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July 30, 1999

Mr. Scott Lyle
Nolte Associates, Inc.
15090 Avenue of Science, Suite 101
San Diego, CA 92128

Dear Scott:

Subject : Gregory Canyon Bridge on the San Luis Rey River

This letter was prepared as a supplement to the report "Fluvial Study and Bridge Scour Analysis for the Proposed Gregory Canyon Bridge on the San Luis Rey River". In the report, the total scour including general scour and local scour at the bridge crossing was computed and provided. In addition, it was shown that the proposed bridge has no significant scour effects on the First San Diego Aqueduct.

In the report, the bridge span of 570 feet was used. Under this long span, the bridge will have minimum effects on flood flow and sediment transport in the river channel. The initial bridge span has now been extended to 638 feet. The new span is longer and it therefore should have even less impacts on the flood flow and sediment transport. In other words, it should have no significant scour effects on the First San Diego Aqueduct. The total scour at the bridge with the new span should be no greater than that computed for the previous span.

Please let me know if you have any questions regarding this matter.

Sincerely yours,

Howard H. Chang
Ph.D., P.E.

Fluvial Study and Bridge Scour Analysis for the Proposed Gregory Canyon Bridge on the San Luis Rey River

Prepared for
Nolte Associates, Inc.
15090 Avenue of Science, Suite 101
San Diego, CA 92128

by
Howard H. Chang, Ph.D., P.E.
November 1999

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GLOSSARY OF TERMS

Aggradation: A rise in channel bed elevation, usually caused by sediment deposition.

Alluvial: Relating to, composed of, or found in alluvium

Bank protection: A structure placed on a river bank to protect the bank against erosion. Such structures are usually made of riprap stones, revetments, dikes, etc.

Bed load: That part of the sediment load that travels in contact with the bed by rolling, sliding and saltation. It is also the coarser portion of the sediment load.

Channel reach: Any stretch of the channel.

Channelization: To make a channel.

Cross sections: Channel sections that are perpendicular to the flow direction that are used to define the river channel geometry for a river study.

Degradation: A lowering of the channel-bed elevation usually caused by erosion.

Drainage basin: A surface area from which rainfall drains toward a single point.

Drop structure: A rigid structure erected across a river channel through which there is a drop in channel-bed elevation.

Erodible boundary model: A model that considers the changes in channel boundary, including channel-bed scour and fill, changes in channel width and changes related to channel curvature.

Erodible bed model: A model that only considers the changes in channel-bed level by assuming that channel width does not change.

Field calibration: The correlation of modeling results using field data. It usually involves fine adjustments of certain parameters used in modeling to improve the correlation.

Flood hydrograph: A relationship showing how the flood discharge varies with time during its occurrence.

Fluvial processes: Processes that are caused by stream action, including sediment transport, flood flow, erosion, deposition, and river channel changes.

Grade control structure: A rigid structure constructed across a river channel used to stabilize the bed elevation at the location. A drop structure is also a grade control structure.

Head cutting: Channel-bed erosion occurring upstream of a sand or gravel pit or any other depression.

Model: For this study, a model is a computer software developed to simulate the hydraulics of flow, sediment transport and river channel changes.

Pit capture: A stream is diverted from its normal course into a pit of lower elevation

Scour (general and local): Erosion or removal of material caused by stream action. General scour is caused by the imbalance (non-uniformity) in sediment transport along a river channel. Local scour is caused by any local obstruction to flow, such as bridge piers, abutments, tree trunks, etc.

Sediment delivery: The cumulative amount of sediment that is delivered passing a river section in a specified period of time.

Sediment transport/replenishment: Sediment transport is the movement of sediment by flow measured usually in volume or weight per unit time. Replenishment is sediment supply to make up any previous deficit.

Study channel reach: A river channel reach that is covered in a study. Such a reach is defined by a series of cross sections taken along the channel.

Suspended load: Sediment load that travels in suspension, consisting of the finer portion of the transported sediment.

Tractive force: The force exerted by the flow on the channel boundary or on any object in the river channel, usually measured in force per unit surface area.

EXECUTIVE SUMMARY

This report was prepared for Nolte Associates, Inc. for a fluvial study of the San Luis Rey in San Diego County. A road and bridge that cross the river at Gregory Canyon have been proposed. The proposed bridge has a span of 570 feet, supported on five sets of 4-foot columns. The crossing is located at about 500 feet downstream of the First San Diego Aqueduct. The purposes of this study were: (1) to provide information on general scour and local scour for bridge design, and (2) to evaluate the impacts of the proposed road and bridge on the First San Diego Aqueduct as well as the San Luis Rey River. In this study, general scour was simulated by mathematical modeling of the 6-mile study reach using the FLUVIAL-12 model. All major causes for scour, including hydraulic structures and sand and gravel mining in the river channel, were considered.

Mining Sites - General scour is affected by sand and gravel mining in the river channel. Major sand and gravel pits created by mining along the study reach include those of Padre/Pankey, J. W. Sand and Materials, H. G. Fenton Materials. At this time, mining operations by Padre/Pankey and J.W. have ceased. The sand and gravel pits created by these parties have been partially refilled during floods. The mining by Fenton is the only active operation within the study reach of the river channel. At the Fenton site, the deep excavation area in the floodplain is surrounded by levees to separate the area from the river channel. The high levee on the upstream side of the deep excavation is designed for the probable maximum flood but the low levee on the downstream side is designed for the 10-yr flood. Floods that are greater than the 10-yr flood will still flow into the deep excavation area by overtopping the low levee. In addition, a new excavation on the downstream side of the low levee is in the river channel and this pit will therefore trap bed sediment during future floods. The new excavation has an estimated depth of 30 feet.

Scope of Mathematical Modeling - The scope of mathematical modeling was devised to cover two flood conditions, the possibility of pit capture, and the respective cases before and after the Gregory Canyon Bridge/Road project. The flood conditions include: (1) the 100-yr flood and (2) the flood series that may be expected in a 100-yr time span. Short term changes were computed using the 100-yr flood. Long term impacts were simulated using the flood series that can be expected in a 100-yr time span. The low levee at the Fenton site will be overtopped by floods

greater than the 10-y flood. Overtopping may result in pit capture. Two scenarios: pit capture and no pit capture were included in the study. For the pit capture scenario, it was also assumed that bed sediment would enter the deep excavation at the Fenton site, and sediment supply to the downstream channel would thus be cut off.

Simulation of Sediment Delivery - Sediment delivery is defined as the cumulative amount of sediment that has been delivered passing a certain channel section for a specified period of time. The spatial variation of sediment delivery depicts the erosion and deposition along a stream reach. Without pit capture, the simulated spatial variations in sediment delivery depict sediment deposition at the smaller Fenton pit and erosion along the stream reach downstream of this pit. With pit capture, the spatial variations in sediment delivery indicate continued erosion along the channel reach downstream of the Fenton site. The spatial variations in sediment delivery for the cases before and after the bridge project are closely similar in pattern; their differences are insignificant. This indicates that the proposed Gregory Canyon Bridge project has insignificant effects on sediment delivery through the river channel.

Changes in Longitudinal Channel-Bed Profiles - Changes in longitudinal channel-bed profiles were simulated for all case scenarios. Such changes are generally characterized by refill of the sand and gravel pits and channel-bed degradation outside the pits. Without pit capture, the existing channel-bed profile has a 30-foot depression, representing the existing Fenton pit outside the levees. This pit is simulated to be refilled by the 100-yr flood or the flood series.

The results based on the 100-yr flood show that changes in bed elevation at the bridge and aqueduct crossings are limited. However, general channel-bed degradation is substantial downstream of river mile 20.8 for these cases. This degradation development is closely related to the previous mining by J. W. Sand located downstream, from river mile 18.8 to river mile 19.6. The results also show that the channel bed near the bridge and aqueduct crossings undergoes greater scour during the flood series. For the case with pit capture, the results show general channel-bed degradation along the channel breach between the J. W. mining site and the Fenton mining site (from river mile 19.4 to river mile 21.4). This degradation is substantial and it is primarily related to the cut-off of sediment supply due to pit capture.

Changes in longitudinal channel-bed profiles are presented for the cases before and after the bridge project; their differences are insignificant. It may therefore be concluded that the proposed bridge project will have insignificant effects on the changes in longitudinal channel-bed profile.

Changes in Cross-Sectional Profile at Proposed Bridge Crossing - Cross-sectional changes at the bridge crossing were simulated. The simulated general scour based on the 100-yr flood is limited; it is also limited based on the flood series without pit capture. For the case of flood series and pit capture, the cross-sectional changes are very substantial. The minimum bed elevation reached by scour for this case is 286 feet (NGVD).

Potential Scour at Aqueduct Crossing and Evaluation of Pipeline Stability - Cross-sectional changes at the aqueduct crossing were simulated for all case scenarios. It can be seen that the patterns of change for the respective cases before and after the bridge project are closely similar and their differences are insignificant. It may therefore be concluded that the proposed bridge project will have insignificant effects on the changes in cross-sectional profile at the aqueduct crossing. The maximum scour depth is represented by the minimum bed elevation reached by general scour. Simulated results on the minimum bed elevation are summarized in the table below for comparison. It can be seen that there is a small increase or decrease of the scour depth at the aqueduct crossing associated with the bridge project. Such changes are less than 1 foot. The FLUVIAL-12 model employs a finite difference scheme and its accuracy on scour depth prediction is limited to1 foot. For this reason, the differences on the predicted maximum scour depths between the cases with and without the bridge project are not significant in consideration of modeling accuracy.

Pipelines buried under a stream bed must always stay beneath the ground cover. If any segment of a pipeline is subject to exposure by potential stream bed scour, it is considered inadequate since a buried pipeline is usually not designed to support itself. Stream bed scour consists of general scour and local scour. The depths of general scour were simulated in mathematical modeling. Local scour may be caused by any local obstruction to flow, such as tree trunks, pipelines, manholes, pier supports, and abutments, etc. If a pipeline is exposed, then the pipeline itself becomes an obstruction to flow. Turbulence so created will usually result in additional local scour around the pipeline. In view of this local scour factor, the minimum ground cover of 6

feet below general scour is considered essential for the stability of a buried pipeline.

Comparison of maximum general scour depths and evaluation of pipeline stability

Case	Flood	Bridge project	Pit capture	Minimum elev. reached by scour, feet	Exposure of pipelines by general scour	Exposure of pipelines by total scour
1	100-yr	Before project	No	297.0	No	Yes
2	100-yr	After project	No	297.6	No	Yes
3	Series	Before project	No	288.5	Yes	Yes
4	Series	After project	No	288.3	Yes	Yes
5	100-yr	Before project	Yes	298.5	No	Yes
6	100-yr	After project	Yes	298.2	No	Yes
7	Series	Before project	Yes	279.7	Yes	Yes
8	Series	After project	Yes	281.1	Yes	Yes

The simulated results show that general scour alone will not reach the pipelines during the next 100-yr flood but it will reach the pipelines during the flood series. These findings are summarized in the table. The general scour during the 100-yr flood will be within 6 feet of the pipelines. In consideration of the total scour (general scour plus the local scour), it may be concluded that the pipelines are subject to exposure by potential scour under the current physical conditions of the San Luis Rey River before the bridge project. **The bridge project will not increase the scour potential for the aqueduct**. This finding is also included in the table.

Recommendations for Gregory Canyon Bridge Design - The bridge footings should be designed to safeguard against potential scour, which consists of general scour and local scour. General scour is provided by the FLUVIAL-12 simulation. Local scour may be caused by local obstructions to flow at the abutments and piers/bents. As a conservative measure, the simulated general scour for the case of flood series and pit capture is recommended for bridge design. The maximum general scour for this case is to reach the minimum bed elevation of 286 feet. Since the thalweg of the river channel may migrate laterally within the bridge opening, the maximum scour depth applies to all the bridge piers/bents. The magnitude of local scour around bridge piers/bents

was computed using the CSU formula. For the 5.5-foot circular columns, the local scour depth was computed to be 10.2 feet.

The maximum total scour at the bridge bents is the general scour plus the local scour. The total scour so computed is to reach the bed elevation of 276 feet. If footings are used, they should be located below the elevation of total scour. In the structural design for the bridge, the bents should be assumed to be exposed to the elevation of 276 feet.

Local scour at the abutments is directly related to the flow contraction at the bridge opening. At this time, there is no reliable method for computing the local scour at the abutments. The proposed bridge has a long span of 570 feet and it does not cause major contraction to flow. In consideration of this situation, the total scour depth at the abutments is assumed to be 276 feet.

Fluvial Study and Bridge Scour Analysis for the Proposed Gregory Canyon Bridge on the San Luis Rey River

I. INTRODUCTION

This report was prepared for Nolte Associates, Inc. for a fluvial study of the San Luis Rey (see Figs. 1 and 2) in San Diego County. A road and bridge that cross the river at Gregory Canyon have been planned; the alignment is along Sections 20.936 - 20.943 shown in Fig. 2. The section numbers are in river miles from the river mouth. The road and bridge crossing is about 500 feet downstream of the First San Diego Aqueduct. The proposed bridge has a span of 570 feet, supported on five sets of 4-foot columns. The bridge abutments have a 3 to 1 side slope.

A stream is the author of its own geometry. In the long term, the characteristics of a stream as described by its width, depth, slope, meandering pattern, etc. are delicately adjusted to provide a balance between its ability to transport and the water and sediment loads supplied from the watershed. The San Luis Rey River is a disturbed stream, primarily due to the dams and reservoirs, and sand and gravel mining. Mining activities have created several major pits in the stream bed. Because of these human activities, the natural equilibrium of the stream channel has been altered. This stream is expected to undergo changes during future floods. The purposes of this study were:
(1) to provide information on general scour and local scour for the bridge design, and
(2) to evaluate the impacts of the proposed road and bridge on the First San Diego Aqueduct as well as the San Luis Rey River.
All major causes for scour, including hydraulic structures and sand and gravel mining in the river channel, were considered.

II. DRAINAGE BASIN AND CHANNEL CHARACTERISTICS

The San Luis Rey River has its origin on Bucksnort Mountain in the Anza-Borrego Desert Park at the elevation of about 5,500 feet. Mean annual precipitation ranges from 11 to 30 inches,

increasing landward to higher elevations. Vegetation is dominated by chaparral, with some coastal sage brush and oak woodland. The river reach used in this study is from river mile 17.758, just above Interstate 15, to river mile 23.729 at Pala (see Fig. 1). The study river reach has a total length of about 6 miles. In the following, river channel characteristics including bed sediment, flood hydrographs, hydraulic structures, and existing mining sites are described.

Sediment Characteristics in the River Channel - The bed material in the study reach is a mixture of sand and gravel, with an insignificant amount of silt or other finer materials. Sediment samples were collected along the stream channel. The bed material along the river reach is fairly uniform with little changes along the 6 mile length. The dominant material is median sand which is highly transportable during floods. Vertical distributions of the alluvium were also obtained by the San Diego County Water Authority from previous boring tests. The sand layer in the river bed was found to extend well beyond the depth of the First San Diego Aqueduct. The predominant material on adjacent hillsides is decomposed granite. The California Division of Mines and Geology (1982) has studied the material under the river bed of the San Luis Rey River. The thickness of alluvium, predominantly sand and gravel, in the river bed extends well beyond the pipelines. The existence of a thick alluvium underlying the river bed is also confirmed by sand mining along the study reach. Many of the sand pits reached depths in excess of 50 feet. Good quality sand has been excavated from these deep pits. Therefore, it may be concluded that the river bed is erodible along the study reach including the aqueduct crossing.

Flood Hydrographs - Hydrographs for 100-yr floods along the study reach are shown in Fig. 3. These hydrological information and those for the 10-yr floods are obtained from a study by the County of San Diego (1974). A typical flood has relatively short duration with discharge rising and falling rapidly, as is characteristic of semi-arid areas. Sediment delivery rates in the river closely follow the flow pattern since water is the agent for sediment transport.

Studies of flood frequencies have also been made by the California Department of Water Resources and the Corps of Engineers. Their 100-yr flood magnitudes are generally similar to those obtained by the County. The County floods were used in the original flood plain mapping and they are used herein for Fluvial simulation. The peak discharges in cubic feet per second for various flood frequencies at several locations are tabulated below:

Location Conc. Point	Q100	Q50	Q25	Q10
Pumping station near Pala	27,800	16,000	8,800	3,300
Monserate Narrows	30,800	17,500	9,500	3,480
Upstream of Keys Canyon	33,781	19,500	10,500	3,891

The 100-yr and 10-yr floods in the above table are from the County report. From the 100-yr and 10-yr discharges, other discharges, such as the 25-yr and 50-yr discharges, may be obtained by a statistical analysis. For this purpose, the flood peaks are assumed to follow the log-probability distribution and then all the discharges at a concentration point are plotted on the same straight line. The 25- and 50-yr floods thus obtained are included in the above table.

Hydraulic Structures - Major hydraulic structures in the study reach that may affect sediment transport and channel changes are described in the following:

(1) New bridge at Shearer crossing - This structure, located at river mile 18.46, was constructed in 1998 based on a design by the County of San Diego. The bridge has a limited span of 150 feet which has the capacity to pass the 28-yr flood. The bridge is subject to overtopping during the 100-yr flood. Prior to the bridge, the Shearer crossing was a dip crossing and it was considered disposable, i.e., erodible.

(2) New bridge at Couser Canyon - This structure, located at river mile 19.91, was designed and constructed by the County of San Diego in 1993. This bridge has a limited span of 180 feet which has the capacity to pass the 25-yr flood. The bridge is subject to overtopping during the 100-yr flood.

(3) Bank protection near Shearer crossing - A short channel reach near Shearer crossing has been channelized with concrete bank protection. This bank protection is assumed non-erodible in the study.

Sand and Gravel Mining in the San Luis Rey River - Major sand and gravel pits created by mining along the study reach include those of Padre/Pankey, J. W. Sand and Materials, H. G. Fenton Materials. Their respective locations in river miles are given below:

Padre/Pankey mining:	River mile 17.7 to river mile18.2
J.W. mining:	River mile 18.8 to river mile 19.6
Fenton mining:	River mile 21.2 to river mile 21.9

At this time, mining operations by Padre/Pankey and J.W. have ceased. The sand and gravel pits created by these parties have been partially refilled during floods.

The mining by H. G. Fenton Material Company, Inc. is the only active operation within the study reach of the river channel. The Fenton mining plan in the San Luis Rey River and its modifications were prepared by Rick Engineering. The modified plan as shown in Fig. 2 includes a bypass channel through the southeastern portion of the floodplain. This bypass channel is separated from the deep excavation site by a levee. The original levee was designed to surround the entire deep excavation site as a protection for the probable maximum flood. Because of environmental problems, the original levee design was later modified. Under the modified plan, the upstream portion of the levee has been constructed to the original standard, but the downstream portion of the levee has been reduced in height. The reduced levee will prevent the 10-yr flood from entering the excavation site but those greater than the 10-yr flood will overtop the reduced levee. The original levee on the upstream side shall be referred to as the high levee and the reduced levee shall be referred to as the low levee, respectively

In addition to levee modification, there is a new excavation on the downstream side of the reduced levee as shown in Fig. 2. The new excavation site is not separated from the river channel and it will therefore trap bed sediment during future flood events. The new excavation has an estimated depth of 30 feet.

Cross-Sectional Data - The study river reach for the San Luis Rey River is defined by a series of cross sections along the channel. The 1992 survey sponsored by the San Diego County Water Authority was used as the basis for the cross-sectional data. The short river reach near Shearer crossing was later surveyed by the County for the new bridge at Shearer crossing. The short river reach from river mile 20.811 to river mile 21.093 was recently surveyed by Nolte for the Gregory Canyon Bridge project. These updated survey data were incorporated into the data set.

III. GENERAL SCOUR AND LOCAL SCOUR

Stream channel scour consists of general scour and local scour. General scour is related to the sediment supplied to and transported out of a channel reach, and local scour is due to any local obstruction to flow, such as by tree trunks, bedform, pipelines, pier supports and abutments.

To determine the general scour, it is necessary to consider the sediment supply to the channel reach and sediment removal out of the reach. Sediment delivery in the river channel is related to the flood hydrograph, channel geometry, and sediment characteristics, etc. Instream gravel mining and hydraulic structures alter the channel-bed configuration and therefore affect sediment delivery and erosion pattern. To account for these factors, it will require mathematical modeling of the hydraulics of stream flow, sediment transport and stream channel changes. To incorporate the effects of channel geometry, channel alterations, and hydraulic structures, the study reach of the stream channel as shown in Fig. 1 covers a channel length of about 6 miles.

In this study, general scour was simulated by mathematical modeling of the study reach, reflecting sediment transport and channel geometry. The general scour so obtained includes the following effects.

(1) Imbalance in sediment transport related to channel geometry, levees, bridges, road crossings, etc.

(2) Contraction scour - Contraction scour occurs at channel contractions, such as narrow sections, bridge openings, channelized reaches, etc.

IV. MATHEMATICAL MODELING USING FLUVIAL-12

The computer model FLUVIAL-12 (Chang, 1988) has been formulated and developed since 1972 for water and sediment routing in natural and man-made channels. The combined effects of flow hydraulics, sediment transport and river channel changes are simulated for a given period of flow. While this model is for erodible channels, physical constraints, such as bank protection, grade-control structures and bedrock outcroppings may also be specified. Applications of this model include evaluations of general scour at bridge crossings, sediment delivery, channels responses to aggregate mining, channelization, and other factors.

Field Calibration of the Model - The FLUVIAL model has been calibrated with field data from several rivers in this area, including the San Diego River (Chang, 1982), the San Dieguito River (Chang, 1984), the San Lorenzo River (Chang, 1985), and San Juan Creek (Chang, 1987). The documentation for these calibration studies may be found in the literature. In addition, this model is also calibrated using data from the San Luis Rey River (Chang, 1990)

Scope of Mathematical Modeling - The computer simulation study for general scour was made for the two following flood conditions: (1) the 100-yr flood and (2) the flood series that may be expected in a 100-yr time span. The short term changes were computed using the 100-yr flood. The long term impacts were simulated using the flood series that can be expected in a 100-yr time span. The useful life span of the bridge may be assumed to be on the order of 100 years. In the future, one should expect various flood events. In the time span of 100 years, one may expect statistically one flood event exceeding the 100-year flood, two events exceeding the 50-year flood, four events exceeding the 25-year flood, ten events exceeding the 10-yr flood, etc. For this river reach, most of the sediment transport occurs during major floods. Those events less than the 10-yr flood have very limited discharge and hence transport capacity; therefore, only those events equal to or greater than the 10-yr flood were included in the flood series for simulation. The series of flood events occur randomly. The sequence of occurrence of these floods is beyond human prediction, but the particular order of flood events does not affect the results pertaining to the long-term sediment delivery. It was assumed in this study that the occurrence follows the following order: 10-yr flood, 30-yr flood, 20-yr flood, 40-yr flood, 15-yr flood, 100-yr flood, 20-yr flood, 15-yr flood, 70-yr flood, and 10-yr flood. This sequence of flood events as shown in Fig. 4 was employed to represent the long-term flood flow.

Pit Capture - The physical conditions at the Fenton mining site were analyzed. The high levee was assumed to provide protection for the probable maximum flood, but there still exists the possibility that the low levee may be overtopped by floodwater to result in pit capture. For the sake of scour evaluation for the bridge and the aqueduct, the following scenarios were considered:

Scenario 1: Pit capture at the deep excavation site: It was assumed for this scenario that floodwater would overtop the low levee at the Fenton site. Since the overtopping flow has a very high velocity at the levee crest, it was assumed that it would result in levee breach. As a conservative measure,

it was also assumed that bed sediment would enter the deep excavation, and sediment supply to the downstream channel would thus be cut off as a result of pit capture.

Scenario 2. No pit capture. It was assumed for this scenario that floodwater would not carry bed sediment into the deep excavation. However, the new excavation outside the levee would still trap bed sediment.

The scope of mathematical modeling that was devised to cover the flood conditions together with the possibility of pit capture consisted of eight cases. Among them, the first four cases as listed below were based on the assumption that pit capture would not occur at the Fenton site although sediment would still be trapped in the smaller pit outside the levees.

Case 1. River channel changes before the bridge project based on the 100-yr flood

Case 2. River channel changes after the bridge project based on the 100-yr flood

Case 3. River channel changes before the bridge project based on the flood series

Case 4. River channel changes after the bridge project based on the flood series.

The second four cases as listed below were based on the assumption that pit capture would occur at the Fenton site to result in the cutoff of sediment supply.

Case 5. River channel changes before the bridge project based on the 100-yr flood

Case 6. River channel changes after the bridge project based on the 100-yr flood

Case 7. River channel changes before the bridge project based on the flood series

Case 8. River channel changes after the bridge project based on the flood series.

V. RESULTS OF MODELING STUDY

Input/output parameters for the FLUVIAL-12 model are explained in Appendix A. Sample input/output listings of the Fluvial run for Case 8 are included in Appendix B. Input/output listings for all other cases are contained in a diskette in Appendix C. Simulated results are presented in graphical forms, in Figs. 5 through 32. For each case, the graphical results usually include those before the flood, at the peak flow, and at the end of flood or series. These results are described below.

Simulation of Sediment Delivery - Sediment delivery is defined as the cumulative amount of sediment that has been delivered passing a certain channel section for a specified period of time, that is,

$$Y = \int_T Q_s \, dt \qquad (1)$$

where Y is sediment delivery (yield); Q_s is sediment discharge; t is time; and T is the duration. The sediment discharge Q_s pertains only to bed-material load of sand, gravel and cobble. Fine sediment of clay and silt constitute the wash load may not be computed by a sediment transport formula. Sediment delivery is widely employed by hydrologists for watershed management; it is used herein to keep track of sediment supply and removal along the channel reach.

Spatial variations in sediment delivery are manifested as channel storage or depletion of sediment associated stream channel changes since the sediment supply from upstream may be different from the removal. The spatial variation of sediment delivery depicts the erosion and deposition along a stream reach. A decreasing delivery in the downstream direction, i.e. negative gradient for the delivery-distance curve, signifies that sediment load is partially stored in the channel to result in a net deposition. On the other hand, an increasing delivery in the downstream direction (positive gradient for the delivery-distance curve) indicates sediment removal from the channel boundary or net scour. A uniform sediment delivery along the channel (horizontal curve) indicates sediment balance, i.e., zero storage or depletion. Channel reaches with net sediment storage or depletion may be designated in each figure on the basis of the gradient. From the engineering viewpoint, it is best to achieve a uniform delivery, the non-silt and non-scour condition, for dynamic equilibrium.

Spatial variations in sediment delivery as shown in Figs. 5 through 12 indicate the potential for net erosion and deposition along the stream reach. The following general trends are depicted for the river reach near the bridge and aqueduct crossings:

(1) For Cases 1, 2, 3, and 4, the spatial variations in sediment delivery are shown in Figs. 5, 6, 7, and 8, respectively. These cases are under the assumption of no pit capture at the Fenton site but river sediment will still be trapped in the smaller pit outside the Fenton levees. These spatial

variations in sediment delivery depict sediment deposition at the smaller Fenton pit and erosion along the stream reach downstream of this pit.

(2) Cases 1 and 2 are based on the 100-yr flood. Total deliveries of sediment for these cases through the Fenton pit has a finite value at the end of the flood. This indicates that the pit will be refilled to allow the passage of bed sediment through the pit. The spatial variations in sediment delivery for Cases 1 and 2 are closely similar in pattern; their differences are insignificant. This indicates that the proposed Gregory Canyon Bridge project has insignificant effects on sediment delivery through the river channel based on the 100-yr flood.

(3) Cases 3 and 4 are based on the flood series. Spatial variations in sediment delivery for Cases 3 and 4 are closely similar in pattern; their differences are insignificant. This indicates that the proposed Gregory Canyon Bridge project has insignificant effects on sediment delivery through the river channel based on the flood series.

(4) For Cases 5, 6, 7, and 8, the spatial variations in sediment delivery are shown in Figs. 9, 10, 11, and 12, respectively. These cases are under the assumption of pit capture at the Fenton site. Since the Fenton pit inside the levees has a very large storage volume, it would cut off bed sediment supply to the downstream river reach. These spatial variations in sediment delivery depict total sediment cutoff at the Fenton site and erosion along the stream reach downstream of this pit.

(5) Spatial variations in sediment delivery for Cases 5 and 6 are closely similar in pattern; their differences are insignificant. This indicates that the proposed Gregory Canyon Bridge project has insignificant effects on sediment delivery in the river channel based on the 100-yr flood.

(6) Spatial variations in sediment delivery for Cases 7 and 8 are closely similar in pattern; their differences are insignificant. This indicates that the proposed Gregory Canyon Bridge project has insignificant effects on sediment delivery in the river channel based on the flood series.

Changes in Longitudinal Bed Profiles - Changes in longitudinal channel-bed profiles are shown in Figs. 13 through 20. The depression in channel bed from Section 21.36 to Section 21.56

in the figures is the Fenton sand and gravel pit located outside the levees. The longitudinal channel-bed profiles are used to depict the channel-bed changes along the river reach near the bridge and aqueduct crossings. Such changes are generally characterized by refill of the sand and gravel pits and channel-bed degradation outside the pits. The Fenton pit outside the levees is simulated to be refilled by the 100-yr flood or the flood series.

The changes in longitudinal channel-bed profiles are presented for the cases before and after the bridge project. Figs. 13 and 14 are for the respective cases before and after the bridge project under the 100-yr flood without pit capture. Figs. 15 and 16 are for the respective cases before and after the bridge project under the flood series without pit capture. Figs. 17 and 18 are for the respective cases before and after the bridge project under the 100-yr flood with pit capture. Figs. 19 and 20 are for the respective cases before and after the bridge project under the flood series with pit capture. It can be seen that the two figures of each set for the respective cases before and after the bridge project are closely similar with insignificant differences. It may therefore be concluded that the proposed bridge project will have insignificant effects on the changes in longitudinal channel-bed profile.

For Cases 1, 2, 5, and 6 that are based on the 100-yr flood, the figures show that the changes in bed elevation at the bridge and aqueduct crossings are limited. However, general channel- bed degradation is substantial downstream of river mile 20.8 for these cases. This degradation development is closely related to the previous mining by J. W. Sand located downstream, from river mile 18.8 to river mile 19.6.

For Cases 3 and 4 that are based on the flood series without pit capture, Figs. 15 and 16 show limited channel-bed scour at the bridge and aqueduct crossings. During the flood series, the channel bed near the bridge and aqueduct crossings undergoes scour when the Fenton pit traps sediment while it is being refilled. The maximum channel-bed scour is reached before the peak flow. As the Fenton pit becomes gradually refilled during the flood series, bed sediment will again be transported downstream. When the downstream channel bed is supplied with sediment, the scour trend reverses at the bridge and aqueduct crossings. The channel-bed profiles at the peak flow and at the end of series do not depict the maximum scour. For these two cases, general channel-bed degradation is

substantial downstream of river mile 20.8. This degradation development is closely related to the previous mining by J. W. Sand located downstream, from river mile 18.8 to river mile 19.6.

For Cases 7 and 8 that are based on the flood series with pit capture, Figs. 19 and 20 show general channel-bed degradation along the channel breach between the J. W. mining site and the Fenton mining site (from river mile 19.4 to river mile 21.4). This degradation is substantial and it is primarily related to the cut-off of sediment supply for the pit capture scenario.

Changes in Cross-Sectional Profile at Proposed Bridge Crossing - The simulated cross-sectional changes at the bridge crossing are shown in Figs. 21 through 24. Fig. 21 is for Case 2 under the 100-yr flood without pit capture. Fig. 22 is for Case 4 under the flood series without pit capture. Fig. 23 is for Case 6 under the 100-yr flood with pit capture and Fig. 24 is for Case 8 under the flood series with pit capture. The simulated general scour is limited for Cases 2, 4, and 6, but it is very substantial for Case 8. The minimum bed elevation reached by scour for Case 8 is 286 feet (NGVD).

Changes in Cross-Sectional Profile at Aqueduct Crossing - The simulated cross-sectional changes at the aqueduct crossing are shown in Figs. 25 through 32. The changes in cross-sectional profile are presented for the cases before and after the bridge project. Figs. 25 and 26 are for the respective cases before and after the bridge project under the 100-yr flood without pit capture. Figs. 27 and 28 are for the respective cases before and after the bridge project under the flood series without pit capture. Figs. 29 and 30 are for the respective cases before and after the bridge project under the 100-yr flood with pit capture. Figs. 31 and 32 are for the respective cases before and after the bridge project under the flood series with pit capture. It can be seen that the two figures of each set for the respective cases before and after the bridge project are closely similar with insignificant differences. It may therefore be concluded that the proposed bridge project will have insignificant effects on the changes in cross-sectional profile at the aqueduct crossing.

Maximum Scour Depths at Aqueduct Crossing - In order to determine the effects of the bridge project on potential scour at the aqueduct, the maximum scour depths for the eight cases evaluated were compared. The maximum scour depth is represented by the minimum bed elevation

reached by general scour during the 100-yr flood or the flood series. The simulated results on the minimum bed elevation are summarized in Table 1 for comparison. It can be seen from the tabulated values that there is a small increase or decrease of the scour depth associated with the bridge project. Such increases are less than 1 foot. The FLUVIAL-12 model employs a finite difference scheme and its accuracy on scour depth prediction is limited to1 foot. For this reason, the differences on the predicted maximum scour depths between the respective cases with and without the bridge project are not significant in consideration of the modeling accuracy.

Table 1. Comparison of the maximum general scour depths

Case	Flood	Bridge project	Pit capture	Minimum elev. reached by scour, feet
1	100-yr	Before project	No	297.0
2	100-yr	After project	No	297.6
3	Series	Before project	No	288.5
4	Series	After project	No	288.3
5	100-yr	Before project	Yes	298.5
6	100-yr	After project	Yes	298.2
7	Series	Before project	Yes	279.7
8	Series	After project	Yes	281.1

Evaluation of Aqueduct Pipeline Stability - Pipelines buried under a stream bed must always stay beneath the ground cover. If any segment of a pipeline is subject to exposure by potential stream bed scour, it is considered inadequate since a buried pipeline is usually not designed to support itself. Stream bed scour consists of general scour and local scour. The depths of general scour were simulated in mathematical modeling; the local scour depths may be computed using available empirical formulas.

