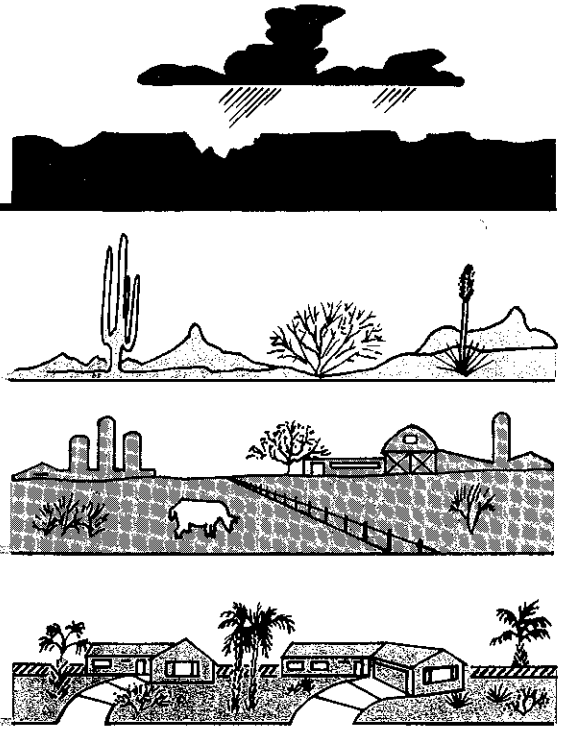

FLOOD CONTROL
DISTRICT OF
MARICOPA COUNTY

DESIGN CONCEPT REPORT

FOR

CASANDRO WASH OUTFALL

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

DESIGN CONCEPT REPORT

FOR

CASANDRO WASH OUTFALL

Prepared for:
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July 20, 1994

Registered Professional Engineer (Civil)
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MICHAEL A. LOPEZ
Date Signed 7/21/94
ARIZONA, U.S.A.

Prepared by:
Casandro Wash Outfall Design Team
Flood Control District of Maricopa County

FLOOD CONTROL DISTRICT
of
Maricopa County

Interoffice Memorandum

DATE: July 20, 1994

TO: Dan E. Sagramoso, P.E.

VIA: Stan Smith, P.E.

FROM: Michael A. Lopez, P.E.

SUBJECT: Design Concept Report, Casandro Wash Outfall System

Enclosed is the Design Concept Report for the Casandro Wash Dam Project Outfall System. This report was prepared to determine a feasible solution to reduce and/or totally remove the floodplain along Casandro Wash downstream of the proposed dam. The report evaluates the future runoff conditions from the 100-year event, considering that the proposed dam captures all of the 100-year runoff from its contributing watershed.

This project was authorized by the Board of Directors on May 17, 1993 under Resolution FCD 93-04. After the adoption of this Resolution, the District entered into an Intergovernmental Agreement (IGA) with the Town of Wickenburg, IGA FCD 93009; this IGA defined the cost-sharing, operations and maintenance responsibilities of the Casandro Wash Dam Project. The Outfall System is only one component of the Project. Under the terms of the IGA, the District agrees to fund the design and construction of the Outfall System, and the Town of Wickenburg agrees to operate and maintain the Outfall System.

This Report was prepared by a team comprised of in-house staff members from various Departments/Divisions. They are as follows: Raju Shah, Engineering Division; Sandy Story, Pedro Calza, Jan Opstein, and Ning Mao, Hydrology Division; and Marta Dent, Francis Crosby, Annabel Montoya-Cooper, GIS Department. The team approach taken on this project proved to be very successful and rewarding for myself and all of the team members.

On behalf of the team, I would like to thank Stan Smith for allowing us the opportunity to work on this important flood control project, and I would also like to thank Ed Raleigh, Dave Johnson, and Tom Lamarche for sharing members of their Departments/Divisions to work on this project.

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EXECUTIVE SUMMARY

Casandro Wash floodplain includes approximately 99 buildings including residential homes, commercial and public buildings. Floodwaters hinder residents and emergency vehicles access to and from the residences during rainfall events. The Flood Control District (District) is planning a flood control project to reduce the 100-year floodplain of Casandro Wash. The planned project consists of two independent elements: 1) an earthen dam (flood retarding structure) to be located on Casandro Wash upstream of Mariposa Drive which will be maintained by the District and 2) an outfall system to convey the flows from the dam's principal outlet works and the runoff from the area below the dam to Sol's Wash which will be maintained by the Town of Wickenburg (Town).

Hydrology was performed for both the 6- and the 24-hour storms to determine the peak flows for the 10-, 25- ,50-, and 100-year events using the Clark method. The 6-hour storm produced the highest peak flows. The 50- and 100-year flows at the inlet to the Outfall System were estimated to be 274 and 317 cfs respectively. The inlet to the Outfall System will be located immediately downstream of the box culvert at the intersection of Navajo Street and Jackson Street. The existing wash between the proposed damsite and the inlet has the capacity to convey the post dam runoff, and the roadway crossings between the proposed dam and the beginning of the outfall system have low flow culverts that are sized for events greater than the discharges that will come from the dams principal outlet works. The Town has agreed, IGA FCD 83009, to adopt a special zoning district to prohibit the building of any permanent structures in the streambed of the existing wash between Mariposa Drive and Navajo Street.

Various outfall alternatives were analyzed to determine their hydraulic capacities and their construction cost estimates. Hydraulic analyses were performed for both the 50- and 100-year events. Because of the limited available head and the shallow cover for a storm drain between the inlet of the outfall system and Sol's Wash, a large shallow box culvert would be required in order to maintain the hydraulic grade line (H.G.L.) underground for the 100-year event. A floodplain delineation was performed for the difference of the 100-year and the 50-year flows; the analysis determined that the floodplain could be maintained within the existing rights-of-way except for a few properties. Twin 48" pipes were determined to be the most feasible alternative. The H.G.L. for the 48" pipes stays underground except for a stretch downstream of the railroad which is in the floodplain of Sol's Wash.

From the inlet, the alignment selected for the outfall system in Jackson Street is on the south side of the road and in Mohave Street it is on the east side of the road following the alignment of an abandoned 8" sanitary sewerline. Beyond the intersection of Mohave Street and Jefferson Street, the alignment will run on the west side paralleling an existing sanitary sewerline to Sol's Wash. Most of the alignment can be accomplished within existing Town rights-of-way except for the portion north of Jefferson Street where a permanent easement and a license to bore underneath the A.T. & S.F. railroad rights-of- way will have to be acquired .

1.0 INTRODUCTION

Casandro Wash is a tributary of Sol's Wash that begins in the Vulture Mountains which are located southwest of the Town of Wickenburg. The wash conveys flows in a northeasterly direction to the Town on the way to its outfall. The floodplain from Casandro Wash includes approximately 99 buildings including residential homes, commercial and public buildings (See Figure 1on page 2).

Resolution FCD 93-04 authorizes the Flood Control District (District) to plan a flood control project to reduce the 100-year floodplain of Casandro Wash and to negotiate Interngovernmental Agreements (IGA's) with others as necessary to define obligations and responsibilities for developing, cost-sharing construction, and the operations and maintenace of the project(s). The planned project consists of two independent elements: 1) an earthen dam (flood retarding structure) to belocated on Casandro Wash upstream of Mariposa Drive to attenuate the runoff from the 100-year event and 2) an outfall system to convey the flows from the dam's principal outlet works and the runoff from the area below the dam to Sol's Wash (See Figure 2 on page 3).

The DISTRICT has contracted with an engineering consultant, CH2M Hill, to design a dam on Casandro Wash approximately 1500 feet west of Mariposa Drive. The dam is to be sized to impound the 100-year runoff and allow the runoff to be discharged through an ungated principal outlet. The flows from the principal outlet are planned to drain the dam within ten days and not be in excess of 20 cfs. Releases from the dam's principal outlet will be discharged back into Casandro Wash where they will continue flowing downstream towards Sol's Wash. The District will design the second element, the outfall system, in-house.

The District and the Town of Wickenburg entered into an IGA, IGA FCD 93009. Under the Agreement, the Town will accept the operation and maintenance responsibilities of the outfall system once it has been constructed and the District will fund the construction of the outfall system. The Agreement also defines other responsibilities and obligations relative to the dam. An improtant issue relative to the overall project is that the Town agrees to adopt a special zoning district to prohibit the building of any permanent structures in the spillway below the proposed dam and in the streambed of the existing wash between Mariposa Drive and Navajo Street.

The purpose of this study, Design Concept Report for Casandro Wash Outfall, is to determine a feasible solution for an outfall system. An outfall system for the Casandro Wash Project is necessary to further reduce the 100-year floodplain that includes residents along Jackson Street and Mohave Street; it will also allow the Town of Wickenburg to pave Jackson Street and Mohave Street, the only unpaved roads in the neighborhood.

This Report provides a presentation of the flooding problems along Casandro Wash and describes the site conditions. Then the results of the hydrology for the Casandro Wash watershed downstream of the proposed dam was calculated using various computer models

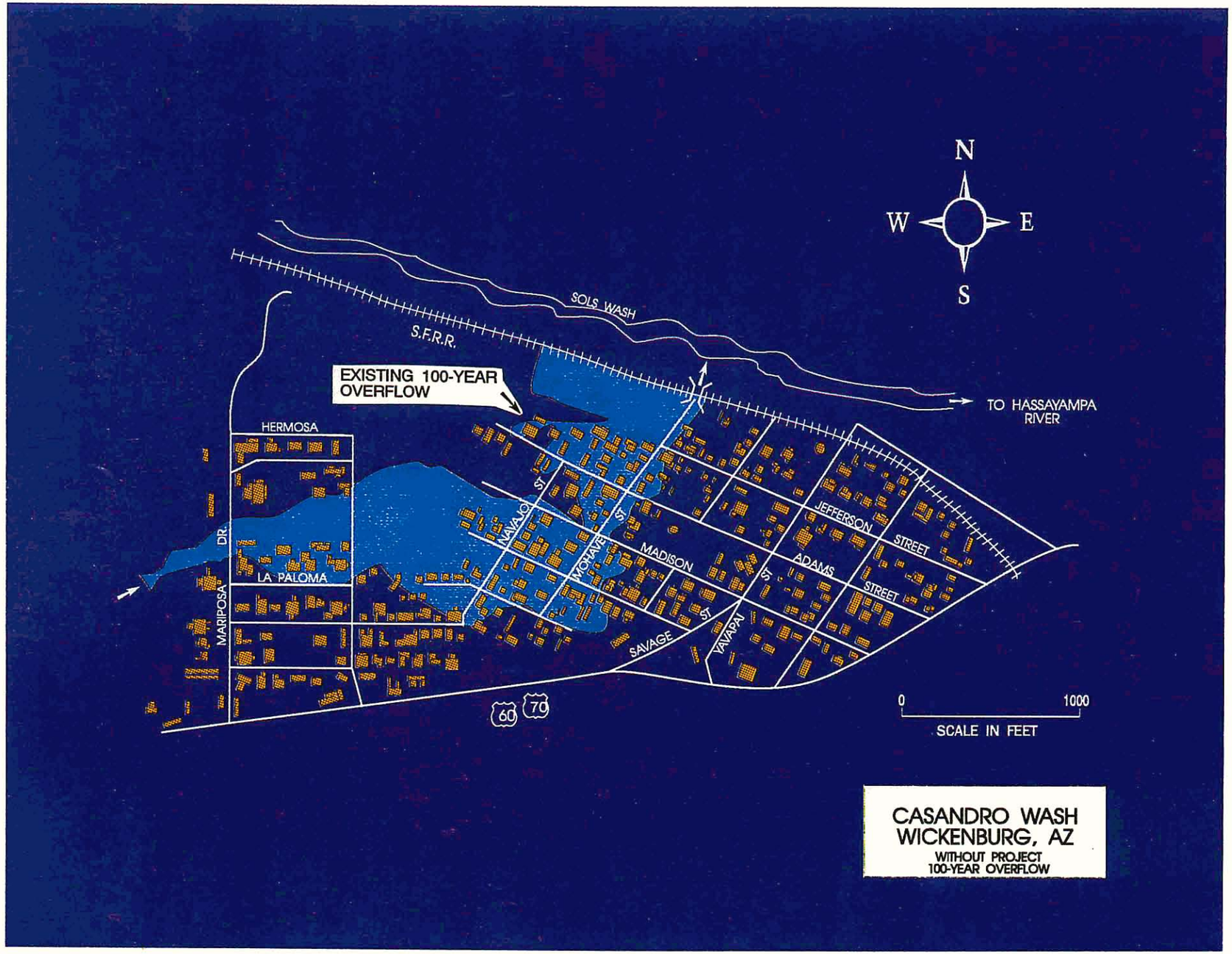

Figure 1. Casandro Wash 100-year Floodplain (Existing Conditions)

Figure 2. **Proposed Outfall System**

including HEC-1 and presented. Once the amount of runoff was determined, the remainder of the wash below Navajo Street was modelled using the post dam hydrology under the pre and post outfall system conditions using the HEC-2 program to determine if any floodplain remained. Along with the floodplain analysis of the wash, various outfall alternatives were analyzed to determine their hydraulic capacities and their different construction cost estimates. Finally, cost estimates of the various alternatives were assembled and a preferred alternative selected.

2.0 PROBLEM

A number of studies have been performed for Casandro Wash, and the studies reviewed have concluded that a dam is the preferred solution to remove the flooding potential that exist for residents along the wash. The most recent study completed by the U.S. Army Corps of Engineers, Hassayampa River Near Wickenburg, Arizona - Reconnaissance Report dated January 1993, also recommended that a dam be constructed on Casandro Wash.

The pre-dam peak runoff for Casandro Wash is approximately 1800 cfs at Sol's Wash according to the Hassayampa River Near Wickenburg, Arizona - Reconnaissance Report. Construction of a dam upstream of Mariposa Drive (element 1) would significantly reduce the flows and the floodplain downstream, but it does not totally eliminate it (See Pocket 1 in Appendix III). Principal discharges from the dam's principal outlet works and runoff from the area below the dam still pose a threat of flooding from the 100-year event along the lower portion of the wash. The lower portion of Casandro Wash (See Figure 3 on page 6) utilizes Jackson Street and Mohave Street to convey the runoff as it travels through a residential neighborhood known as the "Reed Addition" on its way to Sol's Wash; the natural wash ends at the intersection of Navajo and Jackson Streets.

Floodwaters hinder residents and emergency vehicles access to and from the residences during rainfall events. The wash also transports and deposits large amounts of sediment on the roadways; removing this sediment from the roadways is a continual maintenance problem for the Town of Wickenburg. When the wash is not flowing, the unpaved roads through the neighborhood create a dust problem which poses health and environmental hazards to residents of the area. The Town of Wickenburg is unable to pave Jackson Street and Mohave Street until an outfall is constructed because the flows over the roadways would erode the pavement; Town officials have stated that they will apply for Block Grant Funds to finish paving the roadways once the outfall is in place.

3.0 SITE CONDITIONS

3.1 Topography

The watershed for Casandro Wash begins outside of the Town of Wickenburg. Basin elevations range from 2053 to 2400 feet. The wash is approximately 3 miles in length and is normally dry. The terrain in the upper portion of the watershed consists of steep mountainous terrain with highly impervious soils. Most of the watershed is sparesly vegetated with Sonoran desert vegetation. Leaving the steep terrain, the wash crosses underneath U.S. Highway 60 as it heads northeasterly towards Sol's Wash (See Figure 4 on page 7).

The proposed dam is to be constructed downstream of U.S. Highway 60 in the lower terrain aproximately 1500 feet west of Mariposa Drive. Casandro Wash between U.S. Highway 60 and Navajo Street is a well defined wash with a sandy bottom. The proposed dam will be retarding the runoff from the 100-year runoff and limiting discharges into Casandro Wash to 20 cfs.

Figure 3. **Lower Portion of Casandro Wash**

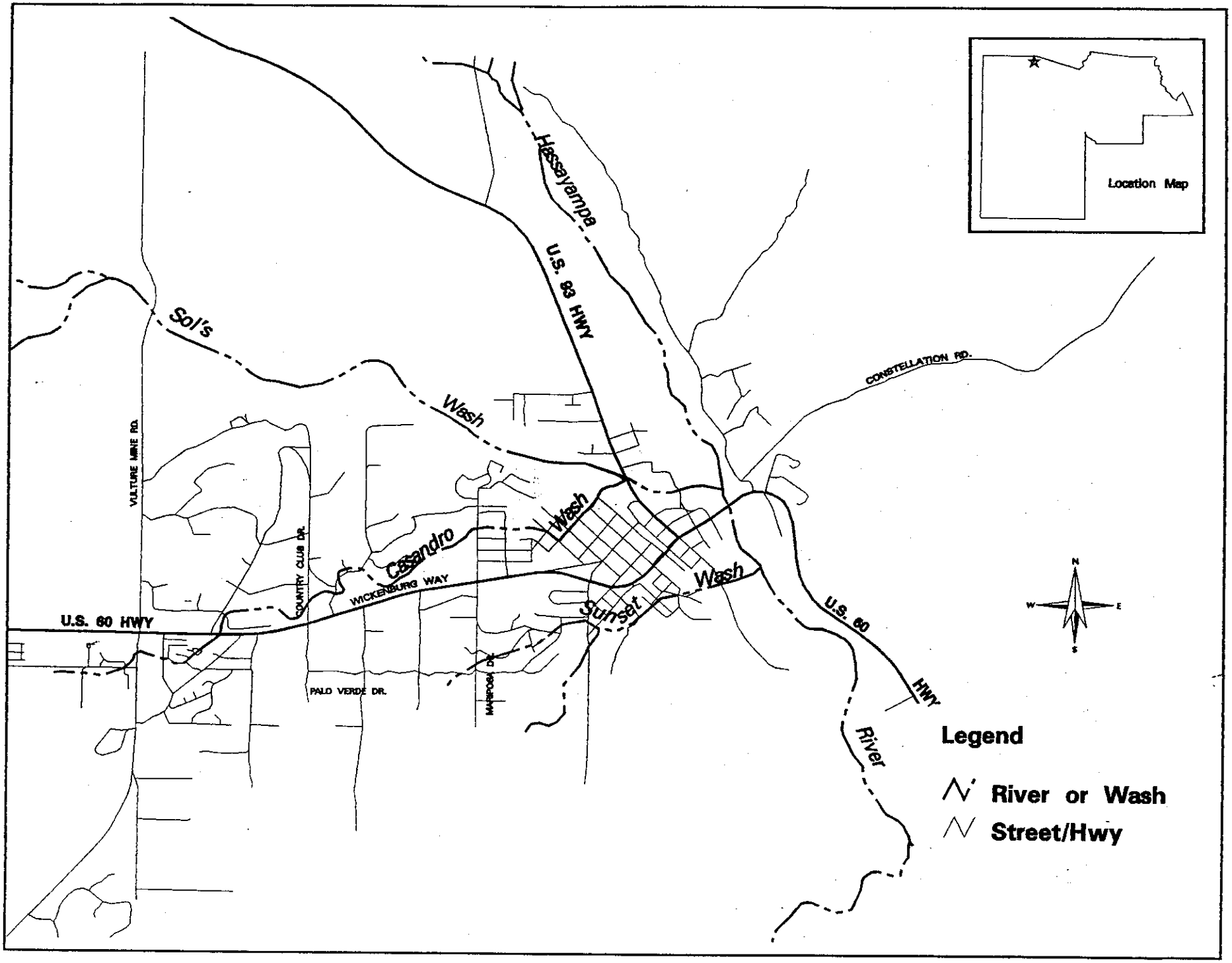

Figure 4. Location Map

There are two low-flow crossings between the proposed damsite and the bigginning of the proposed outfall system: Mariposa Drive and Cucaracha Street. Each of these roadway crossings has 4 - 36" x 22" CMPA culverts to handle low-flows. The capacity of these crossings is 120 cfs and 100 cfs respectively. The prolonged discharge of 20 cfs from the dam that will occur from major events will not cause a problem to any of the roads or roadway crossings downstream of the dam.

The natural wash of Casandro Wash ends at Navajo Street where the neighborhood roadways through the neighborhood function as the wash. This is the lower portion of the wash which bisects the area known as the "Reed's Addition."

3.2 Utility Conflicts

The alignment for the outfall system begins at the downstream side of the concrete box culvert at the intersection of Navajo Street and Jackson Street. From here, the outfall system runs southeast in Jackson Street until it reaches Mohave Street where the outfall system makes a turn to the northeast and stays in Mohave Street until it reaches Jefferson Street. At Jefferson Street, the proposed outfall system parallels the Town's existing sanitary sewer to Sol's Wash (See Figure 2 on page 3).

A number of existing utilities reside in the alignment of the proposed outfall system. Near the beginning of the outfall system a portion of existing 10" sanitary sewerline will have to be relocated in order to construct the inlet structure. The sewerline relocation at this location is also necessary to avoid having to be bridge a large section of existing sewerline to facilitate construction of the outfall system. Another utility that may have to be relocated in Jackson Street is a 1 1/4" to 2" gasline that runs east-west and is located on the north side of Jackson Street. Altough it may be possible that the outfall system can be constructed between the relocated sanitary sewerline and the gasline.

The alignment selected for the outfall system in Mohave Street is on the east side of the road between an existing 2" waterline and 12" sanitary sewerline. This alignment follows the alignment of an abondoned 8" VCP sanitary sewerline; the abandoned line will have to be removed with this project. Other utilities that will require relocation in this section are sanitary sewer and water service connections. The existing sewerline has approximately 8-10 feet of cover over it; this will allow enough room for the sanitary sewer connections to go under the proposed outfall system. Because the proposed outfall will have on average of 2' of cover, it will not be possible for services to be placed over the outfall system.

From Jefferson Street to Sol's Wash, their does not appear to be any conflicts with existing utilities. Just south of the railroad track, the outfall system crosses from the east side of the sanitary sewerline to the west side. The outfall system at this location will cross easily over the sanitary sewer. Just beyond this crossing the outfall system will have to be jacked approximately 100' feet to clear the railroad tracks. The A.T. & S.F. Railway Company operates three tracks at this location that cannot be taken out of service for the construction of the outfall.

3.3 Right-of-Way and Easements

Most of the alignment can be accomplished within existing Town rights-of-way. The only area where there is no rights-of-way for the proposed outfall system is from a few hundred feet south of the A.T & S.F. R.R right-of-way to the Sol's Wash. At the south right-of-way, the abandoned section of sewerline ends that is centered in the easement ends and the remaining sewerline remains centered in the easement to Sol's Wash.

The planned alignment of the proposed outfall system for the stretch from the south right-of-way of the A.T & S.F. RR will parallel the sanitary sewer easement on the west side. The existing easement is a permanent sewerline easement that is 20 foot wide with an 18" sanitary sewerline centered in the easement. An additional 10 - 15 foot wide easement will be necessary to construct the proposed outfall system along this stretch to Sol's Wash. Prior to the south right-of-way line of the A.T & S.F. RR, the alignment of the proposed outfall system will be able to remain centered in the existing easement at the same location as the abandoned 8"sanitary sewerline.

4.0 HYDROLOGY ANALYSIS

The hydrology for the Casandro Wash watershed below the proposed dam has been completed and is based on existing conditions (post dam). It models the pre and post outfall system. This in-house study is being conducted to perform the hydraulics for the outfall system design (the design of the dam has been contracted out). The watershed sub-basin parameters were estimated in conformance with the Hydrology Manual, and the procedures used for estimating the parameters are contained in the following sections.

The hydrology for this area has been analyzed and studied as part of the Wickenburg Area Drainage Master Study (ADMS) . The study was prepared by Black & Veatch, and Coe & Van Loo Engineers. Though the Casandro Wash watershed was originally delineated for hydrology within the ADMS, it was only delineated into three sub-basins. This hydrology was not detailed enough for our analysis. Therefore, new hydrology was developed to determine the peak flow downstream of the dam at major points of concern, such as confluences with streets.

The base mapping used for the watershed delineation consists of detailed 2' contour mapping which was flown in early 1991 by McLain Harbers Co., Inc. for the Wickenburg Area Drainage Master Study. Digitized HEC-2 cross sections for Casandro Wash were used as a basis for routing peak flows between concentration points. The digitized cross-sections were obtained by Flood Control District GIS personnel using the Wickenburg Area Drainage Master Study mapping.

4.1 Hydrograph Methodology

The Clark Unit Hydrograph method was used to determine peak flows for the Casandro Wash watershed. This was based on the size of the watershed as well as a comparison with other methods. A more detailed explanation of this analysis is discussed in the Final Results/Conclusions section. The total watershed area below the proposed dam is 1.55 square miles (See Table 1 next page for input parameters for the Clark method).

TABLE 1 **INPUT PARAMETERS CLARK METHOD**

	Area	Flow Path	Kb	Slope
SC240A	.123	.89	.052	104
SC240B	.108	.70	.051	141
SC240C	.033	.33	.040	173
SC240D	.036	.29	.040	186
SC240E	.021	.13	.034	392
SC240F	.013	.17	.034	259
SC240G	.006	.11	.043	464
SC240H	.008	.12	.043	442
SC240I	.100	.70	.033	147

4.2 Parameter Estimation

4.2.1 Drainage Area Boundaries

The watershed was broken down into 11 sub-basins (See Drainage Area Map in Appendix II). The criteria for delineating the watershed into sub-basins was to obtain peak flows at confluences with streets. This resulted in nine concentration points where the wash intersected with major roads, and at the downstream end where the AT&SF Railroad crosses the wash. These sub-basins varied in size from 0.13 square miles (SC240A), the largest sub-basin located just above the proposed dam site, to 0.01 square miles (SC240F & G), which are the smallest sub-basins located within the most populated area.

4.2.2 Physical Parameters

Time of Concentration -The time of concentration for each sub-basin was estimated using the equation given in the hydrology manual. The variable "L" was set equal to the flow path length for each sub-basin. The resistance coefficient was estimated for each sub-basin using Table 5.1 in the Hydrology Manual by assigning areas to either Type A (minimal roughness: commercial/industrial areas or residential areas) or Type B (moderately low roughness: desert rangeland or undeveloped urban area). Estimated resistance coefficients and lengths for each sub-basin are listed in Table 1.

Landuse Characteristics - The landuse characteristics of the watershed were divided into two types to evaluate surface retention loss (IA): desert and rangeland, and developed desert landscape. The delineation between the two different landuse types was evaluated using engineering judgement. The judgment was based on physical observations of the watershed.

The surface characteristics were used to determine a composite value. The initial abstraction values for each landuse type were taken from Table 4.1 of the Hydrology Manual. The percentages of each landuse type present in each sub-basin were determined and are listed in Table 2.

TABLE 2 **SURFACE RETENTION LOSS (IA)**

	% Natural	IA	% Developed:	% IA	Total
SC240A	95	.33	5	.01	.34
SC240B	88	.31	12	.01	.32
SC240C	30	.11	70	.07	.18
SC240D	25	.08	75	.08	.16
SC240E	5	.02	95	.09	.11
SC240F	0	0	100	.10	.10
SC240G	20	.07	80	.08	.15
SC240H	20	.07	80	.08	.15
SC240I	14	.05	86	.09	.14

Soils Parameters - Green & Ampt Parameters -Soil within this watershed is composed of the Eba-Continental-Cave association. The entire watershed is contained within the map unit #38 of the Aguila-Carefree Soil Survey. Map unit #38 consists of very gravelly loam, to clay, to loam. The XKSAT value for this map unit is 0.13 as given in the Hydrology Manual, DTHETA is equal to 0.19, and PSIF equal to 7.14.

The zoning classifications for this watershed were obtained from Exhibit B for each sub-basin to determine the percent impervious area (RTIMP). Each area was planimetered to determine its percentage, and a composite for percentage impervious area was determined for each sub-basin.

Normal-Depth Routing - The normal-depth routing option in HEC-1 was used to route the flood hydrographs. Digitized HEC-2 cross sections for Casandro Wash were used as a basis for routing peak flows between concentration points.

Transmission Losses - Because of the small size of the watershed, transmission losses were not incorporated into the HEC-1 model, and do not substantially reduce the 100-year peak flow.

4.2.3 Precipitation

This study is based on the 100-year storm recurrence interval. Both the 6 and the 24 hour storms have been studied to determine the maximum peak outflow to delineate the Casandro Wash floodplain. For the final peak flows, the MCUHP1 program was used to produce input for HEC-1. The 6-hour storm was found to produce the higher peaks. The 10, 25 and 50 year storms were also analyzed for design purposes (See TABLE 3). The point precipitation values were determined from the set of isopluvial maps in the Hydrology Manual.

TABLE 3 **CLARK METHOD**
RUNOFF FOR 10-YR, 25-YR, 50-YR, 100-YR

	10-Year	25-Year	50-Year	100-Year
SC240A	126	159	181	209
SC240B	114	144	163	188
SC240C	44	54	61	69
SC240D	62	76	85	97
SC240E	33	41	46	52
SC240F	16	20	22	25
SC240G	16	20	22	25
SC240H	16	20	22	25
SC240I	127	158	178	204
CP-D	191	241	274	317

4.3 Final Results/Conclusions

The S-Graph method was used in the Wickenburg Area Drainage Master Study. It was evaluated to compare its results with those obtained with the Clark method. Peak flows produced were unrealistically high. For another comparison, the rational method was utilized and compared (see Tables 4 & 5 on following page). The rational method will normally produce the highest peak flows for a sub-basin. When the results of the rational method were compared to those of the Clark and S-Graph methods (see Table 6 on page 14), the results indicated that the S-Graph method yielded the highest results, the rational method next, with the Clark method closely following the rational method.

After analyzing the results and evaluating the uses for each method, it was concluded that the results of the Clark method be used in this study as shown in TABLE 3 .

TABLE 4

INPUT PARAMETERS
RATIONAL METHOD

	Length	High	Low	Area	C-	Kb	10-Yr,
SC240A	4699	2222	2129	78.93	.36	.052	2.24
SC240B	3696	2211	2112	68.85	.35	.051	2.24
SC240C	1742	2155	2098	21.10	.37	.040	2.24
SC240D	1531	2140	2086	23.04	.37	.040	2.24
SC240E	686	2128	2077	13.12	.37	.034	2.24
SC240F	898	2116	2072	8.00	.38	.034	2.24
SC240G	581	2120	2069	3.90	.35	.043	2.24
SC240H	634	2120	2067	4.86	.33	.043	2.24
SC240I	3600	2163	2060	63.70	.37	.033	2.24

TABLE 5

RATIONAL METHOD
RUNOFF FOR 10-YR,25-YR,50-YR,100-YR

	10-Year	25-Year	50-Year	100-Year
SC240A	100	132	170	215
SC240B	93	135	171	207
SC240C	40	58	72	87
SC240D	46	65	82	98
SC240E	31	40	50	59
SC240F	20	25	31	37
SC240G	9	11	14	17
SC240H	10	13	17	20
SC240I	103	153	191	230

TABLE 6 COMPARISON OF 100 YEAR PEAK FLOWS (cfs)

	PHOENIX MOUNTAIN S-GRAPH	PHOENIX VALLEY S-GRAPH	CLARK	RATIONAL
SC240A	266	270	209	215
SC240B	232	247	188	207
SC240C	90	84	69	87
SC240D	100	93	97	98
SC240E	59	51	52	59
SC240F	37	34	25	37
SC240G	17	15	25	17
SC240H	23	20	25	20
SC240I	235	232	204	230
CP-D	372	381	319	

Table 3 has 317

5.0 FLOODPLAIN HYDRAULICS

A hydraulic analysis of the lower portion of Casandro Wash has been performed (downstream of Navajo Street, see Figure 3 on page 6). Cross-sections were derived from mapping that was compiled photogrammetrically from aerial photos by Aerial Mapping Company, Inc taken on June 18, 1993. Field surveys were also conducted to verify the topographic mapping.

5.1 Method Description

Water surface elevations for the 100-year recurrence interval (post-dam) were computed using COE HEC-2 Step Backwater Computer Program. The starting water surface elevation for Casandro Wash was determined using the HEC 5 Chart 1 (see computation in Appendix III) to determine the head (H) required for inlet control at the equipment pass at the railroad crossing as the control section. The equipment pass is a 10' x 10' concrete box culvert with wingwalls.

Cross Section locations used for the hydraulic analysis are shown on Figure 1 of Appendix III. The area immediately upstream (south) of the railroad crossing and west of Mohave Street is a naturally depressed area. The hydrologic modeling did not take into account any attentuation at this location. Because of the topography, this area ponds water before it is able to drain underneath the railroad tracks and therefore, it will not be removed from the floodplain by this project.

5.2 Parameter Estimation

Channel and overbank roughness factors (Manning's "n") used in the hydraulic computations were chosen by engineering judgement and were based on field observation of the stream and floodplain areas. The channel "n" values for the study area range from 0.020 to 0.030 and the overbank "n" values range from 0.040 to 0.70. A Manning's "n" of 0.012 was used for all finished concrete structures.

5.3 Floodplain Modeling

The hydraulic analysis for this study was based on unobstructed flow. Flow profiles were not compared to historical events since no information exists with which to make this comparison. The low-flow crossings at Mariposa Drive and Cucaracha Street were analysed using Tables from HEC 5 and found to be capable of passing the principal discharges from the dam without overtopping the roadways (See Appendix III). Because the low-flow culverts at Mariposa Drive and Cucaracha Street and the existing wash between the dam and Navajo Street can handle the principal discharges, this stretch of the wash was not included in the outfall project.

6.0 OUTFALL HYDRAULICS

The purpose of the outfall is to convey flows from Casandro Wash to the Sol's Wash, beginning at the intersection of Navajo and Jackson Streets. This will reduce the runoff that flows down Jackson and Mohave Streets. Because of the construction of a dam on Casandro Wash upstream of Navajo Street and the construction of this outfall system, the floodplain through this area will be reduced significantly. The proposed project requires the construction of an inlet structure to capture the flows from Casandro Wash. The inlet structure will be constructed downstream of the box culvert at Navajo Street and will prevent flows from entering the neighborhood streets. These flows from Casandro Wash will be captured by the inlet structure and will be conveyed through a storm drain system directly to Sols Wash. Stubouts for catch basins will be provided to capture local runoff from the streets; the stubout placements and catch basin sizing will be performed by the Town's engineer. The Town of Wickenburg intends to pave the roads after the storm drain is in place and construct the catch basins.

6.1 Inlet Structure

A grated inlet structure will be constructed to intercept the 50-year flows from Casandro Wash and from the swale next to the box culvert near the intersection of Navajo and Jackson Streets. A retaining wall will be constructed on the north side of the existing channel. The flows will be contained between the existing retaining wall on south side and the proposed retaining wall on the north side. The inlet structure will be constructed between these two retaining walls approximately 30' downstream (measured from the centerline of the box culvert) of the existing box culvert. This location has been selected to take advantage of the existing wall and the alignment of the box culvert. The channel invert between the outlet of the existing box culvert and the proposed inlet structure will be lined with concrete or shotcrete to prevent erosion.

The hydraulics of the inlet structure was based on weir flow equation and orifice equation listed below:

$$Q_{weir} = C*P*H^{(3/2)} \quad (1)$$

$$Q_{orifice} = C*A*(2*G*H)^{0.5} \quad (2)$$

Where,

Q= Discharge in cubic feet per second (cfs)

C = 3.0 for weir flow and 0.67 for orifice flow

P = Perimeter of grates in ft (actual perimeter x .75 for clogging).

A = Clear opening area of grate in sq-ft (actual perimeter x .5 for clogging)

g = 32.2 ft/sec^2

H = Head, depth of water in ft.

The Q is calculated based upon various depth of flow from the weir and orifice equations. The results were plotted on a graph with Q on the vertical axis vs. H on the horizontal axis (See Figure 1 & 2 in Appendix IV). The weir flow regime governs for the flows less than --cfs. The head required to convey 294 cfs (Q50) into the catch basin is x.0 ft based on using x grates (See Table , Appendix IV. Since the design HGL for the pipe is below ground, its HGL will not affect the operation of the catchbasin. The opening of the inlet consists of 8 - 4' x 3' grates to capture the design flow of 294 cfs.

The field investigation reveals that there is a sediment problem at the vicinity of the existing box culvert; after the dam is built upstream , the deposition of sediment will be reduced by a large amount. Also, the storm drain has been designed to flow at high velocities to carry the sediment load and promote self-cleaning. Although, the concept of building a sediment trap just upstream of the existing box culvert may be evaluated at a later date.

6.2 Storm Drain

Different alternatives were analyzed to convey the flows to Sols Wash: a single box culvert and dual pipe culvertsof different sizes. Four different design frequencies were analyzed for the above listed options: a 10-yr, 25-yr, 50-yr, and 100-yr. The HGL was analyzed for two different scenarios: 1) HGL began at Elevation 2060' assuming that

Sols Wash is flowing full, 2) HGL began at the average of critical depth and the height of box or pipe culvert plus the elevation of the storm drain outlet invert.

The hydrology for the Sol's Wash at Casandro Wash indicates that both wash's do not peak coincidentally. Therefore, the beginning HGL used for the preferred alternative assumed Sol's wash to be empty when Casandro Wash's 100-year event peaks. Hydraulic calculations for both assumptions and the final HGL elevations are attached in Appendix IV. These calculations are done for both concrete single box culvert and for the dual concrete pipe alternatives. The minimum cover used for the pipe is two feet and one foot for the box. In Appendix IV, Table 1 through 16 shows the HGL calculations, and table 17 and 18 are for cost comparisons.

6.3 Pipe Losses

The total losses through the pipe/box included friction losses, manhole losses, and bend losses. The total losses were calculated by summing fall of the above losses.

The friction losses were calculated by equation given below:

$$S_f = (Q * n)/(1.484 * A * R^{(2/3)}) \quad (3)$$

and

$$H_f = S_f * L \quad (4)$$

The manhole losses were calculated by equation given below:

$$H_m = K_m*(V^2/(2*g)) \quad (5)$$

where $K_m = .05$, $g = 32.2$ ft/sec^2.

The bend losses were calculated by the following equation:

$$H_b = K_b*(V^2/(2*g)) \quad (6)$$

where $K_b = 1.35$, $g = 32.2$ ft/sec^2.

The HGL has been kept minimum 1' below the ground. The inlet location and sizing has not been analyzed. The Town of Wickenberg intends to pave the streets in the vicinity of this project. Manholes will be provided every 500 feet to provide access for maintenance. The Town of Wickenburg may construct catchbasins along the outfall system to collect local runoff from the streets at a later date.

7.0 CONCLUSION AND RECOMMENDATIONS

Our recommendation is to convey the 50-yr event using dual concrete pipes.

The conclusion reached from this report is to provide enough capacity in the outfall system for the the 50-year runoff. The recommendation is that dual 48" pipes be installed to convey flows from Casandro Wash from the intersection of Navajo Street and Jackson Street to Sol's Wash. The flows in excess of the 50-year runoff will continue to flow along their historic path, Jackson and Mohave Streets, to Sol's Wash. A drop inlet should be constructed immediately downstream of the existing box culvert at Navajo Street to capture the flows. The inlet structure should allow for flows in excess of the design event to be directed back into the roadway. Connector pipes should be installed along the system so that the Town of Wickenburg may construct catch basins to collect surface runoff from events not greater than the 10-year storm.

The difference in cost of providing a storm drain system with the 25-year capacity (241 cfs) as opposed to the 50-year capacity (274 cfs) is only $10,000; the difference of flow is 33 cfs which relates to $300 per additional cfs. In order to handle the 100-year capacity (317 cfs), a concrete box culvert would be required. The concrete box culvert is almost twice the cost of dual concrete pipe for near the same level of protection, and jacking the box underneath the railroad would be more expensive than jacking pipe. The difference in the flows between the 50-year and the 100-year flows is only 43 cfs. The cost of providing the additional protection is $50,000 which relates to over $1100 per additional cfs.

Only a few homes along Mohave Street will be in the floodplain during the 100-year event with the outfall system carrying the 50-year discharge. The remainder of the flows not picked up by the outfall pipes will flow down the roadways; the additional expense of $50,000 more to provide 100-year capacity in the storm drain is not feasible. The few homes that will remain in the floodplain may have finished floor elevations above the 100-year water surface elevations; upon certification of their finished floors, the homes may be removed from the floodplain.

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10 U S Department of Commerce, Bureau of Public Roads; Hydraulic Engineering Circular No. 5; April, 1964.

