyer-Peter	3.00 mm to 30 mm
7. Schoklitsch	0.30 mm to 5 mm
8. Laursen	0.01 mm to 4 mm
9. Shields	1.70 mm to 2.5 mm

LOOK-UP TABLES USED IN DUBOYS FORMULA:

d50	critical shearstress	DuBoys ft^3/
mm	lbs/ft^2	lb sec
0.01	0.017	1000
0.05	0.017	300
0.10	0.017	150
0.15	0.017	120
0.20	0.018	95
0.25	0.018	80
0.30	0.019	70
0.40	0.020	55
0.50	0.022	47
0.60	0.024	42
0.70	0.026	37
0.80	0.028	33
0.90	0.030	30
1.00	0.033	28
1.50	0.040	21
2.00	0.050	17
2.50	0.060	14
3.00	0.070	12
4.00	0.090	10
5.00	0.110	8
selected:	0.033	28

GENERAL PARAMETERS:

Acceleration of gravity	32.2 ft/sec^2
Kinematic viscosity of water	0.000012 ft^2/sec
Specific weight of water	62.4 lbs/ft^3
Specific weight of sediment	165 lbs/ft^3
Einstein-Brown and fall velocity factor:	0.00137

SEDIMENT PARAMETERS:

Median grain size	(D-50)...	1.30 mm
90% passing	(D-90)...	4.40 mm
	(D-50)...	0.0043 ft
(for Eq.3 only)	(D-90)...	0.0144 ft

HYDRAULIC PARAMETERS:

Hydraulic parameters for the sediment transport calculations must be estimated from the following sources:

1) HEC-2 analysis
2) Field measurements
3) Normal depth calculations
4) Other acceptable methods

Discharge (cfs)	Bed Width (ft)	Flow Depth (ft)	X-sect. Area (ft^2)	Flow Velocity (fps)	Hydr. Radius (ft)	Slope ( )
750	73	1.19	86.51	8.67	1.19	0.056
1000	79	1.29	101.73	9.83	1.29	0.056
2000	101	1.68	170.21	11.75	1.68	0.056
3000	116	1.97	227.79	13.17	1.97	0.056
4000	128	2.20	280.90	14.24	2.20	0.056
5000	137	2.39	327.87	15.25	2.39	0.056

BAYLOR CANYON ARROYO 5 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	11852	34917	490	25237	20154	2429	3803	4767	151463	4285
1000 cfs	18655	44540	710	34876	37787	3241	5082	7316	218921	6199
2000 cfs	50895	97220	1373	98971	90965	6492	10202	14553	570216	12377
3000 cfs	92660	152693	2033	182123	156619	9744	15326	22045	1002972	18685
4000 cfs	141168	210382	2683	280086	228859	12997	20452	29533	1493429	24993
5000 cfs	196967	269859	3369	385826	318835	16250	25580	37792	2028019	31686
Q(Bed)=a*Q(Water)^b										
a=	0.69402	25.07470	0.69682	1.52924	2.08730	3.20048	4.92077	4.46011	16.79887	4.59854
b=	1.47408	1.08835	0.99653	1.45970	1.40226	1.00182	1.00463	1.06245	1.37352	1.03794

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 4.598541 b= 1.037943

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	13	6.5
6.5	1800	166	89.5
6.75	900	316	241
7	900	499	407.5
7.25	900	645	572
7.5	900	729	687
7.75	900	762	745.5
8	900	741	751.5
8.25	900	691	716
8.5	900	608	649.5
9	1800	444	526
10	3600	261	352.5
11	3600	168	214.5
12	3600	120	144
13	3600	94	107
14	3600	86	90
17	10800	62	74
20	10800	54	58
24	14400	46	50
40	57600	0	23

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
32.1	0.2	14	1.5
488.1	3.0	439	1.8
1364.6	8.3	614	2.6
2352.9	14.3	1059	2.9
3346.9	20.3	1506	3.1
4047.8	24.5	1822	3.4
4406.1	26.7	1983	3.5
4443.0	26.9	1999	3.6
4225.3	25.6	1901	3.7
3818.7	23.1	1718	3.8
3068.0	18.6	2761	4.2
2025.0	12.3	3645	4.7
1209.2	7.3	2177	4.4
799.6	4.8	1439	4.0
587.5	3.6	1057	3.8
490.9	3.0	884	3.5
400.7	2.4	2164	3.9
311.1	1.9	1680	3.5
266.7	1.6	1920	3.5
119.1	0.7	3431	

Sediment Transport Capacity..... 34,215 tons

Wet Transport Capacity..... 15,360 cy @ 165 pcf..... 9.5 acre-feet

Dry Transport Capacity..... 25,344 cy @ 100 pcf..... 15.7 acre-feet

BAYLOR CANYON ARROYO 10 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	11852	34917	490	25237	20154	2429	3803	4767	151463	4285
1000 cfs	18655	44540	710	34876	37787	3241	5082	7316	218921	6199
2000 cfs	50895	97220	1373	98971	90965	6492	10202	14553	570216	12377
3000 cfs	92660	152693	2033	182123	156619	9744	15326	22045	1002972	18685
4000 cfs	141168	210382	2683	280086	228859	12997	20452	29533	1493429	24993
5000 cfs	196967	266859	3369	385826	318835	16250	25580	37792	2028010	31686
Q(Bed)=a*Q(Water)^b										
a=	0.69402	25.07470	0.69682	1.52924	2.08730	3.20048	4.92077	4.46011	16.79887	4.59854
b=	1.47408	1.08835	0.99653	1.45970	1.40226	1.00182	1.00463	1.06245	1.37352	1.03794

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 4.598541 b= 1.037943

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	24	12
6.5	1800	285	154.5
6.75	900	538	411.5
7	900	836	687
7.25	900	1068	952
7.5	900	1195	1131.5
7.75	900	1237	1216
8	900	1192	1214.5
8.25	900	1102	1147
8.5	900	956	1030
9	1800	688	823
10	3600	393	540.5
11	3600	247	320
12	3600	173	210
13	3600	135	154
14	3600	123	129
17	10800	87	105
20	10800	75	81
24	14400	64	69.5
40	57600	0	32

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
60.6	0.4	27	1.5
860.2	5.2	774	1.8
2377.9	14.4	1070	2.7
4047.8	24.5	1822	2.9
5679.1	34.4	2556	3.2
6794.3	41.2	3057	3.4
7321.6	44.4	3295	3.6
7312.3	44.3	3291	3.7
6890.9	41.8	3101	3.8
6162.8	37.4	2773	3.9
4882.5	29.6	4394	4.3
3155.8	19.1	5680	4.9
1831.6	11.1	3297	4.5
1182.9	7.2	2129	4.1
857.3	5.2	1543	3.8
713.3	4.3	1284	3.5
576.1	3.5	3111	4.0
440.1	2.7	2376	3.6
375.4	2.3	2703	3.6
167.8	1.0	4824	

Sediment Transport Capacity..... 53,117 tons

Wet Transport Capacity..... 23,846 cy @ 165 pcf..... 14.8 acre-feet

Dry Transport Capacity..... 39,346 cy @ 100 pcf..... 24.4 acre-feet

BAYLOR CANYON ARROYO 25 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	11852	34917	490	25237	20154	2429	3803	4767	151463	4285
1000 cfs	18655	44540	710	34876	37787	3241	5082	7316	218921	6199
2000 cfs	50895	97220	1373	98971	90965	6492	10202	14553	570216	12377
3000 cfs	92660	152693	2033	182123	156619	9744	15326	22045	1002972	18685
4000 cfs	141168	210382	2683	280086	228859	12997	20452	29533	1493429	24993
5000 cfs	196967	266859	3369	385826	319835	16250	25580	37792	2028010	31686
Q(Bed)=a*Q(Water)^b										
a=	0.69402	25.07470	0.69682	1.52924	2.08730	3.20048	4.92077	4.46011	16.79887	4.59854
b=	1.47408	1.08835	0.99653	1.45970	1.40226	1.00182	1.00463	1.06245	1.37352	1.03794

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 4.598541 b= 1.037943

INPUT HYDROGRAPH:

SEDIMENT TRANSPORT CAPACITY:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)	Q-sed Bedload (#/sec)	Q-sed @155 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0	0	0	0				
5.75	20700	0	0	0.0	0.0	0	0.0
6	900	35	17.5	89.7	0.5	40	1.6
6.5	1800	396	215.5	1215.1	7.4	1094	1.9
6.75	900	743	569.5	3331.7	20.2	1499	2.7
7	900	1143	943	5623.4	34.1	2531	3.0
7.25	900	1450	1296.5	7825.3	47.4	3521	3.3
7.5	900	1613	1531.5	9302.3	56.4	4186	3.5
7.75	900	1661	1637	9968.3	60.4	4486	3.6
8	900	1594	1627.5	9908.3	60.1	4459	3.8
8.25	900	1466	1530	9292.9	56.3	4182	3.8
8.5	900	1267	1366.5	8264.3	50.1	3719	4.0
9	1800	901	1084	6498.4	39.4	5849	4.4
10	3600	506	703.5	4148.8	25.1	7468	5.0
11	3600	314	410	2368.9	14.4	4264	4.6
12	3600	218	266	1511.9	9.2	2721	4.2
13	3600	168	193	1083.7	6.6	1951	3.9
14	3600	153	160.5	894.9	5.4	1611	3.5
17	10800	107	130	719.1	4.4	3883	4.1
20	10800	93	100	547.7	3.3	2957	3.6
24	14400	79	86	468.3	2.8	3372	3.6
40	57600	0	39.5	208.8	1.3	6014	

Sediment Transport Capacity..... 69,806 tons

Wet Transport Capacity..... 31,338 cy @ 165 pcf..... 19.4 acre-feet

Dry Transport Capacity..... 51,708 cy @ 100 pcf..... 32.1 acre-feet

BAYLOR CANYON ARROYO 50 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	11852	34917	490	25237	20154	2429	3803	4767	151463	4285
1000 cfs	18655	44540	710	34876	37787	3241	5082	7316	218921	6199
2000 cfs	50895	97220	1373	98971	90965	6492	10202	14553	570216	12377
3000 cfs	92660	152693	2033	182123	156619	9744	15326	22045	1002972	18685
4000 cfs	141168	210382	2683	280086	228859	12997	20452	29533	1493429	24993
5000 cfs	196967	266859	3369	385826	318835	16250	25580	37792	2028010	31686
Q(Bed)=a*Q(Water)^b										
a=	0.69402	25.07470	0.69682	1.52924	2.08730	3.20048	4.92077	4.46011	16.79887	4.59854
b=	1.47408	1.08835	0.99653	1.45970	1.40226	1.00182	1.00483	1.06245	1.37352	1.03794

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 4.598541 b= 1.037943

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	49	24.5
6.5	1800	520	284.5
6.75	900	967	743.5
7	900	1477	1222
7.25	900	1863	1670
7.5	900	2064	1963.5
7.75	900	2116	2090
8	900	2023	2069.5
8.25	900	1853	1938
8.5	900	1593	1723
9	1800	1125	1359
10	3600	625	875
11	3600	383	504
12	3600	264	323.5
13	3600	202	232
14	3600	184	193
17	10800	128	156
20	10800	110	119
24	14400	94	102
40	57600	0	47

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
127.2	0.8	57	1.6
1621.1	9.8	1459	1.9
4393.9	26.6	1977	2.8
7359.1	44.6	3312	3.0
10177.0	61.7	4580	3.3
12039.3	73.0	5418	3.5
12845.3	77.9	5780	3.7
12714.6	77.1	5722	3.8
11877.0	72.0	5345	3.9
10512.4	63.7	4731	4.0
8217.2	49.8	7396	4.4
5203.1	31.5	9366	5.0
2934.9	17.8	5283	4.6
1852.4	11.2	3334	4.3
1317.7	8.0	2372	4.0
1083.7	6.6	1951	3.6
858.9	5.3	4692	4.1
656.0	4.0	3543	3.6
559.0	3.4	4025	3.6
250.1	1.5	7204	

Sediment Transport Capacity..... 87,543 tons

Wet Transport Capacity..... 39,301 cy @ 165 pcf..... 24.4 acre-feet

Dry Transport Capacity..... 64,847 cy @ 100 pcf..... 40.2 acre-feet

BAYLOR CANYON ARROYO 100 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 7 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	11852	34917	490	25237	20154	2429	3803	4767	151463	4285
1000 cfs	18655	44540	710	34876	37787	3241	5082	7316	218921	6199
2000 cfs	50895	97220	1373	98971	90965	6492	10202	14553	570216	12377
3000 cfs	92660	152693	2033	182123	156619	9744	15326	22045	1002972	18685
4000 cfs	141168	210382	2683	280086	228859	12997	20452	29533	1493429	24993
5000 cfs	196967	266859	3369	385826	318835	16250	25580	37792	2028010	31686
Q(Bed)=a*Q(Water)^b										
a=	0.69402	25.07470	0.69682	1.52924	2.08730	3.20048	4.92077	4.46011	16.79887	4.59854
b=	1.47408	1.08835	0.99653	1.45970	1.40226	1.00182	1.00463	1.06245	1.37352	1.03794

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 4.598541 b= 1.037943

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	2	1
6	900	65	33.5
6.5	1800	655	360
6.75	900	1209	932
7	900	1833	1521
7.25	900	2301	2067
7.5	900	2539	2420
7.75	900	2595	2567
8	900	2474	2534.5
8.25	900	2258	2366
8.5	900	1934	2096
9	1800	1358	1646
10	3600	747	1052.5
11	3600	454	600.5
12	3600	310	382
13	3600	237	273.5
14	3600	194	215.5
17	10800	149	171.5
20	10800	128	138.5
24	14400	109	118.5
40	57600	0	54.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
4.6	0.0	48	0.0
176.0	1.1	79	1.6
2069.8	12.5	1863	1.9
5555.3	33.7	2500	2.8
9236.2	56.0	4156	3.1
12698.6	77.0	5714	3.3
14956.5	90.6	6730	3.6
15900.6	96.4	7155	3.7
15691.7	95.1	7061	3.8
14610.2	88.5	6575	3.9
12883.6	78.1	5798	4.0
10025.2	60.8	9023	4.5
6302.6	38.2	11345	5.1
3520.1	21.3	6336	4.7
2201.2	13.3	3962	4.3
1556.1	9.4	2801	4.0
1215.1	7.4	2187	3.8
958.7	5.8	5177	3.9
767.9	4.7	4147	3.6
653.2	4.0	4703	3.6
291.7	1.8	8400	

Sediment Transport Capacity..... 105,760 tons

Wet Transport Capacity..... 47,479 cy @ 165 pcf..... 29.4 acre-feet

Dry Transport Capacity..... 78,341 cy @ 100 pcf..... 48.6 acre-feet

ANNUAL SEDIMENT TRANSPORT CAPACITY:

Storm Return Period	Percent Probability Of Occurence	Sediment Transport Capacity (ac-ft)	Incremental Areas Under Curve
100-year	1	48.6	0.486
50-year	2	40.2	0.444
25-year	4	32.1	0.723
10-year	10	24.4	1.695
5-year	20	15.7	2.005
	100	0.0	6.280

Volume under curve 11.63 ac-ft/yr based on 100#/cf

Annual Transport.. 25337 tons/yr based on 100#/cf 18768 cubic yards / year

Job Name..... BLAIR CANYON ARROYO

Job No..... 90035.11

Date..... AUGUST 1, 1991

SEDIMENT TRANSPORT BEDLOAD CALCULATIONS

These calculations determine the bedload transport capacity of a stream using the following bedload equations:

RECOMMENDED RANGES OF APPLICATION:

Bedload Equation:	Median Grain Size (mm)
1. Engelund-Hansen	0.20 mm to 1 mm
2. DuBoys	0.05 mm to 5 mm
3. Meyer-Peter Muller	0.40 mm to 30 mm
4. Einstein-Brown	0.30 mm to 7 mm
5. Inglis-Lacey	0.01 mm to 1 mm
6. Meyer-Peter	3.00 mm to 30 mm
7. Schoklitsch	0.30 mm to 5 mm
8. Laursen	0.01 mm to 4 mm
9. Shields	1.70 mm to 2.5 mm

LOOK-UP TABLES USED IN DUBOYS FORMULA:

d50	critical shearstress	DuBoys ft^3/
mm	lbs/ft^2	lb sec
0.01	0.017	1000
0.05	0.017	300
0.10	0.017	150
0.15	0.017	120
0.20	0.018	95
0.25	0.018	80
0.30	0.019	70
0.40	0.020	55
0.50	0.022	47
0.60	0.024	42
0.70	0.026	37
0.80	0.028	33
0.90	0.030	30
1.00	0.033	28
1.50	0.040	21
2.00	0.050	17
2.50	0.060	14
3.00	0.070	12
4.00	0.090	10
5.00	0.110	8
selected:	0.033	28

GENERAL PARAMETERS:

Acceleration of gravity	32.2 ft/sec^2
Kinematic viscosity of water	0.000012 ft^2/sec
Specific weight of water	62.4 lbs/ft^3
Specific weight of sediment	165 lbs/ft^3
Einstein-Brown and fall velocity factor:	0.00110

SEDIMENT PARAMETERS:

Median grain size	(D-50)...	1.40 mm
90% passing	(D-90)...	4.50 mm
	(D-50)...	0.0046 ft
(for Eq.3 only)	(D-90)...	0.0148 ft

HYDRAULIC PARAMETERS:

Hydraulic parameters for the sediment transport calculations must be estimated from the following sources:

1) HEC-2 analysis
2) Field measurements
3) Normal depth calculations
4) Other acceptable methods

Discharge (cfs)	Bed Width (ft)	Flow Depth (ft)	X-sect. Area (ft^2)	Flow Velocity (fps)	Hydr. Radius (ft)	Slope ( )
750	101	0.90	91.02	8.24	0.90	0.023
1000	102	1.06	108.58	9.21	1.06	0.023
2000	102	1.62	166.25	12.03	1.62	0.023
3000	104	2.06	213.83	14.03	2.06	0.023
4000	105	2.44	255.75	15.64	2.44	0.023
5000	105	2.79	294.29	16.99	2.79	0.023

BLAIR CANYON ARROYO 5 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	2394	4604	432	842	27570	630	918	. 6020	17942	3822
1000 cfs	3873	6494	567	1394	41360	844	1242	8013	28176	5300
2000 cfs	12506	15313	1052	4985	103089	1699	2544	15282	86125	11860
3000 cfs	24671	25121	1513	10367	176917	2552	3846	22425	164277	19304
4000 cfs	39909	35652	1959	17397	259644	3408	5147	29456	259442	27502
5000 cfs	57949	46965	2380	26173	345690	4264	6449	36152	370822	36430
Q(Bed)=a*Q(Water)^b										
a=	0.03517	1.37271	1.13831	0.00507	4.16130	0.80052	1.02513	11.77683	0.45428	1.46756
b=	1.68102	1.22576	0.89815	1.81477	1.33083	1.00754	1.02755	0.94313	1.59834	1.18609

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 1.467559 b= 1.186092

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	181	90.5
6.5	1800	1969	1075
6.75	900	2085	2027
7	900	1640	1862.5
7.25	900	1155	1398
7.5	900	829	992.5
7.75	900	615	722
8	900	471	543
8.25	900	375	423
8.5	900	309	342
9	1800	228	268.5
10	3600	154	191
11	3600	123	138.5
12	3600	101	112
13	3600	92	96.5
14	3600	87	89.5
17	10800	72	79.5
20	10800	63	67.5
24	14400	55	59
40	57600	0	27.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
307.2	1.9	138	1.0
5782.6	35.0	5204	1.8
12269.5	74.4	5521	3.6
11097.8	67.3	4994	4.1
7896.9	47.9	3554	4.1
5260.1	31.9	2367	3.9
3606.5	21.9	1623	3.6
2572.3	15.6	1158	3.3
1912.8	11.6	861	3.1
1486.6	9.0	669	2.9
1115.7	6.8	1004	3.0
744.9	4.5	1341	2.9
508.8	3.1	916	2.5
395.5	2.4	712	2.4
331.5	2.0	597	2.2
303.1	1.8	546	2.1
263.4	1.6	1422	2.2
215.9	1.3	1171	2.1
184.9	1.1	1331	2.0
74.8	0.5	2154	

Sediment Transport Capacity..... 37,282 tons

Wet Transport Capacity..... 16,737 cy @ 165 pcf..... 10.4 acre-feet

Dry Transport Capacity..... 27,617 cy @ 100 pcf..... 17.1 acre-feet

BLAIR CANYON ARROYO 10 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	2394	4604	432	842	27570	630	918	6020	17942	3822
1000 cfs	3873	6494	567	1394	41360	844	1242	8013	28176	5300
2000 cfs	12506	15313	1052	4985	103089	1698	2544	15282	86125	11860
3000 cfs	24671	25121	1513	10367	176917	2552	3846	22425	164277	19304
4000 cfs	39909	35652	1959	17397	259644	3408	5147	29456	259442	27502
5000 cfs	57949	46965	2380	26173	345690	4264	6449	36152	370822	36430
Q(Bed)=a*Q(Water)^b										
a=	0.03517	1.37271	1.13831	0.00507	4.16130	0.80052	1.02513	11.77683	0.45428	1.46756
b=	1.68102	1.22576	0.89815	1.81477	1.33083	1.00754	1.02755	0.94313	1.59834	1.18609

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 1.467559 b= 1.186092

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	1	0.5
6	900	327	164
6.5	1800	3147	1737
6.75	900	3256	3201.5
7	900	2513	2884.5
7.25	900	1745	2129
7.5	900	1234	1489.5
7.75	900	904	1069
8	900	684	794
8.25	900	538	611
8.5	900	440	489
9	1800	321	380.5
10	3600	215	268
11	3600	170	192.5
12	3600	139	154.5
13	3600	126	132.5
14	3600	119	122.5
17	10800	99	109
20	10800	87	93
24	14400	74	80.5
40	57600	0	37

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.6	0.0	7	0.0
621.7	3.8	280	1.2
10216.4	61.9	9195	2.0
21099.3	127.9	9495	3.9
18644.8	113.0	8390	4.5
13005.2	78.8	5852	4.5
8513.6	51.6	3831	4.2
5744.4	34.8	2585	3.9
4036.9	24.5	1817	3.6
2958.7	17.9	1331	3.3
2271.8	13.8	1022	3.1
1687.1	10.2	1518	3.2
1113.2	6.7	2004	3.1
751.9	4.6	1353	2.7
579.3	3.5	1043	2.5
482.8	2.9	869	2.3
439.9	2.7	792	2.2
383.0	2.3	2068	2.3
317.2	1.9	1713	2.2
267.3	1.6	1925	2.2
106.3	0.6	3062	

Sediment Transport Capacity..... 60,152 tons

Wet Transport Capacity..... 27,004 cy @ 165 pcf..... 16.7 acre-feet

Dry Transport Capacity..... 44,557 cy @ 100 pcf..... 27.6 acre-feet

BLAIR CANYON ARROYO 25 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	2394	4604	432	842	27570	630	918	6020	17942	3822
1000 cfs	3873	6494	567	1394	41360	844	1242	8013	28176	5300
2000 cfs	12506	15313	1052	4985	103089	1698	2544	15282	86125	11860
3000 cfs	24671	25121	1513	10367	176917	2552	3846	22425	164277	19304
4000 cfs	39909	35552	1959	17397	259644	3408	5147	29456	259442	27502
5000 cfs	57949	46965	2380	26173	345690	4264	6449	36152	370822	36430
Q(Bed)=a*Q(Water)^b										
a=	0.03517	1.37271	1.13831	0.00507	4.16130	0.80052	1.02513	11.77683	0.45428	1.46756
b=	1.68102	1.22576	0.89815	1.81477	1.33083	1.00754	1.02755	0.94313	1.59834	1.18609