Local scour may be caused by any local obstruction to flow, such as tree trunks, pipelines, manholes, pier supports, and abutments, etc. The scour depth around piers or manholes may be

computed, but not so for other irregular shapes. If a pipeline is exposed, then the pipeline itself becomes an obstruction to flow. Turbulence so created will usually result in additional scour around the pipeline. In view of this local scour factor, the minimum ground cover of 6 feet below the general scour is considered essential for the stability of a buried pipeline.

In order to determine if the pipelines may be exposed by general scour, the simulated pattern of general scour for each case was compared with the pipeline location. On the basis of the comparison, it was determined that the general scour alone will not reach the pipelines during the 100-yr flood but the pipelines will be reached by general scour during the flood series. These findings are summarized in Table 2. While the pipelines will not be reached by general scour for the case of the100-yr flood, the general scour will be within 6 feet of the pipelines. In consideration of the total scour (general scour plus the local scour), it may be concluded that the pipelines are subject to exposure by potential scour under the current physical conditions of the San Luis Rey River. This finding is also included in Table 2.

Table 2. Summary of pipeline stability

Case	Flood	Bridge project	Pit capture	Exposure of pipeline by general scour	Exposure of pipeline by general scour and local scour
1	100-yr	Before project	No	No	Yes
2	100-yr	After project	No	No	Yes
3	Series	Before project	No	Yes	Yes
4	Series	After project	No	Yes	Yes
5	100-yr	Before project	Yes	No	Yes
6	100-yr	After project	Yes	No	Yes
7	Series	Before project	Yes	Yes	Yes
8	Series	After project	Yes	Yes	Yes

VI. RECOMMENDATIONS FOR BRIDGE DESIGN

The bridge footings should be designed to safeguard against potential scour, which consists of general scour and local scour. General scour is provided by the FLUVIAL-12 simulation. Local scour may be caused by local obstructions to flow at the abutments and piers/bents.

General Scour - As a conservative measure, the simulated general scour for Case 8 is recommended for bridge design. The maximum general scour for this case is to reach the minimum bed elevation of 286 feet. Since the thalweg of the river channel may migrate laterally within the bridge opening, the maximum scour depth applies to all the bridge piers/bents.

Local Scour at Bridge Piers/Bents - The magnitude of local scour around bridge piers/bents may be estimated using certain established formulas. The Federal Highway Administration has adopted the following equation (see Hydraulic Engineering Circular No. 18 by Richardson, 1990) for round-nosed piers/bents or cylindrical piers/bents.

$$Y_s/Y_1 = 2.0\, K_1\, K_2\, (b/Y_1)^{0.65}\, \mathbf{F}^{0.43} \qquad (2)$$

where Y = depth of local scour measured from the mean bed elevation, in feet;

K_1 = correction for pier/bent nose shape, equal to 1 for circular piers/bents and 1.1 for rectangular piers/bents;

K_2 = correction factor for angle of attack, equal to 1 for zero skew;

b = projected pier/bent width;

Y_1 = approach flow depth;

$\mathbf{F}$ = Froude number = $V/\sqrt{gY_1}$; and

V = velocity of approach flow.

The required hydraulic information for this equation are included in the FLUVIAL-12 output with the bridge in place.

The depth of local scour at the bridge piers was computed using Eq. 2. For the proposed conditions, pertinent parameters for the bridge hydraulics were taken from the output listings of FLUVIAL-12 for the bridge crossing at the peak discharge for the flood series as tabulated below:

F = Froude number = 0.44

Y_f = depth of flow at the pier location = 12.1 feet

The circular columns have the diameter of 5.5 feet. Based on these values, the local scour depth was computed to be 10.2 feet.

The maximum total scour at the bridge piers is the general scour plus the local scour. The total scour so computed is to reach the bed elevation of 276 feet. If footings are used, they should be located below the elevation of total scour. In the structural design for the bridge, the bents should be assumed to be exposed to the elevation of 276 feet.

Local scour at the abutments is directly related to the flow contraction at the bridge opening. At this time, there is no reliable method for computing the local scour at the abutments. The proposed bridge has a long span of 638 feet and it does not cause major contraction to flow. In consideration of this situation, the total scour depth at the abutments is assumed to be 276 feet.

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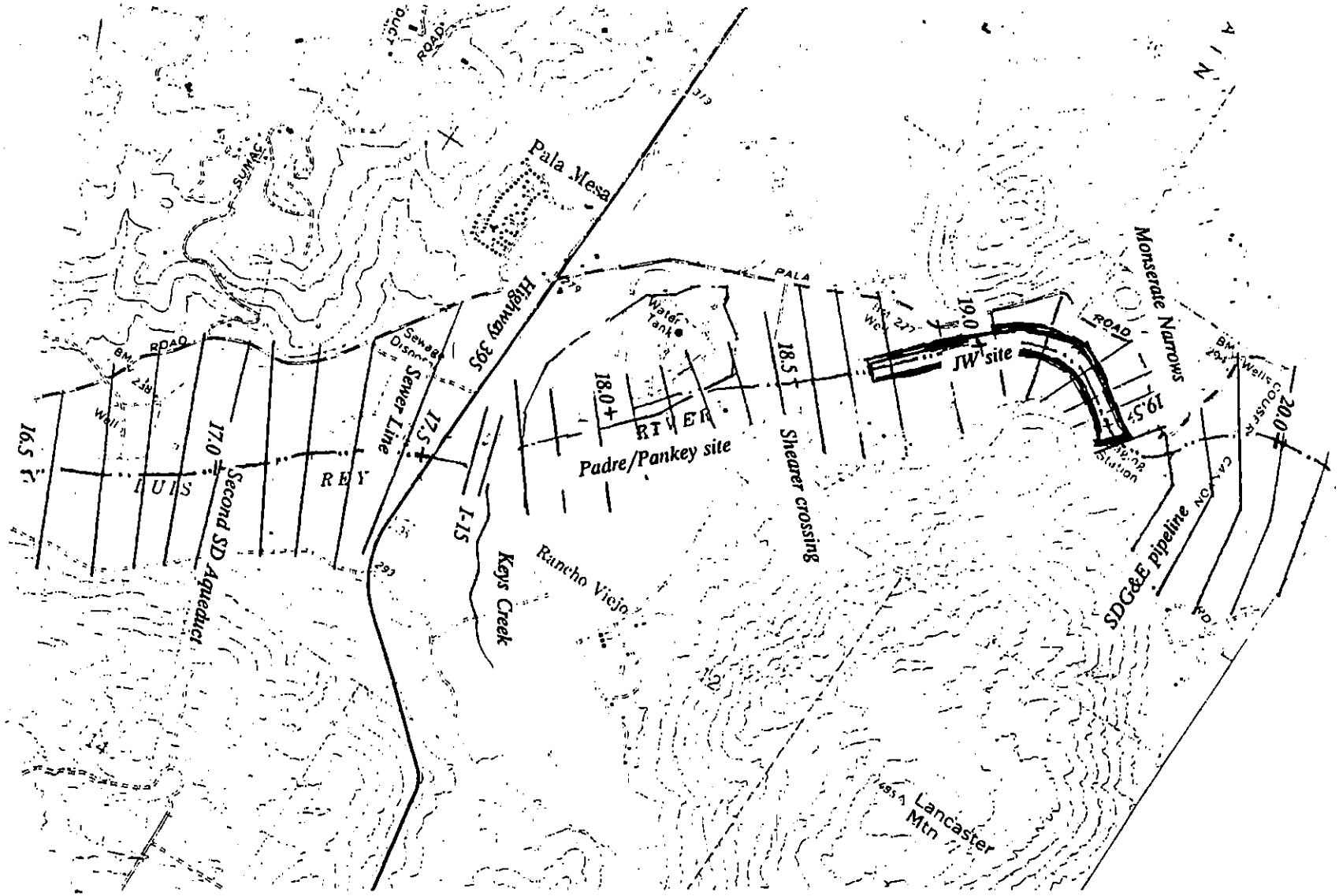

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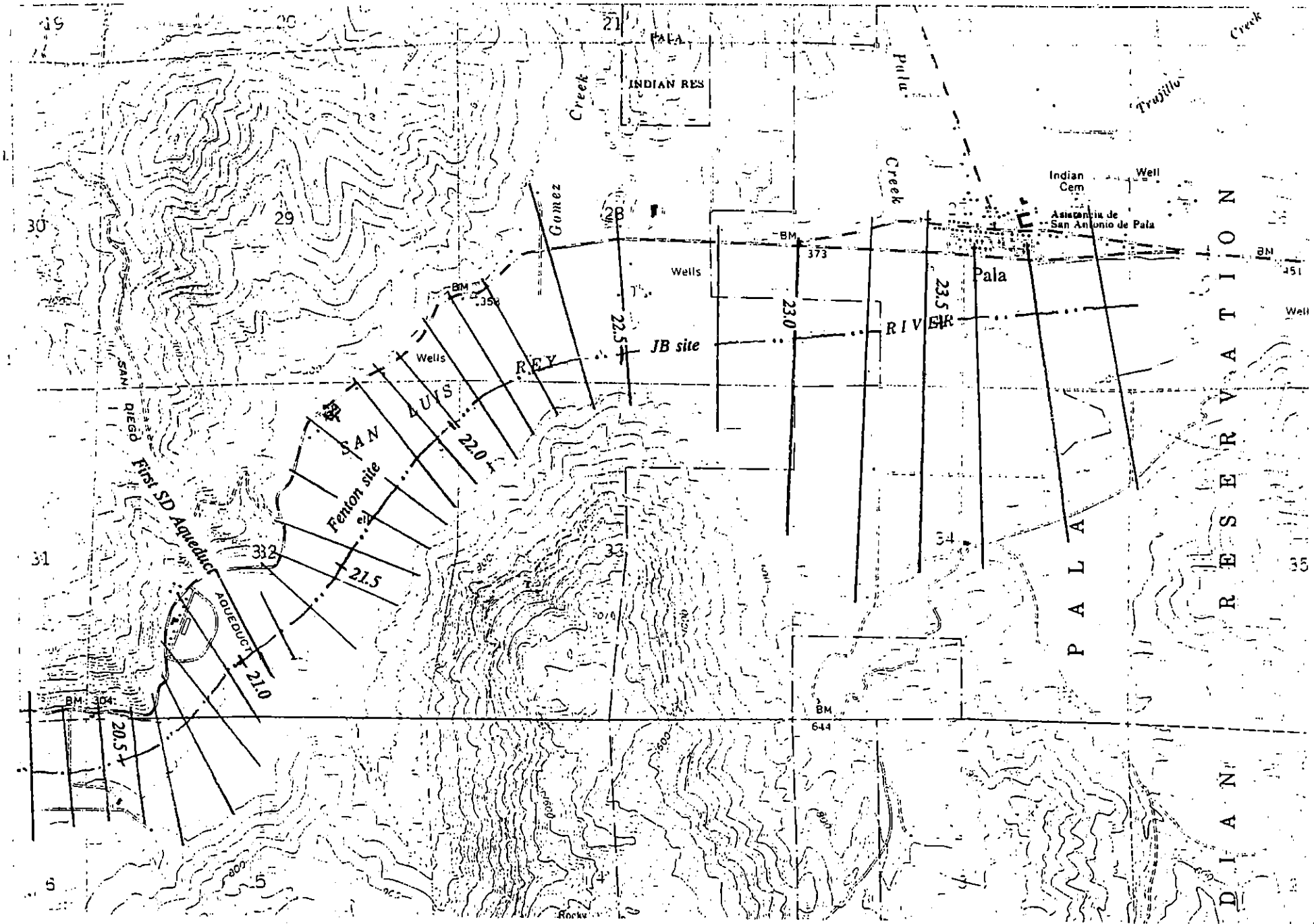

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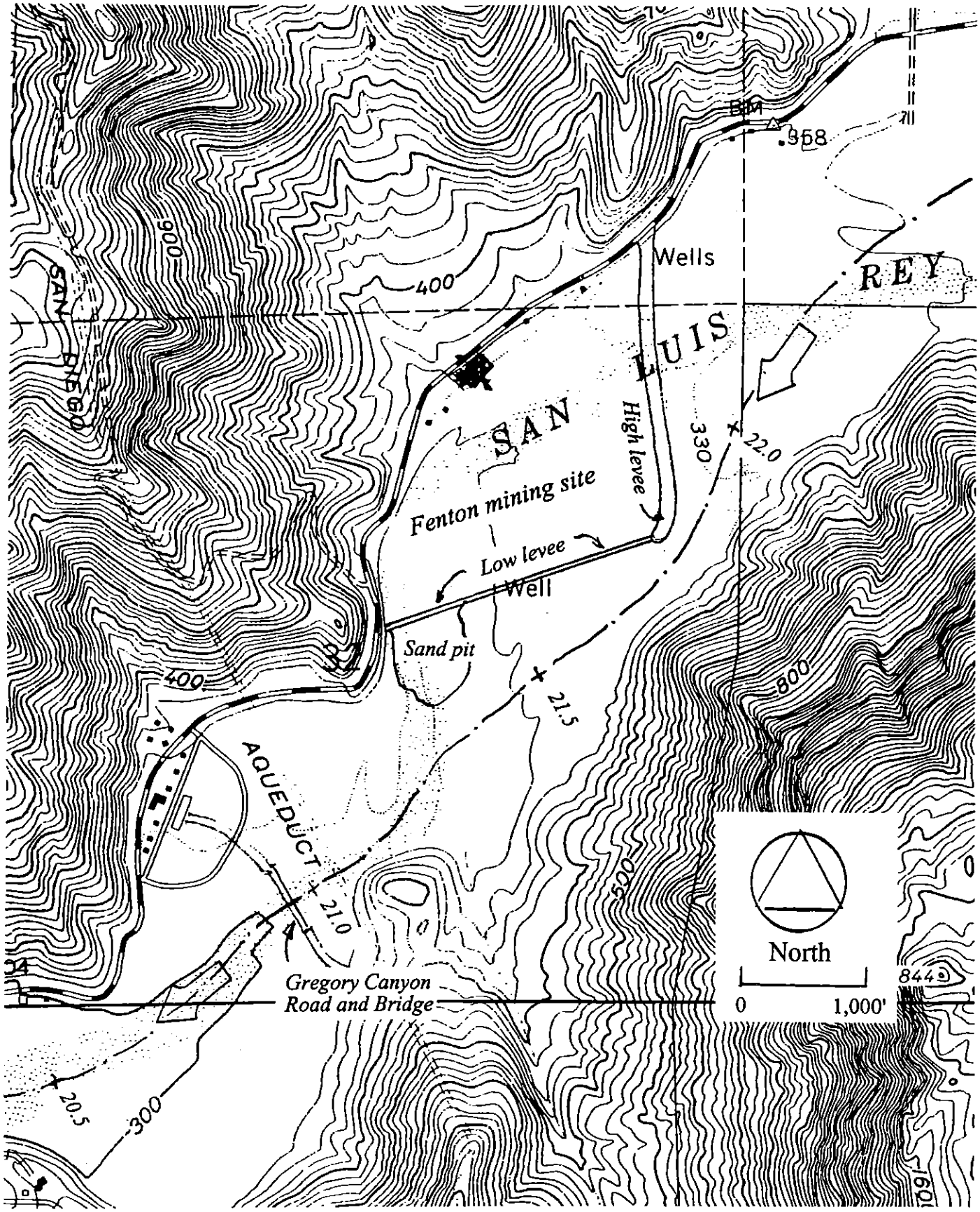

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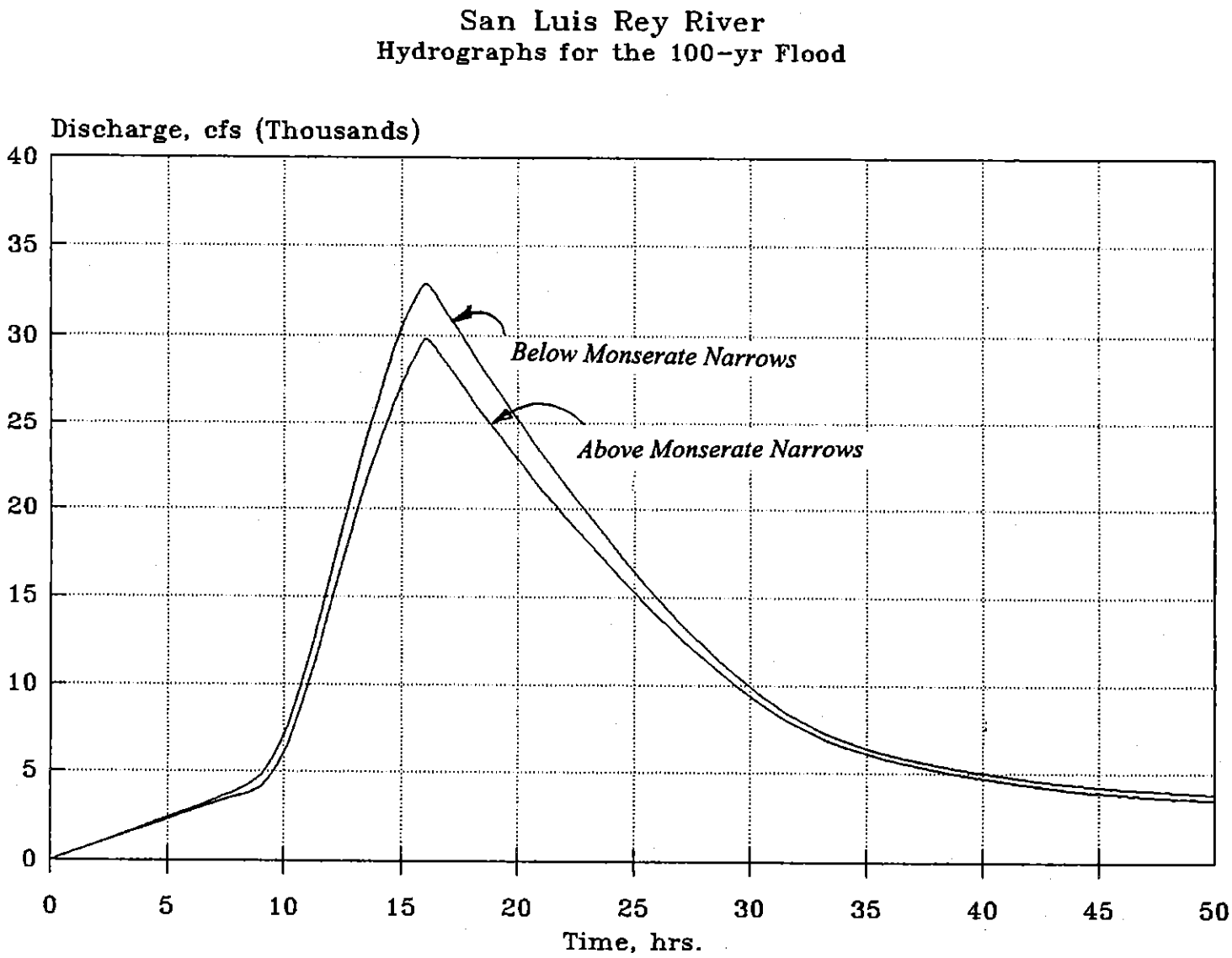

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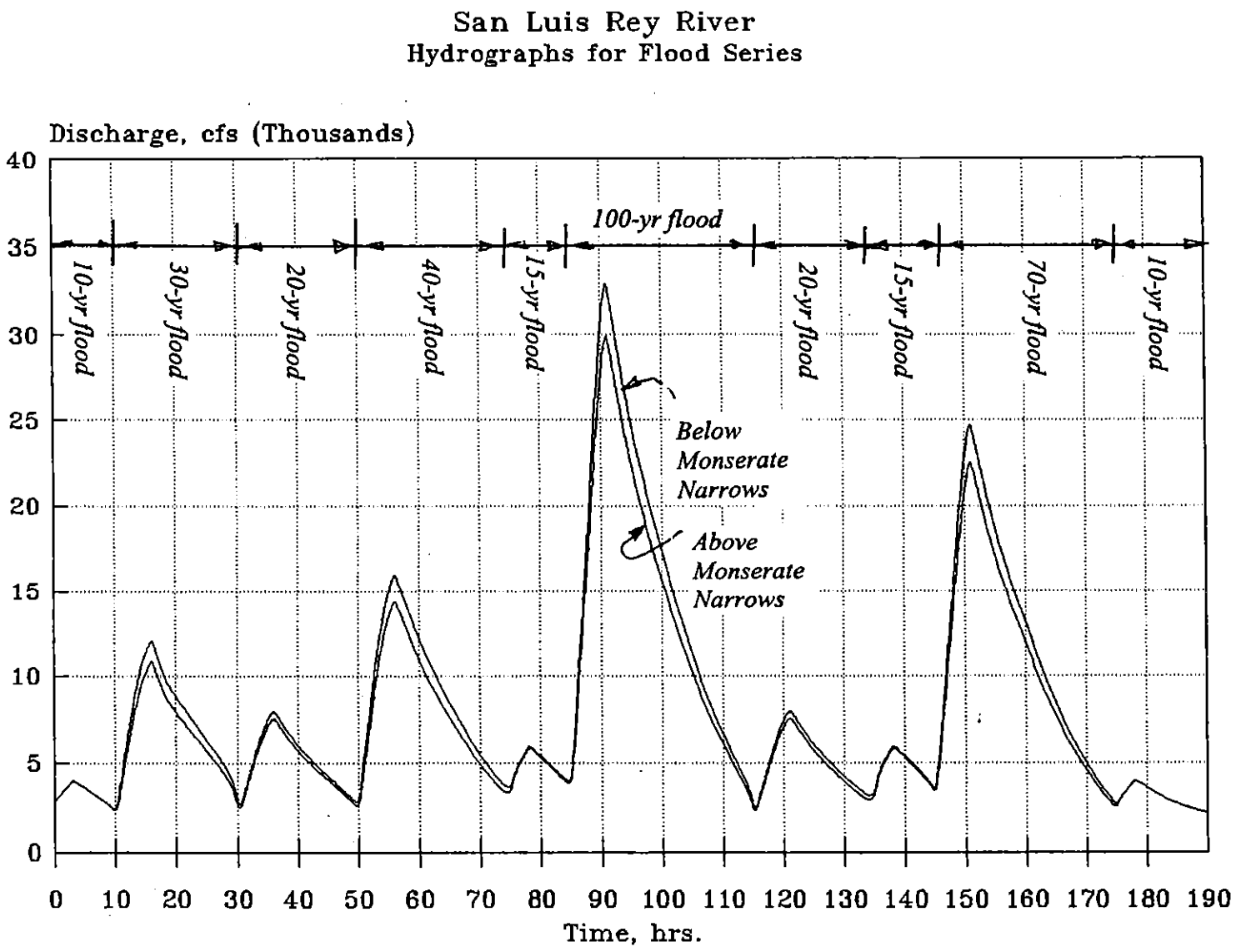

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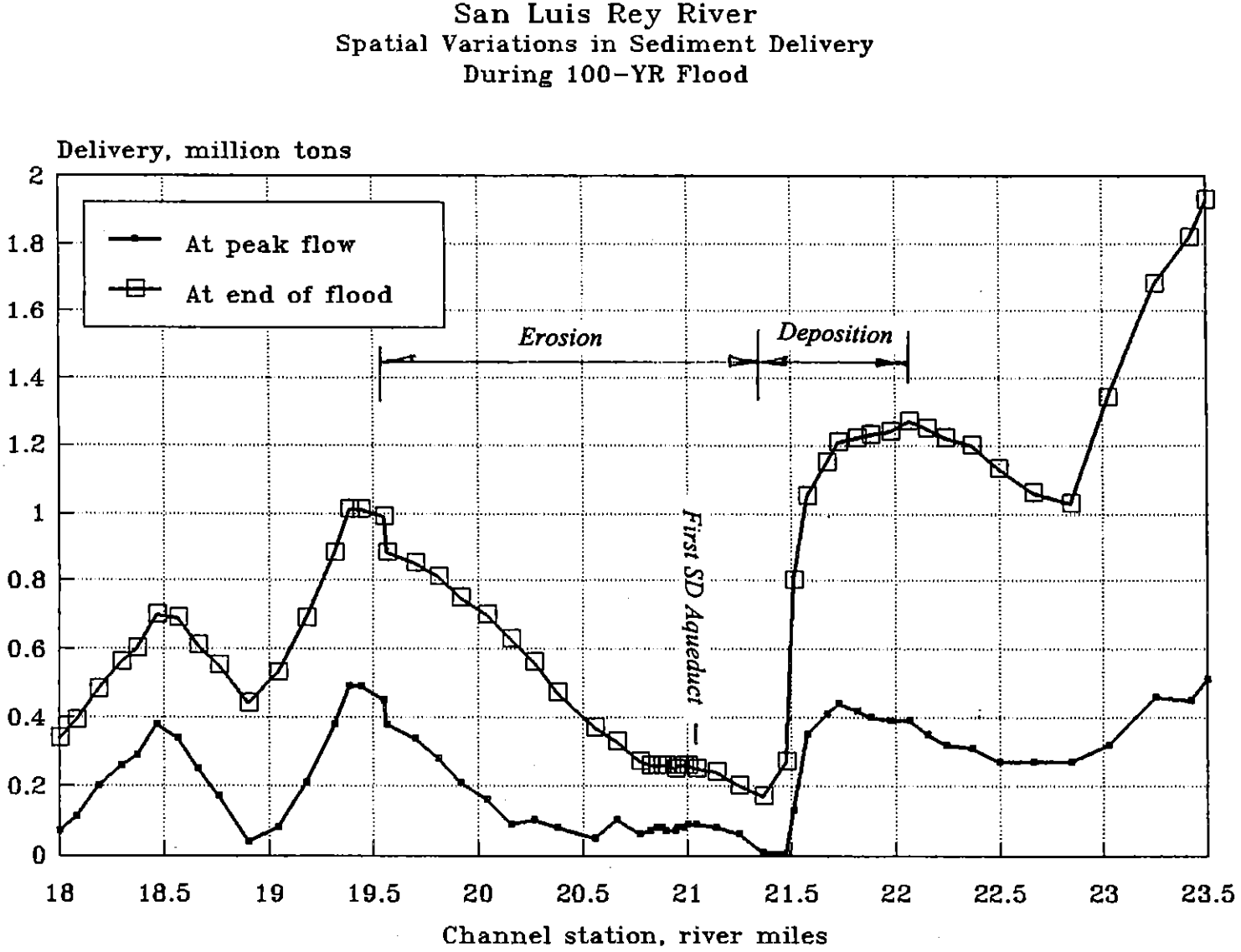

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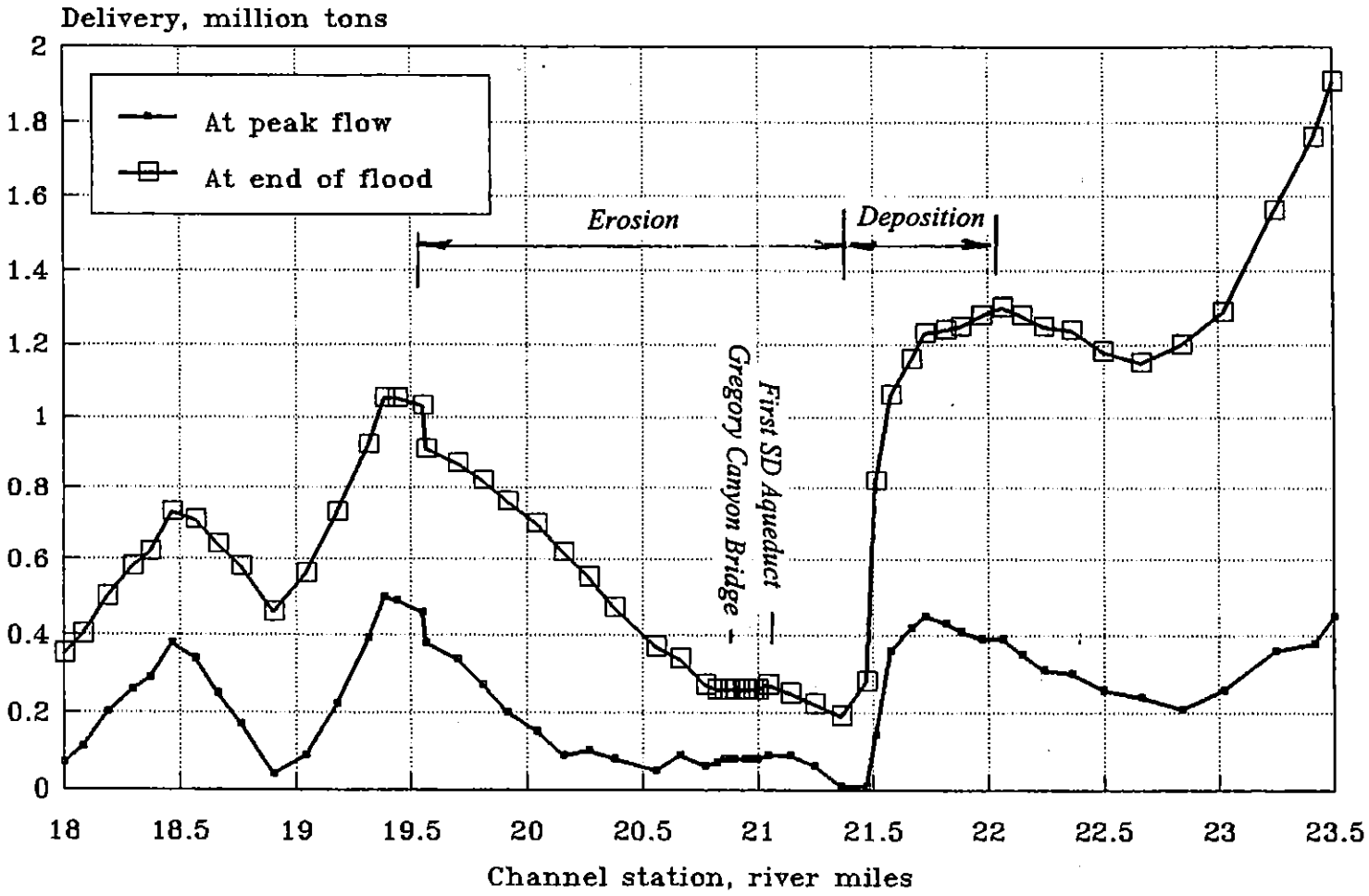

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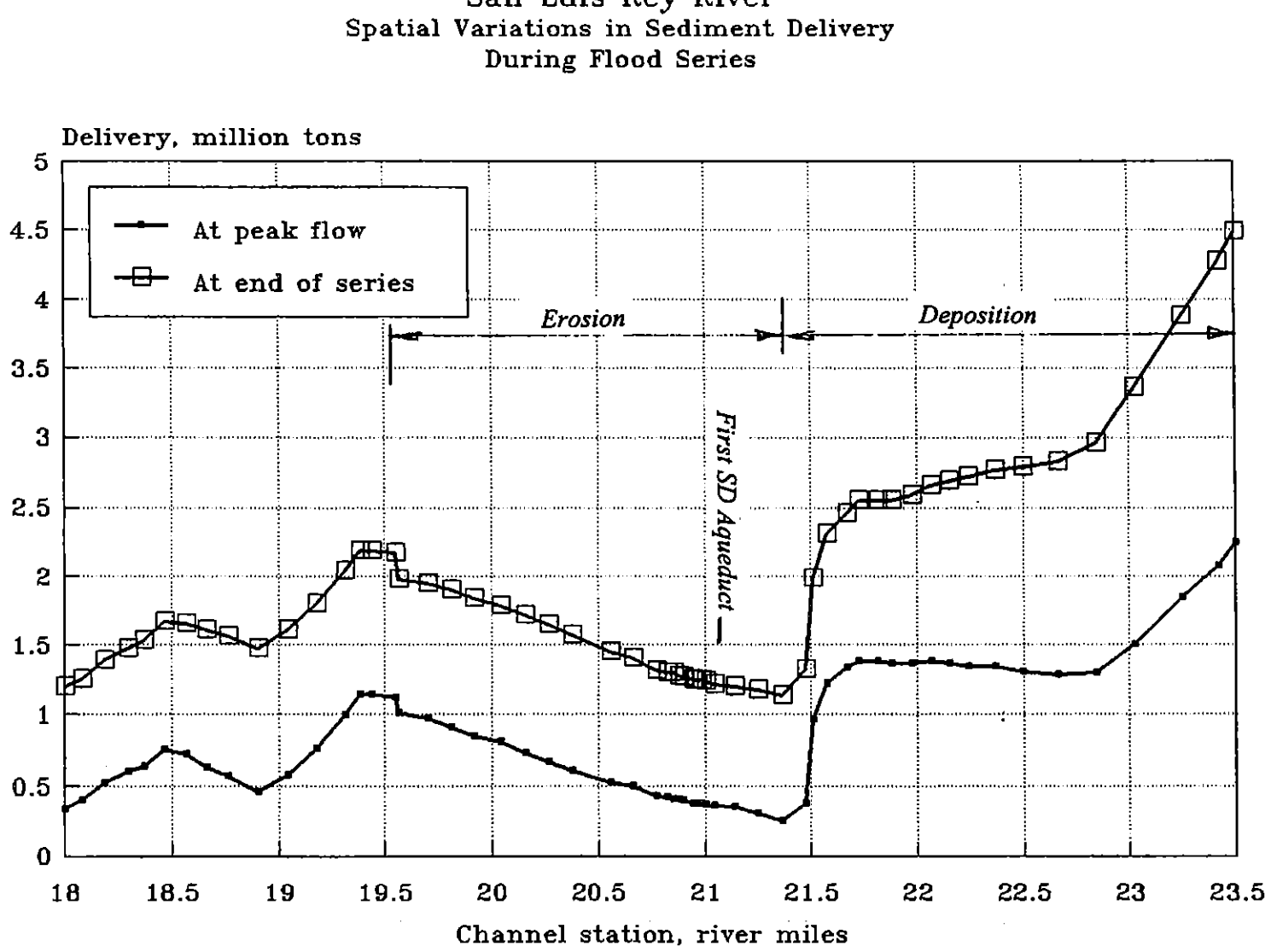