11 Yost and Gardiner Engineers; Casandro Wash, Wickenburg, Arizona, Alternatives For Flood Control; October 22, 1980.

APPENDIX I - DRAINAGE AREA MAP

APPENDIX II - HYDROLOGIC DATA

APPENDIX- II

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LAND USE CLASSIFICATION

Table #.# Classification of Zoning Types for Estimation of Imperviousness

Gilbert-Chandler ADMS Land Use Category	Impervious Area (percent)	Gilbert Zoning Unit	Gilbert Description	Chandler Zoning Unit	Chandler Description	Mesa Zoning Unit	Mesa Description	Tempe Zoning Unit	Tempe Description
Agriculture	0	AG	Agriculture	AG-1	Agriculture	AG	Agriculture	AG	Agriculture
Very Low Density Residential	15					R1-90	Single Residence		
						SR	Suburban Ranch		
		R1-43	Rural						
Low Density Residential	25	R1-35	Rural Residential	SF-33	Single Family	R1-35	Single Residence		
		R1-20	SF, Residential	SF-18	Single Family				
		R1-15	" "			R1-15	Single Residence	R1-15	One Family Residential
Medium Density Residential	45	R1-10	" "	SF-10	Single Family	R1-9	Single Residence	R1-10	One Family Residential
		R1-8	" "					R1-8	One Family Residential
		R1-7	" "	SF-7	Single Family	R1-7	Single Residence	R1-7	One Family Residential
						R1-6	Single Residence	R1-6	One Family Residential
						TCR-1	Town Center, Single Family	RO	Residence/Office
Multiple Family Residential	65	R-2	Duplex	MF-1	Medium Density	R-2	Restricted Multiple Residence	R-2	Multi-Family Residential
		R-3	Multi-Family, Apartments	MF-2	Multi-Family	R-3	Limited Multiple Residence	R-3R	Multi-Family Restricted
		R-4	Multi-Family, General	MF-3	High Density	R-4	General Multiple Residence	R-3	Multi-Family Limited
		R-5	Townhouse Residential					R-4	Multi-Family General
								R-Th	Townhouse
		MH	Mobile Home	MH-1	Mobile Homes	TCR-2	TC, Restricted Multi-Res.	RMH	Mobile Home Residence
		CTP	Commercial Trailer Park			TCR-3	TC, General Res.	MHS	Manufactured Housing Subdivision
								TP	Trailer Park
Industrial	75	I-1	Garden Type Industrial			M-1	Limited Industrial	I-1	Light Industrial
		I-2	Light Industrial	I-1	Light Industrial			I-2	General Industrial
		I-3	General Industrial	I-2	General Industrial	M-2	General Industrial	I-3	Heavy Industrial
Commercial	90	C-1	Light Commercial	C-1	Neighborhood Commercial	C-1	Neighborhood Commercial	CCR	Convenience Commercial
		C-2	General Commercial	C-2	Community Commercial	C-2	Limited Commercial	C-1	Neighborhood Commercial
		C-3	Central Commercial	C-3	Regional Comercial	C-3	General Commercial	C-2	General Commercial
		RS	Residential Services			OS	Office-Sercives	CCD	Central Commercial District
		RCC	Residential Conveniences			TCC	TC,High Intensity Mixed Use		
						TCB-1	TC, Limited Comm./General Manufacturing		
						TCB-2	TC, General Comm./ Light Manufacturing		
		MISCELLANEOUS CATEGORIES: These map units should be evaluated on a case by case basis.							
		PAD	Planned Area Development	PAD	Planned Area Development			S	Private School
		PSC-1	Planned Neighborhood Shopping						
		PSC-2	Planned Shopping Center						
		IB	Industrial Buffer						
				PCO	Planned C Offices	PEP	Planned Employment Park		
						PF	Public Facilities		

Table #.# Classification of Zoning Types for Estimation of Imperviousness

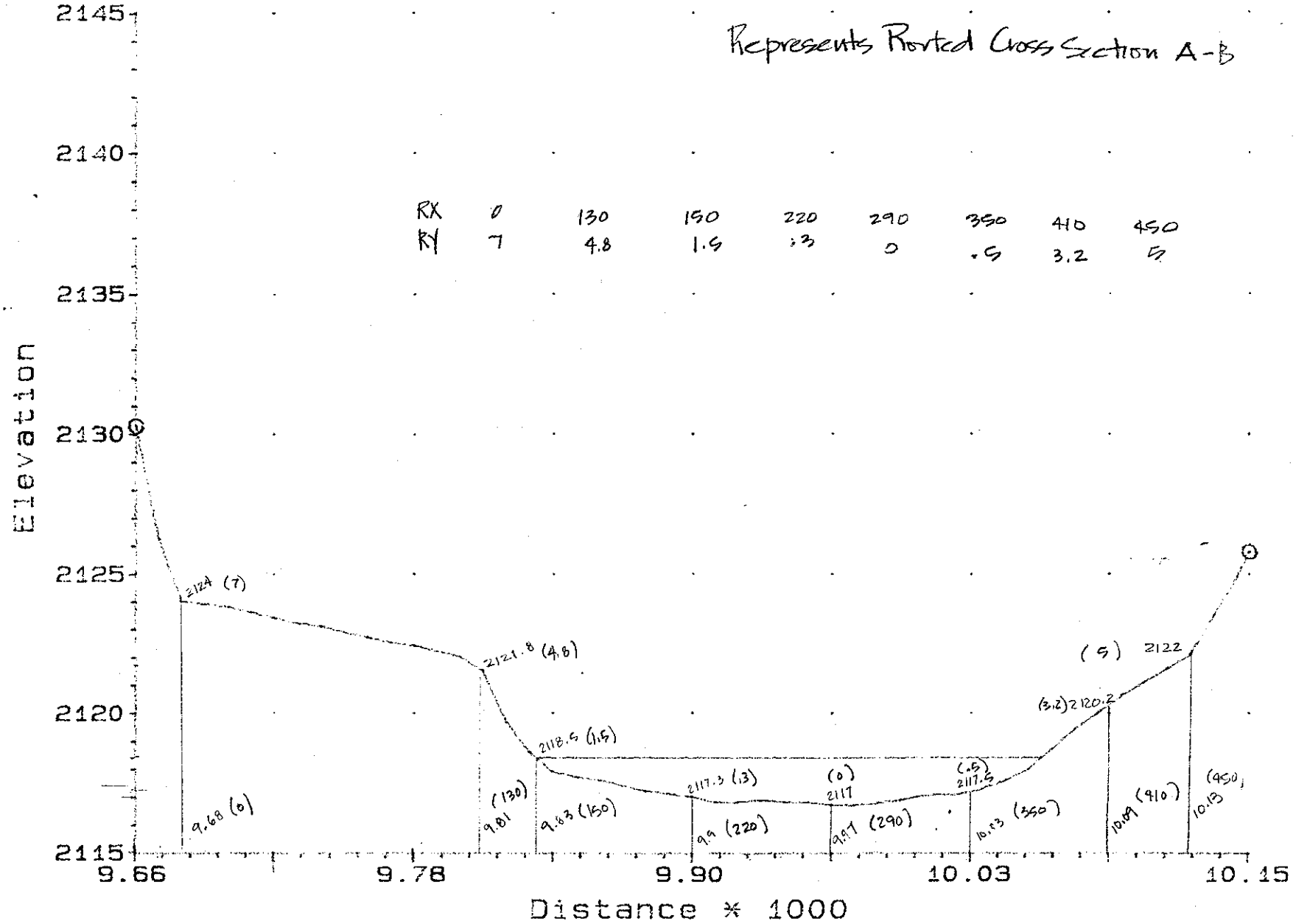
Gilbert-Chandler ADMS Land Use Category	Impervious Area (percent)	County Zoning Unit	Description	Phoenix Zoning Unit	Description	Cave Creek FIS % Imp. Area (including R.O.W.)
Agriculture	0					
Very Low Density Residential	15	RURAL-190	190,000 sq. ft./dwelling unit	S-1	Ranch or Farm Residential, > 1 acre	15
		RURAL-70	70,000 sq. ft./dwelling unit	S-2	Ranch or Farm Commercial	(18) — 18
		RURAL-43	one acre/dwelling unit	RE-43	Single Family, 1 acre minimum	20
Low Density Residential	25	R1-35	Single Family Residential,	RE-35	SF, 35,000 sq.ft min.	22
			35,000 sq. ft./dwelling unit	RE-24	SF, 24,000 sq.ft min.	25 — 25
		R1-18	SFR, 18,000 sq. ft./unit	R1-18	SF, 18,000 sq.ft min.	25
				R1-14	SF, 14,000 sq.ft min.	30
Medium Density Residential	45	R1-10	SFR, 10,000 sq. ft./unit	R1-10	SF, 10,000 sq.ft min.	38
		R1-8	SFR, 8,000 sq. ft./unit	R1-8	SF, 8,000 sq.ft min.	45
						— 50
		R1-6	SFR, 6,000 sq. ft./unit	R1-6	SF, 6,000 sq.ft min.	50
				R-O	Res. Office	50
Multiple Family Residential	65	R-2	2 Family Residence	R-2	MF, 4,000 sq.ft./unit	60
		R-3	Multiple Family, Residential	R-3	MF, 3,000 sq.ft./unit	65
		R-4	Multiple Family, Residential	R-4	MF, 1,500 sq.ft./unit	65
		R-5	Multiple Family, Residential	R-4A	MF, 1,000 sq.ft./unit	70
				R-5	MF, 1,000 sq.ft./unit	70
		MHR	Manufactured Housing, Residential	CP/BP	Business Park	65
				R-H	Resort District	65
Industrial	75			IND PARK	Industrial Park	75
		I-2	Light Industrial	A-1	Light Industrial	75
		I-3	Heavy Industrial	A-2	Heavy Industrial	75
Commercial	90	C-1	Neighborhood Commercial	C-1	Neighborhood Commercial	95
		C-2	Intermediate Commercial	C-2	Intermediate Commercial	95
		C-3	General Commercial	C-3	General Commercial	95
		C-O	Commercial Office	C-O	Commercial Office	75
				HR	High Rise District	85
		MISCELLANEOUS CATEGORIES: These map units should be evaluated on a case by case basis.				
		PD	Planned Development Overlay	PAD	Planned Area Development	85
		CS	Planned Shopping Center	PSC	Planned Shopping Center	85
		SU	Special Uses			
		SC	Senior Citizen Overlay	PCD	Planned Community Development	60
		NUP	Neighborhood Plan of Development			
		RUP	Residential Plan of Development			
		IUP	Industrial Plan of Development			
				R.O.W.	Right of Way	VARIABLE
				P-1	Parking, Open	VARIABLE
				P-2	Parking, Structures	VARIABLE
				D.G	Dwelling Group	85

HEC-2 CROSS SECTIONS
FOR
ROUTING REACHES

Cross-section 1.469 (#42)

Represents Rorted Cross Section A-B

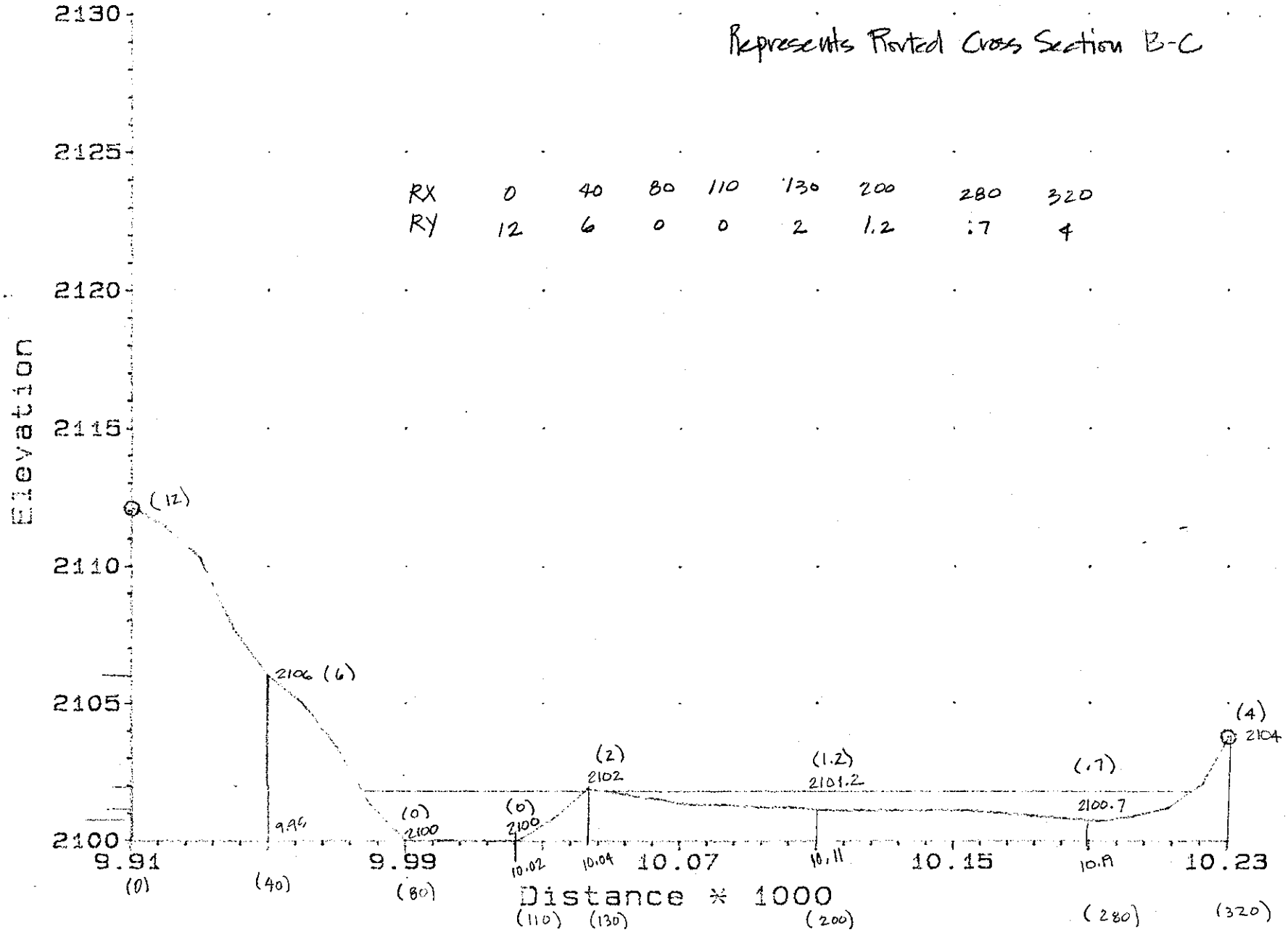
RX	0	130	150	220	290	350	410	450
RY	7	4.8	1.5	.3	0	.5	3.2	5

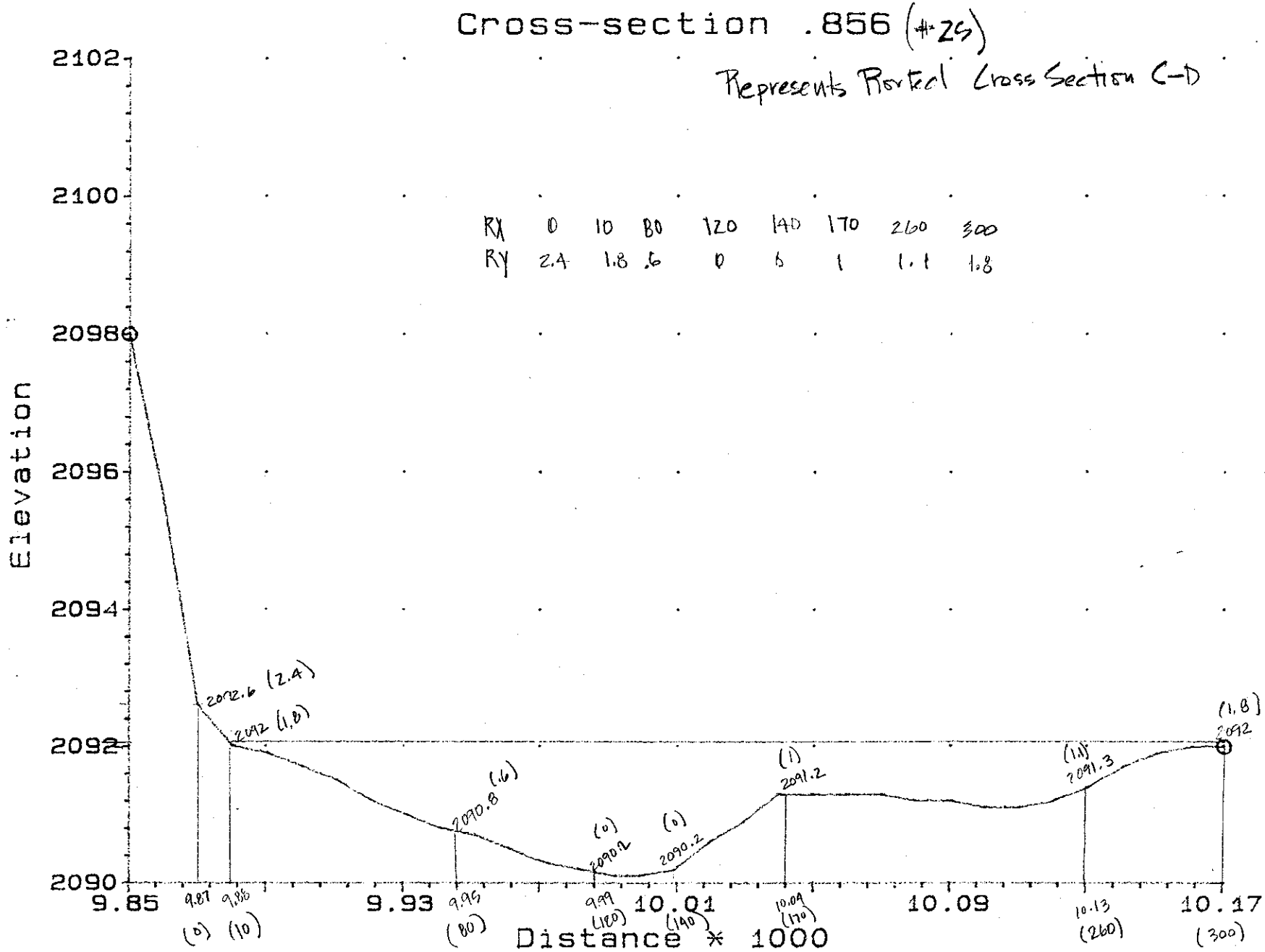


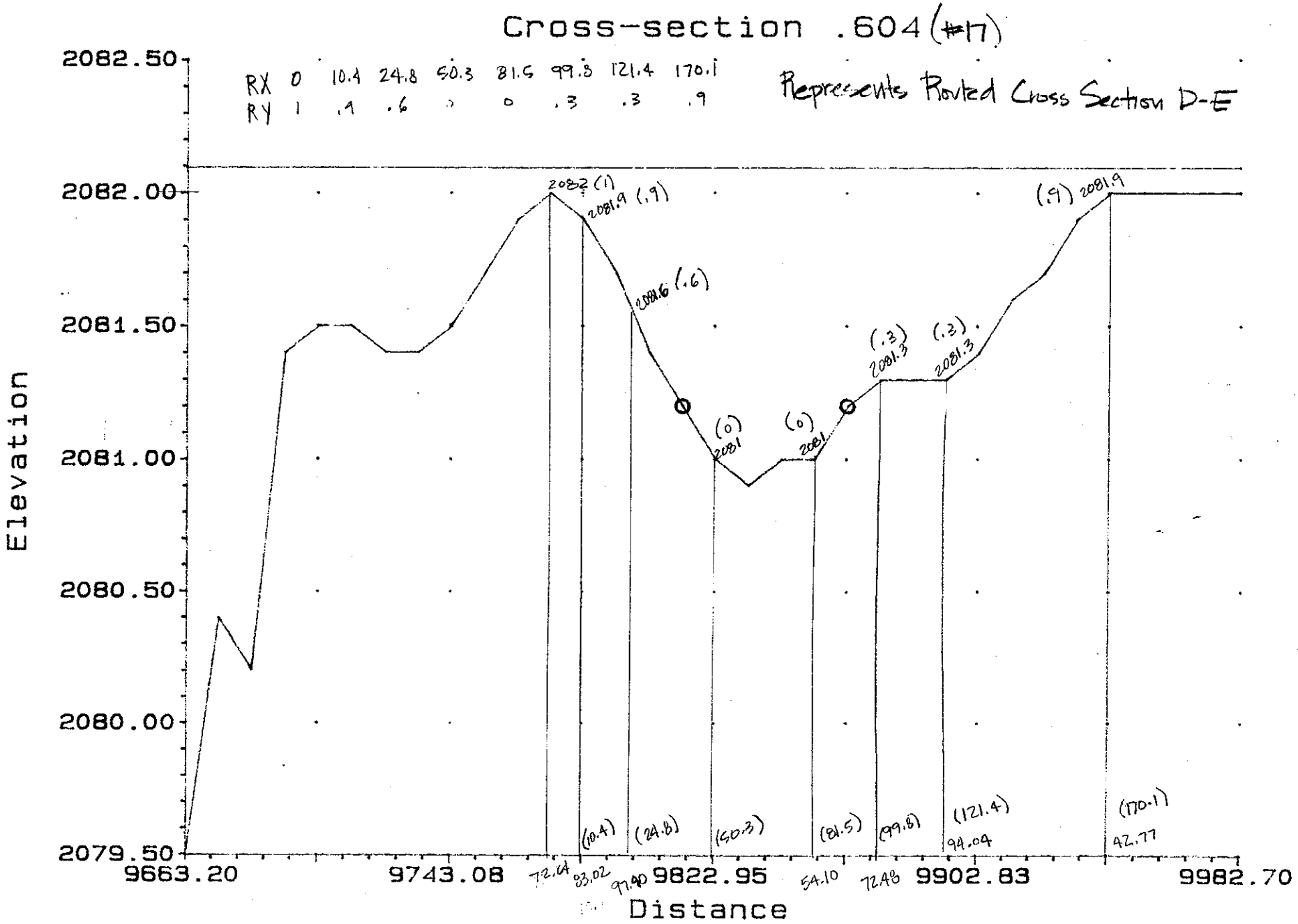
Cross-section 1.107 (#31)

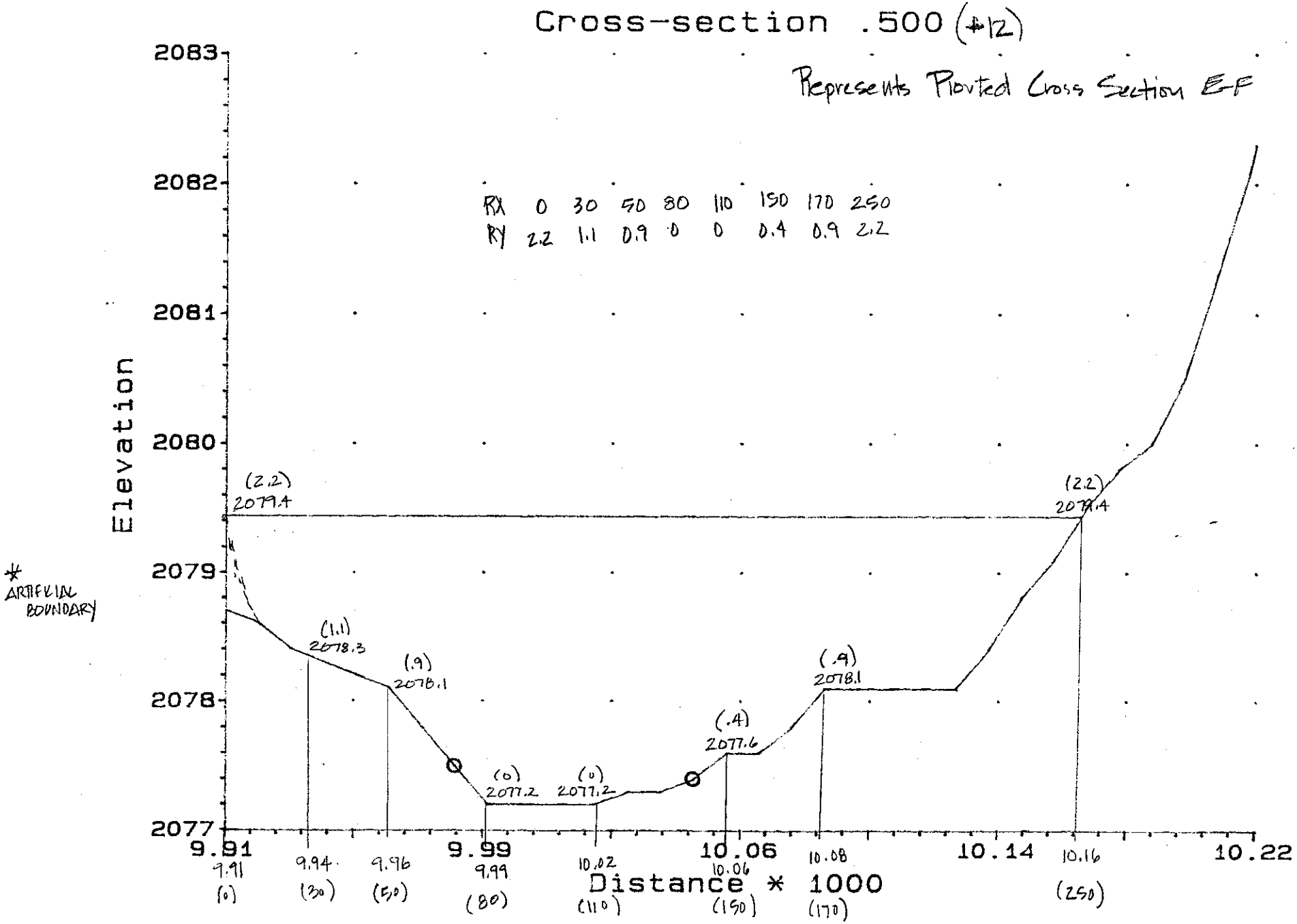
Represents Routed Cross Section B-C

RX	0	40	80	110	130	200	280	320
RY	12	6	0	0	2	1.2	.7	4




Cross-section .856 (#25)
Represents Partial Cross Section C-D
RX 0 10 80 120 140 170 260 300
RY 2.4 1.8 .6 0 0 1 1.1 1.8
Elevation
2102
2100
2098
2096
2094
2092
2090
9.85
9.87
9.89
9.93
9.95
9.99
10.01
10.09
10.13
10.17
Distance * 1000
(0)
(10)
(80)
(100)
(140)
(170)
(260)
(300)
2092.6 (2.4)
2092 (1.8)
2090.8 (.6)
2090.2 (0)
2090.2 (0)
2091.2 (1)
2091.3 (1.1)
2092 (1.8)

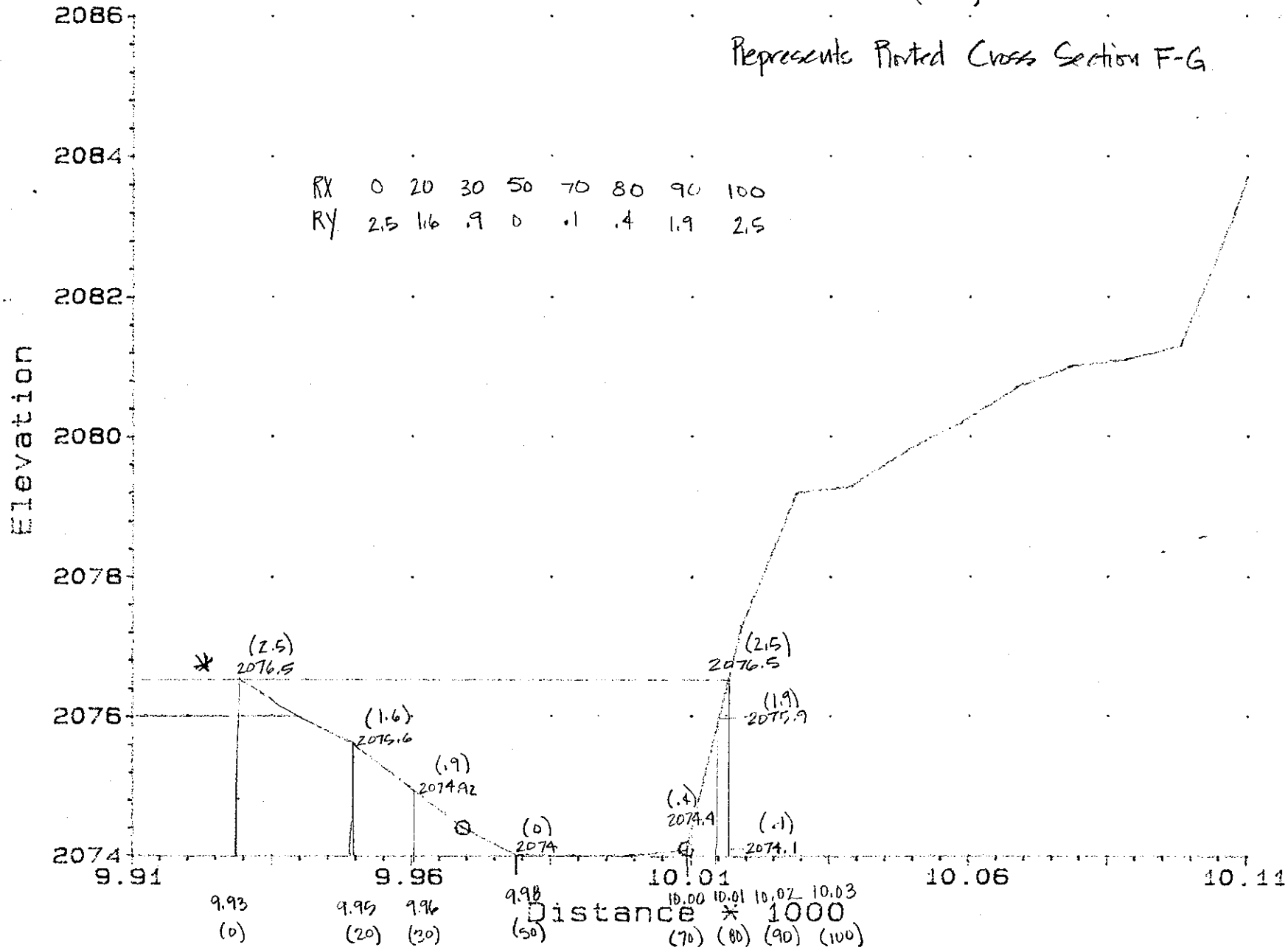

Cross-section .604 (#17)
RX 0 10.4 24.8 50.3 81.5 99.8 121.4 170.1
RY 1 .9 .6 0 0 .3 .3 .9
Represents Routed Cross Section D-E
2082.50
2082.00
2081.50
2081.00
2080.50
2080.00
2079.50
Elevation
9663.20
9743.08
9822.95
9902.83
9982.70
Distance
2082 (1)
2081.9 (.9)
2081.6 (.6)
(0) 2081
(0) 2081
(.3) 2081.3
(.3) 2081.3
(.9) 2081.9
(10.4)
(24.8)
(50.3)
(81.5)
(99.8)
(121.4)
(170.1)
72.14
83.02
97.40
54.10
72.48
94.09
42.77


Cross-section .500 (#12)
Represents Plotted Cross Section E-F
RX 0 30 50 80 110 150 170 250
RY 2.2 1.1 0.9 0 0 0.4 0.9 2.2
Elevation
2083
2082
2081
2080
2079
2078
2077
(2.2) 2079.4
(1.1) 2078.3
(.9) 2078.1
(0) 2077.2
(0) 2077.2
(.4) 2077.6
(.9) 2078.1
(2.2) 2079.4
* ARTIFICIAL BOUNDARY
9.91 9.94 9.96 9.99 10.02 10.06 10.08 10.14 10.16 10.22
9.91 (0) 9.94 (30) 9.96 (50) 9.99 (80) (110) 10.06 (150) (170) (250)
Distance * 1000

Cross-section .418(#10)

Represents Plotted Cross Section F-G

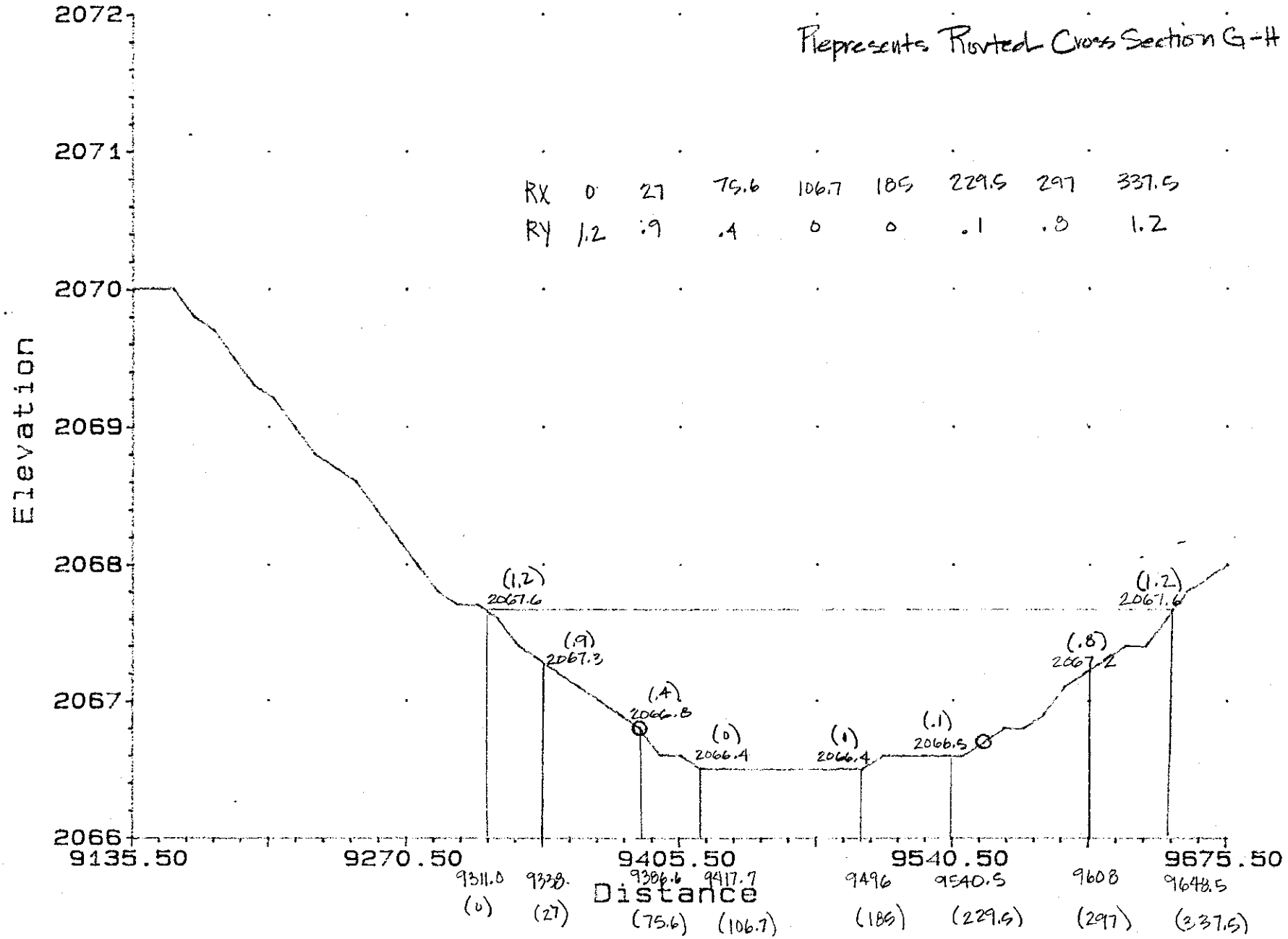
RX	0	20	30	50	70	80	90	100
RY	2.5	1.6	.9	0	.1	.4	1.9	2.5

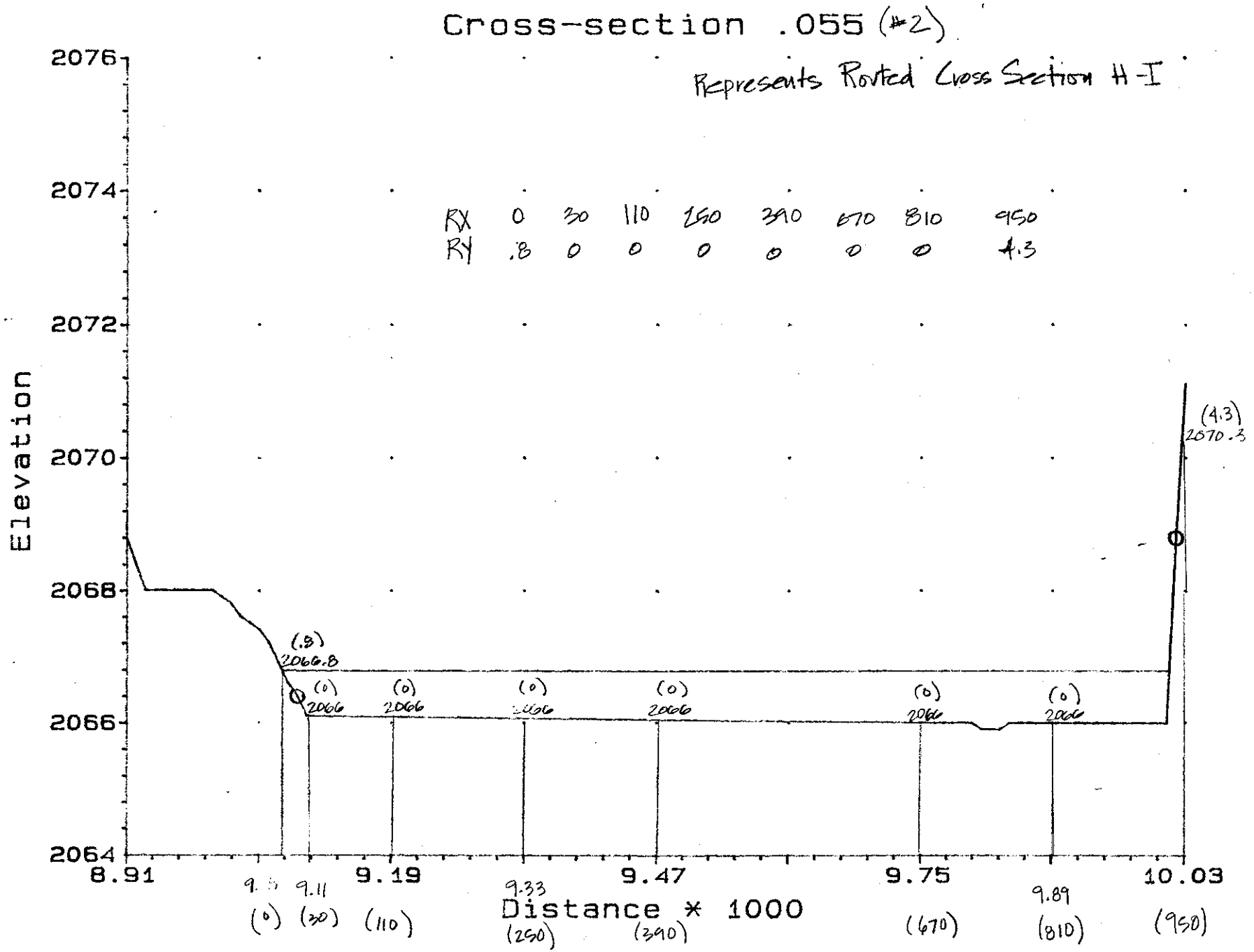


Cross-section .217 (#5)