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 1.467559 b= 1.186092

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	8	4
6	900	477	242.5
6.5	1800	4188	2332.5
6.75	900	4277	4232.5
7	900	3266	3771.5
7.25	900	2248	2757
7.5	900	1578	1913
7.75	900	1147	1362.5
8	900	863	1005
8.25	900	675	769
8.5	900	549	612
9	1800	397	473
10	3600	263	330
11	3600	209	236
12	3600	170	189.5
13	3600	155	162.5
14	3600	147	151
17	10800	121	134
20	10800	106	113.5
24	14400	90	98
40	57600	0	45

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
7.5	0.0	79	0.0
988.7	6.0	445	1.3
14492.5	87.8	13043	2.1
29381.5	178.1	13222	4.2
25625.4	155.3	11531	4.8
17671.4	107.1	7952	4.8
11455.4	69.4	5155	4.4
7659.6	46.4	3447	4.0
5338.8	32.4	2402	3.7
3886.6	23.6	1749	3.5
2964.4	18.0	1334	3.3
2183.9	13.2	1965	3.3
1424.9	8.6	2565	3.3
957.4	5.8	1723	2.8
738.0	4.5	1329	2.5
615.0	3.7	1107	2.4
563.7	3.4	1015	2.3
489.3	3.0	2642	2.5
401.8	2.4	2170	2.3
337.6	2.0	2431	2.3
134.1	0.8	3862	

Sediment Transport Capacity..... 81,167 tons

Wet Transport Capacity..... 36,439 cy @ 165 pcf..... 22.6 acre-feet

Dry Transport Capacity..... 60,124 cy @ 100 pcf..... 37.3 acre-feet

BLAIR CANYON ARROYO 50 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	2394	4604	432	842	27570	630	918	.6020	17942	3822
1000 cfs	3873	6494	567	1394	41360	844	1242	8013	28176	5300
2000 cfs	12506	15313	1052	4985	103089	1698	2544	15282	86125	11860
3000 cfs	24671	25121	1513	10367	176917	2552	3846	22425	164277	19304
4000 cfs	39909	35652	1959	17397	259644	3408	5147	29456	259442	27502
5000 cfs	57949	46965	2380	26173	345690	4264	6449	36152	370822	36430
Q(Bed)=a*Q(Water)^b										
a=	0.03517	1.37271	1.13831	0.00507	4.16130	0.80052	1.02513	11.77683	0.45428	1.46756
b=	1.68102	1.22576	0.89915	1.81477	1.33083	1.00754	1.02755	0.94813	1.59824	1.18609

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 1.467559 b= 1.186092

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	28	14
6	900	656	342
6.5	1800	5293	2974.5
6.75	900	5349	5321
7	900	4053	4701
7.25	900	2771	3412
7.5	900	1935	2353
7.75	900	1399	1667
8	900	1046	1222.5
8.25	900	815	930.5
8.5	900	660	737.5
9	1800	474	567
10	3600	313	393.5
11	3600	248	280.5
12	3600	202	225
13	3600	183	192.5
14	3600	178	180.5
17	10800	143	160.5
20	10800	125	134
24	14400	106	115.5
40	57600	0	53

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
33.6	0.2	347	0.0
1486.6	9.0	669	1.4
19338.8	117.2	17403	2.2
38544.9	233.6	17345	4.4
33277.6	201.7	14975	5.0
22754.6	137.9	10240	5.0
14643.7	88.7	6590	4.6
9729.9	59.0	4378	4.2
6735.3	40.8	3031	3.9
4872.7	29.5	2193	3.6
3698.5	22.4	1664	3.4
2707.7	16.4	2437	3.5
1755.7	10.6	3160	3.4
1175.1	7.1	2115	2.9
904.7	5.5	1628	2.7
751.9	4.6	1353	2.5
696.6	4.2	1254	2.4
606.0	3.7	3273	2.6
489.3	3.0	2642	2.4
410.2	2.5	2954	2.3
162.8	1.0	4690	

Sediment Transport Capacity..... 104,341 tons

Wet Transport Capacity..... 46,842 cy @ 165 pcf..... 29.0 acre-feet

Dry Transport Capacity..... 77,290 cy @ 100 pcf..... 47.9 acre-feet

BLAIR CANYON ARROYO 100 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 2, 4 & 8

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
750 cfs	2394	4604	422	842	27570	630	918	6020	17942	3822
1000 cfs	3873	6494	567	1394	41360	844	1242	8013	28176	5300
2000 cfs	12506	15313	1052	4985	103089	1698	2544	15282	86125	11869
3000 cfs	24671	25121	1513	10367	176917	2552	3846	22425	164277	19304
4000 cfs	39909	35652	1959	17397	259644	3408	5147	29456	259442	27502
5000 cfs	57949	46965	2380	26173	345690	4264	6449	36152	370822	36430
Q(Bed)=a*Q(Water)^b										
a=	0.03517	1.37271	1.13831	0.00507	4.16130	0.80052	1.02513	11.77683	0.45428	1.46756
b=	1.68102	1.22576	0.89815	1.81477	1.33083	1.00754	1.02755	0.94313	1.59834	1.18609

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 1.467559 b= 1.186092

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	63	31.5
6	900	860	461.5
6.5	1800	6445	3652.5
6.75	900	6459	6452
7	900	4864	5661.5
7.25	900	3309	4086.5
7.5	900	2300	2804.5
7.75	900	1655	1977.5
8	900	1233	1444
8.25	900	956	1094.5
8.5	900	772	864
9	1800	552	662
10	3600	362	457
11	3600	287	324.5
12	3600	233	260
13	3600	211	222
14	3600	195	203
17	10800	165	180
20	10800	143	154
24	14400	122	132.5
40	57600	0	61

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
87.8	0.5	909	0.0
2121.0	12.9	954	1.5
24669.2	149.5	22202	2.3
48444.4	293.6	21800	4.5
41487.6	251.4	18669	5.2
28182.2	170.8	12682	5.2
18033.1	109.3	8115	4.8
11915.0	72.2	5362	4.4
8206.0	49.7	3693	4.0
5907.2	35.8	2658	3.7
4452.4	27.0	2008	3.5
3253.8	19.7	2928	3.6
2096.5	12.7	3774	3.5
1396.8	8.5	2514	2.9
1073.9	6.5	1933	2.8
890.4	5.4	1603	2.6
800.8	4.9	1441	2.5
694.3	4.2	3749	2.6
577.0	3.5	3116	2.4
482.8	2.9	3476	2.4
192.4	1.2	5541	

Sediment Transport Capacity..... 129,129 tons

Wet Transport Capacity..... 57,970 cy @ 165 pcf..... 35.9 acre-feet

Dry Transport Capacity..... 95,651 cy @ 100 pcf..... 59.3 acre-feet

ANNUAL SEDIMENT TRANSPORT CAPACITY:

Storm Return Period	Percent Probability Of Occurence	Sediment Transport Capacity (ac-ft)	Incremental Areas Under Curve
100-year	1	59.3	0.593
50-year	2	47.9	0.536
25-year	4	37.3	0.852
10-year	10	27.6	1.947
5-year	20	17.1	2.235
	100	0.0	6.840

Volume under curve 13.00 ac-ft/yr based on 100%/cf

Annual Transport.. 28321 tons/yr based on 100%/cf 20978 cubic yards / year

Job Name..... ORGAN ARROYO
Job No..... 90035.11

Date..... AUGUST 1, 1991

SEDIMENT TRANSPORT BEDLOAD CALCULATIONS

These calculations determine the bedload transport capacity of a stream using the following bedload equations:

RECOMMENDED RANGES OF APPLICATION:

Bedload Equation:	Median Grain Size (mm)
1. Engelund-Hansen	0.20 mm to 1 mm
2. DuBoys	0.05 mm to 5 mm
3. Meyer-Peter Muller	0.40 mm to 30 mm
4. Einstein-Brown	0.30 mm to 7 mm
5. Inglis-Lacey	0.01 mm to 1 mm
6. Meyer-Peter	3.00 mm to 30 mm
7. Schoklitsch	0.30 mm to 5 mm
8. Laursen	0.01 mm to 4 mm
9. Shields	1.70 mm to 2.5 mm

LOOK-UP TABLES USED IN DUBOYS FORMULA:

d50	critical shearstress	DuBoys ft^3/
mm	lbs/ft^2	lb sec
0.01	0.017	1000
0.05	0.017	300
0.10	0.017	150
0.15	0.017	120
0.20	0.018	95
0.25	0.018	80
0.30	0.019	70
0.40	0.020	55
0.50	0.022	47
0.60	0.024	42
0.70	0.026	37
0.80	0.028	33
0.90	0.030	30
1.00	0.033	28
1.50	0.040	21
2.00	0.050	17
2.50	0.060	14
3.00	0.070	12
4.00	0.090	10
5.00	0.110	8
selected:	0.022	47

GENERAL PARAMETERS:

Acceleration of gravity	32.2 ft/sec^2
Kinematic viscosity of water	0.000012 ft^2/sec
Specific weight of water	62.4 lbs/ft^3
Specific weight of sediment	165 lbs/ft^3
Einstein-Brown and fall velocity factor:	0.01808

SEDIMENT PARAMETERS:

Median grain size	(D-50)...	0.55 mm
90% passing	(D-90)...	2.10 mm
	(D-50)...	0.0018 ft
(for Eq.3 only)	(D-90)...	0.0069 ft

HYDRAULIC PARAMETERS:

Hydraulic parameters for the sediment transport calculations must be estimated from the following sources:

1) HEC-2 analysis
2) Field measurements
3) Normal depth calculations
4) Other acceptable methods

Discharge (cfs)	Bed Width (ft)	Flow Depth (ft)	X-sect. Area (ft^2)	Flow Velocity (fps)	Hydr. Radius (ft)	Slope ( )
400	87	0.68	59.17	6.76	0.68	0.03
600	91	0.85	77.72	7.72	0.85	0.03
800	95	0.99	94.34	8.48	0.99	0.03
1000	98	1.12	109.77	9.11	1.12	0.03
1100	100	1.17	117.15	9.39	1.17	0.03
1300	102	1.29	131.45	9.89	1.29	0.03

ORGAN ARROYO 5 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
400 cfs	3453	6513	202	11586	21060	507	1205	1440	31312	10653
600 cfs	6613	10730	288	23778	34389	762	1822	2074	58710	18878
800 cfs	10453	15200	372	39153	49208	1017	2439	2707	91174	28504
1000 cfs	14930	20037	451	58307	64013	1272	3057	3298	128933	39322
1100 cfs	17302	22348	493	67905	72831	1399	3366	3630	148158	45096
1300 cfs	22614	27674	565	92625	87133	1654	3984	4162	193055	57511
Q(Bed)=a*Q(Water)^b										
a=	0.24672	4.25912	1.06263	0.31047	14.71374	1.24134	2.75976	6.33617	3.07682	2.00986
b=	1.59366	1.22392	0.87599	1.75731	1.21307	1.00347	1.01477	0.90570	1.54040	1.43061

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.009863 b= 1.430607

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	0	0
6.5	1800	420	210
6.75	900	380	400
7	900	279	329.5
7.25	900	190	234.5
7.5	900	136	163
7.75	900	101	118.5
8	900	79	90
8.25	900	64	71.5
8.5	900	53	58.5
9	1800	41	47
10	3600	29	35
11	3600	23	26
12	3600	19	21
13	3600	17	18
14	3600	16	16.5
17	10800	14	15
20	10800	12	13
24	14400	10	11
40	57600	0	5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
0.0	0.0	0	ERR
4220.4	25.6	3798	6.1
10609.5	64.3	4774	16.9
8039.5	48.7	3618	17.5
4942.1	30.0	2224	15.8
2937.2	17.8	1322	13.1
1861.4	11.3	838	11.2
1255.8	7.6	565	9.6
903.5	5.5	407	8.6
678.1	4.1	305	7.8
495.8	3.0	446	7.3
325.2	2.0	585	6.8
212.5	1.3	383	5.6
156.6	0.9	282	5.0
125.6	0.8	226	4.5
110.9	0.7	200	4.2
96.8	0.6	522	4.2
78.8	0.5	426	4.0
62.1	0.4	447	3.8
20.1	0.1	579	

Sediment Transport Capacity..... 21,946 tons

Wet Transport Capacity..... 9,852 cy @ 165 pcf..... 6.1 acre-feet

Dry Transport Capacity..... 16,256 cy @ 100 pcf..... 10.1 acre-feet

ORGAN ARROYO 10 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
400 cfs	3453	6513	202	11586	21060	507	1205	1440	31312	10653
600 cfs	6613	10730	288	23778	34389	762	1822	2074	58710	18878
800 cfs	10453	15200	372	39153	49208	1017	2439	2707	91174	28504
1000 cfs	14930	20037	451	58307	64013	1272	3057	3298	128933	39322
1100 cfs	17302	22348	493	67905	72831	1399	3366	3630	148158	45096
1300 cfs	22614	27674	565	92625	87133	1654	3984	4162	193055	57511
Q(Bed)=a*Q(Water)^b										
a=	0.24672	4.25912	1.06263	0.31047	14.71374	1.24134	2.75976	6.33617	3.07682	2.00986
b=	1.59366	1.22392	0.87599	1.75721	1.21307	1.00347	1.01477	0.90570	1.54040	1.43061

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.009863 b= 1.430607

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	33	16.5
6.5	1800	671	352
6.75	900	588	629.5
7	900	415	501.5
7.25	900	279	347
7.5	900	197	238
7.75	900	145	171
8	900	111	128
8.25	900	90	100.5
8.5	900	75	82.5
9	1800	57	66
10	3600	40	48.5
11	3600	32	36
12	3600	27	29.5
13	3600	24	25.5
14	3600	23	23.5
17	10800	19	21
20	10800	17	18
24	14400	14	15.5
40	57600	0	7

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
110.9	0.7	50	2.0
8836.3	53.6	7953	8.0
20297.0	123.0	9134	20.9
14662.0	88.9	6598	21.4
8657.3	52.5	3896	18.8
5048.0	30.6	2272	15.5
3145.6	19.1	1416	13.1
2078.5	12.6	935	11.3
1470.6	8.9	662	9.9
1108.8	6.7	499	9.0
805.8	4.9	725	8.6
518.6	3.1	933	7.9
338.6	2.1	609	6.4
254.6	1.5	458	5.7
206.7	1.3	372	5.2
183.9	1.1	331	4.8
156.6	0.9	846	5.0
125.6	0.8	678	4.5
101.4	0.6	730	4.4
32.5	0.2	937	

Sediment Transport Capacity..... 40,033 tons

Wet Transport Capacity..... 17,972 cy @ 165 pcf..... 11.1 acre-feet

Dry Transport Capacity..... 29,654 cy @ 100 pcf..... 18.4 acre-feet

ORGAN ARROYO 25 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
400 cfs	3453	6513	202	11586	21060	507	1205	1440	31312	10653
600 cfs	6613	10730	288	23778	34389	762	1822	2074	58710	18878
800 cfs	10453	15200	372	39153	49208	1017	2439	2707	91174	28504
1000 cfs	14930	20037	451	58307	64013	1272	3057	3298	128933	39322
1100 cfs	17302	22348	493	67905	72831	1399	3366	3630	148158	45096
1300 cfs	22614	27674	565	92625	87133	1654	3984	4162	193055	57511
Q(Bed)=a*Q(Water)^b										
a=	0.24672	4.25912	1.06263	0.31047	14.71374	1.24134	2.75976	6.33617	3.07682	2.00986
b=	1.59366	1.22392	0.87599	1.75731	1.21307	1.00347	1.01477	0.90570	1.54040	1.43061

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.009863 b= 1.430607

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	60	30
6.5	1800	899	479.5
6.75	900	766	832.5
7	900	530	648
7.25	900	353	441.5
7.5	900	248	300.5
7.75	900	181	214.5
8	900	139	160
8.25	900	111	125
8.5	900	93	102
9	1800	70	81.5
10	3600	49	59.5
11	3600	40	44.5
12	3600	33	36.5
13	3600	30	31.5
14	3600	28	29
17	10800	23	25.5
20	10800	20	21.5
24	14400	17	18.5
40	57600	0	8.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
260.8	1.6	117	2.6
13750.6	83.3	12376	9.3
30275.4	183.5	13624	24.0
21155.7	128.2	9520	24.2
12218.7	74.1	5498	21.0
7046.8	42.7	3171	17.2
4350.3	26.4	1958	14.6
2860.2	17.3	1287	12.5
2009.2	12.2	904	11.0
1502.1	9.1	676	9.8
1089.6	6.6	981	9.4
694.7	4.2	1250	8.6
458.5	2.8	825	6.9
345.3	2.1	622	6.3
279.7	1.7	503	5.7
248.5	1.5	447	5.4
206.7	1.3	1116	5.4
161.9	1.0	874	4.9
130.6	0.8	940	4.7
42.9	0.3	1236	

Sediment Transport Capacity..... 57,928 tons

Wet Transport Capacity..... 26,006 cy @ 165 pcf..... 16.1 acre-feet

Dry Transport Capacity..... 42,909 cy @ 100 pcf..... 26.6 acre-feet

ORGAN ARROYO 50 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
400 cfs	3453	6513	202	11586	21060	507	1205	1440	31312	10653
600 cfs	6613	10730	288	23778	34389	762	1822	2074	58710	18878
800 cfs	10453	15200	372	39153	49208	1017	2439	2707	91174	28504
1000 cfs	14930	20037	451	58307	64013	1272	3057	3298	128933	39322
1100 cfs	17302	22348	493	67905	72831	1399	3366	3630	148158	45096
1300 cfs	22614	27674	565	92625	87133	1654	3984	4162	193055	57511
Q(Bed)=a*Q(Water)^b										
a=	0.24672	4.25912	1.06263	0.31047	14.71374	1.24134	2.75976	6.33617	3.07682	2.00986
b=	1.59366	1.22392	0.87599	1.75731	1.21307	1.00347	1.01477	0.90570	1.54040	1.43061

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.009863 b= 1.430607

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	100	50
6.5	1800	1139	619.5
6.75	900	950	1044.5
7	900	648	799
7.25	900	429	538.5
7.5	900	299	364
7.75	900	218	258.5
8	900	166	192
8.25	900	133	149.5
8.5	900	111	122
9	1800	84	97.5
10	3600	59	71.5
11	3600	47	53
12	3600	39	43
13	3600	35	37
14	3600	33	34
17	10800	28	30.5
20	10800	24	26
24	14400	21	22.5
40	57600	0	10.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload ($/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
541.7	3.3	244	3.3
19837.3	120.2	17854	10.6
41883.2	253.8	18847	26.7
28547.8	173.0	12846	26.7
16233.9	98.4	7305	22.9
9270.4	56.2	4172	18.8
5681.3	34.4	2557	15.8
3712.6	22.5	1671	13.6
2595.5	15.7	1168	11.8
1940.6	11.8	873	10.6
1408.2	8.5	1267	10.2
903.5	5.5	1626	9.3
588.7	3.6	1060	7.6
436.5	2.6	786	6.8
352.1	2.1	634	6.1
312.0	1.9	562	5.7
267.1	1.6	1442	5.8
212.5	1.3	1148	5.4
172.8	1.0	1244	5.0
58.1	0.4	1673	

Sediment Transport Capacity..... 78,978 tons

Wet Transport Capacity..... 35,456 cy @ 165 pcf..... 22.0 acre-feet

Dry Transport Capacity..... 58,502 cy @ 100 pcf..... 36.3 acre-feet

ORGAN ARROYO 100 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
400 cfs	3453	6513	202	11586	21060	507	1205	1440	31312	10653
600 cfs	6613	10730	288	23778	34389	762	1822	2074	58710	18878
800 cfs	10453	15200	372	39153	49208	1017	2439	2707	91174	28504
1000 cfs	14930	20037	451	58307	64013	1272	3057	3298	128933	39322
1100 cfs	17302	22348	493	67905	72831	1399	3366	3630	148158	45096
1300 cfs	22614	27674	565	92625	87133	1654	3984	4162	193055	57511
a=	0.24672	4.25912	1.06263	0.31047	14.71374	1.24134	2.75976	6.33617	3.07682	2.00986
b=	1.59366	1.22392	0.87599	1.75731	1.21307	1.00347	1.01477	0.90570	1.54040	1.43061

Q(Bed)=a*Q(Water)^b

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.009863 b= 1.430607

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	2	1
6	900	158	80
6.5	1800	1389	773.5
6.75	900	1140	1264.5
7	900	769	954.5
7.25	900	506	637.5
7.5	900	351	428.5
7.75	900	255	303
8	900	194	224.5
8.25	900	155	174.5
8.5	900	129	142
9	1800	97	113
10	3600	68	82.5
11	3600	55	61.5
12	3600	45	50
13	3600	41	43
14	3600	39	40
17	10800	32	35.5
20	10800	28	30
24	14400	24	26
40	57600	0	12

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
2.0	0.0	21	0.0
1061.1	6.4	477	4.1
27253.3	165.2	24528	11.9
55054.8	333.7	24775	29.3
36817.7	223.1	16568	29.0
20667.0	125.3	9300	24.8
11707.3	71.0	5268	20.2
7130.8	43.2	3209	16.9
4643.4	28.1	2090	14.5
3238.1	19.6	1457	12.7
2411.3	14.6	1085	11.3
1739.1	10.5	1565	10.9
1108.8	6.7	1996	9.9
728.4	4.4	1311	8.0
541.7	3.3	975	7.3
436.5	2.6	786	6.5
393.6	2.4	709	6.1
331.8	2.0	1792	6.3
260.8	1.6	1408	5.6
212.5	1.3	1530	5.4
70.3	0.4	2025	

Sediment Transport Capacity..... 102,875 tons

Wet Transport Capacity..... 46,184 cy @ 165 pcf..... 28.6 acre-feet

Dry Transport Capacity..... 76,204 cy @ 100 pcf..... 47.2 acre-feet

ANNUAL SEDIMENT TRANSPORT CAPACITY:

Storm Return Period	Percent Probability Of Occurence	Sediment Transport Capacity (ac-ft)	Incremental Areas Under Curve
100-year	1	47.2	0.472
50-year	2	36.3	0.418
25-year	4	26.6	0.629
10-year	10	18.4	1.350
5-year	20	10.1	1.425
	100	0.0	4.040

Volume under curve 8.33 ac-ft/yr based on 100#/cf

Annual Transport.. 18150 tons/yr based on 100#/cf 13445 cubic yards / year

Job Name..... OWL'S NEST ARROYO
Job No..... 90035.11

Date..... AUGUST 1, 1991

SEDIMENT TRANSPORT BEDLOAD CALCULATIONS

These calculations determine the bedload transport capacity of a stream using the following bedload equations:

RECOMMENDED RANGES OF APPLICATION:

Bedload Equation:	Median Grain Size (mm)
1. Engelund-Hansen	0.20 mm to 1 mm
2. DuBoys	0.05 mm to 5 mm
3. Meyer-Peter Muller	0.40 mm to 30 mm
4. Einstein-Brown	0.30 mm to 7 mm
5. Inglis-Lacey	0.01 mm to 1 mm
6. Meyer-Peter	3.00 mm to 30 mm
7. Schoklitsch	0.30 mm to 5 mm
8. Laursen	0.01 mm to 4 mm
9. Shields	1.70 mm to 2.5 mm