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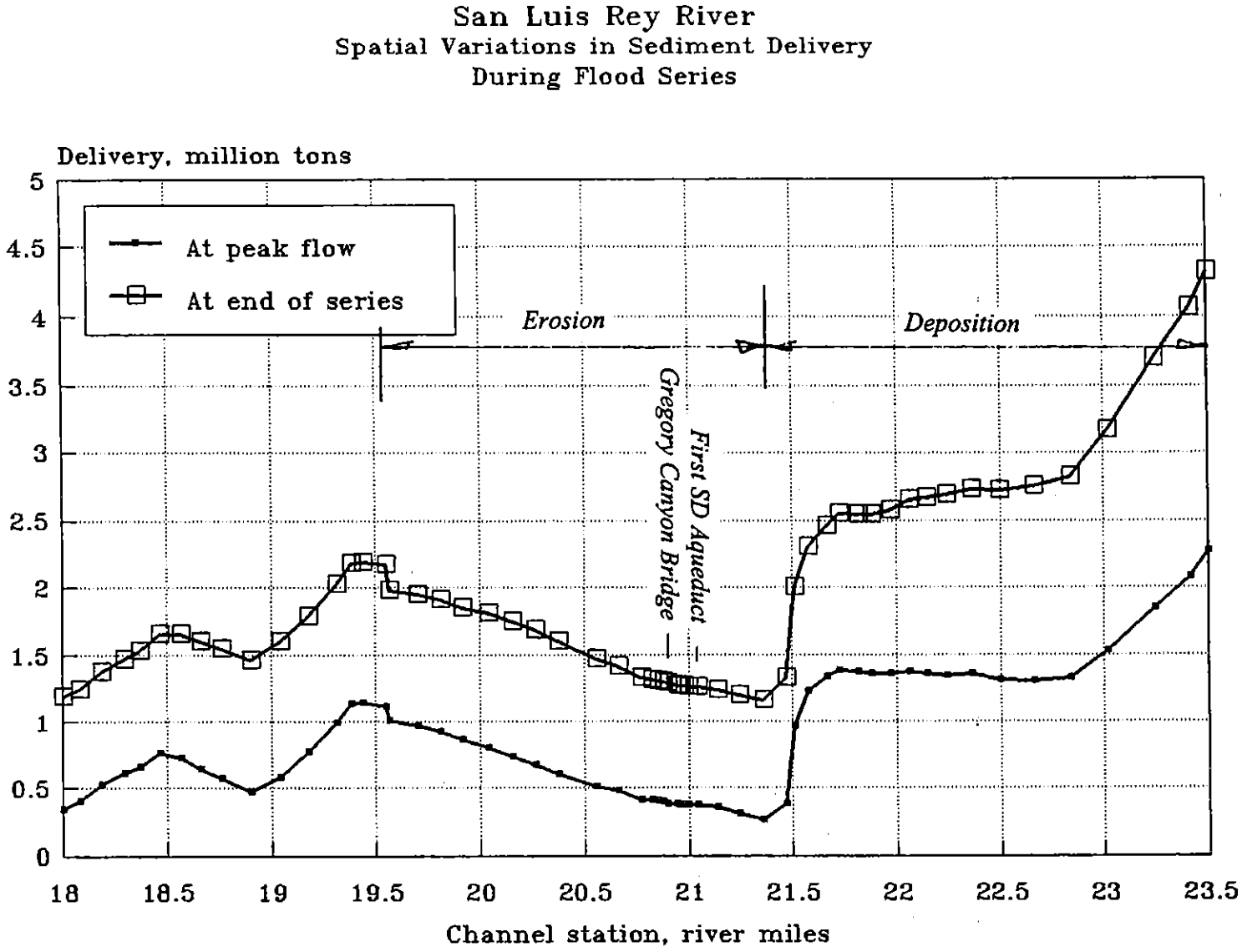

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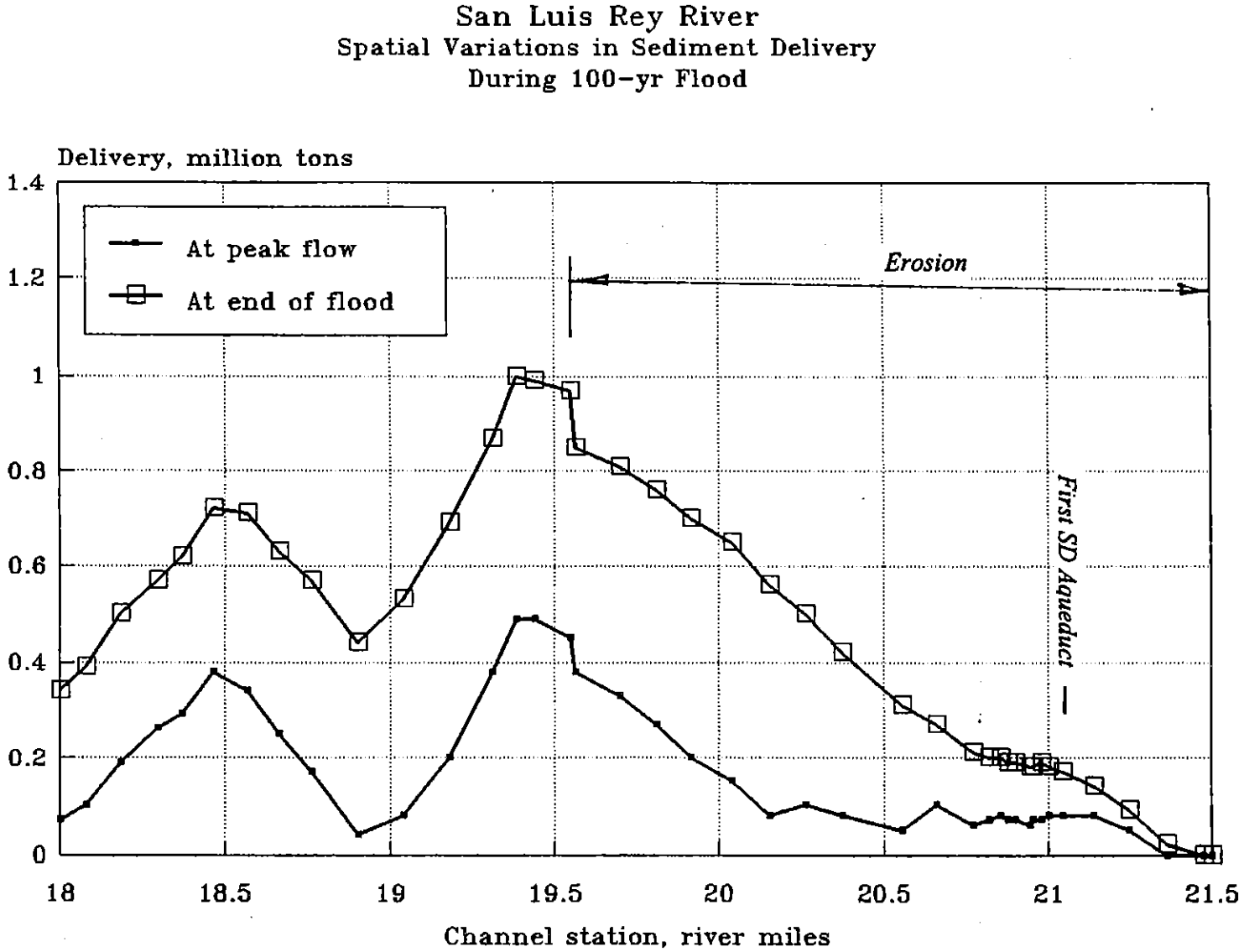

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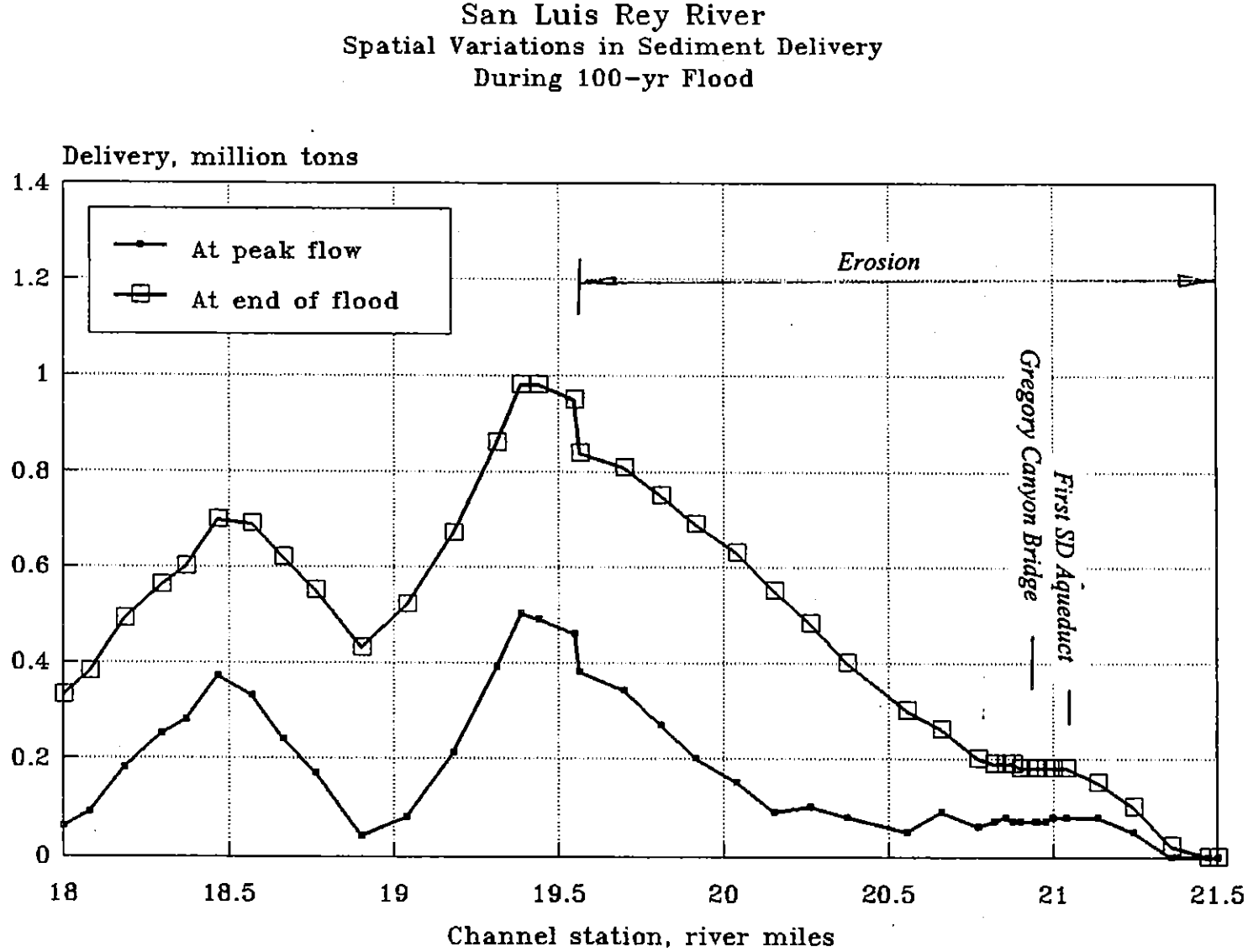

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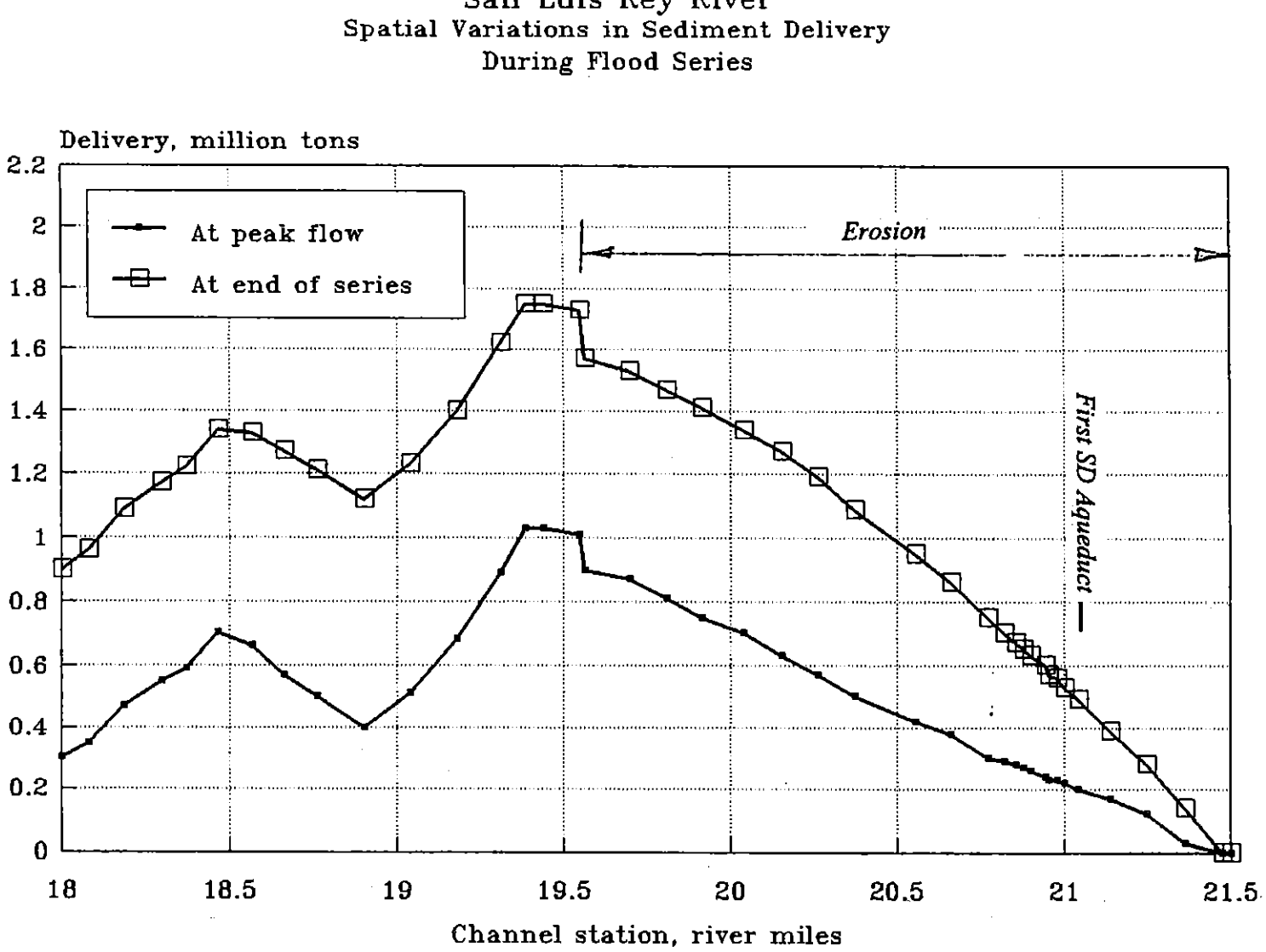

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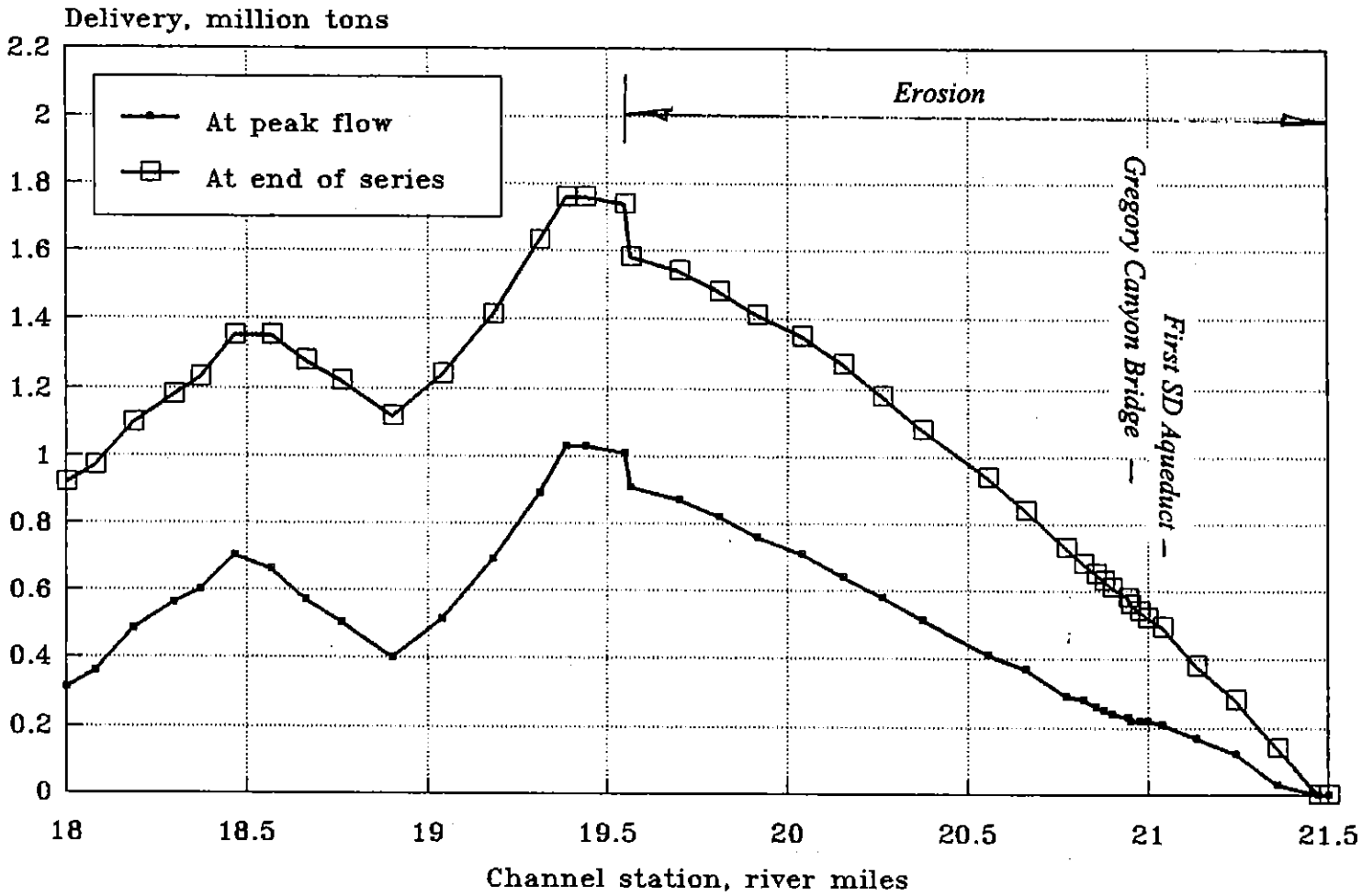

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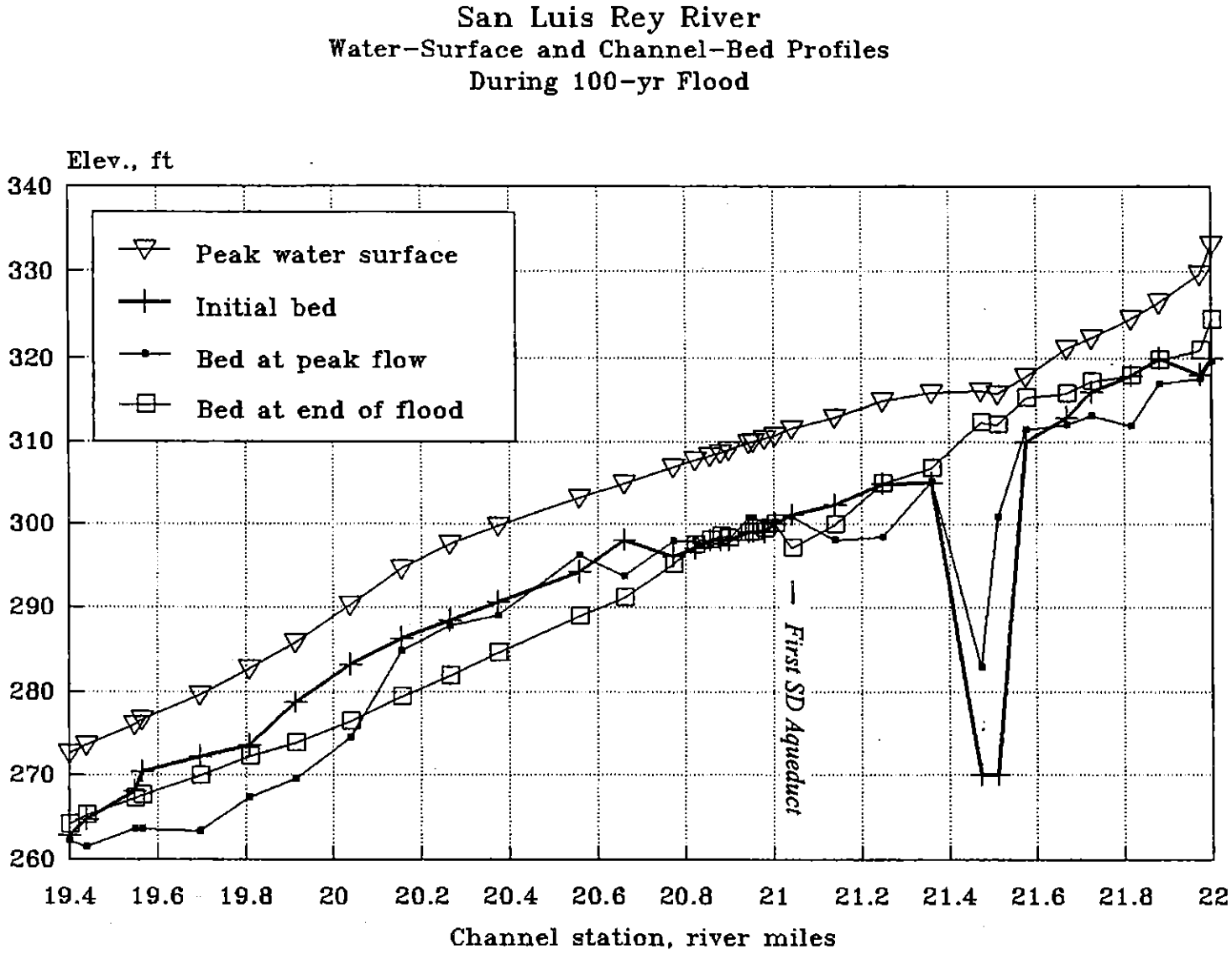

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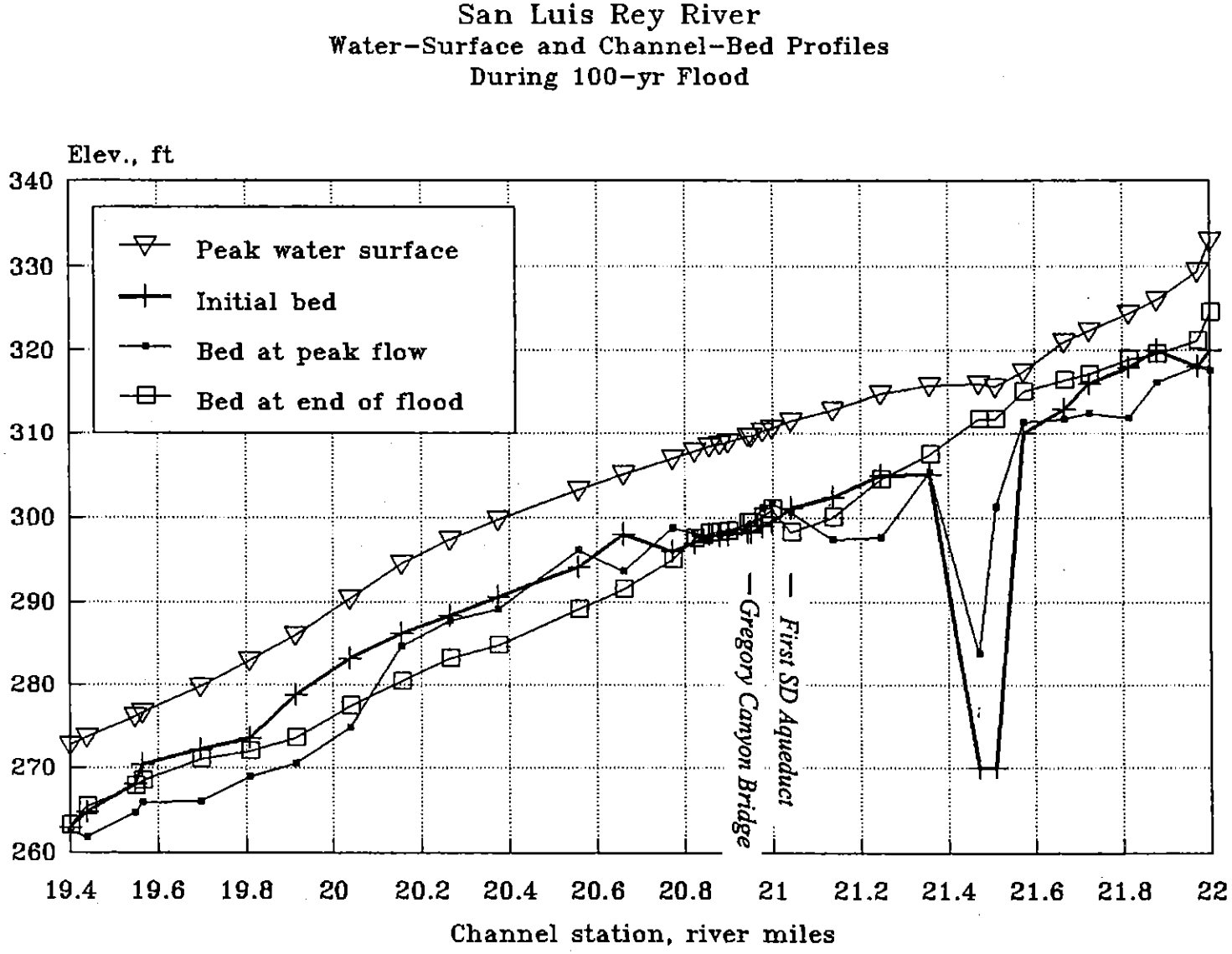

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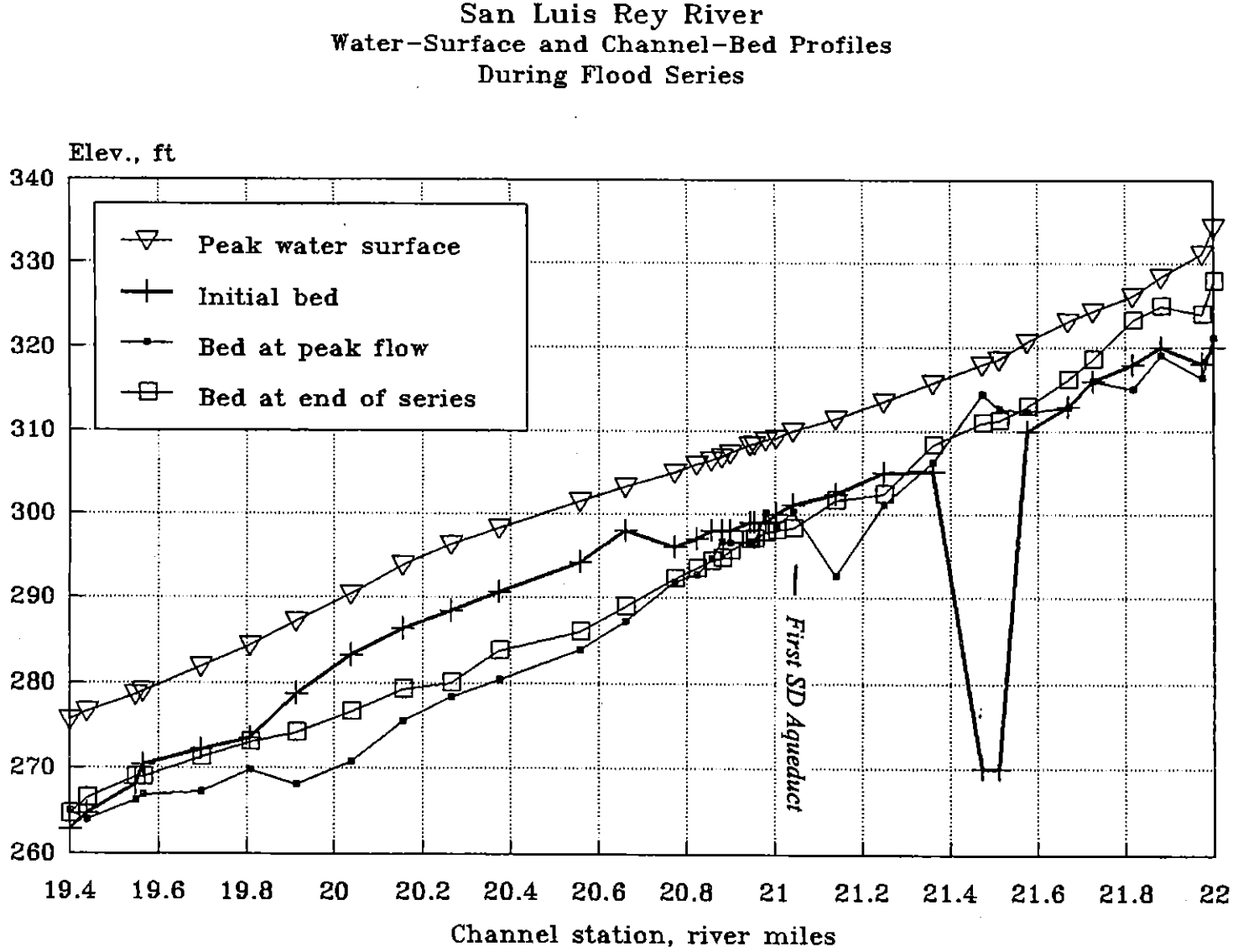

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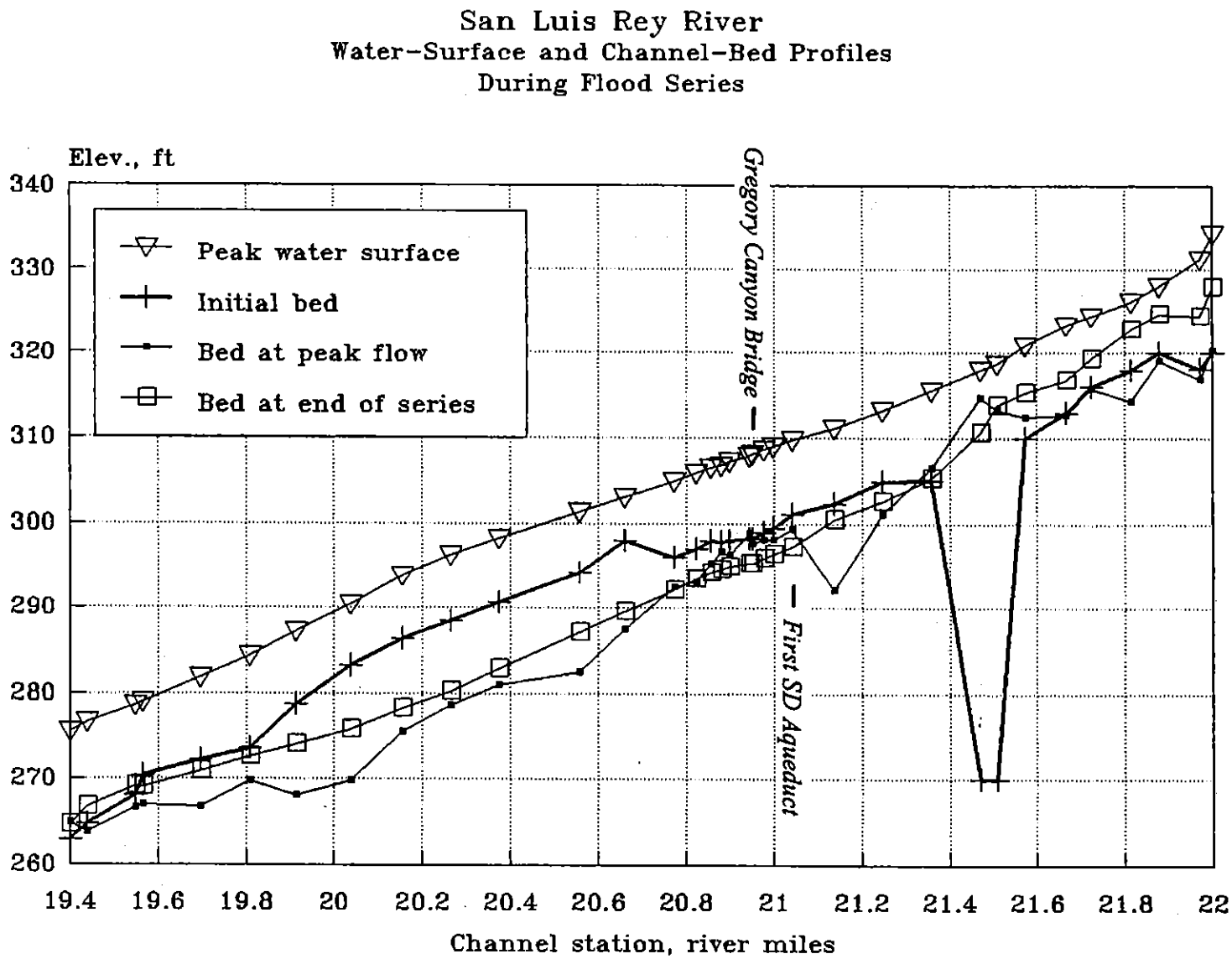

