FLOOD CONTROL STUDY
FOR
EL MIRAGE INDUSTRIAL LANDFILL

EL MIRAGE, ARIZONA

prc

PRC Toups Corporation

A Planning Research Company

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January 15, 1981

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FLOOD CONTROL STUDY

FOR EL MIRAGE INDUSTRIAL LANDFILL

SCOPE OF STUDY:

The purpose of this report is to satisfy Arizona Department of Health Services requirements and Town of El Mirage floodplain regulations for the operation of the El Mirage Landfill within the floodway of the Agua Fria River. The following tasks were carried out during the performance of this study:

1. A review of existing data, maps, photos and reports.
2. An evaluation of the effectiveness of previous bank preservation work, including riprap.
3. An examination of the present work being done to riprap the landfill bank along the river and a description of the method of construction in narrative and chart drawings, including an opinion as to its effectiveness.
4. A HEC-2 computer analysis utilizing the current 100-year flow of 54,000 cfs and the topographical mapping used in the Flood Insurance Study (FIS) updated to include the current landfill and channelization.
5. A second HEC-2 computer analysis to show the effect of the ultimate development of the landfill as proposed.
6. A determination of scour potential in the riverbed utilizing the results of soil tests.

SCOPE OF STUDY: (cont'd)

7. Evaluate alternative embankment protection measures based on a cost-effectiveness analysis.
8. Determine needed channelization and protection measures for the landfill embankment to insure an ultimate development 100-year water surface profile of not more than one foot above the Flood Insurance Study 100-year flood profile.

STUDY AREA:

The El Mirage Landfill site, consisting of Parcel Numbers 1 and 2, is located within and on the east border of the Town of El Mirage, Arizona immediately south of Grand Avenue (see Plate 1). A legal description of Parcel Numbers 1 and 2 follow:

Legal Description: El Mirage Landfill Parcel 1, Phase 1, portion in use at present (from reference 14).

Beginning at the Northwest corner, Section 18, Township 3 North, Range 1 East, Gila and Salt River Base and Meridian; thence S 00° 52' 00" E, a distance of 528.26 feet to the TRUE POINT OF BEGINNING; thence S 00° 52' 00" E, a distance of 4553.32 feet; thence N 87° 56' 59" E, a distance of 665.41 feet; thence N 11° 54' 03" E, a distance of 2321.60 feet; thence N 03° 11' 05" W, a distance of 741.21 feet; thence N 89° 41' 37" E, a distance of 50.14 feet; thence N 00° 13' 25" W, a distance of 1106.35 feet; thence N 71° 21' 33" W, a distance of 1284.65 feet to the TRUE POINT OF BEGINNING.

Legal Description: (cont'd)

The aforedescribed parcel of land lies wholly within Lots 1, 2, 3 & 4 of the said Section 18, T-3-N, R-1-E, G&SRB&M, and contains 104.3427 acres more or less. The landfill portion of this site is approximately 18.9 acres, the remainder being either within the channel of the Agua Fria River or to be utilized for other purposes.

Legal Description: El Mirage Landfill Parcel 2, Phase II, future landfill site (from reference 14).

Beginning at the Northwest corner of Section 24, Township 3 North, Range 1 West, Gila and Salt River Base and Meridian which is the TRUE POINT OF BEGINNING; thence S 89° 47' 52" W, a distance of 2628.49 feet; thence S 00° 39' 34" E, a distance of 2637.91 feet; thence N 89° 49' 08" E, a distance of 1317.73 feet; thence N 25° 50' 56" E, a distance of 2936.67 feet to the TRUE POINT OF BEGINNING.

The aforedescribed parcel of land lies wholly within the northeast quarter of said Section 24, T-3-N, R-1-W, G&SRB&M and contains 119.4983 acres more or less.

GENERAL BACKGROUND:

The El Mirage Landfill was first established in 1973 and has operated continuously since that time. The initial permit was issued on June 8, 1973 by the Maricopa County Department of Health, Bureau of Environmental Health, the regulatory agency for landfills at that time. The permit was

GENERAL BACKGROUND: (cont'd)

issued to be in compliance with the El Mirage Landfill feasibility study and drainage feasibility report (reference 15).

In November, 1979, the Arizona State Department of Health Services, Bureau of Sanitation superceded the Maricopa County Department of Health, Bureau of Environmental Health as the regulatory agency for landfills. After the Arizona Department of Health Services (ADHS) became the regulatory agency for landfills, the El Mirage Landfill operation was questioned as to its compliance with regulations, and a new study was requested as a condition for the continuation of the landfill operation (reference 7). Following review of that study, ADHS and the Town of El Mirage requested that a hydraulic analysis be performed using the same methodology as the 1978 El Mirage Flood Insurance Study.

This study addresses the hydraulics utilizing a HEC-2 computer analysis and stability of the landfill bank for the present and proposed landfill operations as described in the scope of study.

PREVIOUS STUDIES:

Previous studies or reports on the Agua Fria River in the vicinity of the El Mirage Landfill include the "Town of El Mirage Flood Insurance Study" (FIS) (reference 13), the "El Mirage Industrial Landfill, Operations Report and Flood Study" (reference 14), the open-file report "Flood of February, 1980 along the Agua Fria River, Maricopa County, Arizona" (reference 5), and the "El Mirage Landfill Feasibility Study and Drainage Feasibility Report" (reference 15).

HYDROLOGY AND HISTORY OF FLOODING:

The maximum release of 66,600 cfs from Lake Pleasant on February 20, 1980 was the largest since the dam (Waddell Dam) was built in 1927 (reference 5). Waddell Dam is located approximately 17 miles upstream of Grand Avenue on the Agua Fria River. There are no significant contributing streams to the Agua Fria between Waddell Dam and Grand Avenue. The area inundated by the flood of February 20, 1980 in the vicinity of Grand Avenue is shown on Plate 2 (reference 5).

The maximum release from Waddell Dam previous to that of February 20, 1980 occurred on December 19, 1978 and had a discharge of 59,900 cfs. Although the flow from the 1980 release was greater than that in 1978, flood stages and extent of inundated area was greater in some areas in 1978 because of vegetation and other obstructions in the channel.

In addition to the releases on December 19, 1978 and February 20, 1980, flow was released from the reservoir in 1941, 1966, 1968 and the spring of 1978 (reference 5).

Records of stage and discharge for the Agua Fria River are available from 1910, but are intermittent and sketchy prior to 1933. The maximum discharge of about 105,000 cfs occurring in January 1916 and November 1919 is the greatest on record and occurred prior to the construction of Waddell Dam. Records indicate that 11 floods having discharges ranging from 25,000 to 80,000 cfs occurred between 1889 and 1927 (reference 5).

The 100-year discharge of 54,000 cfs has been established by the Corps of Engineers for the Agua Fria River near Grand Avenue (reference 13).

HYDRAULIC ANALYSIS:

General: Water surface elevations for the Agua Fria River near El Mirage were computed through the use of the Corps of Engineers (COE) HEC-2 step backwater computer program (reference 11). The HEC-2 program computational procedure applies Bernoulli's Theorem for the total energy at each cross-section and Manning's formula for the friction head loss between cross-sections. The effects of various hydraulic structures such as bridges, culverts, weirs, embankments and dams may be considered in the computations. The principal use of the program is in determining profiles for various frequency floods for both natural and modified conditions. Modified conditions may include channel improvements, levees, and floodways. Basic input data consists of starting water surface elevations, amount of flow, Manning's "n" values, and cross-sectional information. The HEC-2 computer program is an acceptable method for use in Federal Flood Insurance Studies.

Manning's "n" values or roughness coefficients used in the HEC-2 program were chosen using the procedure from the Soil Conservation Service (reference 9), engineering judgement based on field observations, analysis of aerial photographs and information from a U.S.G.S. published document (reference 10).

Stream cross-section data which describe the stream bed and overbank areas for the HEC-2 program was obtained from the original HEC-2 program used in the Town of El Mirage Flood Insurance Study. Due to changes

General: (cont'd)

occurring around the El Mirage Landfill, recent topographical mapping (reference 8) was obtained in the vicinity of the landfill. Original cross-section data was modified based on the recent mapping.

Starting water surface elevations used in the HEC-2 program were obtained from the Flood Insurance Study for the Town of El Mirage (reference 13).

The water surface profiles through the main Atchison Topeka and Santa Fe (AT&SF) Railroad and Grand Avenue bridges were also computed by the HEC-2 program. The special bridge routine option of the HEC-2 program was used to model each of the bridges. Hydraulic formulas are used in the bridge routine to determine the change in energy and water surface elevation through the bridge.

Ultimate Development Condition for Proposed Landfill: To compare the water surface profile for the proposed levee and channelization of the Agua Fria near the El Mirage Landfill to the natural water surface profile from the Town of El Mirage FIS, the "X5" card option of the HEC-2 program was used. The "X5" card option was used in Profile 1 to input water surface elevations for the 100-year natural flood from the FIS to each stream cross-section. A comparison of Profile 1 (natural condition) to Profile 2 (proposed levee and channelization) can then be made by referring to the column entitled "DIFWSP" difference in water surface elevation, in the HEC-2 output summary.

Ultimate Development Condition for Proposed Landfill: (cont'd)

To model the channelization needed to insure that the water surface elevations did not exceed the FIS elevations by more than one foot, with the proposed embankments in place, the channel modification due to the excavation option of the HEC-2 program was used. The channel modification option can model a hypothetical excavation at each individual stream section in the form of a trapezoidal section of any bottom width, side slope or invert elevation desired using the "CI" card in the HEC-2 program.

Present Condition for Existing Landfill: A HEC-2 computer analysis was conducted to model the base flood for the existing condition using the recent topography of the landfill area. An effective flow encroachment was used downstream and to the west of the landfill embankment to eliminate an ineffective flow area. This ineffective flow area does receive a small amount of breakout flow during the base flood but it was considered insignificant in this analysis. Due to the constriction of flow caused by the present landfill embankment, the base flood water surface profile exceeds by more than one foot the FIS water surface profile in the area of the lower end of the landfill embankment.

Ultimate Development Condition for Proposed Landfill: The water surface profile for the ultimate development condition is shown on Plate 4 for comparison with the FIS water surface profile. The locations and typical cross-section of the proposed embankments and channelization for the landfill are shown on Plates 3, 5, and 6. The HEC-2 computer printout for the proposed condition is reproduced in the Appendix.

Ultimate Development Condition for Proposed Landfill: (cont'd)

It has been estimated by field investigation of highwater marks, analysis of aerial photographs of the flood of February 20, 1980 and by HEC-2 analysis that the secondary Grand Avenue and AT&SF Railroad bridges located to the west of the main bridges will pass approximately 1,000 cfs during a flood of 54,000 cfs. Because the breakout appears to be such a small portion of the total flow, no reduction of flow was modeled below the main Grand Avenue bridge. To convey this estimated 1,000 cfs from the secondary bridges to the main channel of the Agua Fria River, a 250-foot wide drainage easement has been proposed as shown on Plates 5 and 6 with a channel cross-section as shown on Plate 3.

BANK SIDESLOPE DESIGN:

Soil-Grain Size Distribution: Subsurface samples of the bed material for three locations were collected and analyzed by Engineers Testing Laboratories, Inc. The results are included in the Appendix. These samples showed some variation in particle size distributions and a definitive conclusion could not be drawn regarding the median size D_{50}. For simplicity, a D_{50} of 3 mm was adopted for the scour analysis.

Scour Analysis: Changes in bed level which affect an embankment improvement may be described by three types of interrelated phenomena. They are:

1. Local Scour caused by local disturbances in the flow such as vortices and eddies. Examples are scour at the base of piers, dikes and other obstructions in a stream. In this

Scour Analysis: (cont'd)

situation, such scour would be expected in the vicinity of the Grand Avenue and railroad bridge piers and would have very minimal impact on the design. For this reason, no detailed local scour estimate has been included.

2. General Scour due to contractions causing increased velocities and bed shear stresses across the entire contracted width. Scour at contractions occurs because the flow area becomes smaller than the normal stream and the average velocity and bed shear stress increase. Therefore, more bed material is transported through the contracted section than is transported into the section. As the bed level is lowered, the velocity decreases, shear stress decreases and equilibrium is restored when the transport rate of sediment through the contracted section is equal to the incoming rate. General scour is expected to occur immediately downstream of the Grand Avenue Bridge and it may continue as far as Section 16.4. Laursen's equation was applied in computing general scour (see Appendix) by employing hydraulic parameters obtained from HEC-2 analysis. A 100-year design discharge of 54,000 cfs was utilized in the scour computation. The results of this analysis indicated that a scour depth of four feet can be reasonably expected in the stream bed in a 3,000 foot reach immediately downstream of the Grand Avenue Bridge.

3. The third phenomena that affects riverbed scour is degradation or aggradation of a stream channel over long distances and periods of time due to changes in controls such as dams,

Scour Analysis: (cont'd)

changes in sediment content and changes in river geomorphology, such as changing from a meandering river to a braided stream.

Due to channelized flow, the stream velocities will be generally higher and, therefore, degradation will be more likely within the study reach. Estimating degradation is very complex since this process is influenced by several geological, hydraulic and hydrologic variables. Sediment transport is one of the most influential factors in determining the degradation rate. Due to the lack of detailed information regarding sediment transport, sediment routing, breaking and forming of the armor layer, etc., and to obtain solutions in a more economic way, realistic assumptions were utilized to determine the sediment supply from the upstream channels. The Colby procedure was employed (reference 16) which correlates mean stream velocities with concentration of sediment in a sand stream bed. Hydraulic parameters, derived from HEC-2 printouts and median size soil particles (D_{50} = 3mm) estimated from the soil analysis were utilized in estimating a sediment discharge of 400 tons/day/foot of width. Based on this amount, stream bed degradation of approximately four feet has been estimated at a flow rate of 54,000 cfs.

The effects in Items 2 and 3 are generally additive so that while scour due to contraction is occurring degradation of the stream can also take place. This means a total of eight feet of scour can occur within the study reach.

BANK STABILITY MEASURES:

Bank stability, or slope protection, is an important factor for any kind of earthen embankment subject to potential failure due to water velocity wave action, sloughing action caused by excessive internal hydrostatic pressure and undermining of the toe of the embankment.

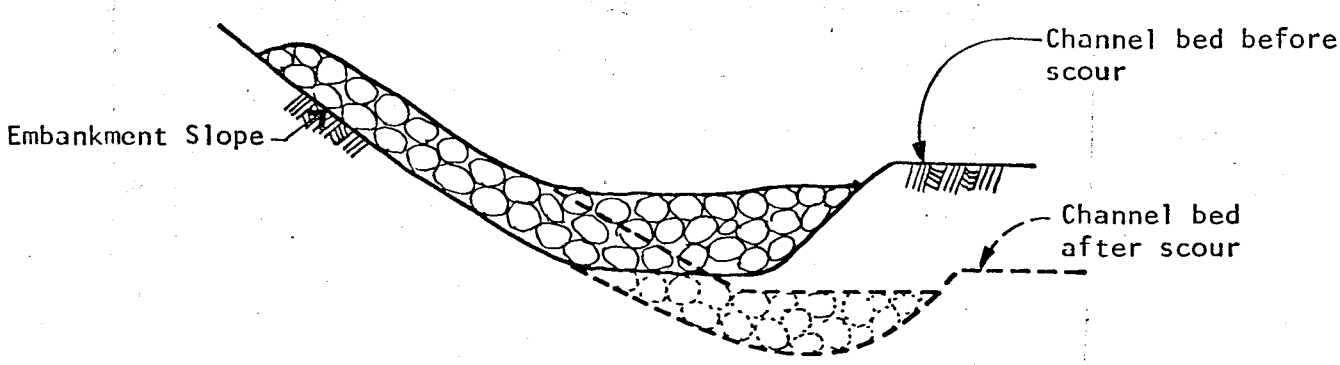
Several methods are available for bank protection. Some of the most common methods are:

1. Dumped riprap
2. Wire-enclosed riprap
3. Grouted riprap
4. Soil cement lining

For this situation, considering the protection needs and scour potential, it was determined that dumped riprap would be the most cost-effective bank protection measure. Dumped riprap is graded stone dumped on a prepared slope in such a manner that segradation of the stone will not take place. Dumped stone riprap is the most flexible of the types listed here and will adjust itself to uneven bank settlement.

A filter blanket or plastic filter cloth beneath the riprap is essential to protect the fine embankment fill from washing out through the riprap. For cost reasons, a plastic filter cloth is recommended. See Plate 3 for a typical cross-section recommended for the embankment protection. Design computations are included in the Appendix.

Riprap Trench: Generally, the region of the channel bed beyond the riprap trench scours and, as the scour hole is formed, the riprap slides down into the scour hole eventually armoring the side of the scour hole adjacent to the embankment. Thus, the embankment is protected from caving caused by erosion at the toe. A typical riprap trench is shown below:



Rock-fill trench

Freeboard: The freeboard of a channel is the vertical distance from the top of the embankment to the water surface at the design condition. This distance should be sufficient to prevent waves or fluctuations in water surface from overflowing the top of the embankment.

In accordance with the SCS Far West State Design Standards, a freeboard equal to 0.2 times the specific energy head for a trapezoidal channel section under subcritical velocity conditions should be used. In this case, the average specific energy head is 15 feet, thus yielding a freeboard requirement of three feet.

PROPOSED CHANNELIZATION AND EARTHWORK:

The Town of El Mirage Floodplain Ordinance states that no construction can be done within the floodway that will cause any increase in the base flood elevation. However, construction within the floodplain up to the floodway limit is permitted as long as the rise in the base flood elevation is not more than one foot when encroachment is complete on both sides of the floodway. In this situation, due to a natural bluff on the Youngtown or east side of the channel, the 100-year floodway limit and floodplain boundary lines coincide thus creating a "natural encroachment" on the east.

A goal of this study was to determine the amount of channelization required adjacent to the landfill to pass the 100-year flow without increasing the water surface elevations by more than one foot. Attainment of this goal would then suggest that complete encroachment on the west side of the channel could occur while still meeting the requirements of the floodplain ordinance. Plate 4 shows the water

PROPOSED CHANNELIZATION AND EARTHWORK: (cont'd)

surface profile for the original FIS and the water surface profile that would result during the 100-year flood following the channel improvements outlined below. It can be seen that throughout the study reach, the maximum one-foot criteria has been met.

Plate 6 indicates a typical channelized section, the limits of the proposed excavations and the proposed channel bottom grades. Using the end area method, earthwork was estimated to be 425,000 cubic yards. Excess soil can either be stockpiled for future landfill use or salvaged for use in nearby subdivisions which may be in need of imported soil.

EXISTING BANK PROTECTION:

Mr. Ken Boyce, the landfill operator, has indicated that the existing embankment has been protected with a layer of rock, broken concrete and broken asphalt paving. This layer was then covered with materials from the river bed by a bulldozer. A site inspection confirmed that materials from the river bed had been pushed up onto the embankment. However, no armor materials were observed in place due to this cover layer.

Examination of photographs taken during and after the February 20, 1980 flood and discussions with Mr. Boyce indicate that the existing embankment withstood the floodwater velocities due to the 66,600 cfs flow with only minor damage and that damage was confined to two areas where bank protection had not been placed due to instructions from official sources. The evidence tends toward the conclusion that adequate bank protection has been placed in the existing landfill embankment.

RIPRAP CONSTRUCTION AND SPECIFIATIONS

ROCK RIPRAP:

Description: Riprap shall consist of furnishing and placing heavy rocks used to protect the embankment from scour and shall include necessary excavation and backfill. Riprap shall be plain as specified and shall be placed at the locations shown on Plate 3 and Plate 5.

Materials: Materials furnished for riprap shall be sound and durable and shall conform to the following grading requirements.

PARTICLE SIZE	PERCENT PASSING (by dry weight)
24"	100
18"	80-100
12"	50-80
6"	20-50
2"	0-20

Construction Details: Rock shall be either equipment or hand placed. Care should be taken in placement of rocks so that proper interlocking between the rocks is insured.

PLASTIC FILTER CLOTH:

Description: This item consists of furnishing and placing plastic filter cloth and 3" thick filter blanket.

Materials: The plastic filter cloth shall be "Mirafi 140S" or equivalent. The filter blanket shall be native dirt borrowed from the channel bed.

Construction Details: The embankment shall be brought to a smooth and clean condition, clear of any stumps, large rocks, or other protruding objects which may damage the fabric. Sections of fabric shall be overlapped 18", with upstream lapping over downstream and uphill lapping over downhill. Rocks placed along the uncovered overlaps shall be used to prevent problems with wind. A 3" filter blanket of borrow material shall be placed on the fabric for protection.

IMPLEMENTATION SCHEDULE:

The following key dates are part of a proposed implementation schedule for completion of the proposed channel improvements and landfill protection measures:

January 19, 1981 - submit this report to the Arizona Department of Health Services and the Town of El Mirage. Initiate channel excavation.

January, 1982 - Complete excavation of the proposed channel improvements, excluding delays due to acts of God or other factors beyond the control of the landfill operator.

Ongoing - Construct landfill embankment including riprap protection in advance of landfilling operations as required.

CONCLUSIONS AND RECOMMENDATIONS:

As a result of this study, it is concluded that:

1. In order to meet the El Mirage Floodplain Ordinance requirement that the base flood elevation established in the Flood Insurance Study of the Agua Fria River should not be exceeded by more than one foot, some channelization will be necessary within the study reach. This channelization will require excavation of an estimated 425,000 cubic yards of material from the river bed.

2. Within the scope of this study and with the amount of data available, an estimated scour depth of eight feet was determined by calculation and was presented as a reasonable approximation of the general scour depth that could be expected in the area

CONCLUSIONS AND RECOMMENDATIONS: (cont'd)

from the Grand Avenue bridge to a point approximately 3,000 feet downstream due to the 100-year flood event and long-term degradation of the channel. To protect the existing embankment from river bed scour, a rock-filled toe trench is required.

3. HEC-2 computer backwater calculations reveal that channelized velocities will generally range from 12 to 15 fps. These velocities are high enough to cause bank scour, and, therefore, bank protection in the form of riprap with plastic filter cloth will be necessary to stabilize the embankment. This riprap should extend at least three feet above the expected 100-year water surface elevation.

It is recommended that channelization, the rock-filled toe trench and bank protection be carried out as described in this report and as shown on the plates. It is further recommended that:

1. A 250-foot wide drainage easement be provided along the westerly boundary of Parcel 1 (see Plate 5). An approximate design resulted in a channel cross-section for this drainage way similar to Section Y-Y as shown on Plate 3. The Town of El Mirage should undertake design of the channel to finalize its dimensions and location and should construct the channel to help reclaim as much land as possible in the current floodway. This channel would not only carry whatever flows pass through the westerly Grand Avenue and

CONCLUSIONS AND RECOMMENDATIONS: (cont'd)

railroad bridges, but also would help to drain the lands immediately to the west.

2. A 100-foot wide drainage easement be provided along the northerly and westerly boundaries of Parcel 2 as shown on Plate 5 to allow runoff from the existing low areas to be conveyed to the main channel of the Agua Fria River.

3. Three existing power transmission line towers are located within the channel bed in the area of the proposed channelization (see Plate 6). The bases of these towers and the towers for the Tucson Gas and Electric powerline adjacent to the property are vulnerable to local as well as general scour.

   It is recommended that the owners of these towers, Arizona Public Service and Tucson Gas and Electric, be contacted prior to excavation in the area in order to apprise them of the proposed channel improvements. Special attention will be required for the tower foundations. It is suggested that excavation be carried out such that an oval shaped island will be formed with side slopes of 3 horizontal to 1 vertical (3:1). Furthermore, these sideslopes may be protected against scour by 2-foot thick riprap material, plastic filter cloth and a toe trench filled with riprap is indicated on Plate 6. It should be noted that the design indicated on Plate 6 is merely a suggestion and should not be considered a final design until the tower owners review the proposed work.

CONCLUSIONS AND RECOMMENDATIONS: (cont'd)

4. It is recommended that the proposed landfill embankment including riprap protection be constructed in advance of the landfilling operations by a distance sufficient to protect the active landfill area from major flows. It is felt that construction of the entire embankment at this time is unnecessary.

GLOSSARY

Aggradation/Degradation: The terms aggradation and degradation generally refer to trends in behavior of the stream bed profile. An aggrading stream is one on which the bed profile is tending to become steeper, where a degrading stream is one for which the bed profile is tending to become flatter.

Bed Shear Stress: When water flows in a channel, a force is developed that acts inthe direction of flow on the channel bed. This force, which is simply the pull of water on the wetted area, is known as shear force. When this force is measured per unit area is called shear stress (lb/ sq. ft.).

cfs: Abbreviation for cubic feet per second. A unit of water flow. sometimes called "second-feet".

Channelization: Structural work of improvement that changes the direction or capacity of flow in a drainage channel.

Confluence: The physical location where two or more streams meet.

Discharge: A term for flow rate as a ratio of volume over a given time, period, usually measured in cubic feet per second (cfs).

D_{50}: The particle size diameter of which 50% of the soil sample is finer by weight.

Erosion: The detachment of soil and rock particles by water, wind, ice or gravity.

Flood: An overflow from the designed channel of a river or other body of water.

Flood Frequency: The average frequency or time interval that a flood of a certain magnitude may be expected to occur.

Levee: An artificial embankment, usually of earth fill, built along the bank of a watercourse and designed to protect land from inundation.

Right-of-Way: Lands and rights of interest in lands necessary for flood control purposes.

Riprap: A layer of large, durable, dense, specially selected and graded, broken rock fragments emplaced to prevent erosion by strong currents and thereby, preserve the shape of a surface or slope.

Runoff: That portion of precipitation not initially captured by soil or vegetation to cause flow across a land surface.

Scour: The powerful and concentrated clearing and digging action of flowing water, especially the downward erosion by stream water in sweeping away sediments during time of flood.

Sediment: Fragmental material that originates from weathering of rocks and is transported by, suspended in, or deposited by water or air or is accumulated in beds by other natural agencies.

Soil Cement: A compacted mixture of soil or granular material, cement and water that hardens to form a durable structural layer with slablike properties.

Velocity: The speed of flow given as a ratio of length over time. Usually measured in feet per second.(fps).

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14. Operational Report and Flood Study "El Mirage Industrial Landfill", by Wm. A. Ramsey, October, 1980.