Represents Routed Cross Section G-H

RX	0	27	75.6	106.7	185	229.5	297	337.5
RY	1.2	.9	.4	0	0	.1	.8	1.2




Cross-section .055 (#2)
Represents Routed Cross Section H-I
RX 0 30 110 250 390 670 810 950
RY .8 0 0 0 0 0 0 4.3
(.8) 2066.8
(0) 2066
(0) 2066
(0) 2066
(0) 2066
(0) 2066
(0) 2066
(4.3) 2070.3
Elevation
2076
2074
2072
2070
2068
2066
2064
8.91
9.11
9.19
9.33
9.47
9.75
9.89
10.03
Distance * 1000
(0) (30) (110) (250) (390) (670) (810) (950)

```
T1NOTE CROSS SECTIONS ARE READ FROM Left to Right
T2[redacted]T LOOKING DOWNSTREAM
T3CASANDRO WASH
J1                                                                  1000
J2      1                -1
NC  .045     .045     .035
X1  .000        59  9775.2 10020.0
GR2068.7  9155.2  2068.4  9165.2  2068.2  9175.2  2068.1  9185.2  2067.9  9195.2
GR2067.6  9205.2  2067.7  9215.2  2068.0  9225.2  2067.5  9235.2  2067.0  9245.2
GR2067.1  9255.2  2067.3  9265.2  2067.5  9275.2  2067.2  9295.2  2066.8  9305.2
GR2066.6  9315.2  2066.6  9325.2  2066.5  9335.2  2066.3  9345.2  2066.1  9355.2
GR2066.0  9365.2  2066.0  9375.2  2066.0  9385.2  2066.0  9395.2  2066.0  9755.2
GR2066.0  9765.2  2066.0  9775.2  2065.9  9785.2  2065.6  9795.2  2065.3  9805.2
GR2065.0  9815.2  2064.7  9825.2  2064.3  9835.2  2064.4  9845.2  2064.4  9855.2
GR2064.4  9865.2  2064.4  9875.2  2064.5  9885.2  2064.5  9895.2  2064.5  9905.2
GR2064.4  9915.2  2064.4  9925.2  2064.4  9935.2  2064.3  9945.2  2064.3  9955.2
GR2064.1  9965.2  2064.0  9975.2  2064.0  9985.2  2064.0  9995.2  2064.0 10000.0
GR2064.0 10010.0  2065.1 10020.0  2066.6 10030.0  2067.8 10040.0  2068.4 10050.0
GR2068.9 10060.0  2069.6 10070.0  2071.1 10080.0  2072.8 10090.0
X1  .055        48  9094.2   10020     300     270     290
GR2068.8  8914.2  2068.4  8924.2  2068.0  8934.2  2068.0  8944.2  2068.0  8954.2
GR2068.0  8964.2  2068.0  8974.2  2068.0  8984.2  2068.0  8994.2  2068.0  9004.2
GR2067.9  9014.2  2067.8  9024.2  2067.6  9034.2  2067.5  9044.2  2067.4  9054.2
GR2067.2  9064.2  2066.9  9074.2  2066.6  9084.2  2066.4  9094.2  2066.1  9104.2
GR2066.0  9764.2  2066.0  9774.2  2066.0  9784.2  2066.0  9794.2  2066.0  9804.2
GR2065.9  9814.2  2065.9  9824.2  2065.9  9834.2  2066.0  9844.2  2066.0  9854.2
GR2066.0  9864.2  2066.0  9874.2  2066.0  9884.2  2066.0  9894.2  2066.0  9904.2
GR2066.0  9914.2  2066.0  9924.2  2066.0  9934.2  2066.0  9944.2  2066.0  9954.2
GR2066.0  9964.2  2066.0  9974.2  2066.0  9984.2  2066.0  9994.2  2066.0 10000.0
GR2066.0 10010.0  2068.8 10020.0  2071.1 10030.0
X1  .098        95  9123.4  9953.4     240     192     225
GR2067.1  9063.4  2067.0  9073.4  2066.9  9083.4  2066.7  9093.4  2066.6  9103.4
GR2066.5  9113.4  2066.3  9123.4  2066.0  9133.4  2066.0  9143.4  2066.0  9153.4
GR2066.0  9163.4  2066.0  9173.4  2066.0  9183.4  2066.0  9193.4  2066.0  9203.4
GR2066.0  9213.4  2066.0  9223.4  2066.0  9233.4  2066.0  9243.4  2066.0  9253.4
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GR2066.6 10010.0  2066.8 10020.0  2066.9 10030.0  2067.3 10040.0  2067.8 10050.0
X1  .137        75  9184.8  9844.8     200     210     210
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X1  .178        80  9346.7  9716.7     215     210     215
GR2069.7  9166.7  2069.3  9176.7  2068.8  9186.7  2068.2  9196.7  2067.9  9206.7
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GR2067.2  9266.7  2067.1  9276.7  2067.0  9286.7  2066.9  9296.7  2066.7  9306.7
GR2066.6  9316.7  2066.5  9326.7  2066.4  9336.7  2066.3  9346.7  2066.2  9356.7
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GR2066.8  9816.7  2066.9  9826.7  2067.0  9836.7  2067.2  9846.7  2067.3  9856.7
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	GR2067.4	9866.7	2067.5	9876.7	2067.7	9886.7	2067.8	9896.7	2067.9	9906.7
	GR2068.0	9916.7	2068.0	9926.7	2068.0	9936.7	2067.9	9946.7	2067.9	9956.7
#5	X1 .217	50	9385.5	9555.5	215	200	205			
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	GR2069.5	9185.5	2069.3	9195.5	2069.2	9205.5	2069.0	9215.5	2068.8	9225.5
	GR2068.7	9235.5	2068.6	9245.5	2068.4	9255.5	2068.2	9265.5	2068.0	9275.5
	GR2067.8	9285.5	2067.7	9295.5	2067.7	9305.5	2067.6	9315.5	2067.4	9325.5
	GR2067.3	9335.5	2067.2	9345.5	2067.1	9355.5	2067.0	9365.5	2066.9	9375.5
	GR2066.8	9385.5	2066.6	9395.5	2066.6	9405.5	2066.5	9415.5	2066.5	9425.5
	GR2066.5	9485.5	2066.5	9495.5	2066.6	9505.5	2066.6	9515.5	2066.6	9525.5
	GR2066.6	9535.5	2066.6	9545.5	2066.7	9555.5	2066.8	9565.5	2066.8	9575.5
	GR2066.9	9585.5	2067.1	9595.5	2067.2	9605.5	2067.3	9615.5	2067.4	9625.5
	GR2067.4	9635.5	2067.6	9645.5	2067.8	9655.5	2067.9	9665.5	2068.0	9675.5
#6	X1 .256	60	9793.2	10234.1	205	200	205			
	GR2070.0	9193.2	2069.6	9203.2	2069.3	9213.2	2069.1	9223.2	2068.9	9233.2
	GR2068.7	9243.2	2068.6	9253.2	2068.4	9263.2	2068.2	9273.2	2068.1	9283.2
	GR2068.1	9293.2	2068.1	9303.2	2068.1	9313.2	2068.1	9323.2	2068.1	9333.2
	GR2068.1	9343.2	2068.1	9353.2	2068.1	9363.2	2068.1	9373.2	2068.1	9383.2
	GR2068.1	9393.2	2068.1	9403.2	2068.1	9413.2	2068.0	9423.2	2068.0	9433.2
	GR2068.0	9443.2	2067.9	9453.2	2067.9	9463.2	2067.9	9473.2	2067.9	9483.2
	GR2067.9	9493.2	2068.0	9503.2	2068.1	9513.2	2068.1	9523.2	2068.1	9533.2
	GR2068.1	9543.2	2068.1	9553.2	2068.1	9563.2	2068.1	9573.2	2068.1	9583.2
	GR2068.1	9593.2	2068.1	9603.2	2068.1	9613.2	2068.3	9623.2	2068.5	9633.2
	GR2068.8	9643.2	2069.0	9653.2	2069.2	9663.2	2069.3	9673.2	2069.5	9683.2
	GR2069.7	9693.2	2069.9	9703.2	2070.1	9713.2	2070.4	9723.2	2070.7	9733.2
	GR2071.0	9743.2	2071.0	9753.2	2071.0	9763.2	2071.0	9773.2	2071.1	9783.2
#7	X1 .297	60	9266.8	9416.8	220	220	220			
	GR2070.1	9206.8	2069.7	9216.8	2069.4	9226.8	2069.1	9236.8	2068.8	9246.8
	GR2068.5	9256.8	2068.2	9266.8	2068.1	9276.8	2068.1	9286.8	2068.1	9296.8
	GR2068.1	9306.8	2068.1	9316.8	2068.1	9326.8	2068.1	9336.8	2068.1	9346.8
	GR2068.1	9356.8	2068.1	9366.8	2068.1	9376.8	2068.1	9386.8	2068.1	9396.8
	GR2068.1	9406.8	2068.2	9416.8	2068.4	9426.8	2068.6	9436.8	2068.8	9446.8
	GR2069.0	9456.8	2069.3	9466.8	2069.5	9476.8	2069.5	9486.8	2069.5	9496.8
	GR2069.5	9506.8	2069.5	9516.8	2069.5	9526.8	2069.5	9536.8	2069.6	9546.8
	GR2069.7	9556.8	2069.7	9566.8	2069.8	9576.8	2070.0	9586.8	2070.1	9596.8
	GR2070.1	9606.8	2070.1	9616.8	2070.1	9626.8	2070.1	9636.8	2070.2	9646.8
	GR2070.2	9656.8	2070.2	9666.8	2070.6	9676.8	2070.9	9686.8	2071.3	9696.8
	GR2071.7	9706.8	2072.0	9716.8	2072.0	9726.8	2072.0	9736.8	2072.0	9746.8
	GR2072.0	9756.8	2072.0	9766.8	2072.0	9776.8	2072.0	9786.8	2072.0	9796.8
#8	X1 .337	38	9596.0	9696.0	195	240	210			
	GR2076.4	9526.0	2074.8	9536.0	2072.6	9546.0	2072.4	9556.0	2072.4	9566.0
	GR2072.2	9576.0	2072.3	9586.0	2072.3	9596.0	2072.2	9606.0	2072.2	9616.0
	GR2072.1	9626.0	2072.0	9636.0	2072.0	9646.0	2072.0	9656.0	2072.0	9666.0
	GR2072.0	9676.0	2072.2	9686.0	2072.3	9696.0	2072.4	9706.0	2072.5	9716.0
	GR2072.6	9726.0	2072.7	9736.0	2072.8	9746.0	2072.8	9756.0	2072.8	9766.0
	GR2072.9	9776.0	2072.9	9786.0	2073.0	9796.0	2073.1	9806.0	2073.2	9816.0
	GR2073.4	9826.0	2073.5	9836.0	2073.6	9846.0	2073.7	9856.0	2073.8	9866.0
	GR2073.8	9876.0	2073.8	9886.0	2073.8	9896.0				
#9	X1 .376	69	9533.2	10020.0	230	175	205			
	GR2084.0	9463.2	2083.1	9473.2	2081.8	9483.2	2080.4	9493.2	2079.0	9503.2
	GR2077.4	9513.2	2075.5	9523.2	2074.0	9533.2	2073.7	9543.2	2073.3	9553.2
	GR2073.2	9563.2	2073.3	9573.2	2073.2	9583.2	2073.2	9593.2	2073.1	9603.2
	GR2073.0	9613.2	2073.0	9623.2	2073.0	9633.2	2073.1	9643.2	2073.1	9653.2
	GR2073.1	9663.2	2073.2	9673.2	2073.3	9683.2	2073.4	9693.2	2073.5	9703.2
	GR2073.6	9713.2	2073.8	9723.2	2073.9	9733.2	2073.9	9743.2	2074.0	9753.2
	GR2074.0	9763.2	2074.0	9773.2	2074.0	9783.2	2074.1	9793.2	2074.1	9803.2
	GR2074.2	9813.2	2074.2	9823.2	2074.2	9833.2	2074.2	9843.2	2074.1	9853.2
	GR2074.1	9863.2	2074.0	9873.2	2074.0	9883.2	2074.0	9893.2	2074.0	9903.2
	GR2074.0	9913.2	2074.0	9923.2	2074.0	9933.2	2074.0	9943.2	2074.0	9953.2
	GR2074.0	9963.2	2073.5	9973.2	2072.3	9983.2	2072.3	9993.2	2072.3	10000.0
	GR2073.1	10010.0	2074.3	10020.0	2074.7	10030.0	2075.0	10040.0	2075.3	10050.0
	GR2075.6	10060.0	2075.9	10070.0	2076.3	10080.0	2076.7	10090.0	2077.1	10100.0
	GR2077.6	10110.0	2078.0	10120.0	2079.1	10130.0	2080.0	10136.6		
#10	X1 .418	23	9969.5	10010	225	210	220			
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	GR2075.0	9959.5	2074.4	9969.5	2074.0	9979.5	2074.0	9989.5	2074.0	9999.5
	GR2074.0	10000.0	2074.1	10010.0	2077.3	10020.0	2079.2	10030.0	2079.3	10040.0
	GR2079.8	10050.0	2080.2	10060.0	2080.7	10070.0	2081.0	10080.0	2081.1	10090.0
	GR2081.3	10100.0	2083.2	10110.0	2083.7	10112.3				
#11	X1 .456	28	9968.0	10020	195	205	200			
	GR2077.3	9908.0	2077.1	9918.0	2077.0	9928.0	2076.8	9938.0	2076.6	9948.0
	GR2076.4	9958.0	2076.2	9968.0	2076.0	9978.0	2076.0	9988.0	2076.0	9998.0
	GR2076.0	10000.0	2076.0	10010.0	2076.8	10020.0	2078.4	10030.0	2079.0	10040.0
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#12	X1 .500	34	9977.4	10050	260	210	235			
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	GR2078.1	9957.4	2077.8	9967.4	2077.5	9977.4	2077.2	9987.4	2077.2	9997.4
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	GR2077.4	10050.0	2077.6	10060.0	2077.6	10070.0	2077.8	10080.0	2078.1	10090.0

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GR2078.1 10100.0  2078.1 10110.0  2078.1 10120.0  2078.1 10130.0  2078.4 10140.0
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#13 X1  .534      42   10040   10100     550      50     180
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#15 X1  .559      73   9667.5 10366.2     620      50     130
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GR2082.1 10302.7  2082.4 10312.7  2082.6 10322.7  2082.8 10332.7  2083.1 10342.7
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GR2081.5  9713.2  2081.4  9723.2  2081.4  9733.2  2081.5  9743.2  2081.7  9753.2
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GR2081.2  9813.2  2081.0  9823.2  2080.9  9833.2  2081.0  9843.2  2081.0  9853.2
GR2081.2  9863.2  2081.3  9873.2  2081.3  9883.2  2081.3  9893.2  2081.4  9903.2
GR2081.6  9913.2  2081.7  9923.2  2081.9  9933.2  2082.0  9943.2  2082.0  9953.2
GR2082.0  9972.7  2082.0  9982.7
#19 X1  .650      65   9669.6  9749.6     230     120     240
GR2079.9  9659.6  2080.4  9669.6  2081.0  9679.6  2081.5  9689.6  2082.0  9699.6
GR2082.0  9709.6  2082.0  9719.6  2082.0  9729.6  2082.0  9739.6  2082.3  9749.6
GR2082.5  9759.6  2082.8  9769.6  2083.1  9779.6  2083.1  9789.6  2083.1  9799.6
GR2083.1  9809.6  2083.2  9819.6  2083.2  9829.6  2083.3  9839.6  2083.3  9849.6
GR2083.5  9859.6  2083.7  9869.6  2083.9  9879.6  2084.0  9889.6  2084.1  9899.6
GR2084.3  9909.6  2084.3  9919.6  2084.4  9929.6  2084.4  9939.6  2084.4  9949.6
GR2084.5  9959.6  2084.5  9969.6  2084.8  9979.6  2084.5  9989.6  2084.2  9999.6
GR2084.3 10000.0  2085.0 10010.0  2084.7 10020.0  2084.2 10030.0  2084.1 10040.0
GR2084.0 10050.0  2084.0 10060.0  2084.0 10070.0  2084.0 10080.0  2084.0 10090.0
GR2084.1 10100.0  2084.1 10110.0  2084.1 10120.0  2084.1 10130.0  2084.1 10140.0
GR2084.1 10150.0  2084.1 10160.0  2084.1 10170.0  2084.1 10180.0  2084.2 10190.0
GR2084.3 10200.0  2084.5 10210.0  2084.6 10220.0  2084.8 10230.0  2085.0 10240.0
GR2085.2 10250.0  2085.5 10260.0  2085.7 10270.0  2086.0 10280.0  2086.1 10285.3
#20 X1  .666      46   9818.8 10260.0      85      90      85
GR2088.6  9818.8  2089.5  9828.8  2089.3  9838.8  2089.0  9848.8  2088.8  9858.8
GR2088.6  9868.8  2088.6  9878.8  2088.8  9888.8  2088.9  9898.8  2089.0  9908.8
GR2088.4  9918.8  2087.7  9928.8  2087.7  9938.8  2086.6  9948.8  2086.6  9958.8
GR2086.3  9968.8  2086.1  9978.8  2086.1  9988.8  2086.1  9998.8  2086.1 10000.0
GR2085.9 10010.0  2085.6 10020.0  2085.3 10030.0  2084.9 10040.0  2084.6 10050.0
GR2084.5 10060.0  2084.5 10070.0  2084.5 10080.0  2084.5 10090.0  2084.6 10100.0
GR2084.5 10110.0  2084.5 10120.0  2084.5 10130.0  2084.5 10140.0  2084.6 10150.0
GR2084.6 10160.0  2084.6 10170.0  2084.7 10180.0  2084.7 10190.0  2084.8 10200.0
GR2084.9 10210.0  2085.1 10220.0  2085.3 10230.0  2085.6 10240.0  2085.8 10250.0
GR2086.1 10260.0
#21 X1  .690      47   9802.3 10256.8      50     200     130
GR2094.0  9802.3  2094.0  9812.3  2094.0  9822.3  2094.0  9832.3  2094.0  9842.3
GR2094.0  9852.3  2094.0  9862.3  2093.9  9872.3  2093.7  9882.3  2093.6  9892.3
GR2093.2  9902.3  2093.1  9912.3  2092.6  9922.3  2092.0  9932.3  2091.8  9942.3
GR2091.3  9952.3  2090.8  9962.3  2090.3  9972.3  2086.2  9982.3  2086.1  9992.3
GR2086.1 10000.0  2086.1 10010.0  2085.8 10020.0  2085.5 10030.0  2085.2 10040.0
GR2085.1 10050.0  2085.1 10060.0  2085.2 10070.0  2085.1 10080.0  2085.1 10090.0
GR2085.0 10100.0  2085.0 10110.0  2085.0 10120.0  2085.0 10130.0  2085.0 10140.0
GR2085.0 10150.0  2085.1 10160.0  2085.1 10170.0  2085.1 10180.0  2085.1 10190.0
GR2085.2 10200.0  2085.3 10210.0  2085.4 10220.0  2085.5 10230.0  2085.7 10240.0
GR2086.0 10250.0  2086.1 10256.8
#22 X1  .732      58   9690.5 10258.8      50     365     220
GR2080.1  9690.5  2083.5  9700.5  2088.5  9710.5  2093.0  9720.5  2097.2  9730.5
GR2100.0  9740.5  2100.0  9750.5  2100.0  9760.5  2100.0  9770.5  2100.0  9780.5
GR2100.0  9790.5  2100.0  9800.5  2100.0  9810.5  2100.0  9820.5  2100.0  9830.5
GR2100.0  9840.5  2100.0  9850.5  2100.0  9860.5  2100.0  9870.5  2099.9  9880.5
GR2099.6  9890.5  2099.3  9900.5  2099.1  9910.5  2098.9  9920.5  2098.7  9930.5
GR2098.5  9940.5  2098.3  9950.5  2098.1  9960.5  2098.1  9970.5  2091.8  9980.5
GR2087.9  9990.5  2087.2 10000.0  2086.4 10010.0  2086.1 10020.0  2086.1 10030.0
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     GR2086.1 10040.0  2086.1 10050.0  2086.0 10060.0  2086.0 10070.0  2085.9 10080.0
     GR2085.8 10090.0  2085.7 10100.0  2085.7 10110.0  2085.6 10120.0  2085.6 10130.0
     GR2085.6 10140.0  2085.6 10150.0  2085.6 10160.0  2085.6 10170.0  2085.5 10180.0
     GR2085.5 10190.0  2085.5 10200.0  2085.6 10210.0  2085.6 10220.0  2085.7 10230.0
     GR2085.7 10240.0  2085.9 10250.0  2086.1 10258.8
#23  X1  .774      62  9676.2 10277.4     165     265     220
     GR2100.0  9676.2  2100.3  9686.2  2100.6  9696.2  2100.8  9706.2  2101.0  9716.2
     GR2101.0  9726.2  2101.1  9736.2  2100.9  9746.2  2100.7  9756.2  2100.5  9766.2
     GR2100.2  9776.2  2100.0  9786.2  2100.0  9796.2  2100.0  9806.2  2100.0  9816.2
     GR2100.0  9826.2  2100.0  9836.2  2100.0  9846.2  2100.0  9856.2  2100.0  9866.2
     GR2100.0  9876.2  2100.0  9886.2  2099.9  9896.2  2099.0  9906.2  2098.9  9916.2
     GR2098.6  9926.2  2098.2  9936.2  2095.1  9946.2  2092.1  9956.2  2090.5  9966.2
     GR2089.7  9976.2  2088.4  9986.2  2088.1  9996.2  2088.1 10000.0  2087.8 10010.0
     GR2088.1 10020.0  2088.1 10030.0  2087.8 10040.0  2087.6 10050.0  2087.5 10060.0
     GR2087.3 10070.0  2087.2 10080.0  2087.1 10090.0  2087.1 10100.0  2087.2 10110.0
     GR2087.1 10120.0  2087.1 10130.0  2087.1 10140.0  2087.0 10150.0  2087.0 10160.0
     GR2087.0 10170.0  2087.0 10180.0  2087.1 10190.0  2087.2 10200.0  2087.3 10210.0
     GR2087.4 10220.0  2087.6 10230.0  2087.7 10240.0  2087.7 10250.0  2087.8 10260.0
     GR2087.9 10270.0  2088.0 10277.4
#24  X1  .814      38  9895.8 10256.8     190     225     215
     GR2096.1  9895.8  2093.1  9905.8  2091.4  9915.8  2090.5  9925.8  2090.1  9935.8
     GR2090.1  9945.8  2090.1  9955.8  2090.1  9965.8  2090.1  9975.8  2090.1  9985.8
     GR2090.1  9995.8  2090.1 10000.0  2090.1 10010.0  2090.0 10020.0  2090.1 10030.0
     GR2090.1 10040.0  2089.9 10050.0  2089.6 10060.0  2089.5 10070.0  2089.3 10080.0
     GR2089.2 10090.0  2089.1 10100.0  2089.1 10110.0  2089.1 10120.0  2089.1 10130.0
     GR2089.1 10140.0  2089.2 10150.0  2089.1 10160.0  2089.2 10170.0  2089.2 10180.0
     GR2089.2 10190.0  2089.3 10200.0  2089.5 10210.0  2089.8 10220.0  2090.0 10230.0
     GR2090.0 10240.0  2090.1 10250.0  2090.1 10256.8
#25  X1  .856      33  9852.5 10169.4     210     225     220
     GR2098.0  9852.5  2095.6  9862.5  2092.6  9872.5  2092.0  9882.5  2091.9  9892.5
     GR2091.7  9902.5  2091.5  9912.5  2091.2  9922.5  2091.0  9932.5  2090.8  9942.5
     GR2090.7  9952.5  2090.5  9962.5  2090.3  9972.5  2090.2  9982.5  2090.1  9992.5
     GR2090.1 10000.0  2090.2 10010.0  2090.6 10020.0  2090.9 10030.0  2091.3 10040.0
     GR2091.3 10050.0  2091.3 10060.0  2091.3 10070.0  2091.2 10080.0  2091.2 10090.0
     GR2091.1 10100.0  2091.1 10110.0  2091.2 10120.0  2091.4 10130.0  2091.7 10140.0
     GR2091.9 10150.0  2092.0 10160.0  2092.0 10169.4
#26  X1  .895      42  9814.4 10212.3     200     220     205
     GR2102.0  9814.4  2100.0  9824.4  2100.0  9834.4  2098.2  9844.4  2098.7  9854.4
     GR2099.1  9864.4  2097.7  9874.4  2095.4  9884.4  2093.6  9894.4  2093.2  9904.4
     GR2092.6  9914.4  2092.2  9924.4  2092.0  9934.4  2092.0  9944.4  2092.0  9954.4
     GR2092.0  9964.4  2092.0  9974.4  2092.0  9984.4  2092.0  9994.4  2092.0 10000.0
     GR2092.0 10010.0  2093.7 10020.0  2093.0 10030.0  2092.1 10040.0  2092.0 10050.0
     GR2092.0 10060.0  2092.0 10070.0  2092.9 10080.0  2093.8 10090.0  2094.0 10100.0
     GR2094.1 10110.0  2094.2 10120.0  2094.1 10130.0  2094.0 10140.0  2094.4 10150.0
     GR2094.8 10160.0  2095.1 10170.0  2095.5 10180.0  2095.7 10190.0  2095.9 10200.0
     GR2096.1 10210.0  2096.1 10212.3
#27  X1  .935      30  9855.6 10130.1     200     220     210
     GR2103.4  9855.6  2099.5  9865.6  2096.9  9875.6  2094.0  9885.6  2094.0  9895.6
     GR2094.0  9905.6  2093.9  9915.6  2093.7  9925.6  2093.6  9935.6  2093.6  9945.6
     GR2093.7  9955.6  2093.8  9965.6  2094.0  9975.6  2094.0  9985.6  2094.0  9995.6
     GR2094.0 10000.0  2094.0 10010.0  2094.0 10020.0  2094.0 10030.0  2094.8 10040.0
     GR2096.1 10050.0  2096.1 10060.0  2096.6 10070.0  2097.2 10080.0  2097.3 10090.0
     GR2097.5 10100.0  2097.8 10110.0  2098.7 10120.0  2100.7 10130.0  2100.7 10130.1
#28  X1  .976      29  9836.6 10100.8     230     200     220
     GR2102.3  9836.6  2100.3  9846.6  2098.8  9856.6  2098.0  9866.6  2097.7  9876.6
     GR2097.4  9886.6  2097.0  9896.6  2096.7  9906.6  2096.3  9916.6  2095.8  9926.6
     GR2095.4  9936.6  2095.1  9946.6  2094.9  9956.6  2094.8  9966.6  2094.5  9976.6
     GR2094.5  9986.6  2094.5  9996.6  2094.5 10000.0  2094.5 10010.0  2094.7 10020.0
     GR2094.8 10030.0  2095.0 10040.0  2095.1 10050.0  2095.3 10060.0  2095.4 10070.0
     GR2095.7 10080.0  2095.9 10090.0  2100.0 10100.0  2100.6 10100.8
#29  X1 1.020      32  9779.5 10074.8     250     240     230
     GR2104.3  9779.5  2103.0  9789.5  2101.9  9799.5  2101.3  9809.5  2101.0  9819.5
     GR2100.0  9829.5  2099.5  9839.5  2098.7  9849.5  2097.9  9859.5  2097.5  9869.5
     GR2097.0  9879.5  2097.0  9889.5  2097.0  9899.5  2096.9  9909.5  2096.8  9919.5
     GR2096.7  9929.5  2096.6  9939.5  2096.4  9949.5  2096.4  9959.5  2096.4  9969.5
     GR2096.4  9979.5  2096.3  9989.5  2096.3  9999.5  2096.3 10000.0  2096.4 10010.0
     GR2096.4 10020.0  2096.7 10030.0  2097.2 10040.0  2098.0 10050.0  2099.0 10060.0
     GR2100.9 10070.0  2101.7 10074.8
#30  X1 1.064      41  9852.9 10243.4     235     240     235
     GR2108.2  9852.9  2107.4  9862.9  2106.8  9872.9  2106.1  9882.9  2104.8  9892.9
     GR2103.7  9902.9  2102.9  9912.9  2102.1  9922.9  2101.2  9932.9  2100.3  9942.9
     GR2099.4  9952.9  2098.5  9962.9  2098.1  9972.9  2098.1  9982.9  2098.1  9992.9
     GR2098.1 10000.0  2098.1 10010.0  2098.1 10020.0  2098.1 10030.0  2098.2 10040.0
     GR2098.4 10050.0  2098.5 10060.0  2098.6 10070.0  2098.4 10080.0  2098.4 10090.0
     GR2098.5 10100.0  2098.5 10110.0  2098.8 10120.0  2099.1 10130.0  2099.3 10140.0
     GR2099.6 10150.0  2099.9 10160.0  2100.3 10170.0  2100.8 10180.0  2101.4 10190.0
     GR2102.0 10200.0  2102.2 10210.0  2102.5 10220.0  2103.1 10230.0  2103.7 10240.0
     GR2103.8 10243.4
#31  X1 1.107      34  9907.0 10227.4     230     225     225
     GR2112.1  9907.0  2111.4  9917.0  2110.3  9927.0  2107.7  9937.0  2106.0  9947.0
     GR2105.0  9957.0  2103.4  9967.0  2101.3  9977.0  2100.0  9987.0  2100.0  9997.0
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    GR2100.0 10000.0  2100.0 10010.0  2100.0 10020.0  2100.8 10030.0  2101.9 10040.0
    GR2101.7 10050.0  2101.5 10060.0  2101.3 10070.0  2101.3 10080.0  2101.2 10090.0
    GR2101.2 10100.0  2101.1 10110.0  2101.1 10120.0  2101.1 10130.0  2101.1 10140.0
    GR2101.1 10150.0  2101.0 10160.0  2100.9 10170.0  2100.8 10180.0  2100.7 10190.0
    GR2100.9 10200.0  2101.2 10210.0  2102.1 10220.0  2103.8 10227.4
# 32X1 1.149       31  9960.6 10253.0     200     200     200
    GR2112.6  9960.6  2110.7  9970.6  2104.4  9980.6  2102.0  9990.6  2102.0 10000.0
    GR2102.0 10010.0  2102.0 10020.0  2102.3 10030.0  2102.5 10040.0  2102.6 10050.0
    GR2102.7 10060.0  2102.8 10070.0  2102.7 10080.0  2102.6 10090.0  2102.6 10100.0
    GR2102.7 10110.0  2102.7 10120.0  2102.6 10130.0  2102.5 10140.0  2102.4 10150.0
    GR2102.3 10160.0  2102.2 10170.0  2102.2 10180.0  2102.1 10190.0  2102.0 10200.0
    GR2102.2 10210.0  2102.7 10220.0  2103.4 10230.0  2104.6 10240.0  2105.7 10250.0
    GR2106.1 10253.0
#33X1 1.189       29  9966.7 10235.3     200     215     215
    GR2117.9  9966.7  2109.8  9976.7  2104.0  9986.7  2104.0  9996.7  2104.0 10000.0
    GR2104.0 10010.0  2104.0 10020.0  2104.0 10030.0  2104.0 10040.0  2104.0 10050.0
    GR2104.0 10060.0  2104.2 10070.0  2104.4 10080.0  2104.3 10090.0  2104.3 10100.0
    GR2104.2 10110.0  2104.2 10120.0  2104.2 10130.0  2104.2 10140.0  2104.2 10150.0
    GR2104.1 10160.0  2104.1 10170.0  2104.0 10180.0  2104.0 10190.0  2104.1 10200.0
    GR2104.4 10210.0  2105.0 10220.0  2106.7 10230.0  2107.6 10235.3
#34 X1 1.233       32  9937.6 10239.6     230     225     230
    GR2114.3  9937.6  2112.6  9947.6  2110.3  9957.6  2107.7  9967.6  2106.5  9977.6
    GR2105.1  9987.6  2104.0  9997.6  2104.0 10000.0  2104.0 10010.0  2104.4 10020.0
    GR2105.8 10030.0  2106.1 10040.0  2106.3 10050.0  2106.5 10060.0  2106.7 10070.0
    GR2106.8 10080.0  2106.6 10090.0  2106.3 10100.0  2106.1 10110.0  2106.1 10120.0
    GR2106.0 10130.0  2105.9 10140.0  2105.8 10150.0  2105.8 10160.0  2105.7 10170.0
    GR2105.9 10180.0  2106.1 10190.0  2106.1 10200.0  2106.1 10210.0  2106.1 10220.0
    GR2106.4 10230.0  2109.4 10239.6
# 35X1 1.273       33  9907.4 10219.4     215     205     210
    GR2118.2  9907.4  2114.7  9917.4  2111.4  9927.4  2109.6  9937.4  2109.1  9947.4
    GR2108.5  9957.4  2107.9  9967.4  2107.3  9977.4  2106.6  9987.4  2106.1  9997.4
    GR2106.1 10000.0  2106.1 10010.0  2107.0 10020.0  2108.0 10030.0  2108.0 10040.0
    GR2108.0 10050.0  2108.0 10060.0  2108.0 10070.0  2108.0 10080.0  2108.1 10090.0
    GR2108.3 10100.0  2108.3 10110.0  2108.2 10120.0  2108.3 10130.0  2108.4 10140.0
    GR2108.3 10150.0  2108.1 10160.0  2108.1 10170.0  2108.6 10180.0  2109.1 10190.0
    GR2110.0 10200.0  2113.1 10210.0  2117.5 10219.4
# 36X1 1.306       33  9888.2 10190.1     180     175     175
    GR2117.9  9888.2  2115.6  9898.2  2112.7  9908.2  2112.4  9918.2  2112.3  9928.2
    GR2112.3  9938.2  2111.7  9948.2  2111.3  9958.2  2110.8  9968.2  2110.1  9978.2
    GR2108.3  9988.2  2107.1  9998.2  2107.0 10000.0  2106.5 10010.0  2106.8 10020.0
    GR2108.5 10030.0  2109.1 10040.0  2109.5 10050.0  2109.5 10060.0  2109.6 10070.0
    GR2109.8 10080.0  2109.9 10090.0  2110.0 10100.0  2110.1 10110.0  2110.1 10120.0
    GR2110.1 10130.0  2110.1 10140.0  2111.5 10150.0  2112.9 10160.0  2114.2 10170.0
    GR2116.7 10180.0  2119.8 10190.0  2119.9 10190.1
# 37X1 1.323       34  9879.4 10194.3     100      85      90
    GR2124.0  9879.4  2122.8  9889.4  2121.4  9899.4  2119.2  9909.4  2118.2  9919.4
    GR2117.4  9929.4  2116.3  9939.4  2115.5  9949.4  2114.8  9959.4  2113.7  9969.4
    GR2112.9  9979.4  2112.0  9989.4  2111.5  9999.4  2111.5 10000.0  2110.9 10010.0
    GR2110.4 10020.0  2111.8 10030.0  2112.2 10040.0  2112.4 10050.0  2112.5 10060.0
    GR2112.7 10070.0  2112.7 10080.0  2113.0 10090.0  2113.4 10100.0  2114.2 10110.0
    GR2115.4 10120.0  2116.4 10130.0  2116.8 10140.0  2117.0 10150.0  2117.8 10160.0
    GR2118.7 10170.0  2119.7 10180.0  2121.0 10190.0  2122.1 10194.3
#38X1 1.338       31  9875.0 10160.0      80      80      80
    GR2124.0  9875.0  2122.4  9885.0  2120.3  9895.0  2119.3  9905.0  2118.5  9915.0
    GR2117.6  9925.0  2116.6  9935.0  2115.6  9945.0  2114.3  9955.0  2113.4  9965.0
    GR2112.7  9975.0  2112.0  9985.0  2112.0  9995.0  2111.9 10000.0  2111.8 10010.0
    GR2112.1 10020.0  2112.5 10030.0  2112.8 10040.0  2113.1 10050.0  2113.4 10060.0
    GR2113.8 10070.0  2114.0 10080.0  2116.1 10090.0  2118.0 10100.0  2118.9 10110.0
    GR2118.8 10120.0  2118.7 10130.0  2118.2 10140.0  2118.5 10150.0  2119.4 10160.0
    GR2120.1 10168.3
# 39 X1 1.352       26  9858.7 10094.3      65      85      75
    GR2122.3  9858.7  2119.2  9868.7  2118.2  9878.7  2117.3  9888.7  2116.4  9898.7
    GR2115.7  9908.7  2115.0  9918.7  2114.3  9928.7  2113.8  9938.7  2113.4  9948.7
    GR2113.0  9958.7  2112.6  9968.7  2112.2  9978.7  2112.0  9988.7  2112.0  9998.7
    GR2112.0 10000.0  2112.0 10010.0  2112.9 10020.0  2114.0 10030.0  2114.0 10040.0
    GR2114.0 10050.0  2114.0 10060.0  2114.0 10070.0  2115.1 10080.0  2119.0 10090.0
    GR2119.3 10094.3
#40 X1 1.386       35  9866.9 10199.0     105     300     180
    GR2125.5  9866.9  2119.3  9876.9  2116.9  9886.9  2115.7  9896.9  2114.8  9906.9
    GR2114.0  9916.9  2114.0  9926.9  2114.0  9936.9  2114.0  9946.9  2114.0  9956.9
    GR2114.0  9966.9  2114.0  9976.9  2114.0  9986.9  2114.0  9996.9  2114.0 10000.0
    GR2114.0 10010.0  2114.0 10020.0  2114.0 10030.0  2114.0 10040.0  2115.9 10050.0
    GR2116.1 10060.0  2116.1 10070.0  2116.1 10080.0  2116.3 10090.0  2116.7 10100.0
    GR2118.4 10110.0  2120.7 10120.0  2120.7 10130.0  2120.8 10140.0  2120.9 10150.0
    GR2120.7 10160.0  2120.5 10170.0  2120.8 10180.0  2121.1 10190.0  2121.2 10199.0
# 41X1 1.428       29  9810.1 10081.3     190     208     220
    GR2125.1  9810.1  2121.4  9820.1  2119.6  9830.1  2118.3  9840.1  2117.8  9850.1
    GR2117.4  9860.1  2117.1  9870.1  2116.8  9880.1  2116.5  9890.1  2116.2  9900.1
    GR2116.0  9910.1  2115.8  9920.1  2115.6  9930.1  2115.5  9940.1  2115.3  9950.1
    GR2115.2  9960.1  2115.1  9970.1  2115.0  9980.1  2114.8  9990.1  2115.1 10000.0
    GR2115.5 10010.0  2115.9 10020.0  2116.1 10030.0  2116.1 10040.0  2116.1 10050.0
```

```
*42 GR2116.1 10060.0  2116.9 10070.0  2119.1 10080.0  2119.4 10081.3
    X1 1.469      50  9664.4 10145.5    215    225    215
    GR2130.3  9664.4  2126.3  9674.4  2124.0  9684.4  2123.9  9694.4  2123.8  9704.4
    GR2123.6  9714.4  2123.4  9724.4  2123.2  9734.4  2123.1  9744.4  2122.9  9754.4
    GR2122.7  9764.4  2122.5  9774.4  2122.4  9784.4  2122.2  9794.4  2122.0  9804.4
    GR2121.5  9814.4  2119.7  9824.4  2118.6  9834.4  2117.9  9844.4  2117.7  9854.4
    GR2117.6  9864.4  2117.4  9874.4  2117.2  9884.4  2117.1  9894.4  2117.0  9904.4
    GR2116.8  9914.4  2116.8  9924.4  2116.9  9934.4  2116.8  9944.4  2116.8  9954.4
    GR2116.7  9964.4  2116.7  9974.4  2116.8  9984.4  2116.9  9994.4  2117.0 10000.0
    GR2117.1 10010.0  2117.1 10020.0  2117.3 10030.0  2117.6 10040.0  2118.0 10050.0
    GR2118.7 10060.0  2119.4 10070.0  2120.0 10080.0  2120.6 10090.0  2121.1 10100.0
    GR2121.6 10110.0  2122.1 10120.0  2123.5 10130.0  2124.9 10140.0  2125.8 10145.5
*44 X1 1.510      64  9529.8 10158.1    210    225    215
    GR2130.7  9529.8  2129.9  9539.8  2129.1  9549.8  2128.3  9559.8  2127.5  9571.6
    GR2126.8  9581.6  2126.1  9591.6  2125.9  9601.6  2125.5  9611.6  2125.1  9621.6
    GR2124.7  9631.6  2124.5  9641.6  2124.2  9651.6  2124.1  9661.6  2124.1  9671.6
    GR2124.1  9681.6  2124.0  9691.6  2123.8  9701.6  2123.6  9711.6  2123.5  9721.6
    GR2123.3  9731.6  2123.1  9741.6  2122.9  9751.6  2122.8  9761.6  2122.6  9771.6
    GR2122.4  9781.6  2122.3  9791.6  2122.2  9801.6  2122.1  9811.6  2122.0  9821.6
    GR2121.8  9831.6  2121.6  9841.6  2121.4  9851.6  2121.2  9861.6  2121.0  9871.6
    GR2120.8  9881.6  2120.5  9891.6  2120.2  9901.6  2119.8  9911.6  2119.4  9921.6
    GR2119.1  9931.6  2118.9  9941.6  2118.6  9951.6  2118.4  9961.6  2118.1  9971.6
    GR2118.0  9981.6  2118.0  9991.6  2118.0 10000.0  2118.0 10010.0  2118.0 10020.0
    GR2118.0 10030.0  2118.2 10040.0  2118.6 10050.0  2119.1 10060.0  2119.5 10070.0
    GR2120.2 10080.0  2121.7 10090.0  2122.6 10100.0  2123.6 10110.0  2124.1 10120.0
    GR2124.3 10130.0  2124.2 10140.0  2124.1 10150.0  2126.4 10158.1
*45 X1 1.549      59  9752.8 10326.4    205    210    210
    GR2138.3  9752.8  2132.4  9762.8  2127.3  9772.8  2126.8  9782.8  2126.4  9792.8
    GR2124.8  9802.8  2122.0  9812.8  2122.0  9822.8  2122.0  9832.8  2122.0  9846.3
    GR2122.0  9856.3  2121.9  9866.3  2121.8  9876.3  2121.6  9886.3  2121.4  9896.3
    GR2121.2  9906.3  2121.0  9916.3  2120.9  9926.3  2120.7  9936.3  2120.6  9946.3
    GR2120.5  9956.3  2120.2  9966.3  2120.0  9976.3  2120.0  9986.3  2120.0  9996.3
    GR2120.0 10000.0  2119.9 10010.0  2119.8 10020.0  2119.8 10030.0  2119.9 10040.0
    GR2120.1 10050.0  2120.1 10060.0  2120.2 10070.0  2120.2 10080.0  2120.5 10090.0
    GR2120.8 10100.0  2121.1 10110.0  2121.4 10120.0  2121.8 10130.0  2122.4 10140.0
    GR2124.4 10150.0  2125.4 10160.0  2125.8 10170.0  2126.1 10180.0  2126.1 10190.0
    GR2126.1 10200.0  2126.1 10210.0  2126.1 10220.0  2126.1 10230.0  2126.1 10240.0
    GR2126.1 10250.0  2126.1 10260.0  2126.1 10270.0  2126.6 10280.0  2127.4 10290.0
    GR2128.1 10300.0  2128.2 10310.0  2128.5 10320.0  2129.4 10326.4
*47 X1 1.589      41  9823.6 10219.5    280    160    210
    GR2129.5  9823.6  2127.3  9833.6  2126.0  9843.6  2124.9  9853.6  2124.5  9863.6
    GR2124.2  9873.6  2123.9  9883.6  2123.8  9893.6  2123.6  9903.6  2123.5  9913.6
    GR2123.4  9923.6  2123.2  9933.6  2123.0  9943.6  2122.8  9953.6  2122.6  9963.6
    GR2122.4  9973.6  2122.2  9983.6  2122.0  9993.6  2121.9 10000.0  2121.9 10010.0
    GR2121.9 10020.0  2122.1 10030.0  2122.3 10040.0  2122.5 10050.0  2122.7 10060.0
    GR2123.1 10070.0  2124.0 10080.0  2123.9 10090.0  2123.7 10100.0  2123.5 10110.0
    GR2123.7 10120.0  2123.9 10130.0  2124.1 10140.0  2125.3 10150.0  2126.7 10160.0
    GR2128.1 10170.0  2128.2 10180.0  2128.2 10190.0  2128.7 10200.0  2129.3 10210.0
    GR2129.6 10219.5
*48 X1 1.603      37  9815.0 10164.0     48     70    100
    GR2128.5  9815.0  2127.4  9825.0  2127.2  9835.0  2126.8  9845.0  2126.4  9855.0
    GR2126.0  9865.0  2125.7  9875.0  2125.4  9885.0  2125.2  9895.0  2124.9  9905.0
    GR2124.6  9915.0  2124.3  9925.0  2124.0  9935.0  2123.8  9945.0  2123.6  9955.0
    GR2123.3  9965.0  2123.1  9975.0  2123.0  9985.0  2122.9  9995.0  2122.8 10000.0
    GR2122.8 10010.0  2122.9 10020.0  2123.1 10030.0  2123.3 10040.0  2123.5 10050.0
    GR2123.8 10060.0  2124.0 10070.0  2125.7 10080.0  2126.1 10090.0  2126.0 10100.0
    GR2127.8 10110.0  2129.1 10120.0  2130.3 10130.0  2131.8 10140.0  2133.0 10150.0
    GR2133.4 10160.0  2133.6 10164.0
    EJ
    ER
```