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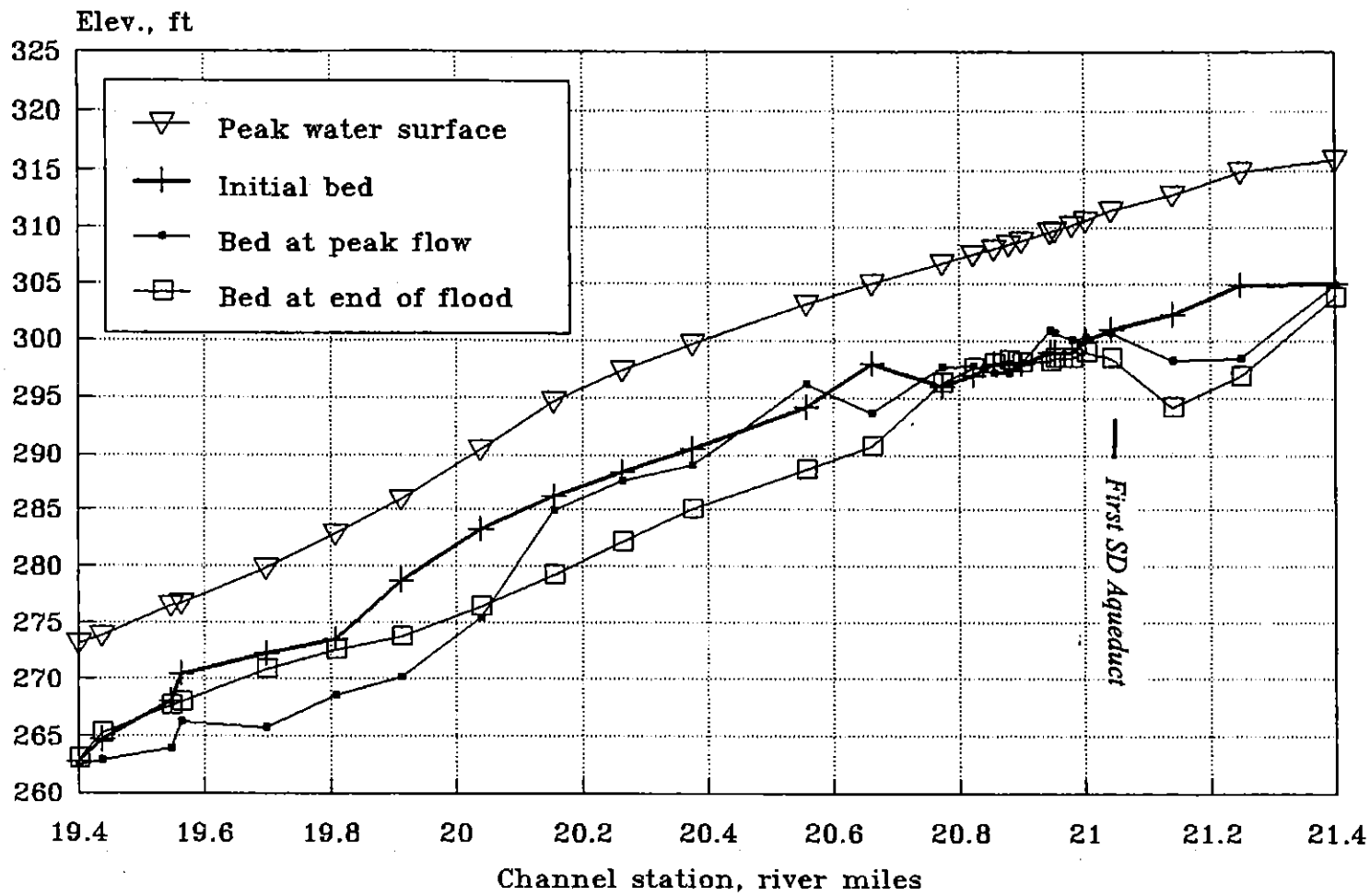

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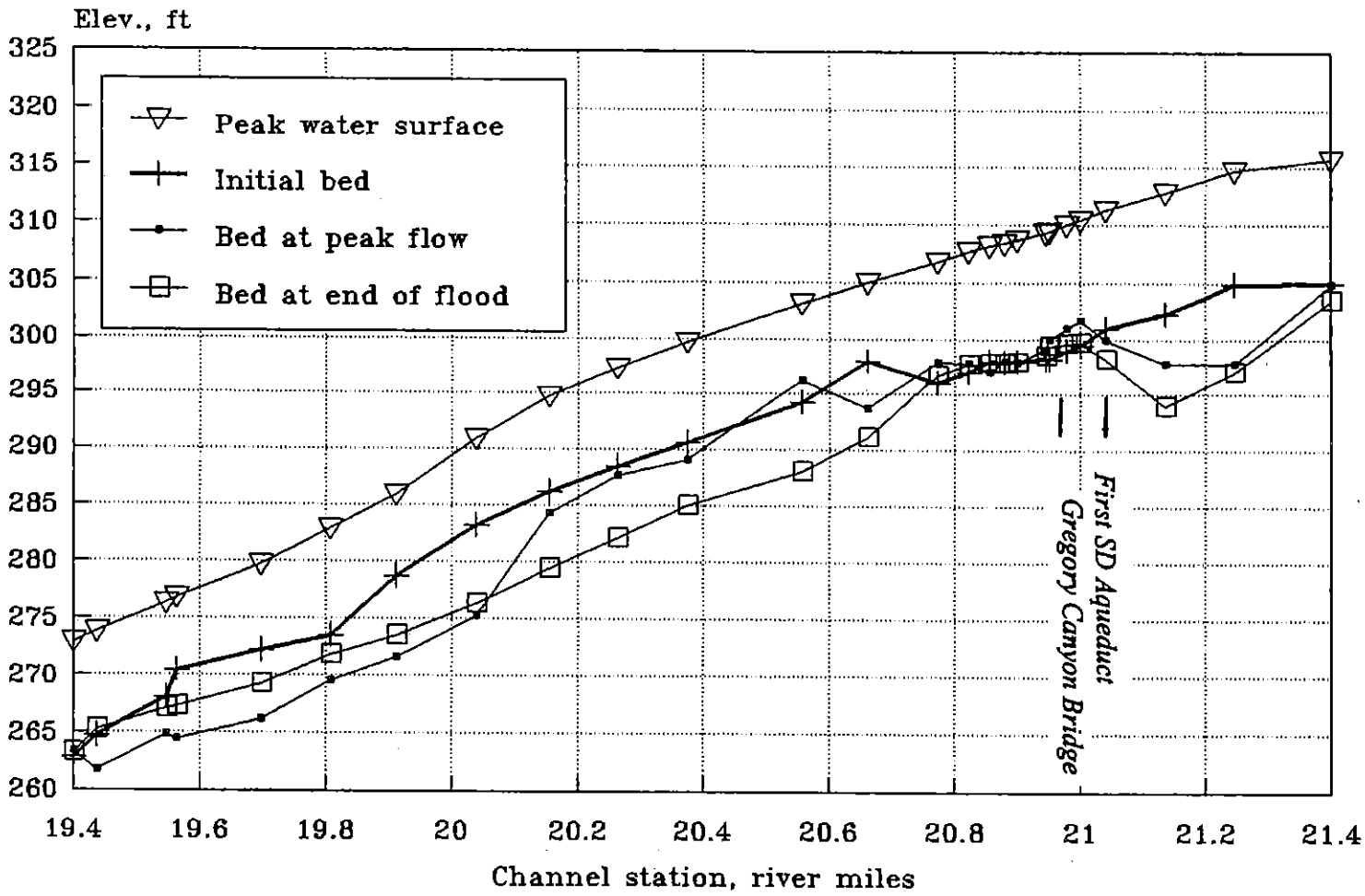

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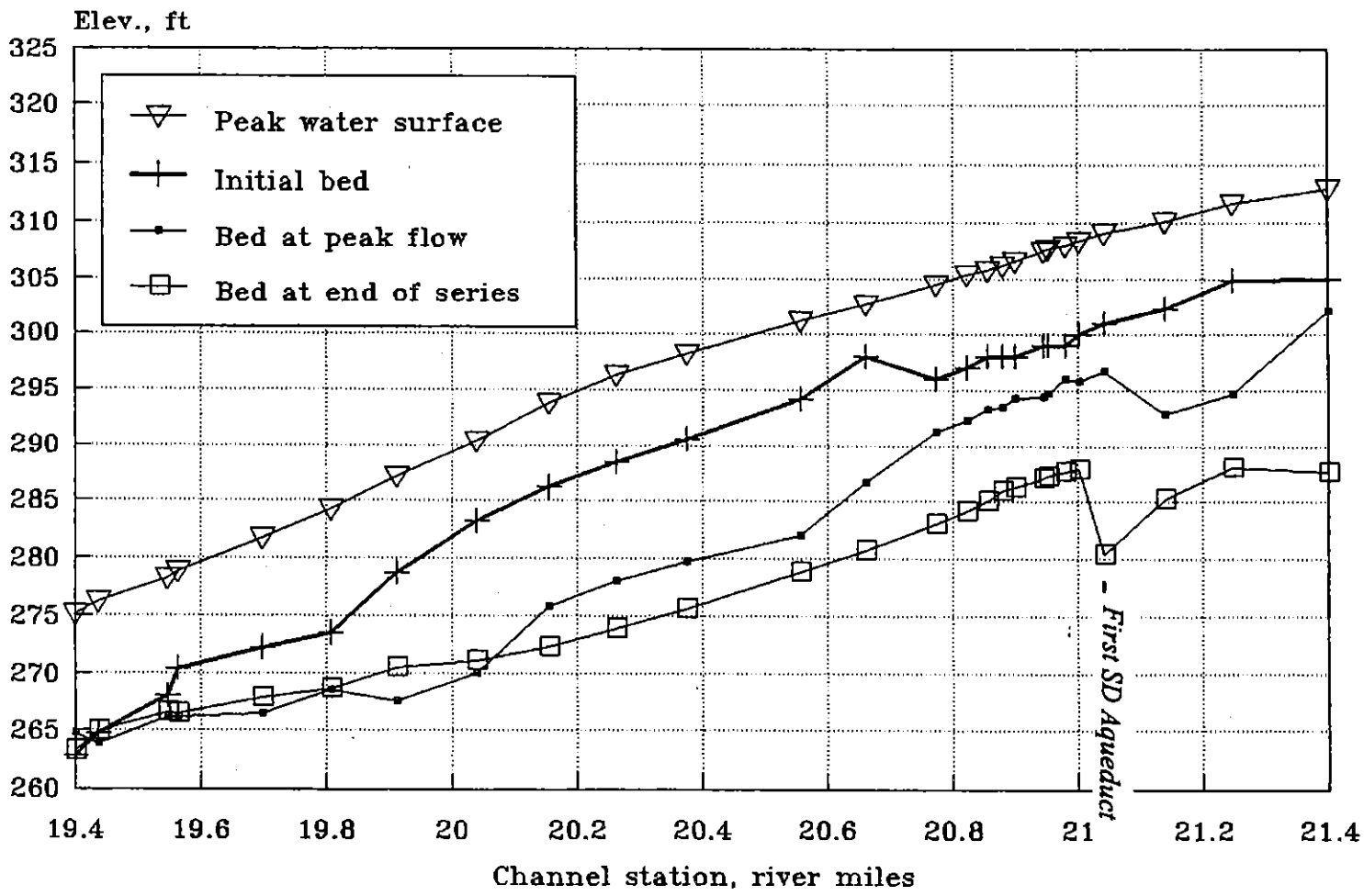

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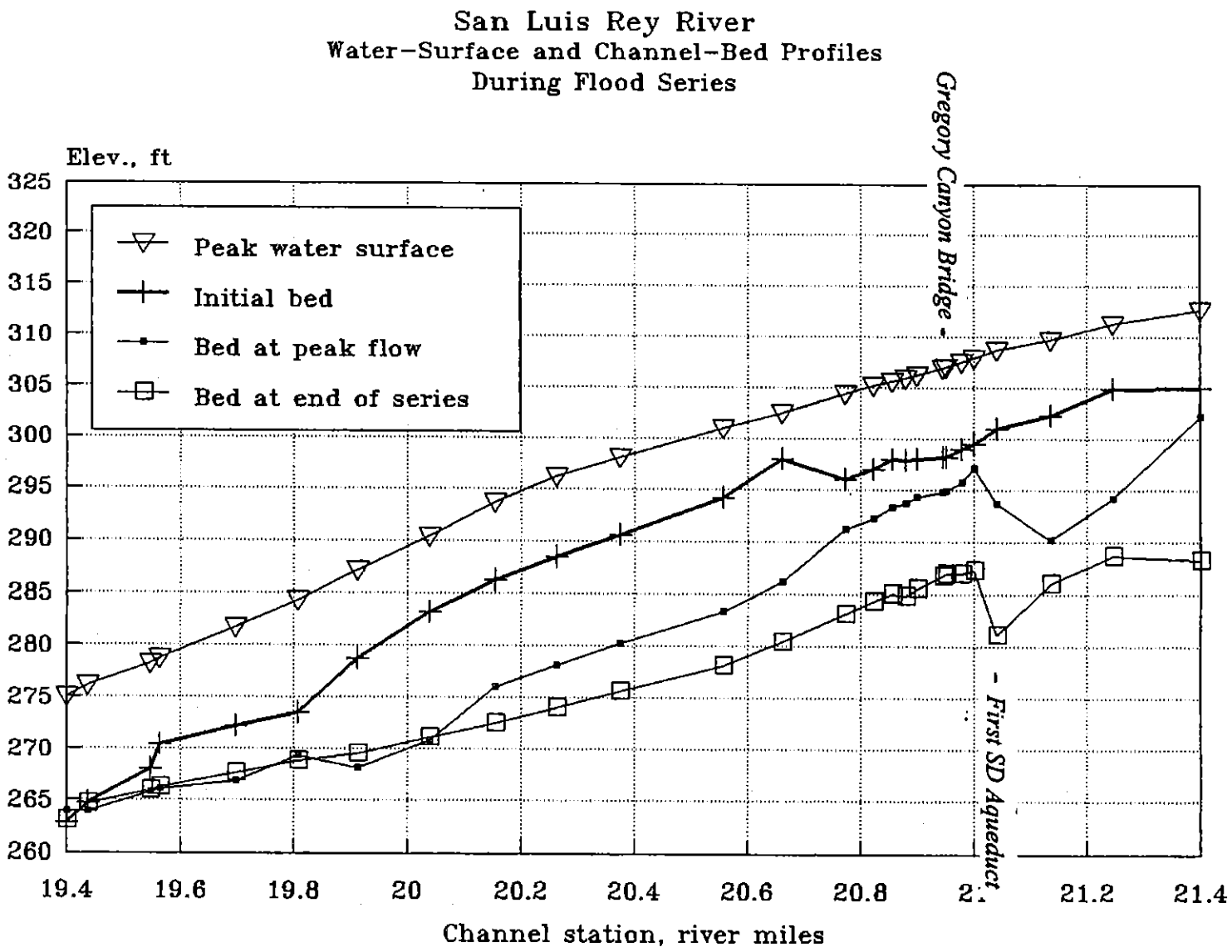

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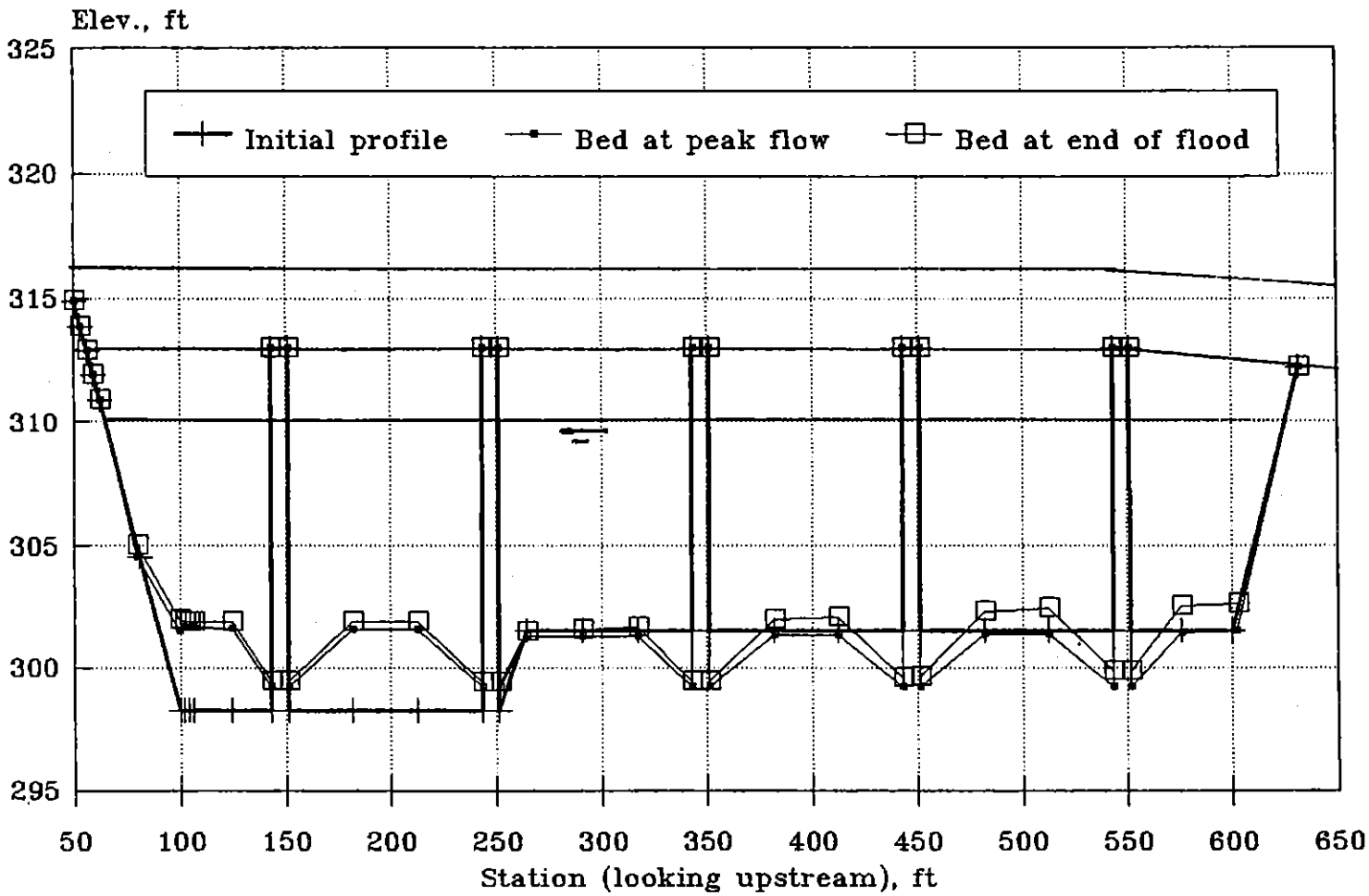

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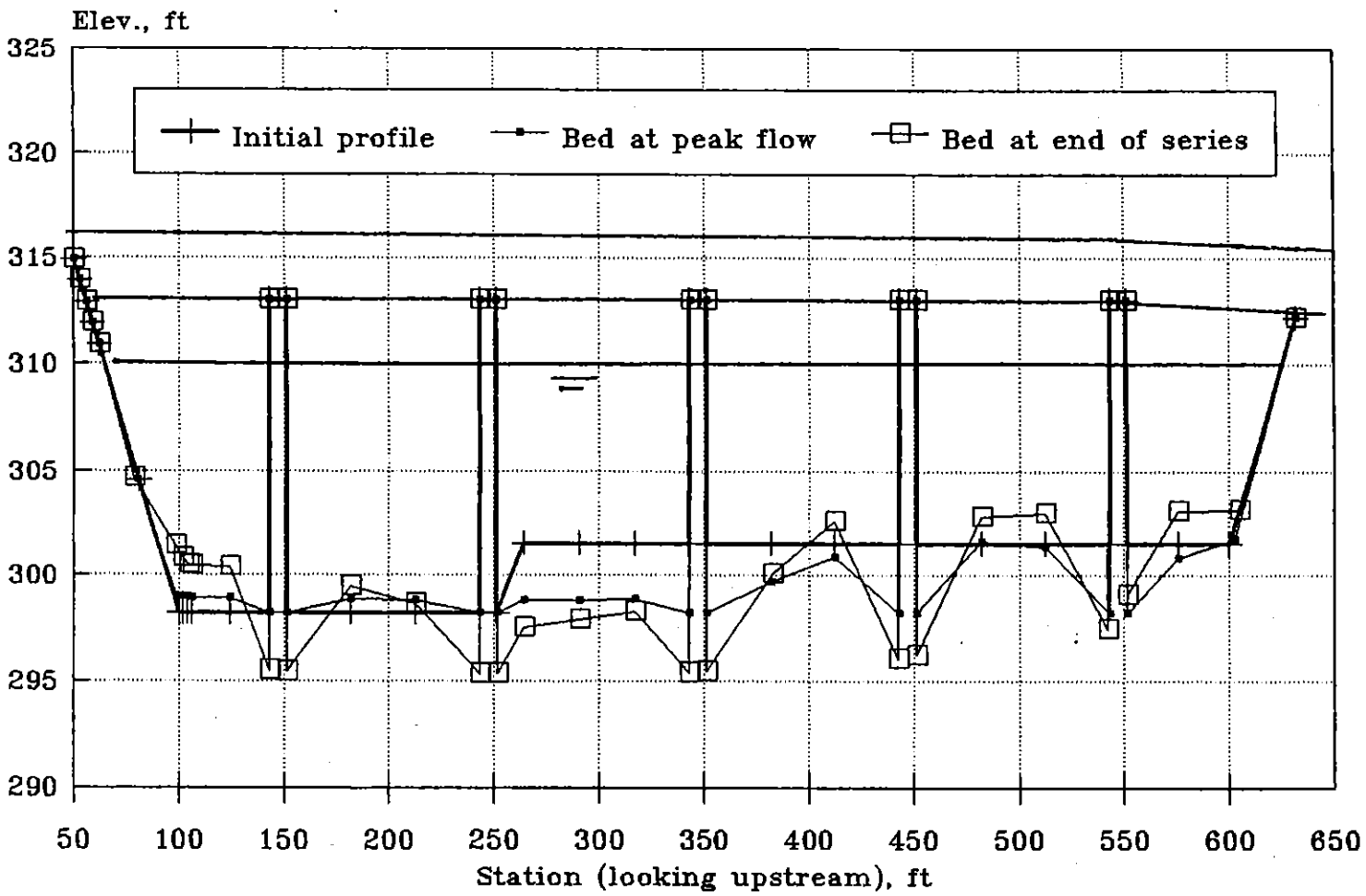

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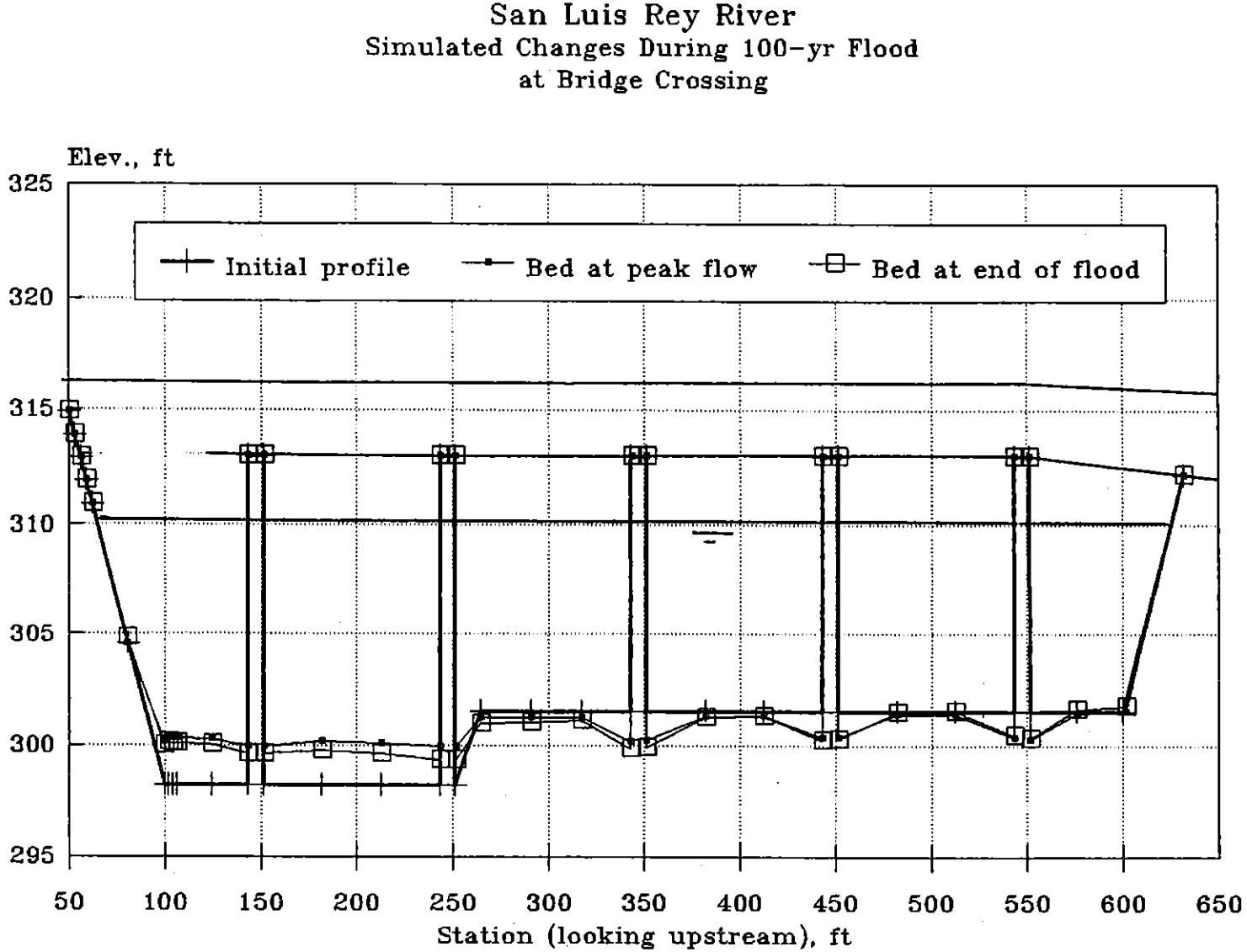

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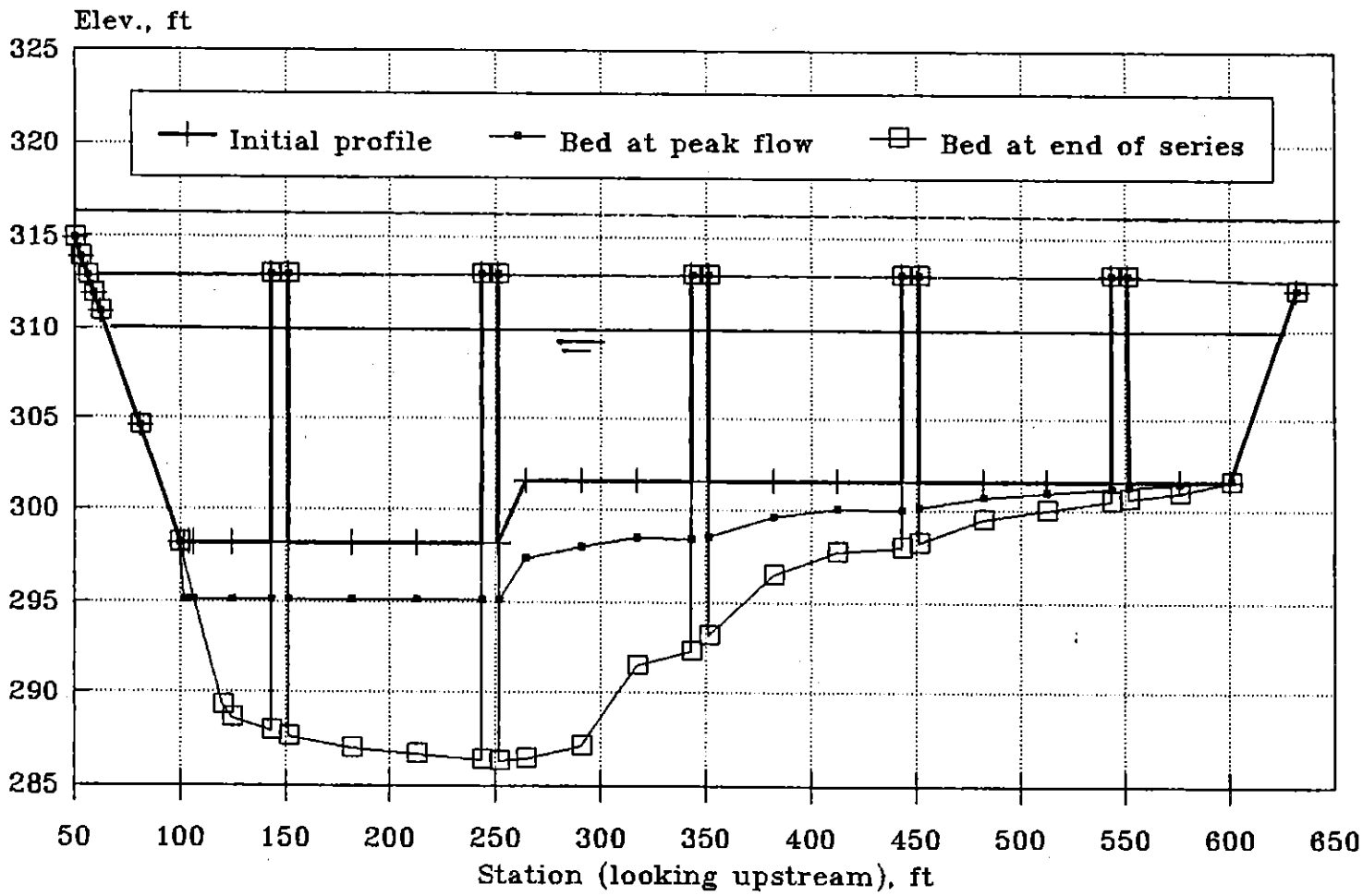

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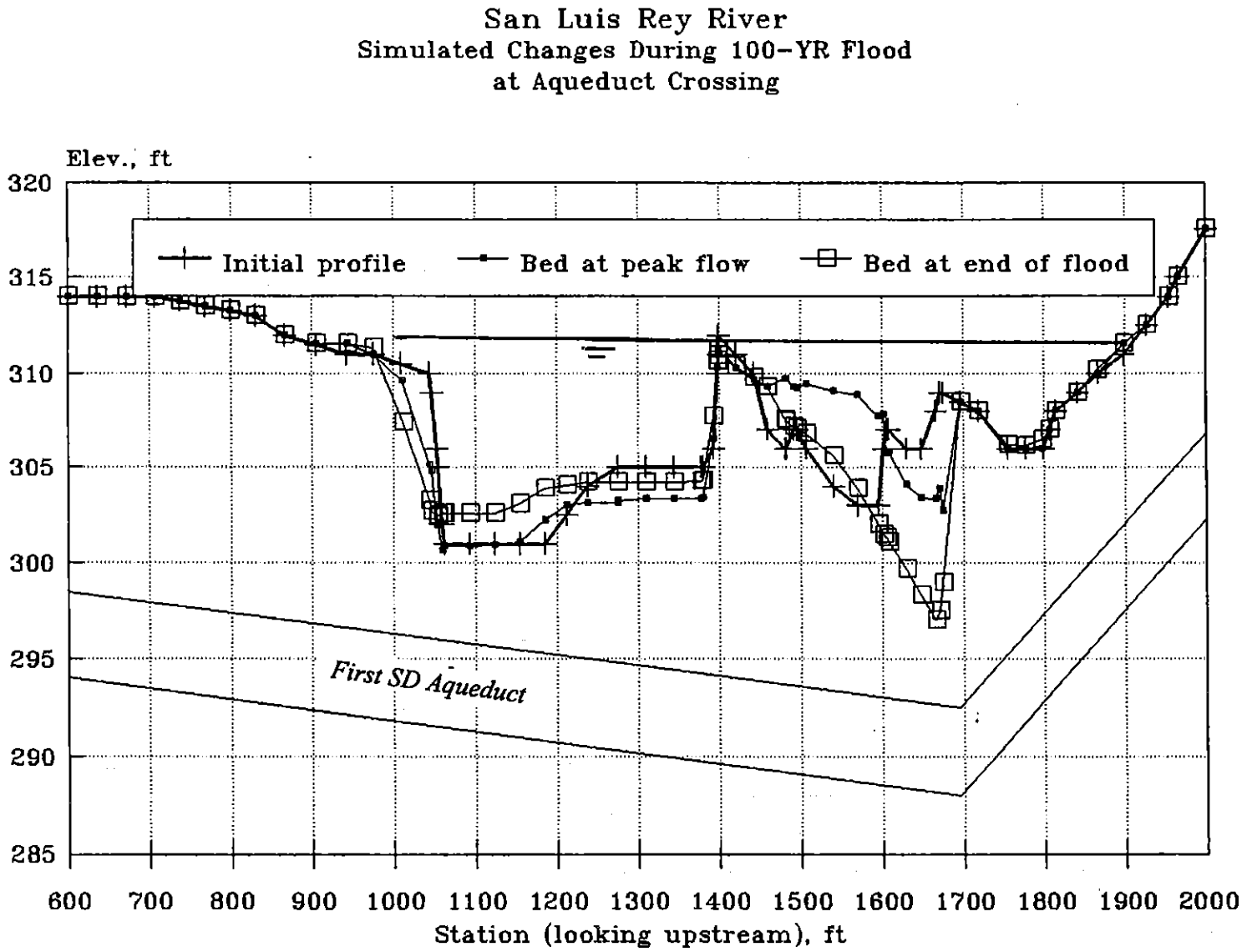