LOOK-UP TABLES USED IN DUBOYS FORMULA:

d50 mm	critical shearstress lbs/ft^2	DuBoys ft^3/ lb sec
0.01	0.017	1000
0.05	0.017	300
0.10	0.017	150
0.15	0.017	120
0.20	0.018	95
0.25	0.018	80
0.30	0.019	70
0.40	0.020	55
0.50	0.022	47
0.60	0.024	42
0.70	0.026	37
0.80	0.028	33
0.90	0.030	30
1.00	0.033	28
1.50	0.040	21
2.00	0.050	17
2.50	0.060	14
3.00	0.070	12
4.00	0.090	10
5.00	0.110	8
selected:	0.024	42

GENERAL PARAMETERS:

Acceleration of gravity	32.2 ft/sec^2
Kinematic viscosity of water	0.000012 ft^2/sec
Specific weight of water	62.4 lbs/ft^3
Specific weight of sediment	165 lbs/ft^3
Einstein-Brown and fall velocity factor:	0.01262

SEDIMENT PARAMETERS:

Median grain size	(D-50)...	0.62 mm
90% passing	(D-90)...	2.40 mm
	(D-50)...	0.0020 ft
(for Eq.3 only)	(D-90)...	0.0079 ft

HYDRAULIC PARAMETERS:

Hydraulic parameters for the sediment transport calculations must be estimated from the following sources:

1) HEC-2 analysis
2) Field measurements
3) Normal depth calculations
4) Other acceptable methods

Discharge (cfs)	Bed Width (ft)	Flow Depth (ft)	X-sect. Area (ft^2)	Flow Velocity (fps)	Hydr. Radius (ft)	Slope ( )
200	47	0.68	32.26	6.20	0.68	0.032
300	52	0.83	42.92	6.99	0.83	0.032
400	55	0.95	52.42	7.63	0.95	0.032
500	58	1.06	61.27	8.16	1.06	0.032
600	61	1.15	69.69	8.61	1.15	0.032
700	63	1.24	77.52	9.03	1.24	0.032

OWL'S NEST ARROYO 5 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	1547	3608	97	5330	6832	279	623	679	15802	4330
300 cfs	2891	5879	139	10565	11114	419	942	984	28931	7612
400 cfs	4502	8235	182	16906	16058	559	1262	1299	44153	11425
500 cfs	6357	10754	222	24601	21091	700	1582	1599	61581	15701
600 cfs	8384	13280	263	32931	26654	840	1902	1910	80172	20312
700 cfs	10652	15941	303	42591	32359	981	2222	2210	100854	25386
Q(Bed)=a*Q(Water)^b										
a=	0.44447	5.80872	0.77651	0.82701	9.30718	1.36898	2.87573	4.53507	6.28176	2.43181
b=	1.53933	1.18460	0.91059	1.65552	1.24395	1.00354	1.01526	0.94432	1.47835	1.41179

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.431807 b= 1.411788

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	1	0.5
6.5	1800	217	109
6.75	900	207	212
7	900	156	181.5
7.25	900	108	132
7.5	900	79	93.5
7.75	900	60	69.5
8	900	47	53.5
8.25	900	38	42.5
8.5	900	32	35
9	1800	25	28.5
10	3600	18	21.5
11	3600	14	16
12	3600	12	13
13	3600	11	11.5
14	3600	10	10.5
17	10800	9	9.5
20	10800	8	8.5
24	14400	7	7.5
40	57600	0	3.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
0.9	0.0	0	0.6
1829.6	11.1	1647	5.1
4679.8	28.4	2106	13.7
3759.3	22.8	1691	14.6
2397.4	14.5	1079	13.5
1473.3	8.9	663	11.3
969.2	5.9	436	9.8
669.9	4.1	301	8.6
484.0	2.9	218	7.7
368.0	2.2	166	7.0
275.3	1.7	248	6.7
184.9	1.1	333	6.2
121.9	0.7	219	5.3
90.9	0.6	164	4.6
76.5	0.5	138	4.2
67.2	0.4	121	4.1
58.4	0.4	315	3.9
49.9	0.3	269	3.8
41.8	0.3	301	3.6
14.3	0.1	411	

Sediment Transport Capacity..... 10,826 tons

Wet Transport Capacity..... 4,860 cy @ 165 pcf..... 3.0 acre-feet

Dry Transport Capacity..... 8,019 cy @ 100 pcf..... 5.0 acre-feet

OWL'S NEST ARROYO 10 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	1547	3608	97	5330	6832	279	623	679	15802	4230
300 cfs	2891	5879	139	10565	11114	419	942	984	28981	7612
400 cfs	4502	8235	182	16906	16058	559	1262	1299	44153	11425
500 cfs	6357	10754	222	24601	21091	700	1582	1599	61581	15701
600 cfs	8384	13280	263	32931	26654	840	1902	1910	80172	20312
700 cfs	10652	15941	303	42591	32359	981	2222	2210	100854	25386
Q(Bed)=a*Q(Water)^b										
a=	0.44447	6.80872	0.77651	0.82701	9.30718	1.36898	2.87573	4.53507	6.28176	2.43181
b=	1.53933	1.18460	0.91059	1.65652	1.24395	1.00354	1.01526	0.94432	1.47835	1.41179

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.431807 b= 1.411788

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	29	14.5
6.5	1800	379	204
6.75	900	342	360.5
7	900	247	294.5
7.25	900	168	207.5
7.5	900	120	144
7.75	900	90	105
8	900	69	79.5
8.25	900	56	62.5
8.5	900	47	51.5
9	1800	36	41.5
10	3600	26	31
11	3600	21	23.5
12	3600	17	19
13	3600	16	16.5
14	3600	15	15.5
17	10800	12	13.5
20	10800	11	11.5
24	14400	9	10
40	57600	0	4.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
106.1	0.6	48	2.2
4432.4	26.9	3989	7.1
9902.4	60.0	4456	17.5
7443.1	45.1	3349	18.3
4540.1	27.5	2043	16.4
2710.7	16.4	1220	13.7
1735.5	10.5	781	11.7
1171.8	7.1	527	10.3
834.3	5.1	375	9.0
634.8	3.8	286	8.2
468.0	2.8	421	7.9
310.0	1.9	558	7.2
209.7	1.3	377	6.1
155.3	0.9	280	5.5
127.3	0.8	229	4.8
116.5	0.7	210	4.7
95.9	0.6	518	4.8
76.5	0.5	413	4.2
62.8	0.4	452	4.2
20.3	0.1	585	

Sediment Transport Capacity..... 21,118 tons

Wet Transport Capacity..... 9,480 cy @ 165 pcf..... 5.9 acre-feet

Dry Transport Capacity..... 15,643 cy @ 100 pcf..... 9.7 acre-feet

OWL'S NEST ARROYO 25 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	1547	3608	97	5330	6832	279	623	679	15802	4330
300 cfs	2891	5879	139	10565	11114	419	942	984	28931	7612
400 cfs	4502	8235	182	16906	16058	559	1262	1299	44153	11425
500 cfs	6357	10754	222	24601	21091	700	1582	1599	61581	15701
600 cfs	8384	13280	263	32931	26654	840	1902	1910	80172	20312
700 cfs	10652	15941	303	42591	32359	981	2222	2210	100854	25386
Q(Bed)=a*Q(Water)^b										
a=	0.44447	6.80872	0.77651	0.82701	9.30718	1.36898	2.87573	4.53507	6.28176	2.43181
b=	1.53933	1.18460	0.91059	1.65652	1.24395	1.00354	1.01526	0.94432	1.47835	1.41179

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.431807 b= 1.411788

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	47	23.5
6.5	1800	526	286.5
6.75	900	472	499
7	900	326	399
7.25	900	220	273
7.5	900	156	188
7.75	900	115	135.5
8	900	97	106
8.25	900	71	84
8.5	900	60	65.5
9	1800	46	53
10	3600	32	39
11	3600	26	29
12	3600	21	23.5
13	3600	19	20
14	3600	18	18.5
17	10800	15	16.5
20	10800	13	14
24	14400	11	12
40	57600	0	5.5

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
209.7	1.3	94	2.7
7159.3	43.4	6443	8.2
15670.3	95.0	7052	20.1
11427.6	69.3	5142	21.2
6687.7	40.5	3009	18.4
3949.7	23.9	1777	15.3
2487.6	15.1	1119	13.1
1758.9	10.7	791	11.0
1266.5	7.7	570	10.8
891.4	5.4	401	9.0
661.1	4.0	595	8.7
428.7	2.6	772	8.1
282.2	1.7	508	6.6
209.7	1.3	377	6.1
167.0	1.0	301	5.3
149.5	0.9	269	5.0
127.3	0.8	687	5.1
100.9	0.6	545	4.7
81.2	0.5	595	4.5
27.0	0.2	777	

Sediment Transport Capacity..... 31,817 tons

Wet Transport Capacity..... 14,284 cy @ 165 pcf..... 8.9 acre-feet

Dry Transport Capacity..... 23,568 cy @ 100 pcf..... 14.6 acre-feet

OWL'S NEST ARROYO 50 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	1547	3608	97	5330	6832	279	623	679	15802	4330
300 cfs	2891	5879	139	10565	11114	419	942	984	28931	7612
400 cfs	4502	8235	182	16906	16058	559	1262	1299	44153	11425
500 cfs	6357	10754	222	24601	21091	700	1582	1599	61581	15701
600 cfs	8384	13280	263	32931	26654	840	1902	1910	80172	20312
700 cfs	10652	15941	303	42591	32359	981	2222	2210	100854	25386
Q(Bed)=a*Q(Water)^b										
a=	0.44447	6.80872	0.77651	0.82701	9.30718	1.36898	2.87573	4.53507	6.28176	2.43181
b=	1.53933	1.18460	0.91059	1.65652	1.24395	1.00354	1.01526	0.94432	1.47835	1.41179

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.431807 b= 1.411789

INPUT HYDROGRAPH:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)
0	0	0	0
5.75	20700	0	0
6	900	70	35
6.5	1800	667	368.5
6.75	900	603	635
7	900	435	519
7.25	900	273	354
7.5	900	192	232.5
7.75	900	141	166.5
8	900	108	124.5
8.25	900	87	97.5
8.5	900	72	79.5
9	1800	55	63.5
10	3600	39	47
11	3600	31	35
12	3600	26	28.5
13	3600	23	24.5
14	3600	22	22.5
17	10800	18	20
20	10800	16	17
24	14400	14	15
40	57600	0	7

SEDIMENT TRANSPORT CAPACITY:

Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0.0	0.0	0	0.0
368.0	2.2	166	3.2
10214.0	61.9	9193	9.3
22021.8	133.5	9910	22.1
16554.2	100.4	7454	23.1
9651.2	58.5	4343	21.4
5321.1	32.3	2399	16.8
3327.3	20.2	1497	14.3
2207.3	13.4	993	12.4
1563.1	9.5	703	10.9
1171.8	7.1	527	9.9
853.2	5.2	768	9.4
557.9	3.4	1004	8.7
368.0	2.2	662	7.2
275.3	1.7	496	6.4
222.4	1.3	400	5.9
197.2	1.2	355	5.4
167.0	1.0	902	5.6
132.8	0.8	717	5.0
111.3	0.7	801	4.8
37.9	0.2	1093	

Sediment Transport Capacity..... 44,383 tons

Wet Transport Capacity..... 19,925 cy @ 165 pcf..... 12.4 acre-feet

Dry Transport Capacity..... 32,876 cy @ 100 pcf..... 20.4 acre-feet

OWL'S NEST ARROYO 100 YEAR STORM EVENT

BEDLOAD TRANSPORT CAPACITY IN LBS/SEC: EQUATIONS USED IN AVERAGE: 1, 2, 4 & 5

Discharge	Eq.1	Eq.2	Eq.3	Eq.4	Eq.5	Eq.6	Eq.7	Eq.8	Eq.9	Average
200 cfs	1547	3608	97	5330	6832	279	623	679	15802	4330
300 cfs	2891	5879	139	10565	11114	419	942	984	28931	7612
400 cfs	4502	8235	182	16906	16058	559	1262	1299	44153	11425
500 cfs	6357	10754	222	24601	21091	700	1582	1599	61581	15701
600 cfs	8384	13280	263	32931	26654	840	1902	1910	80172	20312
700 cfs	10652	15941	303	42591	32359	981	2222	2210	100854	25386
Q(Bed)=a*Q(Water)^b										
a=	0.44447	6.80872	0.77651	0.82701	9.30718	1.36898	2.87573	4.53507	6.28176	2.43181
b=	1.53933	1.18460	0.91059	1.65652	1.24395	1.00354	1.01526	0.94432	1.47835	1.41179

INPUT PARAMETERS FOR BEDLOAD CALCULATIONS: a= 2.431807 b= 1.411788

INPUT HYDROGRAPH:

SEDIMENT TRANSPORT CAPACITY:

Time (hours)	Delta T (sec)	Q-water (cfs)	Avg Q-water (cfs)	Q-sed Bedload (#/sec)	Q-sed @165 pcf (cfs)	Sediment Bedload (tons)	Qsed/Qw (percent)
0	0	0	0				
5.75	20700	0	0	0.0	0.0	0	0.0
6	900	98	49	591.7	3.6	266	3.7
6.5	1800	834	466	14227.4	86.2	12805	10.3
6.75	900	741	787.5	29841.7	180.9	13429	24.4
7	900	527	634	21972.9	133.2	9888	25.3
7.25	900	329	428	12617.5	76.5	5678	23.2
7.5	900	230	279.5	6913.6	41.9	3111	18.2
7.75	900	168	199	4279.8	25.9	1926	15.4
8	900	128	148	2817.6	17.1	1268	13.3
8.25	900	102	115	1973.3	12.0	888	11.7
8.5	900	85	93.5	1473.3	8.9	663	10.5
9	1800	65	75	1079.2	6.5	971	10.1
10	3600	45	55	696.6	4.2	1254	9.4
11	3600	36	40.5	452.2	2.7	814	7.6
12	3600	30	33	338.6	2.1	610	6.8
13	3600	27	28.5	275.3	1.7	496	6.2
14	3600	26	26.5	248.5	1.5	447	5.8
17	10800	21	23.5	209.7	1.3	1132	6.1
20	10800	19	20	167.0	1.0	902	5.3
24	14400	16	17.5	138.3	0.8	996	5.2
40	57600	0	8	45.8	0.3	1319	

Sediment Transport Capacity..... 58,862 tons

Wet Transport Capacity..... 26,425 cy @ 165 pcf..... 16.4 acre-feet

Dry Transport Capacity..... 43,601 cy @ 100 pcf..... 27.0 acre-feet

ANNUAL SEDIMENT TRANSPORT CAPACITY:

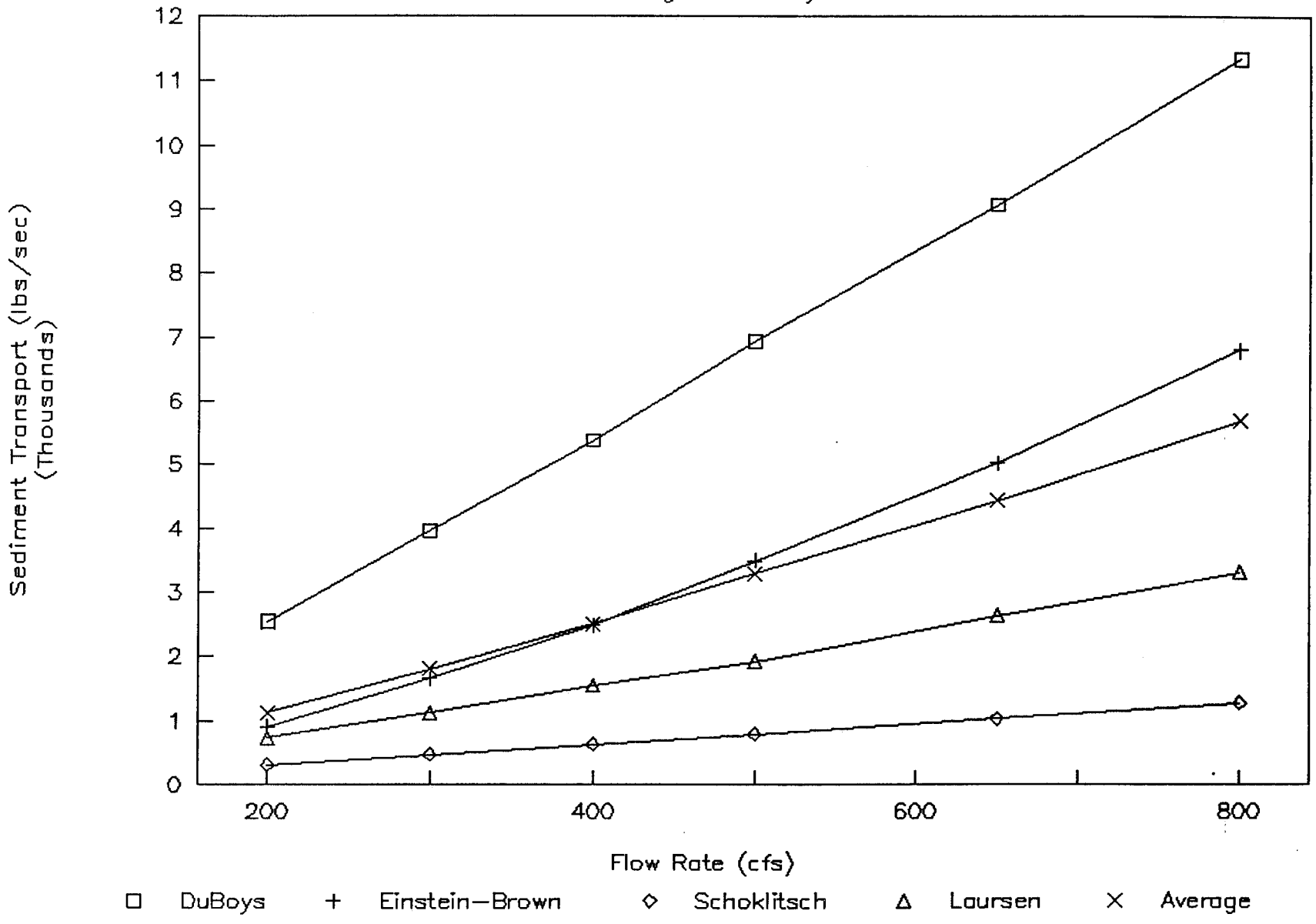
Storm Return Period	Percent Probability Of Occurence	Sediment Transport Capacity (ac-ft)	Incremental Areas Under Curve
100-year	1	27.0	0.270
50-year	2	20.4	0.237
25-year	4	14.6	0.350
10-year	10	9.7	0.729
5-year	20	5.0	0.735
	100	0.0	2.000