15. El Mirage Landfill Feasibility Study and Drainage Feability Report, May, 1973.

16. U.S. Department of Agriculture, Soil Conservation Service, "Sedimentation", Section 3, November, 1973.

Appendix

APPENDIX

SCOUR ANALYSIS

SCOUR ANALYSIS:

In the reach immediately downstream of the Grand Avenue Bridge, the scour would be of the general type and Laursen's Equation is applicable (reference 1). The equation is;

$$\frac{Y_2}{Y_1} = \left(\frac{Q_t}{Q_c}\right)^{6/7} \frac{W_1}{W_2}^{\frac{6\ (2+f)}{7\ (3+f)}} \left(\frac{n_2}{n_1}\right)^{\frac{6f}{7\ (3+f)}}$$

Where: Y_1 = Ave. depth in the upstream approach channel (11.2')

Y_2 = Ave. depth in the downstream channel (11/6')

Q_t = Total design flood discharge (54,000 cfs)

Q_c = Flow in the main channel upstream of the bridge (39,800 cfs as determined by HEC-2 flow distribution @ Section 17.15)

W_1 = Approach channel width (331')

W_2 = Contracted channel width (290')

n_1 = Manning's roughness coefficient for the main channel upstream of the bridge (.032)

n_2 = Manning's roughness coefficient for the main channel downstream of the bridge (.03)

f = This term is dependent on the approach channel shear velocity and the fall velocity of the bed material.

The approach channel shear velocity is:

$$V_{*c} = \sqrt{\frac{T_1}{P}}$$

P = mass density of fluid (1.94 $\frac{slug}{ft.^3}$).

here T_1 = ave. bed shear in the upstream channel or $YY_1\ S_f$.

Y = specific wt. of water (62.4 lb/ cu.ft.)

Y_1 = ave. depth in the upstream approach channel (11.2')

S_f = slope of energy gradeline (.00236± ft/ft)

then, $V_{*c} = \sqrt{\frac{62.4 \times 11.2 \times .00236}{1.94}}$

$= .922$

The median diameter of the bed material is D_{50} 3 mm (sand)

Assume a shape factor of 0.7 (normal for sands) so that the fall velocity is (from Fig. 3.7.2, reference 1).

W = 12 cm/sec. = .39 fps

so that, $\frac{V_{*c}}{W} = \frac{.922}{.39} = 2.36$

for $\frac{V_{*c}}{W} = 2.36$, the value of f = 2.25 (reference 1)

$$\therefore Y_2 = 11.2 \left(\frac{54,000}{39,800}\right)^{6/7} \left(\frac{331}{290}\right) \frac{6\ (2+2.25)}{7\ (3+2.25)} \left(\frac{.03}{.032}\right) \frac{6\ (2.25}{7\ (3+2.25}$$

$= 11.2 \times 1.299 \times 1.096 \times .9766$

$= 15.6'$

The uniform flow depth in the downstream section (Y_2) has been computed as 11.6 feet.

Therefore, the general scour should be (15.6' - 11.6') = 4.0' for the design discharge.

CHANNEL DEGRADATION:

The rate of channel degradation can be estimated by computing the rate of sediment discharge. The rate of sediment discharge, however, depends on several hydraulic, geologic and hydrologic parameters which are difficult to predict. Compilation of such parameters will require years of sediment sampling, soil boring throughout the stream reach, precise dam operation schedules and will be very time consuming and uneconomical. For the purpose of this report, therefore, some simplified assumptions have been made in computing the rate of sediment discharge.

A somewhat crude computation based on Fig. 4-6 of reference 16 will serve this purpose in estimating sediment discharge. Assume the following data is available:

Q_{100} = 54,000 cfs

W = Average width of channel (350') in the reach

Y = Average depth of flow in the reach (10')

L = Reach length. From Waddell Dam to Peoria Road (18 miles)

V = Mean velocity in channel in given reach (10 fps)

D_{50} = 3mm. for given reach. (Based on available soil testing)

Duration of Flow = 10 days

from Fig. 4-6, for D_{50} = 3mm., Y=10', V=10 fps

sediment discharge = 400 tons/day/foot width.

$\therefore$ Total sediment discharge = 400 x 10 days x 350' width

$= 14 \times 10^5$ tons

If the bed material has a dry weight of 100 lbs./cu. ft.,

$$\text{Volume of Sediment} = 14 \times 10^5 \text{ (tons)} \times 2000 \left(\frac{\text{lb.}}{\text{ton}}\right) \times \frac{1}{100} \left(\frac{\text{cu. ft.}}{\text{lb.}}\right)$$

$$= 28 \times 10^6 \text{ cu. ft.}$$

Assume degradation reach = 18 miles, 350' wide,

$$\text{Then average rate of degradation} = \frac{28 \times 10^6 \text{ cu. ft.}}{(18 \times 5280 \text{ ft.})(350 \text{ ft})}$$

$$= \frac{28 \times 10^6}{33.26 \times 10^6} = .84'$$

This 0.84' degradation represents one 100-year storm event for a 10-day duration. There will be storms of 10-year, 25-year and 50-year frequency. For the purpose of this report, let us assume that total degradation due to all these storms for the 100-year design period is: $5 \times .84 = 4.0'$

Total scour depth = General scour due to channel contraction at Grand Avenue + degradation

$$= 4.0' + 4.2'$$

$$= 8.2'$$

Obviously, this scour depth is based on no bank protection, if adequate protection is provided, the scour depth can be reduced up to 50 percent or more (reference 1).

SLOPE PROTECTION

SLOPE PROTECTION:

Given:

Q_{100} = 54,000 cfs
Top width = 530'
Velocity = 15 fps
Depth = 13'
Slope = .0027 (ave.)

} from HEC-2 run

ref. 4

Median size diameter of rock for channel bottom can be estimated by equation:

$$d_{max} = \frac{5\ D_{50}}{\gamma\ So} \quad \text{(ref.}$$

Where d_{max} = 13'

D_{50} = median size rock in feet

γ = 62.4 lb./cu. ft.

So = .0027 ft./ft.

$$\therefore D_{50} = \frac{13 \times 62.4 \times .0027}{5} = .43', \text{ say } 6''$$

From chart 30, angle of repose θ for very angular rock = 41.3° for D_{50} = 6" and for very round rock = 38.7° for D_{50} = 6"

$$\text{Use } \theta = \frac{41.3 + 38.7}{2} = 40° \text{ (ave)}$$

From chart 31, for $B/d = 530/13 = 41$ and sideslope = 3:1

$$K_1 = .85 \qquad \frac{\text{maxi. side shear}}{\text{maxi. bottom shear}}$$

From chart 32, for $\phi = 18°$ and $\theta = 40°$

$$K_2 = .87 \qquad \frac{\text{critical shear on the side}}{\text{critical shear on the bottom}}$$

The required D_{50} for the side slope is $\frac{K_1}{K_2}$ times D_{50} for the bottom.

$$= \frac{.85}{.87} \times .5$$

$$= .49', \text{ say } 0.5' \text{ or } 6''$$

ref. 12 Chart D, Page 112

Given: V = 15 fps from HEC-2

Z = 3 sideslope

Sg_R = sp. gravity of rock (assume 2.65)

from Chart D, size of rock = 11.7", say 12"

Provide D_{50} = 12" for a conservative design

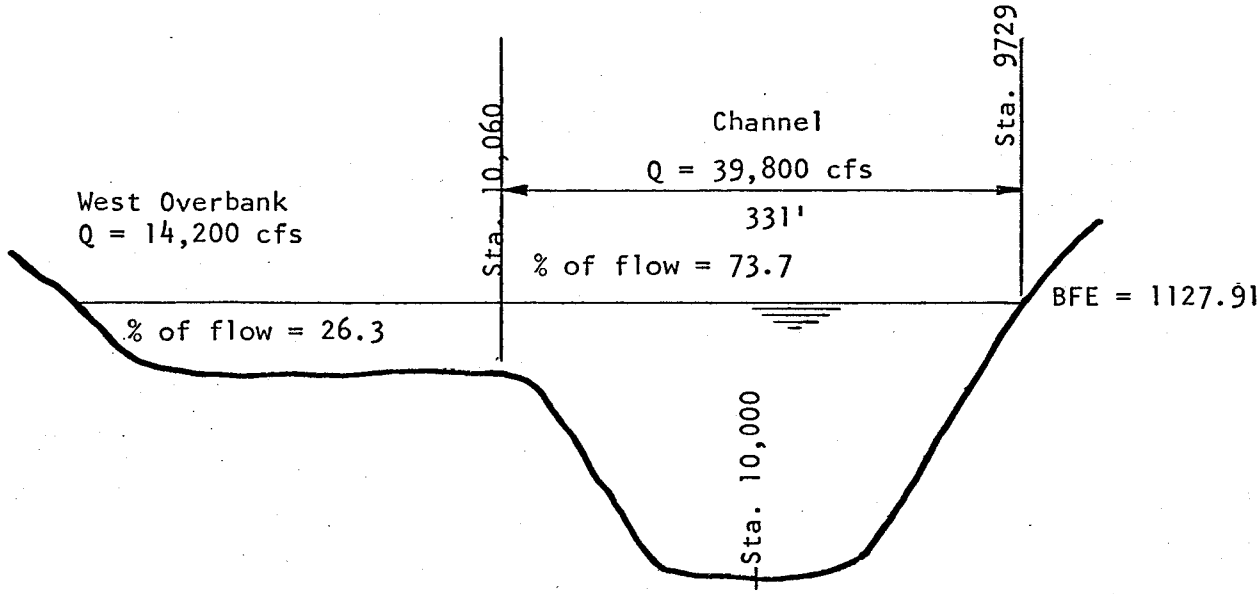
Provide thickness - 2 x D_{50} = 24"

GRADATION DESIGN: (reference 1) Fig. 6.4.3

PERCENT FINER BY WEIGHT	SIZE IN D_{50} (in.) TERMS	SIZE OF ROCK
100	2 x D_{50}	24"
80-100	1.5 x D_{50}	18"
50-80	D_{50}	12"
20-50	0.5 x D_{50}	6"
0-20	0.2 x D_{50}	2"

Plastic filter cloth is recommended underneath the riprap to protect the fine embankment fill from washing out through the riprap.

FROM HEC-2 COMPUTER PRINTOUT, FLOW DISTRIBUTIONS @ SEC. 17.15, Q = 54,000 cfs



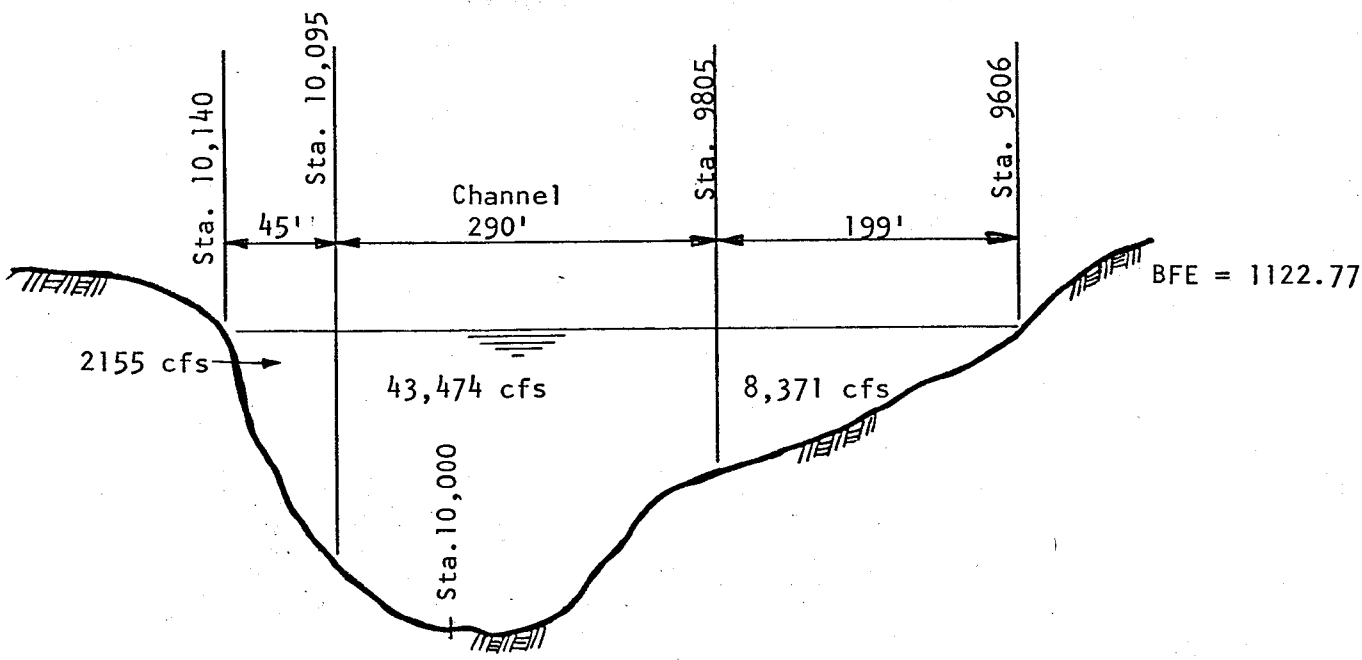
SECTION 17.15, AGUA FRIA RIVER
LOOKING NORTH (not to scale)

$$Y_1 = \text{ave. depth in upstream approach channel} = \frac{\text{Area (A)}}{\text{Top Width (ft.)}}$$

$$= \frac{(122.4 + 2979 + 595)}{(10{,}060-9{,}729)} = \frac{3696.4}{331}$$

$$= 11.2'$$

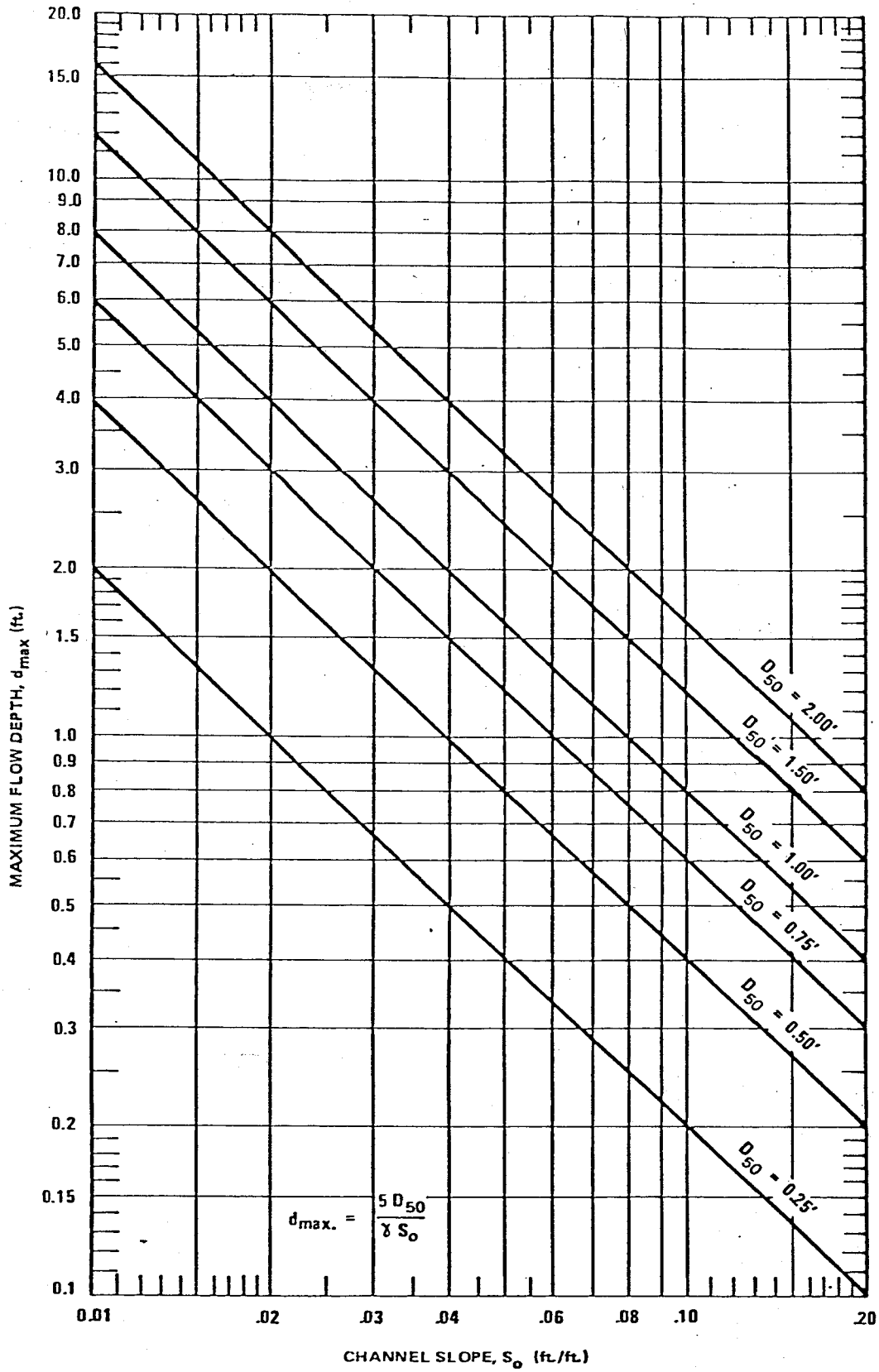
From HEC-2 Computer Printout, Flow Distribution
at Section 17.0, Q = 54,000 cfs



SECTION 17.00, AGUA FRIA RIVER
LOOKING NORTH (not to scale)

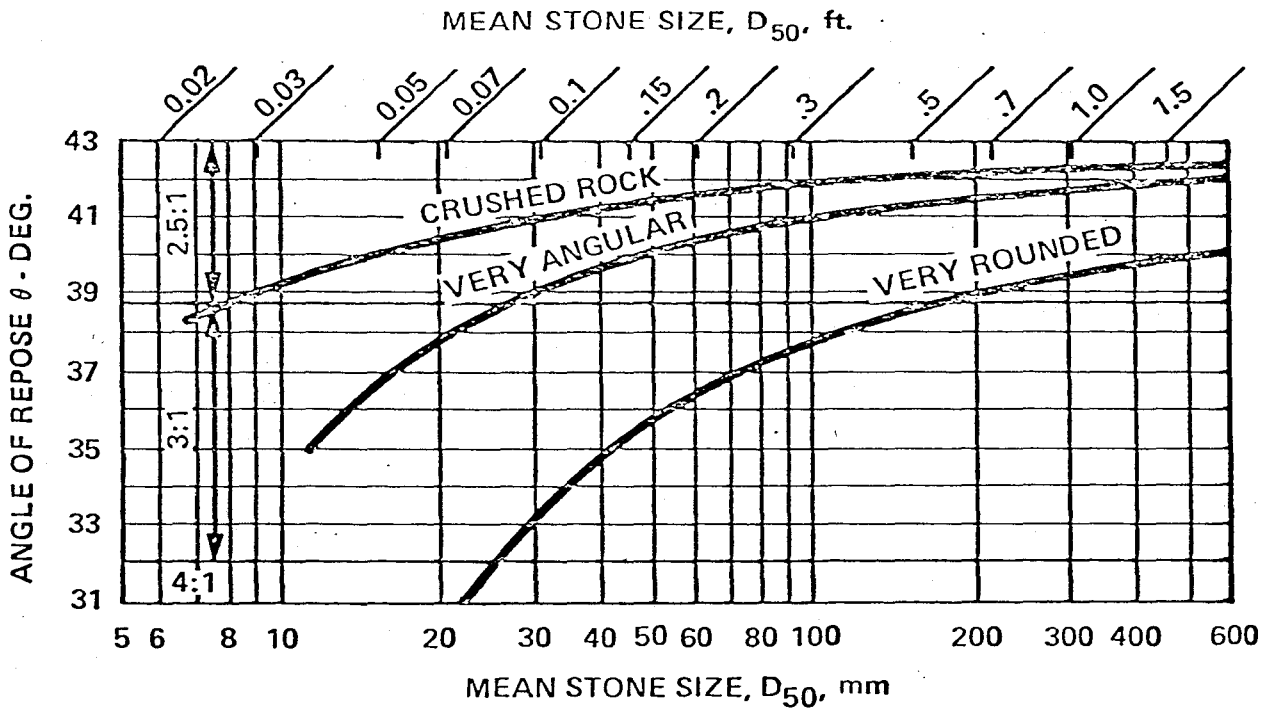
Y_2 = average depth in downstream channel $= \frac{A}{TW} = \frac{3368}{290} = 11.61'$