1 = 100

HEC-1, CLARK METHOD
10YR-6HR

```
1****************************************
****************************************
 *                                      *                                                    *
 *                                      *                                                    *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                    *   U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                                    *
 *            SEPTEMBER 1990            *                                                    *   HYDROLOGIC ENGINEERING CENTER
 *                                      *                                                    *
 *             VERSION 4.0              *                                                    *         609 SECOND STREET
 *                                      *                                                    *
 *                                      *                                                    *      DAVIS, CALIFORNIA 95616
 *                                      *                                                    *
 *  RUN DATE  07/30/1993  TIME  12:35:24 *                                                    *          (916) 756-1104
 *                                      *                                                    *
 *                                      *                                                    *
 ****************************************
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                                HEC-1 INPUT                                                                PAGE  1

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        1           ID   Casandro Wash Dam Design, SS 7/16/93
        2           ID   Clark Hydrograph Methodology
        3           ID   6-HR, 10-YR RAINFALL
                    *DIAGRAM
        4           IT       5                      200
        5           IO       5
                    * ****************************

        6           KK  SAC230
        7           KM    6-HOUR RAINFALL, PATTERN NO. 1.66 WAS USED TO FIND TC & R FOR THIS BASIN
        8           KM    THIS BASIN USED RAINFALL REDUCTION FACTOR OF .983 (2.24 INCHES)
        9           BA     .72
       10           IN      15
       11           PB   2.202
       12           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN NO. OF 1.66
       13           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .075
       14           PC    .087    .100    .119    .155    .240    .426    .742    .862    .911    .942
       15           PC    .954    .966    .978    .989   1.000
       16           LG     .14     .21    6.96     .13    6.70
       17           UC    .508    .424
       18           UA       0       5      16      30      65      77      84      90      94      97
       19           UA     100
                    * ****************************

       20           KK  SAC235
       21           KM    SUB-BASIN SAC235
       22           BA     .38
       23           LG     .14     .21    6.96     .13   10.10
       24           UC    .442    .451
       25           UA       0       5      16      30      65      77      84      90      94      97
       26           UA     100
                    * ****************************

       27           KK  CAC236
       28           KM   COMBINE SAC230 & SAC235 AT CAC236
       29           HC       2
                    * ****************************

       30           KK  RAC236
       31           KM   ROUTE CAC236 TO DAM B
       32           RS       1    FLOW      -1
       33           RC    .045     .03    .045    4400   .0175
       34           RX   463.5   467.5   477.5   487.5   512.5   522.5   532.5   536.5
       35           RY    16.5    12.5    12.5    10.0    10.0    12.5    12.5    16.5
                    * ****************************

       36           KK     DAM
       37           KM   sac240a
       38           BA     .13
       39           LG     .34     .21    6.96     .13      45
       40           UC    .338    .333
       41           UA       0       5      16      30      65      77      84      90      94      97
       42           UA     100
                    * ****************************
1                                                HEC-1 INPUT                                                                PAGE  2

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

       43           KK     CPA
       44           KM   DAM SITE
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 45          HC       2
             * ****************************

 46          KK    STOR
 47          KM   STORAGE BEHIND DAM --- NO SPILLWAY OR PRINCIPAL OUTLET
 48          SA       0    0.32    0.64    1.09    1.54    2.67    4.93    7.55   11.07   16.00
 49          SQ       0       0       0       0       0       0       0       0       0       0
 50          SE    2129    2130    2132    2134    2136    2138    2140    2144    2150    2160
             * ****************************

 51          KK  RCPA-B
 52          KM    ROUTE FROM DAM SITE TO MARIPOSA DR.
 53          RS       1    FLOW      -1
 54          RC    .045     .03    .045     950    .018
 55          RX       0     130     150     220     290     350     410     450
 56          RY       7     4.8     1.5     0.3       0     0.5     3.2       5
             * ****************************

 57          KK  SC240B
 58          KM   BASIN sac240b
 59          BA     .10
 60          LG     .32     .21    6.96     .13      39
 61          UC    .262    .224
 62          UA       0       5      16      30      65      77      84      90      94      97
 63          UA     100
             * ****************************

 64          KK     CPB
 65          KM    MARIPOSA DR.
 66          HC       2
             * ****************************

 67          KK  RCPB-C
 68          KM    ROUTE FROM MARIPOSA DR. TO CUCURACHA ST.
 69          RS       1    FLOW      -1
 70          RC    .045     .03    .045     634    .022
 71          RX       0      40      80     110     130     200     280     320
 72          RY      12       6       0       0       2     1.2     0.7       4
             * ****************************

 73          KK  SC240C
 74          KM   BASIN sac240c
 75          BA     .03
 76          LG     .18     .21    6.96     .13      52
 77          UC    .146    .126
 78          UA       0       5      16      30      65      77      84      90      94      97
 79          UA     100
             * ****************************
1                                    HEC-1 INPUT                                          PAGE  3
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 80          KK     CPC
 81          KM    CUCURACHA ST.
 82          HC       2
             * ****************************

 83          KK  RCPC-D
 84          KM    ROUTE FROM CUCURACHA ST. TO NAVAJO & JACKSON ST'S.
 85          RS       1    FLOW      -1
 86          RC    .045     .03    .045    1003    .012
 87          RX       0      10      80     120     140     170     260     300
 88          RY     2.4     1.8     0.6       0       0       1     1.1     1.8
             * ****************************

 89          KK  SC240D
 90          KM   BASIN sac240d
 91          BA     .04
 92          LG     .16     .21    6.96     .13      52
 93          UC    .133    .098
 94          UA       0       5      16      30      65      77      84      90      94      97
 95          UA     100
             * ****************************

 96          KK     CPD
 97          KM    NAVAJO & JACKSON ST'S.
 98          HC       2
             * ****************************

 99          KK  RCPD-E
100          KM    ROUTE FROM NAVAJO & JACKSON ST'S. TO MOHAVE & JACKSON ST'S.
101          RS       1    FLOW      -1
102          RC    .045     .03    .045     370    .024
103          RX       0    10.4    24.8    50.3    81.5    99.8   121.4   170.1
104          RY       1     0.9     0.6       0       0     0.3     0.3     0.9
             * ****************************

105          KK  SC240E
106          KM   BASIN sac240e
107          BA     .02
108          LG     .11     .21    6.96     .13      54
109          UC    .083    .041
110          UA       0       5      16      30      65      77      84      90      94      97
111          UA     100
             * ****************************

112          KK     CPE
113          KM    MOHAVE & JACKSON ST'S.
114          HC       2
             * ****************************
1                                    HEC-1 INPUT                                          PAGE  4
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

115          KK  RCPE-F
116          KM    ROUTE FROM MOHAVE & JACKSON ST'S. TO MOHAVE & MADISON ST'S.
```

```
117          RS       1    FLOW      -1
118          RC    .045     .03    .045     370    .014
119          RX       0      30      50      80     110     150     170     250
120          RY     2.2     1.1     0.9       0       0     0.4     0.9     2.2
             * ****************************

121          KK  SC240F
122          KM   BASIN sac240f
123          BA     .01
124          LG     .10     .21    6.96     .13      45
125          UC    .083    .068
126          UA       0       5      16      30      65      77      84      90      94      97
127          UA     100
             * ****************************

128          KK     CPF
129          KM    MOHAVE & MADISON ST'S.
130          HC       2
             * ****************************

131          KK   CPF-G
132          KM    ROUTE FROM MOHAVE & MADISON ST'S. TO MOHAVE & ADAMS ST'S.
133          RS       1    FLOW      -1
134          RC    .045     .03    .045     370    .008
135          RX       0      20      30      50      70      80      90     100
136          RY     2.5     1.6     0.9       0     0.1     0.4     1.9     2.5
             * ****************************

137          KK  SC240G
138          KM   BASIN sac240g
139          BA     .01
140          LG     .15     .21    6.96     .13      45
141          UC    .083    .074
142          UA       0       5      16      30      65      77      84      90      94      97
143          UA     100
             * ****************************

144          KK     CPG
145          KM    MOHAVE & ADAMS ST'S.
146          HC       2
             * ****************************

147          KK  RCPG-H
148          KM    ROUTE FROM MOHAVE & ADAMS ST'S TO MOHAVE & JEFFERSON ST'S.
149          RS       1    FLOW      -1
150          RC    .045     .03    .045     370    .005
151          RX       0      27    75.6   106.7     185   229.5     297   337.5
152          RY     1.2     0.9     0.4       0       0     0.1     0.8     1.2
             * ****************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

153          KK  SC240H
154          KM   BASIN sac240h
155          BA     .01
156          LG     .15     .21    6.96     .13      45
157          UC    .083    .067
158          UA       0       5      16      30      65      77      84      90      94      97
159          UA     100
             * ****************************

160          KK     CPH
161          KM    MOHAVE & JEFFERSON ST'S.
162          HC       2
             * ****************************

163          KK  RCPH-I
164          KM    ROUTE FROM MOHAVE & JEFFERSON ST'S. TO ATSF RAILROAD
165          RS       1    FLOW      -1
166          RC    .045     .03    .045     370    .019
167          RX       0      30     110     250     390     670     810     950
168          RY     0.8       0       0       0       0       0       0     4.3
             * ****************************

169          KK  SC240I
170          KM   BASIN sac240i
171          BA     .10
172          LG     .14     .21    6.96     .13      45
173          UC    .204    .177
174          UA       0       5      16      30      65      77      84      90      94      97
175          UA     100
             * ****************************

176          KK     CPI
177          KM    ATSF RAILROAD
178          HC       2
179          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    6     SAC230
              .
              .
   20         .        SAC235
              .            .
              .            .
   27     CAC236............
              V
              V
   30     RAC236
              .
              .
```

```
 36          .          DAM
             .            .
             .            .
 43       CPA............
             V
             V
 51     RCPA-B
             .
             .
 57          .      SC240B
             .            .
             .            .
 64       CPB............
             V
             V
 67     RCPB-C
             .
             .
 73          .      SC240C
             .            .
             .            .
 80       CPC............
             V
             V
 83     RCPC-D
             .
             .
 89          .      SC240D
             .            .
             .            .
 96       CPD............
             V
             V
 99     RCPD-E
             .
             .
105          .      SC240E
             .            .
             .            .
112       CPE............
             V
             V
115     RCPE-F
             .
             .
121          .      SC240F
             .            .
             .            .
128       CPF............
             V
             V
131      CPF-G
             .
             .
137          .      SC240G
             .            .
             .            .
144       CPG............
             V
             V
147     RCPG-H
             .
             .
153          .      SC240H
             .            .
             .            .
160       CPH............
             V
             V
163     RCPH-I
             .
             .
169          .      SC240I
             .            .
             .            .
176       CPI............
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1****************************************
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 *                                      *                                    *
 *                                      *                                    *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                    *
 *            SEPTEMBER 1990            *                                    *   HYDROLOGIC ENGINEERING CENTER
 *                                      *                                    *
 *             VERSION 4.0              *                                    *         609 SECOND STREET
 *                                      *                                    *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616
 *                                      *                                    *
 *  RUN DATE  07/30/1993  TIME  12:35:24 *                                    *           (916) 756-1104
 *                                      *                                    *
 *                                      *                                    *
 ****************************************
****************************************
```

Casandro Wash Dam Design, SS 7/16/93
Clark Hydrograph Methodology
6-HR, 100-YR RAINFALL

```
  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
```

```
                QSCAL          0.  HYDROGRAPH PLOT SCALE

IT          HYDROGRAPH TIME DATA
                NMIN           5  MINUTES IN COMPUTATION INTERVAL
               IDATE      1    0  STARTING DATE
               ITIME        0000  STARTING TIME
                  NQ         200  NUMBER OF HYDROGRAPH ORDINATES
              NDDATE      1    0  ENDING DATE
              NDTIME        1635  ENDING TIME
               ICENT          19  CENTURY MARK

          COMPUTATION INTERVAL     .08 HOURS
               TOTAL TIME BASE   16.58 HOURS

     ENGLISH UNITS
          DRAINAGE AREA          SQUARE MILES
          PRECIPITATION DEPTH    INCHES
          LENGTH, ELEVATION      FEET
          FLOW                   CUBIC FEET PER SECOND
          STORAGE VOLUME         ACRE-FEET
          SURFACE AREA           ACRES
          TEMPERATURE            DEGREES FAHRENHEIT
1
                                        RUNOFF SUMMARY
                                   FLOW IN CUBIC FEET PER SECOND
                                TIME IN HOURS,  AREA IN SQUARE MILES

                                     PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN    MAXIMUM    TIME OF
     OPERATION        STATION        FLOW    PEAK                                          AREA     STAGE    MAX STAGE
+                                                        6-HOUR     24-HOUR     72-HOUR
     HYDROGRAPH AT
+                     SAC230         543.    4.25        86.         31.         31.       .72
     HYDROGRAPH AT
+                     SAC235         284.    4.25        47.         17.         17.       .38
     2 COMBINED AT
+                     CAC236         827.    4.25       133.         48.         48.      1.10
     ROUTED TO
+                     RAC236         793.    4.33       132.         48.         48.      1.10
+                                                                                                12.35       4.33
     HYDROGRAPH AT
+                       DAM          126.    4.17        21.          8.          8.       .13
     2 COMBINED AT
+                       CPA          900.    4.33       153.         56.         56.      1.23
     ROUTED TO
+                      STOR            0.     .08         0.          0.          0.      1.23
+                                                                                             2147.73       9.00
     ROUTED TO
+                     RCPA-B            0.     .08         0.          0.          0.      1.23
     HYDROGRAPH AT
+                     SC240B         114.    4.08        15.          6.          6.       .10
     2 COMBINED AT
+                       CPB          114.    4.08        15.          6.          6.      1.33
     ROUTED TO
+                     RCPB-C         110.    4.17        15.          6.          6.      1.33
+                                                                                                 .63       4.17
     HYDROGRAPH AT
+                     SC240C          44.    4.00         5.          2.          2.       .03
     2 COMBINED AT
+                       CPC          149.    4.08        20.          7.          7.      1.36
     ROUTED TO
+                     RCPC-D         143.    4.17        20.          7.          7.      1.36
+                                                                                                 .75       4.17
     HYDROGRAPH AT
+                     SC240D          62.    4.00         7.          3.          3.       .04
     2 COMBINED AT
+                       CPD          191.    4.08        27.         10.         10.      1.40
     ROUTED TO
+                     RCPD-E         189.    4.08        27.         10.         10.      1.40
+                                                                                                 .62       4.08
     HYDROGRAPH AT
+                     SC240E          33.    4.00         4.          1.          1.       .02
     2 COMBINED AT
+                       CPE          212.    4.08        31.         11.         11.      1.42
     ROUTED TO
+                     RCPE-F         212.    4.08        31.         11.         11.      1.42
+                                                                                                 .73       4.08
     HYDROGRAPH AT
+                     SC240F          16.    4.00         2.          1.          1.       .01
     2 COMBINED AT
+                       CPF          224.    4.08        33.         12.         12.      1.43
     ROUTED TO
+                     CPF-G          223.    4.08        33.         12.         12.      1.43
+                                                                                                1.24       4.08
     HYDROGRAPH AT
```

+		SC240G	16.	4.00	2.	1.	1.	.01		
+	2 COMBINED AT	CPG	235.	4.08	34.	13.	13.	1.44		
+	ROUTED TO	RCPG-H	229.	4.08	34.	13.	13.	1.44	.63	4.08
+										
+	HYDROGRAPH AT	SC240H	16.	4.00	2.	1.	1.	.01		
+	2 COMBINED AT	CPH	241.	4.08	36.	13.	13.	1.45		
+	ROUTED TO	RCPH-I	237.	4.17	36.	13.	13.	1.45	.13	4.17
+										
+	HYDROGRAPH AT	SC240I	127.	4.08	17.	6.	6.	.10		
+	2 COMBINED AT	CPI	352.	4.08	53.	19.	19.	1.55		

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

HEC-1, CLARK METHOD
25YR-6HR

```
1****************************************
****************************************
 *                                      *                                                  *
 *                                      *                                                  *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                  *    U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                                  *
 *            SEPTEMBER 1990            *                                                  *    HYDROLOGIC ENGINEERING CENTER
 *                                      *                                                  *
 *             VERSION 4.0              *                                                  *          609 SECOND STREET
 *                                      *                                                  *
 *                                      *                                                  *       DAVIS, CALIFORNIA 95616
 *                                      *                                                  *
 *  RUN DATE  07/30/1993  TIME  12:37:24 *                                                  *           (916) 756-1104
 *                                      *                                                  *
 *                                      *                                                  *
 ****************************************
****************************************
```

```
X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                                HEC-1 INPUT                                                    PAGE  1

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

        1           ID   Casandro Wash Dam Design, SS 7/16/93
        2           ID   Clark Hydrograph Methodology
        3           ID   6-HR, 25-YR RAINFALL
                    *DIAGRAM
        4           IT       5                     200
        5           IO       5
                    * ****************************

        6           KK  SAC230
        7           KM    6-HOUR RAINFALL, PATTERN NO. 1.66 WAS USED TO FIND TC & R FOR THIS BASIN
        8           KM    THIS BASIN USED RAINFALL REDUCTION FACTOR OF .983  (2.70 INCHES)
        9           BA     .72
       10           IN      15
       11           PB   2.654
       12           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN NO. OF 1.66
       13           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .075
       14           PC    .087    .100    .119    .155    .240    .426    .742    .862    .911    .942
       15           PC    .954    .966    .978    .989   1.000
       16           LG     .14     .21    6.96     .13    6.70
       17           UC    .508    .424
       18           UA       0       5      16      30      65      77      84      90      94      97
       19           UA     100
                    * ****************************

       20           KK  SAC235
       21           KM    SUB-BASIN SAC235
       22           BA     .38
       23           LG     .14     .21    6.96     .13   10.10
       24           UC    .442    .451
       25           UA       0       5      16      30      65      77      84      90      94      97
       26           UA     100
                    * ****************************

       27           KK  CAC236
       28           KM   COMBINE SAC230 & SAC235 AT CAC236
       29           HC       2
                    * ****************************

       30           KK  RAC236
       31           KM   ROUTE CAC236 TO DAM B
       32           RS       1    FLOW      -1
       33           RC    .045     .03    .045    4400   .0175
       34           RX   463.5   467.5   477.5   487.5   512.5   522.5   532.5   536.5
       35           RY    16.5    12.5    12.5    10.0    10.0    12.5    12.5    16.5
                    * ****************************

       36           KK     DAM
       37           KM   sac240a
       38           BA     .13
       39           LG     .34     .21    6.96     .13      45
       40           UC    .338    .333
       41           UA       0       5      16      30      65      77      84      90      94      97
       42           UA     100
                    * ****************************
1                                                HEC-1 INPUT                                                    PAGE  2

      LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

       43           KK     CPA
       44           KM   DAM SITE
```

```
 45          HC        2
             * ****************************

 46          KK    STOR
 47          KM   STORAGE BEHIND DAM --- NO SPILLWAY OR PRINCIPAL OUTLET
 48          SA       0     0.32     0.64     1.09     1.54     2.67     4.93     7.55    11.07    16.00
 49          SQ       0        0        0        0        0        0        0        0        0        0
 50          SE    2129     2130     2132     2134     2136     2138     2140     2144     2150     2160
             * ****************************

 51          KK  RCPA-B
 52          KM    ROUTE FROM DAM SITE TO MARIPOSA DR.
 53          RS       1     FLOW       -1
 54          RC    .045      .03     .045      950     .018
 55          RX       0      130      150      220      290      350      410      450
 56          RY       7      4.8      1.5      0.3        0      0.5      3.2        5
             * ****************************

 57          KK  SC240B
 58          KM   BASIN sac240b
 59          BA     .10
 60          LG     .32      .21     6.96      .13       39
 61          UC    .262     .224
 62          UA       0        5       16       30       65       77       84       90       94       97
 63          UA     100
             * ****************************

 64          KK     CPB
 65          KM    MARIPOSA DR.
 66          HC        2
             * ****************************

 67          KK  RCPB-C
 68          KM    ROUTE FROM MARIPOSA DR. TO CUCURACHA ST.
 69          RS       1     FLOW       -1
 70          RC    .045      .03     .045      634     .022
 71          RX       0       40       80      110      130      200      280      320
 72          RY      12        6        0        0        2      1.2      0.7        4
             * ****************************

 73          KK  SC240C
 74          KM   BASIN sac240c
 75          BA     .03
 76          LG     .18      .21     6.96      .13       52
 77          UC    .146     .126
 78          UA       0        5       16       30       65       77       84       90       94       97
 79          UA     100
             * ****************************
1                                    HEC-1 INPUT                                                    PAGE  3

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 80          KK     CPC
 81          KM    CUCURACHA ST.
 82          HC        2
             * ****************************

 83          KK  RCPC-D
 84          KM    ROUTE FROM CUCURACHA ST. TO NAVAJO & JACKSON ST'S.
 85          RS       1     FLOW       -1
 86          RC    .045      .03     .045     1003     .012
 87          RX       0       10       80      120      140      170      260      300
 88          RY     2.4      1.8      0.6        0        0        1      1.1      1.8
             * ****************************

 89          KK  SC240D
 90          KM   BASIN sac240d
 91          BA     .04
 92          LG     .16      .21     6.96      .13       52
 93          UC    .133     .098
 94          UA       0        5       16       30       65       77       84       90       94       97
 95          UA     100
             * ****************************

 96          KK     CPD
 97          KM    NAVAJO & JACKSON ST'S.
 98          HC        2
             * ****************************

 99          KK  RCPD-E
100          KM    ROUTE FROM NAVAJO & JACKSON ST'S. TO MOHAVE & JACKSON ST'S.
101          RS       1     FLOW       -1
102          RC    .045      .03     .045      370     .024
103          RX       0     10.4     24.8     50.3     81.5     99.8    121.4    170.1
104          RY       1      0.9      0.6        0        0      0.3      0.3      0.9
             * ****************************

105          KK  SC240E
106          KM   BASIN sac240e
107          BA     .02
108          LG     .11      .21     6.96      .13       54
109          UC    .083     .041
110          UA       0        5       16       30       65       77       84       90       94       97
111          UA     100
             * ****************************

112          KK     CPE
113          KM    MOHAVE & JACKSON ST'S.
114          HC        2
             * ****************************
1                                    HEC-1 INPUT                                                    PAGE  4

LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

115          KK  RCPE-F
116          KM    ROUTE FROM MOHAVE & JACKSON ST'S. TO MOHAVE & MADISON ST'S.
```

```
117          RS       1    FLOW      -1
118          RC    .045     .03    .045     370    .014
119          RX       0      30      50      80     110     150     170     250
120          RY     2.2     1.1     0.9       0       0     0.4     0.9     2.2
             * ****************************

121          KK  SC240F
122          KM   BASIN sac240f
123          BA     .01
124          LG     .10     .21    6.96     .13      45
125          UC    .083    .068
126          UA       0       5      16      30      65      77      84      90      94      97
127          UA     100
             * ****************************

128          KK     CPF
129          KM    MOHAVE & MADISON ST'S.
130          HC       2
             * ****************************

131          KK   CPF-G
132          KM    ROUTE FROM MOHAVE & MADISON ST'S. TO MOHAVE & ADAMS ST'S.
133          RS       1    FLOW      -1
134          RC    .045     .03    .045     370    .008
135          RX       0      20      30      50      70      80      90     100
136          RY     2.5     1.6     0.9       0     0.1     0.4     1.9     2.5
             * ****************************

137          KK  SC240G
138          KM   BASIN sac240g
139          BA     .01
140          LG     .15     .21    6.96     .13      45
141          UC    .083    .074
142          UA       0       5      16      30      65      77      84      90      94      97
143          UA     100
             * ****************************

144          KK     CPG
145          KM    MOHAVE & ADAMS ST'S.
146          HC       2
             * ****************************

147          KK  RCPG-H
148          KM    ROUTE FROM MOHAVE & ADAMS ST'S TO MOHAVE & JEFFERSON ST'S.
149          RS       1    FLOW      -1
150          RC    .045     .03    .045     370    .005
151          RX       0      27    75.6   106.7     185   229.5     297   337.5
152          RY     1.2     0.9     0.4       0       0     0.1     0.8     1.2
             * ****************************
```

1 HEC-1 INPUT PAGE 5

```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

153          KK  SC240H
154          KM   BASIN sac240h
155          BA     .01
156          LG     .15     .21    6.96     .13      45
157          UC    .083    .067
158          UA       0       5      16      30      65      77      84      90      94      97
159          UA     100
             * ****************************

160          KK     CPH
161          KM    MOHAVE & JEFFERSON ST'S.
162          HC       2
             * ****************************

163          KK  RCPH-I
164          KM    ROUTE FROM MOHAVE & JEFFERSON ST'S. TO ATSF RAILROAD
165          RS       1    FLOW      -1
166          RC    .045     .03    .045     370    .019
167          RX       0      30     110     250     390     670     810     950
168          RY     0.8       0       0       0       0       0       0     4.3
             * ****************************

169          KK  SC240I
170          KM   BASIN sac240i
171          BA     .10
172          LG     .14     .21    6.96     .13      45
173          UC    .204    .177
174          UA       0       5      16      30      65      77      84      90      94      97
175          UA     100
             * ****************************

176          KK     CPI
177          KM    ATSF RAILROAD
178          HC       2
179          ZZ
```

1

```
             SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE        (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.        (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    6        SAC230
                 .
                 .
   20            .        SAC235
                 .            .
                 .            .
   27        CAC236............
                 V
                 V
   30        RAC236
                 .
                 .
```

```
 36          .          DAM
             .            .
             .            .
 43        CPA............
             V
             V
 51     RCPA-B
             .
             .
 57          .      SC240B
             .            .
             .            .
 64        CPB............
             V
             V
 67     RCPB-C
             .
             .
 73          .      SC240C
             .            .
             .            .
 80        CPC............
             V
             V
 83     RCPC-D
             .
             .
 89          .      SC240D
             .            .
             .            .
 96        CPD............
             V
             V
 99     RCPD-E
             .
             .
105          .      SC240E
             .            .
             .            .
112        CPE............
             V
             V
115     RCPE-F
             .
             .
121          .      SC240F
             .            .
             .            .
128        CPF............
             V
             V
131      CPF-G
             .
             .
137          .      SC240G
             .            .
             .            .
144        CPG............
             V
             V
147     RCPG-H
             .
             .
153          .      SC240H
             .            .
             .            .
160        CPH............
             V
             V
163     RCPH-I
             .
             .
169          .      SC240I
             .            .
             .            .
176        CPI............
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
*************************************
 *                                   *                                   *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                   *    U.S. ARMY CORPS OF ENGINEERS
*
 *            SEPTEMBER 1990             *                                   *    HYDROLOGIC ENGINEERING CENTER
*
 *             VERSION 4.0               *                                   *          609 SECOND STREET
*
 *                                       *                                   *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE  07/30/1993  TIME  12:37:24 *                                   *           (916) 756-1104
*
 *                                       *                                   *
*
 ****************************************
*************************************
```

Casandro Wash Dam Design, SS 7/16/93
Clark Hydrograph Methodology
6-HR, 100-YR RAINFALL

```
  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
```

```
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

IT          HYDROGRAPH TIME DATA
                    NMIN           5  MINUTES IN COMPUTATION INTERVAL
                   IDATE      1    0  STARTING DATE
                   ITIME        0000  STARTING TIME
                      NQ         200  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      1    0  ENDING DATE
                  NDTIME        1635  ENDING TIME
                   ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL     .08 HOURS
                   TOTAL TIME BASE   16.58 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT
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	SAC230	705.	4.25	115.	42.	42.	.72		
+	HYDROGRAPH AT	SAC235	367.	4.25	62.	23.	23.	.38		
+	2 COMBINED AT	CAC236	1072.	4.25	178.	64.	64.	1.10		
+	ROUTED TO	RAC236	1030.	4.33	177.	64.	64.	1.10		
+									12.67	4.33
+	HYDROGRAPH AT	DAM	159.	4.17	26.	10.	10.	.13		
+	2 COMBINED AT	CPA	1166.	4.33	203.	74.	74.	1.23		
+	ROUTED TO	STOR	0.	.08	0.	0.	0.	1.23		
+									2150.31	9.00
+	ROUTED TO	RCPA-B	0.	.08	0.	0.	0.	1.23		
+	HYDROGRAPH AT	SC240B	144.	4.08	20.	7.	7.	.10		
+	2 COMBINED AT	CPB	144.	4.08	20.	7.	7.	1.33		
+	ROUTED TO	RCPB-C	139.	4.17	20.	7.	7.	1.33		
+									.69	4.17
+	HYDROGRAPH AT	SC240C	54.	4.00	7.	2.	2.	.03		
+	2 COMBINED AT	CPC	188.	4.08	26.	9.	9.	1.36		
+	ROUTED TO	RCPC-D	181.	4.17	26.	9.	9.	1.36		
+									.83	4.17
+	HYDROGRAPH AT	SC240D	76.	4.00	9.	3.	3.	.04		
+	2 COMBINED AT	CPD	241.	4.08	35.	13.	13.	1.40		
+	ROUTED TO	RCPD-E	240.	4.08	35.	13.	13.	1.40		
+									.68	4.08
+	HYDROGRAPH AT	SC240E	41.	4.00	4.	2.	2.	.02		
+	2 COMBINED AT	CPE	267.	4.08	39.	14.	14.	1.42		
+	ROUTED TO	RCPE-F	268.	4.08	39.	14.	14.	1.42		
+									.82	4.08
+	HYDROGRAPH AT	SC240F	20.	4.00	2.	1.	1.	.01		
+	2 COMBINED AT	CPF	283.	4.08	41.	15.	15.	1.43		
+	ROUTED TO	CPF-G	283.	4.08	41.	15.	15.	1.43		
+									1.38	4.08
	HYDROGRAPH AT									

```
+                    SC240G      20.   4.00       2.       1.       1.      .01
        2 COMBINED AT
+                       CPG     298.   4.08      43.      16.      16.     1.44
        ROUTED TO
+                    RCPG-H     292.   4.08      43.      16.      16.     1.44
+                                                                          .71      4.08
        HYDROGRAPH AT
+                    SC240H      20.   4.00       2.       1.       1.      .01
        2 COMBINED AT
+                       CPH     307.   4.08      45.      17.      17.     1.45
        ROUTED TO
+                    RCPH-I     300.   4.17      45.      17.      17.     1.45
+                                                                          .17      4.17
        HYDROGRAPH AT
+                    SC240I     158.   4.00      21.       8.       8.      .10
        2 COMBINED AT
+                       CPI     447.   4.08      66.      24.      24.     1.55

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

HEC-1, CLARK METHOD
50YR-6HR

```
1****************************************
****************************************
 *                                      *
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *                                      *
 *            SEPTEMBER 1990            *
 *                                      *
 *             VERSION 4.0              *
 *                                      *
 *                                      *
 *  RUN DATE  07/30/1993  TIME  12:39:09 *
 *                                      *
 *                                      *
 ****************************************
****************************************
```

```
*
*   U.S. ARMY CORPS OF ENGINEERS
*   HYDROLOGIC ENGINEERING CENTER
*         609 SECOND STREET
*      DAVIS, CALIFORNIA 95616
*         (916) 756-1104
*
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```
1                                    HEC-1 INPUT                                                    PAGE  1
  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10
    1           ID   Casandro Wash Dam Design, SS 7/16/93
    2           ID   Clark Hydrograph Methodology
    3           ID   6-HR, 50-YR RAINFALL
                *DIAGRAM
    4           IT       5                     200
    5           IO       5
                * ****************************

    6           KK  SAC230
    7           KM    6-HOUR RAINFALL, PATTERN NO. 1.66 WAS USED TO FIND TC & R FOR THIS BASIN
    8           KM    THIS BASIN USED RAINFALL REDUCTION FACTOR OF .983  (3.00 INCHES)
    9           BA     .72
   10           IN      15
   11           PB   2.949
   12           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN NO. OF 1.66
   13           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .075
   14           PC    .087    .100    .119    .155    .240    .426    .742    .862    .911    .942
   15           PC    .954    .966    .978    .989   1.000
   16           LG     .14     .21    6.96     .13    6.70
   17           UC    .508    .424
   18           UA       0       5      16      30      65      77      84      90      94      97
   19           UA     100
                * ****************************

   20           KK  SAC235
   21           KM    SUB-BASIN SAC235
   22           BA     .38
   23           LG     .14     .21    6.96     .13   10.10
   24           UC    .442    .451
   25           UA       0       5      16      30      65      77      84      90      94      97
   26           UA     100
                * ****************************

   27           KK  CAC236
   28           KM   COMBINE SAC230 & SAC235 AT CAC236
   29           HC       2
                * ****************************

   30           KK  RAC236
   31           KM   ROUTE CAC236 TO DAM B
   32           RS       1    FLOW     -1
   33           RC    .045     .03    .045    4400   .0175
   34           RX   463.5   467.5   477.5   487.5   512.5   522.5   532.5   536.5
   35           RY    16.5    12.5    12.5    10.0    10.0    12.5    12.5    16.5
                * ****************************

   36           KK     DAM
   37           KM   sac240a
   38           BA     .13
   39           LG     .34     .21    6.96     .13      45
   40           UC    .338    .333
   41           UA       0       5      16      30      65      77      84      90      94      97
   42           UA     100
                * ****************************
1                                    HEC-1 INPUT                                                    PAGE  2
  LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   43           KK     CPA
   44           KM   DAM SITE
```

```
 45          HC        2
             * ****************************

 46          KK    STOR
 47          KM   STORAGE BEHIND DAM --- NO SPILLWAY OR PRINCIPAL OUTLET
 48          SA       0     0.32     0.64     1.09     1.54     2.67     4.93     7.55    11.07    16.00
 49          SQ       0        0        0        0        0        0        0        0        0        0
 50          SE    2129     2130     2132     2134     2136     2138     2140     2144     2150     2160
             * ****************************

 51          KK  RCPA-B
 52          KM    ROUTE FROM DAM SITE TO MARIPOSA DR.
 53          RS       1     FLOW       -1
 54          RC    .045      .03     .045      950     .018
 55          RX       0      130      150      220      290      350      410      450
 56          RY       7      4.8      1.5      0.3        0      0.5      3.2        5
             * ****************************

 57          KK  SC240B
 58          KM   BASIN sac240b
 59          BA     .10
 60          LG     .32      .21     6.96      .13       39
 61          UC    .262     .224
 62          UA       0        5       16       30       65       77       84       90       94       97
 63          UA     100
             * ****************************

 64          KK     CPB
 65          KM    MARIPOSA DR.
 66          HC        2
             * ****************************

 67          KK  RCPB-C
 68          KM    ROUTE FROM MARIPOSA DR. TO CUCURACHA ST.
 69          RS       1     FLOW       -1
 70          RC    .045      .03     .045      634     .022
 71          RX       0       40       80      110      130      200      280      320
 72          RY      12        6        0        0        2      1.2      0.7        4
             * ****************************

 73          KK  SC240C
 74          KM   BASIN sac240c
 75          BA     .03
 76          LG     .18      .21     6.96      .13       52
 77          UC    .146     .126
 78          UA       0        5       16       30       65       77       84       90       94       97
 79          UA     100
             * ****************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 80          KK     CPC
 81          KM    CUCURACHA ST.
 82          HC        2
             * ****************************

 83          KK  RCPC-D
 84          KM    ROUTE FROM CUCURACHA ST. TO NAVAJO & JACKSON ST'S.
 85          RS       1     FLOW       -1
 86          RC    .045      .03     .045     1003     .012
 87          RX       0       10       80      120      140      170      260      300
 88          RY     2.4      1.8      0.6        0        0        1      1.1      1.8
             * ****************************

 89          KK  SC240D
 90          KM   BASIN sac240d
 91          BA     .04
 92          LG     .16      .21     6.96      .13       52
 93          UC    .133     .098
 94          UA       0        5       16       30       65       77       84       90       94       97
 95          UA     100
             * ****************************

 96          KK     CPD
 97          KM    NAVAJO & JACKSON ST'S.
 98          HC        2
             * ****************************

 99          KK  RCPD-E
100          KM    ROUTE FROM NAVAJO & JACKSON ST'S. TO MOHAVE & JACKSON ST'S.
101          RS       1     FLOW       -1
102          RC    .045      .03     .045      370     .024
103          RX       0     10.4     24.8     50.3     81.5     99.8    121.4    170.1
104          RY       1      0.9      0.6        0        0      0.3      0.3      0.9
             * ****************************

105          KK  SC240E
106          KM   BASIN sac240e
107          BA     .02
108          LG     .11      .21     6.96      .13       54
109          UC    .083     .041
110          UA       0        5       16       30       65       77       84       90       94       97
111          UA     100
             * ****************************

112          KK     CPE
113          KM    MOHAVE & JACKSON ST'S.
114          HC        2
             * ****************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

115          KK  RCPE-F
116          KM    ROUTE FROM MOHAVE & JACKSON ST'S. TO MOHAVE & MADISON ST'S.
```

```
117          RS       1    FLOW      -1
118          RC    .045     .03    .045     370    .014
119          RX       0      30      50      80     110     150     170     250
120          RY     2.2     1.1     0.9       0       0     0.4     0.9     2.2
             * ****************************

121          KK  SC240F
122          KM   BASIN sac240f
123          BA     .01
124          LG     .10     .21    6.96     .13      45
125          UC    .083    .068
126          UA       0       5      16      30      65      77      84      90      94      97
127          UA     100
             * ****************************

128          KK     CPF
129          KM    MOHAVE & MADISON ST'S.
130          HC       2
             * ****************************

131          KK   CPF-G
132          KM    ROUTE FROM MOHAVE & MADISON ST'S. TO MOHAVE & ADAMS ST'S.
133          RS       1    FLOW      -1
134          RC    .045     .03    .045     370    .008
135          RX       0      20      30      50      70      80      90     100
136          RY     2.5     1.6     0.9       0     0.1     0.4     1.9     2.5
             * ****************************

137          KK  SC240G
138          KM   BASIN sac240g
139          BA     .01
140          LG     .15     .21    6.96     .13      45
141          UC    .083    .074
142          UA       0       5      16      30      65      77      84      90      94      97
143          UA     100
             * ****************************

144          KK     CPG
145          KM    MOHAVE & ADAMS ST'S.
146          HC       2
             * ****************************

147          KK  RCPG-H
148          KM    ROUTE FROM MOHAVE & ADAMS ST'S TO MOHAVE & JEFFERSON ST'S.
149          RS       1    FLOW      -1
150          RC    .045     .03    .045     370    .005
151          RX       0      27    75.6   106.7     185   229.5     297   337.5
152          RY     1.2     0.9     0.4       0       0     0.1     0.8     1.2
             * ****************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

153          KK  SC240H
154          KM   BASIN sac240h
155          BA     .01
156          LG     .15     .21    6.96     .13      45
157          UC    .083    .067
158          UA       0       5      16      30      65      77      84      90      94      97
159          UA     100
             * ****************************

160          KK     CPH
161          KM    MOHAVE & JEFFERSON ST'S.
162          HC       2
             * ****************************

163          KK  RCPH-I
164          KM    ROUTE FROM MOHAVE & JEFFERSON ST'S. TO ATSF RAILROAD
165          RS       1    FLOW      -1
166          RC    .045     .03    .045     370    .019
167          RX       0      30     110     250     390     670     810     950
168          RY     0.8       0       0       0       0       0       0     4.3
             * ****************************

169          KK  SC240I
170          KM   BASIN sac240i
171          BA     .10
172          LG     .14     .21    6.96     .13      45
173          UC    .204    .177
174          UA       0       5      16      30      65      77      84      90      94      97
175          UA     100
             * ****************************

176          KK     CPI
177          KM    ATSF RAILROAD
178          HC       2
179          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    6     SAC230
              .
              .
   20         .       SAC235
              .            .
              .            .
   27     CAC236............
              V
              V
   30     RAC236
              .
              .
```

```
 36          .          DAM
             .            .
             .            .
 43        CPA............
             V
             V
 51     RCPA-B
             .
             .
 57          .      SC240B
             .            .
             .            .
 64        CPB............
             V
             V
 67     RCPB-C
             .
             .
 73          .      SC240C
             .            .
             .            .
 80        CPC............
             V
             V
 83     RCPC-D
             .
             .
 89          .      SC240D
             .            .
             .            .
 96        CPD............
             V
             V
 99     RCPD-E
             .
             .
105          .      SC240E
             .            .
             .            .
112        CPE............
             V
             V
115     RCPE-F
             .
             .
121          .      SC240F
             .            .
             .            .
128        CPF............
             V
             V
131      CPF-G
             .
             .
137          .      SC240G
             .            .
             .            .
144        CPG............
             V
             V
147     RCPG-H
             .
             .
153          .      SC240H
             .            .
             .            .
160        CPH............
             V
             V
163     RCPH-I
             .
             .
169          .      SC240I
             .            .
             .            .
176        CPI............
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
****************************************
 *                                      *                                        *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                        *    U.S. ARMY CORPS OF ENGINEERS
*
 *            SEPTEMBER 1990            *                                        *    HYDROLOGIC ENGINEERING CENTER
*
 *             VERSION 4.0              *                                        *          609 SECOND STREET
*
 *                                      *                                        *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE  07/30/1993  TIME  12:39:09 *                                        *           (916) 756-1104
*
 *                                      *                                        *
*
 ****************************************
****************************************
```

Casandro Wash Dam Design, SS 7/16/93
Clark Hydrograph Methodology
6-HR, 100-YR RAINFALL

```
  5 IO          OUTPUT CONTROL VARIABLES       :
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
```

```
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

IT          HYDROGRAPH TIME DATA
                  NMIN           5  MINUTES IN COMPUTATION INTERVAL
                 IDATE      1    0  STARTING DATE
                 ITIME        0000  STARTING TIME
                    NQ         200  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE      1    0  ENDING DATE
                NDTIME        1635  ENDING TIME
                 ICENT          19  CENTURY MARK

            COMPUTATION INTERVAL     .08 HOURS
                 TOTAL TIME BASE   16.58 HOURS

      ENGLISH UNITS
           DRAINAGE AREA          SQUARE MILES
           PRECIPITATION DEPTH    INCHES
           LENGTH, ELEVATION      FEET
           FLOW                   CUBIC FEET PER SECOND
           STORAGE VOLUME         ACRE-FEET
           SURFACE AREA           ACRES
           TEMPERATURE            DEGREES FAHRENHEIT
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	SAC230	810.	4.25	135.	49.	49.	.72		
+	HYDROGRAPH AT	SAC235	421.	4.25	73.	26.	26.	.38		
+	2 COMBINED AT	CAC236	1231.	4.25	208.	75.	75.	1.10		
+	ROUTED TO	RAC236	1188.	4.33	208.	75.	75.	1.10		
+									12.85	4.33
+	HYDROGRAPH AT	DAM	181.	4.17	30.	11.	11.	.13		
+	2 COMBINED AT	CPA	1343.	4.33	238.	86.	86.	1.23		
+	ROUTED TO	STOR	0.	.08	0.	0.	0.	1.23		
+									2151.58	9.50
+	ROUTED TO	RCPA-B	0.	.08	0.	0.	0.	1.23		
+	HYDROGRAPH AT	SC240B	163.	4.08	22.	8.	8.	.10		
+	2 COMBINED AT	CPB	163.	4.08	22.	8.	8.	1.33		
+	ROUTED TO	RCPB-C	158.	4.17	22.	8.	8.	1.33		
+									.73	4.17
+	HYDROGRAPH AT	SC240C	61.	4.00	7.	3.	3.	.03		
+	2 COMBINED AT	CPC	213.	4.08	30.	11.	11.	1.36		
+	ROUTED TO	RCPC-D	205.	4.17	30.	11.	11.	1.36		
+									.88	4.17
+	HYDROGRAPH AT	SC240D	85.	4.00	10.	4.	4.	.04		
+	2 COMBINED AT	CPD	274.	4.08	40.	14.	14.	1.40		
+	ROUTED TO	RCPD-E	272.	4.08	40.	14.	14.	1.40		
+									.72	4.08
+	HYDROGRAPH AT	SC240E	46.	4.00	5.	2.	2.	.02		
+	2 COMBINED AT	CPE	303.	4.08	45.	16.	16.	1.42		
+	ROUTED TO	RCPE-F	304.	4.08	45.	16.	16.	1.42		
+									.87	4.08
+	HYDROGRAPH AT	SC240F	22.	4.00	2.	1.	1.	.01		
+	2 COMBINED AT	CPF	321.	4.08	47.	17.	17.	1.43		
+	ROUTED TO	CPF-G	321.	4.08	47.	17.	17.	1.43		
+									1.47	4.08
	HYDROGRAPH AT									

```
+                        SC240G      22.   4.00        2.        1.        1.      .01
          2 COMBINED AT
+                           CPG     338.   4.08       50.       18.       18.     1.44
          ROUTED TO
+                        RCPG-H     333.   4.08       50.       18.       18.     1.44
+                                                                                      .76       4.08
          HYDROGRAPH AT
+                        SC240H      22.   4.00        2.        1.        1.      .01
          2 COMBINED AT
+                           CPH     350.   4.08       52.       19.       19.     1.45
          ROUTED TO
+                        RCPH-I     341.   4.17       52.       19.       19.     1.45
+                                                                                      .19       4.17
          HYDROGRAPH AT
+                        SC240I     178.   4.00       24.        9.        9.      .10
          2 COMBINED AT
+                           CPI     508.   4.08       76.       28.       28.     1.55

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

HEC-1, CLARK METHOD
100YR-6HR

```
1****************************************
****************************************
 *                                      *
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *                                      *
 *            SEPTEMBER 1990            *
 *                                      *
 *             VERSION 4.0              *
 *                                      *
 *                                      *
 *  RUN DATE  08/02/1993  TIME  13:02:39 *
 *                                      *
 *                                      *
 ****************************************
****************************************
```

```
*
*   U.S. ARMY CORPS OF ENGINEERS
*   HYDROLOGIC ENGINEERING CENTER
*         609 SECOND STREET
*      DAVIS, CALIFORNIA 95616
*          (916) 756-1104
*
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   Casandro Wash Dam Design, SS 7/16/93
  2           ID   Clark Hydrograph Methodology
  3           ID   6-HR, 100-YR RAINFALL
              *DIAGRAM
  4           IT       5                    200
  5           IO       5
              * ****************************

  6           KK  SAC230
  7           KM    6-HOUR RAINFALL, PATTERN NO. 1.66 WAS USED TO FIND TC & R FOR THIS BASIN
  8           KM    THIS BASIN USED RAINFALL REDUCTION FACTOR OF .983
  9           BA     .72
 10           IN      15
 11           KM   RAINFALL DEPTH OF 3.40 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 12           PB   3.345
 13           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN NO. OF 1.66
 14           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .075
 15           PC    .087    .100    .119    .155    .240    .426    .742    .862    .911    .942
 16           PC    .954    .966    .978    .989   1.000
 17           LG     .14     .21    6.96     .13    6.70
 18           UC    .508    .424
 19           UA       0       5      16      30      65      77      84      90      94      97
 20           UA     100
              * ****************************

 21           KK  SAC235
 22           KM    SUB-BASIN SAC235
 23           BA     .38
 24           LG     .14     .21    6.96     .13   10.10
 25           UC    .442    .451
 26           UA       0       5      16      30      65      77      84      90      94      97
 27           UA     100
              * ****************************

 28           KK  CAC236
 29           KM   COMBINE SAC230 & SAC235 AT CAC236
 30           HC       2
              * ****************************

 31           KK  RAC236
 32           KM   ROUTE CAC236 TO DAM B
 33           RS       1    FLOW      -1
 34           RC    .045     .03    .045    4400   .0175
 35           RX   463.5   467.5   477.5   487.5   512.5   522.5   532.5   536.5
 36           RY    16.5    12.5    12.5    10.0    10.0    12.5    12.5    16.5
              * ****************************

 37           KK     DAM
 38           KM   sac240a
 39           BA     .13
 40           LG     .34     .21    6.96     .13      45
 41           UC    .338    .333
 42           UA       0       5      16      30      65      77      84      90      94      97
 43           UA     100
              * ****************************
```