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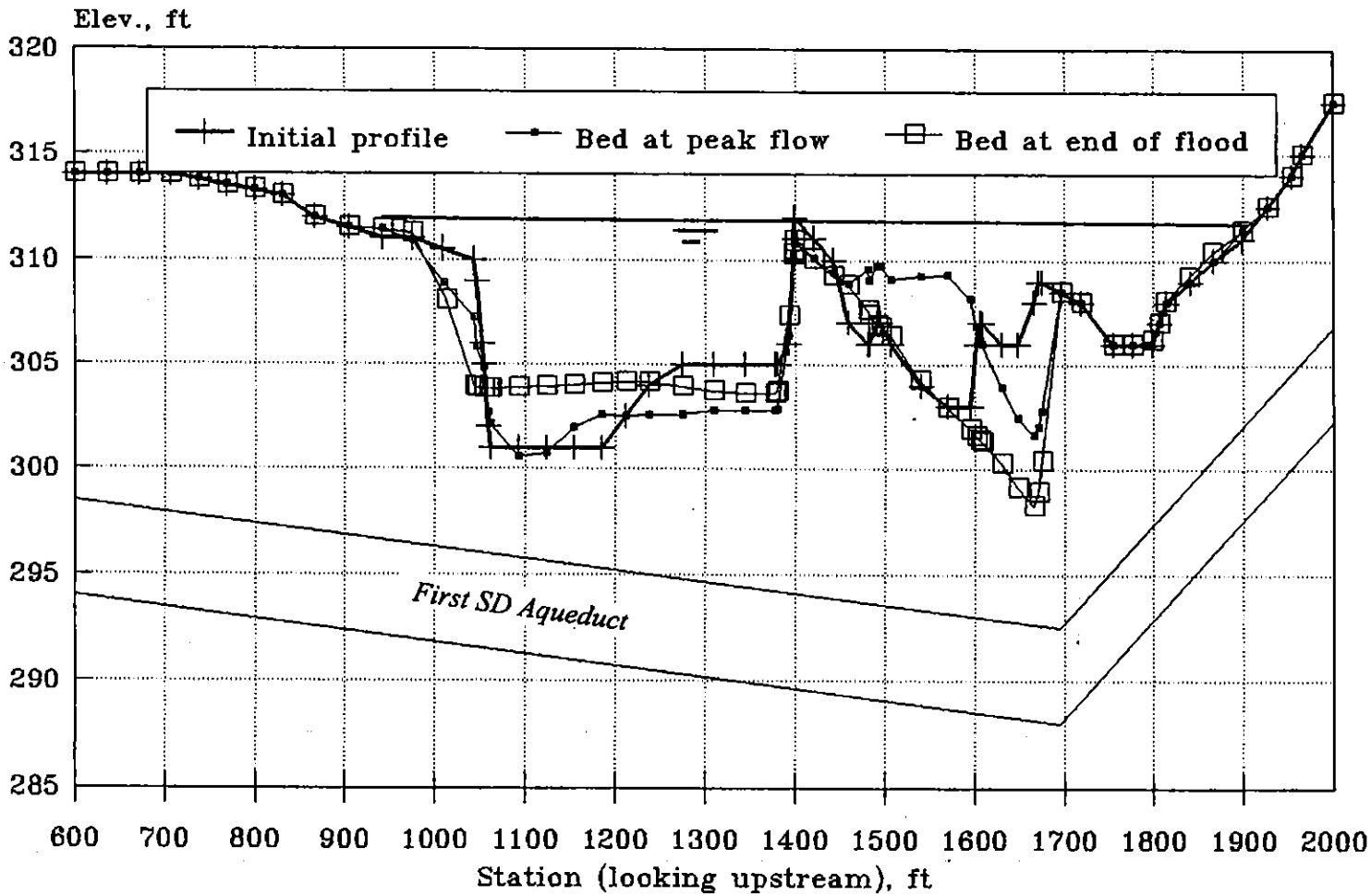

Fig. 26. Simulated changes in cross-sectional profile at aqueduct crossing for Case 2 - during 100-yr flood after bridge project without pit capture

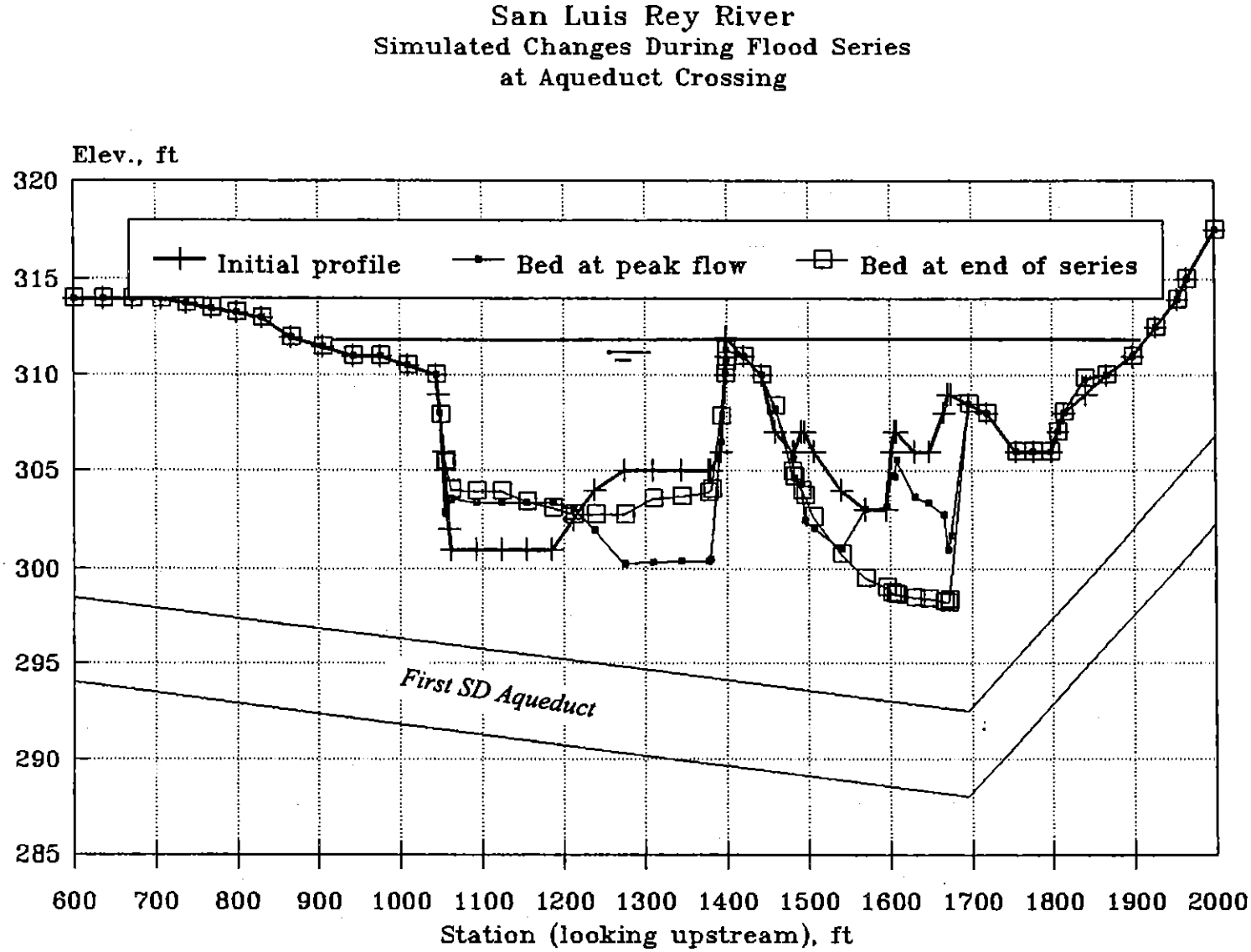

Fig. 27. Simulated changes in cross-sectional profile at aqueduct crossing for Case 3 - during flood series before bridge project without pit capture

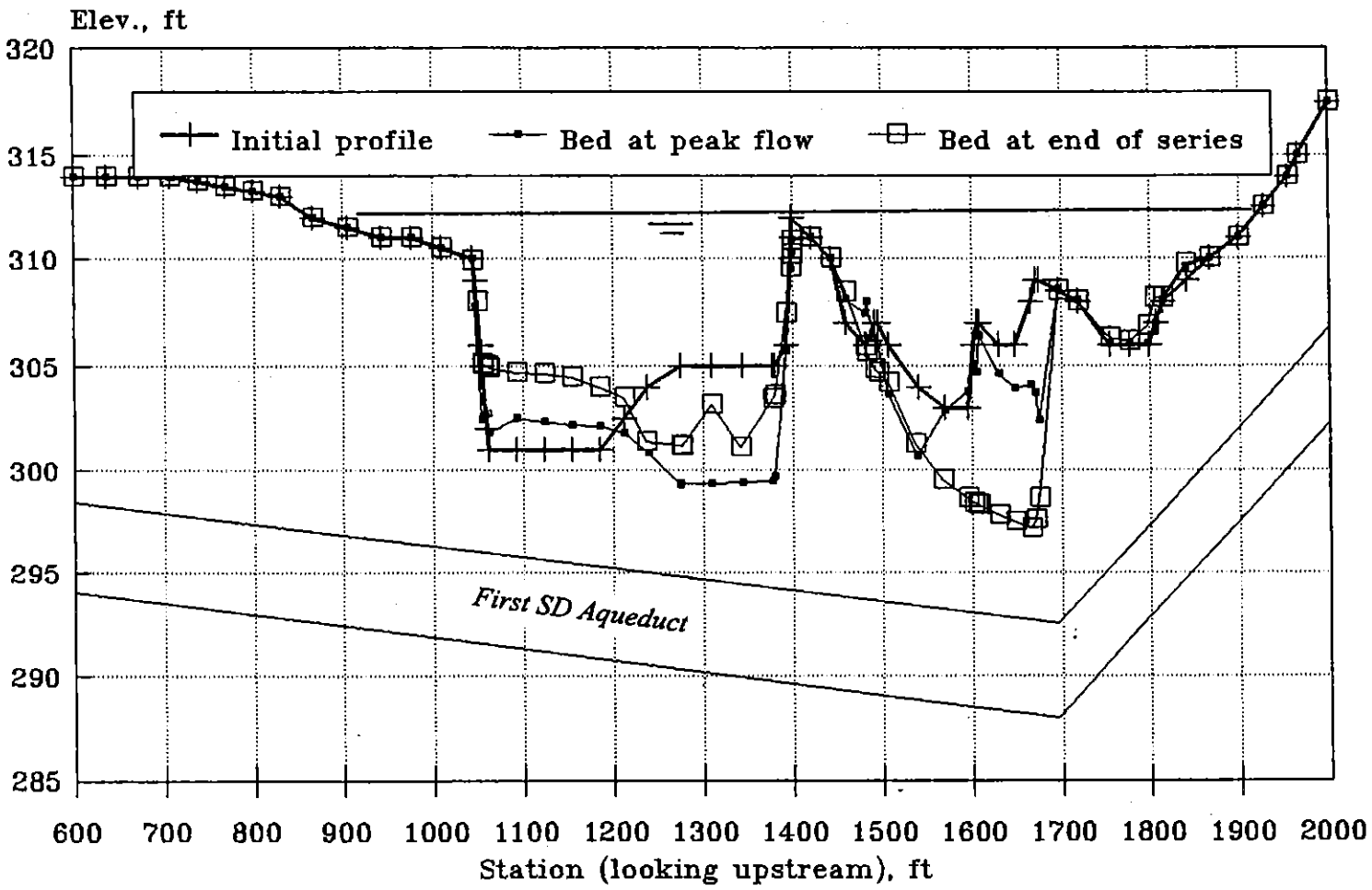

Fig. 28. Simulated changes in cross-sectional profile at aqueduct crossing for Case 4 - during flood series after bridge project without pit capture

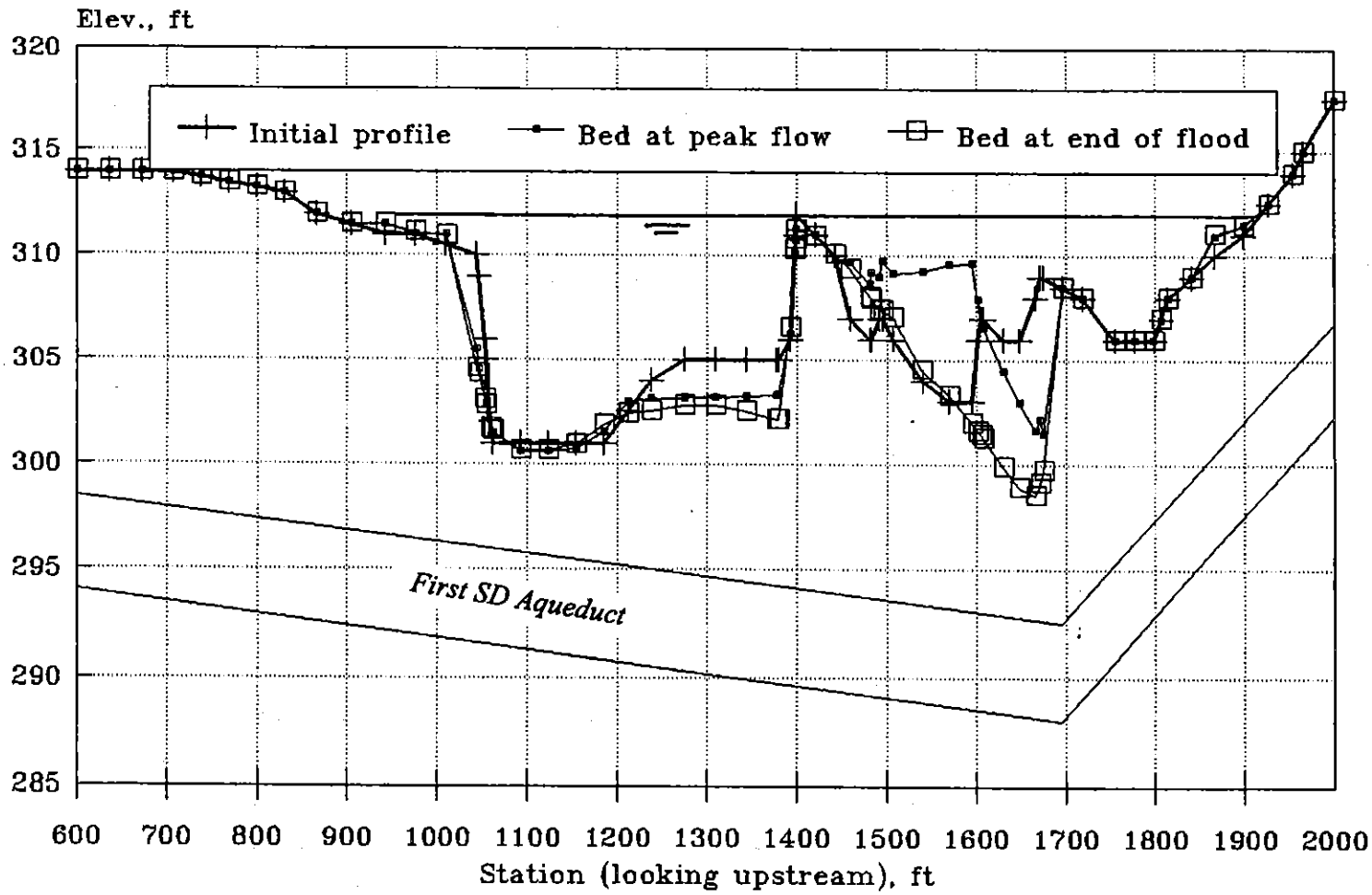

Fig. 29. Simulated changes in cross-sectional profile at aqueduct crossing for Case 5 - during 100-yr flood before bridge project with pit capture

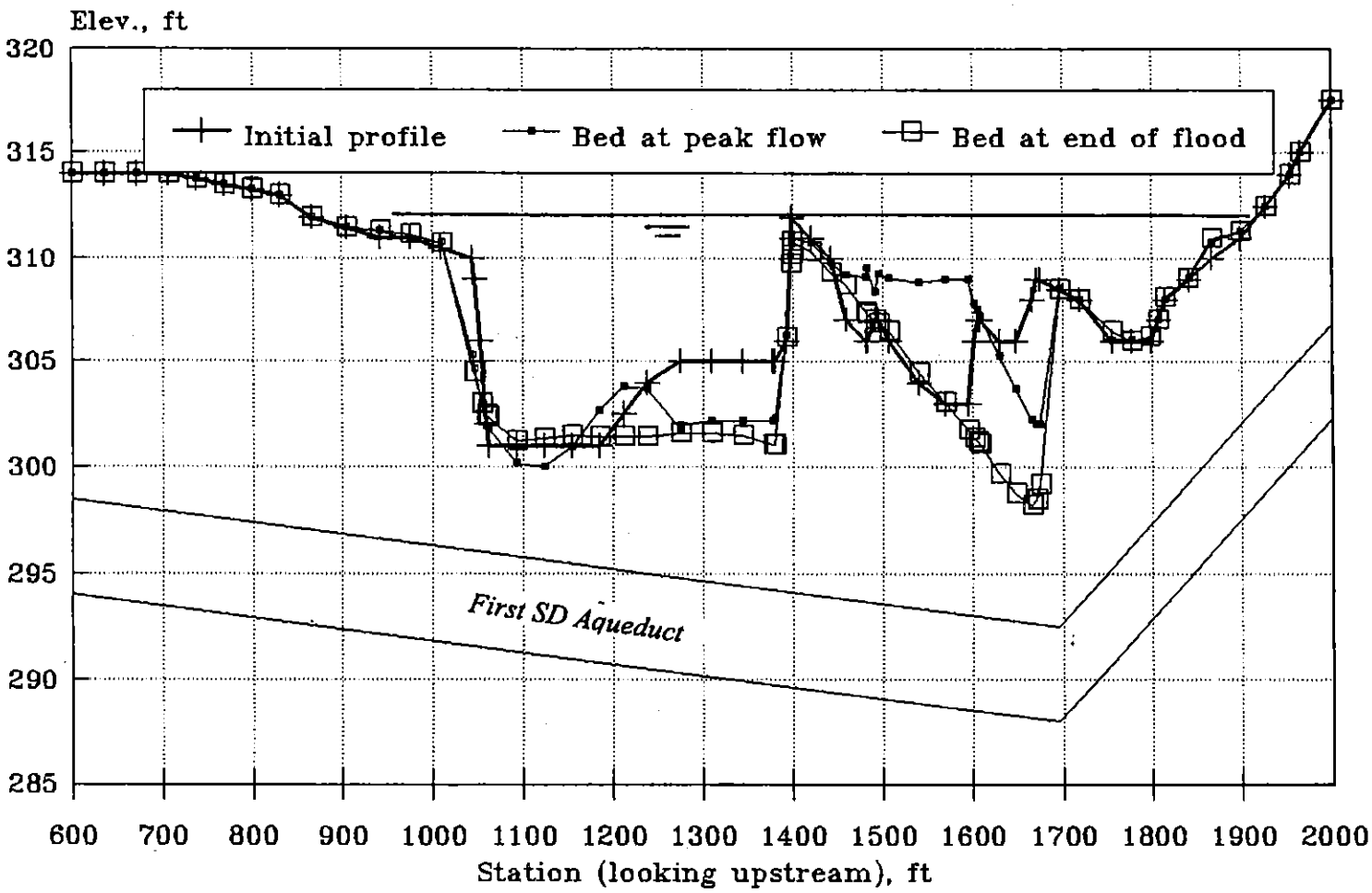

Fig. 30. Simulated changes in cross-sectional profile at aqueduct crossing for Case 6 - during 100-yr flood after bridge project with pit capture

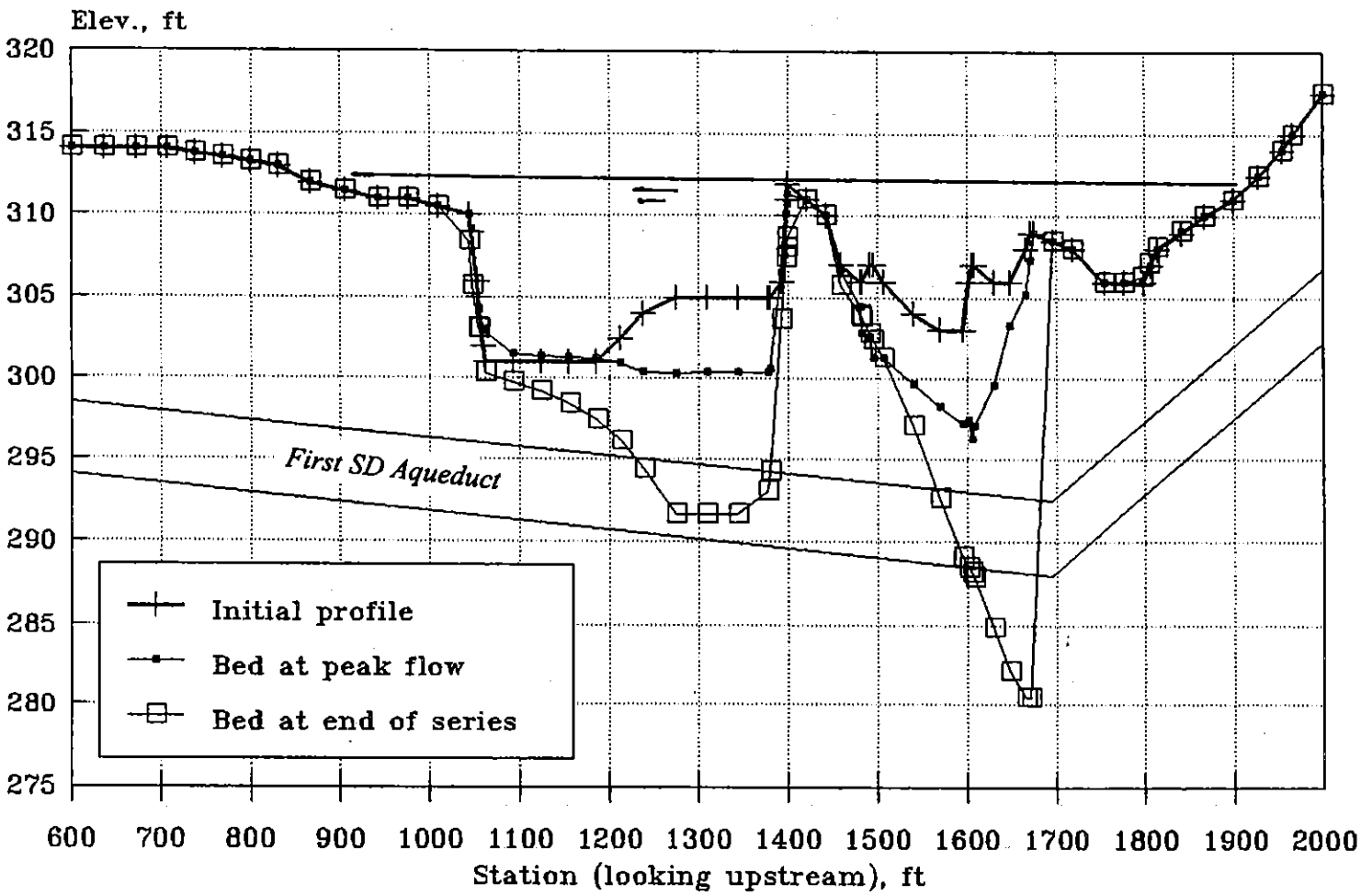

Fig. 31. Simulated changes in cross-sectional profile at aqueduct crossing for Case 7 - during flood series before bridge project with pit capture

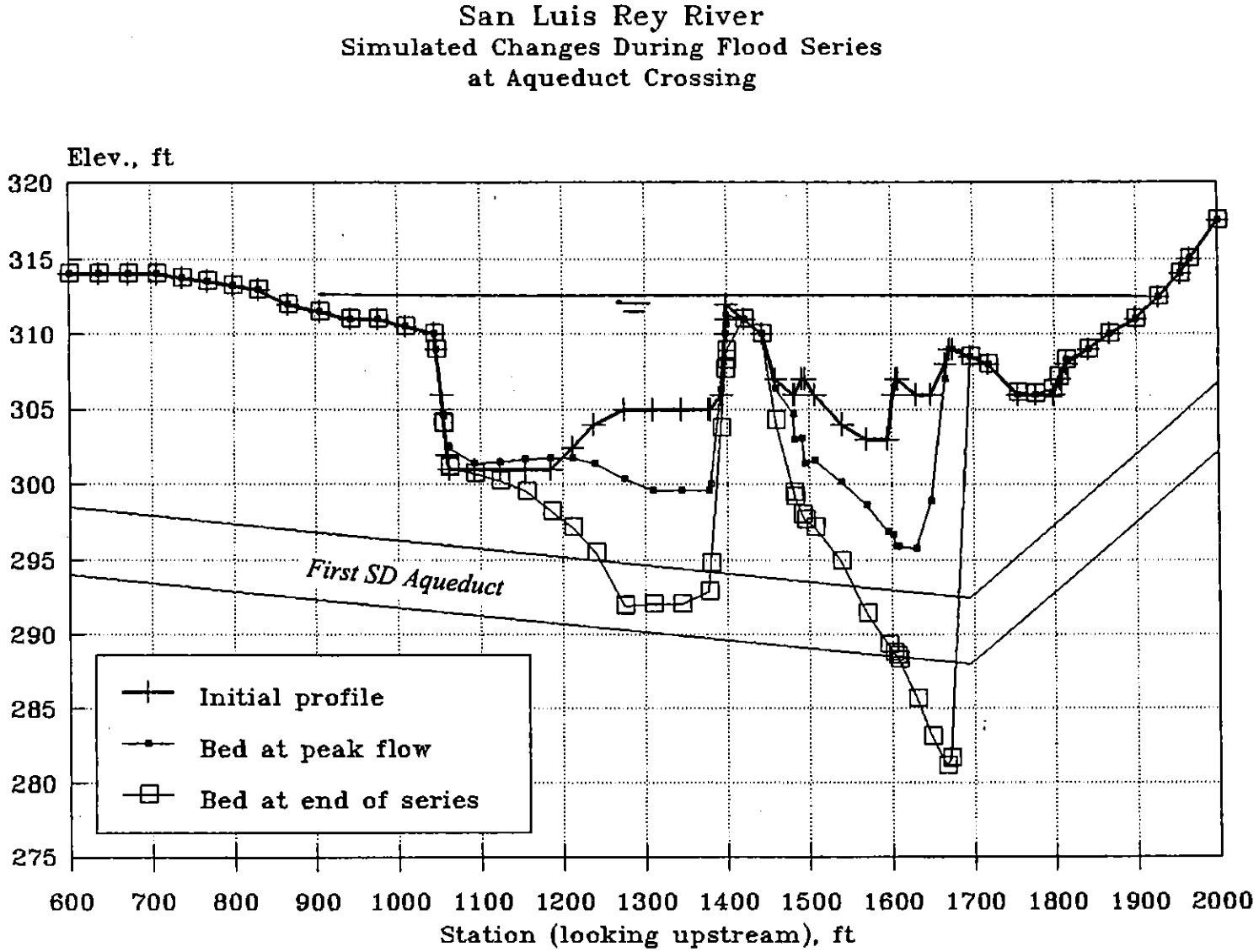

Fig. 32. Simulated changes in cross-sectional profile at aqueduct crossing for Case 8 - during flood series after bridge project with pit capture

APPENDIX A. INPUT/OUTPUT DESCRIPTIONS FOR FLUVIAL-12

I. INPUT DESCRIPTION

The basic data requirements for a modeling study include (1) topographic maps of the river reach from the downstream end to the upstream end of study, (2) digitized data for cross sections in the HEC-2 format with cross-sectional locations shown on the accompanying topographic maps, (3) flow records or flood hydrographs and their variations along the study stream reach, it any, and (4) size distributions of sediment samples along the study reach. Additional data are required for special features of a study river reach.

The HEC-2 format for input data is used in all versions of the FLUVIAL model. Data records for HEC-2 pertaining to cross-sectional geometry (X1 and GR), job title (T1, T2, and T3), and end of job (EJ), are used in the FLUVIAL model. If a HEC-2 data file is available, it is not necessary to delete the unused records except that the information they contain are not used in the computation. For the purpose of water- and sediment-routing, additional data pertaining to sediment characteristics, flood hydrograph, etc., are required and supplied by other data records. Sequential arrangement of data records are given in the following.

Records	**Description of Record Type**
T1,T2,T3	Title Records
G1	General Use Record
G2	General Use Records for Hydrographs
G3	General Use Record
G4	General Use Record for Selected Cross-Sectional Output
G5	General Use Record
G6	General Use Record for Selecting Times for Summary Output
GS	General Use Records for Initial Sediment Compositions
GB	General Use Records for Time Variation of Base-Level
GQ	General Use Records for Stage-Discharge Relation of Downstream Section
GI	General Use Records for Time Variation of Sediment Inflow
X1	Cross-Sectional Record
XF	Record for Specifying Special Features of a Cross Section
GR	Record for Ground Profile of a Cross Section
EJ	End of Job Record

Variable locations for each input record are shown by the field number. Each record has an input format of (A2, F6.0, 9F8.0). Field 0 occupying columns 1 and 2 is reserved for the required record identification characters. Field 1 occupies columns 3 to 8; Fields 2 to 10 occupy 8 columns each. The data records are tabulated and described in the following.

T1, T2, T3 Records - These three records are title records that are required for each job.

Field	Variable	Value	Description
0	IA	T1	Record identification characters
1-10	None		Numbers and alphameric characters for title

G1 Record - This record is required for each job, used to enter the general parameters listed below. This record is placed right after the T1, T2, and T3 records.

Field	Variable	Value	Description
0	IA	G1	Record identification characters
1	TYME	+	Starting time of computation on the hydrograph, in hours
2	ETIME	+	Ending time of computation on the hydrograph, in hours
3	DTMAX	+	Maximum time increment Δt allowed, in seconds
4	ISED	1	Select Graf's sediment transport equation.
		2	Select Yang's unit stream power equation. The sediment size is between 0.063 and 10 mm.
		3	Select Engelund-Hansen sediment equation.
		4	Select Parker gravel equation.
		5	Select Ackers-White sediment equation.
		6	Select Meyer-Peter Muller equation for bed load.
5	BEF	+	Bank erodibility factor for the study reach. This value is used for each section unless otherwise specified in Field 9 of the XF record. Use 1 for highly erodible banks; 0.5 for moderately erodible banks; and 0.2 for erosion-resistant banks. Any value between 0 and 1 may be used.
6	IUC	0	English units are used in input and output.
		1	Metric units are used in input and output.
7	CNN	+	Manning's n value for the study reach. This value is used for a section unless otherwise specified in Field 4 of the XF record. If bed roughness is computed based upon alluvial bedforms as specified in Field 5 of the G3 record, only an approximate n value needs to be entered here.
8	PTM1	+	First time point in hours on the hydrograph at which summary output and complete cross-sectional output are requested. It is usually the peak time, but it may be left blank if no output is requested.

9	PTM2	+	Second time point on the hydrograph in hours at which summary output and complete cross-sectional output are requested. It is usually the time just before the end of the simulation. This field may be left blank if no output is needed.
10	KPF	+	Frequency of printing summary output, in number of time steps. The default value is 1.

G2 Records - These records are required for each job, used to define the flow hydrograph(s) in the channel reach. The first one (or two) G2 records are used to define the spatial variation in water discharge along the reach; the succeeding ones are employed to define the time variation(s) of the discharge. Up to 10 hydrographs, with a maximum of 120 points for each, are currently dimensioned. See section II for tributaries. These records are placed after the G1 record.

Field	Variable	Value	Description
First G2			
0	IA	G2	Record identification characters
1	IHP1	+	Number of last cross section using the first (downstream most) hydrograph. The number of section is counted from downstream to upstream with the downstream section number being one. See also section II.
2	NP1	+	Number of points connected by straight segments used to define the first hydrograph.
3	IHP2	+	Number of last section using the second hydrograph if any. Otherwise leave it blank.
4	NP2	+	Number of points used to define the second hydrograph if any. Otherwise leave it blank.
5	IHP3	+	Number of last section using the third hydrograph if any. Otherwise leave it blank.
6	NP3	+	Number of points used to define the third hydrograph if any. Otherwise leave it blank.
7	IHP4	+	Number of last section using the fourth hydrograph if any. Otherwise leave it blank.
8	NP4	+	Number of points used to define the fourth hydrograph if any. Otherwise leave it blank.
9	IHP5	+	Number of last section using the fifth hydrograph if any.

			Otherwise leave it blank.
10	NP5	+	Number of points used to define the fifth hydrograph if any. Otherwise leave it blank.

Second G2: Note that this record is used only if more than 5 hydrographs are used for the job. It is necessary to place a negative sign in front of NP5 located in the 10th field of the first G2 record as a means to specify that more than 5 hydrographs are used.

0	IA	G2	Record identification characters
1	IHP6	+	Number of last cross section using the sixth hydrograph if any. Otherwise leave it blank.
2	NP6	+	Number of points connected by straight segments used to define the sixth hydrograph if any. Otherwise leave it blank.
3	IHP7	+	Number of last section using the seventh hydrograph if any. Otherwise leave it blank.
4	NP7	+	Number of points used to define the seventh hydrograph
5	IHP8	+	Number of last section using the eighth hydrograph if any. Otherwise leave it blank.
6	NP8	+	Number of points used to define the eighth hydrograph
7	IHP9	+	Number of last section using the ninth hydrograph if any. Otherwise leave it blank.
8	NP9	+	Number of points used to define the ninth hydrograph
9	IHP10	+	Number of last section using the tenth hydrograph if any. Otherwise leave it blank.
10	NP10	+	Number of points used to define the tenth hydrograph

Succeeding G2 Record(s)

1	Q11, Q21 Q31	+	Discharge coordinate of point 1 for each hydrograph, in ft^3/sec or m^3/sec
2	TM11,TM21 TM31	+	Time coordinate of point 1 for each hydrograph, in hours
3	Q12, Q22 Q32	+	Discharge coordinate of point 2 for each hydrograph, in cfs or cms

4	TM12,TM22 TM32	+	Time coordinate of point 2 for each hydrograph, in hours

Continue with additional discharge and time coordinates. Note that time coordinates must be in increasing order.

G3 Record - This record is used to define required and optional river channel features for a job as listed below. This record is placed after the G2 records.

Field	Variable	Value	Description
0	IA	G3	Record identification characters
1	S11	+	Slope of the downstream section, required for a job
2	BSP	0	One-on-one slope for rigid bank or bank protection
		+	Slope of bank protection in BSP horizontal units on 1 vertical unit. In the case of vertical bank, use 0.05 for BSP. This value is used for all cross sections unless otherwise specified in Field 8 of the XF record for a section.
3	DSOP	0	Downstream slope is allowed to vary during simulation.
		1	Downstream slope is fixed at S11 given in Field 1.
4	TEMP	0	Water temperature is 15°C.
		+	Water temperature in degrees Celsius
5	ICNN	0	Manning's n defined in Field 7 of the G1 record or those in Field 4 of the XF records are used.
		1	Brownlie's formula for alluvial bed roughness is used to calculate Manning's n in the simulation.
6	TDZAMA	0	Thickness of erodible bed layer is 100 ft (30.5 m).
		+	Thickness of erodible bed layer in ft or m. This value is applied to the entire channel reach but it may be redefined for a section using Field 10 of the XF record.
7	SPGV	0	Specific gravity of sediment is 2.65.
		+	Specific gravity of sediment
8	KGS	0	The number of size fractions for bed material is 5.
		+	The number of size fractions for bed material. It maximum value is 8.
9	PHI	0	The angle of repose for bed material is 36°.
		+	Angle of repose for bed material

G4 Record - This is an optional record used to select cross sections (up to 4) to be included at each summary output. Each cross section is identified by its number which is counted from the downstream section. This record also contains other options; it is placed after the G3 record.