Chart 27



MAXIMUM PERMISSIBLE DEPTH OF FLOW (d_{max})
FOR CHANNELS LINED WITH ROCK RIPRAP

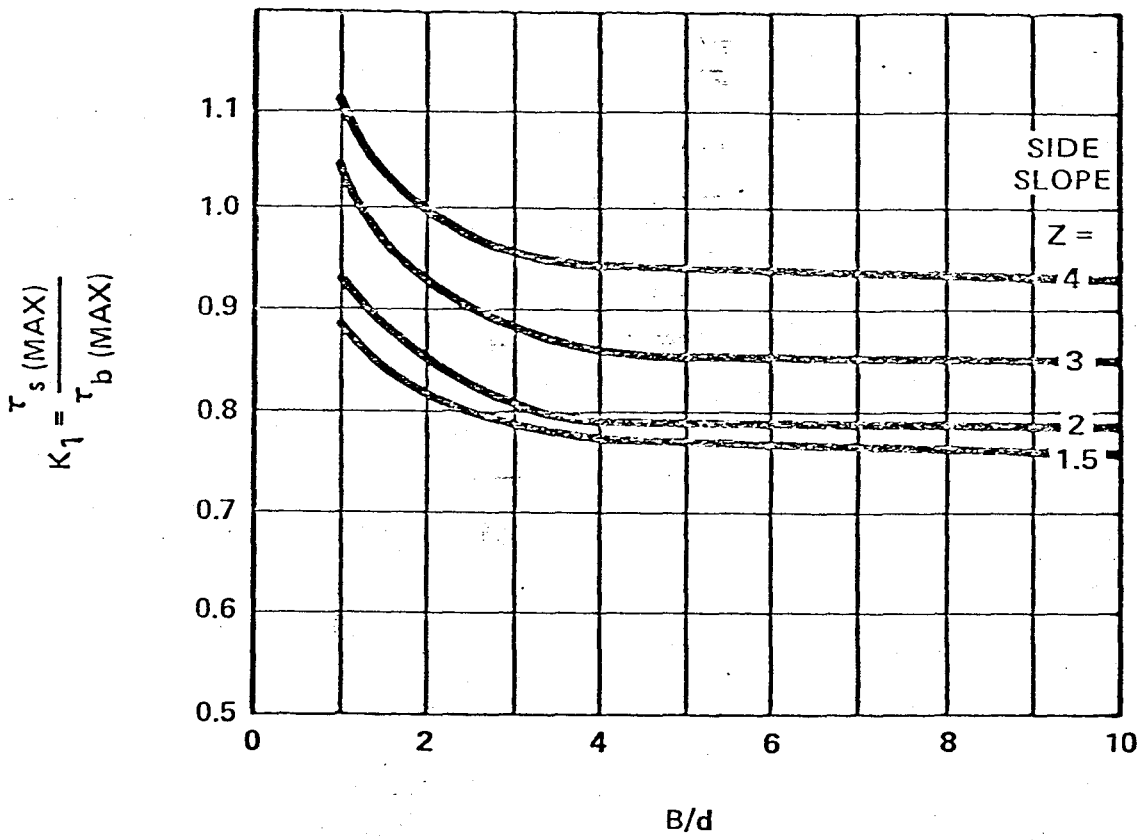
CHART 27
Ref. 4



ANGLE OF REPOSE OF RIPRAP IN TERMS OF MEAN SIZE AND SHAPE OF STONE

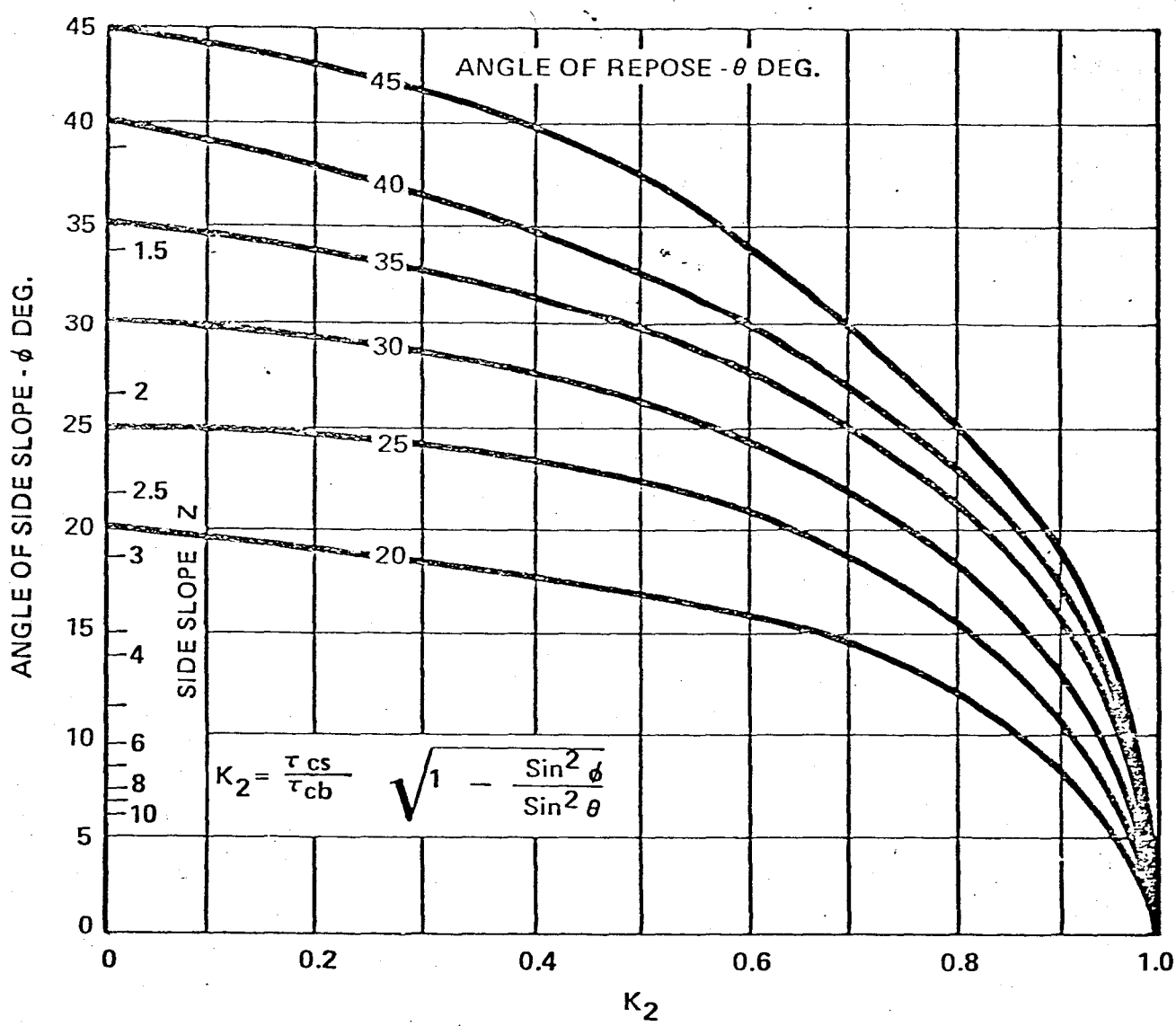
CHART 30
Ref. 4

Chart 31



DISTRIBUTION OF BOUNDARY SHEAR AROUND WETTED PERIMETER OF TRAPEZOIDAL CHANNELS

CHART 31
Ref. 4



RATIO OF CRITICAL SHEAR ON SIDES TO CRITICAL SHEAR ON BOTTOM FOR NONCOHESIVE SEDIMENT

CHART 32
Ref. 4

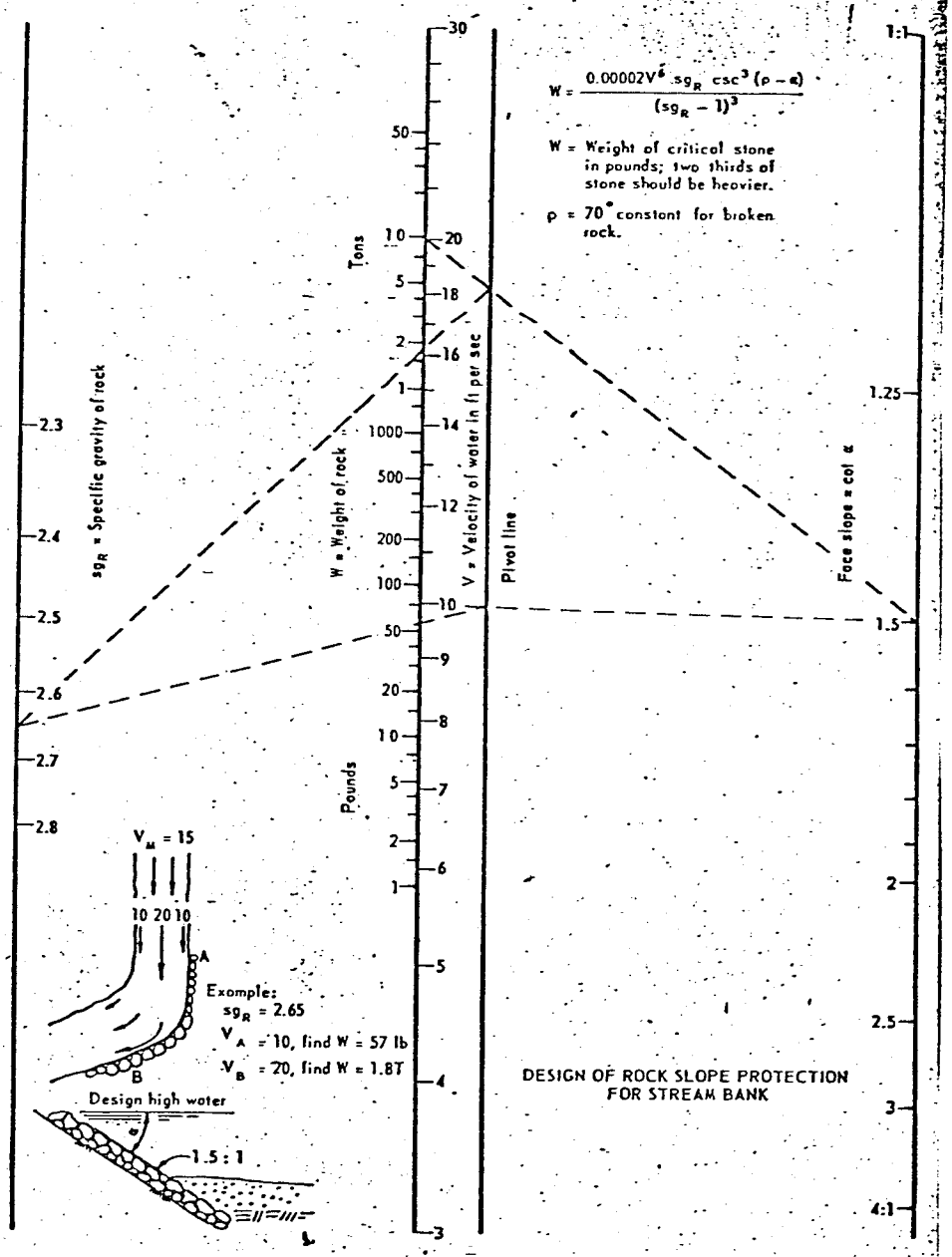


CHART D. Nomograph for design of stream-bank rock slope protection.

CHART D
Ref. 12

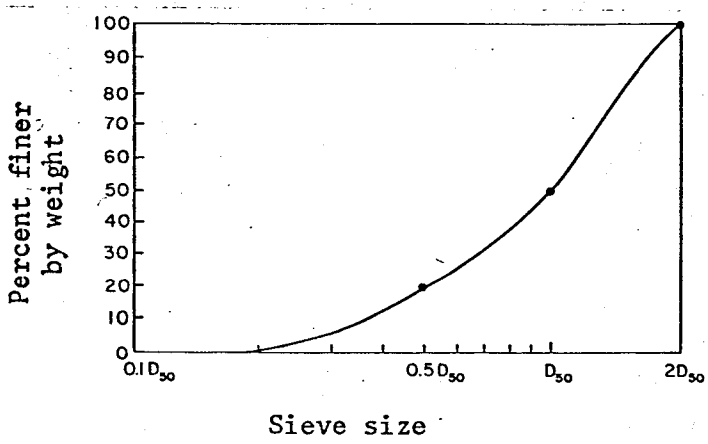


Fig. 6.4.3 Suggested gradation for riprap

REFERENCE 1

HEC-2 COMPUTER PRINTOUTS

1. HEC-2 PROPOSED LANDFILL OPERATIONS
(channelized condition)

EXPLANATION OF HEC-2 OUTPUT VARIABLES

(to be used in conjunction with HEC-2 computer printout)

VARIABLE NAME	DESCRIPTION
SECNO	The cross-section identification number
Q	Total flow in the cross-section (cfs)
CWSEL	Computer water surface elevation
CRIWS	Critical water surface elevation
XLCH	Channel reach length (feet)
VCH	Mean valocity in channel (fps)
VLOB	Average velocity in left overbank area (fps)
VROB	Average velocity in right overbank area (fps)
DEPTH	Depth of maximum flow (feet)
SSTA	Starting station of water surface
ENDST	Ending station of water surface
QLOB	Amount of flow in the left overbank (cfs)
QCH	Amount of flow in the channel (cfs)
QROB	Amount of flow in the right overbank (cfs)
ELMIN	Minimum elevation in the cross-section
TOPWID	Cross-section width at water surface elevation
K*XNL	Manning's "n" for the left overbank area
K*XNCH	Manning's "n" for the channel area
K*XNR	Manning's "n" for the right overbank area
K*	Value has been multiplied by 1000

```
*************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APRI 1980
  ERROR CORR -  01,02,03,04
  MODIFICATION -  50,51,52,53,54
*************************************************

C
T1      EL MIRAGE LANDFILL                    BY PRC TOUPS,PHOENIX,AZ. PH. 954-9191
T2      PROFILE 1  54,000CFS,100-YEAR FLOOD FROM EL MIRAGE FIS
T3      AGUA FRIA RIVER  NEAR GRAND AVENUE    DECEMBER,1980  JOB NO.1831-602

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

      -1.       2.        0.        0.  0.000000      0.00       0.0       0.  1093.700     0.000

J2  NPROF     IPLOT     PREVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

     1.000     0.000    -1.000     0.000     0.000     0.000     0.000     7.000     0.000     0.000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    13.000    43.000    39.000     1.000    50.000    42.000     8.000    33.000    15.000    14.000

    26.000    53.000    54.000     0.000   200.000     0.000     0.000     0.000     0.000     0.000

QT      5.000  54000.000  54000.000  65000.000  75000.000 100000.000     0.000     0.000     0.000     0.000
NC       .045      .045      .035      .100      .300     0.000     0.000     0.000     0.000     0.000

        CROSS SECTION NUMBERS IN RIVER MILES INCREASING UPSTREAM FROM THE

        CONFLUENCE OF THE AGUA FRIA WITH THE GILA RIVER.

        CROSS SECTION STATIONING FROM LEFT TO RIGHT LOOKING DOWNSRREAM WITH

        STATION 10000 AT THE HATCH MARK.

        WATER SURFACE ELEVATIONS INSERTED FROM THE EL MIRAGE FIS USING "X5"

        CARDS FOR PROFILE 1

        PEORIA AVENUE UPSTREAM OF SECTION 15.00

X1     15.000    15.000  9800.000 10000.000     0.000     0.000     0.000     0.000     0.000     0.000
X5      1.000  1093.700     0.000     0.000     0.000     0.000     0.000     0.000     0.000     0.000
GR   1110.000  7340.000  1093.000  7440.000  1095.000  7770.000  1090.000  8680.000  1091.000  8970.000
GR   1090.000  9240.000  1092.000  9550.000  1090.000  9800.000  1087.000 10000.000  1090.000 10280.000
GR   1085.000 11170.000  1090.000 11440.000  1095.000 12050.000  1100.000 12600.000  1105.000 12630.000
NH      4.000     .038  8330.000     .035 10000.000     .030 11130.000     .033 13800.000     0.000
ET      0.000     0.000     7.100     7.100     7.100     7.100  9500.000 11300.000     0.000     0.000
```

```
X1      15.280       9.000    9890.000   10000.000    1300.000    1500.000    1480.000       0.000       0.000       0.000
X5       1.000    1097.600       0.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000
GR    1110.000    8750.000    1097.000    8830.000    1095.000    9140.000    1096.000    9520.000    1095.000    9890.000
GR    1090.000   10000.000    1095.000   11130.000    1100.000   12000.000    1101.000   13800.000       0.000       0.000
NH       4.000       .038    9300.000       .035    9890.000       .030   10400.000       .038   13700.000       0.000
ET       0.000       0.000       7.100       7.100       7.100       7.100    9600.000   11450.000       0.000       0.000

X1      15.440      15.000    9890.000   10000.000     820.000     850.000     870.000       0.000       0.000       0.000
X5       1.000    1101.100       0.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000
GR    1115.000    9240.000    1098.000    9300.000    1095.000    9890.000    1092.000   10000.000    1096.000   10270.000
GR    1094.000   10400.000    1100.000   10550.000    1101.000   10800.000    1097.000   11450.000    1099.000   11660.000
GR    1097.000   11830.000    1100.000   11980.000    1102.000   12110.000    1102.000   12630.000    1105.000   13700.000
NH       3.000       .035    9970.000       .030   11680.000       .038   14250.000       0.000       0.000       0.000
ET       0.000       0.000       7.100       7.100       7.100       7.100    9290.000   11270.000       0.000       0.000

        BEGIN PROPOSED EL MIRAGE LANDFILL LEVEE ENCROACHMENTS

X1      15.640      45.000    9970.000   10215.000    1010.000     960.000    1040.000       0.000       0.000       0.000
X5       1.000    1103.400       0.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000
GR    1120.000    9290.000    1110.000    9320.000    1103.000    9325.000    1106.000    9330.000    1104.000    9435.000
GR    1102.000    9440.000    1100.000    9445.000    1098.000    9480.000    1096.000    9510.000    1096.000    9550.000
GR    1098.000    9630.000    1100.000    9700.000    1100.000    9820.000    1098.000    9970.000    1096.000   10035.000
GR    1093.900   10150.000    1094.000   10160.000    1096.000   10180.000    1093.000   10200.000    1100.000   10215.000
GR    1100.000   10230.000    1093.000   10250.000    1098.000   10270.000    1100.000   10445.000    1100.000   10560.000
GR    1093.000   10655.000    1098.000   10740.000    1100.000   10810.000    1093.000   10830.000    1098.000   10875.000
GR    1093.000   10930.000    1100.000   10945.000    1102.000   10960.000    1104.000   10985.000    1104.000   11180.000
GR    1102.000   11670.000    1100.000   11680.000    1100.000   11910.000    1102.000   11980.000    1102.500   12070.000
GR    1100.000   12140.000    1101.000   12170.000    1104.000   13170.000    1105.000   13820.000    1106.000   14250.000
NH       5.000       .035    9910.000       .030   10725.000       .035   11130.000       .030   11700.000       .038
NH   14370.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000
ET       0.000       0.000       7.100       7.100       7.100       7.100    9880.000   11240.000       0.000       0.000

X1      15.900      28.000    9910.000   10115.000    1210.000    1210.000    1390.000       0.000       0.000       0.000
CI   10985.000    1106.000       .030       3.000       3.000     490.000       .010       0.000       0.000       0.000
X5       1.000    1106.400       0.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000
GR    1130.000    9870.000    1110.000    9890.000    1100.000    9910.000    1093.000    9915.000    1098.400   10020.000
GR    1100.000   10115.000    1102.000   10145.000    1104.000   10160.000    1104.000   10210.000    1102.000   10590.000
GR    1104.000   10725.000    1105.000   10740.000    1106.000   11130.000    1104.000   11370.000    1102.000   11455.000
GR    1102.000   11510.000    1104.000   11530.000    1102.000   11620.000    1104.000   11630.000    1106.000   11640.000
GR    1106.000   11700.000    1105.000   11850.000    1106.000   12150.000    1108.000   12450.000    1108.000   12700.000
GR    1105.000   12970.000    1109.000   13910.000    1110.000   14370.000       0.000       0.000       0.000       0.000
NH       5.000       .035    9790.000       .030   10635.000       .035   11365.000       .030   11800.000       .038
NH   15500.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000       0.000
ET       0.000       0.000       7.100       7.100       7.100       7.100    9670.000   10925.000       0.000       0.000
```

CACTUS ROAD EXTENSION UPSTREAM OF SECTION 16.10

X1	16.100	28.000	9790.000	10035.000	1100.000	1000.000	1080.000	0.000	0.000	0.000
CI	0.000	0.000	0.000	0.000	0.000	.010	0.000	0.000	0.000	0.000
XS	1.000	1110.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1120.000	9670.000	1110.000	9685.000	1102.000	9705.000	1102.000	9790.000	1100.000	9855.000
GR	1100.000	9935.000	1099.200	9970.000	1100.000	10000.000	1102.000	10035.000	1104.000	10045.000
GR	1106.000	10035.000	1106.000	10635.000	1103.000	10650.000	1109.500	11000.000	1108.000	11350.000
GR	1106.000	11355.000	1104.000	11365.000	1104.000	11420.000	1106.000	11475.000	1106.000	11580.000
GR	1104.000	11730.000	1106.000	11800.000	1108.000	12060.000	1110.000	12530.000	1110.500	12910.000
GR	1110.000	13130.000	1111.000	14400.000	1115.000	15500.000	0.000	0.000	0.000	0.000
NH	5.000	.038	9915.000	.030	10885.000	.035	11700.000	.030	12030.000	.038
NH	15500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9340.000	10840.000	0.000	0.000
X1	16.200	27.000	9915.000	10190.000	470.000	500.000	540.000	0.000	0.000	0.000
CI	10470.000	1107.500	.030	3.000	3.000	700.000	0.000	0.000	0.000	0.000
XS	1.000	1112.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1133.000	9840.000	1130.000	9870.000	1110.000	9900.000	1102.000	9915.000	1102.000	10120.000
GR	1104.000	10190.000	1106.000	10200.000	1103.000	10280.000	1108.000	10310.000	1110.000	10340.000
GR	1110.000	10500.000	1108.000	10530.000	1108.000	10885.000	1110.000	10890.000	1110.000	10900.000
GR	1110.000	10910.000	1110.000	10970.000	1112.000	11140.000	1110.000	11610.000	1104.000	11700.000
GR	1108.000	11760.000	1104.000	11820.000	1110.000	11880.000	1110.000	12030.000	1111.000	13330.000
GR	1112.000	14330.000	1115.000	15500.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	5.000	.035	9860.000	.030	11060.000	.035	11490.000	.030	11860.000	.038
NH	16100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9730.000	10690.000	0.000	0.000
X1	16.400	30.000	9860.000	10025.000	1030.000	1030.000	995.000	0.000	0.000	0.000
CI	10350.000	1108.000	.030	3.000	3.000	600.000	0.000	0.000	0.000	0.000
XS	1.000	1114.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1133.000	9730.000	1136.000	9770.000	1134.000	9800.000	1130.000	9815.000	1110.000	9850.000
GR	1102.000	9860.000	1101.200	9910.000	1102.000	9950.000	1104.000	10025.000	1106.000	10040.000
GR	1108.000	10050.000	1110.000	10060.000	1110.000	10375.000	1112.000	10440.000	1112.000	10470.000
GR	1114.000	10565.000	1114.000	10600.000	1112.000	10820.000	1110.000	10860.000	1110.000	11060.000
GR	1113.000	11150.000	1110.000	11490.000	1104.000	11570.000	1110.000	11860.000	1112.000	12000.000
GR	1112.000	13540.000	1113.000	14600.000	1115.000	15200.000	1120.000	15300.000	1124.000	16100.000
NH	3.000	.035	9910.000	.030	10870.000	.038	15800.000	0.000	0.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9675.000	10550.000	0.000	0.000
X1	16.590	31.000	9910.000	10130.000	930.000	870.000	960.000	0.000	0.000	0.000
CI	10155.000	1108.000	.030	3.000	3.000	700.000	0.000	0.000	0.000	0.000
XS	1.000	1115.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1133.000	9675.000	1130.000	9690.000	1120.000	9700.000	1110.000	9710.000	1108.000	9715.000
GR	1108.000	9775.000	1110.000	9785.000	1110.000	9890.000	1108.000	9910.000	1106.000	9930.000
GR	1104.000	10010.000	1103.500	10020.000	1104.000	10045.000	1106.000	10100.000	1108.000	10130.000
GR	1110.000	10150.000	1112.000	10155.000	1112.000	10280.000	1114.000	10390.000	1114.000	10495.000
GR	1112.500	10630.000	1114.000	10870.000	1107.000	11030.000	1110.000	11190.000	1115.000	11480.000
GR	1111.000	12030.000	1111.000	12660.000	1115.000	13070.000	1115.000	14250.000	1120.000	15330.000

GR	1125.000	15800.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	3.000	.032	9530.000	.030	10015.000	.037	15600.000	0.000	0.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9110.000	10100.000	0.000	0.000
X1	16.710	30.000	9530.000	9970.000	870.000	930.000	1050.000	0.000	0.000	0.000
CI	9600.000	1109.500	.030	3.000	3.000	660.000	0.000	0.000	0.000	0.000
X5	1.000	1117.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1140.000	9110.000	1130.000	9125.000	1120.000	9150.000	1113.000	9200.000	1113.000	9370.000
GR	1114.000	9330.000	1112.000	9400.000	1112.000	9415.000	1114.000	9440.000	1114.000	9500.000
GR	1112.000	9530.000	1110.000	9905.000	1106.600	9950.000	1103.000	9970.000	1110.000	9975.000
GR	1120.000	10000.000	1122.000	10015.000	1120.000	10240.000	1130.000	10280.000	1130.000	10330.000
GR	1120.000	10365.000	1116.000	10380.000	1116.000	10420.000	1114.000	11000.000	1117.000	11200.000
GR	1115.000	11430.000	1120.000	13900.000	1127.000	14800.000	1125.000	14900.000	1130.000	15600.000
NC	.032	.037	.030	.100	.300	0.000	0.000	0.000	0.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9230.000	10130.000	0.000	0.000
X1	16.900	28.000	9690.000	10055.000	700.000	820.000	750.000	0.000	0.000	0.000
CI	0.000	0.000	0.000	0.000	0.000	.010	0.000	0.000	0.000	0.000
X5	1.000	1119.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1130.000	9230.000	1120.000	9300.000	1120.000	9370.000	1120.000	9550.000	1116.000	9565.000
GR	1114.000	9690.000	1112.000	9795.000	1110.000	9945.000	1109.500	10015.000	1110.000	10055.000
GR	1120.000	10085.000	1130.000	10110.000	1123.000	10180.000	1126.000	10300.000	1124.000	10345.000
GR	1122.000	10440.000	1120.000	10500.000	1119.500	10610.000	1120.000	10630.000	1116.000	10650.000
GR	1115.000	11170.000	1119.000	11420.000	1116.000	11750.000	1113.000	12600.000	1120.000	13260.000
GR	1125.000	14300.000	1130.000	15530.000	1135.000	15350.000	0.000	0.000	0.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9450.000	10170.000	0.000	0.000
X1	17.000	20.000	9805.000	10095.000	520.000	520.000	520.000	0.000	0.000	0.000
CI	0.000	0.000	0.000	0.000	0.000	.010	0.000	0.000	0.000	0.000
X5	1.000	1123.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1140.000	9450.000	1130.000	9480.000	1124.000	9495.000	1122.000	9675.000	1120.000	9680.000
GR	1113.000	9635.000	1116.000	9700.000	1114.000	9805.000	1112.000	9390.000	1110.000	9975.000
GR	1109.800	10010.000	1110.000	10020.000	1110.000	10095.000	1120.000	10130.000	1130.000	10165.000
GR	1132.000	10170.000	1132.000	10280.000	1130.000	10285.000	1120.000	10315.000	1121.000	10730.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9360.000	10280.000	0.000	0.000
X1	17.030	30.000	9795.000	10150.000	130.000	250.000	150.000	0.000	0.000	0.000
X5	1.000	1124.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1138.000	9360.000	1136.000	9410.000	1134.000	9440.000	1132.000	9480.000	1130.000	9505.000
GR	1128.000	9520.000	1126.000	9540.000	1124.000	9595.000	1122.000	9660.000	1122.000	9715.000
GR	1120.000	9730.000	1113.000	9735.000	1116.000	9755.000	1114.000	9795.000	1112.000	9890.000
GR	1110.200	10015.000	1112.000	10150.000	1113.000	10215.000	1120.000	10220.000	1130.000	10260.000
GR	1134.000	10275.000	1134.000	10300.000	1130.000	10315.000	1124.000	10335.000	1124.000	10380.000
GR	1122.000	10390.000	1120.000	10470.000	1121.000	10670.000	1122.000	10740.000	1121.000	10790.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9450.000	10280.000	0.000	0.000

X1	17.050	17.000	9805.000	10160.000	70.000	100.000	100.000	0.000	0.000	0.000
X5	1.000	1126.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1140.000	9450.000	1138.000	9500.000	1130.000	9600.000	1124.000	9740.000	1116.000	9765.000
GR	1114.000	9805.000	1112.000	9840.000	1110.300	9995.000	1112.000	10085.000	1114.000	10130.000
GR	1114.000	10160.000	1116.000	10215.000	1122.000	10280.000	1122.000	10620.000	1124.000	10665.000
GR	1124.000	10750.000	1122.000	10800.000	0.000	0.000	0.000	0.000	0.000	0.000

GRAND AVENUE BRIDGE

X1	17.060	4.000	9774.000	10226.000	50.000	50.000	50.000	0.000	0.000	0.000
X5	1.000	1125.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1134.500	9774.000	1112.000	9863.000	1112.000	10133.000	1124.500	10226.000	0.000	0.000
SB	.900	1.300	2.800	0.000	363.000	20.000	6083.000	2.800	1112.000	1112.000

X1	17.070	0.000	0.000	0.000	40.000	40.000	40.000	0.000	0.000	0.000
X2	0.000	0.000	1.000	1127.700	1130.500	0.000	0.000	0.000	0.000	0.000
X5	1.000	1125.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

A.T. AND S.F. RAILROAD BRIDGE

X1	17.090	4.000	9774.000	10227.000	85.000	85.000	85.000	0.000	0.000	0.000
X5	1.000	1126.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1134.500	9774.000	1112.000	9868.000	1112.000	10133.000	1134.500	10227.000	0.000	0.000
SB	.900	7.780	2.800	0.000	235.000	27.000	7127.000	4.400	1112.000	1112.000

X1	17.100	0.000	0.000	0.000	20.000	20.000	20.000	0.000	0.000	0.000
X2	0.000	0.000	1.000	1134.500	1136.000	0.000	0.000	0.000	0.000	0.000
X5	1.000	1127.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	4.000	.038	9750.000	- .032	10350.000	.036	10600.000	.040	12621.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9700.000	10475.000	0.000	0.000

X1	17.150	11.000	10000.000	10060.000	300.000	240.000	300.000	0.000	0.000	0.000
X5	1.000	1128.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1145.000	9700.000	1116.000	9750.000	1116.000	10000.000	1120.000	10060.000	1124.000	10350.000
GR	1124.500	10600.000	1120.000	11500.000	1120.000	12300.000	1125.000	12600.000	1131.000	12620.000
GR	1150.000	12621.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	4.000	.038	9750.000	.032	10100.000	.035	10750.000	.040	13101.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9700.000	10800.000	0.000	0.000

X1	17.200	12.000	10000.000	10060.000	260.000	260.000	260.000	0.000	0.000	0.000
X5	1.000	1128.800	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1150.000	9700.000	1116.200	9750.000	1116.200	10000.000	1120.000	10060.000	1125.000	10100.000
GR	1125.000	10500.000	1125.000	10750.000	1120.000	11900.000	1120.000	12900.000	1125.000	13050.000
GR	1130.000	13100.000	1150.000	13101.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	4.000	.038	9770.000	.032	10110.000	.035	10300.000	.040	13676.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9720.000	11370.000	0.000	0.000