Volume under curve 4.32 ac-ft/yr based on 100#/cf

Annual Transport.. 9411 tons/yr based on 100#/cf 6971 cubic yards / year

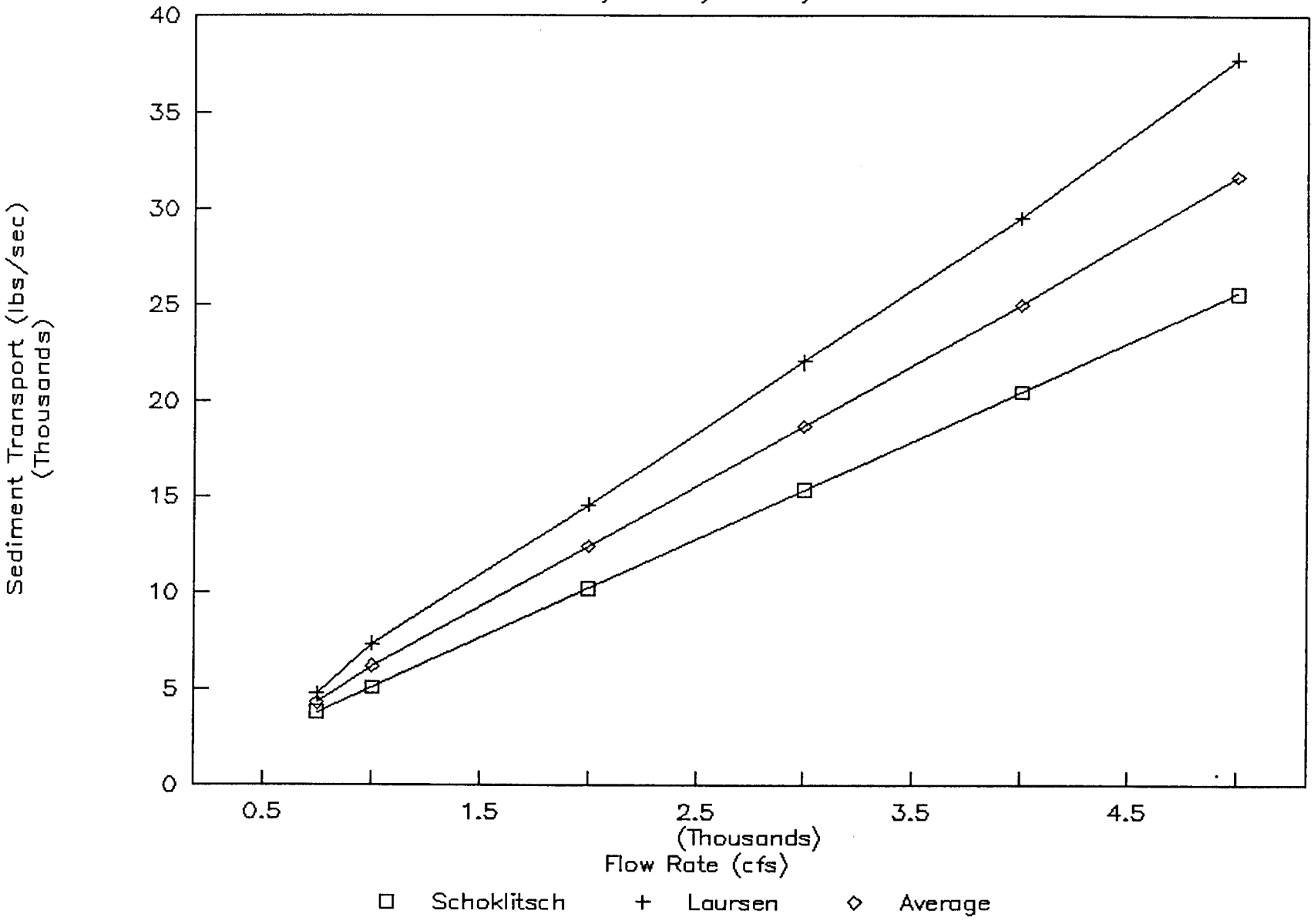
BEDLOAD FORMULAS

San Augustin Arroyo



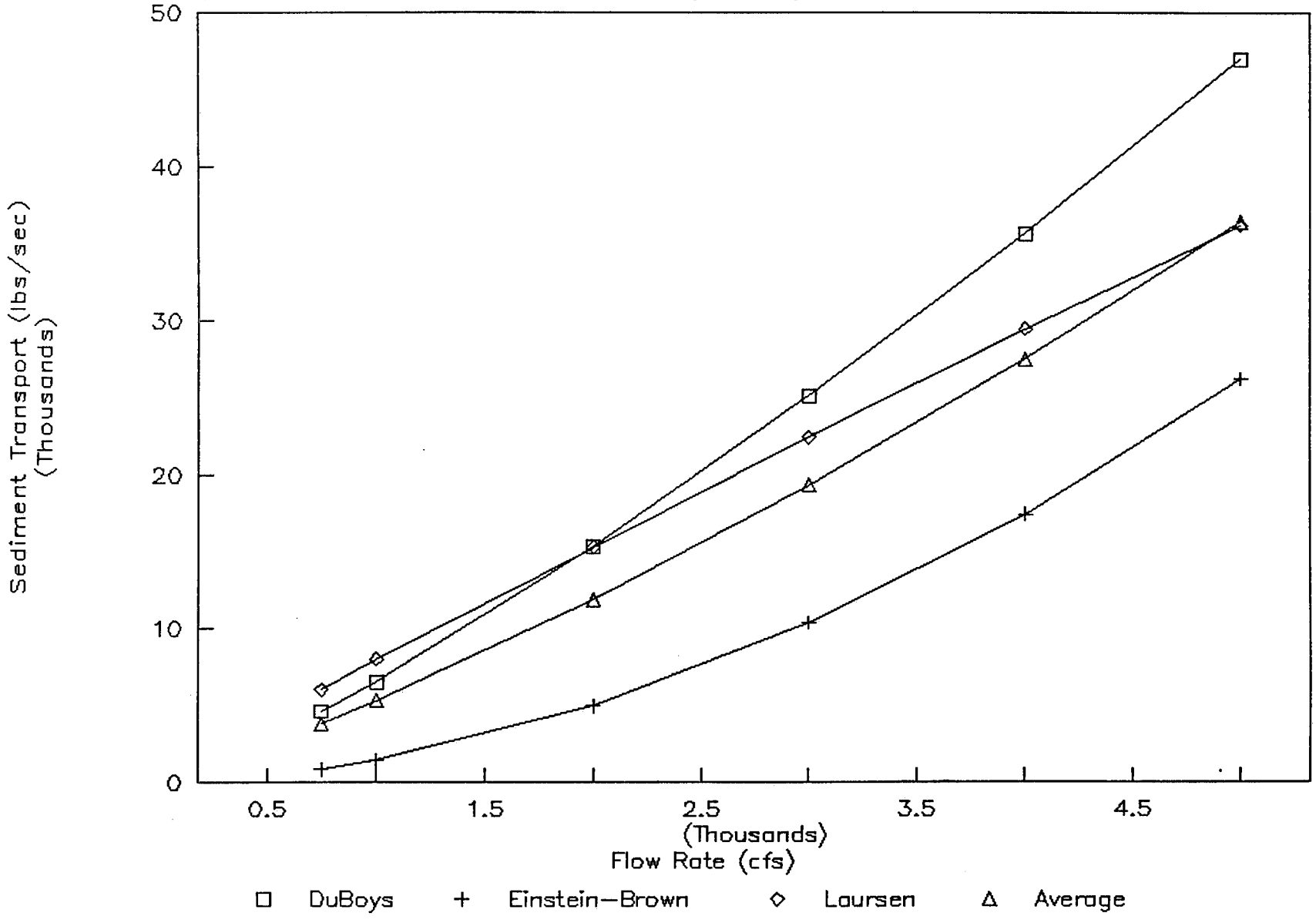
BEDLOAD FORMULAS

Baylor Canyon Arroyo



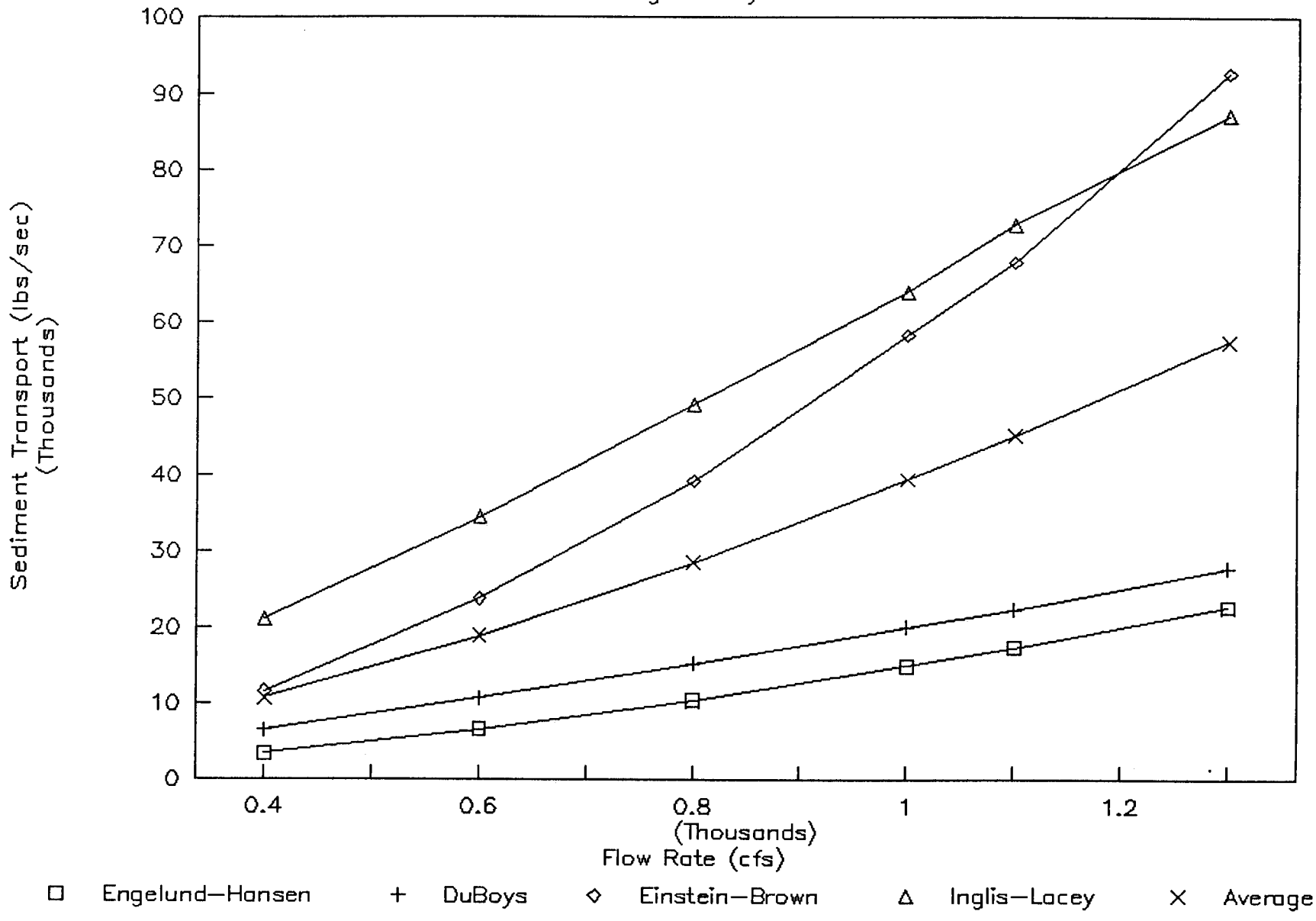
BEDLOAD FORMULAS

Blair Canyon Arroyo



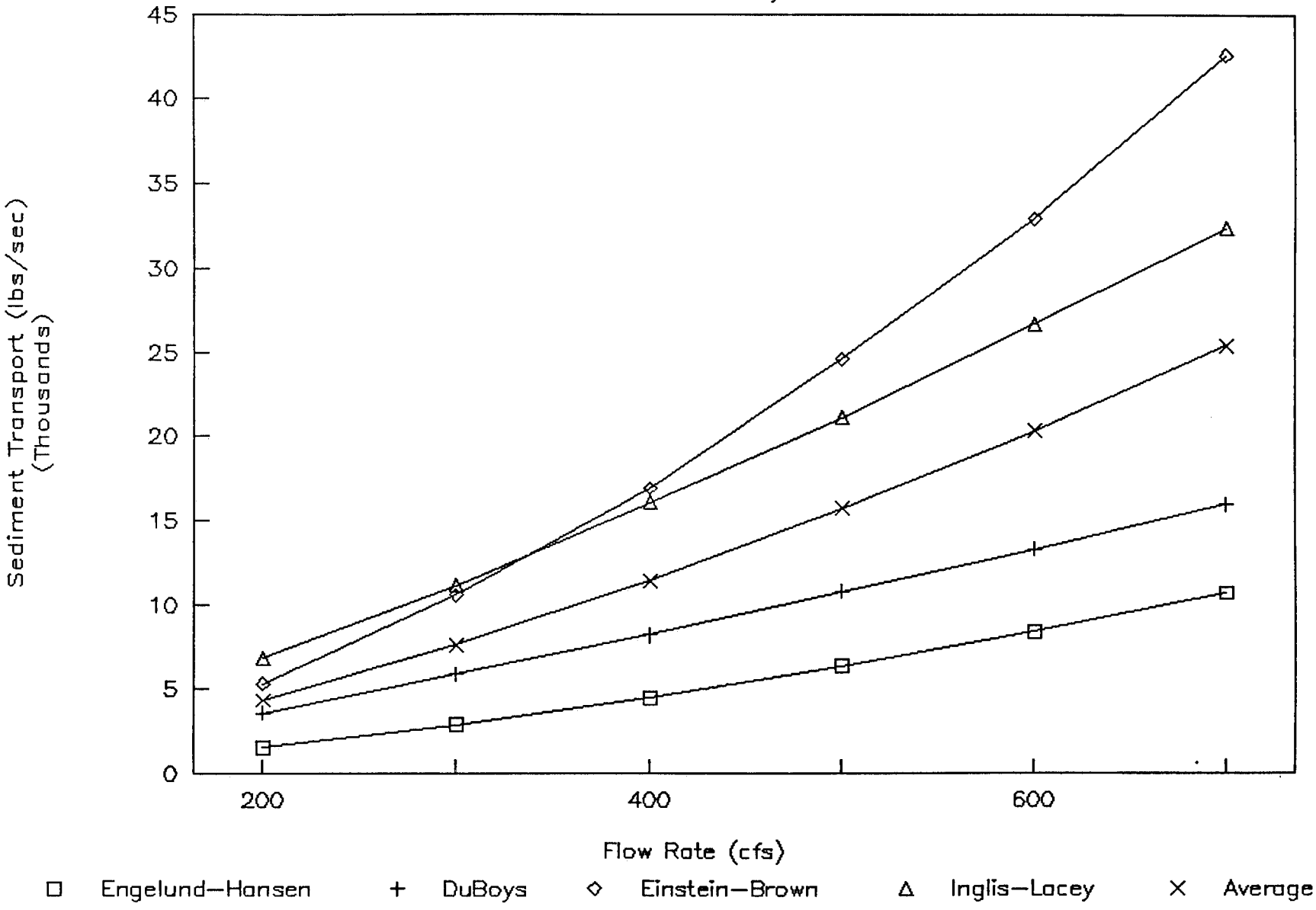
BEDLOAD FORMULAS

Organ Arroyo



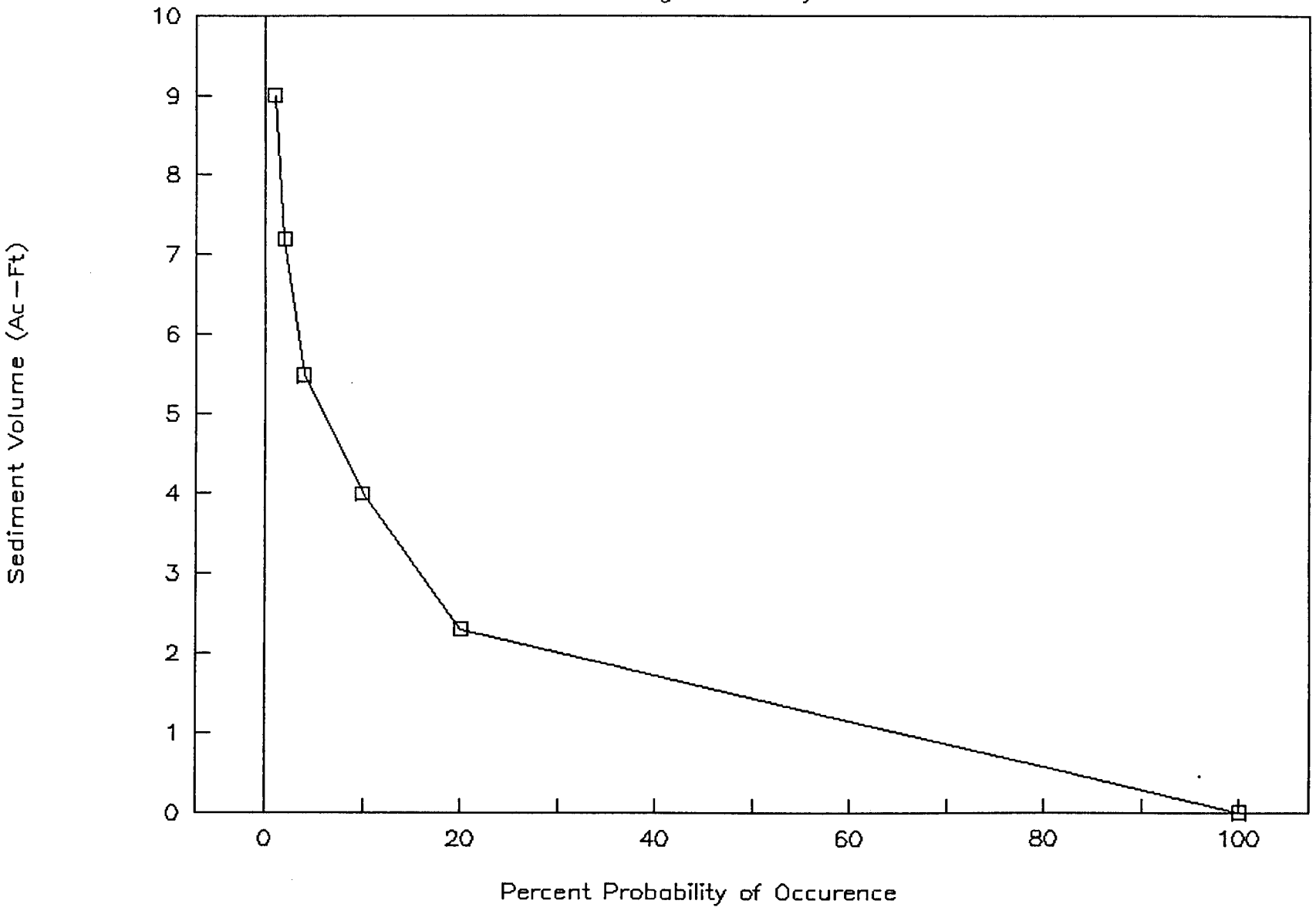
BEDLOAD FORMULAS

Owl's Nest Arroyo



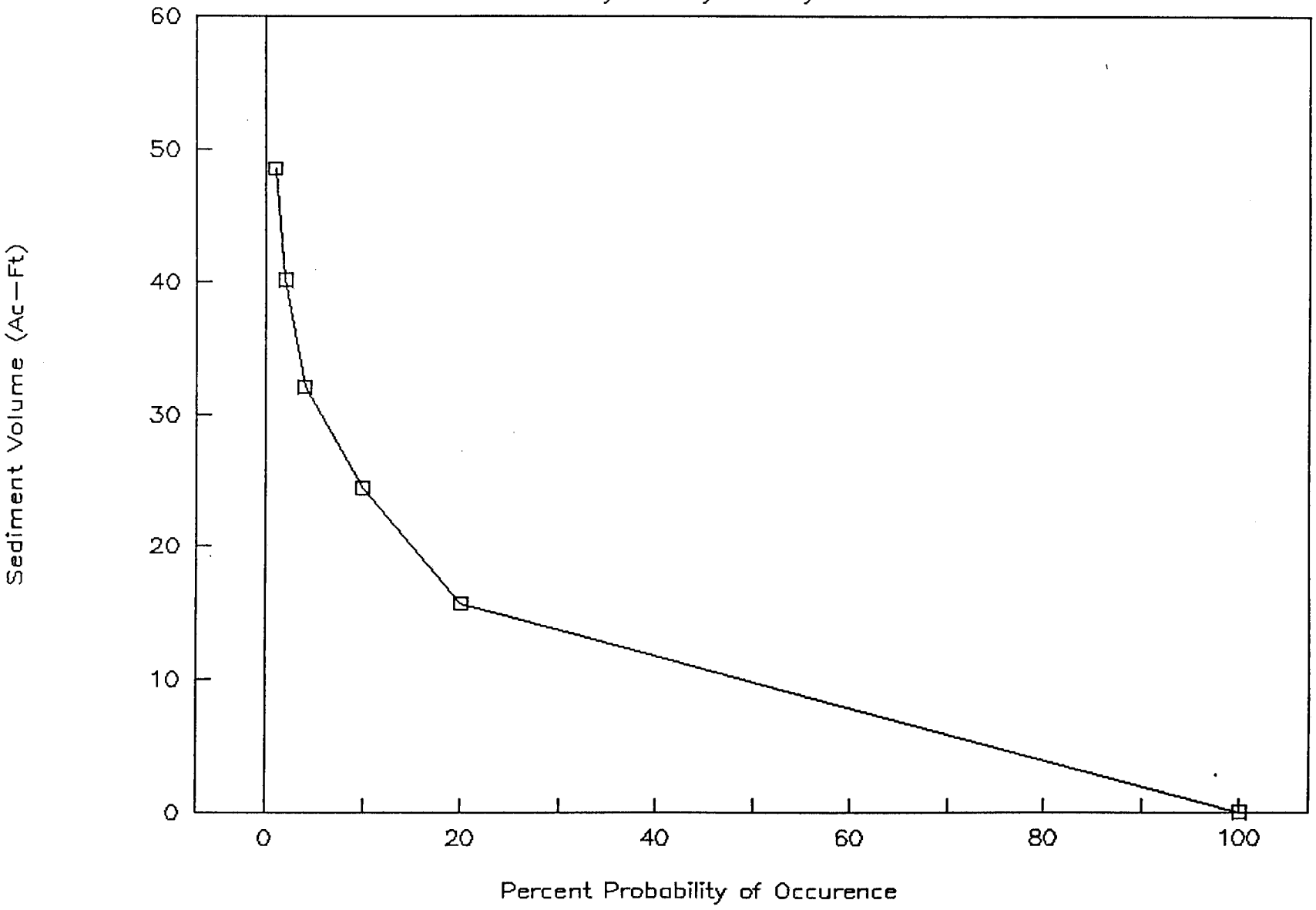
ANNUAL SEDIMENT TRANSPORT CAPACITY

San Augustin Arroyo

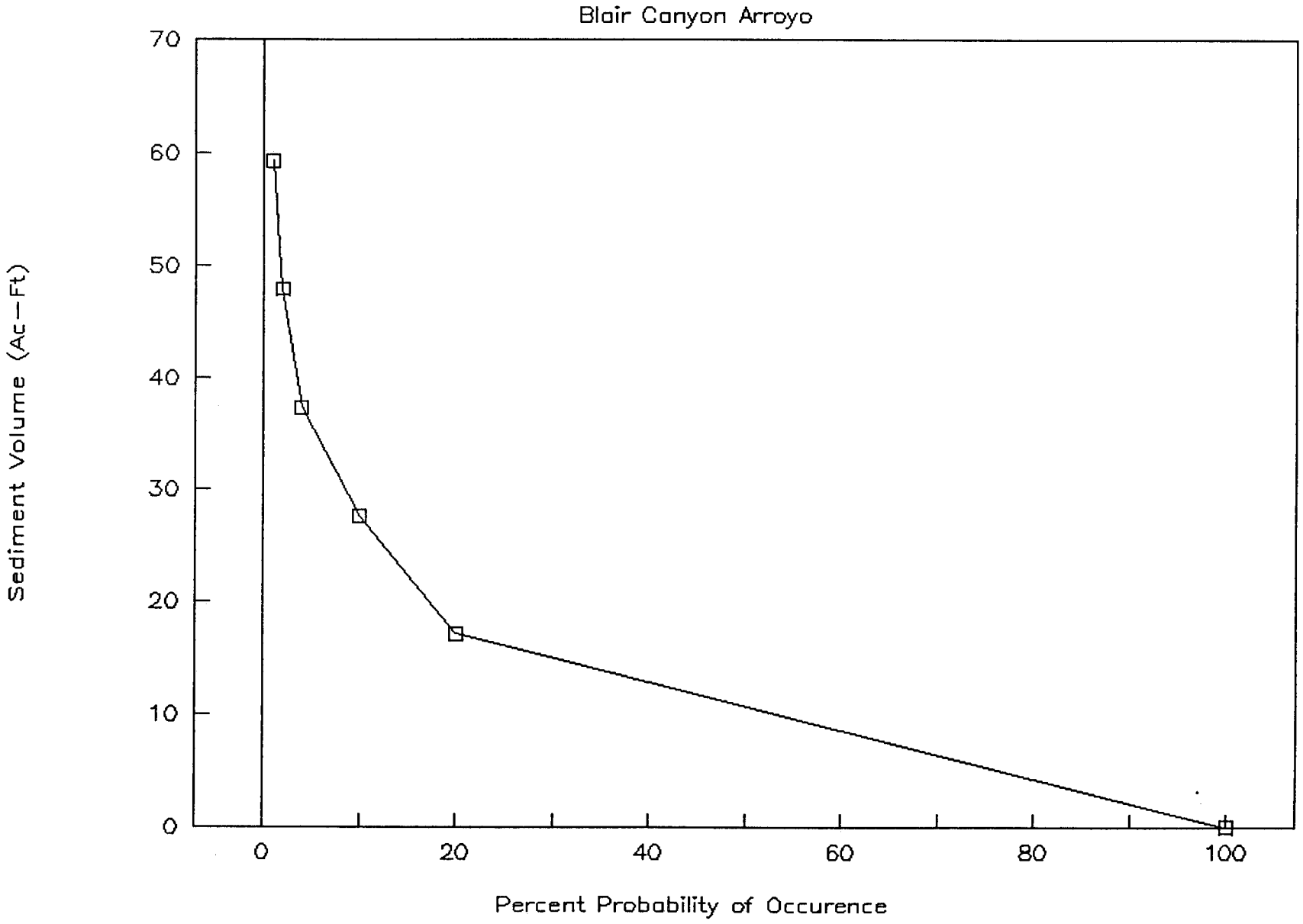


ANNUAL SEDIMENT TRANSPORT CAPACITY

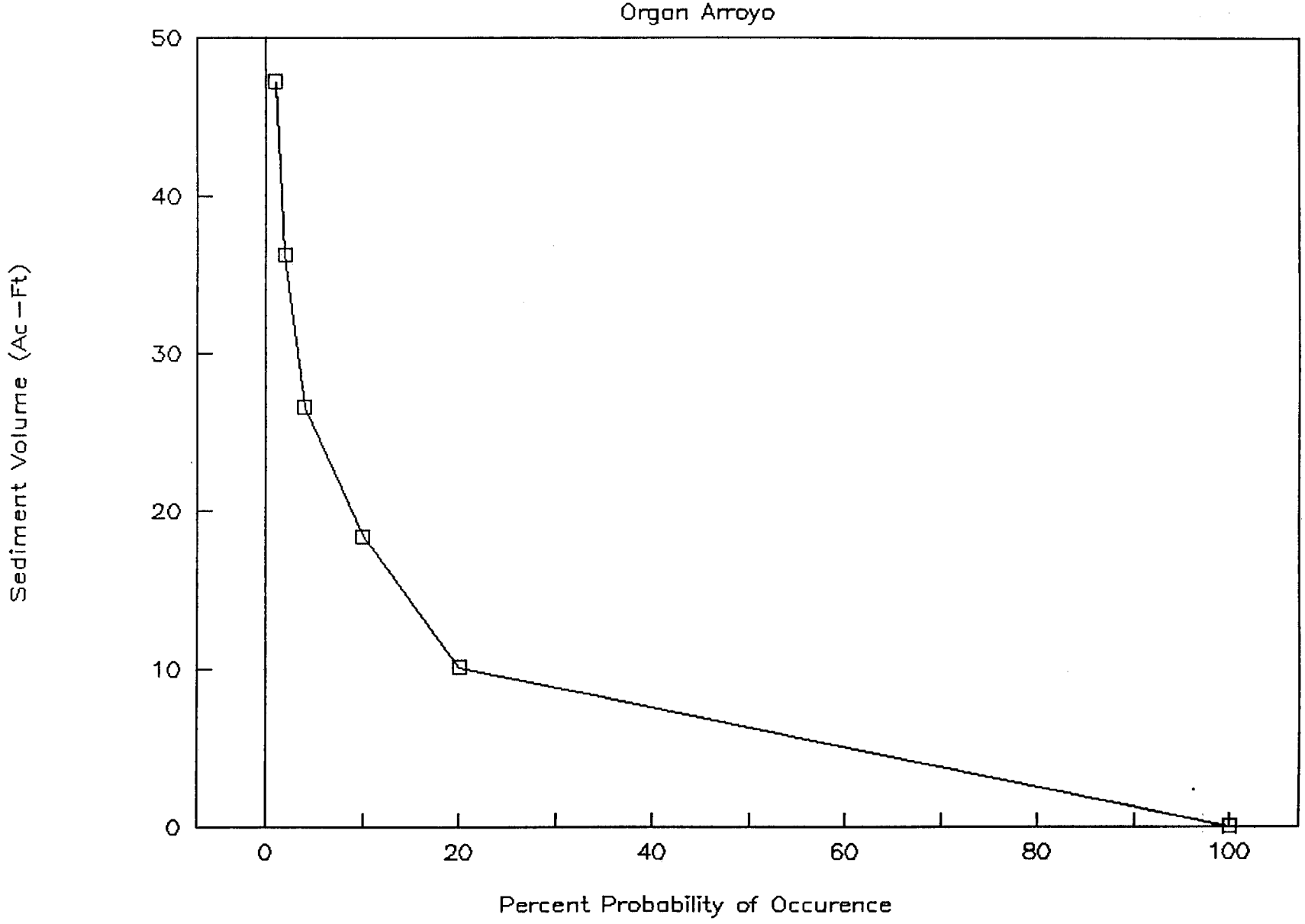