1

HEC-1 INPUT PAGE 2

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 44           KK     CPA
```

```
 45          KM   DAM SITE
 46          HC       2
             * ****************************

 47          KK    STOR
 48          KM   STORAGE BEHIND DAM --- NO SPILLWAY OR PRINCIPAL OUTLET
 49          SA       0    0.32    0.64    1.09    1.54    2.67    4.93    7.55   11.07   16.00
 50          SQ       0       0       0       0       0       0       0       0       0       0
 51          SE    2129    2130    2132    2134    2136    2138    2140    2144    2150    2160
             * ****************************

 52          KK  RCPA-B
 53          KM    ROUTE FROM DAM SITE TO MARIPOSA DR.
 54          RS       1    FLOW      -1
 55          RC    .045     .03    .045     950    .018
 56          RX       0     130     150     220     290     350     410     450
 57          RY       7     4.8     1.5     0.3       0     0.5     3.2       5
             * ****************************

 58          KK  SC240B
 59          KM   BASIN sac240b
 60          BA     .10
 61          LG     .32     .21    6.96     .13      39
 62          UC    .262    .224
 63          UA       0       5      16      30      65      77      84      90      94      97
 64          UA     100
             * ****************************

 65          KK     CPB
 66          KM    MARIPOSA DR.
 67          HC       2
             * ****************************

 68          KK  RCPB-C
 69          KM    ROUTE FROM MARIPOSA DR. TO CUCURACHA ST.
 70          RS       1    FLOW      -1
 71          RC    .045     .03    .045     634    .022
 72          RX       0      40      80     110     130     200     280     320
 73          RY      12       6       0       0       2     1.2     0.7       4
             * ****************************

 74          KK  SC240C
 75          KM   BASIN sac240c
 76          BA     .03
 77          LG     .18     .21    6.96     .13      52
 78          UC    .146    .126
 79          UA       0       5      16      30      65      77      84      90      94      97
 80          UA     100
             * ****************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 81          KK     CPC
 82          KM    CUCURACHA ST.
 83          HC       2
             * ****************************

 84          KK  RCPC-D
 85          KM    ROUTE FROM CUCURACHA ST. TO NAVAJO & JACKSON ST'S.
 86          RS       1    FLOW      -1
 87          RC    .045     .03    .045    1003    .012
 88          RX       0      10      80     120     140     170     260     300
 89          RY     2.4     1.8     0.6       0       0       1     1.1     1.8
             * ****************************

 90          KK  SC240D
 91          KM   BASIN sac240d
 92          BA     .04
 93          LG     .16     .21    6.96     .13      52
 94          UC    .133    .098
 95          UA       0       5      16      30      65      77      84      90      94      97
 96          UA     100
             * ****************************

 97          KK     CPD
 98          KM    NAVAJO & JACKSON ST'S.
 99          HC       2
             * ****************************

100          KK  RCPD-E
101          KM    ROUTE FROM NAVAJO & JACKSON ST'S. TO MOHAVE & JACKSON ST'S.
102          RS       1    FLOW      -1
103          RC    .045     .03    .045     370    .014
104          RX       0    10.4    24.8    50.3    81.5    99.8   121.4   170.1
105          RY       1     0.9     0.6       0       0     0.3     0.3     0.9
             * ****************************

106          KK  SC240E
107          KM   BASIN sac240e
108          BA     .02
109          LG     .11     .21    6.96     .13      54
110          UC    .083    .041
111          UA       0       5      16      30      65      77      84      90      94      97
112          UA     100
             * ****************************

113          KK     CPE
114          KM    MOHAVE & JACKSON ST'S.
115          HC       2
             * ****************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

116          KK  RCPE-F
```

```
117          KM    ROUTE FROM MOHAVE & JACKSON ST'S. TO MOHAVE & MADISON ST'S.
118          RS       1    FLOW      -1
119          RC    .045     .03    .045     370    .014
120          RX       0      30      50      80     110     150     170     250
121          RY     2.2     1.1     0.9       0       0     0.4     0.9     2.2
             * ****************************

122          KK  SC240F
123          KM   BASIN sac240f
124          BA     .01
125          LG     .10     .21    6.96     .13      45
126          UC    .083    .068
127          UA       0       5      16      30      65      77      84      90      94      97
128          UA     100
             * ****************************

129          KK     CPF
130          KM    MOHAVE & MADISON ST'S.
131          HC       2
             * ****************************

132          KK   CPF-G
133          KM    ROUTE FROM MOHAVE & MADISON ST'S. TO MOHAVE & ADAMS ST'S.
134          RS       1    FLOW      -1
135          RC    .045     .03    .045     370    .008
136          RX       0      20      30      50      70      80      90     100
137          RY     2.5     1.6     0.9       0     0.1     0.4     1.9     2.5
             * ****************************

138          KK  SC240G
139          KM   BASIN sac240g
140          BA     .01
141          LG     .15     .21    6.96     .13      45
142          UC    .083    .074
143          UA       0       5      16      30      65      77      84      90      94      97
144          UA     100
             * ****************************

145          KK     CPG
146          KM    MOHAVE & ADAMS ST'S.
147          HC       2
             * ****************************

148          KK  RCPG-H
149          KM    ROUTE FROM MOHAVE & ADAMS ST'S TO MOHAVE & JEFFERSON ST'S.
150          RS       1    FLOW      -1
151          RC    .045     .03    .045     370    .005
152          RX       0      27    75.6   106.7     185   229.5     297   337.5
153          RY     1.2     0.9     0.4       0       0     0.1     0.8     1.2
             * ****************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

154          KK  SC240H
155          KM   BASIN sac240h
156          BA     .01
157          LG     .15     .21    6.96     .13      45
158          UC    .083    .067
159          UA       0       5      16      30      65      77      84      90      94      97
160          UA     100
             * ****************************

161          KK     CPH
162          KM    MOHAVE & JEFFERSON ST'S.
163          HC       2
             * ****************************

164          KK  RCPH-I
165          KM    ROUTE FROM MOHAVE & JEFFERSON ST'S. TO ATSF RAILROAD
166          RS       1    FLOW      -1
167          RC    .045     .03    .045     370    .019
168          RX       0      30     110     250     390     670     810     950
169          RY     0.8       0       0       0       0       0       0     4.3
             * ****************************

170          KK  SC240I
171          KM   BASIN sac240i
172          BA     .10
173          LG     .14     .21    6.96     .13      45
174          UC    .204    .177
175          UA       0       5      16      30      65      77      84      90      94      97
176          UA     100
             * ****************************

177          KK     CPI
178          KM    ATSF RAILROAD
179          HC       2
180          ZZ
```

1

```
          SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    6     SAC230
            .
            .
   21       .       SAC235
            .          .
            .          .
   28     CAC236............
            V
            V
   31     RAC236
            .
```

```
 37          .
             .        DAM
             .          .
             .          .
 44        CPA...........
             V
             V
 52     RCPA-B
             .
             .
 58          .     SC240B
             .          .
             .          .
 65        CPB...........
             V
             V
 68     RCPB-C
             .
             .
 74          .     SC240C
             .          .
             .          .
 81        CPC...........
             V
             V
 84     RCPC-D
             .
             .
 90          .     SC240D
             .          .
             .          .
 97        CPD...........
             V
             V
100     RCPD-E
             .
             .
106          .     SC240E
             .          .
             .          .
113        CPE...........
             V
             V
116     RCPE-F
             .
             .
122          .     SC240F
             .          .
             .          .
129        CPF...........
             V
             V
132      CPF-G
             .
             .
138          .     SC240G
             .          .
             .          .
145        CPG...........
             V
             V
148     RCPG-H
             .
             .
154          .     SC240H
             .          .
             .          .
161        CPH...........
             V
             V
164     RCPH-I
             .
             .
170          .     SC240I
             .          .
             .          .
177        CPI...........
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
****************************************
 *                                      *                                    *
 *                                      *                                    *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                    *   U.S. ARMY CORPS OF ENGINEERS
 *                                      *                                    *
 *            SEPTEMBER 1990            *                                    *   HYDROLOGIC ENGINEERING CENTER
 *                                      *                                    *
 *             VERSION 4.0              *                                    *         609 SECOND STREET
 *                                      *                                    *
 *                                      *                                    *      DAVIS, CALIFORNIA 95616
 *                                      *                                    *
 *  RUN DATE  08/02/1993  TIME  13:02:39 *                                    *          (916) 756-1104
 *                                      *                                    *
 *                                      *                                    *
 ****************************************
****************************************
```

Casandro Wash Dam Design, SS 7/16/93
Clark Hydrograph Methodology
6-HR, 100-YR RAINFALL

```
  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
```

```
                IPLOT          0  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE

IT          HYDROGRAPH TIME DATA
                NMIN           5  MINUTES IN COMPUTATION INTERVAL
                IDATE      1   0  STARTING DATE
                ITIME       0000  STARTING TIME
                   NQ        200  NUMBER OF HYDROGRAPH ORDINATES
              NDDATE      1   0  ENDING DATE
              NDTIME       1635  ENDING TIME
               ICENT         19  CENTURY MARK

          COMPUTATION INTERVAL     .08 HOURS
               TOTAL TIME BASE   16.58 HOURS

     ENGLISH UNITS
          DRAINAGE AREA          SQUARE MILES
          PRECIPITATION DEPTH    INCHES
          LENGTH, ELEVATION      FEET
          FLOW                   CUBIC FEET PER SECOND
          STORAGE VOLUME         ACRE-FEET
          SURFACE AREA           ACRES
          TEMPERATURE            DEGREES FAHRENHEIT
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	SAC230	950.	4.25	162.	59.	59.	.72		
+	HYDROGRAPH AT	SAC235	493.	4.25	87.	32.	32.	.38		
+	2 COMBINED AT	CAC236	1444.	4.25	249.	90.	90.	1.10		
+	ROUTED TO	RAC236	1398.	4.33	249.	90.	90.	1.10	13.07	4.33
+	HYDROGRAPH AT	DAM	209.	4.17	35.	13.	13.	.13		
+	2 COMBINED AT	CPA	1576.	4.33	284.	103.	103.	1.23		
+	ROUTED TO	STOR	0.	.08	0.	0.	0.	1.23	2153.28	9.83
+	ROUTED TO	RCPA-B	0.	.08	0.	0.	0.	1.23		
+	HYDROGRAPH AT	SC240B	188.	4.08	26.	10.	10.	.10		
+	2 COMBINED AT	CPB	188.	4.08	26.	10.	10.	1.33		
+	ROUTED TO	RCPB-C	183.	4.17	26.	10.	10.	1.33	.79	4.17
+	HYDROGRAPH AT	SC240C	69.	4.00	9.	3.	3.	.03		
+	2 COMBINED AT	CPC	246.	4.08	35.	13.	13.	1.36		
+	ROUTED TO	RCPC-D	238.	4.17	35.	13.	13.	1.36	.93	4.17
+	HYDROGRAPH AT	SC240D	97.	4.00	12.	4.	4.	.04		
+	2 COMBINED AT	CPD	317.	4.08	46.	17.	17.	1.40		
+	ROUTED TO	RCPD-E	315.	4.08	46.	17.	17.	1.40	.87	4.08
+	HYDROGRAPH AT	SC240E	52.	4.00	6.	2.	2.	.02		
+	2 COMBINED AT	CPE	350.	4.08	52.	19.	19.	1.42		
+	ROUTED TO	RCPE-F	351.	4.08	52.	19.	19.	1.42	.94	4.08
+	HYDROGRAPH AT	SC240F	25.	4.00	3.	1.	1.	.01		
+	2 COMBINED AT	CPF	370.	4.08	55.	20.	20.	1.43		
+	ROUTED TO	CPF-G	370.	4.08	55.	20.	20.	1.43	1.58	4.08

```
+          HYDROGRAPH AT
                          SC240G      25.   4.00        3.        1.        1.      .01
+          2 COMBINED AT
                             CPG     390.   4.08       58.       21.       21.     1.44
+          ROUTED TO
+                          RCPG-H     385.   4.08       58.       21.       21.     1.44
+                                                                                   .82       4.08
+          HYDROGRAPH AT
                          SC240H      25.   4.00        3.        1.        1.      .01
+          2 COMBINED AT
                             CPH     404.   4.08       61.       22.       22.     1.45
+          ROUTED TO
+                          RCPH-I     394.   4.17       61.       22.       22.     1.45
+                                                                                   .22       4.17
+          HYDROGRAPH AT
                          SC240I     204.   4.00       28.       10.       10.      .10
+          2 COMBINED AT
                             CPI     587.   4.08       88.       32.       32.     1.55

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

HEC-1, CLARK METHOD
100YR-6HR, POST STORM DRAIN

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*            SEPTEMBER 1990            *
*             VERSION 4.0              *
*                                      *
*  RUN DATE  06/15/1994  TIME  12:19:27 *
*                                      *
****************************************
```

```
****************************************
*                                      *
*    U.S. ARMY CORPS OF ENGINEERS      *
*    HYDROLOGIC ENGINEERING CENTER     *
*          609 SECOND STREET           *
*       DAVIS, CALIFORNIA 95616        *
*          (916) 756-1104              *
*                                      *
****************************************
```

```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX        XXX
```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT PAGE 1

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  1           ID   Casandro Wash Outfall Channel Hydrology, 5/26/94
  2           ID   Pipe flow diverting 274 cfs at CP-D
  3           ID   Clark Hydrograph Methodology
  4           ID   6-HR, 100-YR RAINFALL
              *DIAGRAM
  5           IT       5                    200
  6           IO       5
              * ****************************

  7           KK  SAC230
  8           KM    6-HOUR RAINFALL, PATTERN NO. 1.66 WAS USED TO FIND TC & R FOR THIS BASIN
  9           KM    THIS BASIN USED RAINFALL REDUCTION FACTOR OF .983
 10           BA     .72
 11           IN      15
 12           KM   RAINFALL DEPTH OF 3.40 WAS SPACIALLY REDUCED AS SHOWN BY THE PB RECORD
 13           PB   3.345
 14           KM   THE FOLLOWING PC RECORD USED A 6-HOUR STORM WITH A PATTERN NO. OF 1.66
 15           PC    .000    .009    .016    .025    .034    .042    .051    .059    .067    .075
 16           PC    .087    .100    .119    .155    .240    .426    .742    .862    .911    .942
 17           PC    .954    .966    .978    .989   1.000
 18           LG     .14     .21    6.96     .13    6.70
 19           UC    .508    .424
 20           UA       0       5      16      30      65      77      84      90      94      97
 21           UA     100
              * ****************************

 22           KK  SAC235
 23           KM    SUB-BASIN SAC235
 24           BA     .38
 25           LG     .14     .21    6.96     .13   10.10
 26           UC    .442    .451
 27           UA       0       5      16      30      65      77      84      90      94      97
 28           UA     100
              * ****************************

 29           KK  CAC236
 30           KM   COMBINE SAC230 & SAC235 AT CAC236
 31           HC       2
              * ****************************

 32           KK  RAC236
 33           KM   ROUTE CAC236 TO DAM B
 34           RS       1    FLOW      -1
 35           RC    .045     .03    .045    4400   .0175
 36           RX   463.5   467.5   477.5   487.5   512.5   522.5   532.5   536.5
 37           RY    16.5    12.5    12.5    10.0    10.0    12.5    12.5    16.5
              * ****************************

 38           KK     DAM
 39           KM   sac240a
 40           BA     .13
 41           LG     .34     .21    6.96     .13      45
 42           UC    .338    .333
 43           UA       0       5      16      30      65      77      84      90      94      97
 44           UA     100
              * ****************************
```

1

HEC-1 INPUT PAGE 2

```
LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 45           KK     CPA
 46           KM   DAM SITE
 47           HC       2
              * ****************************

 48           KK    STOR
 49           KM   STORAGE BEHIND DAM --- NO SPILLWAY OR PRINCIPAL OUTLET
 50           SA       0    0.32    0.64    1.09    1.54    2.67    4.93    7.55   11.07   16.00
 51           SQ       0       0       0       0       0       0       0       0       0       0
```

```
 52          SE    2129    2130    2132    2134    2136    2138    2140    2144    2150    2160
             * ******************************

 53          KK  RCPA-B
 54          KM    ROUTE FROM DAM SITE TO MARIPOSA DR.
 55          RS       1    FLOW      -1
 56          RC    .045     .03    .045     950    .018
 57          RX       0     130     150     220     290     350     410     450
 58          RY       7     4.8     1.5     0.3       0     0.5     3.2       5
             * ******************************

 59          KK  SC240B
 60          KM   BASIN sac240b
 61          BA     .10
 62          LG     .32     .21    6.96     .13      39
 63          UC    .262    .224
 64          UA       0       5      16      30      65      77      84      90      94      97
 65          UA     100
             * ******************************

 66          KK     CPB
 67          KM    MARIPOSA DR.
 68          HC       2
             * ******************************

 69          KK  RCPB-C
 70          KM    ROUTE FROM MARIPOSA DR. TO CUCURACHA ST.
 71          RS       1    FLOW      -1
 72          RC    .045     .03    .045     634    .022
 73          RX       0      40      80     110     130     200     280     320
 74          RY      12       6       0       0       2     1.2     0.7       4
             * ******************************

 75          KK  SC240C
 76          KM   BASIN sac240c
 77          BA     .03
 78          LG     .18     .21    6.96     .13      52
 79          UC    .146    .126
 80          UA       0       5      16      30      65      77      84      90      94      97
 81          UA     100
             * ******************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 82          KK     CPC
 83          KM    CUCURACHA ST.
 84          HC       2
             * ******************************

 85          KK  RCPC-D
 86          KM    ROUTE FROM CUCURACHA ST. TO NAVAJO & JACKSON ST'S.
 87          RS       1    FLOW      -1
 88          RC    .045     .03    .045    1003    .012
 89          RX       0      10      80     120     140     170     260     300
 90          RY     2.4     1.8     0.6       0       0       1     1.1     1.8
             * ******************************

 91          KK  SC240D
 92          KM   BASIN sac240d
 93          BA     .04
 94          LG     .16     .21    6.96     .13      52
 95          UC    .133    .098
 96          UA       0       5      16      30      65      77      84      90      94      97
 97          UA     100
             * ******************************

 98          KK     CPD
 99          KM    NAVAJO & JACKSON ST'S.
100          HC       2
             * ******************************

101          KK  DIVERT
102          KM    DIVERT PIPE FLOW OF 294 CFS,  REST OF FLOW CONTINUES DOWNSTREAM
103          DT   DIV-D
104          DI       0     100     200     300     400     500     800
105          DQ       0     274     274     274     274     274     274
             * ******************************

106          KK  RCPD-E
107          KM    ROUTE FROM NAVAJO & JACKSON ST'S. TO MOHAVE & JACKSON ST'S.
108          RS       1    FLOW      -1
109          RC    .045     .03    .045     370    .014
110          RX       0    10.4    24.8    50.3    81.5    99.8   121.4   170.1
111          RY       1     0.9     0.6       0       0     0.3     0.3     0.9
             * ******************************

112          KK  SC240E
113          KM   BASIN sac240e
114          BA     .02
115          LG     .11     .21    6.96     .13      54
116          UC    .083    .041
117          UA       0       5      16      30      65      77      84      90      94      97
118          UA     100
             * ******************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

119          KK     CPE
120          KM    MOHAVE & JACKSON ST'S.
121          HC       2
             * ******************************

122          KK  RCPE-F
123          KM    ROUTE FROM MOHAVE & JACKSON ST'S. TO MOHAVE & MADISON ST'S.
```

```
124          RS        1     FLOW      -1
125          RC     .045      .03     .045      370     .014
126          RX        0       30       50       80      110      150      170      250
127          RY      2.2      1.1      0.9        0        0      0.4      0.9      2.2
             * ****************************

128          KK  SC240F
129          KM   BASIN sac240f
130          BA     .01
131          LG     .10      .21     6.96      .13       45
132          UC    .083     .068
133          UA       0        5       16       30       65       77       84       90       94       97
134          UA     100
             * ****************************

135          KK     CPF
136          KM    MOHAVE & MADISON ST'S.
137          HC       2
             * ****************************

138          KK   CPF-G
139          KM    ROUTE FROM MOHAVE & MADISON ST'S. TO MOHAVE & ADAMS ST'S.
140          RS        1     FLOW      -1
141          RC     .045      .03     .045      370     .008
142          RX        0       20       30       50       70       80       90      100
143          RY      2.5      1.6      0.9        0      0.1      0.4      1.9      2.5
             * ****************************

144          KK  SC240G
145          KM   BASIN sac240g
146          BA     .01
147          LG     .15      .21     6.96      .13       45
148          UC    .083     .074
149          UA       0        5       16       30       65       77       84       90       94       97
150          UA     100
             * ****************************

151          KK     CPG
152          KM    MOHAVE & ADAMS ST'S.
153          HC       2
             * ****************************
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

154          KK  RCPG-H
155          KM    ROUTE FROM MOHAVE & ADAMS ST'S TO MOHAVE & JEFFERSON ST'S.
156          RS        1     FLOW      -1
157          RC     .045      .03     .045      370     .005
158          RX        0       27     75.6    106.7      185    229.5      297    337.5
159          RY      1.2      0.9      0.4        0        0      0.1      0.8      1.2
             * ****************************

160          KK  SC240H
161          KM   BASIN sac240h
162          BA     .01
163          LG     .15      .21     6.96      .13       45
164          UC    .083     .067
165          UA       0        5       16       30       65       77       84       90       94       97
166          UA     100
             * ****************************

167          KK     CPH
168          KM    MOHAVE & JEFFERSON ST'S.
169          HC       2
             * ****************************

170          KK  RCPH-I
171          KM    ROUTE FROM MOHAVE & JEFFERSON ST'S. TO ATSF RAILROAD
172          RS        1     FLOW      -1
173          RC     .045      .03     .045      370     .019
174          RX        0       30      110      250      390      670      810      950
175          RY      0.8        0        0        0        0        0        0      4.3
             * ****************************

176          KK  SC240I
177          KM   BASIN sac240i
178          BA     .10
179          LG     .14      .21     6.96      .13       45
180          UC    .204     .177
181          UA       0        5       16       30       65       77       84       90       94       97
182          UA     100
             * ****************************

183          KK     CPI
184          KM    ATSF RAILROAD
185          HC       2
186          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
INPUT
 LINE     (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.     (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    7     SAC230
                .
                .
   22           .       SAC235
                .            .
                .            .
   29     CAC236............
                V
                V
   32     RAC236
                .
                .
```

```
 38          .          DAM
             .            .
             .            .
 45        CPA............
             V
             V
 53     RCPA-B
             .
             .
 59          .      SC240B
             .            .
             .            .
 66        CPB............
             V
             V
 69     RCPB-C
             .
             .
 75          .      SC240C
             .            .
             .            .
 82        CPC............
             V
             V
 85     RCPC-D
             .
             .
 91          .      SC240D
             .            .
             .            .
 98        CPD............
             .
             .
103          .-------->   DIV-D
101     DIVERT
             V
             V
106     RCPD-E
             .
             .
112          .      SC240E
             .            .
             .            .
119        CPE............
             V
             V
122     RCPE-F
             .
             .
128          .      SC240F
             .            .
             .            .
135        CPF............
             V
             V
138      CPF-G
             .
             .
144          .      SC240G
             .            .
             .            .
151        CPG............
             V
             V
154     RCPG-H
             .
             .
160          .      SC240H
             .            .
             .            .
167        CPH............
             V
             V
170     RCPH-I
             .
             .
176          .      SC240I
             .            .
             .            .
183        CPI............
(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                         *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)     *
*            SEPTEMBER 1990               *
*             VERSION 4.0                 *
*                                         *
*  RUN DATE  06/15/1994  TIME  12:19:27   *
*                                         *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```

```
                    Casandro Wash Outfall Channel Hydrology, 5/26/94
                    Pipe flow diverting 274 cfs at CP-D
                    Clark Hydrograph Methodology
                    6-HR, 100-YR RAINFALL

  6 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

   IT         HYDROGRAPH TIME DATA
                    NMIN           5  MINUTES IN COMPUTATION INTERVAL
```

```
          IDATE      1    0  STARTING DATE
          ITIME         0000  STARTING TIME
             NQ          200  NUMBER OF HYDROGRAPH ORDINATES
         NDDATE      1    0  ENDING DATE
         NDTIME         1635  ENDING TIME
          ICENT           19  CENTURY MARK

     COMPUTATION INTERVAL     .08 HOURS
          TOTAL TIME BASE   16.58 HOURS

ENGLISH UNITS
     DRAINAGE AREA          SQUARE MILES
     PRECIPITATION DEPTH    INCHES
     LENGTH, ELEVATION      FEET
     FLOW                   CUBIC FEET PER SECOND
     STORAGE VOLUME         ACRE-FEET
     SURFACE AREA           ACRES
     TEMPERATURE            DEGREES FAHRENHEIT
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	SAC230	950.	4.25	162.	59.	59.	.72		
+	HYDROGRAPH AT	SAC235	493.	4.25	87.	32.	32.	.38		
+	2 COMBINED AT	CAC236	1444.	4.25	249.	90.	90.	1.10		
+	ROUTED TO	RAC236	1398.	4.33	249.	90.	90.	1.10		
+									13.07	4.33
+	HYDROGRAPH AT	DAM	209.	4.17	35.	13.	13.	.13		
+	2 COMBINED AT	CPA	1576.	4.33	284.	103.	103.	1.23		
+	ROUTED TO	STOR	0.	.08	0.	0.	0.	1.23		
+									2153.28	9.83
+	ROUTED TO	RCPA-B	0.	.08	0.	0.	0.	1.23		
+	HYDROGRAPH AT	SC240B	188.	4.08	26.	10.	10.	.10		
+	2 COMBINED AT	CPB	188.	4.08	26.	10.	10.	1.33		
+	ROUTED TO	RCPB-C	183.	4.17	26.	10.	10.	1.33		
+									.79	4.17
+	HYDROGRAPH AT	SC240C	69.	4.00	9.	3.	3.	.03		
+	2 COMBINED AT	CPC	246.	4.08	35.	13.	13.	1.36		
+	ROUTED TO	RCPC-D	238.	4.17	35.	13.	13.	1.36		
+									.93	4.17
+	HYDROGRAPH AT	SC240D	97.	4.00	12.	4.	4.	.04		
+	2 COMBINED AT	CPD	317.	4.08	46.	17.	17.	1.40		
+	DIVERSION TO	DIV-D	274.	4.08	45.	16.	16.	1.40		
+	HYDROGRAPH AT	DIVERT	43.	4.08	1.	0.	0.	1.40		
+	ROUTED TO	RCPD-E	34.	4.08	1.	0.	0.	1.40		
+									.32	4.08
+	HYDROGRAPH AT	SC240E	52.	4.00	6.	2.	2.	.02		
+	2 COMBINED AT	CPE	69.	4.08	7.	3.	3.	1.42		
+	ROUTED TO	RCPE-F	67.	4.08	7.	3.	3.	1.42		
+									.43	4.08
+	HYDROGRAPH AT	SC240F	25.	4.00	3.	1.	1.	.01		
+	2 COMBINED AT	CPF	86.	4.08	10.	4.	4.	1.43		
+	ROUTED TO	CPF-G	86.	4.08	10.	4.	4.	1.43		
+									.80	4.08

```
+          HYDROGRAPH AT
                          SC240G      25.   4.00        3.        1.        1.      .01
+          2 COMBINED AT
                             CPG     106.   4.00       13.        5.        5.     1.44
+          ROUTED TO
                          RCPG-H     106.   4.08       13.        5.        5.     1.44      .42      4.08
+
+          HYDROGRAPH AT
                          SC240H      25.   4.00        3.        1.        1.      .01
+          2 COMBINED AT
                             CPH     125.   4.08       15.        6.        6.     1.45
+          ROUTED TO
                          RCPH-I     124.   4.08       15.        6.        6.     1.45      .07      4.08
+
+          HYDROGRAPH AT
                          SC240I     204.   4.00       28.       10.       10.      .10
+          2 COMBINED AT
                             CPI     328.   4.08       43.       16.       16.     1.55

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

RATIONAL METHOD PARAMETERS

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SS Date: 05-19-1994

LOCATION DATA

Location: CASANDRO WASH / WICKENBURG

Project Name: PA343 Subarea id: SC240A

Drainage Area Cover:

DESIGN DATA

Drainage Area	78.93 acres
Watercourse Length	4699.0 feet
Top Elevation	2222.0 feet
Bottom Elevation	2129.0 feet
Slope	.01979 feet/feet
Roughness Coefficient (Kb)	.05200
10-Year, 6-Hour Rainfall	2.24 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	56	79	100	138	178	215
C	0.360	0.360	0.360	0.399	0.432	0.450
Tc (min)	25.4	22.2	20.3	18.7	17.5	16.5
i (in/hr)	2.0	2.8	3.5	4.4	5.2	6.1

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SS Date: 05-18-1994

LOCATION DATA

Location: CASANDRO WASH / WICKENBURG

Project Name: RA343 Subarea id: SC240B

Drainage Area Cover:

DESIGN DATA

Drainage Area	68.85 acres
Watercourse Length	3696.0 feet
Top Elevation	2211.0 feet
Bottom Elevation	2112.0 feet
Slope	.02679 feet/feet
Roughness Coefficient (Kb)	.05100
10-Year, 6-Hour Rainfall	2.24 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	57	80	93	135	171	207
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	18.9	16.7	15.7	14.1	13.3	12.6
i (in/hr)	2.4	3.3	3.9	5.1	5.9	6.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SS Date: 05-18-1994

LOCATION DATA

Location: CASANDRO WASH / WICKENBURG

Project Name: PGA343 Subarea id: SC240L

Drainage Area Cover:

DESIGN DATA

Drainage Area	21.10 acres
Watercourse Length	1742.0 feet
Top Elevation	2155.0 feet
Bottom Elevation	2098.0 feet
Slope	.03272 feet/feet
Roughness Coefficient (Kb)	.04000
10-Year, 6-Hour Rainfall	2.24 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	25	35	40	58	72	87
C	0.370	0.370	0.370	0.407	0.444	0.463
Tc (min)	9.5	8.4	8.0	7.2	6.9	6.5
i (in/hr)	3.3	4.5	5.1	6.7	7.7	8.9

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SS Date: 05-18-1994

LOCATION DATA

Location: CASANDRO WASH / WICKENBURG

Project Name: PGA343 Subarea id: SC240D

Drainage Area Cover:

DESIGN DATA

Drainage Area	23.04 acres
Watercourse Length	1531.0 feet
Top Elevation	2140.0 feet
Bottom Elevation	2086.0 feet
Slope	.03527 feet/feet
Roughness Coefficient (Kb)	.04000
10-Year, 6-Hour Rainfall	2.24 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	29	40	46	65	82	98
C	0.370	0.370	0.370	0.407	0.444	0.463
Tc (min)	8.6	7.6	7.2	6.5	6.2	5.9
i (in/hr)	3.4	4.7	5.4	7.0	8.0	9.2

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SS Date: 05-18-1994

LOCATION DATA

Location: CASANDRO WASH / WICKENBURG

Project Name: P64343 Subarea id: SC240E

Drainage Area Cover:

DESIGN DATA

Drainage Area	13.12 acres
Watercourse Length	686.0 feet
Top Elevation	2128.0 feet
Bottom Elevation	2077.0 feet
Slope	.07434 feet/feet
Roughness Coefficient (Kb)	.03400
10-Year, 6-Hour Rainfall	2.24 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	20	26	31	40	50	59
C	0.370	0.370	0.370	0.407	0.444	0.463
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	4.1	5.4	6.5	7.6	8.6	9.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SS Date: 05-18-1994

LOCATION DATA

Location: CASANDRO WASH / WICKENBURG

Project Name: PGA343 Subarea id: SC240F

Drainage Area Cover:

DESIGN DATA

Drainage Area	8.00 acres
Watercourse Length	898.0 feet
Top Elevation	2116.0 feet
Bottom Elevation	2072.0 feet
Slope	.04900 feet/feet
Roughness Coefficient (Kb)	.03400
10-Year, 6-Hour Rainfall	2.24 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	13	17	20	25	31	37
C	0.360	0.380	0.380	0.418	0.456	0.475
Tc (min)	5.1	5.0	5.0	5.0	5.0	5.0
i (in/hr)	4.1	5.4	6.5	7.6	8.6	9.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SS Date: 05-18-1994

LOCATION DATA

Location: CASANDRO WASH / WICKENBURG

Project Name: P6A343 Subarea id: SC240G

Drainage Area Cover:

DESIGN DATA

Drainage Area	3.90 acres
Watercourse Length	581.0 feet
Top Elevation	2120.0 feet
Bottom Elevation	2069.0 feet
Slope	.08778 feet/feet
Roughness Coefficient (Kb)	.04300
10-Year, 6-Hour Rainfall	2.24 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	6	7	9	11	14	17
C	0.350	0.350	0.350	0.385	0.420	0.438
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	4.1	5.4	6.5	7.6	8.6	9.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SS Date: 05-13-1994

LOCATION DATA

Location: CASANDRO WASH /WICKENBURG

Project Name: PGB343 Subarea id: SC240H

Drainage Area Cover:

DESIGN DATA

Drainage Area	4.86 acres
Watercourse Length	634.0 feet
Top Elevation	2120.0 feet
Bottom Elevation	2067.0 feet
Slope	.08360 feet/feet
Roughness Coefficient (Kb)	.04300
10-Year, 6-Hour Rainfall	2.24 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	7	9	10	13	17	20
C	0.330	0.330	0.330	0.363	0.396	0.413
Tc (min)	5.0	5.0	5.0	5.0	5.0	5.0
i (in/hr)	4.1	5.4	6.5	7.6	8.6	9.7

Flood Control District of Maricopa County
Hydrologic Design Manual Rational Method

Computed by: SS Date: 05-18-1994

LOCATION DATA

Location: CASANDRO WASH / WICKENBURG

Project Name: PGA343 Subarea id: SC240 I

Drainage Area Cover:

DESIGN DATA

Drainage Area	63.70 acres
Watercourse Length	3600.0 feet
Top Elevation	2163.0 feet
Bottom Elevation	2060.0 feet
Slope	.02861 feet/feet
Roughness Coefficient (Kb)	.03300
10-Year, 6-Hour Rainfall	2.24 inches

Hydrological Summary Table

Parameter	2-Yr	5-Yr	10-Yr	25-Yr	50-Yr	100-Yr
Q (cfs)	65	91	103	153	191	230
C	0.370	0.370	0.370	0.407	0.444	0.463
Tc (min)	13.8	12.1	11.5	10.3	9.8	9.3
i (in/hr)	2.8	3.8	4.4	5.9	6.7	7.8

TABLES

TABLE II-1 C-COEFFICIENT TABLE

	% Undeveloped Desert	% Suburban	% Paved Roads	% Unpaved Roads	C-Coefficient
SC240A	95	3	1	1	.36
SC240B	88	8	2	2	.35
SC240C	30	65	5	0	.37
SC240D	25	71	4	0	.37
SC240E	5	90	2.5	2.5	.37
SC240F	0	92	4	4	.38
SC240G	20	75	1	4	.35
SC240H	20	75	2	3	.33
SC240I	14	80	4	2	.37

*C-Coefficient taken for 2-10yr storm for use with the RATIONAL computer program

C-Coefficient for Undeveloped Desert: .35
C-Coefficient for Suburban: .35
C-Coefficient for Paved Roads: .80
C-Coefficient for Unpaved Roads: .65

TABLE II-2 Kb COEFFICIENT TABLE

	% A	% B		Kb A	Kb B		Kb Coefficient
SC240A	93	7		.050	.002		.052
SC240B	88	12		.048	.003		.051
SC240C	30	70		.018	.022		.040
SC240D	25	75		.016	.024		.040
SC240E	5	95		.003	.031		.034
SC240F	0	100		0	.034		.034
SC240G	20	80		.014	.029		.043
SC240H	20	80		.014	.029		.043
SC240I	14	86		.008	.025		.033

A - Desert Rangeland $Kb = -.01375 \log A + .08$
B - Residential $Kb = -.00625 \log A + .04$

TABLE II-3 PERCENT IMPERVIOUS AREA (RTIMP)

	RI-35 25% Imp (%Area)	RI-12 45% Imp (%Area)	RI-6 45% Imp (%Area)	RM-1 65% Imp (%Area)	IND-2 75% Imp (%Area)	C-3 90% Imp (%Area)	% Total Impervious Area
SC240A	16 (65)	2 (5)	0	0	5 (6)	22 (24)	45
SC240B	12 (46)	21 (47)	0	2 (3)	0	4 (4)	39
SC240C	0	0	38 (84)	0	0	14 (16)	52
SC240D	0	0	38 (84)	0	0	14 (16)	52
SC240E	0	0	31 (69)	13 (20)	0	1 (11)	54
SC240F	0	0	45 (100)	0	0	0	45
SC240G	0	0	45 (100)	0	0	0	45
SC240H	0	0	45 (100)	0	0	0	45
SC240I	10 (38)	1 (2)	12 (26)	22 (34)	0	0	45

TABLE II-4 INPUT PARAMETERS S-GRAPH METHOD

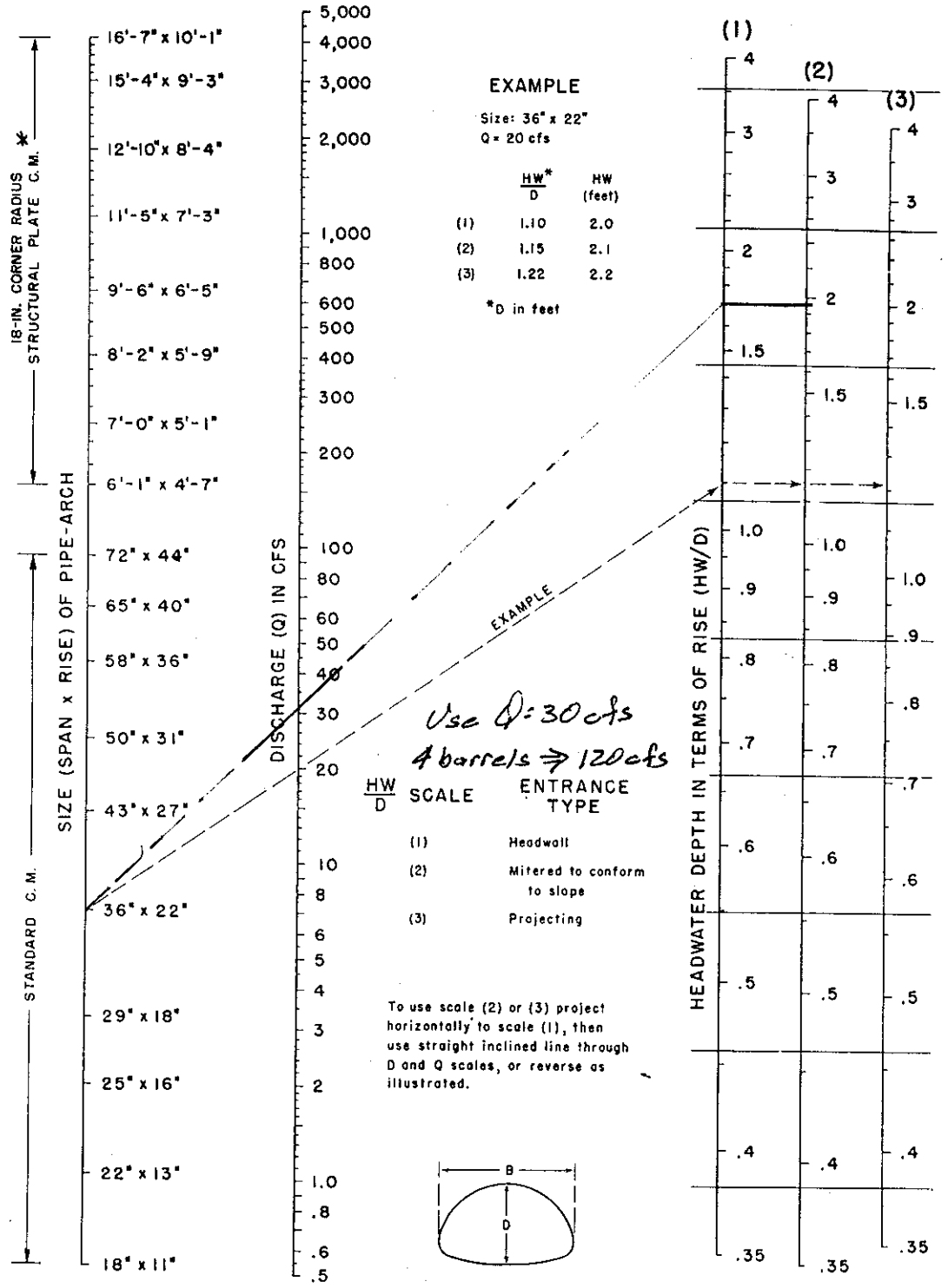
	Area (sqmi)	Length (mi)	Centroid Length (mi)	Slope (ft/mi)	Kn Coefficient	Lag Time (min)
SC240A	.123	.89	.45	104	.035	14.7
SC240B	.108	.70	.35	141	.035	11.53
SC240C	.033	.33	.17	173	.035	6.33
SC240D	.036	.29	.15	186	.035	5.67
SC240E	.021	.13	.07	392	.035	2.71
SC240F	.013	.17	.09	259	.035	3.58
SC240G	.006	.11	.06	464	.035	2.33
SC240H	.008	.12	.06	442	.035	2.43
SC240I	.100	.70	.35	147	.035	11.44