Field	Variable	Value	Description
0	IA	G4	Record identification characters
1	IPLT1	+	Number of cross section
2	IPLT2	+	Number of cross section
3	IPLT3	+	Number of cross section
4	IPLT4	+	Number of cross section
5	IEXCAV	+	A positive integer indicates number of cross section where sand/gravel excavation occurs.
6	GIFAC	+	A non-zero constant is used to modify sediment inflow at the upstream section.
7	PZMIN	0	Minimum bed profile during simulation run is not requested.
		1	Output file entitled TZMIN for minimum bed profile is requested.
10	REXCAV	+	A non-zero value specifies rate of sand/gravel excavation at Section IEXCAV.

G5 Record - This is an optional record used to specify miscellaneous options, including unsteady-flow routing for the job based upon the dynamic wave, bend flow characteristics. If the unsteady flow option is not used, the water-surface profile for each time step is computed using the standard-step method. When the unsteady flow option is used, the downstream water-surface elevation must be specified using the GB records.

Field	Variable	Value	Description
0	IA	G5	Record identification characters
1	DT	0	The first time step is 100 seconds.
		+	Size of the first time step in seconds.
2	IROUT	0	Unsteady water routing is not used; water-surface profiles are computed using standard-step method.
		1	Unsteady water-routing based upon the dynamic wave is used to compute stages and water discharges at all cross sections for each

			time step.
3	PQSS	0	No output of gradation of sediment load
		3	Gradation of sediment load is included in output in 1,000 ppm by weight.
5	TSED	0	Rate of tributary sediment inflow is 1 times the discharge ratio.
		+	Rate of tributary sediment inflow is TSED times the discharge ratio.
6	PTV	0	No output of transverse distribution of depth-averaged velocity
		1	Transverse distribution of depth-averaged velocity is printed. The velocity distribution is for bends with fully developed transverse flow.
10	DYMAX	0	No GR points are inserted for cross sections.
		+	Maximum value of spacing between adjacent points at a cross section (ft or m). If this value is exceeded, intermediate points will be inserted by interpolation. The number of points inserted is given in Field 10 of the X3 record in output.

G6 Record - This is an optional record used to select time points for summary output. Up to 30 time points may be specified. The printing frequency (KPF) in Field 10 of the G1 Record may be suppressed by using a large number such as 9999.

Field	Variable	Value	Description
First G6 Record			
0	IA	G6	Record identification characters
1	NKPS	+	Number of time points
Succeeding G6 Record(s)			
0	IA	G6	Record identification characters
1	SPTM(1)	+	First time point, in hours
2	SPTM(2)	+	Second time point, in hours

Continue with additional time points.

GS Record - At least two GS records are required for each job, used to specify initial bed-material compositions in the channel at the downstream and upstream cross sections. The first GS record is for the downstream section; it should be placed before the first X1 record and after the G4 record, if any. The second GS record is for the upstream section; it should be placed after

all cross-sectional data and just before the EJ record. Additional GS records may be inserted between two cross sections within the stream reach, with the total number of GS records not to exceed 15. Each GS record specifies the sediment composition at the cross section located before the record. From upstream to downstream, exponential decay in sediment size is assumed for the initial distribution. Sediment composition at each section is represented by five size fractions.

Field	Variable	Value	Description
0	IA	GS	Record identification characters
1	DFF	+	Geometric mean diameter of the smallest size fraction in mm
2	PC	+	Fraction of bed material in this size range

Continue with other DFF's and PC's.

GB Records - These optional records are used to define time variation of stage (water-surface elevation) at a cross section. The first set of GB records is placed before all cross section records (X1); it specifies the downstream stage. When the GB option is used, it supersedes other methods for determining the downstream stage. Other sets of GB records may be placed in other parts of the data set; each specifies the time variation of stage for the cross section immediately following the GB records.

Field	Variable	Value	Description
First GB Record			
0	IA	GB	Record identification characters
1	KBL	+	Number of points used to define base-level changes
Succeeding GB Record(s)			
0	IA	GB	Record identification characters
1	BSLL(1)	+	Base level of point 1, in ft or m
2	TMBL(1)	+	Time coordinate of point 1, in hours
3	BSLL(2)	+	Base level of point 2, in ft or m
4	TMBL(2)	+	Time coordinate of point 2, in hours

Continue with additional elevations and time coordinates, in the increasing order of time.

GQ Records - These optional records are used to define stage-discharge relation at the

downstream section. The GQ input data may not used together with the GB records.

Field	Variable	Value	Description
First GQ Record			
0	IA	GQ	Record identification characters
1	KQL	+	Number of points used to define base-level changes
Succeeding GQ Record(s)			
0	IA	GQ	Record identification characters
1	BSLL(1)	+	Base level of point 1, in ft or m
2	TMQ(1)	+	Discharge of point 1, in cfs or cms
3	BSLL(2)	+	Base level of point 2, in ft or m
4	TMQ(2)	+	Discharge of point 2, in cfs or cms

Continue with additional elevations and discharges, in the increasing order of discharge.

GI Records - These optional records are used to define time variation of sediment discharge entering the study reach through the upstream cross section. The GI input data, if included, will supersede other methods for determining sediment inflow. The sediment inflow is classified into the two following cases: (1) specified inflow at the upstream section, such as by a rating curve; and (2) sediment feeding, such as from a dambreach or a sediment feeder. These two cases are distinguished by DXU in Field 2 of this record. For the first case, sediment discharge at the upstream section is computed using size fractions of bed-material at the section, but for the second case, the size fractions of feeding material need to be specified using the PCU values in this record. The upstream section does not change in geometry for the first case but it may undergo scour or fill for the second case.

Field	Variable	Value	Description
First GI Record			
0	IA	GI	Record identification characters
1	KGI	+	Number of points used to define time variation of sediment inflow.
2	DXU	+ or 0	Channel distance measured from the upstream section to the sediment source. A zero value signifies case 1; and non-zero DXU and KGI signify case 2, for which PCU values are required.
3-10	PCU	+	Size fractions of inflow material. The number of size fractions is given in Field 8 of the G3 record and the sizes for the fractions are

given in the second GS record.

Succeeding GI Record(s)

0	IA	GI	Record identification characters
1	QSU(1)	+	Sediment discharge of point 1, in cubic ft or m (net volume) per second
2	TMGI(1)	+	Time coordinate of point 1, in hours
3	QSO(2)	+	Sediment discharge of point 2
4	TMGI(2)	+	Time coordinate of point 2.

Continue with additional sediment discharges and time coordinates, in the increasing order of time coordinates.

X1 Record - This record is required for each cross section (175 cross sections can be used for the study reach); it is used to specify the cross-sectional geometry and program options applicable to that cross-section. Cross sections are arranged in sequential order starting from downstream.

Field	Variable	Value	Description
0	IA	X1	Record identification characters
1	SECNO	+	Original section number from the map
2	NP	+	Total number of stations or points on the next GR records for current cross section
7	DX	+	Length of reach between current cross section and the next downstream section along the thalweg, in feet or meters
8	YFAC	0	Cross-section stations are not modified by the factor YFAC.
		+	Factor by which all cross-section stations are multiplied to increase or decrease area. It also multiplies YC1, YC2 and CPC in the XF record, and applies to the CI record.
9	PXSECE	0	Vertical or Z coordinate of GR points are not modified.
		±	Constant by which all cross-section elevations are raised or lowered
10	NODA	0	Cross section is subject to change.
		1	Cross section is not subject to change.

XF Record - This is an optional record used to specify special features of a cross section.

Field	Variable	Value	Description
0	IA	XF	Record identification characters
1	YC1	0	Regular erodible left bank
		+	Station of rigid left bank in ft or m, to the left of which channel is nonerodible. Note: This station is located at toe of rigid bank; its value must be non-zero and must be equal to one of the Y coordinates in GR records but not the first Y coordinate.
2	YC2	0	Regular erodible right bank
	+		Station of rigid right bank, to the right of which channel is nonerodible. Note: This station is located at toe of rigid bank; its value must be equal to one of the Y coordinates in GR records but not the last Y coordinate.
3	RAD	0	Straight channel with zero curvature
		+	Radius of curvature at channel centerline in ft or m. Center of radius is on same side of channel where the station (Y-coordinate) starts.
		-	Radius of curvature at channel centerline in ft or m. Center of radius is on opposite side of zero station. Note: RAD is used only if concave bank is rigid and so specified using the XF record. RAD produces a transverse bed scour due to curvature.
4	CN	0	Roughness of this section is the same as that given in Field 7 of the G1 record.
		+	Manning's *n* value for this section
5	CPC	0	Center of thalweg coincides with channel invert at this section.
		+	Station (Y-coordinate) of the thalweg in ft or m
6	IRC	0	Regular erodible cross section
		1	Rigid or nonerodible cross section such as drop structure or road crossing. There is no limit on the total number of such cross sections.
8	BSP	0	Slope of bank protection is the same as that given in Field 2 of the G3 record.
		+	Slope of bank protection at this section in BSP horizontal units on 1 vertical unit. Use 0.05 for vertical bank.
		5	Slope of rigid bank is defined by the GR coordinates.
9	BEFX	0	Bank erodibility factor is defined in Field 5 of the G1 record.

		+	A value between 0.1 and 1.0 for BEFX specifies the bank erodibility factor at this section.
	RWD	+	RWD is the width of bank protection of a small channel in the floodplain. Areas outside this zone remains erodible. RWD is specified by a value greater than 1 (ft or m) in this field. When RWD is used, BEFX is not specified.
10	TDZAM	0	Erodible bed layer at this section is defined by TDZAMA in Field 6 of the G3 record.
		+	Thickness of erodible bed layer in ft or m. Only one decimal place is allowed for this number.
	ENEB	±	Elevation of non-erodible bed, used to define the crest elevation of a grade-control structure which may be above or below the existing channel bed. In order to distinguish it from TDZAM, ENEB must have the value of 1 at the second decimal place. For example, the ENEB value of 365 should be inputted as 365.01 and the ENEB value of -5.2 should be inputted as -5.21. When ENEB is specified, it supersedes TDZAM and TDZAMA

CI Record - This is an optional record used to specify channel improvement options due to excavation or fill. The excavation option modifies the cross-sectional geometry by trapezoidal excavation. Those points lower than the excavation level are not filled. The fill option modifies the cross-sectional geometry by raising the bed elevations to a prescribed level. Those points higher than the fill level are not lowered. Excavation and fill can not be used at the same time. This record should be placed after the X1 and XF records but before the GR records. The variable ADDVOL in Field 10 of this record is used to keep track of the total volume of excavation or fill along a channel reach. ADDVOL specifies the initial volume of fill or excavation. A value greater or less than 0.1 needs to be entered in this field to keep track of the total volume of fill or excavation until another ADDVOL is defined.

Field	Variable	Value	Description
0	IA	G5	Record identification characters
1	CLSTA	+	Station of the centerline of the trapezoidal excavation, expressed according to the stations in the GR records, in feet or meter.
2	CELCH	+	Elevation of channel invert for trapezoidal channel, in feet or meters.
4	XLSS	+	Side slope of trapezoidal excavation, in XLSS horizontal units for 1 vertical unit.
5	ELFIL	+	Fill elevation on channel bed, in feet or meters.
6	BW	+	Bed width of trapezoidal channel, in feet or meters. This width is

			measured along the cross section line; therefore, a larger value should be used if a section is skewed.
10	ADDVOL	0	Volume of excavation or fill, if any, is added to the total volume already defined.
		+	Initial volume of fill on channel bed, in cubic feet or cubic meters.
		-	Initial volume of excavation from channel bed, in cubic feet or meters.

GR Record - This record specifies the elevation and station of each point for a digitized cross section; it is required for each X1 record.

Field	Variable	Value	Description
0	IA	GR	Record identification characters
1	Z1	±	Elevation of point 1, in ft or m. It may be positive or negative.
2	Y1	±	Station of point 1, in ft or m
3	Z2	±	Elevation of point 2, in ft or m
4	Y2	±	Station of point 2, in ft or m

Continue with additional GR records using up to 79 points to describe the cross section. Stations should be in increasing order.

EJ Record - This record is required following the last cross section for each job. Each group of records beginning with the T1 record is considered as a job.

Field	Variable	Value	Description
0	IA	EJ	Record identification characters
1-10			Not used

II. OUTPUT DESCRIPTION

Output of the model include initial bed-material compositions, time and spatial variations of the water-surface profile, channel width, flow depth, water discharge, velocity, energy gradient, median sediment size, and bed-material discharge. In addition, cross-sectional profiles are printed at different time intervals.

Symbols used in the output are generally descriptive, some of them are defined

below:

SECTION	Cross section
TIME	Time on the hydrograph
DT	Size of the time step or Δt in sec
W.S.ELEV	Water-surface elevation in ft or m
WIDTH	Surface width of channel flow in ft or m
DEPTH	Depth of flow measured from channel invert to water surface in ft or m
Q	Discharge of flow in cfs or cms
V	Mean velocity of a cross-section in fps or mps
SLOPE	Energy gradient
D50	Median size or d_{50} of sediment load in mm
QS	Bed-material discharge for all size fractions in cfs or cms
FR	Froude number at a cross section
N	Manning's roughness coefficient
SED.YIELD	Bulk volume or weight of sediment having passed a cross section since beginning of simulation, in cubic yards or tons.
WSEL	Water-surface elevation, in ft or m
Z	Vertical coordinate (elevation) of a point on channel boundary at a cross-section, in ft or m
Y	Horizontal coordinate (station) of a point on channel boundary at a cross-section, in ft or m
DZ	Change in elevation during the current time step, in ft or m
TDZ	Total or accumulated change in elevation, in ft or m

APPENDIX B. SAMPLE INPUT/OUTPUT LISTINGS OF FLUVIAL-12 FOR CASE 8

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1*************************************************************
 *     FLUVIAL-12   SIMULATION OF RIVER HYDRAULICS,          *
 *     SEDIMENT TRANSPORT AND RIVER CHANNEL CHANGES          *
 *              FOR USE BY HOWARD H. CHANG                   *
 *************************************************************

 THIS PROGRAM IS DEVELOPED AND FURNISHED BY HOWARD H. CHANG AND IS ACCEPTED AND USED BY THE RECIPIENT
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 T1     SAN LUIS REY RIVER, PROPOSED BRIDGE AT GREGORY CANYON
 T2     FOR NOLTE AND ASSOCIATES
 T3     MAY 1999
 G1       .50   184.70   200.00     3.00      .50      .00      .04   491.00  1184.50  6000.00
 G2     18.00    75.00    58.00    75.00      .00      .00      .00      .00      .00      .00
 G2   2800.00      .00  3600.00     2.00  4000.00     3.00  4000.00     3.20  2470.00    10.00
 G2   2050.00    10.10  8800.00    13.00 11400.00    15.00 12000.00    16.00 12000.00    16.10
 G2  12000.00    16.20  9843.00    18.00  8800.00    20.00  6290.00    25.00  3900.00    30.00
 G2   1660.00    30.10  5760.00    33.00  7600.00    35.00  8000.00    36.00  8000.00    36.20
 G2   5860.00    40.00  4200.00    45.00  2630.00    50.00  2740.00    50.10 11500.00    53.00
 G2  15200.00    55.00 16000.00    56.00 16000.00    56.20 11740.00    60.00  8400.00    65.00
 G2   5260.00    70.00  3120.00    75.00  4160.00    75.10  5400.00    77.00  6000.00    78.00
 G2   6000.00    78.20  3640.00    85.00  4020.00    85.10 16100.00    87.40 31400.00    90.00
 G2  33000.00    91.00 33000.00    91.20 24100.00    95.00 17300.00   100.00 10900.00   105.00
 G2   6440.00   110.00  3220.00   115.00  1660.00   115.10  5760.00   118.00  7600.00   120.00
 G2   8000.00   121.00  8000.00   121.20  5860.00   125.00  4200.00   130.00  2630.00   135.00
 G2   4160.00   135.10  5400.00   137.00  6000.00   138.00  6000.00   138.20  3640.00   145.00
 G2   3020.00   145.10 12100.00   147.40 23600.00   150.00 24800.00   151.00 24800.00   151.20
 G2  18280.00   155.00 13000.00   160.00  8160.00   165.00  4840.00   170.00  2420.00   175.00
 G2   2800.00   175.10  3600.00   177.00  4000.00   178.00  4000.00   178.20  2470.00   185.00
 G2   2800.00      .00  3600.00     2.00  4000.00     3.00  4000.00     3.20  2470.00    10.00
 G2   1900.00    10.10  7900.00    13.00 10300.00    15.00 10800.00    16.00 10800.00    16.10
 G2  10800.00    16.20  8843.00    18.00  7900.00    20.00  5670.00    25.00  3510.00    30.00
 G2   1600.00    30.10  5470.00    33.00  7220.00    35.00  7600.00    36.00  7600.00    36.20
 G2   5570.00    40.00  4000.00    45.00  2500.00    50.00  2430.00    50.10 10350.00    53.00
 G2  13700.00    55.00 14400.00    56.00 14400.00    56.20 10560.00    60.00  7560.00    65.00
 G2   4730.00    70.00  2800.00    75.00  4100.00    75.10  5300.00    77.00  5900.00    78.00
 G2   5900.00    78.20  3540.00    85.00  3920.00    85.10 14700.00    87.40 28600.00    90.00
 G2  30000.00    91.00 30000.00    91.20 21800.00    95.00 15500.00   100.00  9900.00   105.00
 G2   5860.00   110.00  2920.00   115.00  1600.00   115.10  5470.00   118.00  7220.00   120.00
 G2   7600.00   121.00  7600.00   121.20  5500.00   125.00  3900.00   130.00  2400.00   135.00
 G2   4060.00   135.10  5300.00   137.00  5900.00   138.00  5900.00   138.20  3540.00   145.00
 G2   2920.00   145.10 11100.00   147.40 21500.00   150.00 22600.00   151.00 22600.00   151.20
 G2  16680.00   155.00 11800.00   160.00  7420.00   165.00  4440.00   170.00  2220.00   175.00
 G2   2800.00   175.10  3600.00   177.00  4000.00   178.00  4000.00   178.20  2470.00   185.00
 G6      3.00      .00      .00      .00      .00      .00      .00      .00      .00      .00
 G6     91.00   150.00   184.50
 G3       .00      .00     1.00      .00      .00      .00      .00      .00      .00      .00
 G4     35.00    38.00      .00      .00      .00      .00     1.00      .00      .00      .00
 G5       .00      .00      .00      .00      .20      .00      .00      .20      .00   120.00
 GQ      7.00      .00      .00      .00      .00      .00      .00      .00      .00      .00
 GQ    231.00   100.00   237.30  5000.00   241.20 13000.00   242.30 17000.00   243.30 22000.00
 GQ    245.20 31000.00   245.70 34000.00
 GS       .13      .14      .26      .20      .45      .20      .73      .20     2.20      .26
 NC       .04      .04      .04      .10      .30      .00      .00      .00      .00      .00
 QT      4.00  4000.00 20000.00 33000.00 85000.00      .00      .00      .00      .00      .00
 X1     17.76    30.00   425.00   906.00   230.00   430.00   330.00      .00      .00      .00
 X3       .00   234.00      .00      .00      .00      .00      .00      .00      .00      .00
 XF    512.00   900.00      .00      .00      .00      .00      .00     5.00      .00      .00
 X3                                                                                      1.00
 GR    267.20      .00   257.60    43.00   249.60   113.00   248.90   181.00   247.10   211.00
 GR    246.10   251.00   247.60   286.00   247.40   350.00   250.10   384.00   253.30   409.00
 GR    249.40   435.00   247.10   468.00   248.40   489.00   235.10   512.00   234.60   564.00
 GR    227.30   575.00   228.60   641.00   234.20   648.00   235.50   699.00   237.90   713.00
 GR    238.65   800.00   239.40   887.00   240.90   900.00   256.60   935.00   258.10   940.00
 GR    256.60  1016.00   256.50  1098.00   258.10  1121.00   259.40  1171.00   259.80  1211.00
 GR    259.60  1229.00
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X1	17.86	30.00	692.00	1161.00	500.00	600.00	550.00	.00	.00	.00
X3	.00	236.00	.00	.00	.00	.00	.00	.00	.00	.00
XF	706.00	1139.00	.00	.00	.00	.00	.00	5.00	.00	.00
X3										2.00
GR	257.10	.00	249.90	51.00	247.40	141.00	248.90	225.00	250.00	298.00
GR	251.10	371.00	251.70	462.50	252.30	554.00	252.50	608.00	254.40	624.00
GR	253.30	651.00	252.90	665.00	251.00	684.00	238.20	706.00	238.40	749.00
GR	227.40	762.00	228.40	876.00	237.60	889.00	233.50	937.00	234.60	950.00
GR	233.00	960.00	233.90	1050.00	236.00	1060.00	238.40	1077.00	244.10	1139.00
GR	253.90	1164.00	255.40	1166.00	255.00	1198.00	254.60	1238.00	252.70	1268.00
GR	252.30	1297.00	253.30	1320.00						
X1	17.96	22.00	372.00	937.00	500.00	560.00	535.00	.00	.00	.00
X3	.00	238.00	.00	.00	.00	.00	.00	.00	.00	.00
XF	.00	910.00	.00	.00	.00	.00	.00	5.00	.00	.00
X3										2.00
GR	258.00	.00	253.60	59.00	251.90	149.00	252.10	209.50	252.30	270.00
GR	250.50	340.00	251.00	360.00	235.40	387.00	235.30	462.00	239.20	474.00
GR	239.30	497.00	228.30	510.00	229.20	574.00	239.90	590.00	240.00	654.50
GR	240.10	719.00	236.80	746.00	238.00	764.00	238.40	868.00	243.30	910.00
GR	254.80	934.00	257.50	945.00	257.30	981.00	255.40	1051.00		
X1	18.08	24.00	115.00	739.00	590.00	660.00	615.00	.00	.00	.00
X3	.00	240.00	.00	.00	.00	.00	.00	.00	.00	.00
XF	.00	722.00	.00	.00	.00	.00	.00	5.00	.00	.00
X3										1.00
GR	261.50	.00	255.80	27.00	253.70	60.00	251.90	99.00	252.60	103.00
GR	238.90	127.00	236.20	148.00	235.70	257.00	234.10	276.00	230.30	289.00
GR	229.60	311.00	228.90	389.00	236.00	401.00	235.40	467.00	239.30	479.00
GR	240.40	564.00	241.50	649.00	239.80	656.00	243.90	722.00	256.60	750.00
GR	258.10	771.00	256.80	850.00	255.50	883.00	256.70	927.00	257.60	1032.00
X1	18.18	32.00	134.00	630.00	540.00	560.00	550.00	.00	.00	.00
X3	.00	242.00	.00	.00	.00	.00	.00	.00	.00	.00
XF	.00	598.00	.00	.00	.00	.00	.00	5.00	.00	.00
GR	255.80	.00	252.10	55.00	252.20	113.00	250.00	127.00	248.30	142.00
GR	245.20	156.00	239.10	169.00	238.50	241.00	236.50	242.00	237.00	278.00
GR	235.30	283.00	236.00	350.00	237.10	354.00	232.00	374.00	232.40	440.00
GR	240.50	454.00	241.00	510.00	240.00	515.00	243.90	598.00	258.00	629.00
GR	258.90	641.00	256.50	755.00	256.90	795.00	259.20	822.00	259.20	887.00
GR	259.30	955.00	260.50	1034.00	261.70	1084.00	261.60	1139.00	261.00	1181.00
GR	262.80	1260.00	265.20	1289.00						
X1	18.30	25.00	289.00	680.00	500.00	680.00	590.00	.00	.00	.00
X3	.00	244.00	.00	.00	.00	.00	.00	.00	.00	.00
XF	.00	637.00	.00	.00	.00	.00	.00	5.00	.00	.00
X3										1.00
GR	253.30	.00	254.10	75.00	254.40	182.00	253.70	257.00	250.80	280.00
GR	246.60	299.00	246.70	304.00	242.60	310.00	241.95	386.50	241.30	463.00
GR	242.00	481.00	241.60	529.00	236.80	556.00	233.60	561.00	232.90	603.00
GR	235.30	637.00	257.80	690.00	258.40	765.00	262.10	795.00	262.10	854.00
GR	260.20	882.00	261.50	927.00	263.10	968.00	263.10	1033.00	263.30	1093.00
GR	263.30	1127.00								
X1	18.37	25.00	366.00	915.00	500.00	250.00	380.00	.00	.00	.00
X3	.00	245.00	.00	.00	.00	.00	.00	.00	.00	.00
XF	.00	889.00	.00	.00	.00	.00	.00	5.00	.00	.00
GR	264.00	.00	263.10	41.00	256.60	88.00	256.70	205.00	252.80	290.00
GR	245.00	366.00	240.70	422.00	242.00	490.00	243.80	545.00	245.60	579.00
GR	243.50	699.00	244.50	707.00	245.30	751.00	239.00	772.00	234.60	781.00
GR	234.50	830.00	236.20	889.00	259.90	942.00	260.20	943.00	259.30	979.00
GR	260.60	1011.00	265.90	1026.00	264.00	1091.00	262.00	1147.00	264.80	1191.00
X1	18.46	23.00	170.00	520.00	92.00	92.00	514.00	.00	.00	.00
XF	936.00	1065.00	.00	.00	.00	.00	.00	2.00	25.00	.00
X3										6.00
GR	261.10	66.00	261.10	144.00	261.40	170.00	261.55	274.25	261.70	378.50
GR	261.85	482.75	262.00	587.00	262.17	693.67	262.33	800.33	262.50	907.00
GR	248.00	936.00	247.50	940.00	247.50	950.00	247.00	960.00	247.00	970.00
GR	247.00	980.00	246.50	990.00	246.50	1000.00	246.50	1010.00	247.00	1020.00
GR	247.00	1030.00	247.00	1040.00	247.00	1050.00	247.00	1060.00	247.00	1065.00
GR	262.00	1095.00	261.50	1212.50	261.00	1330.00	271.00	1360.00		
X1	18.56	55.00	994.00	1435.00	407.00	407.00	545.00	.00	.00	.00
CI	1160.00	249.00	.00	3.00	3.00	300.00	.00	.00	.00	.00
XF	.00	.00	.00	.00	1500.00	.00	.00	.00	.00	.00
GR	262.90	994.00	259.40	1015.00	257.60	1046.00	256.90	1067.00	256.50	1073.00
GR	256.50	1093.00	256.50	1108.00	257.50	1124.00	257.30	1161.00	257.10	1225.00
GR	258.70	1268.00	260.70	1287.00	261.80	1305.00	259.10	1322.00	259.10	1341.00

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GR   259.20  1372.00   258.20  1403.00   258.20  1432.00   261.60  1435.00   262.30  1437.00
GR   260.10  1441.00   262.60  1445.00   262.50  1451.00   260.80  1453.00   259.70  1456.00
GR   261.90  1457.00   262.80  1460.00   261.00  1463.00   263.60  1465.00   263.70  1469.00
GR   262.10  1473.00   261.90  1479.00   260.80  1484.00   262.20  1489.00   259.00  1495.00
GR   261.20  1499.00   258.70  1503.00   260.80  1508.00   263.30  1510.00   263.50  1513.00
GR   262.70  1519.00   262.60  1524.00   261.80  1528.00   258.80  1531.00   260.80  1537.00
GR   261.90  1541.00   260.80  1547.00   260.60  1551.00   262.10  1558.00   263.40  1567.00
GR   264.00  1573.00   261.70  1579.00   262.30  1590.00   262.30  1605.00   262.00  1631.00
X1    18.66    35.00   884.00  1190.00   490.00   510.00   497.00     .00      .00      .00
CI  1080.00   251.00      .00     3.00     3.00   300.00      .00     .00      .00      .00
XF     .00      .00      .00      .00  1100.00      .00      .00     .00      .00      .00
GR   267.00   439.00   267.00   529.00   266.80   598.00   266.60   640.00   265.80   747.00
GR   264.60   805.00   264.60   827.00   266.90   837.00   265.30   884.00   261.60   897.00
GR   257.80   939.00   257.70   995.00   257.20   998.00   257.20  1020.00   257.70  1023.00
GR   257.70  1050.00   257.70  1099.00   258.60  1149.00   260.60  1162.00   260.90  1174.00
GR   262.80  1190.00   261.40  1211.00   260.20  1216.00   259.50  1243.00   261.10  1301.00
GR   261.80  1341.00   262.20  1408.00   262.20  1516.00   262.80  1604.00   262.80  1681.00
GR   263.00  1771.00   263.10  1846.00   263.10  1916.00   263.10  1964.00   263.50  2025.00
X1    18.76    40.00   797.00  1179.00   500.00   560.00   530.00     .00      .00      .00
CI  1060.00   253.00      .00     3.00     3.00   300.00      .00     .00      .00      .00
XF     .00      .00      .00      .00  1100.00      .00      .00     .00      .00      .00
X3                                                                                   1.00
GR   268.30   527.00   267.50   601.00   264.50   664.00   263.30   688.00   263.30   735.00
GR   264.20   746.00   266.40   763.00   266.80   797.00   262.90   820.00   258.90   853.00
GR   258.90   861.00   258.90   869.00   260.10   881.00   260.70   907.00   261.40   962.00
GR   262.20  1009.00   262.20  1038.00   263.00  1076.00   261.40  1094.00   261.40  1114.00
GR   261.40  1138.00   263.90  1161.00   265.00  1179.00   264.20  1203.00   263.80  1234.00
GR   263.80  1270.00   264.00  1318.00   264.70  1379.00   264.40  1471.00   263.60  1538.00
GR   263.90  1595.00   264.00  1616.00   264.00  1624.00   263.90  1666.00   266.20  1744.00
GR   266.75  1810.00   267.30  1876.00   267.20  1949.00   267.00  2003.00   266.70  2070.00
GR   266.50  2161.00
X1    18.90    30.00   276.00   850.00   735.00   735.00   735.00     .00      .00      .00
X3      .00   257.00      .00      .00      .00      .00      .00     .00      .00      .00
XF   172.00      .00      .00      .00      .00      .00      .00    5.00      .00      .00
X3                                                                                   1.00
GR   276.90   121.00   277.90   143.00   277.50   157.00   270.40   172.00   269.40   203.00
GR   269.90   230.00   268.10   243.00   268.90   267.00   269.70   276.00   259.60   292.00
GR   233.50   362.00   229.50   414.00   242.10   442.00   237.50   462.00   247.10   507.00
GR   259.60   612.00   261.50   619.00   262.90   626.00   268.00   641.00   268.00   665.00
GR   264.00   677.00   263.90   739.00   265.90   850.00   268.00   946.50   270.10  1043.00
GR   270.00  1099.00   270.00  1109.00   269.90  1182.00   269.90  1284.00   271.10  1374.00
GR   272.10  1408.00
X1    19.04    33.00   105.00   567.00   750.00   690.00   735.00     .00      .00      .00
XF    52.00      .00      .00      .00      .00      .00      .00    5.00      .00      .00
X3                                                                                   1.00
GR   284.60      .00   272.90    24.00   272.70    39.00   265.90    52.00   265.20    66.00
GR   265.30   105.00   260.00   116.00   252.50   141.00   253.10   204.00   253.70   267.00
GR   234.50   346.00   239.50   396.00   237.20   466.00   260.00   489.00   263.70   494.00
GR   264.90   517.00   270.30   536.00   271.10   567.00   266.50   577.00   266.80   634.00
GR   266.50   695.00   266.80   706.00   270.40   771.00   274.00   830.00   274.00   873.00
GR   273.40   947.00   273.40   958.00   273.00  1047.00   273.00  1121.00   273.90  1186.00
GR   274.50  1211.00   284.20  1230.00   286.10  1232.00   284.10  1232.00
NC      .00      .04      .00      .00      .00      .00      .00     .00      .00      .00
X1    19.17    35.00   366.00   888.00   930.00   400.00   725.00     .00      .00      .00
X3      .00   257.00      .00      .00      .00      .00      .00     .00      .00      .00
XF    98.00      .00      .00      .00      .00      .00      .00    5.00      .00      .00
X3                                                                                   1.00
GR   274.90    71.00   272.90    98.00   270.80   137.00   270.60   193.00   268.80   233.00
GR   268.80   272.00   268.80   327.00   268.50   344.00   268.30   366.00   260.00   396.00
GR   255.20   446.00   255.70   516.00   241.80   568.00   245.70   638.00   243.30   669.00
GR   251.65   764.00   260.00   859.00   274.90   888.00   274.90   905.00   271.50   914.00
GR   272.50   936.00   273.20   966.00   276.00   996.00   276.60  1023.00   275.60  1060.00
GR   276.80  1178.00   276.00  1241.00   276.00  1255.00   275.40  1329.00   275.40  1345.00
GR   274.70  1442.00   273.60  1519.00   274.00  1554.00   275.10  1606.00   276.40  1613.00
GR   283.50  1656.00
X1    19.31    41.00   554.00  1008.00   930.00   400.00   700.00     .00      .00      .00
X3      .00   257.00      .00      .00      .00      .00      .00     .00      .00      .00
GR   294.60      .00   293.40     8.00   280.00    31.00   279.70    53.00   278.00   113.00
GR   277.80   179.00   279.20   234.00   277.90   248.00   278.10   272.00   277.50   290.00
GR   274.70   297.00   272.60   321.00   271.90   352.00   271.50   422.00   274.90   432.00
GR   275.50   470.00   276.10   531.00   276.60   548.00   279.90   554.00   261.20   587.00
GR   261.00   634.00   259.90   707.00   252.50   735.00   243.50   767.00   246.50   862.00
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GR	241.50	915.00	252.50	934.00	259.90	945.00	261.30	959.00	272.80	997.00
GR	278.90	1008.00	278.90	1020.00	276.60	1034.00	276.80	1088.00	277.60	1152.00
GR	277.90	1198.00	277.90	1260.00	277.00	1341.00	276.40	1415.00	302.00	1517.00
GR	302.10	1517.00								
X1	19.38	30.00	747.00	1091.00	370.00	390.00	380.00	.00	.00	.00
GR	294.80	125.00	280.70	160.00	279.80	260.00	280.00	328.00	279.30	404.00
GR	280.80	457.00	281.40	523.00	281.20	558.00	280.60	570.00	278.50	589.00
GR	277.70	674.00	276.80	727.00	281.40	738.00	270.90	747.00	263.30	763.00
GR	262.80	840.00	263.10	899.00	265.00	952.00	264.80	966.00	263.20	973.00
GR	263.20	978.00	263.20	983.00	266.10	996.00	267.60	1011.00	268.60	1068.00
GR	274.30	1091.00	276.30	1096.00	275.90	1126.00	280.20	1171.00	277.50	1191.00
X1	19.43	33.00	476.00	871.00	370.00	260.00	290.00	.00	.00	.00
XF	33.00	860.00	.00	.00	.00	.00	.00	5.00	.00	.00
GR	295.00	.00	294.50	10.00	281.90	33.00	281.90	62.00	281.10	126.00
GR	281.20	190.00	281.10	250.00	281.60	358.00	282.10	396.00	281.90	454.00
GR	281.90	470.00	285.80	476.00	283.00	484.00	281.60	492.00	276.00	500.00
GR	276.90	534.00	277.20	567.00	277.10	617.00	275.50	667.00	278.30	674.00
GR	266.30	695.00	265.00	714.00	265.00	748.00	265.00	782.00	265.60	796.00
GR	264.70	812.00	264.70	841.00	265.60	848.00	265.40	860.00	271.40	871.00
GR	276.80	892.00	280.30	915.00	280.70	915.00				
QT	4.00	4000.00	10000.00	18000.00	30000.00	.00	.00	.00	.00	.00
X1	19.54	34.00	575.00	787.00	530.00	600.00	580.00	.00	.00	.00
XF	16.00	841.00	.00	.00	.00	.00	.00	5.00	.00	.00
GR	297.50	.00	287.00	16.00	283.10	30.00	282.70	75.00	282.40	131.00
GR	283.20	192.00	283.70	249.00	283.70	312.00	283.20	379.00	282.40	446.00
GR	282.30	482.00	287.80	492.00	281.50	505.00	280.80	535.00	280.70	557.00
GR	286.30	571.00	286.30	575.00	277.10	593.00	276.30	631.00	275.40	665.00
GR	278.10	670.00	270.60	681.00	268.50	689.00	268.00	709.00	268.00	749.00
GR	268.00	772.00	269.60	787.00	270.00	806.00	269.60	817.00	269.60	841.00
GR	274.90	846.00	292.30	863.00	295.60	877.00	293.50	879.00		
X1	19.56	43.00	555.00	863.00	85.00	85.00	85.00	.00	.00	.00
XF	33.00	845.00	.00	.00	.00	.00	.00	5.00	.00	.00
GR	296.70	.00	293.30	7.00	291.80	33.00	292.30	48.00	285.90	65.00
GR	283.00	93.00	283.00	155.00	286.00	167.00	289.20	191.00	286.10	203.00
GR	289.80	229.00	291.80	260.00	294.30	328.00	291.60	353.00	293.30	385.00
GR	289.40	400.00	289.40	425.00	289.70	441.00	286.40	453.00	287.90	469.00
GR	285.30	488.00	288.70	493.00	287.30	497.00	286.90	510.00	281.20	524.00
GR	282.90	540.00	284.90	546.00	282.40	555.00	276.40	593.00	276.80	629.00
GR	276.80	672.00	274.40	690.00	273.30	714.00	274.50	755.00	274.60	815.00
GR	271.40	817.00	270.40	824.00	270.40	836.00	270.40	845.00	276.50	848.00
GR	282.00	863.00	297.20	895.00	303.10	895.00				
NC	.04	.00	.00	.00	.00	.00	.00	.00	.00	.00
ET	.00	9.10	9.10	9.10	9.10	.00	.00	.00	50.00	1100.00
X1	19.69	30.00	173.00	653.00	400.00	850.00	700.00	.00	.00	.00
X3										2.00
GR	290.90	.00	282.30	14.00	282.40	39.00	279.60	53.00	278.00	92.00
GR	278.40	168.00	277.40	173.00	273.00	182.00	272.20	191.00	272.20	225.00
GR	272.20	264.00	277.50	275.00	282.00	296.00	284.00	303.00	284.00	309.00
GR	281.40	318.00	281.40	374.00	281.40	393.00	283.20	418.00	284.70	464.00
GR	284.80	484.00	284.80	522.00	283.40	622.00	284.80	623.00	283.40	627.00
GR	284.30	653.00	284.40	742.00	284.40	859.00	284.40	929.50	284.40	1000.00
GR	284.40	1071.50	284.40	1143.00						
X1	19.80	27.00	211.00	919.00	600.00	440.00	590.00	.00	.00	.00
X3										10.00
GR	303.40	.00	281.60	109.00	280.80	188.00	273.50	222.00	273.50	258.00
GR	280.10	279.00	282.40	345.00	283.20	392.00	283.50	434.00	284.55	496.50
GR	285.60	559.00	286.70	662.00	286.60	724.00	286.50	786.00	286.90	874.00
GR	288.80	919.00	286.90	928.00	287.20	1021.00	287.20	1059.00	287.20	1059.00
GR	287.30	1130.00	287.40	1201.00	287.43	1284.33	287.47	1367.67	287.50	1451.00
GR	287.15	1558.00	286.80	1665.00	286.75	1764.00	286.70	1863.00	286.85	1962.00
GR	287.00	2061.00	287.25	2161.50	287.50	2262.00	288.05	2331.00	288.60	2400.00
GR	286.50	2433.00	290.10	2473.00						
X1	19.91	60.00	838.00	1032.00	568.00	418.00	550.00	.00	.00	.00
XF	860.00	1010.00	.00	.00	.00	.00	.00	2.00	25.00	.00
X3										3.00
GR	290.90	.00	295.40	32.00	295.80	70.00	292.90	86.00	290.10	129.00
GR	287.30	156.00	287.20	195.00	286.20	253.00	286.20	293.00	286.20	413.00
GR	292.20	434.00	287.10	437.00	287.10	456.00	285.90	483.00	284.50	500.00
GR	284.00	573.00	284.10	660.00	284.10	752.00	285.50	800.00	289.70	822.00
GR	290.70	838.00	278.70	860.00	278.70	900.00	278.70	950.00	278.70	1000.00
GR	278.70	1010.00	290.70	1032.00	287.70	1104.00	288.70	1177.00	289.40	1249.00
GR	290.00	1296.00	290.00	1354.00	289.20	1411.00	289.20	1480.00	289.20	1558.00