Baylor Canyon Arroyo



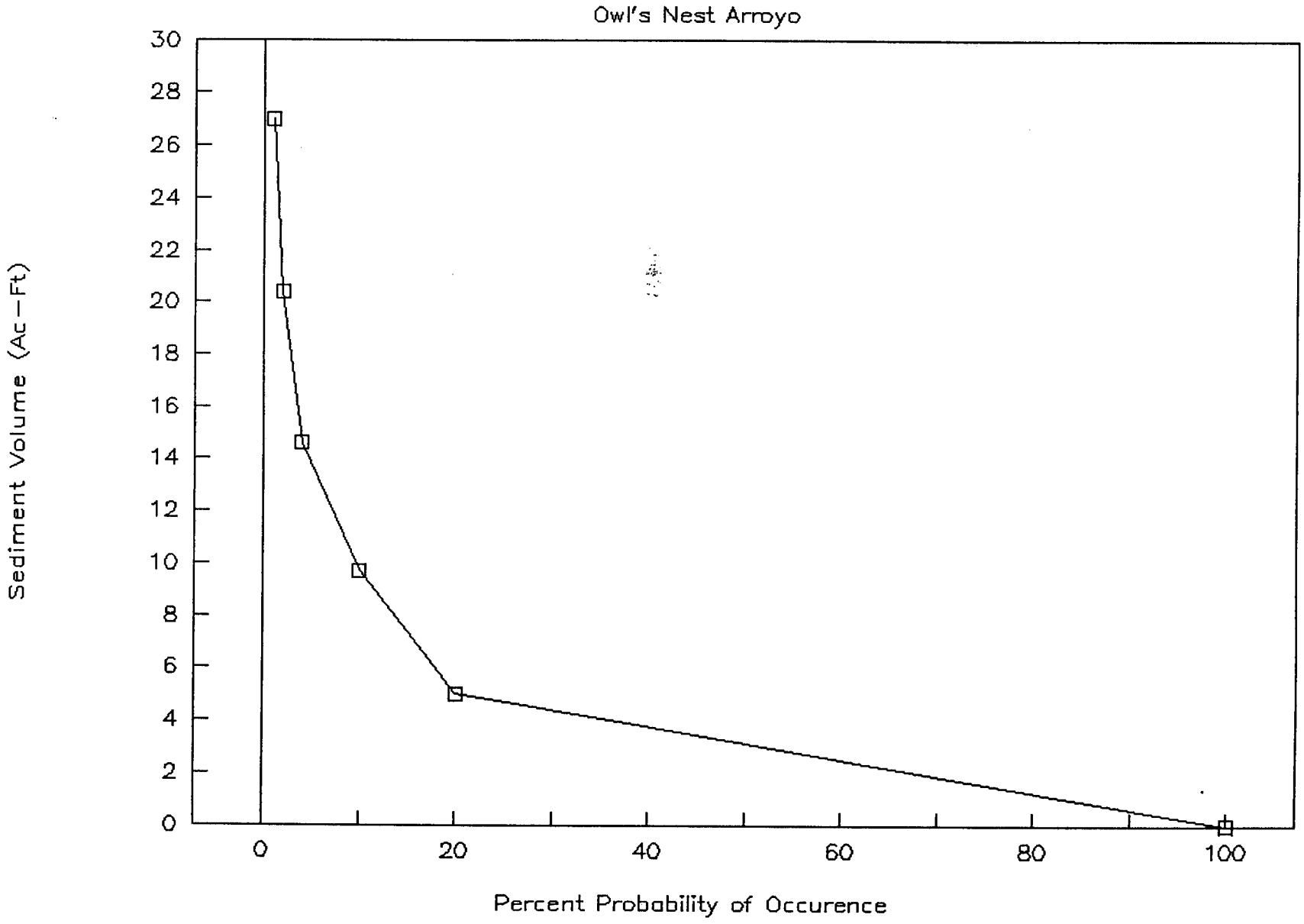
ANNUAL SEDIMENT TRANSPORT CAPACITY

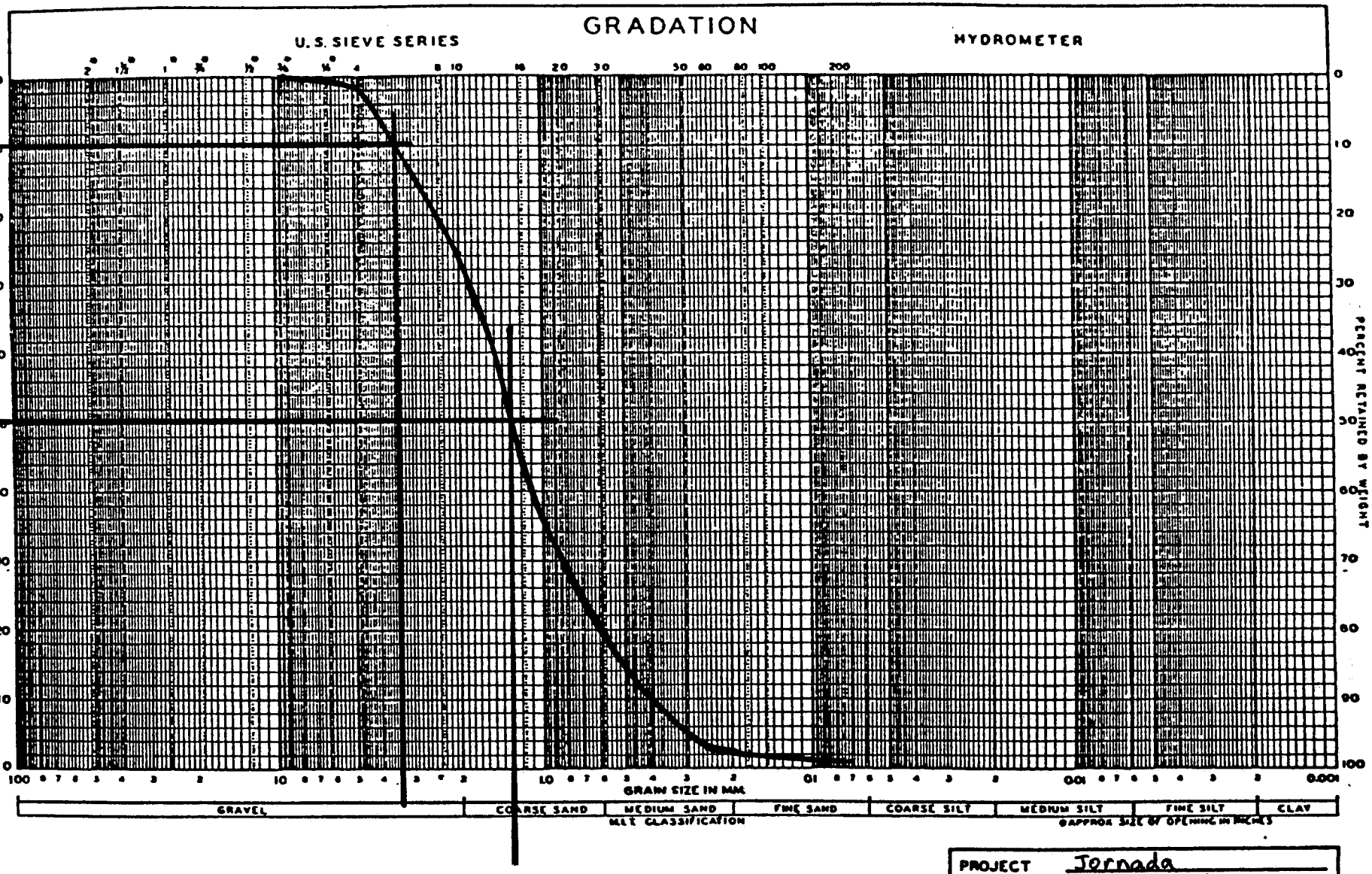


ANNUAL SEDIMENT TRANSPORT CAPACITY



ANNUAL SEDIMENT TRANSPORT CAPACITY

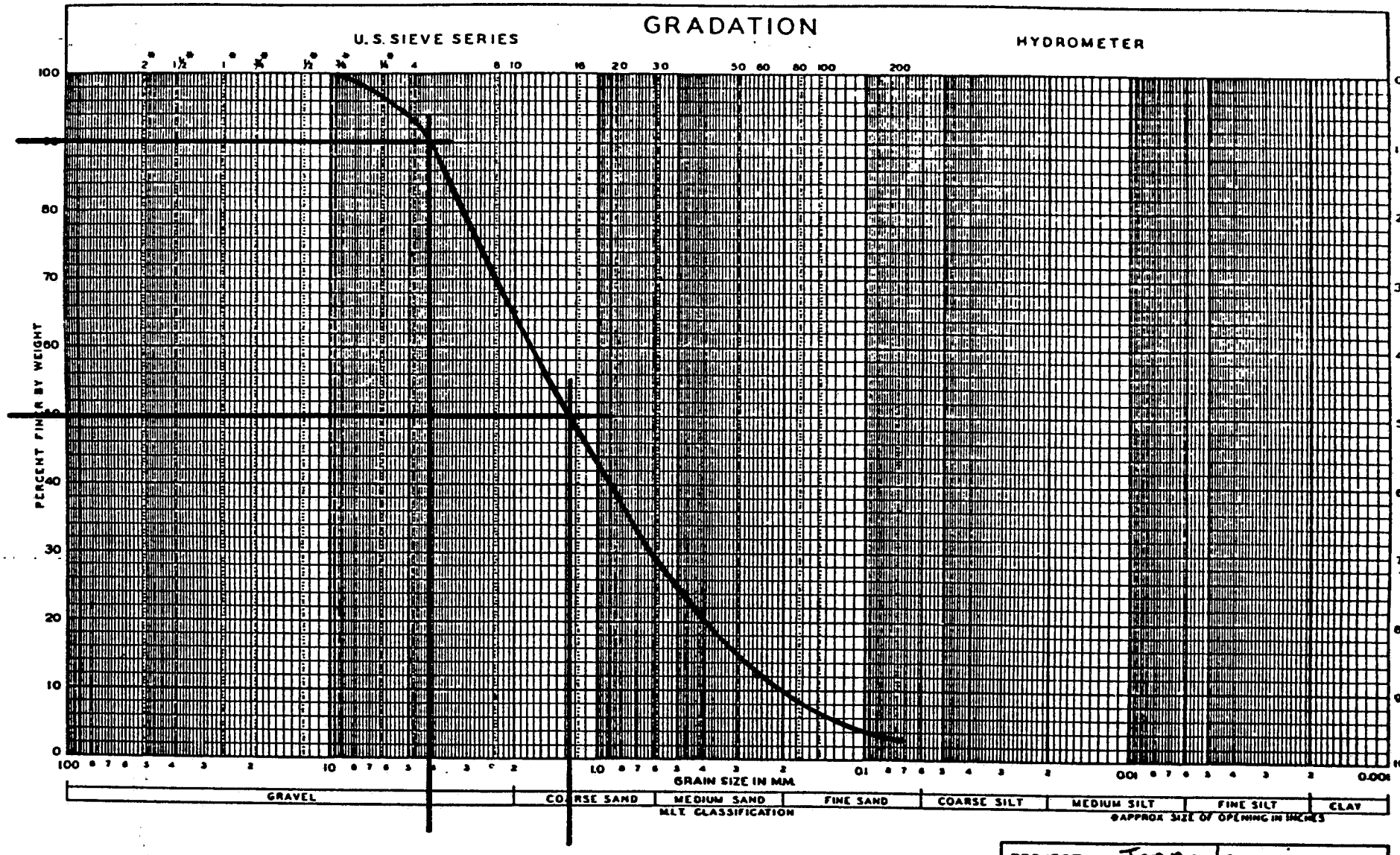




PROJECT	Jornada
LOCATION	San Augustin Arroyo
STATION	
OFFSET	
HOLE NO.	TEST PIT
AUGER HOLE	UNDISTURBED SAMPLE

$D_{90} = 3.4\,mm$

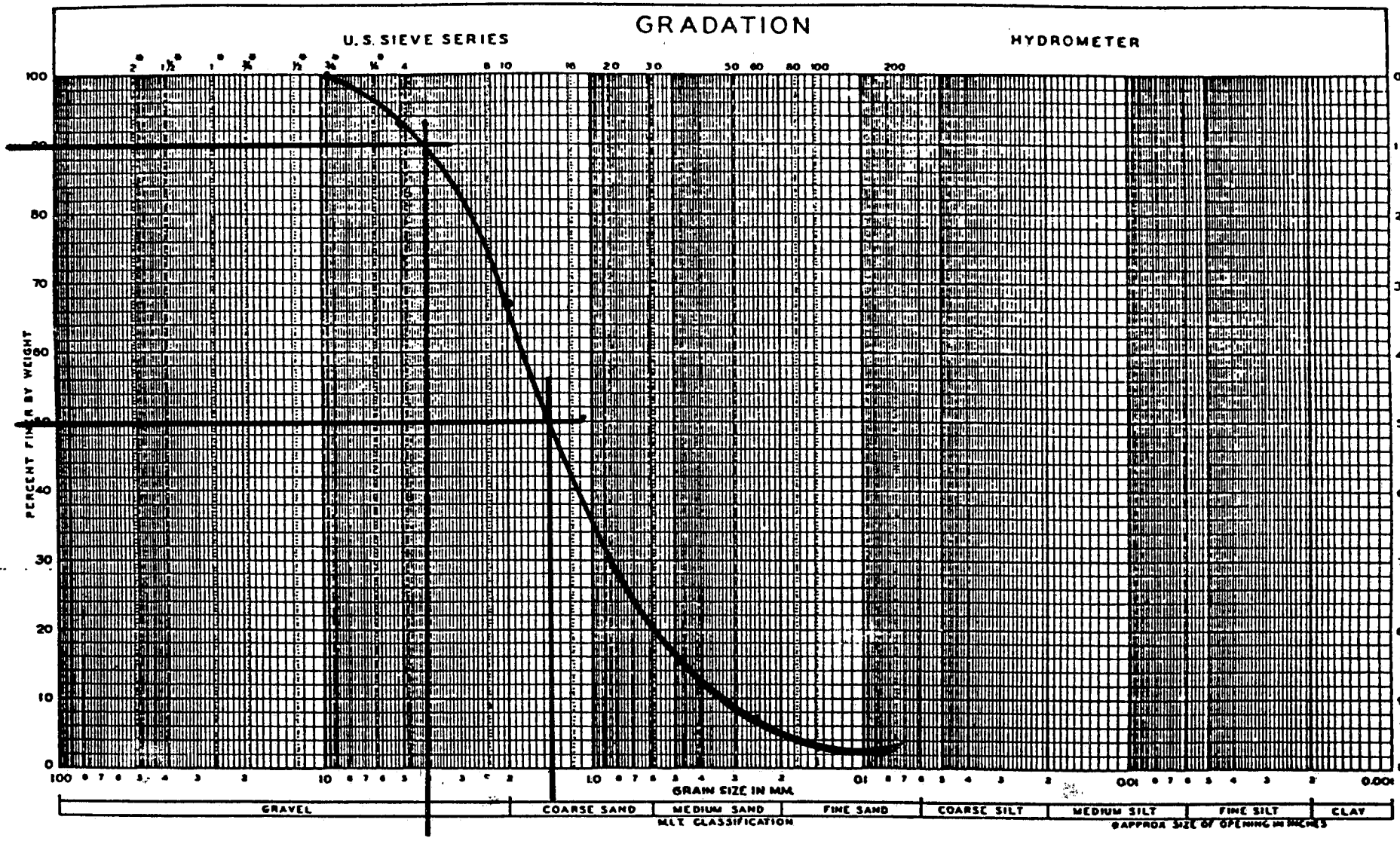
$D_{50} = 1.3\,mm$



PROJECT	Tornado
LOCATION	Baylor Canyon Arroyo
STATION	
OFFSET	
HOLE NO.	TEST PIT
AUGER HOLE	UNDISTURBED SAMPLE

$D_{90} = 4.4$ mm

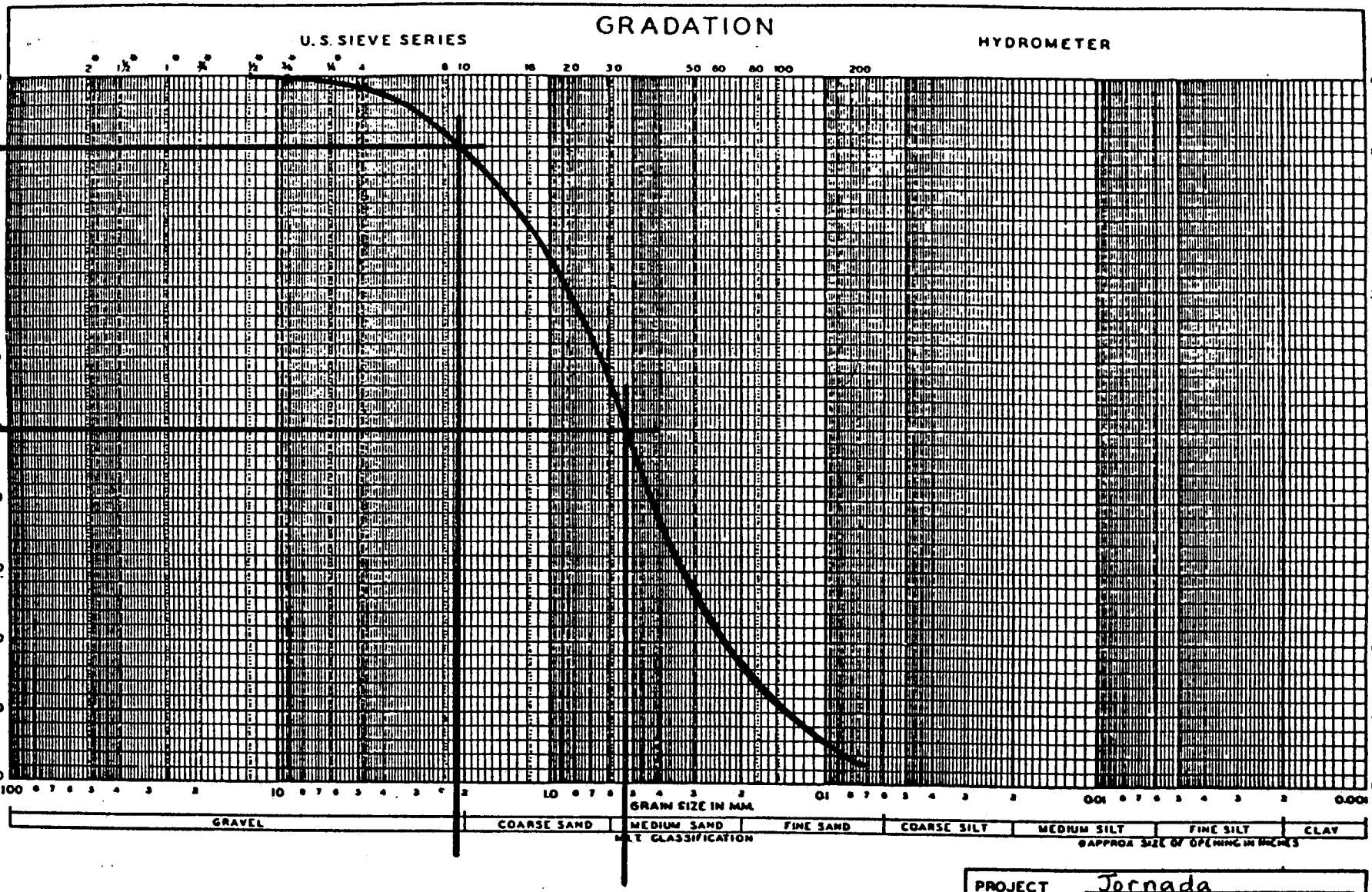
$D_{50} = 1.3$ mm



PROJECT	Tornado
LOCATION	Blair Canyon Arroyo S. of HW 70
OFFSET	
HOLE NO.	TEST PIT
AUGER HOLE	UNDISTURBED SAMPLE