APPENDIX III - HYDRAULIC DATA

Mariposa Drive - 4-36" x 22" CMPA

HW = 3.5 feet

CHART 6



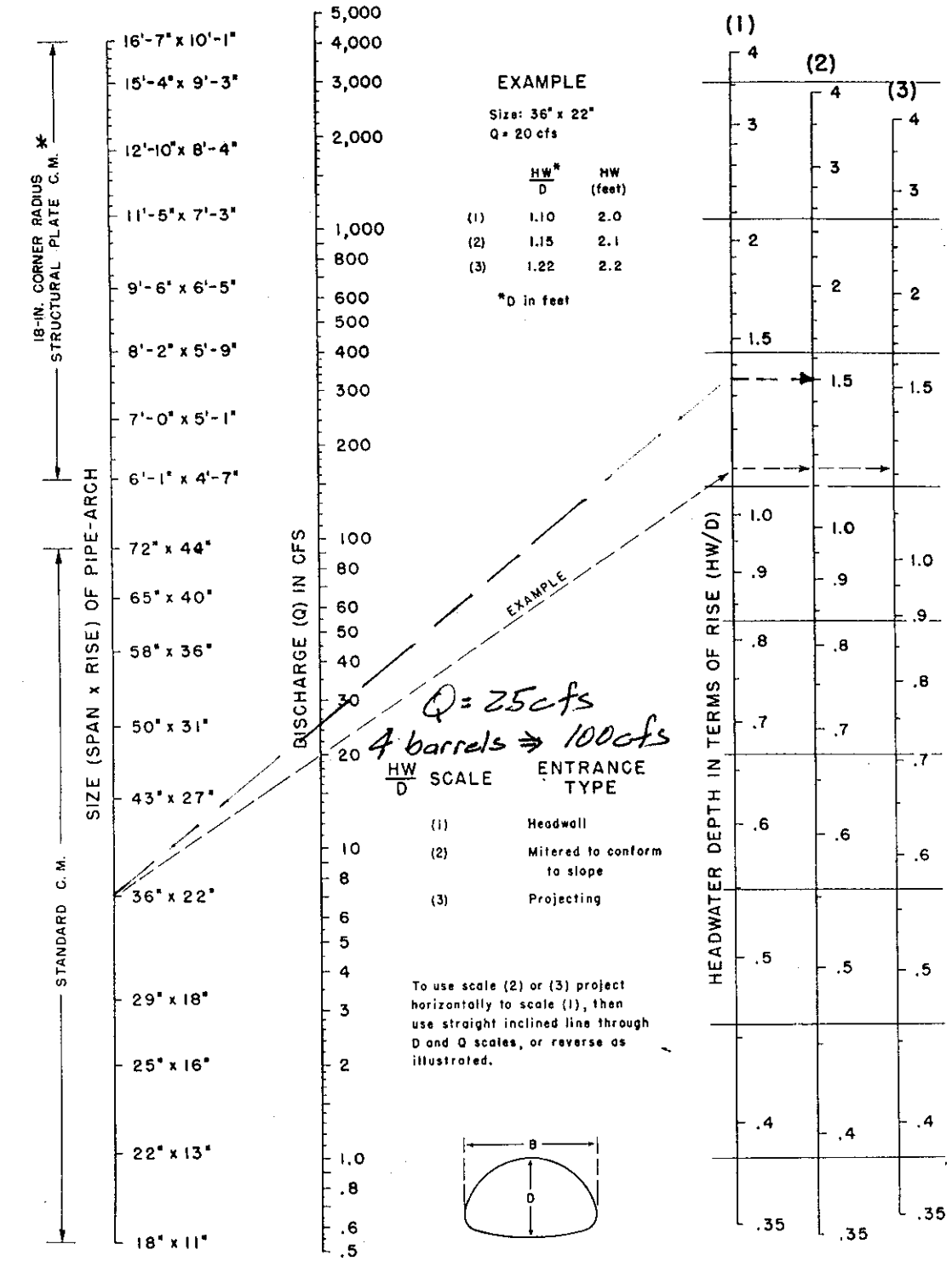
*ADDITIONAL SIZES NOT DIMENSIONED ARE LISTED IN FABRICATOR'S CATALOG

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

Cucaracha Street - 4 - 35"x23" CMPA
HW = 2.8

CHART 6

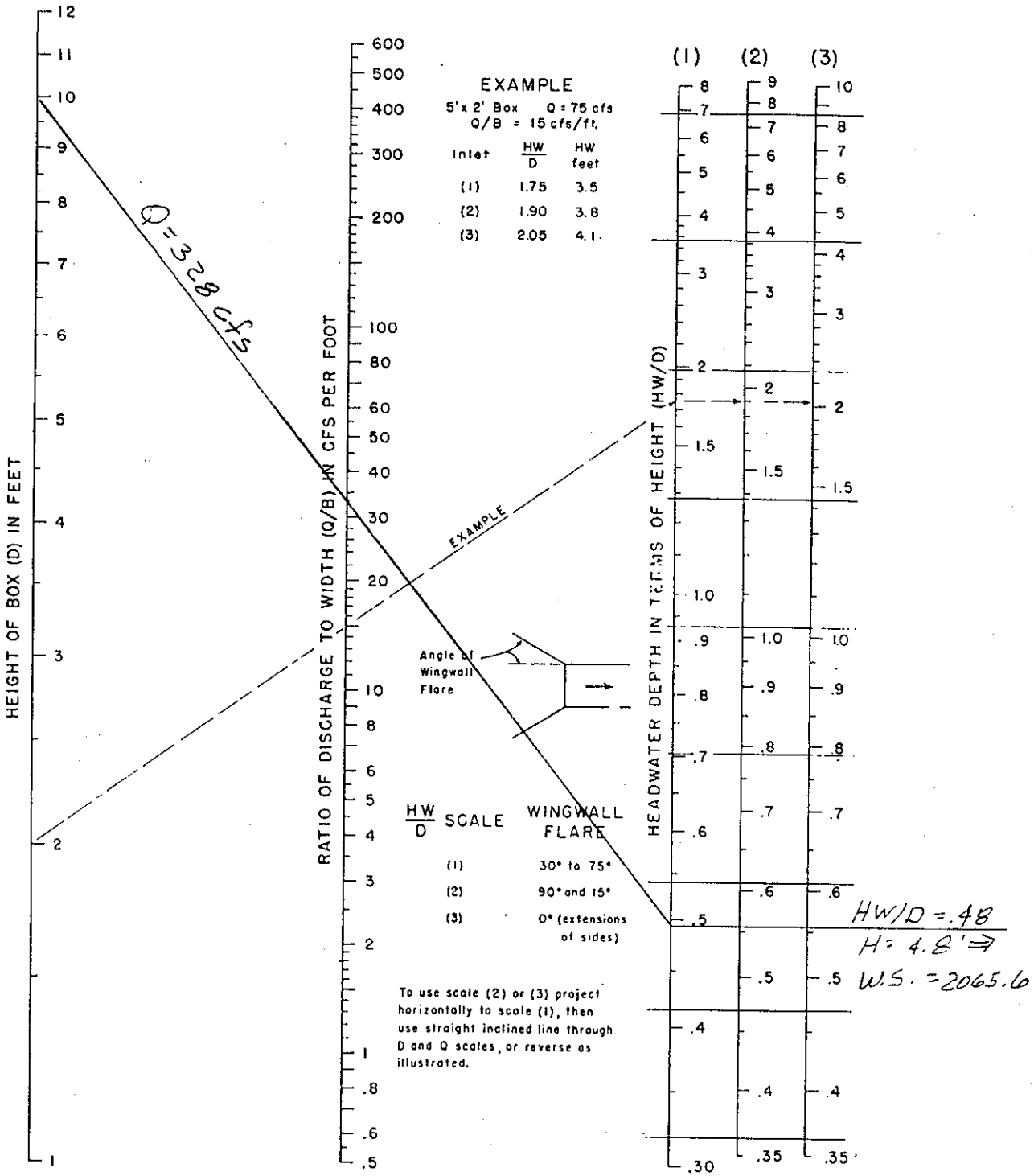


*ADDITIONAL SIZES NOT DIMENSIONED ARE LISTED IN FABRICATOR'S CATALOG

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

CHART I



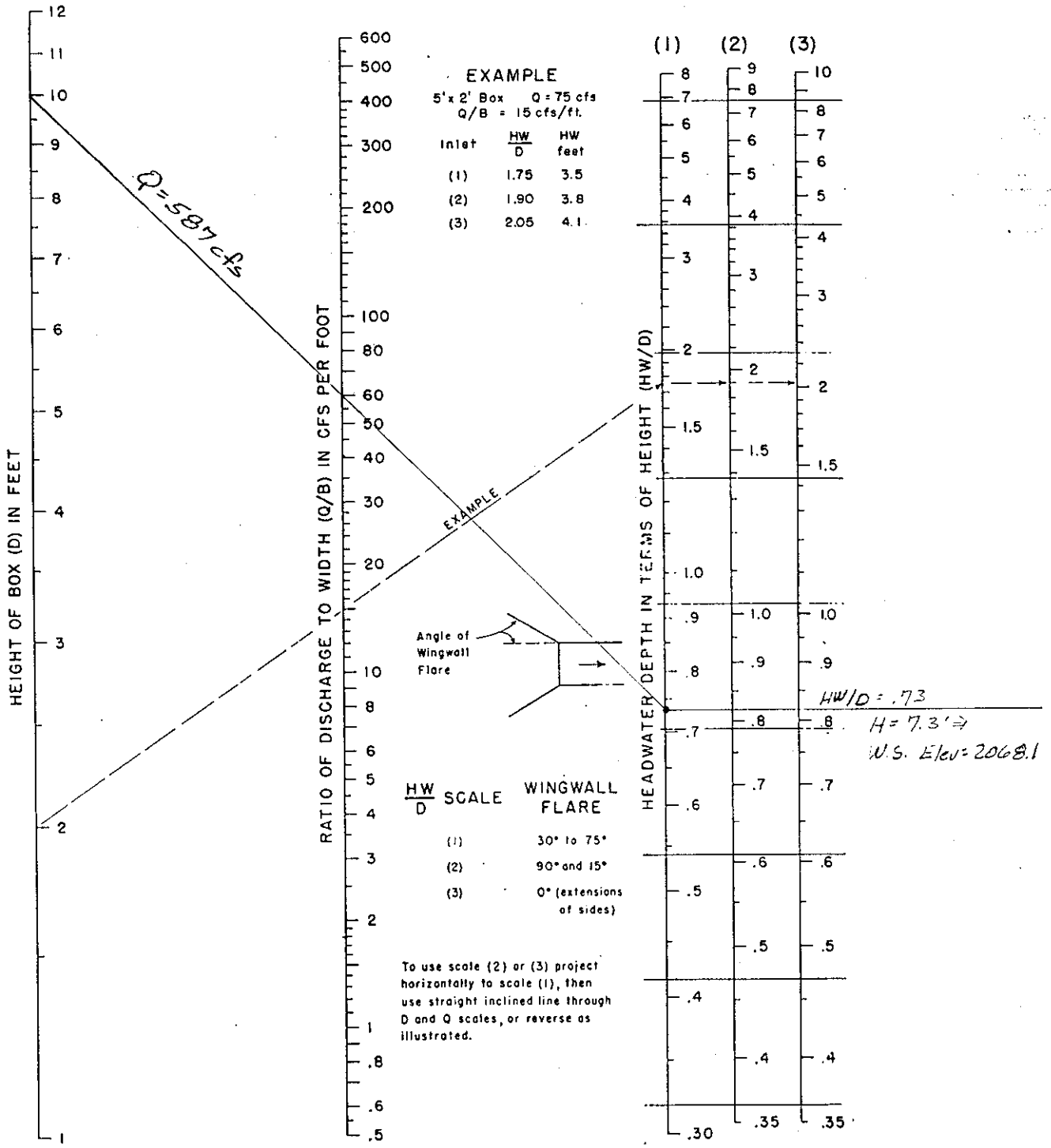
HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

10 X 10 CBC AT THE RAILROAD

with Outfall System

CHART I



HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

10 X 10 CBC AT THE RAILROAD

without Outfall System

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1*****************************************
 *  HEC-2 WATER SURFACE PROFILES          *
 *                                        *
 *  Version   4.6.0;  February 1991       *
 *                                        *
 *  RUN DATE    15JUN94    TIME   11:45:13 *
 *****************************************
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*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*        (916) 756-1104             *
*************************************
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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                        X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                  X
X     X  X        X     X            X
X     X  XXXXXXX   XXXXX              XXXXXXX
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15JUN94 11:45:13


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*************************************
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.0;  February 1991
*************************************
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THIS RUN EXECUTED 15JUN94 11:45:13

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T1 CASANDRO WASH OUTFALL PROJECT
T2    TOWN OF WICKENBURG
T3    P6A343 - R02 BY NMAO
T4 THIS MODEL IS FOR ESTIMATING THE WATERSURFACE PROFILE OF THE LOWER
T4 PORTION OF CASANDRO WASH FOR THE POST CASANDRO WASH DAM CONDITIONS.  THE
T4 DISCHARGES ARE BASED ON THE 100-YEAR, 6-HOUR RUNOFF FOR PRE AND POST OUTFALL
T4 CONDITIONS.  THE PROPOSED OUTFALL SYSTEM WILL HAVE THE CAPACITY TO CONVEY
T4 THE 50-YEAR EVENT (274 CFS); THE REMAINDER IS LEFT TO FLOW DOWN THE LOWER
T4 PORTION OF THE WASH FROM NAVAJO STREET TO SOL'S WASH.  THE FIRST RUN DOES NOT
T4 INCLUDE THE OUTFALL.   BOTH RUNS ASSUME THE EQUIPMENT CROSSING AT MOHAVE
T4 STREET AND THE RAILROAD IS OPERATING UNDER INLET CONTROL.  THE BEGINNING
T4 WATER SURFACE IS BASED ON THIS ASSUMPTION AND CALCULATED FROM HEC-5 CHARTS.

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ
              2                          0                          0     2068.1

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE
     1                -1                                                              15

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

     38       43       1        2        8        26       4        42       53       54

QT       2      587      323
NC    .045     .045     .020       .1       .3

     CASANDRO WASH OUTFALL
     RAILROAD EQUIPMENT CROSSING CULVERT
X1   0.012       10   9995.1    10005        0        0        0
GR    2071     9930     2070     9992     2070     9995   2061.5   9995.1   2061.5    10000
GR  2061.5    10005     2070  10005.1     2070    10015     2070    10018     2072    10064

X1   0.017       18     9993    10004       25       32       29
GR    2070     8790     2069     8875     2070     8975     2070     9055     2068     9080
GR    2066     9140     2064     9882     2062     9993   2061.9    10000     2062    10004
GR    2064    10009     2066    10020     2068    10030     2070    10040     2072    10094
GR    2074    10117     2076    10135     2078    10170

X1   0.036       13     9994    10004      100       97      100
GR    2074     8810     2072     8900     2070     9060     2068     9145     2066     9160
GR    2065     9775   2063.2    10000     2064    10004     2066    10013     2068    10019
GR    2070    10028     2072    10036     2074    10106
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X1   0.055       11     9990    10010      100      100      100
GR    2070     8960     2068     9010     2066     9210     2066     9805     2066     9892
GR    2066     9990   2064.7    10000     2066    10010     2068    10023     2070    10030
GR    2072    10130
     JEFFERSON STREET

QT       2      404      122
X1   0.074       12     9954    10060       96      103      100
GR    2072     9120     2070     9180     2068     9210     2066     9400   2065.2     9660
GR    2066     9750     2067     9954   2066.2    10000     2067    10060     2068    10100
GR    2070  10102.4     2072    10136

X1   0.093       10     9964    10030       95      100      100
X3                              9920     2069
GR    2070     9192     2068     9266     2066     9750     2069     9920   2067.5     9964
GR  2067.2    10000     2066    10030     2068    10220     2070    10230     2072    10236

X1   0.112       17     9983    10020       95      100      100
X3                              9905     2070
GR    2080     8960     2079     8983     2076     9018     2074     9090     2072     9135
GR    2070     9205     2068     9245     2068     9365     2066     9530     2066     9580
GR    2070     9730  2068.84     9815     2070     9905     2070     9983  2068.03    10000
GR    2070    10020   2070.4    10142
```

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X1    0.139        11       9982      10032        100        100        100
X3                                     9925     2071.1
GR     2070      9680       2071       9810     2071.1       9925     2071.1       9976       2072       9979
GR     2070      9982    2069.17      10000       2070      10012       2072      10032    2072.5      10096
GR     2080     10260
     ADAMS STREET

QT        2       390        103
X1    0.150        10       9955      10042         58         59         58
X3                                     9685       2072
GR   2070.4      9650       2071       9685       2072       9768     2072.4       9880       2072       9955
GR   2070.6     10000       2071      10015       2072      10042       2074      10157       2080      10265

X1    0.169         9       9984      10022        102        100        100
GR     2076      9702       2074       9815       2072       9984     2071.2      10000       2072      10012
GR     2074     10022       2077      10029       2078      10158       2080      10167

X1    0.188         9       9976      10022        103        101        100
GR   2075.2      9727     2075.4       9780       2075       9960       2074       9976     2072.3      10000
GR     2074     10014       2076      10022       2078      10084       2080      10155
     MADISON STREET

QT        2       370         79
X1    0.216         9       9983      10026        145        147        145
GR   2077.3      9763     2077.4       9825     2076.4       9929       2075       9983     2074.5      10000
GR     2075     10014       2076      10026       2078      10063       2080      10102
1
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X1    0.235        18       9978      10023         90         92        100
GR     2084      9670       2084       9686       2082       9748       2080       9820       2079       9842
GR     2079      9910       2077       9978       2076       9985   2075.96      10000       2076      10009
GR     2078     10017       2080      10023     2081.5      10043       2082      10101       2084      10120
GR     2086     10123       2088      10140       2090      10247

X1    0.242        14       9973      10015         36         46         37
GR     2084      9663       2084       9682       2082       9743       2080       9809     2079.4       9853
GR     2078      9973       2077       9985    2076.77      10000       2078      10015       2080      10142
GR     2082     10205       2084      10253       2086      10292       2090      10328

X1    0.252        15       9975      10087         49         58         50
GR     2084      9648       2084       9672       2082       9736       2080       9815       2080       9975
GR     2078      9988    2077.74      10000       2078      10087       2080      10107       2082      10280
GR     2084     10356       2084      10368       2084      10429       2086      10488       2090      10494
     MOHAVE

QT        2       350         53
X1    0.268        14       9988      10087         65         82         86
GR     2084      9613       2084       9671       2082       9710       2082       9793       2081       9835
GR     2080      9988     2078.3      10000     2079.3      10050       2080      10087     2080.6      10160
GR   2081.2     10290       2082      10343       2084      10404       2085      10425

X1    0.279        18       9972      10010         54         58         60
GR     2084      9620       2084       9682       2082       9790       2082       9818       2082       9966
GR   2082.2      9972       2082       9978       2080       9984     2079.3      10000       2080      10010
GR     2081     10040       2082      10063       2082      10110     2081.4      10160       2082      10217
GR     2082     10296       2084      10314       2086      10372

X1    0.293        11       9990      10023         70         58         74
GR     2084      9650       2084       9720       2083       9895       2082       9942       2081       9990
GR   2080.3     10000       2081      10023       2082      10032       2082      10280       2084      10297
GR     2086     10381

X1    0.312        10       9981      10020         93        100        100
GR     2084      9680       2084       9890       2082       9982       2081      10000       2082      10005
GR     2084     10014       2084      10028     2083.5      10185       2084      10284       2086      10325

X1    0.331         8       9990      10003         95        100        100
GR     2086      9880       2086       9981       2084       9985       2083       9990    2082.64      10000
GR     2084     10003       2084      10020       2086      10065
1
   15JUN94      11:45:13                                                                                    PAGE    4

     SECNO      DEPTH      CWSEL      CRIWS      WSELK       EG         HV         HL      OLOSS   L-BANK ELEV
     Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL       TWA   R-BANK ELEV
     TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN      ELMIN   SSTA
     SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR    TOPWID   ENDST

 *PROF 1
0

 CCHV=      .100 CEHV=      .300
 *SECNO  .012
      .012      6.60   2068.10       .00   2068.10   2069.35      1.25       .00       .00   2061.50
     587.0        .0     586.9        .0        .3      65.3        .3        .0        .0   2061.50
       .00       .13      8.98       .13      .045      .020      .045      .000   2061.50   9995.02
   .001180        0.        0.        0.         0         0         0       .00     10.05  10005.08


FLOW DISTRIBUTION FOR SECNO=       .01          CWSEL=   2068.10

STA=    9995.    9995.   10005.   10005.
  PER Q=        .0     100.0       .0
   AREA=        .3      65.3       .3
    VEL=        .1       9.0       .1
  DEPTH=       3.3       6.6      3.3

*SECNO  .017

3265 DIVIDED FLOW


3301 HV CHANGED MORE THAN HVINS
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3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO = 24.78

      .017      7.58   2069.48       .00       .00   2069.48       .00       .00       .13   2062.00
     587.0     541.0      32.8      13.2    4225.2      82.8     111.9       1.3        .3   2062.00
       .05       .13       .40       .12      .045      .020      .045      .000   2061.90   8834.37
   .000002       25.       29.       32.         2         0         0       .00   1064.30  10037.39

FLOW DISTRIBUTION FOR SECNO=       .02          CWSEL=   2069.48

STA=    8834.    8875.    8923.    9080.    9140.    9882.    9993.   10004.   10009.   10020.   10030.   10037.
  PER Q=       .0       .0       .1      2.1     70.4     19.5      5.6       .8      1.0       .3       .0
   AREA=      9.7     11.4     13.7    148.7   3322.7    719.1     82.8     32.4     49.3     24.8      5.5
    VEL=       .0       .0       .0       .1       .1       .2       .4       .2       .1       .1       .0
  DEPTH=       .2       .2       .1      2.5      4.5      6.5      7.5      6.5      4.5      2.5       .7
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*SECNO  .036
      .036      6.28   2069.48       .00       .00   2069.48       .00       .00       .00   2065.00
     587.0     245.9     335.6       5.4    2529.9    1233.5      60.1      10.8       2.6   2064.00
       .19       .10       .27       .09      .045      .020      .045      .000   2063.20   9082.19
   .000001      100.      100.       97.         2         0         0       .00    943.46  10025.65

FLOW DISTRIBUTION FOR SECNO=       .04          CWSEL=   2069.48

STA=    9082.    9145.    9160.    9775.   10004.   10013.   10019.   10026.
  PER Q=       .3       .5     41.2     57.2       .7       .2       .0
   AREA=     46.4     37.2   2446.3   1233.5     40.3     14.9      4.9
    VEL=       .0       .1       .1       .3       .1       .1       .0
  DEPTH=       .7      2.5      4.0      5.4      4.5      2.5       .7

*SECNO  .055

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .52

      .055      4.78   2069.48       .00       .00   2069.48       .00       .00       .00   2066.00
     587.0     546.0      36.3       4.7    3235.8      82.6      36.0      19.0       4.9   2066.00
       .34       .17       .44       .13      .045      .020      .045      .000   2064.70   8973.05
   .000005      100.      100.      100.         0         0         0       .00   1055.12  10028.17

FLOW DISTRIBUTION FOR SECNO=       .05          CWSEL=   2069.48

STA=    8973.    9010.    9210.    9805.    9892.    9990.   10010.   10023.   10028.
  PER Q=       .3     11.8     61.7      9.0     10.2      6.2       .8       .0
   AREA=     27.3    495.6   2069.4    302.6    340.8     82.6     32.2      3.8
    VEL=       .1       .1       .2       .2       .2       .4       .1       .1
  DEPTH=       .7      2.5      3.5      3.5      3.5      4.1      2.5       .7

*SECNO  .074
      .074      4.28   2069.48       .00       .00   2069.48       .00       .00       .00   2067.00
     404.0     316.6      80.2       7.2    2452.4     305.1      80.5      25.8       7.1   2067.00
       .52       .13       .26       .09      .045      .020      .045      .000   2065.20   9187.82
   .000003       96.      100.      103.         0         0         0       .00    913.95  10101.77
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

FLOW DISTRIBUTION FOR SECNO=       .07          CWSEL=   2069.48

STA=    9188.    9210.    9400.    9660.    9750.    9954.   10060.   10100.   10102.
  PER Q=       .2     12.3     35.6     12.3     18.0     19.8      1.8       .0
   AREA=     16.4    470.9   1008.4    349.1    607.6    305.1     79.1      1.3
    VEL=       .0       .1       .1       .1       .1       .3       .1       .0
  DEPTH=       .7      2.5      3.9      3.9      3.0      2.9      2.0       .7

*SECNO  .093

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .26

3470 ENCROACHMENT STATIONS=     9920.0   10236.0  TYPE=      1  TARGET=    -9920.000
 ELENCL=   2069.00  ELENCR= 100000.00
      .093      3.48   2069.48       .00       .00   2069.48       .01       .00       .00   2067.50
     404.0      57.9     150.9     195.2     376.0     163.0     476.5      30.1       9.2   2066.00
       .56       .15       .93       .41      .045      .020      .045      .000   2066.00   9230.54
   .000046       95.      100.      100.         0         0         0       .00    996.86  10227.40

FLOW DISTRIBUTION FOR SECNO=       .09          CWSEL=   2069.48

STA=    9231.    9266.    9750.    9920.    9964.   10030.   10220.   10227.
  PER Q=       .2      7.9      2.8      3.5     37.3     48.1       .2
   AREA=      8.5    232.0     81.5     54.1    163.0    471.1      5.5
    VEL=       .1       .1       .1       .3       .9       .4       .2
  DEPTH=       .2       .5       .5      1.2      2.5      2.5       .7

*SECNO  .112
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
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3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     9905.0   10142.0  TYPE=      1  TARGET=    -9905.000
 ELENCL=   2070.00  ELENCR= 100000.00
      .112      4.30   2070.30   2070.30       .00   2070.48       .18       .01       .05   2070.00
     404.0     180.4     217.0       6.6     234.4      47.5      13.7      31.6      11.3   2070.00
       .57       .77      4.57       .49      .045      .020      .045      .000   2066.00   9194.52
   .002726       95.      100.      100.        20        13         0       .00    916.79  10111.31


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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST


FLOW DISTRIBUTION FOR SECNO=       .11          CWSEL=   2070.30

STA=    9195.    9205.    9245.    9365.    9530.    9580.    9730.    9815.    9905.    9983.   10020.   10111.
  PER Q=       .2       2.3      6.9      9.4      2.9      8.6      4.9      5.1      4.5     53.7      1.6
   AREA=      1.6      12.0     35.9     49.4     15.0     44.9     25.4     26.9     23.3     47.5     13.7
    VEL=       .5        .8       .8       .8       .8       .8       .8       .8       .8      4.6       .5
  DEPTH=       .1        .3       .3       .3       .3       .3       .3       .3       .3      1.3       .1

*SECNO  .139

3265 DIVIDED FLOW

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     9925.0   10260.0  TYPE=      1  TARGET=    -9925.000
 ELENCL=   2071.10  ELENCR= 100000.00
      .139      2.26   2071.43   2071.43       .00   2071.73       .30       .27       .04   2070.00
     404.0      81.5     322.5        .0     100.3      65.7        .0      32.1      12.8   2072.00
       .58       .81      4.91       .00      .045      .020      .000      .000   2069.17   9680.00
   .002591      100.      100.      100.        20        11         0       .00    343.59  10026.33


FLOW DISTRIBUTION FOR SECNO=       .14          CWSEL=   2071.43

STA=    9680.    9810.    9925.    9976.    9977.    9982.   10032.
  PER Q=       8.6      7.7      3.4       .0       .5     79.8
   AREA=      43.3     38.3     17.0       .2      1.5     65.7
    VEL=       .8       .8       .8       .5      1.2      4.9
  DEPTH=       .3       .3       .3       .2       .3      1.5

*SECNO  .150

3265 DIVIDED FLOW

3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     9685.0   10265.0  TYPE=      1  TARGET=    -9685.000
1
   15JUN94      11:45:13                                                                                    PAGE    8

    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST


 ELENCL=   2072.00  ELENCR= 100000.00
      .150      1.62   2072.02   2072.02       .00   2072.33       .31       .22       .00   2072.00
     390.0      73.2     316.8        .0      43.5      64.4        .0      32.3      13.1   2072.00
       .59      1.68      4.92       .03      .045      .020      .045      .000   2070.40   9650.00
   .006536       58.       58.       59.        20        19         0       .00    213.72  10042.96


FLOW DISTRIBUTION FOR SECNO=       .15          CWSEL=   2072.02

STA=    9650.    9685.    9768.    9955.   10042.
  PER Q=       .0     18.7       .0     81.2
   AREA=       .6     42.9       .1     64.4
    VEL=       .2      1.7       .0      4.9
  DEPTH=       .0       .5       .0       .7

*SECNO  .169
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .169      1.99   2073.19   2073.19       .00   2073.65       .47       .54       .05   2072.00
     390.0      92.3     297.7        .0      59.5      47.9        .0      32.5      13.5   2074.00
       .59      1.55      6.21       .00      .045      .020      .000      .000   2071.20   9883.76
   .004436      102.      100.      100.        20        11         0       .00    134.17  10017.93


FLOW DISTRIBUTION FOR SECNO=       .17          CWSEL=   2073.19

STA=    9884.    9984.   10022.
  PER Q=      23.7     76.3
   AREA=      59.5     47.9
    VEL=       1.6      6.2
  DEPTH=        .6      1.4

*SECNO  .188
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
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3720 CRITICAL DEPTH ASSUMED
      .188       2.35   2074.65   2074.65       .00   2075.34       .69       .48       .07   2074.00
     390.0        3.7     386.3        .0       3.4      57.8        .0      32.7      13.7   2076.00
       .59       1.11      6.69       .00      .045      .020      .000      .000   2072.30   9965.64
   .005105       103.      100.      101.        20        11         0       .00     50.95  10016.59
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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

FLOW DISTRIBUTION FOR SECNO=       .19          CWSEL=   2074.65

STA=    9966.    9976.   10022.
  PER Q=       1.0      99.0
   AREA=       3.4      57.8
    VEL=       1.1       6.7
  DEPTH=        .3       1.4

*SECNO  .216
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .216       1.69   2076.19   2076.19       .00   2076.71       .52       .74       .02   2075.00
     370.0       45.8     324.0        .2      27.3      52.9        .3      33.0      14.0   2076.00
       .60       1.68      6.12       .49      .045      .020      .045      .000   2074.50   9937.09
   .005155       145.      145.      147.        20        15         0       .00     92.43  10029.52

FLOW DISTRIBUTION FOR SECNO=       .22          CWSEL=   2076.19

STA=    9937.    9983.   10026.   10030.
  PER Q=      12.4      87.6       .0
   AREA=      27.3      52.9       .3
    VEL=       1.7       6.1       .5
  DEPTH=        .6       1.2       .1

*SECNO  .235
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .235       1.74   2077.70   2077.70       .00   2078.34       .64       .49       .04   2077.00
     370.0        9.2     360.8        .0       8.2      55.3        .0      33.1      14.2   2080.00
       .61       1.12      6.52       .00      .045      .020      .000      .000   2075.96   9954.32
   .004678        90.      100.       92.        20         8         0       .00     61.47  10015.79

FLOW DISTRIBUTION FOR SECNO=       .23          CWSEL=   2077.70

STA=    9954.    9978.   10023.
  PER Q=       2.5      97.5
   AREA=       8.2      55.3
    VEL=       1.1       6.5
  DEPTH=        .3       1.5
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    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

*SECNO  .242
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .242       1.87   2078.64   2078.64       .00   2079.12       .48       .16       .02   2078.00
     370.0       17.0     340.4      12.6      17.7      58.9      13.1      33.2      14.2   2078.00
       .61        .96      5.77       .96      .045      .020      .045      .000   2076.77   9917.92
   .003857        36.       37.       46.        20         8         0       .00    137.89  10055.80

FLOW DISTRIBUTION FOR SECNO=       .24          CWSEL=   2078.64

STA=    9918.    9973.   10015.   10056.
  PER Q=       4.6      92.0       3.4
   AREA=      17.7      58.9      13.1
    VEL=       1.0       5.8       1.0
  DEPTH=        .3       1.4        .3

*SECNO  .252

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.84

      .252       1.39   2079.13       .00       .00   2079.25       .12       .10       .04   2080.00
     370.0         .0     365.2       4.8        .0     128.6       6.4      33.3      14.4   2078.00
       .61        .00      2.84       .76      .000      .020      .045      .000   2077.74   9980.67
   .001135        49.       50.       58.         3         0         0       .00    117.60  10098.27

FLOW DISTRIBUTION FOR SECNO=       .25          CWSEL=   2079.13

STA=    9981.   10087.   10098.
  PER Q=      98.7       1.3
   AREA=     128.6       6.4
    VEL=       2.8        .8
  DEPTH=       1.2        .6

*SECNO  .268
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3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .268      1.56   2079.86   2079.86       .00   2080.25       .39       .19       .08   2080.00
     350.0        .0     350.0        .0        .0      69.8        .0      33.5      14.6   2080.00
       .62       .00      5.01       .00      .000      .020      .000      .000   2078.30   9988.99
   .006448       65.       86.       82.        20         8         0       .00     90.59  10079.58
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

FLOW DISTRIBUTION FOR SECNO=       .27          CWSEL=   2079.86

STA=    9989.   10087.
  PER Q=    100.0
   AREA=     69.8
    VEL=      5.0
  DEPTH=       .8

*SECNO  .279
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .279      2.01   2081.31   2081.31       .00   2081.90       .59       .32       .06   2082.20
     350.0        .0     302.3      47.7        .0      45.8      25.4      33.6      14.7   2080.00
       .62       .00      6.61      1.88      .000      .020      .045      .000   2079.30   9980.07
   .004539       54.       60.       58.        20        11         0       .00     67.08  10047.15

FLOW DISTRIBUTION FOR SECNO=       .28          CWSEL=   2081.31

STA=    9980.   10010.   10040.   10047.
  PER Q=     86.4     13.4       .2
   AREA=     45.8     24.3      1.1
    VEL=      6.6      1.9       .6
  DEPTH=      1.5       .8       .2

*SECNO  .293
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .293      1.97   2082.27   2082.27       .00   2082.52       .25       .21       .03   2081.00
     350.0     47.8     250.4      51.9      38.9      53.6      75.0      33.8      15.0   2081.00
       .63      1.23      4.67       .69      .045      .020      .045      .000   2080.30   9929.16
   .002078       70.       74.       58.        20         6         0       .00    353.16  10282.32

FLOW DISTRIBUTION FOR SECNO=       .29          CWSEL=   2082.27

STA=    9929.    9942.    9990.   10023.   10032.   10280.   10282.
  PER Q=       .2     13.4     71.5      2.5     12.3       .0
   AREA=      1.8     37.1     53.6      7.0     67.8       .3
    VEL=       .4      1.3      4.7      1.3       .6       .4
  DEPTH=       .1       .8      1.6       .8       .3       .1
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*SECNO  .312
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .312      2.08   2083.08   2083.08       .00   2083.52       .44       .34       .06   2084.00
     350.0        .0     350.0        .0        .0      65.6        .0      34.1      15.5   2084.00
       .63       .00      5.33       .00      .000      .020      .000      .000   2081.00   9932.43
   .006457       93.      100.      100.        20         8         0       .00     77.42  10009.85

FLOW DISTRIBUTION FOR SECNO=       .31          CWSEL=   2083.08

STA=    9932.   10014.
  PER Q=    100.0
   AREA=     65.6
    VEL=      5.3
  DEPTH=       .8

*SECNO  .331
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .331      2.65   2085.29   2085.29       .00   2085.98       .69       .48       .07   2083.00
     350.0     28.5     241.3      80.2      10.6      30.6      40.6      34.2      15.7   2084.00
       .64      2.69      7.89      1.98      .045      .020      .045      .000   2082.64   9982.42
   .003710       95.      100.      100.        20        11         0       .00     66.58  10049.00

FLOW DISTRIBUTION FOR SECNO=       .33          CWSEL=   2085.29

STA=    9982.    9985.    9990.   10003.   10020.   10049.
  PER Q=       .7      7.5     68.9     14.9      8.0
   AREA=      1.7      8.9     30.6     21.9     18.7
    VEL=      1.4      2.9      7.9      2.4      1.5
  DEPTH=       .6      1.8      2.4      1.3       .6
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```
T1
T2
T3   CASANDRO WASH WITH DAM
T4   THIS MODEL REFLECTS THE WATER SURFACE ELEVATION OF THE Q100,6HR STORM
T4   CONSIDERING THE OUTFALL PIPE TO BE IN PLACE.

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

              3                          0                                  2065.6

J2  NPROF     IPLOT    PRFVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

    2                  -1                                                              15
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*PROF 2
0

CCHV=     .100 CEHV=     .300
*SECNO  .012
     .012      4.10   2065.60       .00   2065.60   2066.58       .98       .00       .00   2061.50
   323.0        .0     323.0        .0        .1      40.6        .1        .0        .0   2061.50
     .00       .01      7.96       .01      .045      .020      .045      .000   2061.50   9995.05
 .001748        0.        0.        0.         0         0         0       .00     10.00  10005.05

FLOW DISTRIBUTION FOR SECNO=       .01          CWSEL=   2065.60

STA=    9995.    9995.   10005.   10005.
  PER Q=        .0    100.0       .0
   AREA=        .1     40.6       .1
    VEL=        .0      8.0       .0
  DEPTH=       2.1      4.1      2.1

*SECNO  .017

3301 HV CHANGED MORE THAN HVINS

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO = 13.43

     .017      4.78   2066.68       .00       .00   2066.68       .00       .00       .10   2062.00
   323.0      282.1      33.9       7.0    1664.5      52.1      38.1        .5        .3   2062.00
     .03       .17       .65       .18      .045      .020      .045      .000   2061.90   9119.51
 .000010       25.       29.       32.         2         0         0       .00    903.90  10023.41

FLOW DISTRIBUTION FOR SECNO=       .02          CWSEL=   2066.68

STA=    9120.    9140.    9882.    9993.   10004.   10009.   10020.   10023.
  PER Q=        .1     56.2     31.0     10.5      1.3       .8       .0
   AREA=       7.0   1248.7    408.8     52.1     18.4     18.5      1.2
    VEL=        .1       .1       .2       .7       .2       .1       .0
  DEPTH=        .3      1.7      3.7      4.7      3.7      1.7       .3
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*SECNO  .036
     .036      3.48   2066.68       .00       .00   2066.68       .00       .00       .00   2065.00
   323.0      78.4      242.6       2.1     728.5     593.2      15.8       4.1       2.3   2064.00
     .12       .11        .41       .13      .045      .020      .045      .000   2063.20   9154.89
 .000009      100.      100.       97.         2         0         0       .00    860.16  10015.04

FLOW DISTRIBUTION FOR SECNO=       .04          CWSEL=   2066.68

STA=    9155.    9160.    9775.   10004.   10013.   10015.
  PER Q=        .0     24.2     75.1       .6       .0
   AREA=       1.7    726.7    593.2     15.1       .7
    VEL=        .0       .1       .4       .1       .0
  DEPTH=        .3      1.2      2.6      1.7       .3

*SECNO  .055

3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =   .15

     .055      1.98   2066.68       .00       .00   2066.69       .01       .00       .00   2066.00
   323.0     275.6      46.9        .5     555.7      26.7       1.5       6.3       4.3   2066.00
     .16       .50      1.76       .31      .045      .020      .045      .000   2064.70   9141.74
 .000387      100.      100.      100.         0         0         0       .00    872.70  10014.44

FLOW DISTRIBUTION FOR SECNO=       .05          CWSEL=   2066.68

STA=    9142.    9210.    9805.    9892.    9990.   10010.   10014.
  PER Q=       2.3     63.3      9.3     10.4     14.5       .1
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   AREA=     23.3    406.2     59.4     66.9     26.7      1.5
    VEL=       .3       .5       .5       .5      1.8       .3
  DEPTH=       .3       .7       .7       .7      1.3       .3

*SECNO  .074

3265 DIVIDED FLOW

      .074     1.51  2066.71      .00      .00  2066.71      .00      .02      .00  2067.00
     122.0    118.1      3.9       .0    457.3     16.4       .0      7.4      5.9  2067.00
       .26      .26      .24      .00     .045     .020     .000     .000  2065.20  9333.67
   .000065      96.     100.     103.        0        0        0      .00   624.79 10037.37
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

FLOW DISTRIBUTION FOR SECNO=       .07          CWSEL=   2066.71

STA=    9334.    9400.    9660.    9750.    9892.   10060.
  PER Q=      2.5     66.1     22.9      5.4      3.2
   AREA=     23.2    285.5     98.8     49.7     16.4
    VEL=       .1       .3       .3       .1       .2
  DEPTH=       .3      1.1      1.1       .3       .2

*SECNO  .093
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     9920.0   10236.0  TYPE=      1  TARGET=    -9920.000
 ELENCL=   2069.00  ELENCR= 100000.00
      .093      .83  2066.83  2066.83      .00  2067.04      .21      .02      .06  2067.50
     122.0       .0     45.4     76.6       .0      8.7     33.0      8.0      6.7  2066.00
       .27      .00     5.23     2.32     .000     .020     .045     .000  2066.00 10009.17
   .015917      95.     100.     100.       20       11        0      .00    99.99 10109.16

FLOW DISTRIBUTION FOR SECNO=       .09          CWSEL=   2066.83

STA=   10009.   10030.   10109.
  PER Q=     37.2     62.8
   AREA=      8.7     33.0
    VEL=      5.2      2.3
  DEPTH=       .4       .4

*SECNO  .112
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     9905.0   10142.0  TYPE=      1  TARGET=    -9905.000
 ELENCL=   2070.00  ELENCR= 100000.00
      .112     3.60  2069.60  2069.60      .00  2070.03      .43     1.02      .07  2070.00
     122.0       .0    122.0       .0       .0     23.1       .0      8.1      6.9  2070.00
       .28      .00     5.28      .00     .000     .020     .000     .000  2066.00  9986.47
   .007052      95.     100.     100.       20       16        0      .00    29.45 10015.92
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

FLOW DISTRIBUTION FOR SECNO=       .11          CWSEL=   2069.60

STA=    9986.   10020.
  PER Q=    100.0
   AREA=     23.1
    VEL=      5.3
  DEPTH=       .8

*SECNO  .139
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     9925.0   10260.0  TYPE=      1  TARGET=    -9925.000
 ELENCL=   2071.10  ELENCR= 100000.00
      .139     1.21  2070.38  2070.38      .00  2070.76      .38      .69      .01  2070.00
     122.0       .1    121.9       .0       .1     24.7       .0      8.1      7.0  2072.00
       .28      .80     4.94      .00     .045     .020     .000     .000  2069.17  9981.42
   .006731      100.     100.     100.        2       22        0      .00    34.41 10015.84

FLOW DISTRIBUTION FOR SECNO=       .14          CWSEL=   2070.38

STA=    9981.    9982.   10032.
  PER Q=       .1     99.9
   AREA=       .1     24.7
    VEL=       .8      4.9
  DEPTH=       .2       .7

*SECNO  .150

3265 DIVIDED FLOW
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3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=     9685.0   10265.0  TYPE=      1  TARGET=    -9685.000
 ELENCL=   2072.00  ELENCR= 100000.00
      .150       1.06   2071.46   2071.46       .00   2071.66       .20       .41       .02   2072.00
     103.0        9.5      93.5        .0       8.9      24.8        .0       8.2       7.0   2072.00
       .29       1.07      3.77       .00      .045      .020      .000      .000   2070.40   9685.00
   .007493        58.       58.       59.        20        15         0       .00     93.65  10027.50
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

FLOW DISTRIBUTION FOR SECNO=       .15          CWSEL=   2071.46

STA=    9685.    9723.   10042.
  PER Q=      9.2      90.8
   AREA=      8.9      24.8
    VEL=      1.1       3.8
  DEPTH=       .2        .4

*SECNO  .169
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .169       1.17   2072.37   2072.37       .00   2072.67       .30       .64       .03   2072.00
     103.0        4.6      98.4        .0       5.7      21.9        .0       8.2       7.2   2074.00
       .29        .80      4.50       .00      .045      .020      .000      .000   2071.20   9952.87
   .005585       102.      100.      100.         1         8         0       .00     60.97  10013.84

FLOW DISTRIBUTION FOR SECNO=       .17          CWSEL=   2072.37

STA=    9953.    9984.   10022.
  PER Q=      4.4      95.6
   AREA=      5.7      21.9
    VEL=       .8       4.5
  DEPTH=       .2        .7

*SECNO  .188
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .188       1.38   2073.68   2073.68       .00   2074.04       .36       .62       .02   2074.00
     103.0         .0     103.0        .0        .0      21.4        .0       8.3       7.3   2076.00
       .30        .00      4.81       .00      .000      .020      .000      .000   2072.30   9980.46
   .006882       103.      100.      101.        20        11         0       .00     30.94  10011.40

FLOW DISTRIBUTION FOR SECNO=       .19          CWSEL=   2073.68

STA=    9980.   10022.
  PER Q=    100.0
   AREA=     21.4
    VEL=      4.8
  DEPTH=       .7
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*SECNO  .216
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .216        .84   2075.34   2075.34       .00   2075.59       .25      1.00       .01   2075.00
      79.0        1.9      77.1        .0       2.2      18.9        .0       8.4       7.5   2076.00
       .31        .84      4.07       .00      .045      .020      .000      .000   2074.50   9969.93
   .006836       145.      145.      147.        15        14         0       .00     48.14  10018.07

FLOW DISTRIBUTION FOR SECNO=       .22          CWSEL=   2075.34

STA=    9970.    9983.   10026.
  PER Q=      2.3      97.7
   AREA=      2.2      18.9
    VEL=       .8       4.1
  DEPTH=       .2        .5

*SECNO  .235
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .235        .68   2076.64   2076.64       .00   2076.94       .29       .69       .01   2077.00
      79.0         .0      79.0        .0        .0      18.2        .0       8.4       7.5   2080.00
       .31        .00      4.35       .00      .000      .020      .000      .000   2075.96   9980.51
   .007062        90.      100.       92.        20        15         0       .00     31.06  10011.57

FLOW DISTRIBUTION FOR SECNO=       .23          CWSEL=   2076.64

STA=    9981.   10023.
  PER Q=    100.0
   AREA=     18.2
    VEL=      4.4
```

```
  DEPTH=        .6

 *SECNO  .242
 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
      .242        .87   2077.64   2077.64        .00   2077.93        .28        .26        .00   2078.00
     79.0         .0      79.0        .0         .0      18.5         .0        8.4        7.6   2078.00
      .32        .00      4.26        .00       .000      .020       .000       .000    2076.77   9977.27
   .007226        36.       37.       46.         20        11          0        .00      33.39  10010.66

1
   15JUN94       11:45:13                                                                                    PAGE   20

    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

 FLOW DISTRIBUTION FOR SECNO=        .24          CWSEL=   2077.64

 STA=    9977.   10015.
   PER Q=    100.0
    AREA=     18.5
     VEL=      4.3
   DEPTH=       .6

 *SECNO  .252
      .252        .43   2078.17        .00        .00   2078.28        .11        .34        .02   2080.00
     79.0         .0      78.9        .1         .0      30.0         .1        8.5        7.7   2078.00
      .32        .00      2.63        .51       .000      .020       .045       .000    2077.74   9986.88
   .006250        49.       50.       58.          2         0          0        .00     101.84  10088.72

 FLOW DISTRIBUTION FOR SECNO=        .25          CWSEL=   2078.17

 STA=    9987.   10087.   10089.
   PER Q=     99.9        .1
    AREA=     30.0        .1
     VEL=      2.6        .5
   DEPTH=       .3        .1

 *SECNO  .268
 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
      .268        .73   2079.03   2079.03        .00   2079.22        .19        .60        .02   2080.00
     53.0         .0      53.0        .0         .0      15.3         .0        8.5        7.8   2080.00
      .33        .00      3.46        .00       .000      .020       .000       .000    2078.30   9994.83
   .008278        65.       86.       82.         20        14          0        .00      41.82  10036.65

 FLOW DISTRIBUTION FOR SECNO=        .27          CWSEL=   2079.03

 STA=    9995.   10087.
   PER Q=    100.0
    AREA=     15.3
     VEL=      3.5
   DEPTH=       .4

1
   15JUN94       11:45:13                                                                                    PAGE   21

    SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS      L-BANK ELEV
    Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA        R-BANK ELEV
    TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN      SSTA
    SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID     ENDST

 *SECNO  .279
 3685 20 TRIALS ATTEMPTED WSEL,CWSEL
 3693 PROBABLE MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
      .279        .86   2080.16   2080.16        .00   2080.40        .25        .47        .02   2082.20
     53.0         .0      52.8        .2         .0      13.2         .4        8.5        7.8   2080.00
      .33        .00      4.00        .52       .000      .020       .045       .000    2079.30   9983.53
   .007347        54.       60.       58.         20        11          0        .00      31.17  10014.70

 FLOW DISTRIBUTION FOR SECNO=        .28          CWSEL=   2080.16

 STA=    9984.   10010.   10015.
   PER Q=     99.6        .4
    AREA=     13.2        .4
     VEL=      4.0        .5
   DEPTH=       .5        .1

 *SECNO  .293
 7185 MINIMUM SPECIFIC ENERGY
 3720 CRITICAL DEPTH ASSUMED
      .293        .78   2081.08   2081.08        .00   2081.30        .21        .55        .00   2081.00
     53.0         .1      52.9        .0         .2      14.3         .0        8.6        7.9   2081.00
      .34        .35      3.70        .03       .045      .020       .045       .000    2080.30   9985.99
   .007574        70.       74.       58.         11        12          0        .00      37.76  10023.75

 FLOW DISTRIBUTION FOR SECNO=        .29          CWSEL=   2081.08

 STA=    9986.    9990.   10023.   10024.
   PER Q=       .1     99.9        .0
    AREA=       .2     14.3        .0
     VEL=       .3      3.7        .0
   DEPTH=       .0       .4        .0
```

```
*SECNO  .312
7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .312      1.07   2082.07   2082.07       .00   2082.32       .25       .75       .01   2084.00
     53.0        .0      53.0       .0        .0      13.2        .0       8.6       8.0   2084.00
      .35       .00      4.01       .00      .000      .020      .000      .000   2081.00   9978.83
  .007432       93.      100.      100.         2        11         0       .00     26.48  10005.31
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

FLOW DISTRIBUTION FOR SECNO=       .31          CWSEL=   2082.07

STA=    9979.   10014.
  PER Q=    100.0
   AREA=     13.2
    VEL=      4.0
  DEPTH=       .5

*SECNO  .331
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
      .331      1.06   2083.70   2083.70       .00   2084.10       .39       .68       .04   2083.00
     53.0        1.6      51.4       .0        1.2      10.1        .0       8.6       8.0   2084.00
      .35       1.29      5.10       .00      .045      .020      .000      .000   2082.64   9986.48
  .006321        95.      100.      100.        20         5         0       .00     15.86  10002.35

FLOW DISTRIBUTION FOR SECNO=       .33          CWSEL=   2083.70

STA=    9986.    9990.   10003.
  PER Q=      3.0     97.0
   AREA=      1.2     10.1
    VEL=      1.3      5.1
  DEPTH=       .4       .8
```



```
*************************************                THIS RUN EXECUTED 15JUN94    11:45:19
 HEC-2 WATER SURFACE PROFILES

 Version   4.6.0;  February 1991
*************************************

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

A343 - R02 BY NMAO

SUMMARY PRINTOUT

      SECNO       Q       CWSEL     CRIWS     DEPTH     VCH     TOPWID    ELMIN     SSTA      ENDST

       .012    587.00   2068.10       .00      6.60     8.98     10.05   2061.50   9995.02  10005.08
       .012    323.00   2065.60       .00      4.10     7.96     10.00   2061.50   9995.05  10005.05

*      .017    587.00   2069.48       .00      7.58      .40   1064.30   2061.90   8834.37  10037.39
*      .017    323.00   2066.68       .00      4.78      .65    903.90   2061.90   9119.51  10023.41

       .036    587.00   2069.48       .00      6.28      .27    943.46   2063.20   9082.19  10025.65
       .036    323.00   2066.68       .00      3.48      .41    860.16   2063.20   9154.89  10015.04

*      .055    587.00   2069.48       .00      4.78      .44   1055.12   2064.70   8973.05  10028.17
*      .055    323.00   2066.68       .00      1.98     1.76    872.70   2064.70   9141.74  10014.44

       .074    404.00   2069.48       .00      4.28      .26    913.95   2065.20   9187.82  10101.77
       .074    122.00   2066.71       .00      1.51      .24    624.79   2065.20   9333.67  10037.37

*      .093    404.00   2069.48       .00      3.48      .93    996.86   2066.00   9230.54  10227.40
*      .093    122.00   2066.83   2066.83       .83     5.23     99.99   2066.00  10009.17  10109.16

*      .112    404.00   2070.30   2070.30      4.30     4.57    916.79   2066.00   9194.52  10111.31
*      .112    122.00   2069.60   2069.60      3.60     5.28     29.45   2066.00   9986.47  10015.92

*      .139    404.00   2071.43   2071.43      2.26     4.91    343.59   2069.17   9680.00  10026.33
*      .139    122.00   2070.38   2070.38      1.21     4.94     34.41   2069.17   9981.42  10015.84

*      .150    390.00   2072.02   2072.02      1.62     4.92    213.72   2070.40   9650.00  10042.96
*      .150    103.00   2071.46   2071.46      1.06     3.77     93.65   2070.40   9685.00  10027.50

*      .169    390.00   2073.19   2073.19      1.99     6.21    134.17   2071.20   9883.76  10017.93
*      .169    103.00   2072.37   2072.37      1.17     4.50     60.97   2071.20   9952.87  10013.84

*      .188    390.00   2074.65   2074.65      2.35     6.69     50.95   2072.30   9965.64  10016.59
*      .188    103.00   2073.68   2073.68      1.38     4.81     30.94   2072.30   9980.46  10011.40
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      SECNO       Q       CWSEL     CRIWS     DEPTH     VCH     TOPWID    ELMIN     SSTA      ENDST
```