X1	17.300	14.000	10000.000	10110.000	540.000	430.000	530.000	0.000	0.000	0.000
X5	1.000	1129.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1150.000	9720.000	1116.700	9770.000	1116.700	10000.000	1120.000	10110.000	1125.000	10170.000
GR	1125.000	10900.000	1125.000	10900.000	1124.500	11100.000	1125.000	11300.000	1126.000	11800.000
GR	1125.000	12300.000	1125.000	13650.000	1132.500	13675.000	1150.000	13676.000	0.000	0.000
NH	4.000	.038	9880.000	.032	10100.000	.036	11100.000	.040	14501.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9830.000	11990.000	0.000	0.000

X1	17.400	14.000	10000.000	10050.000	540.000	490.000	530.000	0.000	0.000	0.000
X5	1.000	1129.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1150.000	9830.000	1118.300	9380.000	1118.300	10000.000	1120.000	10050.000	1125.000	10100.000
GR	1125.000	10400.000	1127.500	11100.000	1129.000	12400.000	1130.000	13100.000	1132.500	14200.000
GR	1130.000	14450.000	1130.000	14500.000	1135.000	14500.000	1150.000	14501.000	0.000	0.000
NC	.055	.045	.055	.100	.300	0.000	0.000	0.000	0.000	0.000
ET	0.000	9.100	0.000	0.000	0.000	0.000	0.000	0.000	9700.000	12150.000

X1	17.600	14.000	9950.000	10050.000	1050.000	750.000	1050.000	0.000	0.000	0.000
X5	1.000	1132.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1160.000	9900.000	1117.400	9950.000	1117.400	10000.000	1120.000	10050.000	1125.000	10080.000
GR	1125.000	10750.000	1125.000	11449.000	1130.000	11450.000	1130.000	11650.000	1131.000	12700.000
GR	1135.000	14500.000	1136.000	14900.000	1135.000	15350.000	1137.500	15380.000	0.000	0.000
ET	0.000	9.100	0.000	0.000	0.000	0.000	0.000	0.000	9025.000	10250.000

X1	17.900	10.000	10000.000	10080.000	1140.000	950.000	1140.000	0.000	0.000	0.000
X5	1.000	1133.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1140.000	8830.000	1125.000	8900.000	1125.000	9860.000	1121.000	9920.000	1120.000	10000.000
GR	1121.000	10080.000	1131.000	10160.000	1134.000	10430.000	1135.000	12480.000	1139.000	14300.000
NC	.045	.045	.045	.100	.300	0.000	0.000	0.000	0.000	0.000
ET	0.000	9.100	0.000	0.000	0.000	0.000	0.000	0.000	9150.000	10400.000

X1	18.140	15.000	9360.000	10400.000	1170.000	1250.000	1140.000	0.000	0.000	0.000
X5	1.000	1135.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1145.000	8500.000	1132.000	8720.000	1132.000	9090.000	1135.000	9400.000	1135.000	9640.000
GR	1130.000	9860.000	1130.000	9940.000	1125.000	10000.000	1130.000	10200.000	1129.000	10290.000
GR	1130.000	10370.000	1135.000	10400.000	1138.000	11300.000	1140.000	11900.000	1141.000	12770.000
ET	0.000	9.100	0.000	0.000	0.000	0.000	0.000	0.000	9300.000	10650.000

X1	18.200	13.000	10000.000	10400.000	350.000	400.000	360.000	0.000	0.000	0.000
X5	1.000	1137.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1145.000	8540.000	1140.000	8640.000	1135.000	8700.000	1132.000	9320.000	1135.000	9620.000
GR	1135.000	9800.000	1127.000	10000.000	1130.000	10100.000	1130.000	10400.000	1130.000	10610.000
GR	1135.000	10660.000	1140.000	11480.000	1141.000	12640.000	0.000	0.000	0.000	0.000
EJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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 HEC2 RELEASE DATED NOV 75 UPDATED APRI 1980
 ERROR CORR -  01,02,03,04
 MODIFICATION -  50,51,52,53,54
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T1      EL MIRAGE LANDFILL                  BY PRC TOUPS,PHOENIX,AZ. PH. 954-9191
T2      PROFILE 2 54,000CFS WITH PROPOSED LEVEE AND CHANNELIZATION
T3      AGUA FRIA RIVER  NEAR GRAND AVENUE   DECEMBER,1980  JOB NO.1831-602

J1  ICHECK    INQ      NINV     ICIR     STRT     METRIC   HVINS    Q        WSEL     FQ
     -10.      3.       0.       0.  0.000000    0.00     0.0      0.  1094.700   0.000
J2  NPROF    IPLOT    PREVS    XSECV    XSECH     FN     ALLDC    IBW     CHNIM    ITRACE
    15.000   0.000   -1.000    0.000    0.000   0.000   0.000   6.000   0.000    15.000
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     SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        CLOSS     BANK ELEV
     Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
     TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
     SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*PROF 2

CCHV=     .100 CEHV=     .300
*SECNO 15.000
        CROSS SECTION NUMBERS IN RIVER MILES INCREASING UPSTREAM FROM THE

        CONFLUENCE OF THE AGUA FRIA WITH THE GILA RIVER.

        CROSS SECTION STATIONING FROM LEFT TO RIGHT LOOKING DOWNSRREAM WITH

        STATION 10000 AT THE HATCH MARK.

        WATER SURFACE ELEVATIONS INSERTED FROM THE EL MIRAGE FIS USING "X5"

        CARDS FOR PROFILE 1

        PEORIA AVENUE UPSTREAM OF SECTION 15.00

     15.00      3.70  1094.70      0.00  1094.70  1094.35       .15      0.00      0.00  1090.00
    54000.    14141.     5200.    34659.     6434.     1240.    10855.        0.        0.  1037.00
      0.00      2.20      4.19      3.19      .045      .035      .045     0.000   1086.00  7824.60
   .000356        0.        0.        0.         0         0         0      0.00   4188.80 12013.40

FLOW DISTRIBUTION FOR SECNO=     15.00          CWSEL=    1094.70

STA=     7825.     8580.     8970.     9240.     9550.     9800.    10000.    10280.    11170.    11440.    12013.
  PER Q=      6.4       5.7       5.3       4.9       4.0       9.6      10.5      37.9      11.5       4.3
   AREA=   2010.2    1218.0    1134.0    1147.0     925.0    1240.0    1736.0    5963.0    1809.0    1347.5
    VEL=      1.7       2.5       2.5       2.3       2.3       4.2       3.3       3.4       3.4       1.7

1490 NH CARD USED
*SECNO 15.280

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=    9500.0   11300.0  TYPE=     1  TARGET=    1800.000
     15.23      6.48  1096.48  1095.48  1097.60  1093.10      1.62      2.80       .44  1095.00
    54000.     1329.     4010.    48660.      373.      438.     4666.      397.       98.  1090.00
       .04      3.57      9.16     10.43      .035      .035      .030      .035   1090.00  9500.00
   .007383     1300.     1430.     1500.         4        19         0      0.00   1800.00 11300.00
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      CCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

FLOW DISTRIBUTION FOR SECNO=     15.28          CWSEL=   1096.48

STA=     9500.     9520.     9890.    10000.    11130.    11300.
  PER Q=      .0       2.4       7.4      89.1       1.0
   AREA=    10.1     362.7     437.8    4497.7     168.6
    VEL=     2.3       3.6       9.2      10.7       3.3

1490 NH CARD USED
*SECNO 15.440

3301 HV CHANGED MORE THAN HVINS


3470 ENCROACHMENT STATIONS=    9600.0   11450.0  TYPE=     1  TARGET=    1850.000
     15.44      9.05   1101.05      0.00   1101.10   1102.00       .95      3.83       .07   1095.00
    54000.    10371.     8727.    34402.     1542.      831.     4772.      520.      133.   1092.00
       .07      7.05     10.50      7.21      .035      .030      .032      .035   1092.00   9600.00
   .003035      920.      870.      850.         3         0         0      0.00   1850.00  11450.00


FLOW DISTRIBUTION FOR SECNO=     15.44          CWSEL=   1101.05

STA=     9600.     9890.    10000.    10270.    10400.    10550.    10800.    11450.
  PER Q=     20.1      16.2      35.4      13.2       6.2        .4       8.6
   AREA=   1541.6     830.9    1904.4     786.9     603.0     138.3    1334.6
    VEL=      7.1      10.5      10.0       9.1       5.5       1.5       3.5

1490 NH CARD USED
*SECNO 15.640

3265 DIVIDED FLOW


3470 ENCROACHMENT STATIONS=    9290.0   11270.0  TYPE=     1  TARGET=    1980.000
        BEGIN PROPOSED EL MIRAGE LANDFILL LEVEE ENCROACHMENTS

     15.64      9.76   1103.66      0.00   1103.40   1104.41       .75      2.39       .02   1093.00
    54000.    15415.    16474.    22111.     2688.     1910.     3541.      693.      171.   1100.00
       .11      5.73      8.62      6.24      .035      .030      .030      .036   1093.90   9435.83
   .001965     1010.     1040.      960.         3         0         0      0.00   1553.90  11270.00.
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SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS    BANK ELEV
Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA      LEFT/RIGHT
TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN    SSTA
SLOPE    XLOBL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID   ENDST

FLOW DISTRIBUTION FOR SECNO=     15.64          CWSEL=   1103.66

STA=    9436.    9510.    9550.    9630.    9700.    9820.    9970.   10215.   10270.   10445.   10560.   10655.   10740.
  PER Q=     4.2      4.2      6.6      3.2      3.7      6.8     30.5      3.1      9.3      4.1      5.0      6.2
   AREA=   380.3    306.8    533.5    326.8    440.3    700.3   1910.1    261.8    817.0    421.9    443.5    481.9
    VEL=     5.9      7.3      6.7      5.3      4.5      5.3      8.6      6.3      6.1      5.2      6.1      7.0
STA=   10740.   10310.   10875.   10930.   11270.
  PER Q=     3.7      4.4      4.0      1.2
   AREA=   326.3    348.5    311.8    127.6
    VEL=     6.1      6.7      7.0      4.9

1490 NH CARD USED
*SECNO 15.900
CHIMP CLSTA=  10985.00 CELCH=   1106.00 BW=    490.00 STCHL=  10739.98 STCHR=  11240.00

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=    9880.0   11240.0  TYPE=     1  TARGET=    1360.000
    15.90     9.20  1107.20  1107.20  1106.96  1109.21     2.01     3.77      .38  1106.01
   54000.   51212.     2738.       0.     4404.      651.       0.      382.     213.  1109.33
      .14    11.63     4.23     0.00     .030     .030     .030     .035  1098.00  9895.60
  .005296    1210.    1390.    1210.        2       11        0     0.00  1344.40 11240.00

FLOW DISTRIBUTION FOR SECNO=     15.90          CWSEL=   1107.20

STA=    9896.   10020.   10115.   10145.   10210.   10590.   10725.   10740.   11240.
  PER Q=    29.0     20.3      4.2      3.4     27.8      9.9       .3      5.2
   AREA=  1033.0    760.2    186.0    223.1   1396.6    567.2     32.9    650.7
    VEL=    15.1     14.4     12.2      8.3      9.4      9.4      5.2      4.3

1490 NH CARD USED
*SECNO 16.100

3301 HV CHANGED MORE THAN HVINS


3470 ENCROACHMENT STATIONS=    9670.0   10925.0  TYPE=     1  TARGET=    1255.000
        CACTUS ROAD EXTENSION UPSTREAM OF SECTION 16.10
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      SNOST

    16.10     11.99  1111.19      0.00  1110.30  1112.19      1.00      2.38       .10  1102.00
   54000.     6350.   26060.    21590.     886.    2663.     3933.     1035.      245.   1102.00
      .18      7.17      9.77      5.49      .035      .030      .031      .034  1099.20  9683.21
  .001612     1100.     1030.     1000.         3         0         0      0.00  1241.79 10925.00

 FLOW DISTRIBUTION FOR SECNO=     16.10          CWSEL=   1111.19

 STA=     9633.    9790.   10035.   10635.   10925.
   PER Q=     11.3     48.3     35.2      4.8
    AREA=    886.1   2667.9   3154.8    778.4
     VEL=      7.2      9.8      6.0      3.3

 1490 NH CARD USED
 *SECNO 16.200
 CHIMP CLSTA=  10470.00 CELCH=   1107.50 BW=    700.00 STCHL=     -1.00 STCHR=  10821.50

 3470 ENCROACHMENT STATIONS=    9340.0   10340.0  TYPE=     1  TARGET=    1000.000
    16.20     10.10  1112.10      0.00  1112.30  1113.42      1.32      1.14      .10100000.00
   54000.        0.   53533.      467.       0.    5783.       76.     1115.      258.   1108.00
      .20      0.00      9.25      6.14      .035      .030      .030      .034  1102.00  9896.33
  .003046      470.      540.      500.         2         0         0      0.00   943.17 10340.00

 FLOW DISTRIBUTION FOR SECNO=     16.20          CWSEL=   1112.10

 STA=     9897.   10322.   10340.
   PER Q=     99.1       .9
    AREA=   5783.1     76.1
     VEL=      9.2      6.1

 1490 NH CARD USED
 *SECNO 16.400
 CHIMP CLSTA=  10350.00 CELCH=   1108.00 BW=    600.00 STCHL=  10049.98 STCHR=  10666.19

 3470 ENCROACHMENT STATIONS=    9730.0   10690.0  TYPE=     1  TARGET=     960.000
    16.40     13.27  1114.47      0.00  1114.20  1115.75      1.23      2.32       .00  1103.01
   54000.    25216.   23720.       64.    2338.    3946.       28.     1255.      278.   1113.40
      .23     10.78      7.23      2.28      .030      .030      .030      .033  1101.20  9842.17
  .001819     1030.      995.     1030.         0         0         0      0.00   847.83 10690.00
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     SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
     Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
     TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
     SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

  FLOW DISTRIBUTION FOR SECNO=     16.40          CWSEL=   1114.47

  STA=     9842.     9910.     9950.    10025.    10050.    10366.    10690.
    PER Q=      14.9      11.1      17.1       3.6      53.2        .1
     AREA=     746.0     515.0     860.6     216.7    3945.7      28.2
      VEL=      10.8      11.6      10.7       8.9       7.3       2.3

  1490 NH CARD USED
  *SECNO 16.590
  CHIMP CLSTA=  10155.00 CELCH=   1108.00 BW=    700.00 STCHL=   9799.00 STCHR=  10522.10

  3470 ENCROACHMENT STATIONS=    9675.0   10550.0  TYPE=      1  TARGET=     875.000
      16.59     12.85  1116.35      0.00  1115.70  1117.20       .85      1.40       .04  1110.00
     54000.     4156.    49592.      252.      720.    6586.       78.     1405.      297.  1113.70
        .26      5.78      7.53      3.22      .035     .030      .030      .033  1103.50  9703.65
    .001219      930.      960.      870.         2        0         0      0.00   846.35 10550.00

  FLOW DISTRIBUTION FOR SECNO=     16.59          CWSEL=   1116.35

  STA=     9704.     9775.     9799.    10522.    10550.
    PER Q=       6.1       1.6      91.3        .5
     AREA=     557.2     162.3    6586.0      78.3
      VEL=       5.9       5.3       7.5       3.2

  1490 NH CARD USED
  *SECNO 15.710
  CHIMP CLSTA=   9600.00 CELCH=   1109.50 BW=    660.00 STCHL=   9244.50 STCHR=  10100.00

  3470 ENCROACHMENT STATIONS=    9110.0   10100.0  TYPE=      1  TARGET=     990.000
      16.71     11.08  1117.68      0.00  1117.37  1118.92      1.24      1.60       .12  1118.00
     54000.        0.    54000.        0.        0.    6043.        0.     1565.      316.  1166.17
        .30      0.00      8.94      0.00      .035     .030      .030      .033  1106.60  9245.46
    .002002      870.     1050.      930.         2        0         0      0.00   748.74  9994.20

  FLOW DISTRIBUTION FOR SECNO=     16.71          CWSEL=   1117.68

  STA=     9245.    10100.
    PER Q=     100.0
     AREA=    6043.2
      VEL=       8.9
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

CCHV=    .100 CEHV=    .300
*SECNO 16.900

3301 HV CHANGED MORE THAN HVINS

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

3470 ENCROACHMENT STATIONS=    9230.0   10130.0  TYPE=      1  TARGET=      900.000
    16.90      9.88  1119.38  1119.38  1119.20  1122.98      3.60      2.44       .71  1114.00
    54000.     5477.   47391.   1131.     569.     2985.     132.     1649.      327.   1110.00
       .31      9.63    15.87     8.58     .032      .030     .037      .032  1109.50   9552.33
   .006232     700.     750.     320.       20         9        0      0.00   530.80  10083.13

FLOW DISTRIBUTION FOR SECNO=     16.90          CWSEL=   1119.38

STA=    9552.    9565.    9690.   10055.   10033.
  PER Q=        .2       9.9      87.8       2.1
   AREA=      21.4     547.2   2985.4     131.9
    VEL=       5.1       9.8      15.9       8.6

*SECNO 17.000
3230 CROSS SECTION     17.00 EXTENDED      1.80 FEET

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    9450.0   10170.0  TYPE=      1  TARGET=      720.000
    17.00     13.00  1122.80     0.00  1123.00  1125.09      2.29      1.98       .13  1114.00
    54000.    8393.   43448.   2159.     964.     3378.     237.     1693.      333.   1110.00
       .32      8.71    12.36     7.53     .032      .030     .037      .032  1109.80   9602.66
   .002555     520.     520.     520.        2         0        0      0.00   537.16  10139.81

FLOW DISTRIBUTION FOR SECNO=     17.00          CWSEL=   1122.80

STA=    9603.    9675.    9680.    9685.    9700.    9805.   10095.   10130.   10140.
  PER Q=        .1       .1       .2      1.2     14.0     30.5      3.9       .1
   AREA=      29.1      9.0     19.0     37.1    819.4   3377.6    273.1     13.8
    VEL=       1.3      3.3      5.4      7.5      9.2     12.9      7.8      2.5
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SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       LEFT/RIGHT
TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*SECNO 17.030
3280 CROSS SECTION      17.03 EXTENDED      2.98 FEET

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    9360.0   10280.0  TYPE=     1  TARGET=     920.000
    17.03     13.77  1123.97      0.00  1124.70  1125.47      1.49       .30       .08  1114.00
   54000.     4448.    45425.     4127.     740.     4391.     640.     1717.      335.  1112.00
      .33      6.01     10.35      6.45      .032      .030      .037      .032  1110.20  9595.74
  .001525     130.     150.      250.        2         0         0      0.00   640.17 10235.91

FLOW DISTRIBUTION FOR SECNO=     17.03          CWSEL=   1123.97

STA=    9526.    9660.    9715.    9730.    9735.    9755.    9795.   10150.   10215.   10220.   10236.
  PER Q=      .2       .6       .3       .2      1.7      5.2     84.1      7.3       .2       .1
   AREA=    63.5    108.7     44.7     24.9    139.5    359.1   4390.9    583.5     24.9     31.6
    VEL=     1.8      2.9      3.7      5.0      6.6      7.8     10.3      6.8      4.4      2.4

*SECNO 17.050
3230 CROSS SECTION      17.05 EXTENDED      2.09 FEET

3470 ENCROACHMENT STATIONS=    9450.0   10280.0  TYPE=     1  TARGET=     330.000
    17.05     13.79  1124.09      0.00  1126.00  1125.63      1.54       .15       .01  1114.00
   54000.     3384.    45622.     4994.     466.     4361.     831.     1730.      336.  1114.00
      .33      7.26     10.46      6.01      .032      .030      .037      .032  1110.30  9737.34
  .001574      70.      100.      100.        2         0         0      0.00   542.15 10280.00

FLOW DISTRIBUTION FOR SECNO=     17.05          CWSEL=   1124.09

STA=    9738.    9765.    9805.   10160.   10215.   10280.
  PER Q=      .9       5.4     84.5      6.4      2.3
   AREA=   102.3     363.7   4361.0    500.1    331.0
    VEL=     4.6       8.0     10.5      6.9      4.6

*SECNO 17.060

3301 HV CHANGED MORE THAN HVINS
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      CCH       QROB      ALOB      ACH       AROB      VCL       TWA       LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

        GRAND AVENUE BRIDGE

    17.06     10.74   1122.74      0.00   1125.30   1126.40      3.65       .13       .63   1134.50
   54000.        0.   54000.        0.        0.    3522.        0.     1735.      337.   1124.50
      .33      0.00     15.33      0.00      .032      .030      .037      .032   1112.00   9823.07
  .005129       50.       50.       50.         3         0         0      0.00    389.94  10213.01

FLOW DISTRIBUTION FOR SECNO=     17.06          CWSEL=   1122.74

STA=    9823.   10226.
  PER Q=    100.0
   AREA=   3521.6
    VEL=     15.3


SPECIAL BRIDGE

SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
      .90      1.30      2.80      0.00    363.00     20.00   6083.00      2.80   1112.00   1112.00

*SECNO 17.070

3301 HV CHANGED MORE THAN HVINS

CLASS A LOW FLOW

3420 BRIDGE W.S.=   1121.95 BRIDGE VELOCITY=,     14.64      CALCULATED CHANNEL AREA=,     3689.

 EGPRS     EGLWC     H3        QWEIR     QPR       BAREA     TRAPEZOID     ELLC      ELTPD
                                                             AREA
     0.00   1126.80      1.24        0.   54000.     6083.     6075.     1127.70   1130.60


    17.07     11.98   1123.98      0.00   1125.60   1126.30      2.82       .40      0.00   1134.50
   54000.        0.   54000.        0.        0.    4010.        0.     1738.      337.   1124.50
      .33      0.00     13.47      0.00      .032      .030      .037      .032   1112.00   9817.94
  .003493       40.       40.       40.         0         0         0      0.00    404.22  10222.15


FLOW DISTRIBUTION FOR SECNO=     17.07          CWSEL=   1123.98

STA=    9818.   10226.
  PER Q=    100.0
   AREA=   4009.7
    VEL=     13.5
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      CCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*SECNO 17.090
        A.T. AND S.F. RAILROAD BRIDGE

    17.09     12.07  1124.07      0.00  1126.50  1127.19      3.12       .30       .09  1134.50
   54000.        0.   54000.        0.        0.    3309.       0.     1746.      338.   1134.50
      .33      0.00     14.18      0.00      .032      .030      .037      .032  1112.00   9817.55
  .003640       85.       85.       85.         2         0         0      0.00   365.90  10183.45

FLOW DISTRIBUTION FOR SECNO=     17.09          CWSEL=   1124.07

STA=     9818.    10227.
  PER Q=     100.0
   AREA=    3309.4
    VEL=      14.2

SPECIAL BRIDGE

5227 DOWNSTREAM ELEV IS   1120.83 ,NOT   1124.07 HYDRAULIC JUMP OCCURS DOWNSTREAM (IF LOW FLOW CONTROLS)

SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
      .90      7.78      2.80      0.00    235.00     27.00   7127.00      4.40   1112.00   1112.00

*SECNO 17.100

3301 HV CHANGED MORE THAN HVINS

CLASS B LOW FLOW

3420 BRIDGE W.S.=   1123.72 BRIDGE VELOCITY=,     17.75      CALCULATED CHANNEL AREA=,     3043.

 EGPRS     EGLWC     H3        QWEIR     QPR       BAREA     TRAPEZOID     ELLC      ELTRD
                                                                AREA
     0.00  1128.82      0.00        0.   54000.     7127.      6908.     1134.50   1136.00


    17.10     14.92  1126.92      0.00  1127.00  1128.82      1.90      1.63      0.00  1134.50
   54000.        0.   54000.        0.        0.    4384.       0.     1748.      338.   1134.50
      .33      0.00     11.06      0.00      .032      .030      .037      .032  1112.00   9305.66
  .001731       20.       20.       20.         0         0         0      0.00   339.68  10195.34


FLOW DISTRIBUTION FOR SECNO=     17.10          CWSEL=   1126.92

STA=     9806.    10227.
  PER Q=     100.0
   AREA=    4384.4
    VEL=      11.1
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

1490 NH CARD USED
*SECNO 17.150

3470 ENCROACHMENT STATIONS=    9700.0   10475.0  TYPE=     1  TARGET=     775.000
    17.15     11.91  1127.91      0.00  1128.70  1129.42      1.51       .56       .04  1116.00
    54000.   33953.     5874.   14173.     3101.     595.    2189.     1784.      342.  1120.00
      .34     10.95      9.87     6.47      .032     .032      .033      .032  1116.00  9729.46
  .002128      300.      300.     240.         2        0         0      0.00   745.54 10475.00

FLOW DISTRIBUTION FOR SECNO=     17.15          CWSEL=   1127.91

STA=     9729.     9750.    10000.    10060.    10350.    10475.
  PER Q=      1.2      61.7      10.9      22.3       4.0
   AREA=    122.4    2979.0     595.0    1715.6     473.9
    VEL=      5.4      11.2       9.9       7.0       4.5

1490 NH CARD USED
*SECNO 17.200

3470 ENCROACHMENT STATIONS=    9700.0   10300.0  TYPE=     1  TARGET=    1100.000
    17.20     12.25  1128.45      0.00  1128.80  1129.98      1.52       .55       .01  1116.20
    54000.   35362.     6293.   12343.     3174.     621.    2660.     1821.      347.  1120.00
      .35     11.14     10.13     4.64      .032     .032      .035      .032  1116.20  9731.38
  .002116      260.      260.     260.         2        0         0      0.00  1068.12 10800.00

FLOW DISTRIBUTION FOR SECNO=     17.20          CWSEL=   1128.45

STA=     9732.     9750.    10000.    10060.    10100.    10500.    10750.    10300.
  PER Q=      1.1      54.4      11.7       3.1      11.4       7.1       1.3
   AREA=    111.0    3062.7     621.0     238.0    1380.3     862.7     173.5
    VEL=      5.3      11.4      10.1       7.0       4.5       4.5       3.8