$D_{90} = 4.5\,mm$

$D_{50} = 1.4\,mm$



PROJECT Tornada

LOCATION Organ Arroyo North Branch

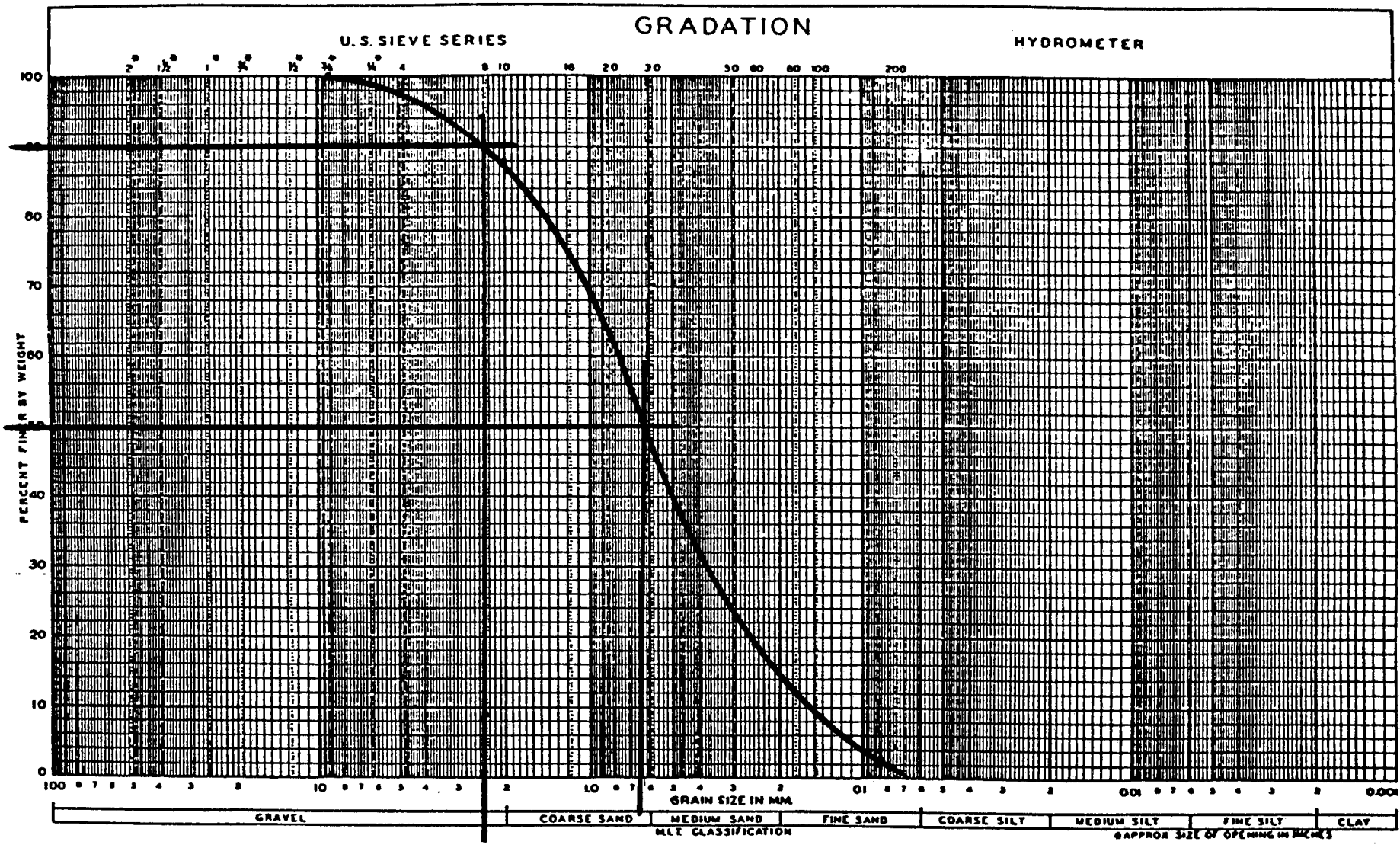
OFFSET

HOLE NO. ____ TEST PIT ____

AUGER HOLE ____ UNDISTURBED SAMPLE ____

$D_{90} = 2.1\ mm$

$D_{50} = 0.55\ mm$



PROJECT	Jornada
LOCATION	Owl's Nest Arroyo(S)
STATION	
OFFSET	
HOLE NO.	TEST PIT
AUGER HOLE	UNDISTURBED SAMPLE

$D_{90} = 2.4\text{mm}$

$D_{50} = 0.62\text{mm}$

HLEP 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
RO YPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR
ETA...

DONA ANA COUNTY FLOOD COMMISSION - AUGUSTINE ARROYO N. FORK
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
AUGSTN ARROYO Q=200 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	3	0	1	0.028	0	0	0	4836.50	

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
2	0	-1	0	0	0	0	0	0	

LEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
PFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR
TAILS.

DONA ANA COUNTY FLOOD COMMISSION - AUGUSTINE ARROYO N. FORK
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
AUGSTN ARROYO Q=300 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	4	0	1	0.028	0	0	0	4836.60	

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
3	0	-1	0	0	0	0	0	0	

LEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
PILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR
TAILS.

DONA ANA COUNTY FLOOD COMMISSION - AUGUSTINE ARROYO N. FORK
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
AUGSTN ARROYO Q=400 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	5	0	1	0.028	0	0	0	4836.65	

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
4	0	-1	0	0	0	0	0	0	

EQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
FILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR
AILS.

DONA ANA COUNTY FLOOD COMMISSION - AUGUSTINE ARROYO N. FORK
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DAT
AUGSTN ARROYO Q=500 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	6	0	1	0.028	0	0	0	4836.70	

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
5	0	-1	0	0	0	0	0	0	

LEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
PFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR
TAILS.

DONA ANA COUNTY FLOOD COMMISSION - AUGUSTINE ARROYO N. FORK
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
AUGSTN ARROYO Q=650 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	7	0	1	0.028	0	0	0	4836.75	

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
6	0	-1	0	0	0	0	0	0	

LEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
PFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR
TAILS.

1 DONA ANA COUNTY FLOOD COMMISSION - AUGUSTINE ARROYO N. FORK
2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
3 AUGSTN ARROYO Q=800 cfs

1

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	8	0	1	0.028	0	0	0	4836.80	

2

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
7	0	-1	0	0	0	0	0	0	

HLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
'OFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR
ETAILS.

DONA ANA COUNTY FLOOD COMMISSION - AUGUSTINE ARROYO N. FORK
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
AUGSTN ARROYO Q=1000 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	9	0	1	0.028	0	0	0	4836.85	

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
8	0	-1	0	0	0	0	0	0	

.EQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF
OFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR
FAILS.

THIS RUN EXECUTED 6DEC91 10:10:49

****
EC-2 WATER SURFACE PROFILES

ersion 4.6.0; February 1991
****

TE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

UGSTN ARROYO Q=100 cfs

MMARY PRINTOUT TABLE 150

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
6.000	.00	.00	.00	4836.00	100.00	4836.50	4836.66	4837.04	285.15	5.90	16.95	5.92
6.000	.00	.00	.00	4836.00	200.00	4836.75	4837.02	4837.62	280.16	7.45	26.84	11.95
6.000	.00	.00	.00	4836.00	300.00	4836.95	4837.30	4838.08	280.13	8.52	35.19	17.92
6.000	.00	.00	.00	4836.00	400.00	4837.11	4837.54	4838.47	280.44	9.36	42.74	23.89
6.000	.00	.00	.00	4836.00	500.00	4837.26	4837.76	4838.83	280.25	10.04	49.79	29.87
6.000	.00	.00	.00	4836.00	650.00	4837.46	4838.04	4839.30	280.32	10.90	59.66	38.82
6.000	.00	.00	.00	4836.00	800.00	4837.63	4838.31	4839.72	280.28	11.61	68.93	47.79
6.000	.00	.00	.00	4836.00	1000.00	4837.85	4838.66	4840.21	274.54	12.32	81.17	60.35
5.000	500.00	.00	.00	4822.00	100.00	4823.14	4823.38	4823.96	239.06	7.28	13.73	6.47
5.000	500.00	.00	.00	4822.00	200.00	4823.55	4823.92	4824.73	235.92	8.67	23.06	13.02
5.000	500.00	.00	.00	4822.00	300.00	4823.88	4824.40	4825.30	231.95	9.56	31.38	19.70
5.000	500.00	.00	.00	4822.00	400.00	4824.11	4824.75	4825.80	227.80	10.44	38.75	26.50
5.000	500.00	.00	.00	4822.00	500.00	4824.29	4824.99	4826.25	224.27	11.30	46.97	33.39
5.000	500.00	.00	.00	4822.00	650.00	4824.50	4825.26	4826.77	222.52	12.36	60.45	43.57
5.000	500.00	.00	.00	4822.00	800.00	4824.68	4825.46	4827.18	222.86	13.22	74.15	53.59
5.000	500.00	.00	.00	4822.00	1000.00	4824.87	4825.70	4827.65	228.02	14.26	91.41	66.22
4.000	520.00	.00	.00	4808.00	100.00	4808.40	4808.56	4808.91	336.19	5.71	17.51	5.45
4.000	520.00	.00	.00	4808.00	200.00	4808.61	4808.87	4809.46	347.72	7.42	26.94	10.73
4.000	520.00	.00	.00	4808.00	300.00	4808.76	4809.12	4809.92	356.76	8.63	34.75	15.88
4.000	520.00	.00	.00	4808.00	400.00	4808.89	4809.32	4810.32	364.58	9.60	41.65	20.95
4.000	520.00	.00	.00	4808.00	500.00	4809.00	4809.53	4810.69	371.17	10.42	47.96	25.95
4.000	520.00	.00	.00	4808.00	650.00	4809.17	4809.79	4811.19	374.04	11.40	57.01	33.61
4.000	520.00	.00	.00	4808.00	800.00	4809.31	4810.18	4811.62	373.70	12.20	65.57	41.38
4.000	520.00	.00	.00	4808.00	1000.00	4809.50	4810.45	4812.14	367.27	13.03	76.72	52.18

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
3.000	500.00	.00	.00	4794.00	100.00	4795.35	4795.51	4795.98	198.54	6.38	15.68	7.10
3.000	500.00	.00	.00	4794.00	200.00	4796.08	4796.13	4796.41	191.33	4.56	43.84	14.46
3.000	500.00	.00	.00	4794.00	300.00	4796.21	4796.33	4796.63	191.47	5.20	57.65	21.68
3.000	500.00	.00	.00	4794.00	400.00	4796.31	4796.41	4796.82	191.97	5.70	70.14	28.87
3.000	500.00	.00	.00	4794.00	500.00	4796.41	4796.57	4797.00	192.48	6.12	81.76	36.04
3.000	500.00	.00	.00	4794.00	650.00	4796.53	4796.74	4797.22	196.87	6.67	97.38	46.33
3.000	500.00	.00	.00	4794.00	800.00	4796.63	4796.84	4797.43	201.98	7.16	111.66	56.29
3.000	500.00	.00	.00	4794.00	1000.00	4796.74	4797.00	4797.68	211.81	7.78	128.54	68.71
2.000	480.00	.00	.00	4782.00	100.00	4783.24	4783.52	4784.10	295.60	7.41	13.50	5.82
2.000	480.00	.00	.00	4782.00	200.00	4783.62	4783.99	4784.80	288.61	8.73	22.91	11.77
2.000	480.00	.00	.00	4782.00	300.00	4783.90	4784.34	4785.30	276.25	9.50	31.57	18.05
2.000	480.00	.00	.00	4782.00	400.00	4784.13	4784.65	4785.70	266.64	10.08	39.69	24.50
2.000	480.00	.00	.00	4782.00	500.00	4784.33	4784.87	4786.06	258.60	10.53	47.47	31.09
2.000	480.00	.00	.00	4782.00	650.00	4784.60	4785.20	4786.49	245.43	11.03	58.93	41.49
2.000	480.00	.00	.00	4782.00	800.00	4784.83	4785.48	4786.85	233.78	11.41	70.13	52.32
2.000	480.00	.00	.00	4782.00	1000.00	4785.13	4785.81	4787.26	217.31	11.74	85.21	67.84
1.000	520.00	.00	.00	4770.00	100.00	4770.68	4770.78	4771.08	207.63	5.05	19.80	6.94
1.000	520.00	.00	.00	4770.00	200.00	4770.92	4771.10	4771.52	220.02	6.21	32.21	13.48
1.000	520.00	.00	.00	4770.00	300.00	4771.09	4771.34	4771.87	234.89	7.08	42.40	19.57
1.000	520.00	.00	.00	4770.00	400.00	4771.24	4771.54	4772.18	246.63	7.76	51.52	25.47
1.000	520.00	.00	.00	4770.00	500.00	4771.36	4771.97	4772.45	257.42	8.36	59.84	31.16
1.000	520.00	.00	.00	4770.00	650.00	4771.52	4772.14	4772.81	273.60	9.14	71.08	39.30
1.000	520.00	.00	.00	4770.00	800.00	4771.63	4772.25	4773.13	287.93	9.83	81.39	47.15
1.000	520.00	.00	.00	4770.00	1000.00	4771.78	4772.38	4773.54	306.28	10.65	93.92	57.14

AUGSTN ARROYO Q=100 cfs

JM PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
6.000	100.00	4836.50	.00	.00	.00	37.53	.00
6.000	200.00	4836.75	.25	.00	.25	41.29	.00
6.000	300.00	4836.95	.20	.00	.35	44.22	.00
6.000	400.00	4837.11	.17	.00	.46	46.71	.00
6.000	500.00	4837.26	.15	.00	.56	48.93	.00
6.000	650.00	4837.46	.20	.00	.71	51.86	.00
6.000	800.00	4837.63	.17	.00	.83	54.48	.00
6.000	1000.00	4837.85	.22	.00	1.00	57.75	.00
5.000	100.00	4823.14	.00	-13.37	.00	19.19	500.00
5.000	200.00	4823.56	.43	-13.19	.00	24.53	500.00
5.000	300.00	4823.88	.32	-13.07	.00	28.45	500.00
5.000	400.00	4824.11	.23	-13.00	.00	38.80	500.00
5.000	500.00	4824.29	.18	-12.97	.00	53.25	500.00
5.000	650.00	4824.50	.21	-12.95	.00	70.81	500.00
5.000	800.00	4824.68	.18	-12.95	.00	85.02	500.00
5.000	1000.00	4824.87	.19	-12.98	.00	100.10	500.00
4.000	100.00	4808.40	.00	-14.73	.00	46.10	520.00
4.000	200.00	4808.61	.20	-14.96	.00	49.07	520.00
4.000	300.00	4808.76	.15	-15.12	.00	51.40	520.00
4.000	400.00	4808.89	.13	-15.22	.00	53.38	520.00
4.000	500.00	4809.00	.11	-15.29	.00	55.13	520.00
4.000	650.00	4809.17	.16	-15.33	.00	57.53	520.00
4.000	800.00	4809.31	.14	-15.37	.00	59.72	520.00
4.000	1000.00	4809.50	.19	-15.37	.00	62.46	520.00
3.000	100.00	4795.35	.00	-13.06	.00	23.43	500.00
3.000	200.00	4796.08	.74	-12.52	.00	105.80	500.00
3.000	300.00	4796.21	.13	-12.55	.00	114.27	500.00
3.000	400.00	4795.31	.11	-12.58	.00	121.42	500.00
3.000	500.00	4796.41	.10	-12.59	.00	127.72	500.00
3.000	650.00	4796.53	.12	-12.64	.00	135.73	500.00
3.000	800.00	4796.63	.10	-12.68	.00	142.65	500.00
3.000	1000.00	4796.74	.11	-12.76	.00	150.43	500.00
2.000	100.00	4783.24	.00	-12.10	.00	21.74	480.00
2.000	200.00	4783.62	.37	-12.46	.00	28.32	480.00
2.000	300.00	4783.90	.28	-12.31	.00	33.24	480.00
2.000	400.00	4784.13	.23	-12.19	.00	37.27	480.00
2.000	500.00	4784.33	.20	-12.08	.00	40.76	480.00
2.000	650.00	4784.60	.27	-11.93	.00	45.42	480.00
2.000	800.00	4784.83	.23	-11.80	.00	49.54	480.00
2.000	1000.00	4785.13	.30	-11.62	.00	54.61	480.00

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
1.000	100.00	4770.68	.00	-12.56	.00	43.68	520.00
1.000	200.00	4770.92	.24	-12.69	.00	54.43	520.00
1.000	300.00	4771.09	.17	-12.81	.00	61.88	520.00
1.000	400.00	4771.24	.15	-12.89	.00	67.86	520.00
1.000	500.00	4771.36	.12	-12.97	.00	72.88	520.00
1.000	650.00	4771.52	.15	-13.08	.00	79.17	520.00
1.000	800.00	4771.63	.11	-13.20	.00	84.52	520.00
1.000	1000.00	4771.78	.15	-13.35	.00	90.60	520.00

THIS RUN EXECUTED 6DEC91 10:18:52

-** ************************
HEC-2 WATER SURFACE PROFILES

Version 4.6.0; February 1991
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DONA ANA COUNTY FLOOD COMMISSION - BAYLOR ARROYO
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
BAYLOR ARROYO Q=250 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	2	0	1	0.040	0	1	0	4857	

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
1	0	-1	0	0	0	0	0	0	

LPRNT	NUMSEC	********REQUESTED SECTION NUMBERS********
-10	-10	

IPROF	ICOPY	SUBDIV	STRTDS	RMILE
0	1			

0.03 0.03 0.025 0.1 0.3

RANGE OF FLOWS FOR SEDIMENT TRANSPORT CALIBRATION

8	250	500	750	1000	2000	3000	4000	5000	
7	9	480	680	280	240	260	0	0	
10	0	0	0	0	0	0	0	0	
4862	0	4860	170	4858	340	4858	480	4856	620
4858	645	4856	680	4860	770	4862	1000		
6	8	450	675	250	280	265	0	0	
10	0	0	0	0	0	0	0	0	
4850	0	4844	450	4842	545	4842	565	4844	675
4848	715	4848	800	4850	1010				
5	9	280	510	270	230	250	0	0	
10	0	0	0	0	0	0	0	0	
4832	0	4830	20	4830	280	4828	400	4826	410
4826	420	4828	430	4830	510	4832	850		

4	12	240	490	355	345	350	0	0	
10	0	0	0	0	0	0	0	0	
4824	0	4818	55	4816	80	4815	240	4814	400
4814	480	4815	490	4816	500	4818	560	4820	650
4822	940	4824	1100						
3	11	85	380	280	280	280	0	0	
10	0	0	0	0	0	0	0	0	
4816	0	4808	75	4806	85	4804	100	4804	270
4806	380	4808	480	4810	650	4812	900	4814	1080
4816	1270								
2	9	240	500	200	210	205	0	0	
10	0	0	0	0	0	0	0	0	
4804	0	4798	90	4794	400	4796	500	4798	640
4800	750	4802	1130	4804	1210				
1	8	100	300	0	0	0	0	0	
10	0	0	0	0	0	0	0	0	
4794	0	4790	75	4788	100	4786	230	4786	280
4788	300	4790	510	4794	1300				

DONA ANA COUNTY FLOOD COMMISSION - BAYLOR ARROYO
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
BAYLOR ARROYO Q=500 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	3	0	1	0.040	0	1	0	4857.1	

LTIPLE PROFILE RUN WITH INTERPOLATED CROSS SECTIONS

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
2	0	-1	0	0	0	0	0	0	

DONA ANA COUNTY FLOOD COMMISSION - BAYLOR ARROYO
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
BAYLOR ARROYO Q=750 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	4	0	1	0.040	0	1	0	4857.20	

LTIPLE PROFILE RUN WITH INTERPOLATED CROSS SECTIONS

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
3	0	-1	0	0	0	0	0	0	

DONA ANA COUNTY FLOOD COMMISSION - BAYLOR ARROYO
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
BAYLR ARROYO Q=1000 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	5	0	1	0.040	0	1	0	4857.40	

"LTIPLE PROFILE RUN WITH INTERPOLATED CROSS SECTIONS

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
4	0	-1	0	0	0	0	0	0	

DONA ANA COUNTY FLOOD COMMISSION - BAYLOR ARROYO
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
BAYLR ARROYO Q=2000 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	6	0	1	0.040	0	1	0	4857.60	

TIPLE PROFILE RUN WITH INTERPOLATED CROSS SECTIONS

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
5	0	-1	0	0	0	0	0	0	

DONA ANA COUNTY FLOOD COMMISSION - BAYLOR ARROYO
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
BAYLR ARROYO Q=3000 cfs

ICHECK	INC	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	7	0	1	0.040	0	1	0	4857.80	

ULTIPLE PROFILE RUN WITH INTERPOLATED CROSS SECTIONS

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
6	0	-1	0	0	0	0	0	0	

DONA ANA COUNTY FLOOD COMMISSION - BAYLOR ARROYO
SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
BAYLR ARROYO Q=4000 cfs

ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	8	0	1	0.040	0	1	0	4858.00	

LTIPLE PROFILE RUN WITH INTERPOLATED CROSS SECTIONS

NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
7	0	-1	0	0	0	0	0	0	

1 DONA ANA COUNTY FLOOD COMMISSION - BAYLOR ARROYO
2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
3 BAYLR ARROYO Q=5000 cfs

1 ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
0	9	0	1	0.040	0	1	0	4858.20	

ULTIPLE PROFILE RUN WITH INTERPOLATED CROSS SECTIONS

2 NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
8	0	-1	0	0	0	0	0	0	

THIS RUN EXECUTED 6DEC91 10:19:16

****
EC-2 WATER SURFACE PROFILES

ersior 4.6.0; February 1991
****

TE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

AYLOR ARROYO Q=250 cfs

MARY PRINTOUT TABLE 150

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
7.000	.00	.00	.00	4856.00	250.00	4856.67	4856.90	4857.40	399.35	6.83	36.59	12.51
7.000	.00	.00	.00	4856.00	500.00	4856.93	4857.27	4857.97	398.88	8.20	61.00	25.03
7.000	.00	.00	.00	4856.00	750.00	4857.12	4857.52	4858.40	399.31	9.11	82.35	37.53
7.000	.00	.00	.00	4856.00	1000.00	4857.27	4857.73	4858.75	395.11	9.77	102.38	50.31
7.000	.00	.00	.00	4856.00	2000.00	4857.71	4858.42	4859.83	398.21	11.69	171.10	100.22
7.000	.00	.00	.00	4856.00	3000.00	4858.02	4858.77	4860.67	402.33	13.07	232.33	149.38
7.000	.00	.00	.00	4856.00	4000.00	4858.22	4859.06	4861.36	396.42	14.42	303.21	200.90
7.000	.00	.00	.00	4856.00	5000.00	4858.38	4859.32	4861.94	398.74	15.59	363.73	250.40
6.000	260.00	.00	.00	4842.00	250.00	4842.60	4842.90	4843.67	726.47	8.28	30.18	9.26
6.000	260.00	.00	.00	4842.00	500.00	4842.82	4843.24	4844.33	715.10	9.85	50.74	18.70
6.000	260.00	.00	.00	4842.00	750.00	4842.98	4843.49	4844.82	705.99	10.88	68.94	28.23
6.000	260.00	.00	.00	4842.00	1000.00	4843.11	4843.70	4845.23	706.66	11.71	85.39	37.62
6.000	260.00	.00	.00	4842.00	2000.00	4843.50	4844.27	4846.45	681.67	13.77	145.23	76.60
6.000	260.00	.00	.00	4842.00	3000.00	4843.78	4844.71	4847.33	664.73	15.11	198.53	116.36
6.000	260.00	.00	.00	4842.00	4000.00	4844.01	4845.10	4848.12	665.63	16.27	245.88	155.04
6.000	260.00	.00	.00	4842.00	5000.00	4844.23	4845.42	4848.60	550.03	16.79	299.98	213.29
5.000	265.00	.00	.00	4826.00	250.00	4827.31	4827.90	4829.36	412.02	11.49	21.75	12.32
5.000	265.00	.00	.00	4826.00	500.00	4827.83	4828.77	4830.98	437.75	14.23	35.13	23.90
5.000	265.00	.00	.00	4826.00	750.00	4828.51	4829.10	4830.39	432.40	11.00	68.21	36.07
5.000	265.00	.00	.00	4826.00	1000.00	4828.73	4829.35	4830.68	436.24	11.20	89.25	47.88
5.000	265.00	.00	.00	4826.00	2000.00	4829.26	4830.17	4831.76	451.77	12.68	157.69	94.19
5.000	265.00	.00	.00	4826.00	3000.00	4829.60	4830.52	4832.60	461.95	13.89	215.93	139.58
5.000	265.00	.00	.00	4826.00	4000.00	4829.86	4830.74	4833.27	465.50	14.83	269.70	185.40
5.000	265.00	.00	.00	4826.00	5000.00	4830.02	4830.97	4834.23	531.61	15.47	307.44	216.85