GR	288.60	1626.00	289.10	1704.00	288.60	1758.00	290.20	1821.00	290.20	1829.00
GR	287.90	1829.00	288.00	1886.00	288.30	1945.00	288.10	2039.00	288.80	2147.00
GR	288.85	2208.00	288.90	2269.00	289.40	2347.50	289.90	2426.00	289.80	2529.00
GR	289.40	2601.00	289.00	2673.00	289.00	2716.00	289.70	2778.00	290.30	2865.00
GR	289.60	2882.00	290.60	2968.00	290.30	2995.00	289.30	3020.00	290.40	3048.00
GR	290.60	3120.00	291.30	3184.00	291.90	3271.00				
X1	20.03	26.00	821.00	1389.00	750.00	450.00	665.00	.00	.00	.00
X3										19.00
GR	292.50	.00	292.20	29.00	289.50	62.00	289.40	160.00	289.30	258.00
GR	289.35	365.00	289.40	472.00	288.65	556.50	287.90	641.00	287.45	727.00
GR	287.00	813.00	286.80	865.00	283.30	951.00	283.20	973.00	286.20	1004.00
GR	285.20	1019.00	289.80	1055.00	289.80	1121.50	289.80	1188.00	291.90	1262.00
GR	291.65	1381.50	291.40	1501.00	291.10	1584.00	290.80	1667.00	290.50	1750.00
GR	291.20	1866.67	291.90	1983.33	292.60	2100.00	291.75	2168.50	290.90	2237.00
GR	290.80	2322.00	290.70	2407.00	290.60	2492.00	291.25	2588.50	291.90	2685.00
GR	292.55	2781.50	293.20	2878.00	294.50	2949.50	295.80	3021.00	296.70	3113.67
GR	297.60	3206.33	298.50	3299.00	293.10	3327.00	294.20	3346.00	300.30	3386.00
NC	.00	.00	.05	.00	.00	.00	.00	.00	.00	.00
X1	20.15	42.00	878.00	1399.00	640.00	580.00	610.00	.00	.00	.00
X3										8.00
GR	296.60	.00	298.00	9.00	294.70	22.00	294.60	54.00	293.00	70.00
GR	292.50	84.00	293.20	151.00	294.20	215.00	293.20	264.00	291.70	317.00
GR	292.50	371.00	290.90	402.00	293.30	421.00	292.00	483.00	291.80	536.00
GR	292.40	620.00	292.00	735.00	292.50	798.50	293.00	862.00	290.50	903.00
GR	290.00	984.00	290.00	1053.00	289.20	1086.00	289.40	1162.00	287.60	1205.00
GR	287.20	1243.00	286.20	1261.00	288.60	1302.00	294.30	1367.00	295.60	1399.00
GR	293.00	1419.00	293.30	1478.00	293.60	1549.00	293.40	1627.50	293.20	1706.00
GR	293.33	1786.67	293.47	1867.33	293.60	1948.00	293.17	2036.00	292.73	2124.00
GR	292.30	2212.00	292.20	2282.50	292.10	2353.00	292.20	2471.00	292.20	2543.50
GR	292.20	2616.00	292.70	2718.00	297.00	2776.00	298.90	2814.00	299.00	2829.00
NC	.04	.05	.05	.00	.00	.00	.00	.00	.00	.00
X1	20.26	49.00	1040.00	1416.00	575.00	575.00	575.00	.00	.00	.00
X3										2.00
GR	318.80	.00	312.70	22.00	303.30	50.00	297.90	73.00	295.80	96.00
GR	292.70	125.00	295.40	191.00	294.90	217.00	296.60	288.00	298.00	303.00
GR	297.40	314.00	298.70	341.00	296.40	379.00	294.80	440.50	293.20	502.00
GR	291.70	533.00	292.70	568.00	294.90	639.00	296.70	690.00	296.60	717.00
GR	298.70	747.00	301.40	785.00	304.60	831.00	303.80	853.00	303.90	862.00
GR	295.60	957.00	295.30	1033.00	290.10	1059.00	294.00	1085.00	304.00	1101.00
GR	304.80	1131.00	298.10	1147.00	293.10	1172.00	291.50	1214.00	288.40	1246.00
GR	288.50	1267.00	290.30	1280.00	290.40	1290.00	289.60	1308.00	291.10	1399.00
GR	296.50	1429.00	295.50	1451.00	294.70	1484.00	294.70	1517.00	292.50	1539.00
GR	295.60	1578.00	296.10	1649.00	295.30	1736.00	295.55	1825.00	295.80	1914.00
GR	301.10	2017.00								
X1	20.37	40.00	886.00	1234.00	600.00	580.00	585.00	.00	.00	.00
GR	309.10	.00	307.70	15.00	299.50	30.00	299.40	52.00	296.50	69.00
GR	296.80	161.00	298.10	252.00	299.90	288.00	300.80	315.00	299.00	390.00
GR	297.60	461.00	297.10	517.00	295.20	534.00	295.80	546.00	295.10	554.00
GR	295.70	563.00	295.60	575.00	295.40	591.00	295.80	648.00	295.90	734.00
GR	294.40	775.00	292.40	790.00	294.50	800.00	296.40	819.00	299.60	831.00
GR	303.80	858.00	293.70	919.00	292.80	952.00	292.90	1069.00	292.70	1142.00
GR	291.50	1171.00	290.60	1194.00	304.10	1234.00	303.30	1300.00	302.50	1342.00
GR	302.50	1364.00	311.90	1382.00	314.90	1412.00	313.60	1419.00	314.40	1424.00
X1	20.55	32.00	511.00	894.00	490.00	510.00	960.00	.00	.00	.00
X3										1.00
GR	307.60	.00	305.60	7.00	302.70	28.00	301.10	52.00	301.50	134.00
GR	303.50	200.00	301.50	289.00	298.40	401.00	298.30	426.00	308.20	454.00
GR	307.20	471.00	307.80	498.00	300.40	511.00	296.40	533.00	294.40	549.00
GR	294.40	649.00	296.00	666.00	294.50	669.00	296.00	673.00	295.30	718.00
GR	294.20	743.00	298.80	826.00	297.80	871.00	297.10	925.00	297.10	976.00
GR	297.40	1027.00	297.70	1084.00	297.40	1124.00	297.90	1220.00	297.55	1292.00
GR	297.20	1364.00	299.70	1449.00	309.40	1484.00				
NC	.05	.04	.05	.00	.00	.00	.00	.00	.00	.00
X1	20.66	47.00	143.00	881.00	500.00	600.00	550.00	.00	.00	.00
X3										3.00
GR	313.60	.00	311.00	12.00	307.30	26.00	309.40	52.00	300.90	110.00
GR	300.10	143.00	298.80	165.00	300.00	188.00	298.00	234.00	298.10	254.00
GR	298.80	305.00	301.75	381.50	304.70	458.00	304.70	482.00	302.40	513.00
GR	300.30	560.00	299.60	582.00	298.70	637.00	300.10	722.33	301.50	807.67
GR	302.90	893.00	301.80	944.00	303.40	1020.00	305.50	1050.00	305.20	1158.00
GR	305.20	1270.00	305.60	1314.00	306.30	1319.00	306.30	1330.00	305.40	1363.00
GR	306.30	1394.00	306.80	1433.00	307.20	1442.00	306.50	1494.00	305.10	1517.00

GR	305.10	1529.00	305.50	1567.00	305.60	1613.00	305.70	1639.00	304.50	1660.00
GR	304.00	1685.00	303.30	1710.00	303.70	1738.00	303.80	1787.00	305.10	1826.00
GR	308.60	1904.00	315.80	1969.00	318.60	1989.00	320.60	2006.00	323.80	2029.00
X1	20.77	30.00	434.90	722.25	591.00	591.00	591.00	.00	.00	.00
X3	.00	300.40	.00	.00	.00	.00	.00	.00	.00	.00
X3										2.00
GR	305.00	.00	306.00	4.29	307.00	51.88	306.00	133.51	305.50	196.20
GR	305.00	258.89	304.00	260.95	303.00	262.99	302.00	264.93	301.00	267.26
GR	300.00	314.54	299.00	429.82	298.00	432.30	297.00	434.90	296.00	443.48
GR	296.00	546.24	296.00	649.01	297.00	653.25	297.00	680.45	297.00	712.29
GR	298.00	718.19	299.00	722.25	300.00	734.94	301.00	741.38	302.00	743.92
GR	303.00	746.32	303.00	746.32	303.00	767.11	302.00	774.39	302.00	886.90
GR	302.00	893.01	302.00	900.83						
X1	20.82	43.00	556.79	874.35	225.00	330.00	263.00	.00	.00	.00
X3										3.00
GR	307.00	.00	307.00	98.01	307.00	146.43	308.00	148.78	309.00	150.95
GR	310.00	161.04	310.00	177.28	310.00	184.42	310.00	198.04	309.00	202.46
GR	308.00	205.83	307.00	208.88	306.00	211.66	305.50	277.48	305.00	343.29
GR	304.00	354.32	303.00	412.21	302.00	417.10	301.00	423.26	299.00	490.02
GR	297.00	556.79	297.00	578.23	297.00	604.23	297.00	693.82	297.00	783.41
GR	298.00	803.83	299.00	828.79	300.00	830.32	301.00	831.84	302.00	833.31
GR	303.00	834.85	304.00	836.37	304.00	836.37	305.00	838.25	306.00	841.96
GR	307.00	845.86	307.00	868.70	306.00	874.35	305.00	881.82	304.00	892.68
GR	303.00	901.80	303.00	926.00	304.00	930.85	305.00	996.43	306.00	1056.93
GR	306.00	1056.94								
X1	20.85	52.00	463.72	799.07	102.00	88.00	172.00	.00	.00	.00
X3										1.00
GR	309.00	.00	309.00	91.45	308.00	146.14	307.00	153.29	307.00	165.00
GR	307.00	216.33	306.00	324.60	305.00	336.12	304.00	375.00	304.00	380.87
GR	305.00	396.61	304.00	412.50	303.00	414.68	302.00	417.26	302.00	429.11
GR	303.00	449.78	303.00	463.72	302.00	476.91	301.00	485.68	300.00	492.59
GR	299.00	496.44	298.00	504.01	298.00	594.49	298.00	684.98	299.00	713.93
GR	299.00	727.94	299.00	758.28	300.00	761.97	301.00	764.00	302.00	765.97
GR	303.00	775.56	304.00	785.81	305.00	791.33	306.00	795.68	307.00	799.07
GR	308.00	802.36	308.00	835.80	308.00	835.80	307.00	865.14	306.00	890.85
GR	305.00	893.20	304.00	897.92	304.00	912.55	305.00	923.73	306.00	930.06
GR	306.00	933.59	306.00	946.94	306.00	964.45	305.00	967.73	305.00	989.77
GR	306.00	992.87	306.00	1098.99	306.00	1099.04				
X1	20.87	35.00	455.45	836.90	105.00	162.00	124.00	.00	.00	.00
XF	.00	917.00	.00	.00	.00	.00	.00	5.00	.00	.00
GR	308.00	217.11	307.00	292.47	306.00	341.93	305.00	419.40	305.00	426.87
GR	305.00	431.97	304.00	449.05	303.00	455.45	301.00	476.80	300.00	478.55
GR	299.00	480.32	297.90	481.92	297.90	600.77	297.90	631.90	300.00	646.90
GR	300.00	716.93	300.00	763.20	300.00	765.47	300.00	767.74	300.00	772.07
GR	300.00	800.49	304.00	836.90	305.00	839.90	306.00	842.90	307.00	846.36
GR	308.00	854.80	308.00	858.18	308.00	858.21	307.00	866.10	306.00	871.68
GR	305.00	877.15	305.00	877.19	304.00	904.44	304.00	917.00	309.00	927.52
ET	.00	5.10	7.10	.00	324.00	967.00	350.00	967.00	.00	.00
X1	20.89	35.00	445.51	872.55	115.00	95.00	110.00	.00	.00	.00
XF	.00	920.00	.00	.00	.00	.00	.00	5.00	.00	.00
X3										1.00
GR	308.00	242.49	307.60	270.00	307.00	348.49	306.00	445.51	305.00	447.34
GR	304.00	449.37	303.00	450.87	302.00	452.63	301.00	454.39	300.00	456.45
GR	299.00	458.44	298.00	460.55	298.00	545.64	298.00	610.55	301.00	619.55
GR	301.00	689.78	301.00	760.00	301.00	766.74	301.00	777.34	301.00	785.40
GR	301.00	826.59	301.00	829.47	301.00	848.87	301.00	860.55	302.00	863.55
GR	303.00	866.55	304.00	869.55	305.00	872.55	305.00	889.69	304.00	898.11
GR	303.00	905.86	303.00	905.87	303.00	912.34	304.00	915.88	305.00	920.00
GR	306.00	927.59								
G5	.00	.00	.00	.00	.00	.00	.00	.00	.00	35.00
ET	.00	5.10	7.10	.00	64.25	629.75	64.25	627.98	.00	.00
X1	20.94	32.00	62.00	632.00	240.00	240.00	240.00	.00	.00	.00
XF	100.00	600.00	.00	.00	.00	.00	1.00	5.00	.00	.00
X3										11.00
GR	314.90	50.00	313.90	53.00	312.90	56.00	311.90	59.00	310.90	62.00
GR	304.55	81.00	298.20	100.00	298.20	102.11	298.20	103.97	298.20	105.96
GR	298.20	124.48	298.20	143.00	313.00	143.10	313.00	151.10	298.20	151.20
GR	298.20	181.80	298.20	212.40	298.20	243.00	313.00	243.10	313.00	251.10
GR	298.20	251.20	301.50	264.40	301.50	290.60	301.50	316.80	301.50	343.00
GR	313.00	343.10	313.00	351.10	301.50	351.20	301.50	381.80	301.50	412.40
GR	301.50	443.00	313.00	443.10	313.00	451.10	301.50	451.20	301.50	481.80
GR	301.50	512.40	301.50	543.00	313.00	543.10	313.00	551.10	301.50	551.20

GR	301.50	575.60	301.50	600.00	312.20	632.00				
ET	.00	5.10	7.10	.00	64.25	629.75	64.25	628.24	.00	.00
X1	20.94	32.00	62.00	632.00	35.50	35.50	35.50	.00	.00	.00
XF	100.00	600.00	.00	.00	.00	.00	1.00	5.00	.00	.00
X3										11.00
GR	314.90	50.00	313.90	53.00	312.90	56.00	311.90	59.00	310.90	62.00
GR	304.55	81.00	298.20	100.00	298.20	102.11	298.20	103.97	298.20	105.96
GR	298.20	124.48	298.20	143.00	313.00	143.10	313.00	151.10	298.20	151.20
GR	298.20	181.80	298.20	212.40	298.20	243.00	313.00	243.10	313.00	251.10
GR	298.20	251.20	301.50	264.40	301.50	290.60	301.50	316.80	301.50	343.00
GR	313.00	343.10	313.00	351.10	301.50	351.20	301.50	381.80	301.50	412.40
GR	301.50	443.00	313.00	443.10	313.00	451.10	301.50	451.20	301.50	481.80
GR	301.50	512.40	301.50	543.00	313.00	543.10	313.00	551.10	301.50	551.20
GR	301.50	575.60	301.50	600.00	312.20	632.00				
G5	.00	.00	.00	.00	.00	.00	.00	.00	.00	100.00
ET	.00	5.10	7.10	.00	254.00	1058.00	254.00	1020.00	.00	.00
X1	20.96	70.00	259.40	834.83	140.00	235.00	140.00	.00	.00	.00
XF	.00	.00	.00	.00	650.00	.00	.00	.00	.00	.00
X3										4.00
GR	312.00	.00	311.50	61.21	311.00	122.42	310.50	172.64	310.00	222.86
GR	309.00	254.28	308.00	255.53	307.00	256.74	306.00	258.00	305.00	259.40
GR	304.00	260.63	303.00	261.89	302.00	264.49	301.00	267.17	299.00	273.24
GR	299.00	315.77	299.00	394.51	299.00	473.24	302.50	486.74	302.50	489.38
GR	302.50	489.39	302.50	490.06	302.50	491.46	302.50	558.18	302.50	614.97
GR	302.50	616.81	302.50	618.58	302.50	619.65	302.50	620.42	302.50	621.32
GR	302.50	622.21	302.50	623.31	302.50	624.03	302.50	625.46	302.50	625.47
GR	302.50	627.53	302.50	628.74	302.50	630.35	302.50	632.20	302.50	640.06
GR	302.50	642.01	302.50	667.95	302.50	704.09	302.50	717.00	302.50	732.04
GR	302.50	735.97	302.50	742.45	302.50	773.24	302.50	777.74	302.50	797.79
GR	302.50	815.00	308.00	834.83	308.00	841.13	307.00	868.00	306.00	871.65
GR	305.00	875.19	305.00	880.20	306.00	884.32	307.00	906.50	308.00	927.00
GR	308.00	959.11	307.00	961.68	306.00	964.50	306.00	979.28	307.00	981.72
GR	308.00	983.99	309.00	1000.00	309.00	1069.52	309.00	1139.03	310.00	1185.56
GR	311.00	1236.19	312.00	1289.73	313.00	1312.19	314.00	1325.77		
ET	.00	5.10	7.10	.00	1026.00	2060.00	1026.00	1845.00	.00	.00
X1	21.00	75.00	1104.74	1753.62	108.00	95.00	115.00	.00	.00	.00
X3	.00	302.30	.00	.00	.00	.00	.00	.00	.00	.00
X3										5.00
GR	317.00	186.99	316.00	228.97	315.00	284.71	314.00	380.19	313.67	459.32
GR	313.33	538.45	313.00	617.58	313.00	707.39	313.00	797.19	312.00	875.69
GR	311.50	939.79	311.00	1003.89	310.50	1054.31	310.00	1104.74	309.00	1105.96
GR	309.00	1105.96	309.00	1105.96	308.00	1107.19	307.00	1108.41	306.00	1109.63
GR	305.00	1110.90	304.00	1112.70	303.00	1114.62	302.00	1117.04	299.50	1119.84
GR	299.50	1146.87	299.50	1161.04	299.50	1236.62	299.50	1319.84	303.00	1332.04
GR	303.00	1346.05	303.00	1353.36	303.00	1359.33	303.00	1366.46	303.00	1417.35
GR	303.00	1418.57	303.00	1451.11	303.00	1467.92	303.00	1472.91	303.00	1474.45
GR	303.00	1475.37	303.00	1475.94	303.00	1476.60	303.00	1477.15	303.00	1477.78
GR	303.00	1486.37	303.00	1489.39	303.00	1491.74	303.00	1491.74	303.00	1494.12
GR	303.00	1498.82	303.00	1563.05	303.00	1577.50	303.00	1593.75	303.00	1615.20
GR	303.00	1619.02	303.00	1669.00	306.10	1677.92	306.10	1677.97	308.00	1753.62
GR	308.00	1771.72	308.00	1787.21	308.00	1837.32	307.00	1839.25	306.00	1841.18
GR	306.00	1856.50	307.00	1862.65	308.00	1877.26	309.00	1884.92	310.00	1971.42
GR	311.00	2006.73	312.00	2032.47	313.00	2059.21	315.00	2107.77	316.00	2128.87
GR	317.00	2166.25	317.00	2175.98	317.00	2186.08	318.00	2197.73	320.00	2217.74
G5	.00	.00	.00	.00	.00	.00	.00	.00	.00	40.00
X1	21.09	50.00	1052.13	1379.03	227.00	135.00	215.00	.00	.00	.00
X3	.00	304.00	.00	.00	.00	.00	.00	.00	.00	.00
XF	.00	1674.58	800.00	.05	1550.00	.00	.00	5.00	.00	.00
X3										18.00
GR	314.00	600.00	314.00	635.80	314.00	671.59	314.00	707.39	313.75	738.17
GR	313.50	768.94	313.25	799.72	313.00	830.50	312.00	865.76	311.50	903.96
GR	311.00	942.15	311.00	975.48	310.50	1009.24	310.00	1043.00	309.00	1045.35
GR	306.00	1052.13	305.00	1053.89	302.00	1059.03	301.00	1060.65	301.00	1091.67
GR	301.00	1122.69	301.00	1153.71	301.00	1184.73	302.50	1211.19	304.00	1237.65
GR	305.00	1273.88	305.00	1273.88	305.00	1308.46	305.00	1343.05	305.00	1377.63
GR	305.00	1379.03	306.00	1392.25	310.00	1397.52	311.00	1398.39	312.00	1399.25
GR	311.00	1420.97	310.00	1442.70	307.00	1459.02	306.00	1480.59	306.00	1482.85
GR	307.00	1491.78	307.00	1495.54	306.00	1506.18	304.00	1539.90	303.00	1569.33
GR	303.00	1595.08	306.00	1602.21	307.00	1605.27	307.00	1607.67	306.00	1629.98
GR	306.00	1648.02	308.00	1665.28	309.00	1671.41	309.00	1674.58	308.50	1696.61
GR	308.00	1718.65	306.00	1754.19	306.00	1775.88	306.00	1797.56	307.00	1805.89
GR	308.00	1813.55	309.00	1840.12	310.00	1866.69	311.00	1898.21	312.50	1926.09

GR	314.00	1953.97	315.00	1964.61	317.50	2000.00				
GS	.00	.00	.00	.00	.00	.00	.00	.00	.00	120.00
X1	21.14	39.00	990.00	1485.00	450.00	530.00	510.00	.00	.00	.00
XF	.00	1476.00	800.00	.00	.00	.00	.00	5.00	.00	.00
X3										2.00
GR	323.70	.00	322.80	20.00	324.60	29.00	316.90	41.00	319.30	57.00
GR	320.40	64.00	318.30	81.00	317.10	117.00	316.50	150.00	315.70	256.00
GR	315.25	333.00	314.80	410.00	314.30	437.00	313.40	540.00	313.75	610.50
GR	314.10	681.00	318.70	697.00	318.50	703.00	313.00	714.00	313.60	745.00
GR	313.40	770.00	317.30	788.00	317.30	800.00	313.20	814.00	312.10	919.00
GR	311.20	1035.00	310.50	1048.00	310.50	1059.00	310.40	1090.00	310.70	1125.00
GR	302.90	1162.00	303.30	1214.00	302.30	1272.00	302.40	1316.00	302.50	1359.00
GR	303.50	1393.00	304.10	1416.00	307.60	1434.00	307.00	1476.00	338.80	1531.00
GR	342.50	1540.00								
X1	21.25	46.00	613.00	1216.00	450.00	650.00	575.00	.00	.00	.00
XF	.00	1479.00	1800.00	.00	.00	.00	.00	5.00	.00	.00
X3										1.00
GR	320.40	.00	318.60	22.00	314.10	39.00	314.10	56.00	314.10	95.00
GR	314.30	156.00	314.20	211.00	313.70	265.00	313.50	304.00	313.50	354.00
GR	313.30	405.00	312.60	449.00	312.00	478.00	311.30	515.00	311.90	527.00
GR	313.10	543.00	313.70	575.00	313.50	613.00	307.70	682.00	309.10	778.50
GR	310.50	875.00	305.40	916.00	305.10	939.00	304.90	949.00	305.70	968.00
GR	305.50	986.00	305.20	1004.00	305.30	1013.00	306.90	1020.00	306.80	1032.00
GR	310.90	1079.00	310.90	1143.00	314.60	1216.00	314.90	1262.00	314.40	1346.00
GR	315.80	1368.00	312.80	1415.00	318.30	1462.00	321.90	1479.00	324.80	1489.00
GR	324.00	1496.00	320.50	1517.00	318.20	1540.00	318.90	1580.00	319.80	1610.00
GR	320.10	1633.00	322.20	1660.00						
NC	.04	.04	.03	.00	.00	.00	.00	.00	.00	.00
X1	21.36	40.00	689.00	1544.00	380.00	800.00	600.00	.00	.00	.00
X3										4.00
GR	338.90	.00	316.60	35.00	316.60	66.00	314.80	85.00	314.90	150.00
GR	315.50	197.00	321.80	211.00	321.80	235.00	313.40	258.00	313.60	296.00
GR	313.20	330.00	312.90	377.00	310.30	415.00	309.80	443.00	309.80	494.00
GR	311.90	538.00	311.60	586.00	311.70	596.00	311.60	604.00	312.30	638.00
GR	312.00	655.00	312.30	689.00	310.80	713.00	305.50	748.00	305.00	793.00
GR	305.00	828.00	305.80	855.00	305.20	893.00	305.40	915.00	305.80	925.00
GR	305.80	980.00	305.40	1045.00	305.00	1110.00	305.00	1175.00	305.00	1240.00
GR	305.00	1330.00	305.00	1420.00	313.35	1484.50	321.70	1549.00	328.70	1561.00
GR	331.90	1569.00	326.80	1577.00	320.90	1595.00	321.30	1632.00		
X1	21.47	34.00	901.00	1817.00	590.00	590.00	590.00	.00	.00	.00
XF	.00	.00	.00	.00	1200.00	.00	.00	.00	.00	.00
X3										3.00
GR	351.50	.00	310.80	39.00	311.50	118.00	312.90	135.00	313.90	164.00
GR	313.90	266.00	320.10	274.00	317.90	288.00	314.30	298.00	315.70	324.00
GR	307.70	378.00	306.90	437.00	305.60	494.00	270.00	590.00	270.00	621.00
GR	270.00	660.00	270.00	723.00	270.00	786.00	270.00	850.00	270.00	895.00
GR	270.00	901.00	270.00	1000.00	309.00	1100.00	307.50	1175.00	306.00	1250.00
GR	308.00	1310.00	310.00	1400.00	311.00	1500.00	310.00	1600.00	309.00	1700.00
GR	311.25	1764.00	313.50	1828.00	323.70	1848.00	324.90	1879.00	328.50	1890.00
GR	324.60	1905.00	352.40	1920.00						
X1	21.51	17.00	.00	.00	.00	.00	200.00	.00	.00	.00
XF	15.00	.00	.00	.00	1000.00	.00	.00	5.00	.00	.00
X3										3.00
GR	316.00	.00	310.00	15.00	270.00	100.00	270.00	200.00	270.00	250.00
GR	270.00	310.00	308.00	410.00	309.00	500.00	310.00	610.00	309.00	695.00
GR	308.00	780.00	310.00	850.00	310.20	925.00	310.40	1000.00	310.60	1075.00
GR	310.80	1150.00	312.00	1240.00	320.00	1260.00	322.00	1325.00	330.00	1400.00
GS	.11	.11	.25	.20	.46	.20	.74	.20	2.20	.29
EJ	.00	.00	.00	.00	.00	.00	.00	.00	.00	.00

TI SECTION	INITIAL BED MATERIAL COMPOSITION SIZE MM	FRACTION	SIZE MM	FRACTION	SIZE MM	FRACTION	SIZE MM	FRACTION	SIZE MM	FRACTION
17.76	.13	.139	.26	.200	.45	.200	.73	.200	2.20	.261
17.86	.13	.138	.26	.200	.45	.200	.73	.200	2.20	.262
17.96	.13	.138	.26	.200	.45	.200	.73	.200	2.20	.262
18.08	.13	.137	.26	.200	.45	.200	.73	.200	2.20	.263
18.18	.13	.136	.26	.200	.45	.200	.73	.200	2.20	.264
18.30	.13	.135	.26	.200	.45	.200	.73	.200	2.20	.265
18.37	.13	.135	.26	.200	.45	.200	.73	.200	2.20	.265
18.46	.13	.134	.26	.200	.45	.200	.73	.200	2.20	.266
18.56	.13	.134	.26	.200	.45	.200	.73	.200	2.20	.266
18.66	.12	.133	.26	.200	.45	.200	.73	.200	2.20	.267
18.76	.12	.132	.26	.200	.45	.200	.73	.200	2.20	.268
18.90	.12	.131	.26	.200	.45	.200	.73	.200	2.20	.269
19.04	.12	.130	.26	.200	.45	.200	.73	.200	2.20	.270
19.17	.12	.130	.26	.200	.45	.200	.73	.200	2.20	.270
19.31	.12	.129	.26	.200	.45	.200	.73	.200	2.20	.271
19.38	.12	.128	.26	.200	.45	.200	.73	.200	2.20	.272
19.43	.12	.128	.26	.200	.45	.200	.73	.200	2.20	.272
19.54	.12	.127	.26	.200	.45	.200	.73	.200	2.20	.273
19.56	.12	.127	.26	.200	.45	.200	.73	.200	2.20	.273
19.69	.12	.126	.25	.200	.46	.200	.74	.200	2.20	.274
19.80	.12	.125	.25	.200	.46	.200	.74	.200	2.20	.275
19.91	.12	.125	.25	.200	.46	.200	.74	.200	2.20	.275
20.03	.12	.124	.25	.200	.46	.200	.74	.200	2.20	.276
20.15	.12	.123	.25	.200	.46	.200	.74	.200	2.20	.277
20.26	.12	.122	.25	.200	.46	.200	.74	.200	2.20	.278
20.37	.12	.122	.25	.200	.46	.200	.74	.200	2.20	.278
20.55	.11	.120	.25	.200	.46	.200	.74	.200	2.20	.280
20.66	.11	.120	.25	.200	.46	.200	.74	.200	2.20	.280
20.77	.11	.119	.25	.200	.46	.200	.74	.200	2.20	.281
20.82	.11	.119	.25	.200	.46	.200	.74	.200	2.20	.281
20.85	.11	.118	.25	.200	.46	.200	.74	.200	2.20	.282
20.87	.11	.118	.25	.200	.46	.200	.74	.200	2.20	.282
20.89	.11	.118	.25	.200	.46	.200	.74	.200	2.20	.282
20.94	.11	.118	.25	.200	.46	.200	.74	.200	2.20	.282
20.94	.11	.118	.25	.200	.46	.200	.74	.200	2.20	.282
20.96	.11	.118	.25	.200	.46	.200	.74	.200	2.20	.282
21.00	.11	.117	.25	.200	.46	.200	.74	.200	2.20	.283
21.09	.11	.117	.25	.200	.46	.200	.74	.200	2.20	.283
21.14	.11	.116	.25	.200	.46	.200	.74	.200	2.20	.284
21.25	.11	.116	.25	.200	.46	.200	.74	.200	2.20	.284
21.36	.11	.115	.25	.200	.46	.200	.74	.200	2.20	.285
21.47	.11	.114	.25	.200	.46	.200	.74	.200	2.20	.286
21.51	.11	.114	.25	.200	.46	.200	.74	.200	2.20	.286