*	.216	370.00	2076.19	2076.19	1.69	6.12	92.43	2074.50	9937.09	10029.52
*	.216	79.00	2075.34	2075.34	.84	4.07	48.14	2074.50	9969.93	10018.07
*	.235	370.00	2077.70	2077.70	1.74	6.52	61.47	2075.96	9954.32	10015.79
*	.235	79.00	2076.64	2076.64	.68	4.35	31.06	2075.96	9980.51	10011.57
*	.242	370.00	2078.64	2078.64	1.87	5.77	137.89	2076.77	9917.92	10055.80
*	.242	79.00	2077.64	2077.64	.87	4.26	33.39	2076.77	9977.27	10010.66
*	.252	370.00	2079.13	.00	1.39	2.84	117.60	2077.74	9980.67	10098.27
	.252	79.00	2078.17	.00	.43	2.63	101.84	2077.74	9986.88	10088.72
*	.268	350.00	2079.86	2079.86	1.56	5.01	90.59	2078.30	9988.99	10079.58
*	.268	53.00	2079.03	2079.03	.73	3.46	41.82	2078.30	9994.83	10036.65
*	.279	350.00	2081.31	2081.31	2.01	6.61	67.08	2079.30	9980.07	10047.15
*	.279	53.00	2080.16	2080.16	.86	4.00	31.17	2079.30	9983.53	10014.70
*	.293	350.00	2082.27	2082.27	1.97	4.67	353.16	2080.30	9929.16	10282.32
*	.293	53.00	2081.08	2081.08	.78	3.70	37.76	2080.30	9985.99	10023.75
*	.312	350.00	2083.08	2083.08	2.08	5.33	77.42	2081.00	9932.43	10009.85
*	.312	53.00	2082.07	2082.07	1.07	4.01	26.48	2081.00	9978.83	10005.31
*	.331	350.00	2085.29	2085.29	2.65	7.89	66.58	2082.64	9982.42	10049.00
*	.331	53.00	2083.70	2083.70	1.06	5.10	15.86	2082.64	9986.48	10002.35