1490 NH CARD USED
*SECNO 17.300

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    9720.0   11370.0  TYPE=     1  TARGET=    1650.000
    17.30     13.47  1130.17      0.00  1129.00  1130.66       .50       .59       .10  1116.70
    54000.   22602.     3516.   22382.     3235.    1301.    6765.     1918.      361.  1120.00
      .37      6.99      6.55     3.38      .032     .032      .037      .032  1116.70  9749.77
  .000738      540.      530.     430.         2        0         0      0.00  1620.23 11370.00
```

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

FLOW DISTRIBUTION FOR SECNO=     17.30          CWSEL=   1130.17

STA=    9750.    9770.   10000.   10110.   10170.   10900.   11100.   11300.   11370.
  PER Q=      .8     41.0     15.8      3.8     24.1      6.3      6.3      1.9
   AREA=   136.3   3099.1   1300.7    460.5   3777.4   1084.9   1084.9    357.3
    VEL=     3.4      7.1      5.5      4.5      3.5      3.1      3.1      2.9

1490 NH CARD USED
*SECNO 17.400

3470 ENCROACHMENT STATIONS=    9330.0   11990.0  TYPE=     1  TARGET=    2160.000
    17.40    12.21  1130.51     0.00  1129.70  1131.32      .81      .56      .09  1113.30
   54000.   15897.    5656.    32446.    1534.     569.    7278.    2039.     333.   1120.00
      .40    10.03     9.95     4.46     .032     .032     .036     .032  1118.30  9860.72
  .001796     540.     530.     490.        2        0        0     0.00  2129.27 11990.00

FLOW DISTRIBUTION FOR SECNO=     17.40          CWSEL=   1130.51

STA=    9861.    9880.   10000.   10050.   10100.   10400.   11100.   11990.
  PER Q=      1.1     28.4     10.5      5.8     16.8     25.5     12.0
   AREA=   117.3   1466.5    563.5    401.0   1656.2   2989.5   2231.5
    VEL=     4.9     10.4      9.9      7.9      5.5      4.6      2.9

CCHV=    .100 CEHV=    .300
*SECNO 17.600

3301 HV CHANGED MORE THAN HVINS

    17.60    14.89  1132.29     0.00  1132.40  1132.52      .23     1.14      .06  1117.40
   54000.     366.    7409.    46224.     130.    1424.   12932.    2253.     431.   1120.00
      .46     2.32     5.20     3.56     .055     .055     .045     .034  1117.40  9932.53
  .001075    1050.    1050.     750.        2        0        0     0.00  3346.84 13279.37

FLOW DISTRIBUTION FOR SECNO=     17.60          CWSEL=   1132.29

STA=    9933.    9950.   10050.   10080.   10750.   11449.   11650.   12700.   13279.
  PER Q=      .7     13.7      2.7     36.8     38.4      1.6      5.5      .6
   AREA=   130.1   1423.7    293.6   4832.6   5094.0    462.3   1376.9    373.0
    VEL=     2.8      5.2      4.9      4.1      4.1      1.9      1.6       .8
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA     LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*SECNO 17.900
    17.90     13.53   1133.53      0.00   1133.60   1133.35       .32      1.31       .03   1120.00
   54000.    44733.     5945.     3322.    10032.     1042.      890.     2574.      487.   1121.00
      .52      4.46      5.70      3.73      .055      .055      .045      .036   1120.00   8360.20
  .001454     1140.     1140.      950.         2         0         0      0.00   1527.40  10387.60

FLOW DISTRIBUTION FOR SECNO=     17.90          CWSEL=   1133.53

STA=    3860.    8900.    9860.    9920.   10000.   10080.   10160.   10383.
  PER Q=       .3     65.2      5.8     11.0     11.0      5.4       .8
   AREA=    169.7   8187.8    631.7   1042.3   1042.3    602.3    287.8
    VEL=      2.7      4.3      4.9      5.7      5.7      4.8      1.5

CCHV=    .100 CEHV=    .300
*SECNO 13.140

3301 HV CHANGED MORE THAN HVINS

    13.14     11.00   1136.00      0.00   1135.70   1137.01      1.01      2.95       .20   1130.00
   54000.    18087.    35633.      230.     3397.     3393.      149.     2834.      535.   1135.00
      .56      5.32      9.15      1.54      .045      .045      .045      .037   1125.00   8552.36
  .005515     1170.     1140.     1250.         3         0         0      0.00   2046.75  10699.11

FLOW DISTRIBUTION FOR SECNO=     13.14          CWSEL=   1136.00

STA=    8652.    8720.    9090.    9400.    9640.    9960.   10400.   10699.
  PER Q=      1.0     16.9      5.5      1.1      3.0     66.1       .4
   AREA=    135.2   1478.9    774.1    239.3    769.3   3898.4    149.1
    VEL=      3.9      6.2      4.5      2.4      5.6      9.2      1.5

*SECNO 13.200

3301 HV CHANGED MORE THAN HVINS

    18.20     10.79   1137.79      0.00   1137.60   1133.16       .36      1.08       .06   1127.00
   54000.    23464.    19012.    11524.     5855.     3266.     2540.     2913.      554.   1130.00
      .58      4.01      5.82      4.54      .045      .045      .045      .037   1127.00   8566.51
  .001389      350.      360.      400.         2         0         0      0.00   2451.24  11117.75
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SECNO    DEPTH    CWSEL    CRIWS    WSELK    EG       HV       HL       OLOSS    BANK ELEV
Q        QLOB     QCH      QROB     ALOB     ACH      AROB     VOL      TWA      LEFT/RIGHT
TIME     VLOB     VCH      VROB     XNL      XNCH     XNR      WTN      ELMIN    SSTA
SLOPE    XLOSL    XLCH     XLOBR    ITRIAL   IDC      ICONT    CORAR    TOPWID   ENDST

FLOW DISTRIBUTION FOR SECNO=     18.20          CWSEL=   1137.79

STA=     3667.    8700.    9320.    9620.    9800.   10000.   10400.   10610.   10660.   11118.
  PER Q=     .2     18.7      9.0      2.6     12.9     35.2     17.1      2.1      2.1
   AREA=   46.7   2660.5   1287.3    502.4   1358.2   3266.5   1636.1    264.6    639.8
    VEL=    1.8      3.8      3.8      2.8      5.1      5.8      5.6      4.3      1.8
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*****************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED APRI 1980
  ERROR CORR -  01,02,03,04
  MODIFICATION -  50,51,52,53,54
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NOTE- ASTERISK (*) AT LEFT OF CROSS-SECTION NUMBER INDICATES MESSAGE IN SUMMARY OF CAUTIONS.

AGUA FRIA RIVER NEAR GRAND AVE.

SUMMARY PRINTOUT

	SECNO	Q	XLCH	CWSEL	DIFWSP	ELMIN	DEPTH	K*CHSL	QROB	QCH	VCH	SSTA	ENDST
*	15.000	54000.00	0.00	1093.70	0.00	1086.00	7.70	0.00	36593.14	5494.65	5.28	8006.60	11891.40
	15.000	54000.00	0.00	1094.70	1.00	1086.00	8.70	0.00	34658.36	5199.75	4.19	7824.60	12013.40
*	15.230	54000.00	1480.00	1097.60	0.00	1090.00	7.60	2.70	43570.32	3519.04	6.27	8326.31	11582.40
*	15.280	54000.00	1480.00	1096.48	-1.12	1090.00	6.48	2.70	48660.21	4010.47	9.16	9500.00	11300.00
*	15.440	54000.00	870.00	1101.10	0.00	1092.00	9.10	2.30	33156.90	6954.34	8.32	9289.06	12051.50
	15.440	54000.00	870.00	1101.05	-.05	1092.00	9.05	2.30	34402.15	8727.33	10.50	9600.00	11450.00
*	15.640	54000.00	1040.00	1103.40	0.00	1093.90	9.50	1.83	25725.66	14309.41	8.03	9436.50	12970.00
	15.640	54000.00	1040.00	1103.66	.26	1093.90	9.76	1.83	22110.80	16474.37	8.62	9435.33	11270.00
*	15.900	54000.00	1390.00	1106.40	0.00	1098.00	8.96	2.95	33356.53	20383.07	12.01	9896.07	13431.63
*	15.900	54000.00	1390.00	1107.20	.80	1098.00	9.20	2.95	0.00	2788.13	4.28	9895.60	11240.00
*	16.100	54000.00	1080.00	1110.30	0.00	1099.20	11.10	1.11	29923.43	19503.39	7.96	9684.55	13511.00
	16.100	54000.00	1080.00	1111.19	.89	1099.20	11.99	1.11	21589.89	26060.04	9.77	9683.21	10925.00
*	16.200	54000.00	540.00	1112.30	0.00	1102.00	10.30	5.19	30369.57	23202.57	8.40	9896.55	14447.00
	16.200	54000.00	540.00	1112.10	-.20	1102.00	10.10	5.19	466.95	53533.05	9.25	9896.33	10840.00
*	16.400	54000.00	995.00	1114.20	0.00	1101.20	13.00	-.30	38378.37	14746.75	7.47	9342.65	14960.00
	16.400	54000.00	995.00	1114.47	.27	1101.20	13.27	-.30	64.34	28720.09	7.28	9342.17	10690.00
*	16.590	54000.00	960.00	1115.70	0.00	1103.50	12.20	2.40	32305.03	15995.90	6.96	9704.30	14401.20
	16.590	54000.00	960.00	1116.35	.65	1103.50	12.35	2.40	251.78	49592.36	7.53	9703.65	10550.00
*	16.710	54000.00	1050.00	1117.40	0.00	1106.60	10.77	2.95	14233.14	34920.93	11.65	9371.58	12600.75
	16.710	54000.00	1050.00	1117.68	.28	1106.60	11.08	2.95	0.00	54000.00	8.94	9245.46	9994.20
*	16.900	54000.00	750.00	1119.20	0.00	1109.50	9.70	3.37	20302.45	29361.45	10.22	9553.00	12996.00
* -	16.900	54000.00	750.00	1119.38	.18	1109.50	9.88	3.37	1131.33	47391.42	15.87	9552.33	10033.13

	SECNO	Q	XLCH	CWSEL	DIFWSP	ELMIN	DEPTH	K*CHSL	QROB	QCH	VCH	SSTA	ENDST
*	17.000	54000.00	520.00	1123.00	0.00	1109.30	13.20	.58	5576.59	40459.18	11.78	9585.00	10730.00
	17.000	54000.00	520.00	1122.30	-.20	1109.30	13.00	.58	2159.28	43447.81	12.86	9602.66	10139.81
*	17.030	54000.00	150.00	1124.70	0.00	1110.20	14.50	2.67	8696.75	40813.56	8.78	9575.75	10790.00
	17.030	54000.00	150.00	1123.97	-.73	1110.20	13.77	2.67	4127.24	45424.53	10.35	9595.74	10235.91
*	17.050	54000.00	100.00	1126.00	0.00	1110.30	15.70	1.00	9916.77	40601.83	8.06	9693.33	10800.00
	17.050	54000.00	100.00	1124.09	-1.91	1110.30	13.79	1.00	4994.38	45621.96	10.46	9737.84	10280.00
*	17.060	54000.00	50.00	1125.30	0.00	1112.00	13.30	34.00	0.00	54000.00	11.87	9312.44	10226.00
	17.060	54000.00	50.00	1122.74	-2.56	1112.00	10.74	34.00	0.00	54000.00	15.33	9323.07	10213.01
*	17.070	54000.00	40.00	1125.60	0.00	1112.00	13.60	0.00	0.00	54000.00	11.55	9311.18	10226.00
	17.070	54000.00	40.00	1123.98	-1.62	1112.00	11.98	0.00	0.00	54000.00	13.47	9317.94	10222.15
*	17.090	54000.00	85.00	1126.50	0.00	1112.00	14.50	0.00	0.00	54000.00	11.44	9307.42	10193.58
	17.090	54000.00	85.00	1124.07	-2.43	1112.00	12.07	0.00	0.00	54000.00	14.18	9317.55	10183.45
*	17.100	54000.00	20.00	1127.00	0.00	1112.00	15.00	0.00	0.00	54000.00	10.99	9305.33	10195.67
*	17.100	54000.00	20.00	1126.92	-.08	1112.00	14.92	0.00	0.00	54000.00	11.06	9305.66	10195.34
*	17.150	54000.00	300.00	1128.70	0.00	1116.00	12.70	13.33	39059.13	2240.24	3.49	9729.10	12612.33
	17.150	54000.00	300.00	1127.91	-.79	1116.00	11.91	13.33	14172.97	5874.11	9.87	9729.46	10475.00
*	17.200	54000.00	260.00	1128.80	0.00	1116.20	12.60	.77	40273.26	2087.17	3.25	9731.36	13038.00
	17.200	54000.00	260.00	1128.45	-.35	1116.20	12.25	.77	12345.13	6293.23	10.13	9731.38	10800.00
*	17.300	54000.00	530.00	1129.20	0.00	1116.70	12.30	.94	31260.47	6130.64	5.23	9751.53	13663.33
	17.300	54000.00	530.00	1130.17	0.97	1116.70	13.47	.94	22882.27	8516.20	6.55	9749.77	11370.00
*	17.400	54000.00	530.00	1129.50	0.00	1118.30	11.40	3.02	29567.21	6381.08	12.10	9862.02	12839.59
	17.400	54000.00	530.00	1130.51	1.07	1118.30	12.21	3.02	32446.14	5656.41	9.95	9860.72	11990.00
*	17.600	54000.00	1050.00	1132.40	0.00	1117.40	15.00	-.86	46106.32	7519.27	5.24	9932.39	12150.00
	17.600	54000.00	1050.00	1132.29	-.11	1117.40	14.89	-.86	46224.36	7409.26	5.20	9932.53	13279.37
*	17.900	54000.00	1140.00	1133.60	0.00	1120.00	13.60	2.28	3645.07	6567.90	6.27	9025.00	10250.00
	17.900	54000.00	1140.00	1133.53	-.07	1120.00	13.53	2.28	3322.02	5945.46	5.70	8860.20	10337.60
*	18.140	54000.00	1140.00	1135.70	0.00	1125.00	10.70	4.39	0.00	45906.22	12.28	9150.00	10400.00
	18.140	54000.00	1140.00	1136.00	.30	1125.00	11.00	4.39	229.00	35683.45	9.15	8652.36	10699.11
*	18.200	54000.00	360.00	1137.60	0.00	1127.00	10.60	5.56	12930.37	24090.61	7.55	9300.00	10650.00
	18.200	54000.00	360.00	1137.79	.19	1127.00	10.79	5.56	11523.99	19011.85	5.82	8666.51	11117.75

SUMMARY OF CAUTIONS

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NOTE      SECNO=  15.000  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  15.230  PROFILE= 1  WSEL BASED ON X5 CARD
CAUTION   SECNO=  15.280  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION   SECNO=  15.230  PROFILE= 2  MINIMUM SPECIFIC ENERGY

NOTE      SECNO=  15.440  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  15.640  PROFILE= 1  WSEL BASED ON X5 CARD

CAUTION   SECNO=  15.900  PROFILE= 1  CRITICAL DEPTH ASSUMED
NOTE      SECNO=  15.900  PROFILE= 1  WSEL BASED ON X5 CARD
CAUTION   SECNO=  15.900  PROFILE= 1  MINIMUM SPECIFIC ENERGY
CAUTION   SECNO=  15.900  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION   SECNO=  15.900  PROFILE= 2  MINIMUM SPECIFIC ENERGY

NOTE      SECNO=  16.100  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  16.200  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  16.400  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  16.590  PROFILE= 1  WSEL BASED ON X5 CARD

CAUTION   SECNO=  16.710  PROFILE= 1  CRITICAL DEPTH ASSUMED
NOTE      SECNO=  16.710  PROFILE= 1  WSEL BASED ON X5 CARD
CAUTION   SECNO=  16.710  PROFILE= 1  MINIMUM SPECIFIC ENERGY

NOTE      SECNO=  16.900  PROFILE= 1  WSEL BASED ON X5 CARD
CAUTION   SECNO=  16.900  PROFILE= 2  CRITICAL DEPTH ASSUMED
CAUTION   SECNO=  16.900  PROFILE= 2  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION   SECNO=  16.900  PROFILE= 2  20 TRIALS ATTEMPTED TO BALANCE WSEL

NOTE      SECNO=  17.000  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  17.030  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  17.050  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  17.060  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  17.070  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  17.090  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  17.100  PROFILE= 1  WSEL BASED ON X5 CARD
CAUTION   SECNO=  17.100  PROFILE= 2  HYDRAULIC JUMP C.S.

NOTE      SECNO=  17.150  PROFILE= 1  WSEL BASED ON X5 CARD
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NOTE      SECNO=  17.200  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  17.300  PROFILE= 1  WSEL BASED ON X5 CARD

CAUTION   SECNO=  17.400  PROFILE= 1  CRITICAL DEPTH ASSUMED
NOTE      SECNO=  17.400  PROFILE= 1  WSEL BASED ON X5 CARD
CAUTION   SECNO=  17.400  PROFILE= 1  MINIMUM SPECIFIC ENERGY

NOTE      SECNO=  17.600  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  17.900  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  18.140  PROFILE= 1  WSEL BASED ON X5 CARD

NOTE      SECNO=  18.200  PROFILE= 1  WSEL BASED ON X5 CARD
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FLOODWAY DATA, AGUA FRIA RIVER NEAR GR
PROFILE NO. 2

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
15.000	4189.	13530.	2.9	1094.7	1093.7	1.0
15.280	1300.	5477.	9.9	1096.6	1097.6	-1.0
15.440	1850.	7145.	7.6	1101.1	1101.1	0.0
15.640	1834.	8139.	6.6	1103.7	1103.4	.3
15.900	1344.	5055.	10.7	1107.2	1106.4	.8
16.100	1242.	7437.	7.2	1111.2	1110.3	.9
16.200	943.	5864.	9.2	1112.2	1112.3	-.1
16.400	848.	6312.	8.5	1114.5	1114.2	.3
16.590	846.	7384.	7.3	1116.3	1115.7	.6
16.710	749.	6043.	8.9	1117.7	1117.4	.3
16.900	531.	3636.	14.7	1119.4	1119.2	.2
17.000	537.	4628.	11.7	1122.9	1123.0	-.1
17.030	640.	5771.	9.4	1124.1	1124.7	-.6
17.050	542.	5658.	9.5	1124.2	1126.0	-1.8
17.060	390.	3522.	15.3	1122.8	1125.3	-2.5
17.070	404.	4010.	13.5	1124.1	1125.6	-1.5
17.090	366.	3809.	14.2	1124.2	1126.5	-2.3
17.100	390.	4334.	11.1	1127.0	1127.0	0.0
17.150	746.	5886.	9.2	1128.0	1128.7	-.7
17.200	1068.	6454.	8.4	1128.6	1128.8	-.2
17.300	1620.	11301.	4.3	1130.2	1129.2	1.0
17.400	2129.	9431.	5.7	1130.5	1129.5	1.0
17.600	3347.	14536.	3.7	1132.4	1132.4	0.0
17.900	1527.	11964.	4.5	1133.6	1133.6	0.0
18.140	2047.	7444.	7.3	1136.0	1135.7	.3
18.200	2451.	11661.	4.6	1137.8	1137.6	.2

2. HEC-2 PRESENT CONDITION

12/23/80 11:30 A.M.

It models an encroachment downstream of the landfill embankment along a ridge of possible breakout
It also has a force feed (X5 cards)
Profile from the FIS for 54,100 cfs
(Profile 1 - Flood plain flow.

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*************************************************
 HEC2 RELEASE DATED NOV 76 UPDATED APRI 1980
 ERROR CORR - 01,02,03,04
 MODIFICATION - 50,51,52,53,54
*************************************************

T1      EL MIRAGE LANDFILL                BY PRC TOUPS,PHOENIX,AZ. PH. 954-9191
T2      PROFILE 1
T3      AGUA FRIA RIVER  NEAR GRAND AVENUE    DECEMBER,1980  JOB NO.1831-602

J1  ICHECK    INQ     NINV    IDIR    STRT     METRIC   HVINS    Q      WSEL    EQ

     -1.      2.      0.      0.  0.000000     0.00     0.0      0.  1093.700  0.000

J2  NPROF    IPLOT   PRFVS   XSECV   XSECH    FN      ALLDC   IBW     CHNIM   ITRACE

     1.000   0.000  -1.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

    38.000  43.000  39.000   1.000  50.000  42.000   8.000  33.000  15.000  14.000

    26.000  53.000  54.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000

QT   5.000  54000.000 54000.000 65000.000 75000.000 100000.000   0.000   0.000   0.000   0.000
NC    .045    .045    .035    .100    .300   0.000   0.000   0.000   0.000   0.000

X1  15.000  15.000  9800.000  10000.000   0.000   0.000   0.000   0.000   0.000   0.000
X5   1.000  1093.600   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
GR 1110.000  7340.000  1098.000  7440.000  1095.000  7770.000  1090.000  8680.000  1091.000  8970.000
GR 1090.000  9240.000  1092.000  9550.000  1090.000  9800.000  1087.000  10000.000  1090.000  10280.000
GR 1086.000  11170.000  1090.000  11440.000  1095.000  12050.000  1100.000  12600.000  1105.000  12630.000
NH   4.000    .038  8830.000    .035  10000.000    .030  11130.000    .038  13800.000   0.000
ET   0.000   7.100   7.100   7.100   7.100   7.100  8750.000  11800.000   0.000   0.000

X1  15.280   9.000  9890.000  10000.000  1300.000  1500.000  1480.000   0.000   0.000   0.000
X5   1.000  1097.600   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
GR 1110.000  8750.000  1097.000  8830.000  1095.000  9140.000  1096.000  9520.000  1095.000  9890.000
GR 1090.000  10000.000  1095.000  11130.000  1100.000  12000.000  1101.000  13800.000   0.000   0.000
NH   4.000    .038  9300.000    .035  9890.000    .030  10400.000    .038  13700.000   0.000
ET   0.000   7.100   7.100   7.100   7.100   7.100  9240.000  10800.000   0.000   0.000

X1  15.440  15.000  9890.000  10000.000   820.000   850.000   870.000   0.000   0.000   0.000
X5   1.000  1101.100   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
GR 1115.000  9240.000  1098.000  9300.000  1095.000  9890.000  1092.000  10000.000  1096.000  10270.000
GR 1094.000  10400.000  1100.000  10550.000  1101.000  10800.000  1097.000  11450.000  1099.000  11660.000
GR 1097.000  11830.000  1100.000  11980.000  1102.000  12110.000  1102.000  12630.000  1105.000  13700.000
NH   3.000    .035  9970.000    .030  11680.000    .038  14250.000   0.000   0.000   0.000
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ET	0.000	7.100	7.100	7.100	7.100	7.100	9290.000	11270.000	0.000	0.000
X1	15.640	45.000	9970.000	10215.000	1010.000	960.000	1040.000	0.000	0.000	0.000
X5	1.000	1103.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1120.000	9290.000	1110.000	9320.000	1108.000	9325.000	1106.000	9330.000	1104.000	9435.000
GR	1102.000	9440.000	1100.000	9445.000	1098.000	9480.000	1096.000	9510.000	1096.000	9550.000
GR	1098.000	9630.000	1100.000	9700.000	1100.000	9820.000	1098.000	9970.000	1096.000	10035.000
GR	1093.900	10150.000	1094.000	10160.000	1096.000	10180.000	1098.000	10200.000	1100.000	10215.000
GR	1100.000	10230.000	1098.000	10250.000	1098.000	10270.000	1100.000	10445.000	1100.000	10560.000
GR	1098.000	10655.000	1098.000	10740.000	1100.000	10810.000	1098.000	10830.000	1098.000	10875.000
GR	1098.000	10930.000	1100.000	10945.000	1102.000	10960.000	1104.000	10985.000	1104.000	11180.000
GR	1102.000	11670.000	1100.000	11680.000	1100.000	11910.000	1102.000	11980.000	1102.500	12070.000
GR	1100.000	12140.000	1101.000	12170.000	1104.000	13170.000	1105.000	13820.000	1106.000	14250.000
NH	5.000	.035	9910.000	.030	10725.000	.035	11130.000	.030	11700.000	.038
NH	14370.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9870.000	11000.000	0.000	0.000
X1	15.900	28.000	9910.000	10115.000	1210.000	1210.000	1390.000	0.000	0.000	0.000
X5	1.000	1106.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1130.000	9870.000	1110.000	9890.000	1100.000	9910.000	1098.000	9915.000	1098.400	10020.000
GR	1100.000	10115.000	1102.000	10145.000	1104.000	10160.000	1104.000	10210.000	1102.000	10590.000
GR	1104.000	10725.000	1106.000	10740.000	1106.000	11130.000	1104.000	11370.000	1102.000	11455.000
GR	1102.000	11510.000	1104.000	11530.000	1102.000	11620.000	1104.000	11630.000	1106.000	11640.000
GR	1106.000	11700.000	1105.000	11850.000	1106.000	12150.000	1108.000	12450.000	1108.000	12700.000
GR	1105.000	12970.000	1109.000	13910.000	1110.000	14370.000	0.000	0.000	0.000	0.000
NH	5.000	.035	9790.000	.030	10635.000	.035	11365.000	.030	11800.000	.038
NH	15500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9670.000	11050.000	0.000	0.000
X1	16.100	28.000	9790.000	10035.000	1100.000	1000.000	1080.000	0.000	0.000	0.000
X5	1.000	1110.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1120.000	9670.000	1110.000	9685.000	1102.000	9705.000	1102.000	9790.000	1100.000	9855.000
GR	1100.000	9935.000	1099.200	9970.000	1100.000	10000.000	1102.000	10035.000	1104.000	10045.000
GR	1106.000	10055.000	1106.000	10635.000	1108.000	10650.000	1109.500	11000.000	1108.000	11350.000
GR	1106.000	11355.000	1104.000	11365.000	1104.000	11420.000	1106.000	11475.000	1106.000	11580.000
GR	1104.000	11730.000	1106.000	11800.000	1108.000	12060.000	1110.000	12530.000	1110.500	12910.000
GR	1110.000	13130.000	1111.000	14400.000	1115.000	15500.000	0.000	0.000	0.000	0.000
NH	5.000	.038	9915.000	.030	10885.000	.035	11700.000	.030	12030.000	.038
NH	15500.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9840.000	11150.000	0.000	0.000
X1	16.200	27.000	9915.000	10190.000	470.000	500.000	540.000	0.000	0.000	0.000
X5	1.000	1112.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1138.000	9840.000	1130.000	9870.000	1110.000	9900.000	1102.000	9915.000	1102.000	10120.000
GR	1104.000	10190.000	1106.000	10200.000	1108.000	10280.000	1108.000	10310.000	1110.000	10340.000
GR	1110.000	10500.000	1108.000	10530.000	1108.000	10885.000	1110.000	10890.000	1110.000	10900.000
GR	1110.000	10910.000	1110.000	10970.000	1112.000	11140.000	1110.000	11610.000	1104.000	11700.000
GR	1108.000	11760.000	1104.000	11820.000	1110.000	11880.000	1110.000	12030.000	1111.000	13330.000
GR	1112.000	14330.000	1115.000	15500.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	5.000	.035	9860.000	.030	11060.000	.035	11490.000	.030	11860.000	.038

NH	16100.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9730.000	11100.000	0.000	0.000
X1	16.400	30.000	9860.000	10025.000	1030.000	1030.000	995.000	0.000	0.000	0.000
X5	1.000	1114.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1138.000	9730.000	1136.000	9770.000	1134.000	9800.000	1130.000	9815.000	1110.000	9850.000
GR	1102.000	9860.000	1101.200	9910.000	1102.000	9950.000	1104.000	10025.000	1106.000	10040.000
GR	1108.000	10050.000	1110.000	10060.000	1110.000	10375.000	1112.000	10440.000	1112.000	10470.000
GR	1114.000	10565.000	1114.000	10600.000	1112.000	10820.000	1110.000	10860.000	1110.000	11060.000
GR	1113.000	11150.000	1110.000	11490.000	1104.000	11570.000	1110.000	11860.000	1112.000	12000.000
GR	1112.000	13540.000	1113.000	14600.000	1115.000	15200.000	1120.000	15800.000	1124.000	16100.000
NH	3.000	.035	9910.000	.030	10870.000	.038	15800.000	0.000	0.000	0.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9675.000	10860.000	0.000	0.000
X1	16.590	31.000	9910.000	10130.000	930.000	870.000	960.000	0.000	0.000	0.000
X5	1.000	1115.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1138.000	9675.000	1130.000	9690.000	1120.000	9700.000	1110.000	9710.000	1108.000	9715.000