SECND	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
000	250.00	.00	.00	4814.00	250.00	4814.43	4814.55	4814.82	318.50	5.02	49.77	14.01
.000	250.00	.00	.00	4814.00	500.00	4814.61	4814.80	4815.20	324.32	6.18	80.85	27.76
4.000	250.00	.00	.00	4814.00	750.00	4814.60	4814.99	4816.01	784.19	9.52	78.80	26.78
4.000	250.00	.00	.00	4814.00	1000.00	4814.71	4815.14	4816.35	774.79	10.28	97.30	35.93
4.000	250.00	.00	.00	4814.00	2000.00	4814.98	4815.62	4817.34	757.01	12.32	162.32	72.69
4.000	250.00	.00	.00	4814.00	3000.00	4815.19	4816.04	4818.33	722.07	14.23	213.08	111.64
4.000	250.00	.00	.00	4814.00	4000.00	4815.35	4816.30	4819.16	694.26	15.73	261.89	151.81
4.000	250.00	.00	.00	4814.00	5000.00	4815.52	4816.55	4819.73	633.43	16.65	316.01	198.66
3.000	350.00	.00	.00	4804.00	250.00	4804.32	4804.40	4804.62	266.46	4.36	57.29	15.32
3.000	350.00	.00	.00	4804.00	500.00	4804.49	4804.62	4804.97	263.20	5.62	88.99	30.82
3.000	350.00	.00	.00	4804.00	750.00	4804.70	4804.80	4805.17	158.49	5.52	135.82	59.57
3.000	350.00	.00	.00	4804.00	1000.00	4804.60	4804.96	4805.81	493.28	8.82	113.37	45.02
3.000	350.00	.00	.00	4804.00	2000.00	4804.95	4805.48	4806.70	416.94	10.64	187.96	97.95
3.000	350.00	.00	.00	4804.00	3000.00	4805.23	4805.88	4807.37	371.31	11.73	255.77	155.69
3.000	350.00	.00	.00	4804.00	4000.00	4805.56	4806.21	4807.71	284.38	11.77	339.96	237.20
3.000	350.00	.00	.00	4804.00	5000.00	4805.75	4806.51	4808.25	288.88	12.69	393.89	294.18
2.000	280.00	.00	.00	4794.00	250.00	4794.77	4794.99	4795.42	412.02	6.44	38.81	12.32
2.000	280.00	.00	.00	4794.00	500.00	4795.01	4795.30	4795.91	403.99	7.60	65.76	24.88
2.000	280.00	.00	.00	4794.00	750.00	4795.37	4795.53	4795.97	183.42	6.26	119.84	55.38
2.000	280.00	.00	.00	4794.00	1000.00	4795.45	4795.72	4796.31	242.64	7.47	133.89	64.20
2.000	280.00	.00	.00	4794.00	2000.00	4795.83	4796.26	4797.18	276.06	9.32	214.54	120.37
2.000	280.00	.00	.00	4794.00	3000.00	4796.09	4796.68	4797.90	303.27	10.78	278.64	172.27
2.000	280.00	.00	.00	4794.00	4000.00	4796.24	4797.00	4798.69	365.59	12.57	319.95	209.20
2.000	280.00	.00	.00	4794.00	5000.00	4796.43	4797.28	4799.20	361.77	13.39	378.19	262.88
1.000	205.00	.00	.00	4786.00	250.00	4786.55	4786.75	4787.22	388.04	6.57	38.07	12.69
1.000	205.00	.00	.00	4786.00	500.00	4786.78	4787.10	4787.79	387.10	8.05	62.11	25.41
1.000	205.00	.00	.00	4786.00	750.00	4787.02	4787.36	4788.11	316.02	8.39	89.34	42.19
1.000	205.00	.00	.00	4786.00	1000.00	4787.13	4787.59	4788.55	362.98	9.56	104.63	52.49
1.000	205.00	.00	.00	4786.00	2000.00	4787.56	4788.22	4789.74	390.42	11.84	168.94	101.22
1.000	205.00	.00	.00	4786.00	3000.00	4787.87	4788.71	4790.65	405.62	13.36	224.47	148.96
1.000	205.00	.00	.00	4786.00	4000.00	4788.17	4789.14	4791.26	353.21	14.09	285.25	212.64
1.000	205.00	.00	.00	4786.00	5000.00	4788.38	4789.50	4791.95	338.60	15.19	336.25	271.72

AYLOR ARROYO Q=250 cfs

MMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
7.000	250.00	4856.67	.00	.00	-.33	83.83	.00
7.000	500.00	4856.93	.26	.00	-.17	106.30	.00
7.000	750.00	4857.12	.19	.00	-.08	122.63	.00
7.000	1000.00	4857.27	.15	.00	-.13	136.17	.00
7.000	2000.00	4857.71	.44	.00	.11	174.84	.00
7.000	3000.00	4858.02	.31	.00	.22	342.79	.00
7.000	4000.00	4858.22	.20	.00	.22	368.69	.00
7.000	5000.00	4858.38	.16	.00	.18	389.45	.00
6.000	250.00	4842.60	.00	-14.07	.00	81.16	260.00
6.000	500.00	4842.82	.22	-14.11	.00	103.93	260.00
6.000	750.00	4842.98	.16	-14.13	.00	120.55	260.00
6.000	1000.00	4843.11	.12	-14.17	.00	133.81	260.00
6.000	2000.00	4843.50	.40	-14.21	.00	173.70	260.00
6.000	3000.00	4843.78	.28	-14.24	.00	202.73	260.00
6.000	4000.00	4844.01	.22	-14.21	.00	225.37	260.00
6.000	5000.00	4844.23	.23	-7.04	.00	247.13	260.00
5.000	250.00	4827.31	.00	-15.30	.00	23.13	265.00
5.000	500.00	4827.83	.52	-7.27	.00	28.33	265.00
5.000	750.00	4828.51	.68	-14.47	.00	80.88	265.00
5.000	1000.00	4828.73	.22	-14.38	.00	103.68	265.00
5.000	2000.00	4829.26	.53	-14.24	.00	156.32	265.00
5.000	3000.00	4829.60	.34	-14.19	.00	189.95	265.00
5.000	4000.00	4829.85	.25	-14.15	.00	216.43	265.00
5.000	5000.00	4830.02	.16	-14.21	.00	492.72	265.00
4.000	250.00	4814.43	.00	-5.96	.00	152.71	250.00
4.000	500.00	4814.61	.18	-5.95	.00	184.09	250.00
4.000	750.00	4814.60	-.01	-13.91	.00	182.18	250.00
4.000	1000.00	4814.71	.10	-14.02	.00	198.70	250.00
4.000	2000.00	4814.98	.28	-14.26	.00	248.17	250.00
4.000	3000.00	4815.15	.21	-14.42	.00	280.80	250.00
4.000	4000.00	4815.35	.17	-14.50	.00	308.94	250.00
4.000	5000.00	4815.52	.17	-14.50	.00	337.41	250.00
3.000	250.00	4804.32	.00	-10.11	.00	199.96	350.00
3.000	500.00	4804.48	.16	-10.13	.00	200.06	350.00
3.000	750.00	4804.70	.21	-9.91	.00	214.19	350.00
3.000	1000.00	4804.60	-.10	-5.30	.00	207.54	350.00
3.000	2000.00	4804.95	.35	-5.31	.00	228.90	350.00
3.000	3000.00	4805.23	.29	-5.31	.00	246.72	350.00
3.000	4000.00	4805.56	.33	-3.33	.00	267.20	350.00
3.000	5000.00	4805.75	.19	-3.35	.00	279.53	350.00

SECND	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
.000	250.00	4794.77	.00	-9.55	.00	99.48	280.00
.000	500.00	4795.01	.24	-9.48	.00	129.49	280.00
2.000	750.00	4795.37	.36	-4.35	.00	174.81	280.00
2.000	1000.00	4795.45	.08	-9.15	.00	184.78	280.00
2.000	2000.00	4795.83	.38	-9.11	.00	233.90	280.00
2.000	3000.00	4796.09	.26	-9.14	.00	268.32	280.00
2.000	4000.00	4796.24	.15	-9.32	.00	290.15	280.00
2.000	5000.00	4796.43	.19	-9.32	.00	318.38	280.00
1.000	250.00	4786.55	.00	-8.22	.00	90.61	205.00
1.000	500.00	4786.78	.24	-8.23	.00	108.70	205.00
1.000	750.00	4787.02	.23	-3.88	.00	126.10	205.00
1.000	1000.00	4787.13	.12	-3.97	.00	134.89	205.00
1.000	2000.00	4787.56	.43	-4.00	.00	166.86	205.00
1.000	3000.00	4787.87	.31	-8.22	.00	190.19	205.00
1.000	4000.00	4788.17	.30	-8.06	.00	219.74	205.00
1.000	5000.00	4788.38	.21	-8.04	.00	245.50	205.00

SUMMARY OF ERRORS AND SPECIAL NOTES

:UTION SECNO= 6.000 PROFILE= 8 INTERPOLATED X-SECTIONS USED

:UTION SECNO= 5.000 PROFILE= 2 INTERPOLATED X-SECTIONS USED

:UTION SECNO= 4.000 PROFILE= 1 INTERPOLATED X-SECTIONS USED
:UTION SECNO= 4.000 PROFILE= 2 INTERPOLATED X-SECTIONS USED

:RNING SECNO= 3.000 PROFILE= 3 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
:UTION SECNO= 3.000 PROFILE= 4 INTERPOLATED X-SECTIONS USED
:TION SECNO= 3.000 PROFILE= 5 INTERPOLATED X-SECTIONS USED
:UTION SECNO= 3.000 PROFILE= 6 INTERPOLATED X-SECTIONS USED
:UTION SECNO= 3.000 PROFILE= 7 INTERPOLATED X-SECTIONS USED
:UTION SECNO= 3.000 PROFILE= 8 INTERPOLATED X-SECTIONS USED

:TION SECNO= 2.000 PROFILE= 3 INTERPOLATED X-SECTIONS USED

:TION SECNO= 1.000 PROFILE= 3 INTERPOLATED X-SECTIONS USED
:TION SECNO= 1.000 PROFILE= 4 INTERPOLATED X-SECTIONS USED
:UTION SECNO= 1.000 PROFILE= 5 INTERPOLATED X-SECTIONS USED

:mal program termination

THIS RUN EXECUTED 6DEC91 10:19:52

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.0; February 1991
****

T1 DONA ANA COUNTY FLOOD COMMISSION - BLAIR CANYON ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 BLAIR CANYON Q=250 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	2	0	1	0.02	0	0	0	4820.5	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	1	0	-1	0	0	0	0	0	0	

J'	NT	NUMSEC	********REQUESTED SECTION NUMBERS********
	-10	-10	

J6	IHLEQ	ICOPY	SUBDIV	STRTDS	RMILE
	0	1			

NC	0.03	0.03	0.025	0.1	0.3

RANGE OF FLOWS FOR SEDIMENT TRANSPORT CALIBRATION

QT	8	250	500	750	1000	2000	3000	4000	5000
X1	7	7	50	162	500	500	500		
GR	4833	0	4823	30	4823	50	4820	56	4820	156
GR	4823	162	4826	440						
X1	6	7	50	162	530	470	500		
GR	4821	0	4811	30	4811	50	4808	56	4808	156
GR	4811	162	4814	520						
X1	5	7	50	162	500	500	500		
GR	4808	0	4796	30	4798	50	4795	56	4795	156
GR	4798	162	4800	515						
X1	4	7	50	162	500	480	490		
GR	4797	0	4787	30	4787	50	4784	56	4784	156
GR	4787	162	4789	385						

X1	3	7	50	162	480	530	505			
GR	4785	0	4775	30	4775	50	4772	56	4772	156
GR	4775	162	4776	255						
X1	2	7	50	162	510	490	500			
GR	4773	0	4763	30	4763	50	4760	56	4760	156
GR	4763	162	4766	390						
X1	1	7	50	162						
GR	4763	0	4753	30	4753	50	4750	56	4750	156
GR	4753	162	4754	370						

T1 DONA ANA COUNTY FLOOD COMMISSION - BLAIR CANYON ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 BLAIR CANYON Q=500 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	3	0	1	0.020	0	0	0	4820.7	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	2	0	-1	0	0	0	0	0	0	

T1 DONA ANA COUNTY FLOOD COMMISSION - BLAIR CANYON ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 BLAIR CANYON Q=750 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	4	0	1	0.020	0	0	0	4820.9	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	3	0	-1	0	0	0	0	0	0	

T1 DONA ANA COUNTY FLOOD COMMISSION - BLAIR CANYON ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 BLAIR CANYON Q=1000 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	5	0	1	0.020	0	0	0	4821.1	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	4	0	-1	0	0	0	0	0	0	

T1 DONA ANA COUNTY FLOOD COMMISSION - BLAIR CANYON ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 BLAIR CANYON Q=2000 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	6	0	1	0.020	0	0	0	4821.3	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	5	0	-1	0	0	0	0	0	0	

T1 DONA ANA COUNTY FLOOD COMMISSION - BLAIR CANYON ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 BLAIR CANYON Q=3000 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	7	0	1	0.020	0	0	0	4821.5	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	6	0	-1	0	0	0	0	0	0	

T1 DONA ANA COUNTY FLOOD COMMISSION - BLAIR CANYON ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 BLAIR CANYON Q=4000 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	8	0	1	0.020	0	0	0	4821.7	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	7	0	-1	0	0	0	0	0	0	

T1 DONA ANA COUNTY FLOOD COMMISSION - BLAIR CANYON ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 BLAIR CANYON Q=5000 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	9	0	1	0.020	0	0	0	4821.9	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	8	0	-1	0	0	0	0	0	0	

THIS RUN EXECUTED 6DEC91 10:20:08

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HEC-2 WATER SURFACE PROFILES

Version 4.6.0; February 1991
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

BLAIR CANYON Q=250 cfs

SUMMARY PRINTOUT TABLE 150

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
7.000	.00	.00	.00	4820.00	250.00	4820.48	4820.58	4820.89	198.84	5.12	48.81	17.73
7.000	.00	.00	.00	4820.00	500.00	4820.73	4820.92	4821.44	200.03	6.74	74.16	35.35
7.000	.00	.00	.00	4820.00	750.00	4820.93	4821.18	4821.91	203.35	7.94	94.44	52.59
7.000	.00	.00	.00	4820.00	1000.00	4821.10	4821.44	4822.32	201.49	8.86	112.89	70.45
7.000	.00	.00	.00	4820.00	2000.00	4821.68	4822.28	4823.75	199.81	11.55	173.19	141.49
7.000	.00	.00	.00	4820.00	3000.00	4822.13	4822.98	4824.96	199.76	13.48	222.59	212.26
7.000	.00	.00	.00	4820.00	4000.00	4822.53	4823.80	4826.04	199.84	15.03	266.21	282.95
7.000	.00	.00	.00	4820.00	5000.00	4822.89	4824.40	4827.04	199.83	16.33	306.10	353.70
6.000	500.00	.00	.00	4808.00	250.00	4808.42	4808.58	4808.94	292.35	5.76	43.44	14.62
6.000	500.00	.00	.00	4808.00	500.00	4808.65	4808.91	4809.53	287.42	7.53	66.44	29.49
6.000	500.00	.00	.00	4808.00	750.00	4808.85	4809.18	4810.03	279.79	8.75	85.70	44.84
6.000	500.00	.00	.00	4808.00	1000.00	4809.00	4809.44	4810.49	280.41	9.80	102.05	59.72
6.000	500.00	.00	.00	4808.00	2000.00	4809.52	4810.28	4812.05	275.50	12.75	156.88	120.49
6.000	500.00	.00	.00	4808.00	3000.00	4809.96	4810.96	4813.35	269.82	14.79	202.78	182.63
6.000	500.00	.00	.00	4808.00	4000.00	4810.33	4811.85	4814.51	265.49	16.42	243.65	245.49
6.000	500.00	.00	.00	4808.00	5000.00	4810.67	4812.45	4815.58	261.72	17.77	281.30	309.07
5.000	500.00	.00	.00	4795.00	250.00	4795.46	4795.57	4795.91	233.06	5.37	46.52	16.38
5.000	500.00	.00	.00	4795.00	500.00	4795.70	4795.91	4796.48	236.93	7.10	70.45	32.48
5.000	500.00	.00	.00	4795.00	750.00	4795.87	4796.19	4796.97	243.63	8.39	89.39	48.05
5.000	500.00	.00	.00	4795.00	1000.00	4796.04	4796.44	4797.41	243.27	9.38	106.57	64.11
5.000	500.00	.00	.00	4795.00	2000.00	4796.58	4797.28	4798.94	247.88	12.34	162.07	127.03
5.000	500.00	.00	.00	4795.00	3000.00	4796.99	4797.98	4800.26	252.90	14.50	206.89	188.65
5.000	500.00	.00	.00	4795.00	4000.00	4797.35	4798.94	4801.45	256.18	16.24	246.38	249.91
5.000	500.00	.00	.00	4795.00	5000.00	4797.68	4799.52	4802.55	258.84	17.71	282.28	310.78

SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	E6	10*KS	VCH	AREA	.01K
4.000	500.00	.00	.00	4784.00	250.00	4784.48	4784.58	4784.90	207.81	5.19	48.16	17.34
4.000	500.00	.00	.00	4784.00	500.00	4784.73	4784.91	4785.44	205.48	6.80	73.56	34.88
4.000	500.00	.00	.00	4784.00	750.00	4784.94	4785.19	4785.91	200.51	7.91	94.85	52.97
4.000	500.00	.00	.00	4784.00	1000.00	4785.10	4785.44	4786.32	201.49	8.86	112.89	70.45
4.000	500.00	.00	.00	4784.00	2000.00	4785.67	4786.28	4787.75	200.20	11.55	173.09	141.35
4.000	500.00	.00	.00	4784.00	3000.00	4786.14	4786.98	4788.95	198.69	13.46	222.96	212.83
4.000	500.00	.00	.00	4784.00	4000.00	4786.54	4787.82	4790.03	198.55	15.00	266.75	283.87
4.000	500.00	.00	.00	4784.00	5000.00	4786.90	4788.44	4791.03	198.93	16.31	306.54	354.50
3.000	490.00	.00	.00	4772.00	250.00	4772.43	4772.58	4772.95	290.15	5.74	43.54	14.68
3.000	490.00	.00	.00	4772.00	500.00	4772.65	4772.91	4773.54	291.02	7.55	66.19	29.31
3.000	490.00	.00	.00	4772.00	750.00	4772.83	4773.19	4774.06	295.50	8.90	84.28	43.63
3.000	490.00	.00	.00	4772.00	1000.00	4772.99	4773.44	4774.51	291.67	9.92	100.83	58.55
3.000	490.00	.00	.00	4772.00	2000.00	4773.51	4774.28	4776.08	284.87	12.88	155.28	118.50
3.000	490.00	.00	.00	4772.00	3000.00	4773.94	4774.97	4777.41	280.02	14.96	200.47	179.28
3.000	490.00	.00	.00	4772.00	4000.00	4774.30	4775.79	4778.58	275.05	16.60	240.99	241.19
3.000	490.00	.00	.00	4772.00	5000.00	4774.65	4776.39	4779.65	270.26	17.95	278.49	304.15
2.000	505.00	.00	.00	4760.00	250.00	4760.48	4760.58	4760.89	198.84	5.12	48.81	17.73
2.000	505.00	.00	.00	4760.00	500.00	4760.73	4760.91	4761.43	199.14	6.73	74.26	35.43
2.000	505.00	.00	.00	4760.00	750.00	4760.94	4761.19	4761.90	197.73	7.87	95.25	53.34
2.000	505.00	.00	.00	4760.00	1000.00	4761.11	4761.44	4762.32	200.30	8.84	113.09	70.66
2.000	505.00	.00	.00	4760.00	2000.00	4761.66	4762.28	4763.77	206.59	11.67	171.42	139.15
2.000	505.00	.00	.00	4760.00	3000.00	4762.11	4762.97	4765.03	211.20	13.71	218.78	206.43
2.000	505.00	.00	.00	4760.00	4000.00	4762.49	4763.77	4766.16	215.18	15.38	260.14	272.69
2.000	505.00	.00	.00	4760.00	5000.00	4762.82	4764.37	4767.21	219.10	16.81	297.40	337.79
1.000	500.00	.00	.00	4750.00	250.00	4750.49	4750.57	4750.90	200.87	5.14	48.66	17.64
1.000	500.00	.00	.00	4750.00	500.00	4750.73	4750.91	4751.44	200.48	6.75	74.11	35.31
1.000	500.00	.00	.00	4750.00	750.00	4750.92	4751.19	4751.90	202.28	7.93	94.60	52.73
1.000	500.00	.00	.00	4750.00	1000.00	4751.11	4751.44	4752.32	199.71	8.83	113.19	70.76
1.000	500.00	.00	.00	4750.00	2000.00	4751.69	4752.28	4753.73	194.64	11.45	174.60	143.36
1.000	500.00	.00	.00	4750.00	3000.00	4752.16	4752.96	4754.91	191.99	13.31	225.35	216.51
1.000	500.00	.00	.00	4750.00	4000.00	4752.57	4754.08	4755.97	190.20	14.80	270.35	290.04
1.000	500.00	.00	.00	4750.00	5000.00	4752.95	4754.46	4756.94	188.69	16.04	311.66	364.00