SUMMARY OF ERRORS AND SPECIAL NOTES

```
WARNING SECNO=      .017  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .017  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .055  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO=      .055  PROFILE=  2  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO=      .093  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
CAUTION SECNO=      .093  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .093  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .093  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=      .112  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .112  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .112  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .112  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .112  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .112  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=      .139  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .139  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .139  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .139  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .139  PROFILE=  2  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=      .150  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .150  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .150  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .150  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .150  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .150  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=      .169  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .169  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .169  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .169  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .169  PROFILE=  2  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=      .188  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .188  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .188  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .188  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .188  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .188  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=      .216  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .216  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .216  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .216  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .216  PROFILE=  2  MINIMUM SPECIFIC ENERGY

CAUTION SECNO=      .235  PROFILE=  1  CRITICAL DEPTH ASSUMED
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CAUTION SECNO=      .235  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .235  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .235  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .235  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .235  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION SECNO=      .242  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .242  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .242  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
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CAUTION SECNO=      .242  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .242  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL

WARNING SECNO=      .252  PROFILE=  1  CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

CAUTION SECNO=      .268  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .268  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
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CAUTION SECNO=      .268  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .268  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
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CAUTION SECNO=      .279  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .279  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
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CAUTION SECNO=      .279  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
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CAUTION SECNO=      .293  PROFILE=  1  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .293  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .293  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .293  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .293  PROFILE=  2  MINIMUM SPECIFIC ENERGY

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CAUTION SECNO=      .312  PROFILE=  1  PROBABLE MINIMUM SPECIFIC ENERGY
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CAUTION SECNO=      .331  PROFILE=  1  20 TRIALS ATTEMPTED TO BALANCE WSEL
CAUTION SECNO=      .331  PROFILE=  2  CRITICAL DEPTH ASSUMED
CAUTION SECNO=      .331  PROFILE=  2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION SECNO=      .331  PROFILE=  2  20 TRIALS ATTEMPTED TO BALANCE WSEL
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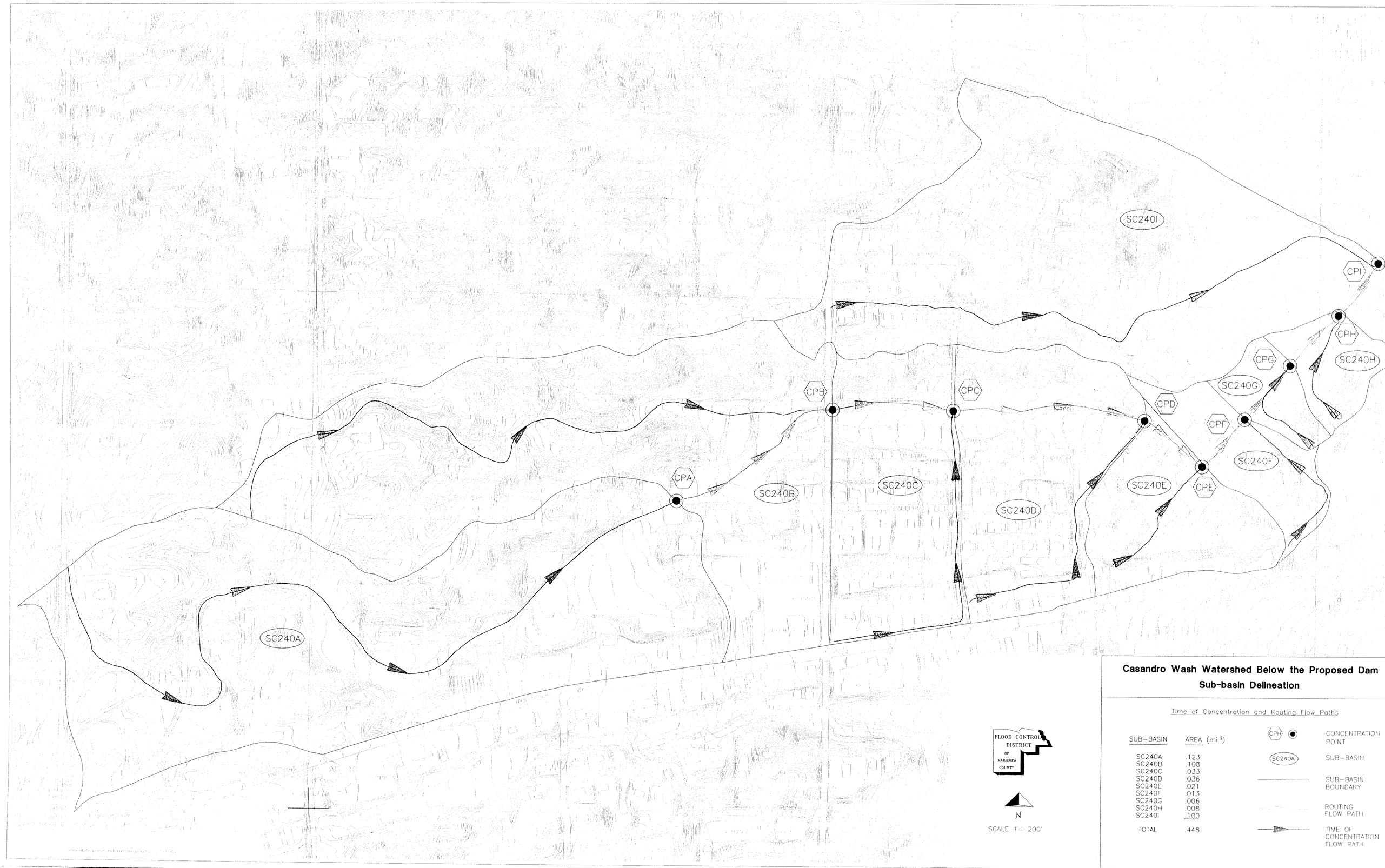
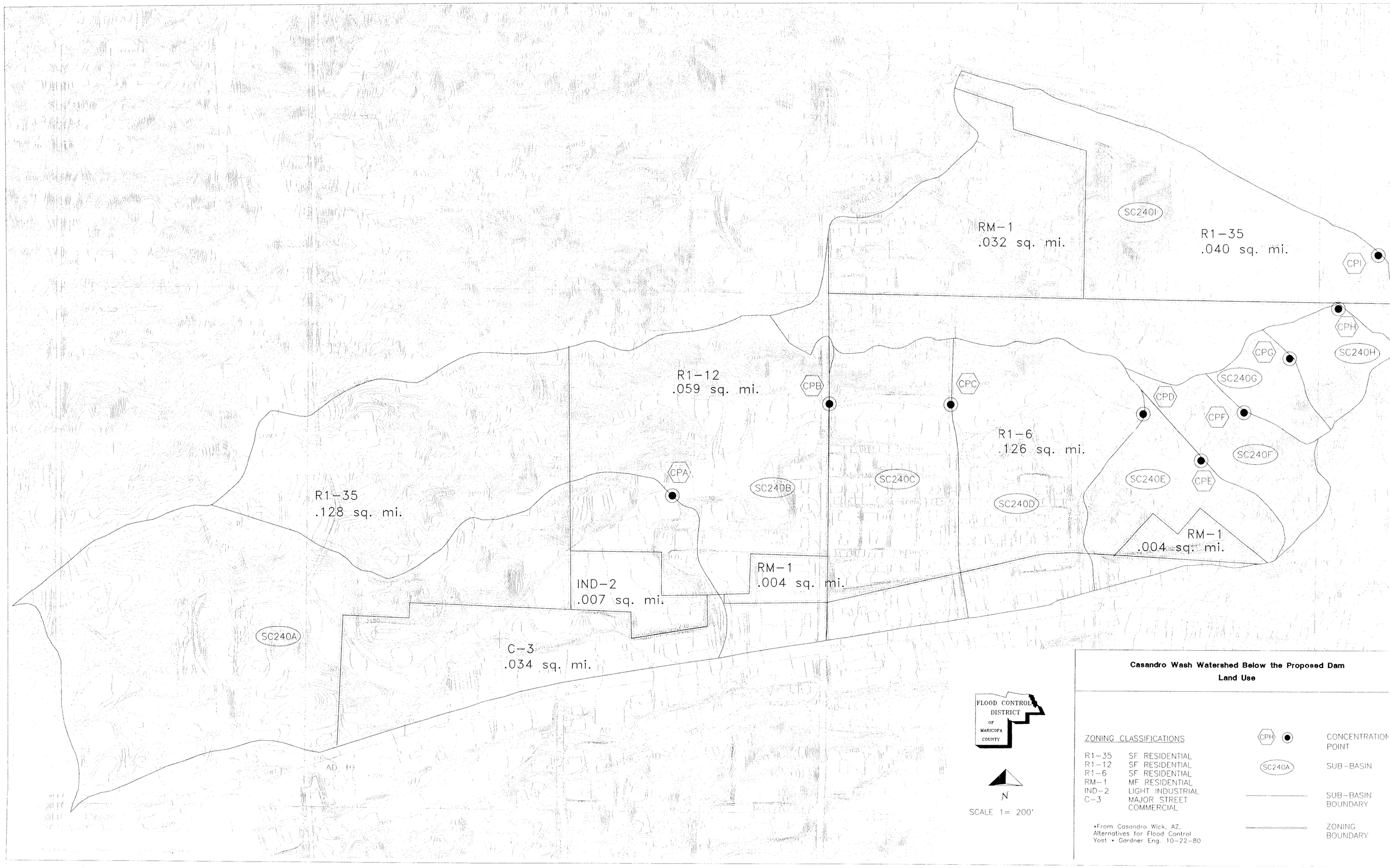

SC240I
CPI
CPH
SC240H
CPG
SC240G
CPD
CPF
SC240F
CPE
SC240E
SC240D
CPC
CPB
SC240C
SC240B
CPA
SC240A
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
N
SCALE 1= 200'
Casandro Wash Watershed Below the Proposed Dam
Sub-basin Delineation
Time of Concentration and Routing Flow Paths
SUB-BASIN
AREA (mi²)
SC240A .123
SC240B .108
SC240C .033
SC240D .036
SC240E .021
SC240F .013
SC240G .006
SC240H .008
SC240I .100
TOTAL .448
CONCENTRATION POINT
SUB-BASIN
SUB-BASIN BOUNDARY
ROUTING FLOW PATH
TIME OF CONCENTRATION FLOW PATH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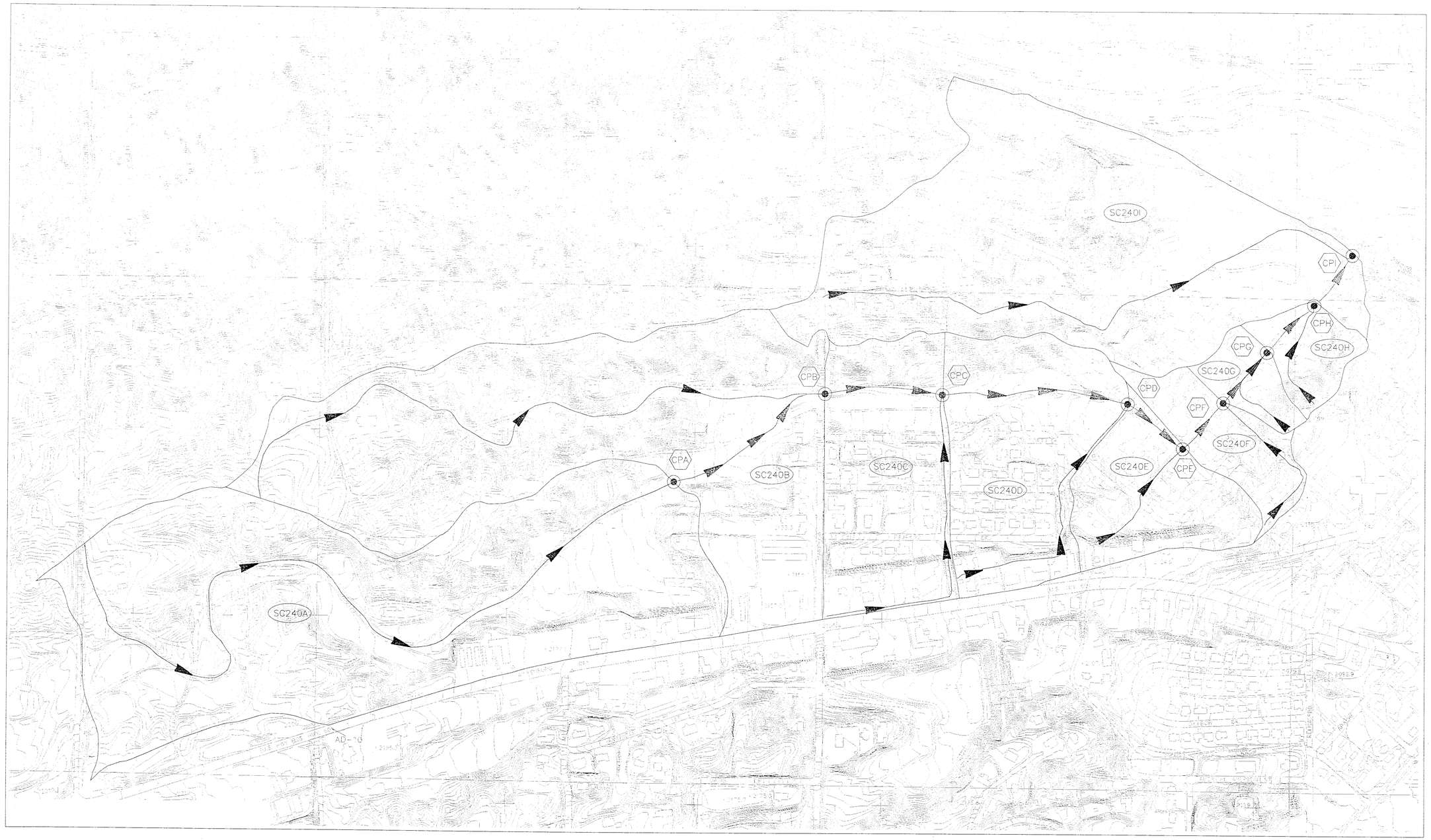
SC240I
R1-35
.040 sq. mi.
CPI
CPH
SC240H
CPG
SC240G
CPD
CPF
SC240F
R1-6
.126 sq. mi.
SC240E
CPE
SC240D
RM-1
.004 sq. mi.
R1-12
.059 sq. mi.
CPB
CPC
SC240C
SC240B
CPA
R1-35
.128 sq. mi.
RM-1
.004 sq. mi.
IND-2
.007 sq. mi.
SC240A
C-3
.034 sq. mi.
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
N
SCALE 1= 200'
Casandro Wash Watershed Below the Proposed Dam
Land Use
ZONING CLASSIFICATIONS
R1-35 SF RESIDENTIAL
R1-12 SF RESIDENTIAL
R1-6 SF RESIDENTIAL
RM-1 MF RESIDENTIAL
IND-2 LIGHT INDUSTRIAL
C-3 MAJOR STREET COMMERCIAL
*From Casandro Wick, AZ.
Alternatives for Flood Control
Yost • Gardner Eng. 10-22-80
CPH
CONCENTRATION POINT
SC240A
SUB-BASIN
SUB-BASIN BOUNDARY
ZONING BOUNDARY



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

CASANDRO WASH WATERSHED BELOW THE PROPOSED DAM

SUB-BASIN DELINEATION

TIME OF CONCENTRATION AND ROUTING FLOWPATHS

LEGEND

SUB-BASIN	AREA (mi^2)
SC240A	.123
SC240B	.108
SC240C	.033
SC240D	.036
SC240E	.021
SC240F	.013
SC240G	.006
SC240H	.008
SC240I	.100
TOTAL	.448

CPH — CONCENTRATION POINT

SC240A — SUB-BASIN

SUB-BASIN BOUNDARY

TIME OF CONCENTRATION FLOW PATH

ROUTING FLOW PATH

N

SCALE 1= 200'

APPENDIX IV - HYDRAULIC GRADE LINE OF OUTFALL

APPENDIX- IV

LIST OF TABLES

1 - 10-YR Flow - 7' x 4' (max) Concrete Box Section

2 - 25-YR Flow - 7' x 4' (max) Concrete Box Section

3 - 50-YR Flow - 7' x 4' (max) Concrete Box Section

4 - 100-YR Flow - 7' x 4' (max) Concrete Box Sectionx

5 - 10-YR Flow - 5' x 4' (max) Concrete Box Section

6 - 25-YR Flow - 5' x 4' (max) Concrete Box Section

7 - 50-YR Flow - 5' x 4' (max) Concrete Box Section

8 - 100-YR Flow - 5' x 4' (max) Concrete Box Sectionx

9 - 10-YR Flow - Dual 42" Diameter Pipe Section

10 - 25-YR Flow - Dual 42"- 48" Diameter Pipe Section

11 - 50-YR Flow - Dual 48" Diameter Pipe Section

12 - 100-YR Flow - Dual 48"- 54" Diameter Pipe Section

13 - 10-YR Flow - Dual 42" Diameter Pipe Section

14 - 25-YR Flow - Dual 42"- 48" Diameter Pipe Section

15 - 50-YR Flow - Dual 48" Diameter Pipe Section

16 - 100-YR Flow - Dual 48"- 54" Diameter Pipe Section

17 - Inlet Structure Capacity for 8 Grates

18 - Inlet Structure Capacity for 7 Grates

LIST OF FIGURES

1 - Graph of Discharge vs Head for 8 Grates

2 - Graph of Discharge vs Head for 7 Grates

LIST OF POCKETS

1 - Hydraulic Profile for 50YR - Dual 48" Diameter Pipe Section

TABLE 1
10-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY BOX SIZE

N=	0.012
Q=	211 cfs
Yc=	3.051 ft
HGL=	2060 ft.
L=	2410 ft.

LINE NO.	BOX SPAN FT.	DIM. HT. FT.	LEN. L FT.	PIPE D/S FT.	INVERT U/S FT.	AREA A FT^2	HYD. RAD. R (FT)	FRICT. SLOPE (FT/FT)	VD/S	VU/S	FRIC. LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOTAL LOSS Htot	D/S HGL	U/S HGL	TOP OF GRND.	STAT.	CHK CVR
1	7	4	540	2053.2	2056	28	1.2727	0.002685	7.536	7.536	1.45	0	0	1.44984	2060	2061.4	2062	OK	OK
2	MAN	HOLE	10	2056	2056.1						0.027	0.044	0	0.07094	2061.4	2061.5	2062	OK	OK
3	5	4	120	2056.1	2057.3	20	1.1111	0.006307	10.55	10.55	0.757	0	0	0.75683	2061.5	2062.3	2065.5	OK	OK
4	MAN	HOLE	10	2057.3	2057.4						0.063	0.086	0	0.14948	2062.3	2062.4	2065.5	OK	OK
5	5	4	264	2057.4	2060.4	20	1.1111	0.006307	10.55	10.55	1.665	0	0	1.66504	2062.4	2064.1	2066	OK	OK
6	MAN	HOLE	10	2060.4	2060.5						0.063	0.086	0	0.14948	2064.1	2064.2	2066	OK	OK
7	5	4	391	2060.5	2063.7	20	1.1111	0.006307	10.55	10.55	2.466	0	0	2.46602	2064.2	2066.7	2070.8	OK	OK
8	MAN	HOLE	10	2063.7	2063.79						0.063	0.086	0	0.14948	2066.7	2066.9	2070.8	OK	OK
9	5	4	376	2063.79	2066.98	20	1.1111	0.006307	10.55	10.55	2.371	0	0	2.37142	2066.9	2069.2	2073.2	OK	OK
10	MAN	HOLE	10	2066.98	2067.07						0.063	0.086	0	0.14948	2069.2	2069.4	2073.2	OK	OK
11	4	4	330	2067.07	2069.87	16	1	0.011341	13.19	13.19	3.743	0	0	3.74252	2069.4	2073.1	2080	OK	OK
12	MAN	HOLE	10	2069.87	2069.97						0.113	0.135	3.6456	3.89407	2073.1	2077	2080	OK	OK
13	4	4	300	2069.97	2072.52	16	1	0.011341	13.19	13.19	3.402	0	0	3.40229	2077	2080.4	2082	OK	OK

TABLE 2
25-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY BOX SIZE

N=	0.012
Q=	261 cfs
Yc=	3.216 ft
HGL=	2060 ft.
L=	2410 ft.

LINE NO.	BOX SPAN FT.	DIM. HT. FT.	LEN. L FT.	PIPE D/S FT.	INVERT U/S FT.	AREA A FT^2	HYD. RAD. R (FT)	FRICT. SLOPE (FT/FT)	VD/S	VU/S	FRIC. LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOTAL LOSS Htot	D/S HGL	U/S HGL	TOP OF GRND.	STAT.	CHK CVR
1	8	4	540	2053.2	2056	32	1.3333	0.002956	8.156	8.156	1.596	0	0	1.5963	2060	2061.6	2062	OK	OK
2	MAN	HOLE	10	2056	2056.1						0.03	0.052	0	0.08121	2061.6	2061.7	2062	OK	OK
3	6	4	120	2056.1	2057.3	24	1.2	0.006048	10.88	10.88	0.726	0	0	0.72575	2061.7	2062.4	2065.5	OK	OK
4	MAN	HOLE	10	2057.3	2057.4						0.06	0.092	0	0.1523	2062.4	2062.6	2065.5	OK	OK
5	6	4	264	2057.4	2060.4	24	1.2	0.006048	10.88	10.88	1.597	0	0	1.59666	2062.6	2064.2	2066	OK	OK
6	MAN	HOLE	10	2060.4	2060.5						0.06	0.092	0	0.1523	2064.2	2064.3	2066	OK	OK
7	6	4	391	2060.5	2063.7	24	1.2	0.006048	10.88	10.88	2.365	0	0	2.36475	2064.3	2066.7	2070.8	OK	OK
8	MAN	HOLE	10	2063.7	2063.79						0.06	0.092	0	0.1523	2066.7	2066.8	2070.8	OK	OK
9	5	4	376	2063.79	2066.98	20	1.1111	0.00965	13.05	13.05	3.628	0	0	3.62847	2066.8	2070.5	2073.2	OK	OK
10	MAN	HOLE	10	2066.98	2067.07						0.097	0.132	0	0.22872	2070.5	2070.7	2073.2	OK	OK
11	5	4	330	2067.07	2069.87	20	1.1111	0.00965	13.05	13.05	3.185	0	0	3.18456	2070.7	2073.9	2080	OK	OK
12	MAN	HOLE	10	2069.87	2069.97						0.097	0.132	3.57	3.79873	2073.9	2077.7	2080	OK	OK
13	5	4	300	2069.97	2072.52	20	1.1111	0.00965	13.05	13.05	2.895	0	0	2.89506	2077.7	2080.6	2082	OK	OK

TABLE 3
50-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY BOX SIZE

N=	0.012
Q=	294 cfs
Yc=	3.219 ft
HGL=	2060 ft.
L=	2410 ft.

LINE NO.	BOX SPAN FT.	DIM. HT. FT.	LEN. L FT.	PIPE D/S FT.	INVERT U/S FT.	AREA A FT^2	HYD. RAD. R (FT)	FRICT. SLOPE (FT/FT)	VD/S	VU/S	FRIC. LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOTAL LOSS Htot	D/S HGL	U/S HGL	TOP OF GRND.	STAT.	CHK CVR
1	9	4	540	2053.2	2056	36	1.3846	0.002818	8.167	8.167	1.522	0	0	1.52184	2060	2061.5	2062	OK	OK
2	MAN	HOLE	10	2056	2056.1						0.028	0.052	0	0.07996	2061.5	2061.6	2062	OK	OK
3	6	4	120	2056.1	2057.3	24	1.2	0.007674	12.25	12.25	0.921	0	0	0.92088	2061.6	2062.5	2065.5	OK	OK
4	MAN	HOLE	10	2057.3	2057.4						0.077	0.117	0	0.19325	2062.5	2062.7	2065.5	OK	OK
5	6	4	264	2057.4	2060.4	24	1.2	0.007674	12.25	12.25	2.026	0	0	2.02594	2062.7	2064.7	2066	OK	OK
6	MAN	HOLE	10	2060.4	2060.5						0.077	0.117	0	0.19325	2064.7	2064.9	2066	OK	OK
7	6	4	391	2060.5	2063.7	24	1.2	0.007674	12.25	12.25	3.001	0	0	3.00054	2064.9	2067.9	2070.8	OK	OK
8	MAN	HOLE	10	2063.7	2063.79						0.077	0.117	0	0.19325	2067.9	2068.1	2070.8	OK	OK
9	6	4	376	2063.79	2066.98	24	1.2	0.007674	12.25	12.25	2.885	0	0	2.88543	2068.1	2071	2073.2	OK	OK
10	MAN	HOLE	10	2066.98	2067.07						0.077	0.117	0	0.19325	2071	2071.2	2073.2	OK	OK
11	6	4	330	2067.07	2069.87	24	1.2	0.007674	12.25	12.25	2.532	0	0	2.53242	2071.2	2073.7	2080	OK	OK
12	MAN	HOLE	10	2069.87	2069.97						0.077	0.117	3.1457	3.33897	2073.7	2077.1	2080	OK	OK
13	5	4	300	2069.97	2072.52	20	1.1111	0.012245	14.7	14.7	3.673	0	0	3.67342	2077.1	2080.8	2082	OK	OK

TABLE 4
100-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY BOX SIZE

N=	0.012
Q=	337 cfs
Yc=	3.814 ft
HGL=	2060 ft.
L=	2410 ft.

LINE NO.	BOX SPAN FT.	DIM. HT. FT.	LEN. L FT.	PIPE D/S FT.	INVERT U/S FT.	AREA A FT^2	HYD. RAD. R (FT)	FRICT. SLOPE (FT/FT)	VD/S	VU/S	FRIC. LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOTAL LOSS Htot	D/S HGL	U/S HGL	TOP OF GRND.	STAT.	CHK CVR
1	8	5	540	2053.2	2056	40	1.5385	0.002606	8.425	8.425	1.407	0	0	1.40737	2060	2061.4	2062	OK	OK
2	MAN	HOLE	10	2056	2056.1						0.026	0.055	0	0.08117	2061.4	2061.5	2062	OK	OK
3	7	4	120	2056.1	2057.3	28	1.2727	0.006849	12.04	12.04	0.822	0	0	0.82187	2061.5	2062.3	2065.5	OK	OK
4	MAN	HOLE	10	2057.3	2057.4						0.068	0.112	0	0.18096	2062.3	2062.5	2065.5	OK	OK
5	7	4	264	2057.4	2060.4	28	1.2727	0.006849	12.04	12.04	1.808	0	0	1.80811	2062.5	2064.3	2066	OK	OK
6	MAN	HOLE	10	2060.4	2060.5						0.068	0.112	0	0.18096	2064.3	2064.5	2066	OK	OK
7	7	4	391	2060.5	2063.7	28	1.2727	0.006849	12.04	12.04	2.678	0	0	2.67792	2064.5	2067.2	2070.8	OK	OK
8	MAN	HOLE	10	2063.7	2063.79						0.068	0.112	0	0.18096	2067.2	2067.3	2070.8	OK	OK
9	7	4	376	2063.79	2066.98	28	1.2727	0.006849	12.04	12.04	2.575	0	0	2.57519	2067.3	2069.9	2073.2	OK	OK
10	MAN	HOLE	10	2066.98	2067.07						0.068	0.112	0	0.18096	2069.9	2070.1	2073.2	OK	OK
11	6	4	330	2067.07	2069.87	24	1.2	0.010083	14.04	14.04	3.327	0	0	3.32737	2070.1	2073.4	2080	OK	OK
12	MAN	HOLE	10	2069.87	2069.97						0.101	0.153	4.1332	4.3871	2073.4	2077.8	2080	OK	OK
13	6	4	300	2069.97	2072.52	24	1.2	0.010083	14.04	14.04	3.025	0	0	3.02488	2077.8	2080.8	2082	OK	OK

TABLE 5
10-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY BOX SIZE

N=	0.012
Q=	211 cfs
Yc=	3.818 ft
HGL=	2057 ft.
L=	2410 ft.

LINE NO.	BOX SPAN FT.	DIM. HT. FT.	LEN. L FT.	PIPE D/S FT.	INVERT U/S FT.	AREA A FT^2	HYD. RAD. R (FT)	FRICT. SLOPE (FT/FT)	VD/S	VU/S	FRIC. LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOTAL LOSS Htot	D/S HGL	U/S HGL	TOP OF GRND.	STAT.	CHK CVR
1	5	4	540	2053.2	2056	20	1.1111	0.006307	10.55	10.55	3.406	0	0	3.40576	2057.1	2060.5	2062	OK	OK
2	MAN	HOLE	10	2056	2056.1						0.063	0.086	0	0.14948	2060.5	2060.7	2062	OK	OK
3	5	4	120	2056.1	2057.3	20	1.1111	0.006307	10.55	10.55	0.757	0	0	0.75683	2060.7	2061.4	2065.5	OK	OK
4	MAN	HOLE	10	2057.3	2057.4						0.063	0.086	0	0.14948	2061.4	2061.6	2065.5	OK	OK
5	5	4	264	2057.4	2060.4	20	1.1111	0.006307	10.55	10.55	1.665	0	0	1.66504	2061.6	2063.2	2066	OK	OK
6	MAN	HOLE	10	2060.4	2060.5						0.063	0.086	0	0.14948	2063.2	2063.4	2066	OK	OK
7	5	4	391	2060.5	2063.7	20	1.1111	0.006307	10.55	10.55	2.466	0	0	2.46602	2063.4	2065.9	2070.8	OK	OK
8	MAN	HOLE	10	2063.7	2063.79						0.063	0.086	0	0.14948	2065.9	2066	2070.8	OK	OK
9	4	4	376	2063.79	2066.98	16	1	0.011341	13.19	13.19	4.264	0	0	4.2642	2066	2070.3	2073.2	OK	OK
10	MAN	HOLE	10	2066.98	2067.07						0.113	0.135	0	0.24843	2070.3	2070.5	2073.2	OK	OK
11	4	4	330	2067.07	2069.87	16	1	0.011341	13.19	13.19	3.743	0	0	3.74252	2070.5	2074.3	2080	OK	OK
12	MAN	HOLE	10	2069.87	2069.97						0.113	0.135	3.6456	3.89407	2074.3	2078.1	2080	OK	OK
13	4	4	300	2069.97	2072.52	16	1	0.011341	13.19	13.19	3.402	0	0	3.40229	2078.1	2081.6	2082	OK	OK

TABLE 6
25-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY BOX SIZE

N=	0.012
Q=	261 cfs
Yc=	3.896 ft
HGL=	2057 ft.
L=	2410 ft.

LINE NO.	BOX SPAN FT.	DIM. HT. FT.	LEN. L FT.	PIPE D/S FT.	INVERT U/S FT.	AREA A FT^2	HYD. RAD. R (FT)	FRICT. SLOPE (FT/FT)	VD/S	VU/S	FRIC. LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOTAL LOSS Htot	D/S HGL	U/S HGL	TOP OF GRND.	STAT.	CHK CVR
1	6	4	540	2053.2	2056	24	1.2	0.006048	10.88	10.88	3.266	0	0	3.26589	2057.1	2060.4	2062	OK	OK
2	MAN	HOLE	10	2056	2056.1						0.06	0.092	0	0.1523	2060.4	2060.6	2062	OK	OK
3	6	4	120	2056.1	2057.3	24	1.2	0.006048	10.88	10.88	0.726	0	0	0.72575	2060.6	2061.3	2065.5	OK	OK
4	MAN	HOLE	10	2057.3	2057.4						0.06	0.092	0	0.1523	2061.3	2061.4	2065.5	OK	OK
5	5	4	264	2057.4	2060.4	20	1.1111	0.00965	13.05	13.05	2.548	0	0	2.54765	2061.4	2064	2066	OK	OK
6	MAN	HOLE	10	2060.4	2060.5						0.097	0.132	0	0.22872	2064	2064.2	2066	OK	OK
7	5	4	391	2060.5	2063.7	20	1.1111	0.00965	13.05	13.05	3.773	0	0	3.77322	2064.2	2068	2070.8	OK	OK
8	MAN	HOLE	10	2063.7	2063.79						0.097	0.132	0	0.22872	2068	2068.2	2070.8	OK	OK
9	5	4	376	2063.79	2066.98	20	1.1111	0.00965	13.05	13.05	3.628	0	0	3.62847	2068.2	2071.9	2073.2	OK	OK
10	MAN	HOLE	10	2066.98	2067.07						0.097	0.132	0	0.22872	2071.9	2072.1	2073.2	OK	OK
11	5	4	330	2067.07	2069.87	20	1.1111	0.00965	13.05	13.05	3.185	0	0	3.18456	2072.1	2075.3	2080	OK	OK
12	MAN	HOLE	10	2069.87	2069.97						0.097	0.132	3.57	3.79873	2075.3	2079.1	2080	OK	OK
13	5	4	300	2069.97	2072.52	20	1.1111	0.00965	13.05	13.05	2.895	0	0	2.89506	2079.1	2082	2082	OK	OK

TABLE 7
50-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY BOX SIZE

N=	0.012
Q=	294 cfs
Yc=	3.806 ft
HGL=	2057 ft.
L=	2410 ft.

LINE NO.	BOX SPAN FT.	DIM. HT. FT.	LEN. L FT.	PIPE D/S FT.	INVERT U/S FT.	AREA A FT^2	HYD. RAD. R (FT)	FRICT. SLOPE (FT/FT)	VD/S	VU/S	FRIC. LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOTAL LOSS Htot	D/S HGL	U/S HGL	TOP OF GRND.	STAT.	CHK CVR
1	7	4	540	2053.2	2056	28	1.2727	0.005213	10.5	10.5	2.815	0	0	2.81482	2057.1	2059.9	2062	OK	OK
2	MAN	HOLE	10	2056	2056.1						0.052	0.086	0	0.13772	2059.9	2060.1	2062	OK	OK
3	6	4	120	2056.1	2057.3	24	1.2	0.007674	12.25	12.25	0.921	0	0	0.92088	2060.1	2061	2065.5	OK	OK
4	MAN	HOLE	10	2057.3	2057.4						0.077	0.117	0	0.19325	2061	2061.2	2065.5	OK	OK
5	6	4	264	2057.4	2060.4	24	1.2	0.007674	12.25	12.25	2.026	0	0	2.02594	2061.2	2063.2	2066	OK	OK
6	MAN	HOLE	10	2060.4	2060.5						0.077	0.117	0	0.19325	2063.2	2063.4	2066	OK	OK
7	6	4	391	2060.5	2063.7	24	1.2	0.007674	12.25	12.25	3.001	0	0	3.00054	2063.4	2066.4	2070.8	OK	OK
8	MAN	HOLE	10	2063.7	2063.79						0.077	0.117	0	0.19325	2066.4	2066.6	2070.8	OK	OK
9	6	4	376	2063.79	2066.98	24	1.2	0.007674	12.25	12.25	2.885	0	0	2.88543	2066.6	2069.5	2073.2	OK	OK
10	MAN	HOLE	10	2066.98	2067.07						0.077	0.117	0	0.19325	2069.5	2069.7	2073.2	OK	OK
11	6	4	330	2067.07	2069.87	24	1.2	0.007674	12.25	12.25	2.532	0	0	2.53242	2069.7	2072.2	2080	OK	OK
12	MAN	HOLE	10	2069.87	2069.97						0.077	0.117	3.1457	3.33897	2072.2	2075.5	2080	OK	OK
13	5	4	300	2069.97	2072.52	20	1.1111	0.012245	14.7	14.7	3.673	0	0	3.67342	2075.5	2079.2	2082	OK	OK

TABLE 8
100-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY BOX SIZE

N=	0.012
Q=	337 cfs
Yc=	3.814 ft
HGL=	2057 ft.
L=	2410 ft.

LINE NO.	BOX SPAN FT.	DIM. HT. FT.	LEN. L FT.	PIPE D/S FT.	INVERT U/S FT.	AREA A FT^2	HYD. RAD. R (FT)	FRICT. SLOPE (FT/FT)	VD/S	VU/S	FRIC. LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOTAL LOSS Htot	D/S HGL	U/S HGL	TOP OF GRND.	STAT.	CHK CVR
1	8	4	540	2053.2	2056	32	1.3333	0.004928	10.53	10.53	2.661	0	0	2.6613	2057.1	2059.8	2062	OK	OK
2	MAN	HOLE	10	2056	2056.1						0.049	0.086	0	0.13539	2059.8	2059.9	2062	OK	OK
3	7	4	120	2056.1	2057.3	28	1.2727	0.006849	12.04	12.04	0.822	0	0	0.82187	2059.9	2060.7	2065.5	OK	OK
4	MAN	HOLE	10	2057.3	2057.4						0.068	0.112	0	0.18096	2060.7	2060.9	2065.5	OK	OK
5	7	4	264	2057.4	2060.4	28	1.2727	0.006849	12.04	12.04	1.808	0	0	1.80811	2060.9	2062.7	2066	OK	OK
6	MAN	HOLE	10	2060.4	2060.5						0.068	0.112	0	0.18096	2062.7	2062.9	2066	OK	OK
7	7	4	391	2060.5	2063.7	28	1.2727	0.006849	12.04	12.04	2.678	0	0	2.67792	2062.9	2065.6	2070.8	OK	OK
8	MAN	HOLE	10	2063.7	2063.79						0.068	0.112	0	0.18096	2065.6	2065.8	2070.8	OK	OK
9	6	4	376	2063.79	2066.98	24	1.2	0.010083	14.04	14.04	3.791	0	0	3.79119	2065.8	2069.5	2073.2	OK	OK
10	MAN	HOLE	10	2066.98	2067.07						0.101	0.153	0	0.25391	2069.5	2069.8	2073.2	OK	OK
11	6	4	330	2067.07	2069.87	24	1.2	0.010083	14.04	14.04	3.327	0	0	3.32737	2069.8	2073.1	2080	OK	OK
12	MAN	HOLE	10	2069.87	2069.97						0.101	0.153	4.1332	4.3871	2073.1	2077.5	2080	OK	OK
13	6	4	300	2069.97	2072.52	24	1.2	0.010083	14.04	14.04	3.025	0	0	3.02488	2077.5	2080.5	2082	OK	OK

TABLE 9
10-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY DUAL PIPE SIZE

N=	0.012
Yc =	2.992 ft
Q =	191 cfs
HGL=	2057 ft

LINE NO.	Pipe Q (CFS)	PIPE DIA. FT.	LEN. L FT.	PIPE INVERT D/S FT.	PIPE INVERT U/S FT.	AREA FT^2	HYD. RAD. R (FT)	FRIC. SLOPE (FT/FT)	V D/S	V U/S	FRIC LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOT LOSS TOT HL	D/S HGL	U/S HGL	U/S TOG	STAT.	CHK CVR
1	95.5	3.5	540	2053.2	2056	9.621	0.875	0.007677	9.926	9.926	4.146	0	0	4.14568	2057	2061.1	2062	OK	OK
2	95.5		10	2056	2056.1			MH#1				0.076		0.0765	2061.1	2061.2	2062	OK	OK
3	95.5	3.5	120	2056.1	2057.3	9.621	0.875	0.007677	9.926	9.926	0.921	0	0	0.92126	2061.2	2062.1	2065.5	OK	OK
4	95.5		10	2057.3	2057.4			MH#2				0.076		0.0765	2062.1	2062.2	2065.5	OK	OK
5	95.5	3.5	264	2057.4	2060.4	9.621	0.875	0.007677	9.926	9.926	2.027	0	0	2.02678	2062.2	2064.2	2066	OK	OK
6	95.5		10	2060.4	2060.5			MH#3				0.076		0.0765	2064.2	2064.3	2066	OK	OK
7	95.5	3.5	391	2060.5	2063.7	9.621	0.875	0.007677	9.926	9.926	3.002	0	0	3.00178	2064.3	2067.3	2070.8	OK	OK
8	95.5		10	2063.7	2063.79			MH#4				0.076		0.0765	2067.3	2067.4	2070.8	OK	OK
9	95.5	3.5	376	2063.79	2066.98	9.621	0.875	0.007677	9.926	9.926	2.887	0	0	2.88662	2067.4	2070.3	2073.2	OK	OK
10	95.5		10	2066.98	2067.07			MH#5				0.076		0.0765	2070.3	2070.4	2073.2	OK	OK
11	95.5	3.5	330	2067.07	2069.87	9.621	0.875	0.007677	9.926	9.926	2.533	0	0	2.53347	2070.4	2072.9	2080	OK	OK
12	95.5		10	2069.87	2069.97			MH#6				0.076	0.3825	0.45898	2072.9	2073.4	2080	OK	OK
13	95.5	3	300	2069.97	2072.52	7.069	0.75	0.017468	13.51	13.51	5.241	0	0	5.2405	2073.4	2078.6	2082	OK	OK

TABLE 10
25-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY DUAL PIPE SIZE

N=	0.012
Yc =	3.246 ft
Q =	241 cfs
HGL=	2057 ft

LINE NO.	Pipe Q (CFS)	PIPE DIA. FT.	LEN. L FT.	PIPE INVERT D/S FT.	PIPE INVERT U/S FT.	AREA FT^2	HYD. RAD. R (FT)	FRIC. SLOPE (FT/FT)	V D/S	V U/S	FRIC LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOT LOSS TOT HL	D/S HGL	U/S HGL	U/S TOG	STAT.	CHK CVR
1	120.5	4	540	2053.2	2056	12.57	1	0.005996	9.589	9.589	3.238	0	0	3.23797	2057	2060.2	2062	OK	OK
2	120.5		10	2056	2056.1			MH#1				0.071		0.07139	2060.2	2060.3	2062	OK	OK
3	120.5	4	120	2056.1	2057.3	12.57	1	0.005996	9.589	9.589	0.72	0	0	0.71955	2060.3	2061	2065.5	OK	OK
4	120.5		10	2057.3	2057.4			MH#2				0.071		0.07139	2061	2061.1	2065.5	OK	OK
5	120.5	4	264	2057.4	2060.4	12.57	1	0.005996	9.589	9.589	1.583	0	0	1.58301	2061.1	2062.7	2066	OK	OK
6	120.5		10	2060.4	2060.5			MH#3				0.071		0.07139	2062.7	2062.8	2066	OK	OK
7	120.5	3.5	391	2060.5	2063.7	9.621	0.875	0.012223	12.52	12.52	4.779	0	0	4.7791	2062.8	2067.5	2070.8	OK	OK
8	120.5		10	2063.7	2063.79			MH#4				0.122		0.12179	2067.5	2067.7	2070.8	OK	OK
9	120.5	3.5	376	2063.79	2066.98	9.621	0.875	0.012223	12.52	12.52	4.596	0	0	4.59576	2067.7	2072.3	2073.2	OK	OK
10	120.5		10	2066.98	2067.07			MH#5				0.122		0.12179	2072.3	2072.4	2073.2	OK	OK
11	120.5	3.5	330	2067.07	2069.87	9.621	0.875	0.012223	12.52	12.52	4.034	0	0	4.03351	2072.4	2076.4	2080	OK	OK
12	120.5		10	2069.87	2069.97			MH#6				0.122	0.6089	0.73073	2076.4	2077.1	2080	OK	OK
13	120.5	3.5	300	2069.97	2072.52	9.621	0.875	0.012223	12.52	12.52	3.667	0	0	3.66683	2077.1	2080.8	2082	OK	OK

TABLE 11
50-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY DUAL PIPE SIZE

N=	0.012
Yc =	3.461 ft
Q =	274 cfs
HGL=	2057 ft

LINE NO.	Pipe Q (CFS)	PIPE DIA. FT.	LEN. L FT.	PIPE INVERT D/S FT.	PIPE INVERT U/S FT.	AREA FT^2	HYD. RAD. R (FT)	FRIC. SLOPE (FT/FT)	V D/S	V U/S	FRIC LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOT LOSS TOT HL	D/S HGL	U/S HGL	U/S TOG	STAT.	CHK CVR
1	137	4	540	2053.2	2056	12.57	1	0.007751	10.9	10.9	4.185	0	0	4.18543	2057	2061.2	2062	OK	OK
2	137		10	2056	2056.1			MH#1				0.092		0.09228	2061.2	2061.3	2062	OK	OK
3	137	4	120	2056.1	2057.3	12.57	1	0.007751	10.9	10.9	0.93	0	0	0.9301	2061.3	2062.2	2065.5	OK	OK
4	137		10	2057.3	2057.4			MH#2				0.092		0.09228	2062.2	2062.3	2065.5	OK	OK
5	137	4	264	2057.4	2060.4	12.57	1	0.007751	10.9	10.9	2.046	0	0	2.04621	2062.3	2064.3	2066	OK	OK
6	137		10	2060.4	2060.5			MH#3				0.092		0.09228	2064.3	2064.4	2066	OK	OK
7	137	4	391	2060.5	2063.7	12.57	1	0.007751	10.9	10.9	3.031	0	0	3.03056	2064.4	2067.5	2070.8	OK	OK
8	137		10	2063.7	2063.79			MH#4				0.092		0.09228	2067.5	2067.6	2070.8	OK	OK
9	137	4	376	2063.79	2066.98	12.57	1	0.007751	10.9	10.9	2.914	0	0	2.9143	2067.6	2070.5	2073.2	OK	OK
10	137		10	2066.98	2067.07			MH#5				0.092		0.09228	2070.5	2070.6	2073.2	OK	OK
11	137	3.5	330	2067.07	2069.87	9.621	0.875	0.015799	14.24	14.24	5.214	0	0	5.21375	2070.6	2075.8	2080	OK	OK
12	137		10	2069.87	2069.97			MH#6				0.157	0.7871	0.94455	2075.8	2076.7	2080	OK	OK
13	137	3.5	300	2069.97	2072.52	9.621	0.875	0.015799	14.24	14.24	4.74	0	0	4.73978	2076.7	2081.5	2082	OK	OK

TABLE 12
100-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY DUAL PIPE SIZE

N=	0.012
Yc =	3.61 ft
Q =	317 cfs
HGL=	2057 ft

LINE NO.	Pipe Q (CFS)	PIPE DIA. FT.	LEN. L FT.	PIPE INVERT D/S FT.	PIPE INVERT U/S FT.	AREA FT^2	HYD. RAD. R (FT)	FRIC. SLOPE (FT/FT)	V D/S	V U/S	FRIC LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOT LOSS TOT HL	D/S HGL	U/S HGL	U/S TOG	STAT.	CHK CVR
1	158.5	4.5	540	2053.2	2056	15.9	1.125	0.005535	9.966	9.966	2.989	0	0	2.98912	2057	2060	2062	OK	OK
2	158.5		10	2056	2056.1			MH#1				0.077		0.07711	2060	2060.1	2062	OK	OK
3	158.5	4	120	2056.1	2057.3	12.57	1	0.010374	12.61	12.61	1.245	0	0	1.24493	2060.1	2061.3	2065.5	OK	OK
4	158.5		10	2057.3	2057.4			MH#2				0.124		0.12352	2061.3	2061.4	2065.5	OK	OK
5	158.5	4	264	2057.4	2060.4	12.57	1	0.010374	12.61	12.61	2.739	0	0	2.73885	2061.4	2064.2	2066	OK	OK
6	158.5		10	2060.4	2060.5			MH#3				0.124		0.12352	2064.2	2064.3	2066	OK	OK
7	158.5	4	391	2060.5	2063.7	12.57	1	0.010374	12.61	12.61	4.056	0	0	4.0564	2064.3	2068.4	2070.8	OK	OK
8	158.5		10	2063.7	2063.79			MH#4				0.124		0.12352	2068.4	2068.5	2070.8	OK	OK
9	158.5	4	376	2063.79	2066.98	12.57	1	0.010374	12.61	12.61	3.901	0	0	3.90078	2068.5	2072.4	2073.2	OK	OK
10	158.5		10	2066.98	2067.07			MH#5				0.124		0.12352	2072.4	2072.5	2073.2	OK	OK
11	158.5	4	330	2067.07	2069.87	12.57	1	0.010374	12.61	12.61	3.424	0	0	3.42356	2072.5	2075.9	2080	OK	OK
12	158.5		10	2069.87	2069.97			MH#6				0.124	0.6176	0.7411	2075.9	2076.7	2080	OK	OK
13	158.5	4	300	2069.97	2072.52	12.57	1	0.010374	12.61	12.61	3.112	0	0	3.11232	2076.7	2079.8	2082	OK	OK

TABLE 13
10-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY DUAL PIPE SIZE

N=	0.012
Yc=	2.802 ft
Q=	191 cfs
HGL=	2060 ft

LINE NO.	Pipe Q (CFS)	PIPE DIA. FT.	LEN. L FT.	PIPE INVERT D/S FT.	PIPE INVERT U/S FT.	AREA FT^2	HYD. RAD. R (FT)	FRIC. SLOPE (FT/FT)	V D/S	V U/S	FRIC LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOT LOSS TOT HL	D/S HGL	U/S HGL	U/S TOG	STAT.	CHK CVR
1	95.5	4.5	540	2053.2	2056	15.9	1.125	0.00201	6.005	6.005	1.085	0	0	1.08516	2060	2061.1	2062	OK	OK
2	95.5		10	2056	2056.1			MH#1				0.028		0.02799	2061.1	2061.1	2062	OK	OK
3	95.5	4	120	2056.1	2057.3	12.57	1	0.003766	7.6	7.6	0.452	0	0	0.45195	2061.1	2061.6	2065.5	OK	OK
4	95.5		10	2057.3	2057.4			MH#2				0.045		0.04484	2061.6	2061.6	2065.5	OK	OK
5	95.5	3.5	264	2057.4	2060.4	9.621	0.875	0.007677	9.926	9.926	2.027	0	0	2.02678	2061.6	2063.6	2066	OK	OK
6	95.5		10	2060.4	2060.5			MH#3				0.076		0.0765	2063.6	2063.7	2066	OK	OK
7	95.5	3.5	391	2060.5	2063.7	9.621	0.875	0.007677	9.926	9.926	3.002	0	0	3.00178	2063.7	2066.7	2070.8	OK	OK
8	95.5		10	2063.7	2063.79			MH#4				0.076		0.0765	2066.7	2066.8	2070.8	OK	OK
9	95.5	3.5	376	2063.79	2066.98	9.621	0.875	0.007677	9.926	9.926	2.887	0	0	2.88662	2066.8	2069.7	2073.2	OK	OK
10	95.5		10	2066.98	2067.07			MH#5				0.076		0.0765	2069.7	2069.8	2073.2	OK	OK
11	95.5	3	330	2067.07	2069.87	7.069	0.75	0.017468	13.51	13.51	5.765	0	0	5.76455	2069.8	2075.5	2080	OK	OK
12	95.5		10	2069.87	2069.97			MH#6				0.142	0.7086	0.85031	2075.5	2076.4	2080	OK	OK
13	95.5	3	300	2069.97	2072.52	7.069	0.75	0.017468	13.51	13.51	5.241	0	0	5.2405	2076.4	2081.6	2082	OK	OK

TABLE 14
25-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY DUAL PIPE SIZE

N=	0.012
Yc=	3.148 ft
Q=	241 cfs
HGL=	2060 ft

LINE NO.	Pipe Q (CFS)	PIPE DIA. FT.	LEN. L FT.	PIPE D/S FT.	INVERT U/S FT.	AREA FT^2	HYD. RAD. R (FT)	FRIC. SLOPE (FT/FT)	V D/S	V U/S	FRIC LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOT LOSS TOT HL	D/S HGL	U/S HGL	U/S TOG	STAT.	CHK CVR
1	120.5	4.5	540	2053.2	2056	15.9	1.125	0.003199	7.577	7.577	1.728	0	0	1.72767	2060	2061.7	2062	OK	OK
2	120.5		10	2056	2056.1			MH#1				0.045		0.04457	2061.7	2061.8	2062	OK	OK
3	120.5	4	120	2056.1	2057.3	12.57	1	0.005996	9.589	9.589	0.72	0	0	0.71955	2061.8	2062.5	2065.5	OK	OK
4	120.5		10	2057.3	2057.4			MH#2				0.071		0.07139	2062.5	2062.6	2065.5	OK	OK
5	120.5	4	264	2057.4	2060.4	12.57	1	0.005996	9.589	9.589	1.583	0	0	1.58301	2062.6	2064.1	2066	OK	OK
6	120.5		10	2060.4	2060.5			MH#3				0.071		0.07139	2064.1	2064.2	2066	OK	OK
7	120.5	4	391	2060.5	2063.7	12.57	1	0.005996	9.589	9.589	2.345	0	0	2.34453	2064.2	2066.6	2070.8	OK	OK
8	120.5		10	2063.7	2063.79			MH#4				0.071		0.07139	2066.6	2066.6	2070.8	OK	OK
9	120.5	4	376	2063.79	2066.98	12.57	1	0.005996	9.589	9.589	2.255	0	0	2.25459	2066.6	2068.9	2073.2	OK	OK
10	120.5		10	2066.98	2067.07			MH#5				0.071		0.07139	2068.9	2069	2073.2	OK	OK
11	120.5	3.5	330	2067.07	2069.87	9.621	0.875	0.012223	12.52	12.52	4.034	0	0	4.03351	2069	2073	2080	OK	OK
12	120.5		10	2069.87	2069.97			MH#6				0.122	0.6089	0.73073	2073	2073.7	2080	OK	OK
13	120.5	3.5	300	2069.97	2072.52	9.621	0.875	0.012223	12.52	12.52	3.667	0	0	3.66683	2073.7	2077.4	2082	OK	OK

TABLE 15
50-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY DUAL PIPE SIZE

N=	0.012
Yc =	3.266 ft
Q =	274 cfs
HGL=	2060 ft

LINE NO.	Pipe Q (CFS)	PIPE DIA. FT.	LEN. L FT.	PIPE INVERT D/S FT.	PIPE INVERT U/S FT.	AREA FT^2	HYD. RAD. R (FT)	FRIC. SLOPE (FT/FT)	V D/S	V U/S	FRIC LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOT LOSS TOT HL	D/S HGL	U/S HGL	U/S TOG	STAT.	CHK CVR
1	137	5	540	2053.2	2056	19.63	1.25	0.002358	6.977	6.977	1.273	0	0	1.27317	2060	2061.3	2062	OK	OK
2	137		10	2056	2056.1			MH#1				0.038		0.0378	2061.3	2061.3	2062	OK	OK
3	137	4	120	2056.1	2057.3	12.57	1	0.007751	10.9	10.9	0.93	0	0	0.9301	2061.3	2062.2	2065.5	OK	OK
4	137		10	2057.3	2057.4			MH#2				0.092		0.09228	2062.2	2062.3	2065.5	OK	OK
5	137	4	264	2057.4	2060.4	12.57	1	0.007751	10.9	10.9	2.046	0	0	2.04621	2062.3	2064.4	2066	OK	OK
6	137		10	2060.4	2060.5			MH#3				0.092		0.09228	2064.4	2064.5	2066	OK	OK
7	137	4	391	2060.5	2063.7	12.57	1	0.007751	10.9	10.9	3.031	0	0	3.03056	2064.5	2067.5	2070.8	OK	OK
8	137		10	2063.7	2063.79			MH#4				0.092		0.09228	2067.5	2067.6	2070.8	OK	OK
9	137	4	376	2063.79	2066.98	12.57	1	0.007751	10.9	10.9	2.914	0	0	2.9143	2067.6	2070.5	2073.2	OK	OK
10	137		10	2066.98	2067.07			MH#5				0.092		0.09228	2070.5	2070.6	2073.2	OK	OK
11	137	3.5	330	2067.07	2069.87	9.621	0.875	0.015799	14.24	14.24	5.214	0	0	5.21375	2070.6	2075.8	2080	OK	OK
12	137		10	2069.87	2069.97			MH#6				0.157	0.7871	0.94455	2075.8	2076.8	2080	OK	OK
13	137	3.5	300	2069.97	2072.52	9.621	0.875	0.015799	14.24	14.24	4.74	0	0	4.73978	2076.8	2081.5	2082	OK	OK

TABLE 16
100-YEAR DESIGN FLOW
CASANDRO WASH
PRELIMINARY DUAL PIPE SIZE

N=	0.012
Yc =	3.513 ft
Q =	317 cfs
HGL=	2060 ft

LINE NO.	Pipe Q (CFS)	PIPE DIA. FT.	LEN. L FT.	PIPE INVERT D/S FT.	PIPE INVERT U/S FT.	AREA FT^2	HYD. RAD. R (FT)	FRIC. SLOPE (FT/FT)	V D/S	V U/S	FRIC LOSS Hf	MH LOSS Hm	BEND LOSS Hb	TOT LOSS TOT HL	D/S HGL	U/S HGL	U/S TOG	STAT.	CHK CVR
1	158.5	5	540	2053.2	2056	19.63	1.25	0.003156	8.072	8.072	1.704	0	0	1.70414	2060	2061.7	2062	OK	OK
2	158.5		10	2056	2056.1			MH#1				0.051		0.05059	2061.7	2061.8	2062	OK	OK
3	158.5	4.5	120	2056.1	2057.3	15.9	1.125	0.005535	9.966	9.966	0.664	0	0	0.66425	2061.8	2062.4	2065.5	OK	OK
4	158.5		10	2057.3	2057.4			MH#2				0.077		0.07711	2062.4	2062.5	2065.5	OK	OK
5	158.5	4.5	264	2057.4	2060.4	15.9	1.125	0.005535	9.966	9.966	1.461	0	0	1.46135	2062.5	2064	2066	OK	OK
6	158.5		10	2060.4	2060.5			MH#3				0.077		0.07711	2064	2064	2066	OK	OK
7	158.5	4	391	2060.5	2063.7	12.57	1	0.010374	12.61	12.61	4.056	0	0	4.0564	2064	2068.1	2070.8	OK	OK
8	158.5		10	2063.7	2063.79			MH#4				0.124		0.12352	2068.1	2068.2	2070.8	OK	OK
9	158.5	4	376	2063.79	2066.98	12.57	1	0.010374	12.61	12.61	3.901	0	0	3.90078	2068.2	2072.1	2073.2	OK	OK
10	158.5		10	2066.98	2067.07			MH#5				0.124		0.12352	2072.1	2072.2	2073.2	OK	OK
11	158.5	4	330	2067.07	2069.87	12.57	1	0.010374	12.61	12.61	3.424	0	0	3.42356	2072.2	2075.7	2080	OK	OK
12	158.5		10	2069.87	2069.97			MH#6				0.124	0.6176	0.7411	2075.7	2076.4	2080	OK	OK
13	158.5	4	300	2069.97	2072.52	12.57	1	0.010374	12.61	12.61	3.112	0	0	3.11232	2076.4	2079.5	2082	OK	OK

TABLE IV-17

INLET STRUCTURE CAPACITY for 8 GRATES

CASANDRO WASH DRAINAGE OUTFALL
5/31/1994

Q = CPH^(3/2) WEIR EQ.
Q = CA(2GH)^.5 ORIFICE EQ.

3 For Weir Equation
0.67 For Orifice Equation
32.2
(ft) Depth of flow
(ft^2) Area of Opening
(ft) Perimeter of Opening

Use P-1-7/8 Grates	
Size of Grates	36"X48"
Area of Each Grates	12
# of Grates	8
Total Area of Grates	96
Opening Ratio	0.8
Effective Area of Grates	76.8
Clogging Factor	50%
Net Area of Grates	38.4
Total Perimeter of Grates	32
Net Perimeter of Grates	28

	Q in cfs	
H (ft)	Orifice Eq.	Weir Eq.
0.0	0	0
0.2	92	8
0.4	131	21
0.6	160	39
0.8	185	60
1.0	206	84
1.2	226	110
1.4	244	139
1.6	261	170
1.8	277	203
2.0	292	238
2.2	306	274
2.4	320	312
2.6	333	352
2.8	345	394
3.0	358	436
3.2	369	481
3.4	381	527
3.6	392	574
3.8	402	622
4.0	413	672

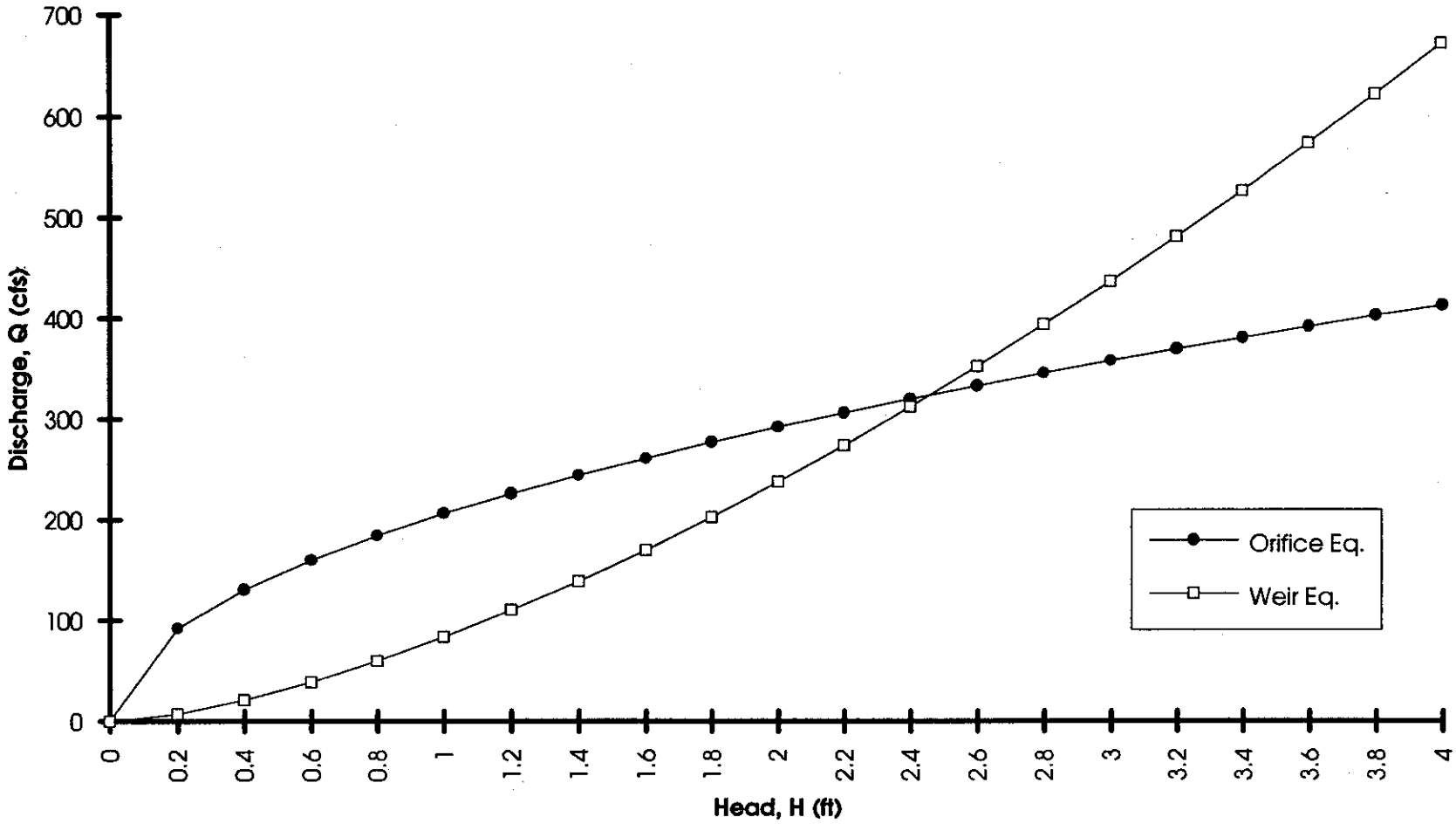


Figure IV-1 **Graph Discharge vs Head for 8 Grates**

TABLE IV-18

INLET STRUCTURE CAPACITY for 7 GRATES

CASANDRO WASH DRAINAGE OUTFALL
5/31/1994

Q = CPH^(3/2) WEIR EQ.
Q = CA(2GH)^.5 ORIFICE EQ.

3 For Weir Equation
0.67 For Orifice Equation
32.2
(ft) Depth of flow
(ft^2) Area of Opening
(ft) Perimeter of Opening

Use P-1-7/8 Grates	
Size of Grates	36"X48"
Area of Each Grates	12
# of Grates	7
Total Area of Grates	84
Opening Ratio	0.8
Effective Area of Grates	67.2
Clogging Factor	50%
Net Area of Grates	33.6
Total Perimeter of Grates	29
Net Perimeter of Grates	25

	Q in cfs	
H (ft)	Orifice Eq.	Weir Eq.
0.0	0	0
0.2	92	8
0.4	131	21
0.6	160	39
0.8	185	60
1.0	206	84
1.2	226	110
1.4	244	139
1.6	261	170
1.8	277	203
2.0	292	238
2.2	306	274
2.4	320	312
2.6	333	352
2.8	345	394
3.0	358	436
3.2	369	481
3.4	381	527
3.6	392	574
3.8	402	622
4.0	413	672

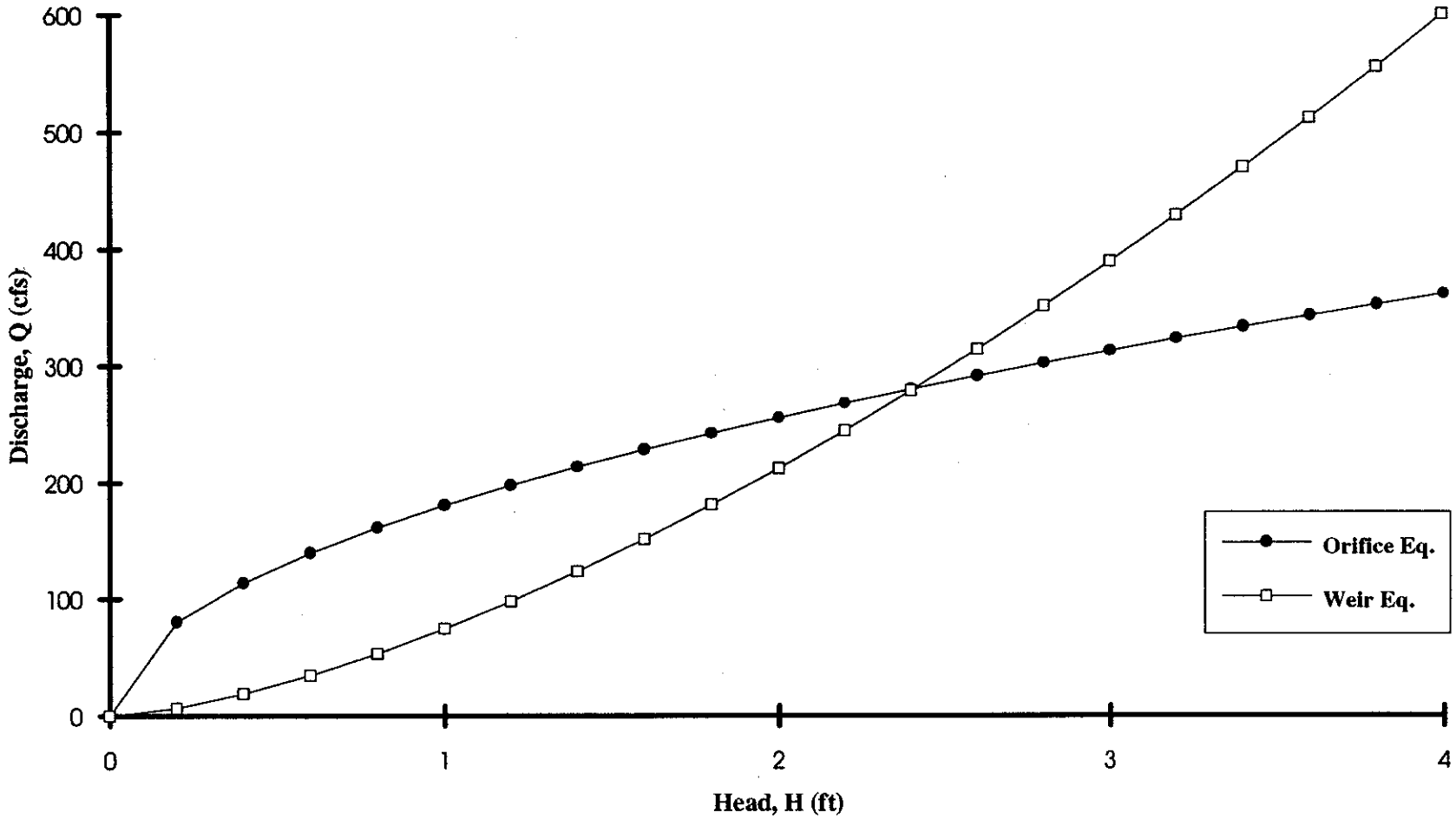
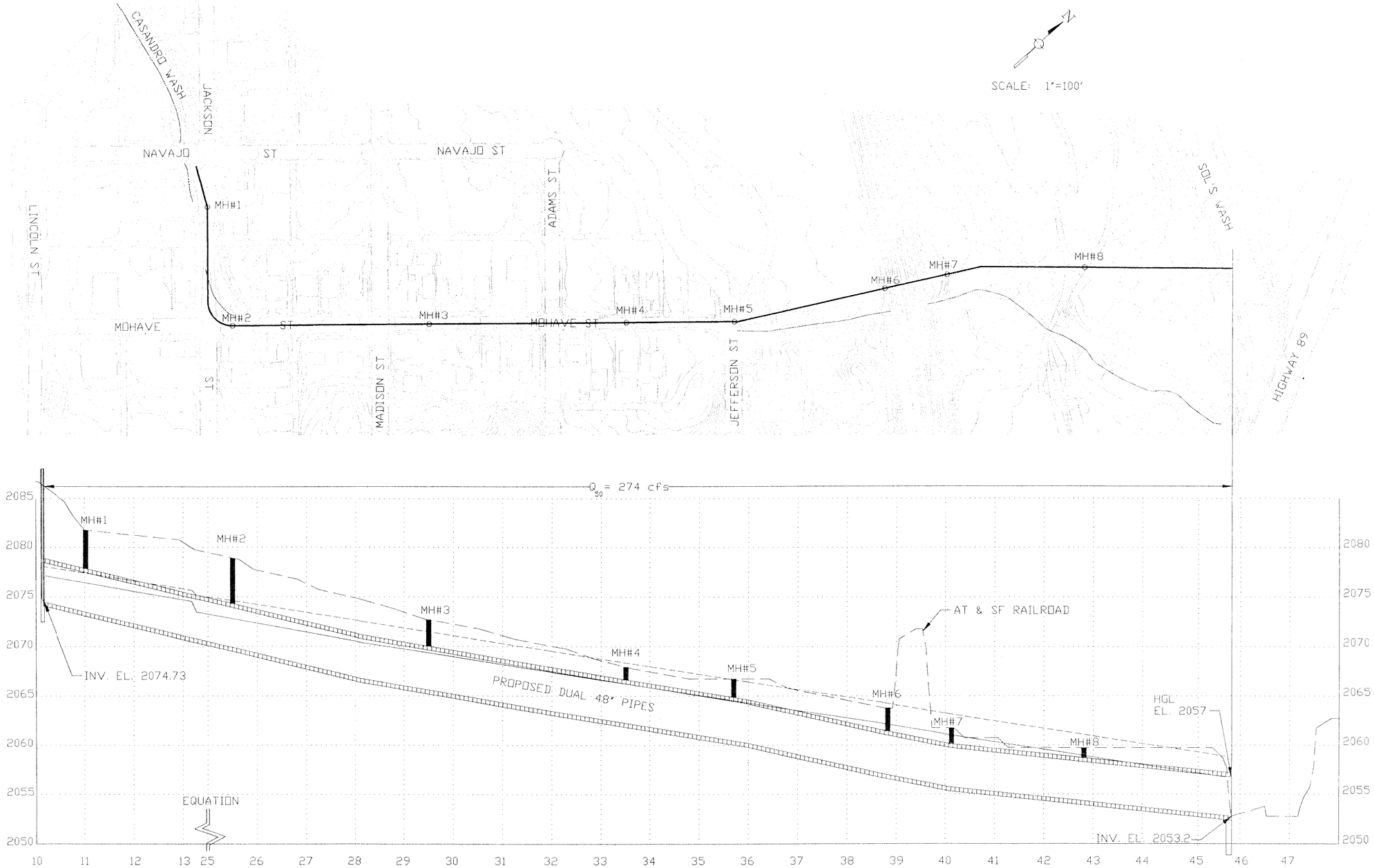


Figure IV-2 Graph of Discharge vs Head for 7 Grates



SCALE
VER : 1" = 5'
HOR : 1" =100'

FLOOD CONTROL DISTRICT
OF MARICOPA COUNTY
ENGINEERING DIVISION

CASANDRO WASH
OUTFALL

	BY	DATE
DESIGNED	RCS	07/94
DRAWN	FC	07/94
CHECKED	MAL	

HYDRAULIC PROFILE

SHEET OF

TRACS NO.

C:\CASANDRO\PROFILE 08/05/94 10:28 FC

APPENDIX V - ENGINEERS COST ESTIMATE

PRELIMINARY COST ESTIMATE
PIPE CULVERT

PROJECT: CASANDRO WASH OUTFALL

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
107	Mobilization	1	EA.	$50,000	$50,000
405	Survey Monument	1	EA.	150	$150
505-1	Inlet Structure	1	EA.	$4,000	$4,000
505-2	Outlet HeadWall	1	EA.	$3,000	$3,000
602	Jacking Operation of 48" RCP	200	LF	$500	$100,000
610	Waterline Relocation:				
	4" Waterline	174	LF	$18	$3,132
	2" Waterline	432	LF	$15	$6,480
615-1	Sewerline Relocation:				
	10" VCP Sewerline	80	LF	$28	$2,240
618	48" Reinforce Concrete Pipe	4800	LF	$100	$480,000
625-1	Manholes	8	EA.	$5,000	$40,000
625-2	48"X18" tees	10	EA.	$200	$2,000
625-3	18" pipe plugs	10	EA.	$300	$3,000
625-4	Pipe Support	3	EA.	$800	$2,400
633	Riprap	50	CY	$50	$2,500
	Subtotal				$698,902
	Contingency	20	%		$139,780
	Total Construction Cost				$838,682
	Land, Permanent Easement	0.46	Ac	$20,000	$9,200
	Total Project Cost				**$847,882**

PRELIMINARY COST ESTIMATE
BOX CULVERT

PROJECT: CASANDRO WASH OUTFALL

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
107	Mobilization	1	EA.	$50,000	$50,000
405	Survey Monument	1	EA.	$150	$150
505-1	Inlet Structure	1	EA.	$4,000	$4,000
505-2	HeadWall	1	EA.	$3,000	$3,000
602	Jacking Operation of 6'x4' RCB	100	LF	$1,200	$120,000
610	Waterline Relocation:				
	4" Waterline	174	LF	$18	$3,132
	2" Waterline	432	LF	$15	$6,480
615-1	Sewerline Relocation:				
	10" VCP Sewerline	80	LF	$28	$2,240
618	6'x4' CONCRETE BOX CULVERT	2400	LF	$300	$720,000
625-1	Manholes	8	EA.	$3,000	$24,000
625-2	48"X18" tees	10	EA.	$200	$2,000
625-3	18" pipe plugs	10	EA.	$300	$3,000
625-4	Pipe Support	3	EA.	$800	$2,400
633	Riprap	50	CY	$50	$2,500
	Subtotal				$942,902
	Contingency	20	%		$188,580
	Total Construction Cost				$1,131,482
	Land, Permanent Easement	0.46	Ac	$20,000	$9,200
	Total Project Cost				**$1,140,682**