GR	1108.000	9775.000	1110.000	9785.000	1110.000	9890.000	1108.000	9910.000	1106.000	9930.000
GR	1104.000	10010.000	1103.500	10020.000	1104.000	10045.000	1106.000	10100.000	1108.000	10130.000
GR	1110.000	10150.000	1112.000	10155.000	1112.000	10280.000	1114.000	10390.000	1114.000	10495.000
GR	1112.500	10630.000	1114.000	10870.000	1107.000	11030.000	1110.000	11190.000	1115.000	11480.000
GR	1111.000	12030.000	1111.000	12660.000	1115.000	13070.000	1115.000	14250.000	1120.000	15330.000
GR	1125.000	15800.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	3.000	.032	9530.000	.030	10015.000	.037	15600.000	0.000	0.000	0.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9110.000	10100.000	0.000	0.000
X1	16.710	30.000	9530.000	9970.000	870.000	930.000	1050.000	0.000	0.000	0.000
X5	1.000	1117.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1140.000	9110.000	1130.000	9125.000	1120.000	9150.000	1118.000	9200.000	1118.000	9370.000
GR	1114.000	9380.000	1112.000	9400.000	1112.000	9415.000	1114.000	9440.000	1114.000	9500.000
GR	1112.000	9530.000	1110.000	9905.000	1106.600	9950.000	1108.000	9970.000	1110.000	9975.000
GR	1120.000	10000.000	1122.000	10015.000	1120.000	10240.000	1130.000	10280.000	1130.000	10330.000
GR	1120.000	10365.000	1116.000	10380.000	1116.000	10420.000	1114.000	11000.000	1117.000	11200.000
GR	1115.000	11430.000	1120.000	13900.000	1127.000	14800.000	1125.000	14900.000	1130.000	15600.000
NC	.032	.037	.030	.100	.300	0.000	0.000	0.000	0.000	0.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9230.000	10130.000	0.000	0.000
X1	16.900	28.000	9690.000	10055.000	700.000	820.000	750.000	0.000	0.000	0.000
X5	1.000	1119.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1130.000	9230.000	1120.000	9300.000	1120.000	9370.000	1120.000	9550.000	1116.000	9565.000
GR	1114.000	9690.000	1112.000	9795.000	1110.000	9945.000	1109.500	10015.000	1110.000	10055.000
GR	1120.000	10085.000	1130.000	10110.000	1128.000	10180.000	1126.000	10300.000	1124.000	10345.000
GR	1122.000	10440.000	1120.000	10500.000	1119.500	10610.000	1120.000	10630.000	1116.000	10650.000
GR	1115.000	11170.000	1119.000	11420.000	1116.000	11750.000	1118.000	12600.000	1120.000	13260.000
GR	1125.000	14800.000	1130.000	15530.000	1135.000	15850.000	0.000	0.000	0.000	0.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9450.000	10170.000	0.000	0.000

X1	17.000	20.000	9805.000	10095.000	520.000	520.000	520.000	0.000	0.000	0.000
X5	1.000	1123.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1140.000	9450.000	1130.000	9480.000	1124.000	9495.000	1122.000	9675.000	1120.000	9680.000
GR	1118.000	9685.000	1116.000	9700.000	1114.000	9805.000	1112.000	9890.000	1110.000	9975.000
GR	1109.800	10010.000	1110.000	10020.000	1110.000	10095.000	1120.000	10130.000	1130.000	10165.000
GR	1132.000	10170.000	1132.000	10280.000	1130.000	10285.000	1120.000	10315.000	1121.000	10730.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9360.000	10280.000	0.000	0.000
X1	17.030	30.000	9795.000	10150.000	130.000	250.000	150.000	0.000	0.000	0.000
X5	1.000	1124.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1138.000	9360.000	1136.000	9410.000	1134.000	9440.000	1132.000	9480.000	1130.000	9505.000
GR	1128.000	9520.000	1126.000	9540.000	1124.000	9595.000	1122.000	9660.000	1122.000	9715.000
GR	1120.000	9730.000	1118.000	9735.000	1116.000	9755.000	1114.000	9795.000	1112.000	9890.000
GR	1110.200	10015.000	1112.000	10150.000	1118.000	10215.000	1120.000	10220.000	1130.000	10260.000
GR	1134.000	10275.000	1134.000	10300.000	1130.000	10315.000	1124.000	10335.000	1124.000	10380.000
GR	1122.000	10390.000	1120.000	10470.000	1121.000	10670.000	1122.000	10740.000	1121.000	10790.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9450.000	10280.000	0.000	0.000
X1	17.050	17.000	9805.000	10160.000	70.000	100.000	100.000	0.000	0.000	0.000
X5	1.000	1126.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1140.000	9450.000	1138.000	9500.000	1130.000	9600.000	1124.000	9740.000	1116.000	9765.000
GR	1114.000	9805.000	1112.000	9840.000	1110.300	9995.000	1112.000	10085.000	1114.000	10130.000
GR	1114.000	10160.000	1116.000	10215.000	1122.000	10280.000	1122.000	10620.000	1124.000	10665.000
GR	1124.000	10760.000	1122.000	10800.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	17.060	4.000	9774.000	10226.000	50.000	50.000	50.000	0.000	0.000	0.000
X5	1.000	1125.300	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1134.500	9774.000	1112.000	9868.000	1112.000	10133.000	1124.500	10226.000	0.000	0.000
SB	.900	1.300	2.800	0.000	363.000	20.000	6083.000	2.800	1112.000	1112.000
X1	17.070	0.000	0.000	0.000	40.000	40.000	40.000	0.000	0.000	0.000
X2	0.000	0.000	1.000	1127.700	1130.600	0.000	0.000	0.000	0.000	0.000
X5	1.000	1125.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	17.090	4.000	9774.000	10227.000	85.000	85.000	85.000	0.000	0.000	0.000
X5	1.000	1126.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1134.500	9774.000	1112.000	9868.000	1112.000	10133.000	1134.500	10227.000	0.000	0.000
SB	.900	7.780	2.800	0.000	235.000	27.000	7127.000	4.400	1112.000	1112.000
X1	17.100	0.000	0.000	0.000	20.000	20.000	20.000	0.000	0.000	0.000
X2	0.000	0.000	1.000	1134.500	1136.000	0.000	0.000	0.000	0.000	0.000
X5	1.000	1127.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	4.000	.038	9750.000	.032	10350.000	.036	10600.000	.040	12621.000	0.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9700.000	10475.000	0.000	0.000

X1	17.150	11.000	10000.000	10060.000	300.000	240.000	300.000	0.000	0.000	0.000
X5	1.000	1128.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1145.000	9700.000	1116.000	9750.000	1116.000	10000.000	1120.000	10060.000	1124.000	10350.000
GR	1124.500	10600.000	1120.000	11500.000	1120.000	12300.000	1125.000	12600.000	1131.000	12620.000
GR	1150.000	12621.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	4.000	.038	9750.000	.032	10100.000	.035	10750.000	.040	13101.000	0.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9700.000	10800.000	0.000	0.000
X1	17.200	12.000	10000.000	10060.000	260.000	260.000	260.000	0.000	0.000	0.000
X5	1.000	1128.800	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1150.000	9700.000	1116.200	9750.000	1116.200	10000.000	1120.000	10060.000	1125.000	10100.000
GR	1125.000	10500.000	1125.000	10750.000	1120.000	11800.000	1120.000	12900.000	1125.000	13050.000
GR	1130.000	13100.000	1150.000	13101.000	0.000	0.000	0.000	0.000	0.000	0.000
NH	4.000	.038	9770.000	.032	10110.000	.035	10900.000	.040	13676.000	0.000
ET	0.000	7.100	7.100	7.100	7.100	7.100	9720.000	11370.000	0.000	0.000
X1	17.300	14.000	10000.000	10110.000	540.000	430.000	530.000	0.000	0.000	0.000
X5	1.000	1129.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1150.000	9720.000	1116.700	9770.000	1116.700	10000.000	1120.000	10110.000	1125.000	10170.000
GR	1125.000	10900.000	1125.000	10900.000	1124.500	11100.000	1125.000	11300.000	1126.000	11800.000
GR	1125.000	12300.000	1125.000	13650.000	1132.500	13675.000	1150.000	13676.000	0.000	0.000
NH	4.000	.038	9880.000	.032	10100.000	.036	11100.000	.040	14501.000	0.000
ET	0.000	0.000	7.100	7.100	7.100	7.100	9830.000	11990.000	0.000	0.000
X1	17.400	14.000	10000.000	10050.000	540.000	490.000	530.000	0.000	0.000	0.000
X5	1.000	1129.200	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1150.000	9830.000	1118.300	9880.000	1118.300	10000.000	1120.000	10050.000	1125.000	10100.000
GR	1125.000	10400.000	1127.500	11100.000	1129.000	12400.000	1130.000	13100.000	1132.500	14200.000
GR	1130.000	14450.000	1130.000	14500.000	1135.000	14500.000	1150.000	14501.000	0.000	0.000
NC	.055	.045	.055	.100	.300	0.000	0.000	0.000	0.000	0.000
ET	0.000	9.100	0.000	0.000	0.000	0.000	0.000	0.000	9700.000	12150.000
X1	17.600	14.000	9950.000	10050.000	1050.000	750.000	1050.000	0.000	0.000	0.000
X5	1.000	1132.400	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1160.000	9900.000	1117.400	9950.000	1117.400	10000.000	1120.000	10050.000	1125.000	10080.000
GR	1125.000	10750.000	1125.000	11449.000	1130.000	11450.000	1130.000	11650.000	1131.000	12700.000
GR	1135.000	14500.000	1136.000	14900.000	1135.000	15350.000	1137.500	15380.000	0.000	0.000
ET	0.000	9.100	0.000	0.000	0.000	0.000	0.000	0.000	9025.000	10250.000
X1	17.900	10.000	10000.000	10080.000	1140.000	950.000	1140.000	0.000	0.000	0.000
X5	1.000	1133.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1140.000	8830.000	1125.000	8900.000	1125.000	9860.000	1121.000	9920.000	1120.000	10000.000
GR	1121.000	10080.000	1131.000	10160.000	1134.000	10430.000	1135.000	12480.000	1139.000	14300.000
NC	.045	.045	.045	.100	.300	0.000	0.000	0.000	0.000	0.000
ET	0.000	9.100	0.000	0.000	0.000	0.000	0.000	0.000	9150.000	10400.000

X1	18.140	15.000	9860.000	10400.000	1170.000	1250.000	1140.000	0.000	0.000	0.000
X5	1.000	1135.700	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1145.000	8500.000	1132.000	8720.000	1132.000	9090.000	1135.000	9400.000	1135.000	9640.000
GR	1130.000	9860.000	1130.000	9940.000	1125.000	10000.000	1130.000	10200.000	1129.000	10290.000
GR	1130.000	10370.000	1135.000	10400.000	1138.000	11300.000	1140.000	11900.000	1141.000	12770.000
ET	0.000	9.100	0.000	0.000	0.000	0.000	0.000	0.000	9300.000	10650.000

X1	18.200	13.000	10000.000	10400.000	350.000	400.000	360.000	0.000	0.000	0.000
X5	1.000	1137.600	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	1145.000	8540.000	1140.000	8640.000	1135.000	8700.000	1132.000	9320.000	1135.000	9620.000
GR	1135.000	9800.000	1127.000	10000.000	1130.000	10100.000	1130.000	10400.000	1130.000	10610.000
GR	1135.000	10660.000	1140.000	11480.000	1141.000	12640.000	0.000	0.000	0.000	0.000
EJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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 HEC2 RELEASE DATED NOV 76 UPDATED APRI 1980
 ERROR CORR -  01,02,03,04
 MODIFICATION -  50,51,52,53,54
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T1      EL MIRAGE LANDFILL                BY PRC TOUPS,PHOENIX,AZ. PH. 954-9191
T2      PROFILE 2
T3      AGUA FRIA RIVER  NEAR GRAND AVENUE    DECEMBER,1980  JOB NO.1831-602

J1  ICHECK    INQ      NINV     IDIR     STRT     METRIC   HVINS    Q        WSEL     FQ

    -10.       3.       0.       0.    .002200    0.00     0.0      0.     1094.000   0.000

J2  NPROF     IPLOT    PREVS    XSECV    XSECH    FN       ALLDC    IBW      CHNIM    ITRACE

    2.000     0.000   -1.000    0.000    0.000    0.000    0.000    0.000    0.000    15.000
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

*PROF 2

CCHV=     .100 CEHV=     .300
*SECNO 15.000
    15.00      7.40   1093.40      0.00   1094.00   1093.69       .29      0.00      0.00   1090.00
    54000.    11099.     5594.   37307.     4022.      980.     8343.        0.        0.   1087.00
      0.00      2.76      5.71      4.47      .045      .035      .045     0.000   1086.00   8061.03
  .002170        0.        0.        0.         0         0         4      0.00   3793.89  11854.92


FLOW DISTRIBUTION FOR SECNO=     15.00          CWSEL=   1093.40

STA=     8061.     8680.     8970.     9240.     9550.     9800.    10000.    10280.    11170.    11440.    11855.
  PER Q=     4.3       4.9       4.5       3.8       3.1      10.4      11.3      42.2      12.8       2.9
   AREA=  1052.5     841.3     783.3     744.3     600.2     980.2    1372.3    4806.8    1458.3     705.6
    VEL=     2.2       3.1       3.1       2.8       2.8       5.7       4.4       4.7       4.7       2.2

1490 NH CARD USED
*SECNO 15.280

3301 HV CHANGED MORE THAN HVINS


3470 ENCROACHMENT STATIONS=    8750.0   11800.0  TYPE=      1  TARGET=    3050.000
    15.28      7.11   1097.11      0.00   1097.60   1098.02       .91      4.14       .19   1095.00
    54000.     5290.     3675.   45035.     1547.      507.     5590.      348.      105.   1090.00
      .05      3.42      7.25      8.06      .035      .035      .030      .035   1090.00   8829.35
  .003814     1300.     1480.     1500.         2         0         0      0.00   2667.01  11496.36


FLOW DISTRIBUTION FOR SECNO=     15.28          CWSEL=   1097.11

STA=     8829.     9140.     9520.     9890.    10000.    11130.    11496.
  PER Q=     1.8       4.1       4.0       6.8      81.6       1.8
   AREA=   342.7     610.1     594.0     506.6    5204.2     385.7
    VEL=     2.8       3.6       3.6       7.3       8.5       2.5

1490 NH CARD USED
*SECNO 15.440

3301 HV CHANGED MORE THAN HVINS
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

3470 ENCROACHMENT STATIONS=    9240.0   10800.0  TYPE=     1  TARGET=    1560.000
     15.44      8.27  1100.27      0.00  1101.10  1101.75      1.48      3.56       .17  1095.00
     54000.   15636.     9006.   29357.     2233.     745.     2878.      479.      143.  1092.00
       .08      7.00     12.09    10.20      .035     .030      .031      .036   1092.00  9291.99
   .004656      820.      870.     850.         2        0         0      0.00   1325.51 10617.50

FLOW DISTRIBUTION FOR SECNO=     15.44          CWSEL=   1100.27

STA=    9292.    9300.    9890.   10000.   10270.   10400.   10550.   10618.
  PER Q=      .0     28.9     16.7     36.0     13.0      5.3       .0
   AREA=     9.1   2224.3    744.7   1692.9    685.1    490.5      9.1
    VEL=     2.8      7.0     12.1     11.5     10.2      5.9       .7

1490 NH CARD USED
*SECNO 15.640

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    9290.0   11270.0  TYPE=     1  TARGET=    1980.000
     15.64      9.93  1103.83      0.00  1103.40  1104.53       .70      2.71       .08  1098.00
     54000.   15458.    16253.   22288.     2775.    1950.     3670.      641.      176.  1100.00
       .12      5.57     8.34     6.07      .035     .030      .030      .036   1093.90  9435.42
   .001785     1010.    1040.     960.         3        0         0      0.00   1596.18 11270.00

FLOW DISTRIBUTION FOR SECNO=     15.64          CWSEL=   1103.83

STA=    9435.    9510.    9550.    9630.    9700.    9820.    9970.   10215.   10270.   10445.   10560.   10655.   10740.
  PER Q=      4.2      4.1      6.5      3.2      3.7      6.9     30.1      3.1      9.4      4.2      5.1      6.2
   AREA=    392.4    313.3    546.5    338.2    459.8    724.7   1950.0    270.7    845.5    440.6    459.0    495.7
    VEL=      5.7      7.1      6.5      5.1      4.4      5.1      8.3      6.1      6.0      5.1      6.0      6.8
STA=   10740.   10810.   10875.   10930.   11270.
  PER Q=      3.7      4.4      4.0      1.2
   AREA=    338.2    359.0    320.7    140.7
    VEL=      6.0      6.6      6.8      4.6
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

1490 NH CARD USED
*SECNO 15.900

3301 HV CHANGED MORE THAN HVINS

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

3470 ENCROACHMENT STATIONS=    9870.0   11000.0  TYPE=      1  TARGET=    1130.000
    15.90      9.47  1107.47  1107.47  1106.96  1109.67      2.20      3.53       .45  1100.00
    54000.     367.   26273.   27361.      56.    1801.     3156.      835.      215.   1100.00
      .15      6.57     14.58     8.67     .035     .030      .030      .036   1098.00   9895.06
  .004793    1210.    1390.    1210.       20       11         0      0.00   1104.94  11000.00


FLOW DISTRIBUTION FOR SECNO=     15.90          CWSEL=   1107.47

STA=     9895.     9910.    10115.    10145.    10210.    10590.    10725.    11000.
  PER Q=      .7      48.7      4.3      3.7      29.3      10.4       3.0
   AREA=    55.8    1801.4    194.1    240.6    1698.7     603.5     419.3
    VEL=     6.6      14.6     11.9      8.2       9.3       9.3       3.9

1490 NH CARD USED
*SECNO 16.100

3301 HV CHANGED MORE THAN HVINS


3470 ENCROACHMENT STATIONS=    9670.0   11050.0  TYPE=      1  TARGET=    1380.000
    16.10     12.21  1111.41      0.00  1110.30  1112.29       .88      2.49       .13  1102.00
    54000.    6215.   25286.   22499.     910.    2722.     4385.      990.      244.   1102.00
      .19      6.83     9.29     5.13     .035     .030      .031      .036   1099.20   9682.88
  .001420    1100.    1080.    1000.        3        0         0      0.00   1367.12  11050.00


FLOW DISTRIBUTION FOR SECNO=     16.10          CWSEL=   1111.41

STA=     9683.     9790.    10035.    10635.    11000.    11050.
  PER Q=    11.5      46.8     35.4      5.8       .5
   AREA=  909.6    2721.7   3286.6    997.5     100.9
    VEL=     6.8       9.3      5.8      3.2       2.5
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

1490 NH CARD USED
*SECNO 16.200

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

3470 ENCROACHMENT STATIONS=    9840.0   11150.0  TYPE=     1  TARGET=    1310.000
    16.20      9.76  1111.76  1111.76  1112.30  1113.90      2.14      1.13       .38  1102.00
    54000.     617.   35618.   17765.     89.    2613.     2628.     1069.      259.   1104.00
      .20      6.95     13.63     6.76    .038     .030      .030      .036  1102.00  9897.36
  .003760      470.     540.     500.       4       15         0      0.00  1222.08 11119.44

FLOW DISTRIBUTION FOR SECNO=     16.20          CWSEL=   1111.76

STA=    9897.    9915.   10190.   10280.   10500.   10885.   11119.
  PER Q=      1.1      66.0      7.4      4.8     19.1      1.7
   AREA=     88.7    2613.5    448.2    476.8   1416.9    285.8
    VEL=      7.0      13.6      8.9      5.4      7.3      3.2

1490 NH CARD USED
*SECNO 16.400

3301 HV CHANGED MORE THAN HVINS


3470 ENCROACHMENT STATIONS=    9730.0   11100.0  TYPE=     1  TARGET=    1370.000
    16.40     14.05  1115.25     0.00  1114.20  1116.64      1.39      2.66       .08  1102.00
    54000.     726.   25968.   27306.    117.    2147.     4483.     1210.      288.   1104.00
      .24      6.22     12.09     6.09    .035     .030      .030      .036  1101.20  9840.81
  .001947     1030.     995.     1030.       2        0         0      0.00  1259.19 11100.00

FLOW DISTRIBUTION FOR SECNO=     16.40          CWSEL=   1115.25

STA=    9841.    9860.   10025.   10050.   10375.   10470.   10820.   11060.   11100.
  PER Q=      1.3      48.1      4.3     21.1      3.8      5.1     14.6      1.6
   AREA=    116.6    2147.3    236.3   1716.4    373.8    752.6   1220.1    183.3
    VEL=      6.2      12.1      9.8      6.6      5.5      3.7      6.5      4.9
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

1490 NH CARD USED
*SECNO 16.590

3470 ENCROACHMENT STATIONS=    9675.0    10860.0  TYPE=      1  TARGET=     1185.000
    16.59     13.69   1117.19      0.00   1115.70   1118.28      1.08      1.61       .03   1108.00
   54000.    10845.    26957.    16197.     1619.     2626.     3087.     1356.      313.   1108.00
      .27      6.70     10.26      5.25      .035      .030      .030      .036   1103.50   9702.81
  .001576      930.      960.      870.         3         0         0      0.00   1157.19  10860.00


FLOW DISTRIBUTION FOR SECNO=     16.59          CWSEL=   1117.19

STA=     9703.     9775.     9890.     9910.    10130.    10280.    10390.    10630.    10860.
  PER Q=      8.2       9.8       2.1      49.9       9.9       4.4       7.5       8.3
   AREA=    618.4     837.2     163.9    2626.2     843.9     461.2     867.5     914.0
    VEL=      7.2       6.3       6.8      10.3       6.3       5.1       4.7       4.9

1490 NH CARD USED
*SECNO 16.710

3301 HV CHANGED MORE THAN HVINS


3470 ENCROACHMENT STATIONS=    9110.0    10100.0  TYPE=      1  TARGET=      990.000
    16.71     12.17   1118.77      0.00   1117.67   1120.93      2.16      2.33       .32   1112.00
   54000.     7793.    44813.     1394.      986.      3614.      145.     1492.      334.   1108.00
      .29      7.90     12.40      9.62      .032      .030      .030      .036   1106.60   9180.78
  .003784      870.     1050.      930.         2         0         0      0.00    816.14   9996.92


FLOW DISTRIBUTION FOR SECNO=     16.71          CWSEL=   1118.77

STA=     9181.     9415.     9500.     9530.     9970.     9997.
  PER Q=      4.8       6.7       2.9      83.0       2.6
   AREA=    382.7     430.3     173.1    3613.7     145.0
    VEL=      6.7       8.5       9.2      12.4       9.6

CCHV=      .100 CEHV=     .300
*SECNO 16.900

3470 ENCROACHMENT STATIONS=    9230.0    10130.0  TYPE=      1  TARGET=      900.000
    16.90     11.80   1121.30      0.00   1119.40   1123.33      2.03      2.39       .01   1114.00
   54000.     7783.    44899.     1319.     1168.     3687.      191.     1575.      348.   1110.00
      .31      6.66     12.18      6.90      .032      .030      .037      .036   1109.50   9290.89
  .002767      700.      750.      820.         3         0         0      0.00    797.36  10088.25
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   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

FLOW DISTRIBUTION FOR SECNO=     16.90          CWSEL=  1121.30

STA=    9291.     9300.     9370.     9550.     9565.     9690.    10055.    10085.    10088.
  PER Q=      .0        .5       1.3        .5      12.2      83.1       2.4        .0
  AREA=      5.9      91.1     234.1      49.5     787.6    3687.3     189.0       2.1
   VEL=      1.8       2.9       2.9       5.3       8.3      12.2       7.0       1.5

*SECNO 17.000
3280 CROSS SECTION     17.00 EXTENDED      1.46 FEET


3470 ENCROACHMENT STATIONS=    9450.0   10170.0  TYPE=     1  TARGET=     720.000
    17.00     12.66  1122.46      0.00  1123.00  1124.92      2.46      1.46       .13  1114.00
    54000.    8178.   43711.     2111.     900.     3279.     272.     1632.      355.   1110.00
      .32      9.08     13.33     7.76     .032      .030      .037      .035  1109.80  9633.15
  .002853     520.      520.      520.        2         0         0      0.00   505.48 10138.63

FLOW DISTRIBUTION FOR SECNO=     17.00          CWSEL=  1122.46

STA=    9633.     9675.     9680.     9685.     9700.     9805.    10095.    10130.    10139.
  PER Q=      .0        .0        .2       1.2      13.8      80.9       3.9        .0
  AREA=      9.7       7.3      17.3      82.0     783.8    3279.3     261.3      10.6
   VEL=       .9       3.0       5.4       7.7       9.5      13.3       8.0       2.4

*SECNO 17.030
3280 CROSS SECTION     17.03 EXTENDED      2.78 FEET


3301 HV CHANGED MORE THAN HVINS


3470 ENCROACHMENT STATIONS=    9360.0   10280.0  TYPE=     1  TARGET=     920.000
    17.03     13.58  1123.78      0.00  1124.70  1125.34      1.56       .32       .09  1114.00
    54000.    4329.   45581.     4089.     702.     4322.     623.     1650.      358.   1112.00
      .32      6.17     10.55     6.56     .032      .030      .037      .035  1110.20  9602.09
  .001619     130.      150.      250.        3         0         0      0.00   633.04 10235.13

FLOW DISTRIBUTION FOR SECNO=     17.03          CWSEL=  1123.78

STA=    9602.     9660.     9715.     9730.     9735.     9755.     9795.    10150.    10215.    10220.    10235.
  PER Q=      .2        .5        .3        .2       1.7       5.2      84.4       7.3        .2        .1
  AREA=     51.6      98.0      41.7      23.9     135.6     351.3    4321.6     570.8      23.9      28.6
   VEL=      1.7       2.7       3.7       5.0       6.7       7.9      10.5       6.9       4.4       2.4
```