BLAIR CANYON Q=250 cfs

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
7.000	250.00	4820.48	.00	.00	-.02	101.93	.00
7.000	500.00	4820.73	.25	.00	.03	102.92	.00
7.000	750.00	4820.93	.20	.00	.03	103.71	.00
7.000	1000.00	4821.10	.18	.00	.00	104.42	.00
7.000	2000.00	4821.68	.57	.00	.38	106.70	.00
7.000	3000.00	4822.13	.46	.00	.63	108.54	.00
7.000	4000.00	4822.53	.40	.00	.83	110.13	.00
7.000	5000.00	4822.89	.36	.00	.99	111.57	.00
6.000	250.00	4808.42	.00	-12.06	.00	101.72	500.00
6.000	500.00	4808.65	.23	-12.08	.00	102.62	500.00
6.000	750.00	4808.85	.20	-12.08	.00	103.37	500.00
6.000	1000.00	4809.00	.15	-12.10	.00	104.00	500.00
6.000	2000.00	4809.52	.52	-12.15	.00	106.09	500.00
6.000	3000.00	4809.96	.43	-12.18	.00	107.81	500.00
6.000	4000.00	4810.33	.37	-12.21	.00	109.31	500.00
6.000	5000.00	4810.67	.34	-12.22	.00	110.68	500.00
5.000	250.00	4795.46	.00	-12.96	.00	101.84	500.00
5.000	500.00	4795.70	.24	-12.95	.00	102.78	500.00
5.000	750.00	4795.87	.17	-12.97	.00	103.51	500.00
5.000	1000.00	4796.04	.17	-12.96	.00	104.18	500.00
5.000	2000.00	4796.58	.53	-12.95	.00	106.29	500.00
5.000	3000.00	4796.99	.42	-12.96	.00	107.96	500.00
5.000	4000.00	4797.35	.36	-12.97	.00	109.41	500.00
5.000	5000.00	4797.68	.33	-12.99	.00	110.72	500.00
4.000	250.00	4784.48	.00	-10.97	.00	101.91	500.00
4.000	500.00	4784.73	.24	-10.97	.00	102.90	500.00
4.000	750.00	4784.94	.21	-10.94	.00	103.72	500.00
4.000	1000.00	4785.10	.17	-10.94	.00	104.42	500.00
4.000	2000.00	4785.67	.57	-10.90	.00	106.70	500.00
4.000	3000.00	4786.14	.47	-10.85	.00	108.55	500.00
4.000	4000.00	4786.54	.40	-10.81	.00	110.15	500.00
4.000	5000.00	4786.90	.36	-10.78	.00	111.59	500.00
3.000	250.00	4772.43	.00	-12.05	.00	101.73	490.00
3.000	500.00	4772.65	.22	-12.08	.00	102.61	490.00
3.000	750.00	4772.83	.19	-12.10	.00	103.32	490.00
3.000	1000.00	4772.99	.15	-12.12	.00	103.96	490.00
3.000	2000.00	4773.51	.52	-12.16	.00	106.03	490.00
3.000	3000.00	4773.94	.43	-12.21	.00	107.72	490.00
3.000	4000.00	4774.30	.37	-12.24	.00	109.21	490.00
3.000	5000.00	4774.65	.34	-12.26	.00	110.58	490.00

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
2.000	250.00	4760.48	.00	-11.95	.00	101.93	505.00
2.000	500.00	4760.73	.24	-11.92	.00	102.93	505.00
2.000	750.00	4760.94	.21	-11.90	.00	103.74	505.00
2.000	1000.00	4761.11	.17	-11.88	.00	104.43	505.00
2.000	2000.00	4761.66	.55	-11.85	.00	106.64	505.00
2.000	3000.00	4762.11	.45	-11.83	.00	108.40	505.00
2.000	4000.00	4762.49	.38	-11.81	.00	109.91	505.00
2.000	5000.00	4762.82	.34	-11.82	.00	111.26	505.00
1.000	250.00	4750.49	.00	-10.00	.00	101.93	500.00
1.000	500.00	4750.73	.25	-9.99	.00	102.92	500.00
1.000	750.00	4750.92	.19	-10.01	.00	103.71	500.00
1.000	1000.00	4751.11	.18	-10.00	.00	104.43	500.00
1.000	2000.00	4751.69	.58	-9.97	.00	106.76	500.00
1.000	3000.00	4752.16	.47	-9.94	.00	108.64	500.00
1.000	4000.00	4752.57	.41	-9.92	.00	110.29	500.00
1.000	5000.00	4752.95	.37	-9.88	.00	111.77	500.00

THIS RUN EXECUTED 6DEC91 10:20:28

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**************************************
 HEC-2 WATER SURFACE PROFILES

 Version  4.6.0;  February 1991
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T1       DONA ANA COUNTY FLOOD COMMISSION - ORGAN ARROYO
T2       SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3       ORGAN ARROYO, Q=100 cfs

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

       0         2         0         1      0.03         0         0         0      4841

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

      1         0        -1         0         0         0         0         0         0


J5  LPRNT     NUMSEC                    ********REQUESTED SECTION NUMBERS********

    -10       -10

J6  IHLEQ     ICOPY     SUBDIV    STRTDS     RMILE

      1         0


NC     0.03      0.03     0.025       0.1       0.3

         RANGE OF FLOWS FOR SEDIMENT TRANSPORT CALIBRATION

QT        8       100       200       400       600       800      1000      1100      1300

X1        6         9        30       370       450       540       500
GR     4846         0      4844        30      4842        55      4840        90      4840       200
GR     4840       290      4842       315      4844       370      4846       405

X1        5         7        40       270       550       460       500
GR     4828         0      4826        40      4824        65      4824       150      4824       200
GR     4826       240      4828       270

X1        4         8        50       230       430       580       500
GR     4814         0      4814        50      4812       100      4810       120      4810       180
GR     4812       200      4814       230      4816       320

X1        3         7        80       260       600       400       500
GR     4800         0      4800        80      4798        95      4796       115      4798       235
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X1	2	6	25	190	450	550	500			
GR	4784	0	4784	25	4782	40	4782	90	4784	190
GR	4786	260								
X1	1	7	25	170						
GR	4770	0	4768	25	4766	40	4766	100	4768	110
GR	4770	170	4770	215						

FLOW ENTERS THE PONDING AREA BEHIND THE DETENTION DAM

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - ORGAN ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 ORGAN ARROYO, Q=200 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	3	0	1	0.03	0	0	0	4841.05	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	2	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - ORGAN ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 ORGAN ARROYO, Q=400 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	4	0	1	0.03	0	0	0	4841.10	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	3	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - ORGAN ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 ORGAN ARROYO,Q=600 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	5	0	1	0.03	0	0	0	4841.15	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	4	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - ORGAN ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 ORGAN ARROYO,Q=800 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	6	0	1	0.03	0	0	0	4841.20	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	5	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - ORGAN ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 ORGAN ARROYO,Q=1000 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	7	0	1	0.03	0	0	0	4841.25	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	6	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - ORGAN ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 ORGAN ARROYO,Q=1100 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	8	0	1	0.03	0	0	0	4841.30	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	7	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - ORGAN ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 ORGAN ARROYO,Q=1300 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	9	0	1	0.03	0	0	0	4841.35	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	8	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

THIS RUN EXECUTED 6DEC91 10:20:45

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HEC-2 WATER SURFACE PROFILES

Version 4.6.0; February 1991
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

ORGAN ARROYO, Q=100 cfs

SV ' PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	6.000	.00	.00	.00	4840.00	100.00	4840.16	4840.20	4840.31	299.14	3.04	32.92	5.78
	6.000	.00	.00	.00	4840.00	200.00	4840.25	4840.31	4840.49	299.30	3.99	50.13	11.56
	6.000	.00	.00	.00	4840.00	400.00	4840.37	4840.49	4840.80	299.81	5.23	76.49	23.10
	6.000	.00	.00	.00	4840.00	600.00	4840.48	4840.64	4841.05	294.96	6.08	98.61	34.94
	6.000	.00	.00	.00	4840.00	800.00	4840.56	4840.78	4841.28	298.42	6.82	117.35	46.31
	6.000	.00	.00	.00	4840.00	1000.00	4840.64	4840.90	4841.50	299.51	7.43	134.60	57.78
	6.000	.00	.00	.00	4840.00	1100.00	4840.68	4840.95	4841.60	299.89	7.71	142.76	63.52
	6.000	.00	.00	.00	4840.00	1300.00	4840.75	4841.06	4841.80	299.77	8.21	158.44	75.08
	5.000	500.00	.00	.00	4824.00	100.00	4824.21	4824.25	4824.41	336.35	3.65	27.40	5.45
	5.000	500.00	.00	.00	4824.00	200.00	4824.30	4824.40	4824.65	334.10	4.76	42.00	10.94
	5.000	500.00	.00	.00	4824.00	400.00	4824.45	4824.63	4825.04	329.71	6.17	64.80	22.03
	5.000	500.00	.00	.00	4824.00	600.00	4824.57	4824.81	4825.37	331.29	7.19	83.40	32.96
	5.000	500.00	.00	.00	4824.00	800.00	4824.68	4824.98	4825.66	325.46	7.95	100.57	44.34
	5.000	500.00	.00	.00	4824.00	1000.00	4824.79	4825.14	4825.94	321.63	8.60	116.33	55.76
	5.000	500.00	.00	.00	4824.00	1100.00	4824.83	4825.21	4826.05	320.75	8.89	123.73	61.42
	5.000	500.00	.00	.00	4824.00	1300.00	4824.93	4825.34	4826.31	318.51	9.42	138.02	72.84
*	4.000	500.00	.00	.00	4810.00	100.00	4810.36	4810.43	4810.66	225.27	4.36	22.95	6.66
	4.000	500.00	.00	.00	4810.00	200.00	4810.55	4810.67	4811.04	221.36	5.60	35.73	13.44
	4.000	500.00	.00	.00	4810.00	400.00	4810.82	4811.04	4811.61	218.18	7.14	56.06	27.08
	4.000	500.00	.00	.00	4810.00	600.00	4811.04	4811.35	4812.07	212.91	8.14	73.69	41.12
	4.000	500.00	.00	.00	4810.00	800.00	4811.23	4811.60	4812.48	212.65	8.97	89.22	54.86
	4.000	500.00	.00	.00	4810.00	1000.00	4811.40	4811.83	4812.84	212.38	9.65	103.63	68.62
	4.000	500.00	.00	.00	4810.00	1100.00	4811.48	4811.94	4813.02	211.00	9.93	110.75	75.73
	4.000	500.00	.00	.00	4810.00	1300.00	4811.63	4812.16	4813.33	210.35	10.47	124.13	89.63

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	3.000	500.00	.00	.00	4796.00	100.00	4796.56	4796.64	4796.82	306.34	4.47	24.69	5.71
	3.000	500.00	.00	.00	4796.00	200.00	4796.73	4796.83	4797.11	313.12	5.36	41.19	11.30
	3.000	500.00	.00	.00	4796.00	400.00	4796.95	4797.11	4797.49	322.05	6.45	68.54	22.29
	3.000	500.00	.00	.00	4796.00	600.00	4797.08	4797.30	4797.77	333.21	7.23	91.72	32.87
	3.000	500.00	.00	.00	4796.00	800.00	4797.21	4797.46	4798.01	338.85	7.81	113.09	43.46
	3.000	500.00	.00	.00	4796.00	1000.00	4797.31	4797.60	4798.21	344.23	8.31	132.91	53.90
	3.000	500.00	.00	.00	4796.00	1100.00	4797.35	4797.66	4798.31	347.95	8.55	142.19	58.97
	3.000	500.00	.00	.00	4796.00	1300.00	4797.45	4797.77	4798.50	352.59	8.95	160.36	69.23
*	2.000	500.00	.00	.00	4782.00	100.00	4782.36	4782.46	4782.69	288.33	4.60	21.75	5.89
	2.000	500.00	.00	.00	4782.00	200.00	4782.54	4782.69	4783.04	279.51	5.70	35.11	11.96
	2.000	500.00	.00	.00	4782.00	400.00	4782.79	4783.02	4783.54	267.10	6.93	57.68	24.47
	2.000	500.00	.00	.00	4782.00	600.00	4782.99	4783.28	4783.91	254.72	7.68	78.12	37.59
	2.000	500.00	.00	.00	4782.00	800.00	4783.17	4783.49	4784.23	247.51	8.25	96.93	50.85
	2.000	500.00	.00	.00	4782.00	1000.00	4783.31	4783.68	4784.49	241.36	8.71	114.85	64.37
	2.000	500.00	.00	.00	4782.00	1100.00	4783.38	4783.77	4784.61	238.23	8.90	123.61	71.27
	2.000	500.00	.00	.00	4782.00	1300.00	4783.51	4783.92	4784.83	233.69	9.25	140.49	85.04
*	1.000	500.00	.00	.00	4766.00	100.00	4766.32	4766.43	4766.72	350.89	5.08	19.70	5.34
	1.000	500.00	.00	.00	4766.00	200.00	4766.48	4766.68	4767.17	354.76	6.64	30.14	10.62
	1.000	500.00	.00	.00	4766.00	400.00	4766.71	4767.07	4767.87	358.11	8.62	46.39	21.14
	1.000	500.00	.00	.00	4766.00	600.00	4766.91	4767.39	4768.47	360.07	10.02	59.89	31.62
	1.000	500.00	.00	.00	4766.00	800.00	4767.09	4767.66	4769.00	358.19	11.09	72.13	42.27
	1.000	500.00	.00	.00	4766.00	1000.00	4767.24	4767.91	4769.46	355.53	11.97	83.51	53.04
	1.000	500.00	.00	.00	4766.00	1100.00	4767.31	4768.03	4769.69	354.10	12.37	88.96	58.46
	1.000	500.00	.00	.00	4766.00	1300.00	4767.44	4768.28	4770.09	350.70	13.06	99.51	69.42

ORGAN ARROYO, Q=100 cfs

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	6.000	100.00	4840.16	.00	.00	-.84	204.88	.00
	6.000	200.00	4840.25	.08	.00	-.80	207.38	.00
	6.000	400.00	4840.37	.13	.00	-.73	211.16	.00
	6.000	600.00	4840.48	.10	.00	-.67	214.28	.00
	6.000	800.00	4840.56	.09	.00	-.64	216.89	.00
	6.000	1000.00	4840.64	.08	.00	-.61	219.26	.00
	6.000	1100.00	4840.68	.04	.00	-.62	220.38	.00
	6.000	1300.00	4840.75	.07	.00	-.60	222.50	.00
	5.000	100.00	4824.21	.00	-15.96	.00	141.44	500.00
	5.000	200.00	4824.30	.09	-15.95	.00	144.76	500.00
	5.000	400.00	4824.45	.15	-15.92	.00	149.79	500.00
	5.000	600.00	4824.57	.12	-15.91	.00	153.77	500.00
	5.000	800.00	4824.68	.11	-15.88	.00	157.36	500.00
	5.000	1000.00	4824.79	.11	-15.85	.00	160.58	500.00
	5.000	1100.00	4824.83	.03	-15.85	.00	162.07	500.00
	5.000	1300.00	4824.93	.10	-15.82	.00	164.91	500.00
*	4.000	100.00	4810.36	.00	-13.84	.00	67.22	500.00
	4.000	200.00	4810.55	.19	-13.75	.00	70.92	500.00
	4.000	400.00	4810.82	.27	-13.63	.00	76.44	500.00
	4.000	600.00	4811.04	.22	-13.53	.00	80.92	500.00
	4.000	800.00	4811.23	.19	-13.45	.00	84.67	500.00
	4.000	1000.00	4811.40	.17	-13.40	.00	88.01	500.00
	4.000	1100.00	4811.48	.09	-13.34	.00	89.61	500.00
	4.000	1300.00	4811.63	.14	-13.30	.00	92.55	500.00
	3.000	100.00	4796.56	.00	-13.80	.00	87.49	500.00
	3.000	200.00	4796.73	.17	-13.82	.00	113.00	500.00
	3.000	400.00	4796.95	.22	-13.87	.00	145.77	500.00
	3.000	600.00	4797.08	.14	-13.96	.00	168.62	500.00
	3.000	800.00	4797.21	.13	-14.03	.00	187.24	500.00
	3.000	1000.00	4797.31	.10	-14.09	.00	202.98	500.00
	3.000	1100.00	4797.35	.05	-14.13	.00	209.95	500.00
	3.000	1300.00	4797.45	.09	-14.18	.00	222.96	500.00
*	2.000	100.00	4782.36	.00	-14.20	.00	70.72	500.00
	2.000	200.00	4782.54	.18	-14.19	.00	80.86	500.00
	2.000	400.00	4782.79	.25	-14.15	.00	95.57	500.00
	2.000	600.00	4782.99	.20	-14.09	.00	107.16	500.00
	2.000	800.00	4783.17	.18	-14.04	.00	116.82	500.00
	2.000	1000.00	4783.31	.15	-13.99	.00	125.33	500.00

2.000	1300.00	4783.51	.13	-13.94	.00	136.59	500.00

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	1.000	100.00	4766.32	.00	-16.04	.00	63.97	500.00
	1.000	200.00	4766.48	.17	-16.05	.00	65.98	500.00
	1.000	400.00	4766.71	.23	-16.08	.00	68.99	500.00
	1.000	600.00	4766.91	.20	-16.08	.00	71.40	500.00
	1.000	800.00	4767.09	.17	-16.08	.00	73.51	500.00
	1.000	1000.00	4767.24	.15	-16.08	.00	75.42	500.00
	1.000	1100.00	4767.31	.07	-16.07	.00	76.31	500.00
	1.000	1300.00	4767.44	.13	-16.06	.00	78.02	500.00

THIS RUN EXECUTED 6DEC91 10:20:58

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HEC-2 WATER SURFACE PROFILES

Version 4.6.0; February 1991
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T1 DONA ANA COUNTY FLOOD COMMISSION - OWL'S NEST ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 OWL'S ARROYO, Q=100 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	2	0	1	0.03	0	0	0	4859	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	1	0	-1	0	0	0	0	0	0	

J5 LPRNT NUMSEC ********REQUESTED SECTION NUMBERS********

-10 -10

J6 [illegible]LEQ ICOPY SUBDIV STRTDS RMILE

1 0

NC 0.03 0.03 0.025 0.1 0.3

RANGE OF FLOWS FOR SEDIMENT TRANSPORT CALIBRATION

ST	8	100	200	300	400	500	600	700	900	
X1	6	7	360	650	525	535	530			
GR	4862	0	4860	240	4860	360	4858	405	4858	625
GR	4860	650	4862	785						
X1	5	7	275	610	420	445	435			
GR	4844	0	4842	275	4840	345	4840	530	4842	610
GR	4842	870	4844	1000						
X1	4	6	100	270	575	525	550			
GR	4828	0	4826	100	4824	140	4824	210	4826	270
GR	4828	320								
	3	5	130	195	375	375	375			
GR	4810	0	4808	130	4806	175	4808	195	4810	390

```
X1      2       8     330     435     640     620     630
GR   4798       0    4798     330    4796     360    4795     380    4795     400
GR   4796     415    4798     435    4798     520

X1      1       7     230     280
GR   4778       0    4776     150    4776     230    4774     260    4774     270
GR   4776     280    4776     340
```

FLOW ENTERS THE PONDING AREA BEHIND THE DETENTION DAM

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - OWL'S NEST ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 OWL'S ARROYO, Q=200 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	3	0	1	0.03	0	0	0	4859.05	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	2	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - OWL'S NEST ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 OWL'S ARROYO, Q=300 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	4	0	1	0.03	0	0	0	4859.10	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	3	0	-1	0	0	0	0	0	0	

.RLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - OWL'S NEST ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 OWL'S ARROYO, Q=400 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	5	0	1	0.03	0	0	0	4859.15	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	4	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - OWL'S NEST ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 OWL'S ARROYO, Q=500 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	6	0	1	0.03	0	0	0	4859.20	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	5	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - OWL'S NEST ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 OWL'S ARROYO,Q=600 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	7	0	1	0.03	0	0	0	4859.25	
J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	6	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - OWL'S NEST ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 OWL'S ARROYO,Q=700 cfs

**	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	8	0	1	0.03	0	0	0	4859.30	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	7	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

T1 DONA ANA COUNTY FLOOD COMMISSION - OWL'S NEST ARROYO
T2 SUPERCRITICAL SEDIMENTATION TRANSPORTATION DATA
T3 OWL'S ARROYO,Q=900 cfs

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	9	0	1	0.03	0	0	0	4859.35	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	8	0	-1	0	0	0	0	0	0	

IHLEQ = 1. THEREFORE FRICTION LOSS (HL) IS CALCULATED AS A FUNCTION OF PROFILE TYPE, WHICH CAN VARY FROM REACH TO REACH. SEE DOCUMENTATION FOR DETAILS.

THIS RUN EXECUTED 6DEC91 10:21:18

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HEC-2 WATER SURFACE PROFILES

Version 4.6.0; February 1991
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF ERRORS LIST

OWL'S ARROYO, Q=100 cfs

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	6.000	.00	.00	.00	4858.00	100.00	4858.15	4858.19	4858.29	294.39	2.91	34.36	5.83
	6.000	.00	.00	.00	4856.00	200.00	4858.23	4858.29	4858.46	299.26	3.84	52.08	11.56
	6.000	.00	.00	.00	4858.00	300.00	4858.30	4858.38	4858.61	296.71	4.49	66.85	17.42
	6.000	.00	.00	.00	4858.00	400.00	4858.35	4858.46	4858.74	299.30	5.03	79.51	23.12
	6.000	.00	.00	.00	4858.00	500.00	4856.40	4858.54	4858.87	299.84	5.49	91.12	28.87
	6.000	.00	.00	.00	4858.00	600.00	4858.45	4858.60	4858.99	300.17	5.89	101.90	34.63
	6.000	.00	.00	.00	4858.00	700.00	4858.49	4858.67	4859.09	294.23	6.21	112.75	40.81
	6.000	.00	.00	.00	4858.00	900.00	4858.57	4858.79	4859.30	297.41	6.86	131.28	52.19
*	5.000	530.00	.00	.00	4840.00	100.00	4840.16	4840.21	4840.33	381.63	3.32	30.11	5.12
*	5.000	530.00	.00	.00	4840.00	200.00	4840.24	4840.32	4840.53	378.53	4.32	46.31	10.28
*	5.000	530.00	.00	.00	4840.00	300.00	4840.30	4840.42	4840.70	378.16	5.03	59.65	15.43
*	5.000	530.00	.00	.00	4840.00	400.00	4840.36	4840.50	4840.84	375.11	5.58	71.64	20.65
	5.000	530.00	.00	.00	4840.00	500.00	4840.41	4840.58	4840.98	374.85	6.06	82.50	25.83
	5.000	530.00	.00	.00	4840.00	600.00	4840.46	4840.66	4841.11	373.94	6.47	92.70	31.03
*	5.000	530.00	.00	.00	4840.00	700.00	4840.50	4840.73	4841.23	378.71	6.87	101.88	35.97
	5.000	530.00	.00	.00	4840.00	900.00	4840.58	4840.85	4841.46	375.43	7.50	120.04	46.45
*	4.000	435.00	.00	.00	4824.00	100.00	4824.29	4824.38	4824.60	342.74	4.51	22.16	5.40
*	4.000	435.00	.00	.00	4824.00	200.00	4824.43	4824.58	4824.94	338.74	5.74	34.83	10.87
	4.000	435.00	.00	.00	4824.00	300.00	4824.54	4824.75	4825.21	334.03	6.56	45.71	16.41
	4.000	435.00	.00	.00	4824.00	400.00	4824.65	4824.89	4825.46	332.02	7.21	55.50	21.95
	4.000	435.00	.00	.00	4824.00	500.00	4824.73	4825.02	4825.66	329.49	7.73	64.68	27.55
	4.000	435.00	.00	.00	4824.00	600.00	4824.82	4825.14	4825.85	327.26	8.18	73.38	33.17
	4.000	435.00	.00	.00	4824.00	700.00	4824.89	4825.25	4826.02	321.17	8.53	82.06	39.06
	4.000	435.00	.00	.00	4824.00	900.00	4825.03	4825.44	4826.35	319.38	9.21	97.77	50.36

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TORWID	XLCH
1.000	100.00	4774.78	.00	-20.77	.00	25.77	630.00
1.000	200.00	4775.01	.33	-20.68	.00	32.31	630.00
1.000	300.00	4775.36	.25	-20.61	.00	37.13	630.00
1.000	400.00	4775.56	.20	-20.56	.00	41.03	630.00
1.000	500.00	4775.73	.17	-20.52	.00	44.38	630.00
1.000	600.00	4775.87	.15	-20.48	.00	47.34	630.00
1.000	700.00	4776.00	.13	-20.46	.00	50.00	630.00
1.000	900.00	4776.14	.14	-20.43	.00	201.06	630.00