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

 *SECNO 17.050
 3280 CROSS SECTION    17.05 EXTENDED    1.92 FEET

 3470 ENCROACHMENT STATIONS=   9450.0   10280.0  TYPE=    1  TARGET=    830.000
      17.05    13.62  1123.92     0.00  1126.00  1125.51     1.59      .16      .01  1114.00
     54000.     3348.   45725.    4928.     455.    4299.     810.    1663.     359.  1114.00
        .33     7.36    10.64     6.08     .032     .030     .037     .035  1110.30  9740.26
    .001658      70.     100.     100.        2        0        0     0.00   539.74 10280.00

 FLOW DISTRIBUTION FOR SECNO=     17.05          CWSEL=   1123.92

 STA=    9740.    9765.    9805.   10160.   10215.   10280.
   PER Q=      .8      5.4     84.7      6.4      2.7
    AREA=    98.0    356.7  4299.2    490.5    319.7
     VEL=     4.6      8.1    10.6      7.0      4.6

 *SECNO 17.060

 3301 HV CHANGED MORE THAN HVINS

      17.06    10.42  1122.42     0.00  1125.30  1126.35     3.94      .14      .70  1134.50
     54000.       0.   54000.       0.       0.    3391.       0.     1668.     359.  1124.50
        .33     0.00    15.93     0.00     .032     .030     .037     .035  1112.00  9824.48
    .005741      50.      50.      50.        4        0        0     0.00   386.02 10210.50

 FLOW DISTRIBUTION FOR SECNO=    17.06          CWSEL=   1122.42

 STA=    9824.   10226.
   PER Q=   100.0
    AREA=  3390.7
     VEL=    15.9

 SPECIAL BRIDGE

 5227 DOWNSTREAM ELEV IS   1119.27 ,NOT   1122.42 HYDRAULIC JUMP OCCURS DOWNSTREAM (IF LOW FLOW CONTROLS)
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       LEFT/RIGHT
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

 SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHO
       .90      1.30      2.80      0.00    363.00     20.00   6083.00     2.80   1112.00   1112.00

 *SECNO 17.070
 CLASS B LOW FLOW

 3420 BRIDGE W.S.=   1120.94 BRIDGE VELOCITY=.     16.42      CALCULATED CHANNEL AREA=.     3289.

  EGPRS     EGLWC      H3       QWEIR      QPR       BAREA   TRAPEZOID      ELLC      ELTRD
                                                              AREA
     0.00   1126.47    0.00        0.    54000.     6083.     6075.     1127.70   1130.60


    17.07    11.03  1123.03     0.00  1125.60  1126.47      3.44       .11      0.00  1134.50
   54000.       0.   54000.       0.       0.     3628.       0.     1671.      360.   1124.50
      .33     0.00    14.89     0.00     .032      .030      .037      .035  1112.00  9821.94
  .004696      40.      40.      40.        0         0         0      0.00   393.09 10215.03


 FLOW DISTRIBUTION FOR SECNO=    17.07          CWSEL=   1123.03

 STA=     9822.   10226.
   PER Q=    100.0
    AREA=   3627.8
     VEL=     14.9

 *SECNO 17.090
    17.09    11.27  1123.27     0.00  1126.50  1126.93      3.66       .40       .07  1134.50
   54000.       0.   54000.       0.       0.     3517.       0.     1678.      360.   1134.50
      .33     0.00    15.35     0.00     .032      .030      .037      .035  1112.00  9820.92
  .004631      85.      85.      85.        2         0         0      0.00   359.16 10180.08

 FLOW DISTRIBUTION FOR SECNO=     17.09          CWSEL=   1123.27

 STA=     9821.   10227.
   PER Q=    100.0
    AREA=   3516.9
     VEL=     15.4
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```
SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     BANK ELEV
Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       LEFT/RIGHT
TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST

SPECIAL BRIDGE

5227 DOWNSTREAM ELEV IS   1120.88 ,NOT   1123.27 HYDRAULIC JUMP OCCURS DOWNSTREAM (IF LOW FLOW CONTROLS)

SB  XK        XKOR      COFQ      RDLEN     BWC       BWP       BAREA     SS        ELCHU     ELCHD
     .90      7.78      2.80      0.00    235.00     27.00   7127.00     4.40   1112.00   1112.00

*SECNO 17.100

3301 HV CHANGED MORE THAN HVINS

CLASS B LOW FLOW

3420 BRIDGE W.S.=   1123.72 BRIDGE VELOCITY=.     17.75      CALCULATED CHANNEL AREA=.     3043.

EGPRS     EGLWC     H3        QWEIR     QPR       BAREA     TRAPEZOID AREA    ELLC      ELTRD
    0.00  1128.82      0.00        0.   54000.     7127.      6908.   1134.50   1136.00

   17.10     14.92  1126.92      0.00  1127.00  1128.82      1.90      1.89      0.00   1134.50
   54000.        0.    54000.        0.       0.    4884.        0.     1680.      361.   1134.50
     .33      0.00     11.06      0.00      .032      .030      .037      .035   1112.00   9805.66
 .001731       20.       20.       20.        0         0         0      0.00    389.68  10195.34

FLOW DISTRIBUTION FOR SECNO=     17.10          CWSEL=   1126.92

STA=    9806.   10227.
  PER Q=    100.0
  AREA=   4884.4
   VEL=     11.1

1490 NH CARD USED
*SECNO 17.150

3470 ENCROACHMENT STATIONS=   9700.0   10475.0  TYPE=    1  TARGET=    775.000
   17.15     11.91  1127.91      0.00  1128.70  1129.42      1.51       .56       .04   1116.00
   54000.    33960.    5875.    14165.    3100.      595.    2188.     1715.      364.   1120.00
     .34     10.95      9.88      6.48      .032      .032      .033      .035   1116.00   9729.46
 .002132       300.      300.      240.         2         0         0      0.00    745.54  10475.00
```

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

FLOW DISTRIBUTION FOR SECNO=     17.15          CWSEL=   1127.91

STA=     9729.     9750.    10000.    10060.    10350.    10475.
  PER Q=      1.2      61.7      10.9      22.3       4.0
   AREA=    122.3    2977.8     594.7    1714.3     473.3
    VEL=      5.4      11.2       9.9       7.0       4.5

1490 NH CARD USED
*SECNO 17.200

3470 ENCROACHMENT STATIONS=    9700.0   10800.0  TYPE=     1  TARGET=    1100.000
    17.20     12.25   1128.45      0.00   1128.80   1129.98      1.52       .55       .01   1116.20
   54000.    35361.     6293.    12346.     3174.      621.     2660.     1752.      370.   1120.00
      .35     11.14     10.13      4.64      .032      .032      .035      .035   1116.20   9731.88
  .002116      260.      260.      260.         2         0         0      0.00   1068.12  10800.00

FLOW DISTRIBUTION FOR SECNO=     17.20          CWSEL=   1128.45

STA=     9732.     9750.    10000.    10060.    10100.    10500.    10750.    10800.
  PER Q=      1.1      64.4      11.7       3.1      11.4       7.1       1.3
   AREA=    111.0    3062.8     621.1     238.0    1380.4     862.8     178.5
    VEL=      5.3      11.4      10.1       7.0       4.5       4.5       3.8

1490 NH CARD USED
*SECNO 17.300

3301 HV CHANGED MORE THAN HVINS

3470 ENCROACHMENT STATIONS=    9720.0   11370.0  TYPE=     1  TARGET=    1650.000
    17.30     13.47   1130.17      0.00   1129.00   1130.66       .50       .59       .10   1116.70
   54000.    22601.     8516.    22882.     3235.     1301.     6765.     1850.      384.   1120.00
      .37      6.99      6.55      3.38      .032      .032      .037      .035   1116.70   9749.77
 .000738      540.      530.      430.         2         0         0      0.00   1620.23  11370.00

FLOW DISTRIBUTION FOR SECNO=     17.30          CWSEL=   1130.17

STA=     9750.     9770.    10000.    10110.    10170.    10900.    11100.    11300.    11370.
  PER Q=       .8      41.0      15.8       3.8      24.1       6.3       6.3       1.9
   AREA=    136.3    3099.1    1300.7     460.5    3777.4    1084.9    1084.9     357.3
    VEL=      3.4       7.1       6.5       4.5       3.5       3.1       3.1       2.9
```

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

1490 NH CARD USED
*SECNO 17.400

3470 ENCROACHMENT STATIONS=    9830.0   11990.0  TYPE=     1  TARGET=    2160.000
    17.40    12.21  1130.51     0.00  1129.70  1131.32      .81       .56       .09  1118.30
    54000.   15897.    5656.   32446.    1584.     569.    7278.     1970.     405.   1120.00
      .39    10.03     9.95     4.46     .032     .032     .036      .035  1118.30   9860.72
  .001796     540.     530.     490.        2        0        0      0.00  2129.27  11990.00

FLOW DISTRIBUTION FOR SECNO=    17.40          CWSEL=   1130.51

STA=    9861.    9880.   10000.   10050.   10100.   10400.   11100.   11990.
  PER Q=      1.1     28.4     10.5      5.8     16.8     25.5     12.0
   AREA=    117.8   1466.5    568.5    401.0   1656.2   2989.6   2231.5
    VEL=      4.9     10.4      9.9      7.9      5.5      4.6      2.9

CCHV=    .100 CEHV=    .300
*SECNO 17.600

3301 HV CHANGED MORE THAN HVINS

    17.60    14.89  1132.29     0.00  1132.40  1132.52      .23      1.14       .06  1117.40
    54000.     366.    7409.   46224.     130.    1424.   12982.     2190.     453.   1120.00
      .46     2.82     5.20     3.56     .055     .055     .045      .037  1117.40   9932.53
  .001076    1050.    1050.     750.        2        0        0      0.00  3346.85  13279.38

FLOW DISTRIBUTION FOR SECNO=    17.60          CWSEL=   1132.29

STA=    9933.    9950.   10050.   10080.   10750.   11449.   11650.   12700.   13279.
  PER Q=       .7     13.7      2.7     36.8     38.4      1.6      5.5       .6
   AREA=    130.1   1423.8    293.6   4882.6   5094.0    462.3   1876.9     373.0
    VEL=      2.8      5.2      4.9      4.1      4.1      1.9      1.6        .8

*SECNO 17.900
    17.90    13.53  1133.53     0.00  1133.60  1133.85      .32      1.31       .03  1120.00
    54000.   44733.    5945.    3322.   10032.    1042.     890.     2506.     509.   1121.00
      .52     4.46     5.70     3.73     .055     .055     .045      .039  1120.00   8860.20
  .001454    1140.    1140.     950.        2        0        0      0.00  1527.40  10387.60
```

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

FLOW DISTRIBUTION FOR SECNO=     17.90          CWSEL=   1133.53

STA=    8860.     8900.     9860.     9920.    10000.    10080.    10160.    10388.
  PER Q=       .8      65.2       5.8      11.0      11.0       5.4       .8
   AREA=    169.7    8187.8     631.7    1042.3    1042.3     602.3    287.8
    VEL=      2.7       4.3       4.9       5.7       5.7       4.8      1.5

CCHV=    .100 CEHV=    .300
*SECNO 18.140

3301 HV CHANGED MORE THAN HVINS

     18.14     11.00   1136.00      0.00   1135.70   1137.01      1.01      2.95       .20   1130.00
    54000.    18087.    35683.      230.     3397.     3898.      149.     2766.      558.   1135.00
       .56      5.32      9.15      1.54      .045      .045      .045      .039   1125.00   8652.36
   .005515     1170.     1140.     1250.         3         0         0      0.00   2046.75  10699.11

FLOW DISTRIBUTION FOR SECNO=     18.14          CWSEL=   1136.00

STA=    8652.     8720.     9090.     9400.     9640.     9860.    10400.    10699.
  PER Q=       1.0      16.9       6.5       1.1       8.0      66.1       .4
   AREA=    135.2    1478.9     774.1     239.3     769.3    3898.4    149.1
    VEL=      3.9       6.2       4.5       2.4       5.6       9.2      1.5

*SECNO 18.200

3301 HV CHANGED MORE THAN HVINS

     18.20     10.79   1137.79      0.00   1137.60   1138.16       .36      1.08       .06   1127.00
    54000.    23464.    19012.    11524.     5855.     3266.     2540.     2845.      576.   1130.00
       .58      4.01      5.82      4.54      .045      .045      .045      .039   1127.00   8666.51
   .001889      350.      360.      400.         2         0         0      0.00   2451.24  11117.75

FLOW DISTRIBUTION FOR SECNO=     18.20          CWSEL=   1137.79

STA=    8667.     8700.     9320.     9620.     9800.    10000.    10400.    10610.    10660.    11118.
  PER Q=       .2      18.7       9.0       2.6      12.9      35.2      17.1       2.1       2.1
   AREA=     46.7    2660.5    1287.3     502.4    1358.2    3266.5    1636.1     264.6     638.8
    VEL=      1.8       3.8       3.8       2.8       5.1       5.8       5.6       4.3       1.8
```

SOIL TEST REPORT

BY

ENGINEERS TESTING LABORATORIES, INC.

ENGINEERS TESTING LABORATORIES, INC.
3737 EAST BROADWAY ROAD • P.O. BOX 21387 • PHOENIX, ARIZONA 85036
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RECEIVED DEC 24 1980

PRC Toups
4131 North 24th Street
Phoenix, Arizona 85016

22 December 1980

Attention: Mr. Ashok C. Patel, P.E.
Project Manager

Job No. 2120J373
Inv. No. 21200519

Project: River Scour Investigation
Agua Fria River south of Grand Avenue
El Mirage, Arizona

Attached, herewith, are the results of the test pits and materials properties tests on recovered samples performed for the above-mentioned project.

If there are any questions regarding the attached data, please do not hesitate to contact us.

Respectfully submitted,
ENGINEERS TESTING LABORATORIES, INC.
Geotechnical Services

REGISTERED PROFESSIONAL ENGINEER CERTIFICATE 12359 THOMAS C. ANDERSON Date Signed 12-22-80 ARIZONA, U.S.A.

Thomas C. Anderson, P.E.
/jm
copies to: Addressee (3)

Type of Material: River Bed Deposits — Job No. 2120J373

Source of Material: Agua Fria River, S. of Grand Ave., El Mirage, AZ

Test Procedure: ASTM D422, D424 — Tested/Calc. By: MS — Date: 12-16-80

Reviewed By: TB — Date: 12-18-80

Hole No.	Location	Depth	Classification		LL	PI	Sieve Analysis - Accum % Passing													
			AASHTO	Unified			200	100	40	16	10	4	¼	⅜	¾	1	1½	2	3	
1	TP-1	0-1'		SP			1.0	4	69	96	99	99	100							
1	TP-1	1-5'		GW-SW			0.5	1	21	37	42	48	50	54	62	67	75	82	91	4"/100
2	TP-2	0-3'		GM			24.3	25	31	39	46	51	55	60	73	79	86	92	94	4"/100
2	TP-2	3-4'		SC	32	13	36.4	50	67	81	86	94	96	98	100					
2	TP-2	9-12'		GW	23	NP	3.5	4	8	19	27	41	45	51	66	72	100			
3	TP-3	0-2'		SP			2.0	8	38	69	74	79	80	82	85	85	85	100		
3	TP-3	8-11'		SW			2.0	5	26	53	60	68	71	76	85	90	96	100		

TABULATION OF TEST RESULTS

SOIL CLASSIFICATION AND LEGEND

COARSE-GRAINED SOIL

MORE THAN 50% LARGER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISONS
	GW	WELL-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size.
	GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% - 200 FINES	
	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% - 200 FINES	
	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, MORE THAN 12% - 200 FINES	
	SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	SANDS More than half of coarse fraction is smaller than No. 4 sieve size.
	SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% - 200 FINES	
	SM	SILTY SANDS, SAND-SILT MIXTURES MORE THAN 12% - 200 FINES	
	SC	CLAYEY SANDS, SAND-CLAY MIXTURES MORE THAN 12% - 200 FINES	

FINE-GRAINED SOIL

MORE THAN 50% SMALLER THAN 200 SIEVE SIZE

Symbol	Letter	DESCRIPTION	MAJOR DIVISIONS
	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	SILTS AND CLAYS Liquid limit less than 50
	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	
	OL	ORGANIC SILTS AND ORGANIC SILT-CLAYS OF LOW PLASTICITY	
	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	SILTS AND CLAYS Liquid limit greater than 50
	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	
	PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

NOTE — Soils with 5 to 12 percent minus 200 fines should be classified with dual symbols

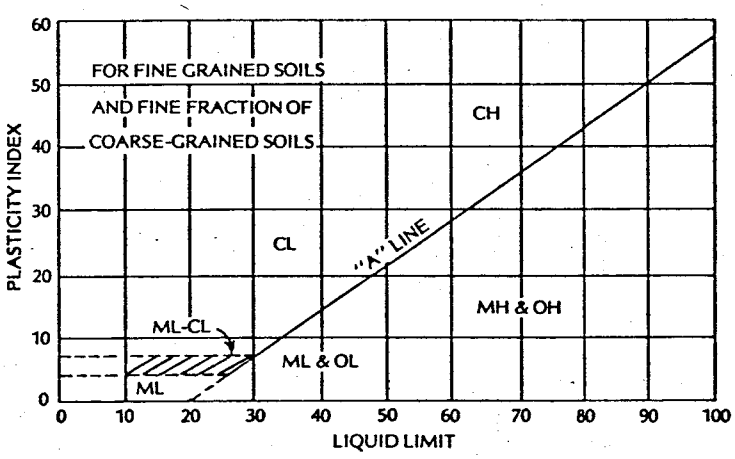
SOIL FRACTIONS

Component	Size Range
Boulders	Above 12 in.
Cobbles	3 in to 12 in.
Gravel	3 in. to No. 4 sieve
Coarse Gravel	3 in. to ¾ in.
Fine Gravel	¾ in. to No. 4 sieve
Sand	No. 4 to No. 200
Coarse	No. 4 to No. 10
Medium	No. 10 to No. 40
Fine	No. 40 to No. 200
Fines (silt or clay)	Below No. 200 sieve

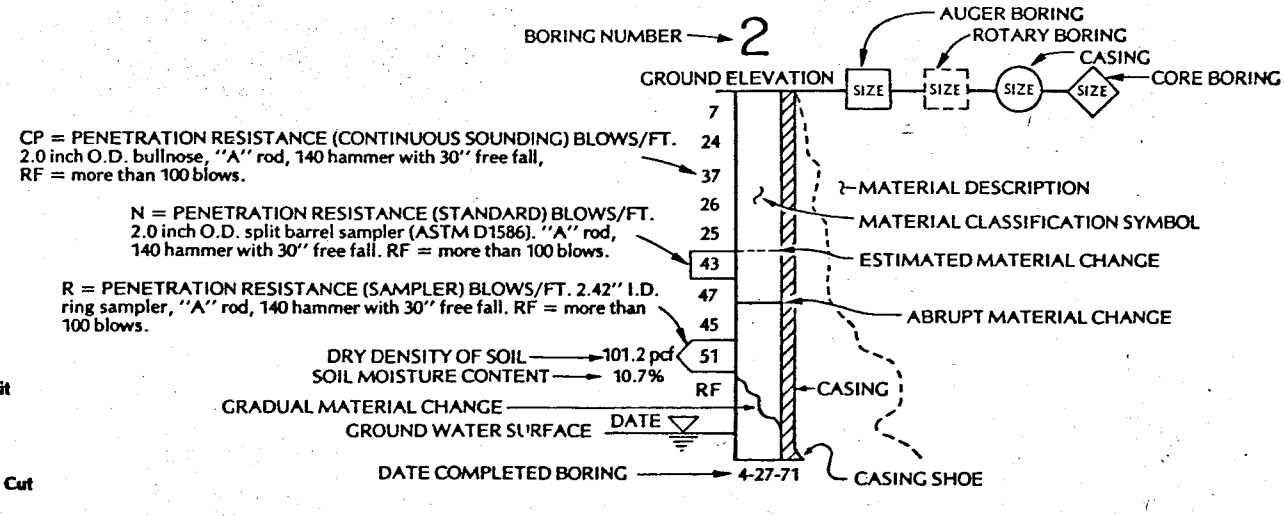
Soil Classification: ASTM D2487

Classification is visual unless accompanied by mechanical analysis and Atterberg limits. Percentage shown on log denotes visual approximation ± 5%.

PLASTICITY CHART



LEGEND OF BORING OPERATIONS



Sample Type

- **R** Ring
- **T** Shelby Tube
- **S** Standard Split Barrel
- **B** Block
- **G** Grab
- **C** Cutting
- **V** Vertical Face Cut

E

SOIL BORING DATA

Location of Boring: Agua Fria River Scour No.: TP-1 Job No.: 2120J373

Elev. Top of Hole: Datum: Prepared By: BS Date: 12-12-80

Type/Size of Boring: Backhoe Date: 12-12-80 Driller: EE Reviewed By: TCA Date: 12-18-80

Depth Ft.	Penetration Resistance Blows/Ft. C	Penetration Resistance Blows/Ft. N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size, In.	Particle Size Distribution % Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation Well Med. Poor	Grain Shape Angular Subangular Rounded Subrounded	Relative Density Low Med High	Dry Strength None Very Low Low Medium High Very High	Plasticity None Low Medium High	Consistency Soft Firm Stiff Very Stiff Hard	Cementation None Light Moderate Heavy
1					moist		Poorly graded sand, trace	SP	½"			Tr	100	Tr	x	xxx	x	x	x		x
2							fine gravel.														
3					wet		Well graded gravel, some	GW	10"		20	50	30	Trx		xx	xxx	x	x		x
4							sand & cobbles.														
5																					
6							Clayey lense @ 6'														
7							Trace reddish brown clay												x		
8							below 6'														
9																					
10																					
1																					
2																					
3									+12"								x				
4																					
5																					
6																					
7							Stopped @ 15'														
8							No groundwater table														
9							encountered														
20																					
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Agua Fria River Scour No. TP-2 Job No. 2120J373

Elev. Top of Hole: ____ Datum: ____ Prepared By: BS Date: 12-12-80

Type/Size of Boring: Backhoe Date: 12-12-80 Driller: EE Reviewed By: TCA Date: 12-18-80

Depth Ft.	Penetration Resistance Blows/Ft. C	N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size. In.	Particle Size Distribution % Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation Well Med. Poor	Grain Shape Angular Subangular Rounded Subrounded	Relative Density Low Med High	Dry Strength None Very Low Low Medium High Very High	Plasticity None Low Medium High	Consistency Soft Firm Stiff Very Stiff Hard	Cementation None Light Moderate Heavy
1					wet		Gravel & sand, some cobbles	GW	6"		10	50	30	Tr	x	xx	x	x	x		x
2											20	60									
3																					
4					+PL		Silty clay, some sand, dark	CL/ML	½"			Tr	25	75	x	x x		x	x	x	x
5							brown						35	85							
6					wet		Well graded sand & gravel w/	GW	10"		20	50	30	Tr	x	xx	xx	x	x		x
7							trace clay; some cobbles														
8																					
9																					
10							Below 8', cobbles increase,		+12"	10	40	30	20	Tr			x				
1							some boulders, hard digging														
2																					
3																					
4																					
5																					
6																					
7							Stopped @ 15'														
8							No groundwater table														
9							encountered														
20																					
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

E

SOIL BORING DATA

Location of Boring: Agua Fria River Scour No. TP-3 Job No. 2120J373

Elev. Top of Hole: Datum: Prepared By: BS Date: 12-12-80

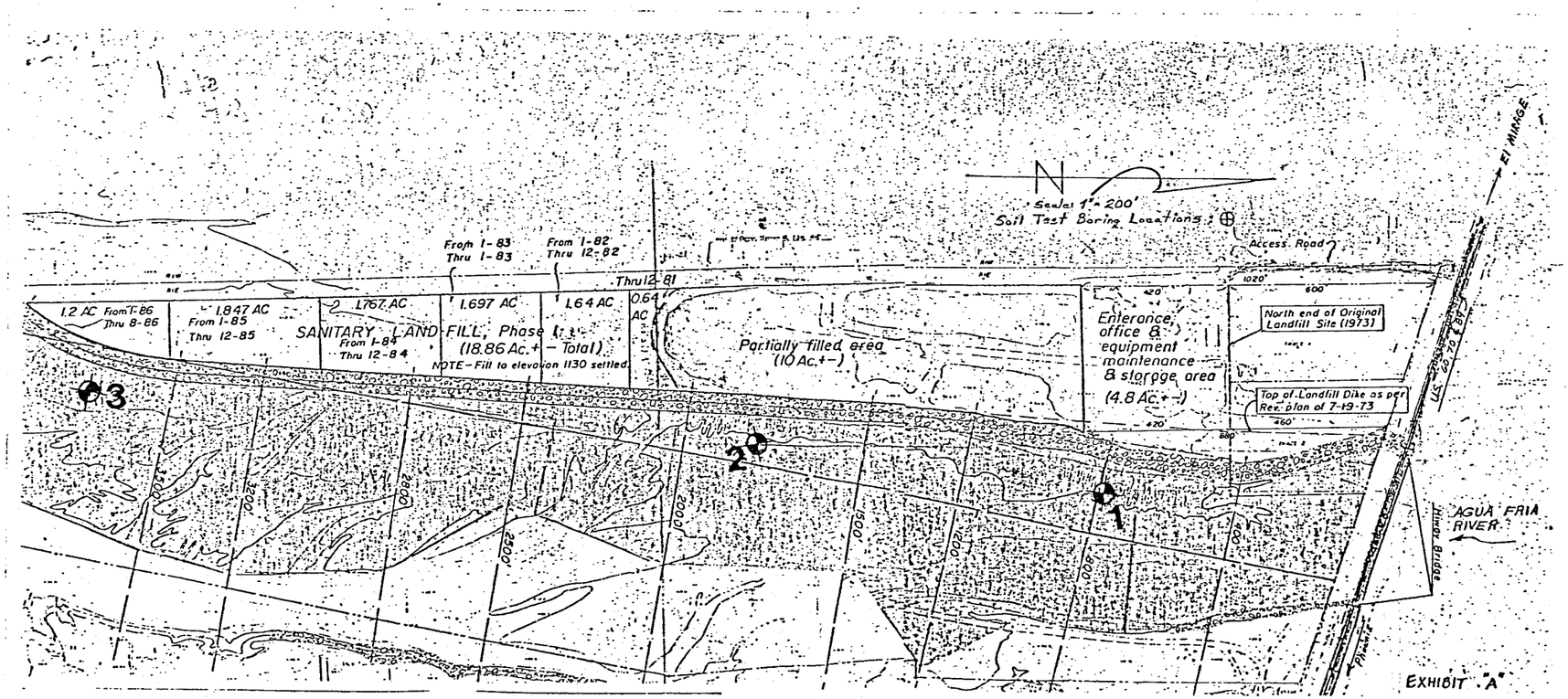
Type/Size of Boring: Backhoe Date: 12-12-80 Driller: EE Reviewed By: TCA Date: 12-18-80

Depth Ft.	Penetration Resistance Blows/Ft. C	N	Sample Type	Dry Density pcf	Moisture Content	Graphical Log	Description	Soil Classification	Max. Size, In.	Particle Size Distribution % Boulders	Cobbles	Gravel	Sand	Silt & Clay	Gradation Well Med. Poor	Grain Shape Angular Subangular Rounded Subrounded	Relative Density Low Med High	Dry Strength None Very Low Low Medium High Very High	Plasticity None Low Medium High	Consistency Soft Firm Stiff Very Stiff Hard	Cementation None Light Moderate Heavy
1					dry		Poorly graded sand, trace-	SP	2"			5	95	Tr	x	xxx	x	x	x		x
2							some gravel; predominantly					15	85								
3							medium sand; lenses of de-														
4							posited gravel @ 1', 2.5',														
5							3.5', 7' and 9'. Color change														
6							below 3.5'. Some roots below		6"		Tr										
7							3.5', cobbles below 5'.														
8																					
9					moist										x						
10																					
1																					
2							Trace reddish brown clay														
3							below 12'.														
4																					
5																					
6																					
7							Stopped @ 15'														
8							No groundwater table														
9							encountered														
20																					
1																					
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
30																					

NOTE: THE DATA PRESENTED ON THESE BORING LOGS REPRESENTS SUBSURFACE CONDITIONS ONLY AT THE SPECIFIC TEST LOCATIONS AND AT THE TIME DESIGNATED. THIS DATA MAY NOT REPRESENT CONDITIONS AT OTHER LOCATIONS AND/OR TIMES. THIS BORING DATA WAS COMPILED PRIMARILY FOR DESIGN PURPOSES. THIS DATA SHOULD NOT BE CONSTRUED AS PART OF THE PLANS GOVERNING CONSTRUCTION OR AS DEFINING CONSTRUCTION TECHNIQUES.

Job No. 2120J373

SITE PLAN/TEST BORING LOCATION



PLATES

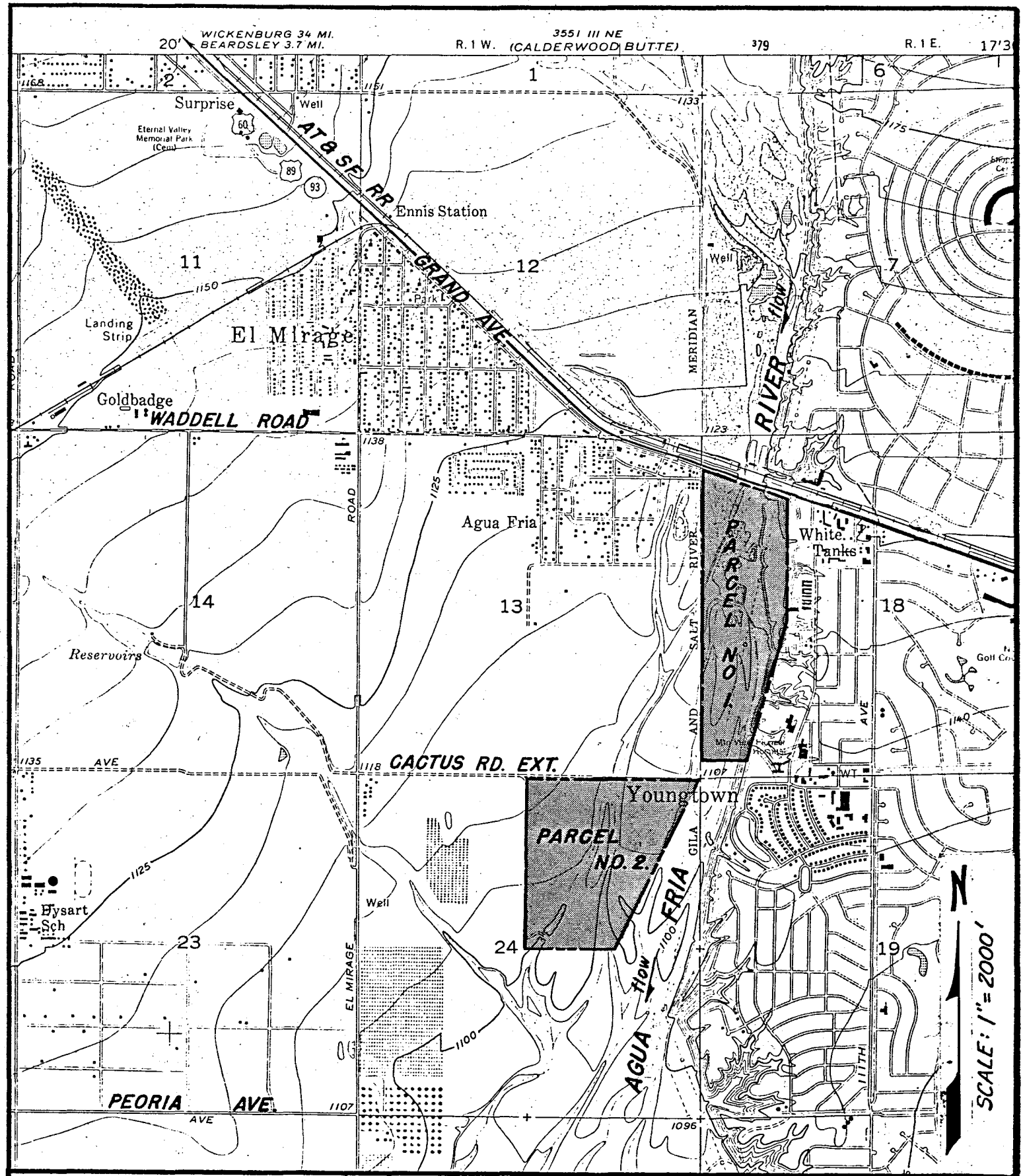
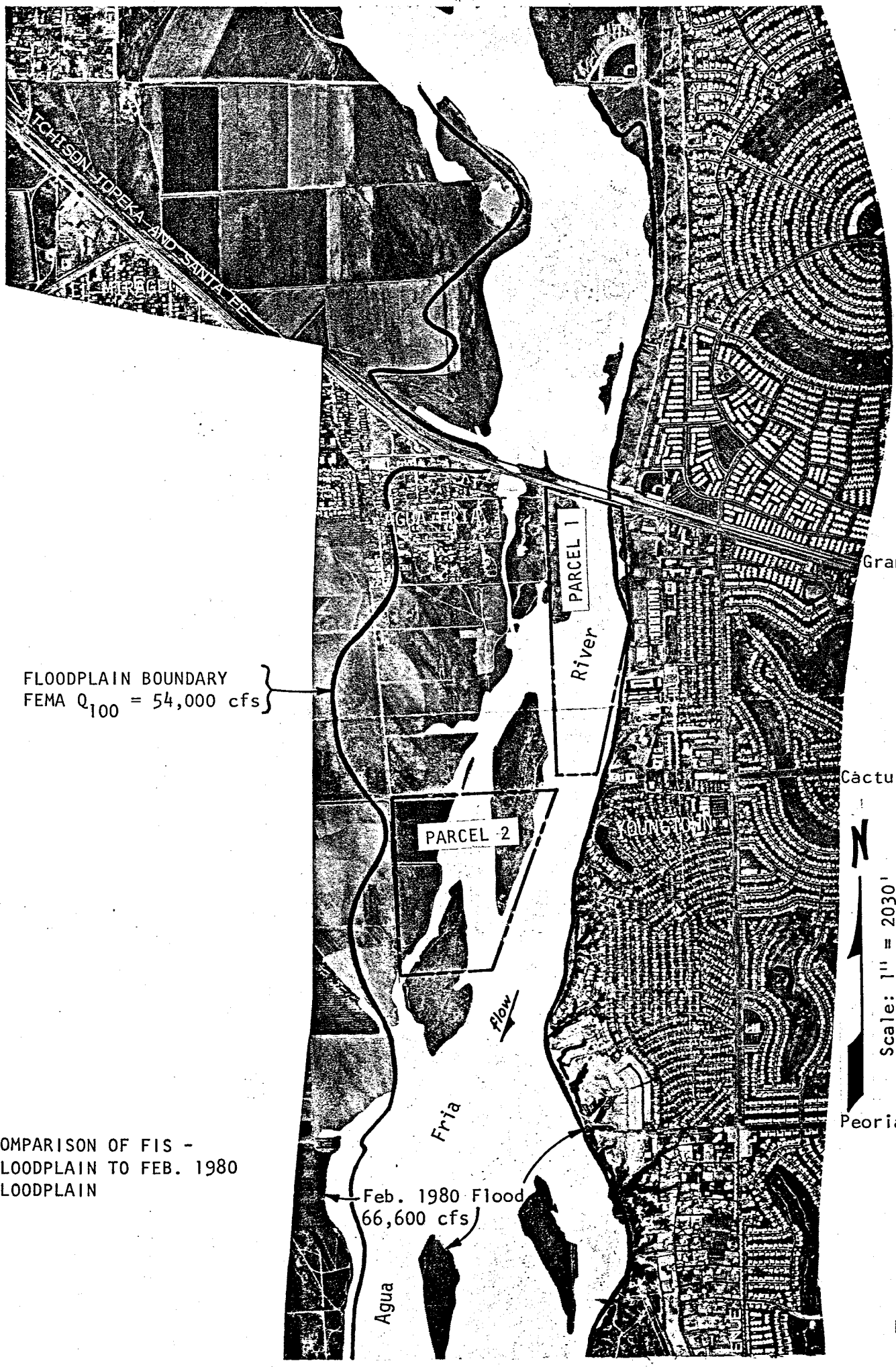


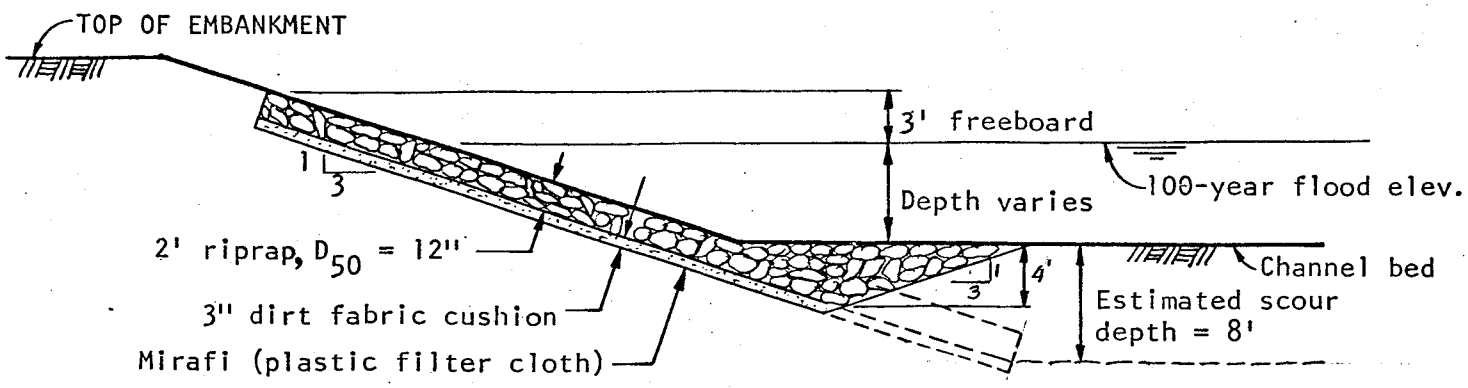
PLATE 1

LOCATION MAP



COMPARISON OF FIS - FLOODPLAIN TO FEB. 1980 FLOODPLAIN

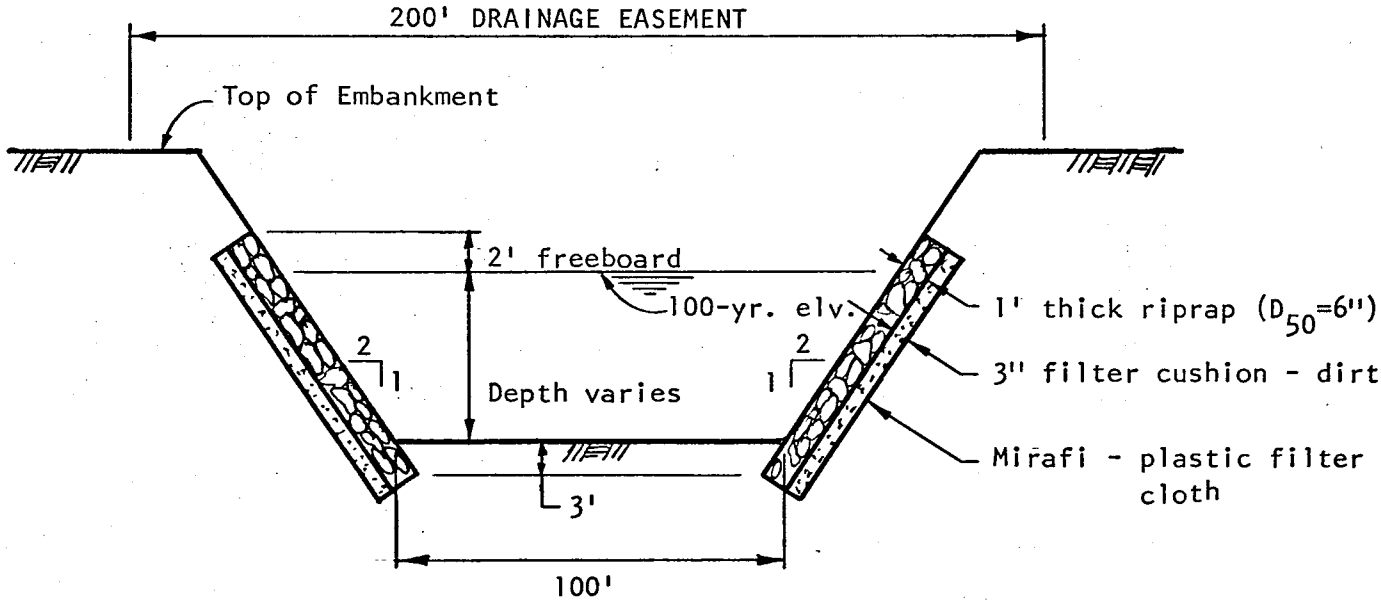
PLATE 2



TYPICAL CROSS-SECTION

AGUA FRIA RIVER - MAIN CHANNEL

SECTION X-X

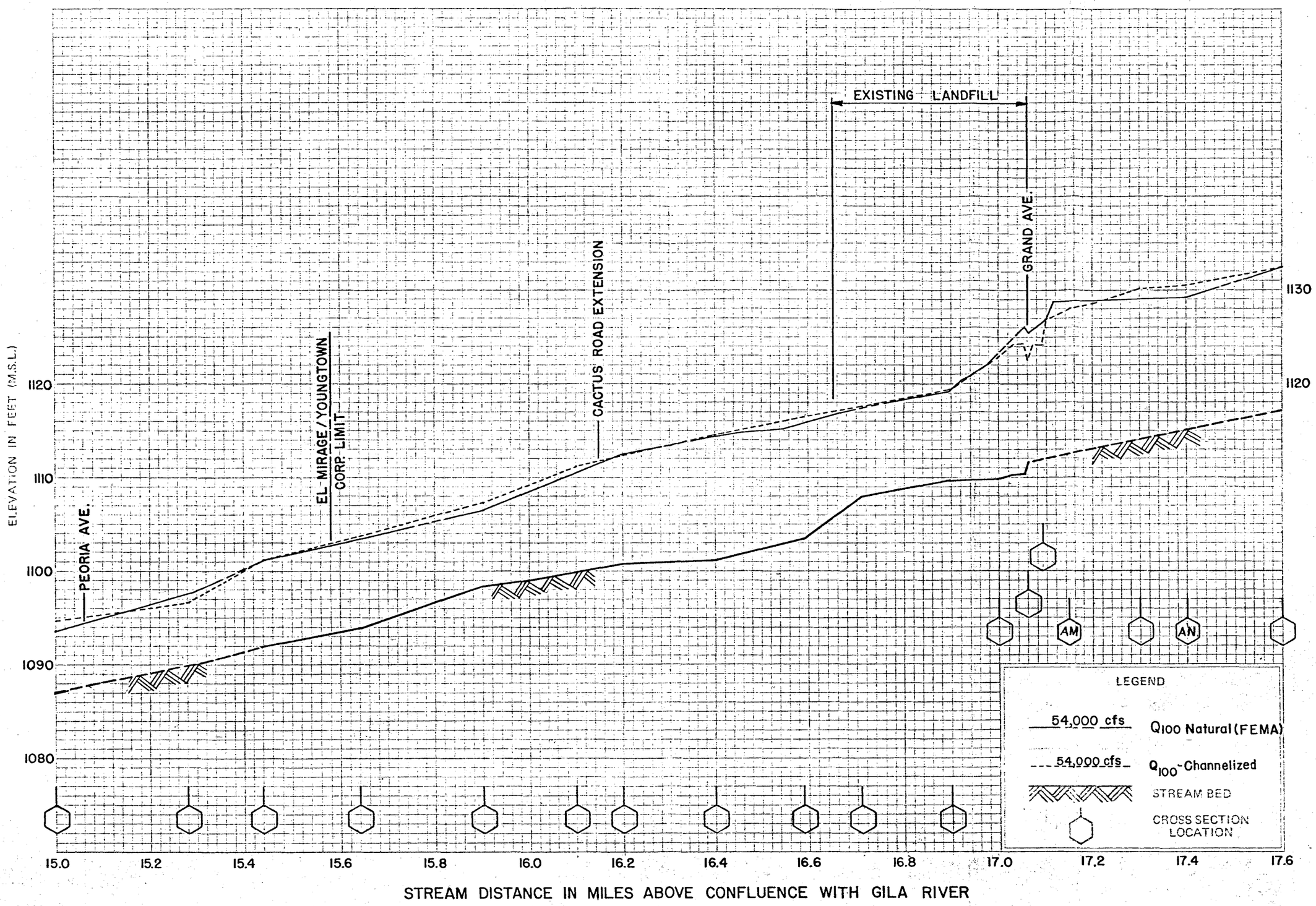


TYPICAL CROSS-SECTION

SIDE CHANNEL

SECTION Y-Y

PROPOSED BANK PROTECTIONS
TYPICAL CROSS-SECTIONS
PLATE 3



AGUA FRIA RIVER-FLOOD PROFILES

EL MIRAGE INDUSTRIAL LANDFILL

EL MIRAGE
MARICOPA COUNTY, AZ.

PLATE 4

AGUA FRIA RIVER

PARCEL NO 1

PARCEL NO 2

115 th AVE.

250' FUTURE DRAINAGE EASEMENT (BY OTHERS)

100' DRAINAGE EASEMENT

FLOODWAY LIMIT LINE F.I.S. - 1978 (PRESENT)

FLOODWAY LIMIT LINE F.I.S. 1978

FLOOD BOUNDARY LINE

GILA AND SALT RIVER MERIDIAN

R.I.E. R.I.W.

WADDELL ROAD

CACTUS ROAD EXTENSION

PEORIA AVENUE

GRAND AVENUE

A.T.&S.F. RR.

flow

17.60 17.40 17.30 17.20 17.15 17.06 17.05 17.03 17.00 16.90 16.71 16.59 16.40 16.20 16.10 15.90 15.64 15.44 15.28 15.00

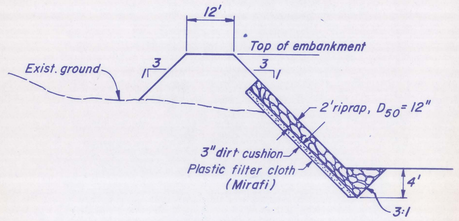
Scale: 1" = 400'

LEGEND

BRIDGE CROSSING

TOE OF SLOPE
CHANNEL SIDE SLOPE
TOP OF SLOPE

16.40 CROSS SECTION LOCATION
10,000 REFERENCE (HEC-2 PROGRAM)



SECTION W-W
(LOOKING UPSTREAM)
NTS

NOTES:

1. Present floodway limit line (F.I.S.-1978) shown will be moved to the limits of shaded area once the channelization has been accomplished.
2. For cross sections X-X and Y-Y see Plate 3.

MAPPING SOURCE:

1. Dibble And Assoc. (1965 - for M.C.F.C.D.) (4' Contour interval)
2. Kenney Aerial Mapping Inc. (1980-Ramsey) (2' Contour interval)

PROPOSED LAND OPERATION FLOODPLAIN MAP EMBANKMENT LIMITS

DRAFTSPERSON: L.J.C.	REVISIONS BY	DATE	PRC Toups Corporation — A Planning Research Company, 4131 North 24th Street, Phoenix, Arizona 85016, Telephone (602) 954-9191
DESIGNER: A.C.P & G.A.S.	△		
PROJECT SUPERVISOR: A.C.P.	△		EL MIRAGE LANDFILL
SURVEY SUPERVISOR:	△		AGUA FRIA RIVER
PROJECT MANAGER: W.C.S.	△		
	DATE: JAN. 16, 81		JOB NO. 1831-602 — PLATE 5

FILE H 407

EXCEPTION TO EXCAVATED AREA

PARCEL NO 1

Elev. 1109.5

LIMITS OF CHANNEL EXCAVATION (425,000 cu.yd.)

Elev. 1108

Elev. 1108

AGUA FRIA RIVER

flow

115 th AVE. AVENUE

GILA AND SALT RIVER MERIDIAN

R1E R1W

PROPOSED FLOODWAY AND FLOODPLAIN LIMIT

FLOOD BOUNDARY LINE

FLOODWAY LIMIT LINE F.I.S. 1978

PARCEL NO 2

FLOODWAY LIMIT LINE F.I.S. 1978

FLOOD BOUNDARY LINE

PEORIA AVENUE

CACTUS ROAD EXTENSION

WADDELL ROAD

GRAND AVENUE

A.T.&S.F. RR.

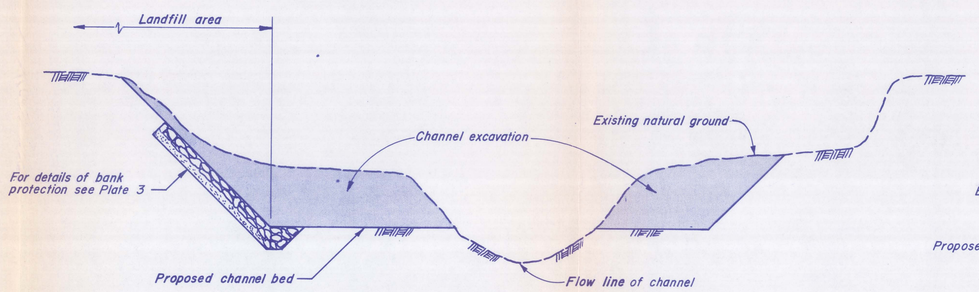
17.60 17.40 17.30 17.20 17.15 17.06 17.05 17.03 16.90 16.71 16.59 16.40 16.20 16.10 15.90 15.64 15.44 15.28 15.00

Scale: 1" = 400'

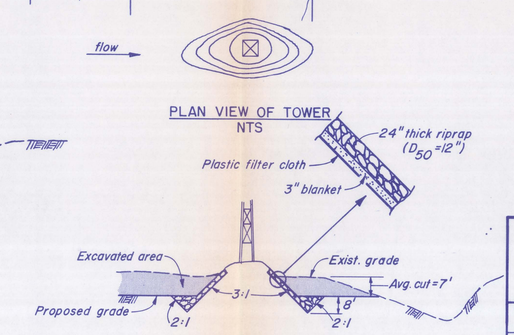
LEGEND

BRIDGE CROSSING

Elev. 1108 FINISHED CONTOUR IN EXCAVATED AREA



(LOOKING UPSTEAM)
SECTION Z-Z
TYPICAL CHANNEL CROSS SECTION
NOT TO SCALE



(LOOKING UPSTREAM)
TYPICAL SECTION
NEAR POWER LINE TOWER
NOT TO SCALE

MAPPING SOURCE:

1. Dibble And Assoc. (1965 – for M.C.F.C.D.) (4' Contour interval)
2. Kenney Aerial Mapping Inc. (1980 – Ramsey) (2' Contour interval)

PROPOSED LAND OPERATION FLOODPLAIN MAP
CHANNEL EXCAVATION LIMITS

DRAFTSPERSON	L.J.C.
DESIGNER	A.C.P. & G.A.S.
PROJECT SUPERVISOR	A.C.P.
SURVEY SUPERVISOR	
PROJECT MANAGER	W.C.S.

REVISIONS		
	BY	DATE
1		
2		
3		
4		
5		

DATE JAN. 16, 81

PRC Toups Corporation

A Planning Research Company
4131 North 24th Street, Phoenix, Arizona 85016
Telephone (602) 954-9191

EL MIRAGE LANDFILL
AGUA FRIA RIVER

JOB NO. 1831-602

PLATE 6

FILE 11407