THE ENGELUND-HANSEN SEDIMENT FORMULA IS USED

TIME = .50 HRS DT = 100 SECS TIME STEP = 0

SECTION	W.S.ELEV. FT	WIDTH FT	DEPTH FT	Q CFS	V FPS	SLOPE	D50 MM	QS/Q 1000 PPM	FR	SED. YIELD TONS
17.758	234.73	118.1	7.43	3000	5.78	.00353	.52	9.48	.49	.888E+02
17.862	236.06	288.5	8.66	3000	2.22	.00047	.52	.37	.18	.351E+01
17.963	236.48	165.0	8.18	3000	4.54	.00245	.52	3.97	.40	.372E+02
18.080	237.56	336.2	8.66	3000	2.29	.00063	.53	.50	.20	.464E+01
18.184	238.11	208.7	6.11	3000	4.17	.00247	.53	1.30	.40	.122E+02
18.295	239.54	106.4	6.64	3000	5.85	.00312	.52	4.76	.47	.446E+02
18.368	240.72	134.1	6.22	3000	4.40	.00164	.52	8.17	.34	.765E+02
18.462	249.57	137.3	3.07	3000	8.68	.01608	.53	83.63	.96	.783E+03
18.563	259.18	361.5	2.68	3000	5.99	.01693	.54	59.01	.90	.552E+03
18.658	262.02	464.4	4.82	3000	2.42	.00115	.53	1.10	.26	.103E+02
18.758	263.33	386.4	4.43	3000	4.57	.00747	.54	14.72	.62	.138E+03
18.897	264.00	408.6	34.50	3000	.47	.00000	.53	.00	.02	.218E-03
19.036	264.00	392.0	29.50	3000	.45	.00000	.54	.00	.02	.792E-03
19.174	264.00	485.3	22.20	3000	.49	.00001	.54	.00	.02	.166E-02
19.306	264.00	385.9	22.50	3000	.67	.00001	.53	.04	.03	.355E+00
19.378	265.20	233.0	2.40	3000	7.39	.01899	.55	87.75	.99	.821E+03
19.433	268.40	174.2	3.70	3000	5.40	.00454	.52	23.47	.53	.220E+03
19.543	271.64	163.5	3.64	3000	6.47	.00765	.54	57.54	.68	.539E+03
19.559	275.84	168.5	5.44	3000	8.01	.01670	.60	95.82	.95	.897E+03
19.692	280.05	236.2	7.85	3000	3.13	.00112	.54	1.79	.27	.168E+02
19.803	281.14	155.0	7.64	3000	5.73	.00476	.54	10.66	.55	.997E+02
19.908	283.12	166.2	4.42	3000	4.29	.00200	.54	6.06	.37	.568E+02
20.033	287.35	289.5	4.15	3000	6.70	.01821	.54	49.01	.95	.459E+03
20.149	290.25	377.1	4.05	3000	6.06	.01848	.56	65.30	.93	.611E+03
20.258	294.06	517.9	5.66	3000	2.57	.00163	.55	1.78	.30	.166E+02
20.369	295.33	366.9	4.73	3000	3.58	.00309	.55	2.29	.42	.215E+02
20.550	298.20	837.1	4.00	3000	2.45	.00261	.54	2.82	.36	.264E+02
20.655	300.53	419.0	2.53	3000	5.86	.01908	.57	64.34	.94	.602E+03
20.767	302.49	608.8	6.49	3000	1.27	.00019	.56	.05	.11	.471E+00
20.817	302.53	419.6	5.53	3000	1.54	.00022	.56	.15	.13	.140E+01
20.849	302.56	326.6	4.56	3000	2.51	.00081	.56	.80	.23	.751E+01
20.872	302.67	365.8	4.77	3000	2.41	.00083	.56	.82	.23	.768E+01
20.891	302.77	414.6	4.77	3000	2.50	.00111	.56	1.13	.26	.105E+02
20.936	303.07	478.2	4.87	3000	2.45	.00134	.56	1.42	.27	.133E+02
20.943	303.12	478.5	4.92	3000	2.40	.00126	.56	1.38	.26	.129E+02
20.960	303.32	556.5	4.32	3000	2.51	.00165	.56	2.21	.30	.207E+02
20.996	303.53	556.9	4.03	3000	2.93	.00276	.55	4.50	.38	.421E+02
21.093	304.35	259.6	3.35	3000	5.10	.00807	.56	19.39	.60	.182E+03
21.137	306.41	282.5	4.11	3000	3.16	.00145	.54	3.79	.30	.354E+02
21.246	308.41	215.6	3.51	3000	7.40	.01711	.58	84.97	.95	.795E+03
21.359	310.44	841.1	5.44	3000	.80	.00006	.56	.00	.07	.298E-01
21.471	310.46	1274.0	40.46	3000	.13	.00000	.56	.00	.01	.588E-05
21.509	310.46	1008.4	40.46	3000	.23	.00000	.56	.00	.01	.782E-04

TIME = 91.00 HRS DT = 200 SECS TIME STEP = 1690

SECTION	W.S.ELEV. FT	WIDTH FT	DEPTH FT	Q CFS	V FPS	SLOPE	D50 MM	QS/Q 1000 PPM	FR	SED. YIELD TONS
17.758	245.53	416.6	11.56	33000	7.98	.00220	.53	6.38	.45	.273E+06
17.862	246.82	455.6	10.97	33000	7.90	.00238	.52	7.58	.46	.270E+06
17.963	248.27	554.2	10.80	33000	7.68	.00280	.52	7.45	.49	.310E+06
18.080	250.16	628.2	8.98	33000	7.75	.00341	.58	10.55	.52	.362E+06
18.184	251.91	493.4	10.42	33000	8.61	.00350	.60	9.14	.54	.478E+06
18.295	254.40	645.6	13.05	33000	8.37	.00458	.69	16.42	.60	.556E+06
18.368	256.16	648.8	14.32	33000	7.74	.00354	.62	9.31	.53	.596E+06
18.462	256.76	166.0	24.68	33000	11.51	.00234	.70	11.04	.49	.700E+06
18.563	259.28	437.3	19.61	33000	9.02	.00359	.72	11.91	.55	.661E+06
18.658	260.83	352.2	16.43	33000	9.54	.00319	.68	11.40	.54	.572E+06
18.758	262.55	355.7	13.66	33000	9.42	.00315	.60	12.08	.53	.501E+06
18.897	265.33	512.2	11.92	33000	8.50	.00356	.55	12.94	.54	.400E+06
19.036	268.21	637.3	10.77	33000	7.99	.00385	.57	12.45	.55	.513E+06
19.174	271.08	754.0	12.58	33000	7.26	.00350	1.25	12.28	.52	.688E+06
19.306	273.51	499.7	10.71	33000	9.44	.00485	1.03	14.32	.63	.891E+06
19.378	275.00	363.3	11.09	33000	10.37	.00436	1.10	14.48	.62	.103E+07
19.433	276.07	298.7	12.22	33000	10.84	.00399	1.11	14.16	.60	.103E+07
19.543	278.22	266.0	12.48	33000	11.04	.00364	1.14	13.37	.58	.101E+07
19.559	278.77	285.1	12.79	30000	10.46	.00377	1.10	12.65	.58	.911E+06
19.692	281.75	355.2	14.97	30000	9.75	.00396	1.11	11.89	.58	.875E+06
19.803	284.29	415.0	14.95	30000	9.15	.00389	1.11	10.51	.57	.819E+06
19.908	287.15	754.9	19.09	30000	7.50	.00448	1.06	9.01	.57	.760E+06
20.033	290.37	1159.5	19.54	30000	6.44	.00472	1.06	7.67	.57	.709E+06
20.149	293.70	2555.8	17.72	30000	4.87	.00533	1.03	5.34	.55	.637E+06
20.258	296.21	1382.6	18.10	30000	5.63	.00383	1.10	4.46	.51	.576E+06
20.369	298.09	937.7	17.91	30000	6.04	.00289	.99	3.82	.46	.506E+06
20.550	300.99	1081.5	17.67	30000	5.80	.00305	.77	3.81	.47	.413E+06
20.655	302.49	683.8	16.35	30000	7.09	.00324	.99	5.82	.50	.366E+06
20.767	304.34	640.2	13.19	30000	7.14	.00303	.96	5.55	.49	.290E+06
20.817	305.15	644.0	12.99	30000	7.12	.00303	.99	5.52	.49	.275E+06
20.849	305.58	527.9	12.30	30000	7.43	.00269	.98	5.16	.47	.265E+06
20.872	305.94	548.5	12.30	30000	7.34	.00271	.99	5.03	.47	.253E+06
20.891	306.22	520.4	11.93	30000	7.43	.00264	1.02	4.93	.47	.244E+06
20.936	306.93	501.6	12.13	30000	7.18	.00278	1.05	4.82	.44	.232E+06
20.943	307.03	502.6	12.16	30000	7.21	.00284	1.10	4.79	.44	.224E+06
20.960	307.50	661.6	11.80	30000	7.01	.00300	1.13	4.77	.49	.219E+06
20.996	307.85	677.8	10.78	30000	7.00	.00305	1.16	4.76	.49	.215E+06
21.093	308.68	710.4	15.06	30000	6.44	.00315	1.20	4.66	.44	.209E+06
21.137	309.74	356.9	19.61	30000	8.06	.00210	1.26	4.05	.44	.174E+06
21.246	311.28	523.1	17.09	30000	6.69	.00188	1.34	2.67	.40	.125E+06
21.359	312.69	1100.7	10.53	30000	4.30	.00115	1.39	.72	.30	.331E+05
21.471	313.20	1585.5	43.18	30000	1.14	.00002	.56	.01	.05	.526E+02
21.509	313.18	1235.9	43.18	30000	1.84	.00008	.56	.03	.09	.254E+03

ID
38 SECTION 21.093 TIME = 91.00 HRS WS = 308.68 WIDTH = 710.4

Z	DZ	TDZ	Y	Z	DZ	TDZ	Y	Z	DZ	TDZ	Y
314.00	.00	.00	600.0	314.00	.00	.00	635.8	314.00	.00	.00	671.6
314.00	.00	.00	707.4	313.75	.00	.00	738.2	313.50	.00	.00	768.9
313.25	.00	.00	799.7	313.00	.00	.00	830.5	312.00	.00	.00	865.8
311.50	.00	.00	904.0	311.00	.00	.00	942.2	311.00	.00	.00	975.5
310.50	.00	.00	1009.2	310.00	.00	.00	1043.0	309.00	.00	.00	1045.3
304.68	-.02	-1.32	1054.0	304.54	-.02	-.46	1054.2	302.60	-.01	.60	1059.3
302.46	-.02	1.46	1060.7	301.44	-.05	.44	1091.7	301.53	-.06	.53	1122.7
301.69	-.06	.69	1153.7	301.78	-.06	.78	1184.7	301.75	-.06	-.75	1211.2
301.46	-.06	-2.54	1238.1	300.36	-.12	-4.64	1273.9	300.39	-.07	-4.61	1274.1
299.62	-.06	-5.38	1308.5	299.63	-.06	-5.37	1343.0	299.64	-.06	-5.36	1377.2
300.05	-.06	-4.95	1379.9	306.30	-.06	.31	1392.3	310.06	.00	.07	1397.5
310.69	.00	-.31	1398.4	311.32	.00	-.69	1399.3	311.00	.00	.00	1421.0
310.00	.00	.00	1442.7	306.41	-.06	-.59	1459.0	304.69	.94	-1.31	1480.5
303.04	-1.06	-2.96	1482.8	303.12	.94	-3.88	1491.7	301.44	-1.06	-5.56	1495.5
301.62	.02	-4.38	1506.2	300.15	-.07	-3.85	1539.3	298.60	-.09	-4.40	1569.3
296.88	-.11	-6.12	1595.5	296.66	.94	-9.34	1602.2	295.02	-1.06	-11.98	1605.3
294.93	.02	-12.07	1607.7	293.79	.17	-12.21	1630.0	298.89	.94	-7.11	1648.4
307.00	-.38	-1.00	1665.3	309.00	.00	.00	1671.4	309.00	.00	.00	1674.6

308.50	.00	.00	1696.6	308.00	.00	.00	1718.7	305.97	.00	-.03	1754.2
305.97	.00	-.03	1775.8	305.97	.00	-.03	1796.9	306.97	.00	-.03	1805.5
308.26	.00	.26	1813.3	309.00	.00	.00	1840.1	310.00	.00	.00	1866.7
311.00	.00	.00	1898.2	312.50	.00	.00	1926.1	314.00	.00	.00	1954.0
315.00	.00	.00	1964.6	317.50	.00	.00	2000.0				

ID
35 SECTION 20.943 TIME = 91.00 HRS WS = 307.03 WIDTH = 502.6

Z	DZ	TDZ	Y	Z	DZ	TDZ	Y	Z	DZ	TDZ	Y
314.90	.00	.00	50.0	313.90	.00	.00	53.0	312.90	.00	.00	56.0
311.90	.00	.00	59.0	310.90	.00	.00	62.0	304.57	.00	.02	81.0
298.20	.00	.00	99.4	294.87	.00	-3.33	102.1	294.87	.00	-3.33	104.0
294.87	.00	-3.33	106.0	294.87	.00	-3.33	124.5	294.87	.00	-3.33	143.0
313.00	.00	.00	143.2	313.00	.00	.00	151.1	294.87	.00	-3.33	151.3
294.87	.00	-3.33	181.8	294.87	.00	-3.33	212.4	294.87	.00	-3.33	243.0
313.00	.00	.00	243.2	313.00	.00	.00	251.1	294.87	.00	-3.33	251.3
297.73	.00	-3.77	264.4	298.30	.00	-3.20	290.6	298.81	.00	-2.69	316.8
298.36	.00	-3.14	343.0	313.00	.00	.00	343.2	313.00	.00	.00	351.1
298.50	.00	-3.00	351.3	299.68	.00	-1.82	381.9	299.94	.00	-1.56	412.4
299.82	.00	-1.68	443.0	313.00	.00	.00	443.2	313.00	.00	.00	451.1
299.91	.00	-1.59	451.3	300.80	.00	-.70	481.8	300.94	.00	-.56	512.4
300.97	.00	-.53	543.0	313.00	.00	.00	543.2	313.00	.00	.00	551.1
301.03	.00	-.47	551.3	301.44	.00	-.06	575.6	301.68	.00	.18	600.5
312.20	.00	.00	632.0								

TIME = 150.00 HRS DT = 200 SECS TIME STEP = 2755

SECTION	W.S.ELEV. FT	WIDTH FT	DEPTH FT	Q CFS	V FPS	SLOPE	D50 MM	QS/Q 1000 PPM	FR	SED. YIELD TONS
17.758	243.64	409.6	10.41	23601	7.27	.00245	.55	6.17	.45	.668E+06
17.862	245.06	447.3	10.61	23601	7.23	.00270	.58	6.52	.47	.668E+06
17.963	246.67	541.4	10.84	23601	6.99	.00311	.58	6.89	.49	.712E+06
18.080	248.69	558.9	10.58	23601	7.25	.00364	.64	8.17	.53	.765E+06
18.184	250.64	477.7	8.83	23601	7.92	.00396	.75	9.72	.56	.887E+06
18.295	252.86	393.7	9.78	23601	8.62	.00408	.86	10.99	.58	.970E+06
18.368	254.30	348.5	12.19	23601	9.02	.00404	.92	11.76	.58	.102E+07
18.462	255.56	161.2	17.36	23601	10.84	.00282	.93	11.01	.52	.115E+07
18.563	258.15	356.5	15.37	23601	8.50	.00348	.87	9.34	.54	.112E+07
18.658	259.79	328.7	12.67	23601	8.49	.00308	.85	8.39	.51	.104E+07
18.758	261.49	351.3	10.85	23601	8.13	.00291	.80	7.22	.50	.980E+06
18.897	263.94	468.9	10.69	23601	7.52	.00328	.79	7.13	.51	.885E+06
19.036	266.43	487.5	10.55	23601	7.59	.00354	.79	7.69	.53	.100E+07
19.174	269.18	517.9	10.44	23601	7.68	.00398	.86	8.92	.56	.117E+07
19.306	271.76	403.7	9.84	23601	8.36	.00381	.90	9.21	.56	.139E+07
19.378	273.06	336.0	9.79	23601	9.08	.00394	1.01	10.78	.58	.153E+07
19.433	274.10	294.6	9.81	23601	9.44	.00383	1.05	10.99	.57	.153E+07
19.543	276.25	277.5	9.85	23601	9.59	.00372	1.10	10.88	.57	.150E+07
19.559	276.64	272.4	10.03	21501	9.41	.00387	1.08	10.70	.57	.136E+07
19.692	279.45	293.1	11.16	21501	9.22	.00395	1.10	10.72	.58	.132E+07
19.803	282.05	366.9	12.42	21501	8.59	.00416	1.12	9.77	.58	.127E+07
19.908	284.50	417.6	17.09	21501	8.20	.00431	1.13	9.38	.58	.121E+07
20.033	287.33	423.6	15.89	21501	7.99	.00399	1.14	8.86	.56	.114E+07
20.149	289.32	298.6	15.49	21501	8.36	.00292	1.12	5.87	.50	.106E+07
20.258	291.03	291.2	14.86	21501	8.63	.00315	1.14	7.23	.52	.985E+06
20.369	292.98	323.1	15.64	21501	8.24	.00311	1.12	6.69	.51	.893E+06
20.550	295.81	294.1	16.00	21501	8.34	.00283	1.10	6.13	.50	.764E+06
20.655	297.40	300.5	14.77	21501	8.23	.00280	1.12	5.96	.49	.682E+06
20.767	299.02	291.8	12.95	21501	8.16	.00260	1.11	5.44	.48	.574E+06
20.817	299.86	349.1	13.16	21501	7.67	.00268	1.13	4.98	.48	.538E+06
20.849	300.32	340.6	12.51	21501	7.62	.00254	1.15	4.63	.47	.515E+06
20.872	300.73	379.7	12.37	21501	7.26	.00248	1.15	4.07	.46	.494E+06
20.891	301.08	413.7	12.48	21501	7.01	.00250	1.14	3.86	.45	.479E+06
20.936	301.85	467.7	13.05	21501	6.45	.00273	1.13	3.74	.43	.455E+06
20.943	301.97	472.6	12.84	21501	6.35	.00264	1.07	3.55	.42	.435E+06
20.960	302.31	505.8	11.75	21501	6.50	.00258	1.07	3.69	.45	.423E+06
20.996	302.56	450.7	10.37	21501	6.71	.00240	1.07	3.55	.44	.405E+06
21.093	303.30	554.8	13.12	21501	5.97	.00276	1.06	3.61	.41	.382E+06
21.137	304.38	329.6	15.43	21501	7.56	.00237	1.23	4.15	.45	.305E+06
21.246	305.83	367.9	15.55	21501	6.85	.00201	1.35	2.99	.41	.226E+06
21.359	307.29	732.0	14.15	21501	4.47	.00118	1.42	.78	.31	.107E+06
21.471	307.83	866.2	37.78	21501	1.10	.00001	.55	.00	.04	.183E+03
21.509	307.81	389.8	37.81	21501	1.90	.00003	.56	.01	.06	.811E+03

ID
38 SECTION 21.093 TIME = 150.00 HRS WS = 303.30 WIDTH = 554.8

Z	DZ	TDZ	Y	Z	DZ	TDZ	Y	Z	DZ	TDZ	Y
314.00	.00	.00	600.0	314.00	.00	.00	635.8	314.00	.00	.00	671.6
314.00	.00	.00	707.4	313.75	.00	.00	738.2	313.50	.00	.00	768.9
313.25	.00	.00	799.7	313.00	.00	.00	830.5	312.00	.00	.00	865.8
311.50	.00	.00	904.0	311.00	.00	.00	942.2	311.00	.00	.00	975.5
310.50	.00	.00	1009.2	310.00	.00	.00	1043.0	309.00	.00	.00	1045.3
304.16	.00	-1.84	1054.0	304.09	.00	-.90	1054.2	302.75	.00	.75	1060.3
302.21	.02	1.21	1061.0	301.18	.01	.18	1092.2	300.50	.02	-.50	1123.1
299.95	.01	-1.05	1154.1	299.24	.01	-1.76	1185.2	298.32	.01	-4.18	1211.7
296.83	.00	-7.17	1239.3	294.31	.02	-10.69	1273.9	294.30	.02	-10.70	1274.1
293.78	.01	-11.22	1308.5	293.78	.01	-11.21	1343.0	294.73	.00	-10.27	1377.2
295.39	.00	-9.61	1379.9	304.40	.00	-1.59	1392.3	308.24	.00	-1.75	1397.5
308.92	.00	-2.08	1398.4	309.54	.00	-2.47	1399.3	311.00	.00	.00	1421.0
310.00	.00	.00	1442.7	304.29	.00	-2.71	1459.0	301.86	.01	-4.14	1480.5
301.39	-.37	-4.61	1482.8	300.94	.80	-6.06	1491.7	299.63	-.23	-7.37	1495.5
299.12	.03	-6.88	1506.2	297.21	-.01	-6.79	1539.3	295.68	.05	-7.32	1569.3
294.16	.16	-8.84	1595.5	292.81	-.99	-13.19	1602.2	293.08	1.01	-13.91	1605.3
292.07	-.48	-14.93	1607.7	291.78	.05	-14.22	1630.0	291.19	.03	-14.81	1648.4
290.21	.02	-17.79	1665.3	290.21	.02	-18.79	1671.4	290.21	.02	-18.79	1671.6

308.50	.00	.00	1696.6	308.00	.00	.00	1718.7	306.08	.00	.08	1754.2
306.02	.00	.02	1775.8	306.35	.00	.35	1796.8	307.18	.00	.18	1805.1
308.26	.00	.26	1813.2	309.00	.00	.00	1840.1	310.00	.00	.00	1866.7
311.00	.00	.00	1898.2	312.50	.00	.00	1926.1	314.00	.00	.00	1954.0
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311.90	.00	.00	59.0	310.90	.00	.00	62.0	304.55	.00	.00	81.0
298.20	.00	.00	99.4	290.22	.00	-7.99	102.1	290.15	.00	-8.05	104.0
290.11	.00	-8.09	106.0	289.89	.00	-8.31	124.5	289.26	.00	-8.95	143.0
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293.83	.00	-7.66	351.3	297.21	.00	-4.29	381.9	297.98	.00	-3.52	412.4
298.07	.00	-3.43	443.0	313.00	.00	.00	443.2	313.00	.00	.00	451.1
298.19	.00	-3.31	451.3	299.74	.00	-1.76	481.8	300.07	.00	-1.43	512.4
300.24	.00	-1.26	543.0	313.00	.00	.00	543.2	313.00	.00	.00	551.1
300.34	.00	-1.16	551.3	300.93	.00	-.58	575.6	301.50	.00	.00	600.5
312.20	.00	.00	632.0								

TIME = 184.50 HRS DT = 200 SECS TIME STEP = 3376

SECTION	W.S.ELEV. FT	WIDTH FT	DEPTH FT	Q CFS	V FPS	SLOPE	D50 MM	QS/Q 1000 PPM	FR	SED. YIELD TONS
17.758	234.19	168.7	4.18	2581	5.33	.00505	1.00	5.71	.55	.885E+06
17.862	237.04	217.9	4.68	2581	4.81	.00504	.94	5.14	.54	.878E+06
17.963	239.49	197.9	4.28	2581	4.69	.00410	.84	4.06	.50	.918E+06
18.080	242.09	239.4	4.46	2581	4.38	.00419	.90	3.76	.49	.974E+06
18.184	244.31	295.4	3.51	2581	3.89	.00373	.88	2.62	.46	.110E+07
18.295	246.31	259.4	3.80	2581	3.86	.00306	.77	2.23	.42	.118E+07
18.368	247.35	202.6	3.93	2581	4.02	.00253	.72	1.89	.40	.123E+07
18.462	248.53	133.1	4.56	2581	4.61	.00232	.69	2.00	.40	.135E+07
18.563	250.00	173.9	4.19	2581	4.55	.00311	.72	2.86	.44	.135E+07
18.658	251.70	211.2	3.99	2581	4.43	.00367	.76	3.30	.47	.128E+07
18.758	253.82	264.8	4.93	2581	4.20	.00418	.88	3.44	.49	.122E+07
18.897	256.71	252.5	3.63	2581	4.11	.00364	.91	2.82	.46	.112E+07
19.036	259.37	240.4	3.92	2581	4.18	.00360	.99	2.14	.46	.124E+07
19.174	262.13	229.6	3.24	2581	4.42	.00409	1.03	3.56	.49	.141E+07
19.306	264.71	215.1	3.84	2581	4.21	.00319	1.05	1.85	.44	.163E+07
19.378	266.06	234.3	3.11	2581	4.37	.00405	1.00	3.04	.49	.176E+07
19.433	267.25	245.6	2.63	2581	4.25	.00396	.98	3.47	.48	.176E+07
19.543	269.27	243.7	3.34	2581	3.90	.00291	1.11	1.40	.42	.174E+07
19.559	269.48	203.7	3.30	2581	4.32	.00325	1.08	2.34	.44	.158E+07
19.692	271.63	179.8	4.00	2581	4.39	.00290	1.07	2.05	.43	.154E+07
19.803	273.31	168.4	4.50	2581	4.49	.00284	1.06	2.12	.43	.148E+07
19.908	274.77	137.0	5.31	2581	4.71	.00258	1.03	2.09	.42	.141E+07
20.033	276.48	127.3	5.42	2581	4.86	.00260	1.02	2.20	.42	.135E+07
20.149	278.13	132.4	5.59	2581	4.93	.00285	1.08	2.47	.44	.127E+07
20.258	279.73	119.5	5.68	2581	5.10	.00278	1.10	2.48	.44	.118E+07
20.369	281.40	121.5	5.82	2581	5.14	.00295	1.14	2.65	.45	.108E+07
20.550	284.25	118.5	6.10	2581	5.22	.00300	1.17	2.73	.45	.940E+06
20.655	285.93	123.4	5.49	2581	5.20	.00310	1.16	2.81	.46	.843E+06
20.767	287.93	155.4	4.78	2581	4.92	.00349	1.20	2.99	.47	.725E+06
20.817	288.82	151.7	4.45	2581	4.82	.00315	1.19	2.52	.45	.678E+06
20.849	289.39	164.3	4.33	2581	4.68	.00318	1.20	2.41	.45	.651E+06
20.872	289.82	184.8	4.97	2581	4.50	.00325	1.21	2.30	.45	.626E+06
20.891	290.17	176.0	4.60	2581	4.52	.00308	1.22	2.18	.44	.607E+06
20.936	290.96	192.5	4.24	2581	4.27	.00317	1.22	2.04	.42	.578E+06
20.943	291.08	187.5	4.11	2581	4.22	.00298	1.22	1.86	.41	.555E+06
20.960	291.47	178.2	4.49	2581	4.31	.00273	1.22	1.75	.41	.541E+06
20.996	291.80	194.2	4.52	2581	4.16	.00266	1.24	1.61	.41	.518E+06
21.093	292.47	212.5	11.32	2581	3.64	.00251	1.29	1.32	.35	.485E+06
21.137	293.49	162.0	7.48	2581	3.83	.00161	1.29	.81	.33	.382E+06
21.246	294.29	142.4	5.65	2581	3.60	.00111	1.22	.47	.28	.276E+06
21.359	294.99	176.8	6.79	2581	3.31	.00111	1.42	.43	.28	.138E+06
21.471	295.29	543.0	25.24	2581	.21	.00000	.55	.00	.01	.239E+03
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ID
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313.25	.00	.00	799.7	313.00	.00	.00	830.5	312.00	.00	.00	865.8
311.50	.00	.00	904.0	311.00	.00	.00	942.2	311.00	.00	.00	975.5
310.50	.00	.00	1009.2	310.00	.00	.00	1043.0	309.00	.00	.00	1045.3
304.16	.00	-1.84	1054.0	304.09	.00	-.90	1054.2	301.22	.00	-.79	1060.8
301.12	.00	.12	1061.0	300.74	.00	-.26	1092.4	300.25	.00	-.74	1123.3
299.54	.00	-1.46	1154.4	298.18	.00	-2.82	1185.3	297.15	.00	-5.35	1211.8
295.48	.00	-8.52	1239.4	291.95	.00	-13.05	1273.9	291.92	.00	-13.08	1274.1
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294.81	.00	-10.19	1379.9	303.81	.00	-2.18	1392.3	307.63	.00	-2.36	1397.5
308.27	.00	-2.73	1398.4	308.89	.00	-3.12	1399.3	311.00	.00	.00	1421.0
310.00	.00	.00	1442.7	304.29	.00	-2.71	1459.0	299.46	.00	-6.54	1480.5
299.18	.00	-6.81	1482.8	297.97	.00	-9.03	1491.7	297.67	.00	-9.33	1495.5
297.16	.00	-8.84	1506.2	294.89	.00	-9.11	1539.3	291.46	.00	-11.54	1569.3
289.34	.00	-13.66	1595.5	288.79	.00	-17.20	1602.2	288.53	.00	-18.47	1605.3
288.29	.00	-18.71	1607.7	285.65	.00	-20.35	1630.0	283.11	.00	-22.89	1648.4
281.15	.00	-26.85	1665.3	281.60	.00	-27.40	1671.4	281.68	.00	-27.32	1671.6

308.50	.00	.00	1696.6	308.00	.00	.00	1718.7	306.08	.00	.08	1754.2
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308.26	.00	.26	1813.2	309.00	.00	.00	1840.1	310.00	.00	.00	1866.7
311.00	.00	.00	1898.2	312.50	.00	.00	1926.1	314.00	.00	.00	1954.0
315.00	.00	.00	1964.6	317.50	.00	.00	2000.0				

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298.32	.00	.12	99.6	288.89	.00	-9.31	102.1	288.79	.00	-9.41	104.0
288.72	.00	-9.48	106.0	288.22	.00	-9.98	124.5	287.84	.00	-10.36	143.0
313.00	.00	.00	143.2	313.00	.00	.00	151.1	287.77	.00	-10.43	151.3
287.49	.00	-10.71	181.8	287.20	.00	-11.00	212.4	287.00	.00	-11.20	243.0
313.00	.00	.00	243.2	313.00	.00	.00	251.1	286.96	.00	-11.24	251.3
287.03	.00	-14.47	264.4	288.65	.00	-12.85	290.7	292.95	.00	-8.55	316.8
291.94	.00	-9.56	342.9	313.00	.00	.00	343.2	313.00	.00	.00	351.1
293.02	.00	-8.48	351.3	296.92	.00	-4.58	381.9	297.79	.00	-3.71	412.4
297.91	.00	-3.59	443.0	313.00	.00	.00	443.2	313.00	.00	.00	451.1
298.05	.00	-3.45	451.3	299.70	.00	-1.80	481.8	300.05	.00	-1.45	512.4
300.23	.00	-1.27	543.0	313.00	.00	.00	543.2	313.00	.00	.00	551.1
300.61	.00	-.89	551.3	300.93	.00	-.57	575.6	301.51	.00	.01	600.5
312.20	.00	.00	632.0								

HYDRAULIC/HYDROLOGY REPORT

FOR THE

GREGORY CANYON ROAD IMPROVEMENT PROJECT

FINAL REPORT

Prepared By:

NOLTE ASSOCIATES, INC.
15090 AVENUE OF SCIENCE, SUITE 101
SAN DIEGO, CA 92128

PROJECT NUMBER: SD0030

NOVEMBER 1999

NOLTE
BEYOND ENGINEERING

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Appendix A 1996 County of San Diego HEC-2 Model (GRCYNFW.DAT)
Appendix B 1998 Existing Conditions HEC-2 Model (HECTOPO2.DAT)
Appendix C 1999 Proposed Conditions HEC-2 Model (GREG3_99.DAT)
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EXECUTIVE SUMMARY

The purpose of this study is to evaluate impacts to the San Luis Rey River's 100-year flood elevations and channel velocities resulting from the proposed Gregory Canyon Landfill project. Proposed improvements include: realignment of Pala Road/State Route 76 (SR76); a landfill access road from SR76 to the proposed Gregory Canyon Landfill; an access bridge crossing the San Luis Rey River; and the construction of the landfill. The study site is approximately three miles upstream of the Interstate 15/San Luis Rey River crossing.

The existing limits of the 100-year floodplain are shown on the effective FEMA Flood Insurance Rate Maps (FIRMs) dated June 19, 1997 [5]. These limits are designated as 100-year special flood hazard area with no Base Flood Elevations (100-year). The County of San Diego's "equilibrium invert" HEC-2 model dated February 5, 1996 was used as the existing condition model for our hydraulic analyses. Cross section data for the 1996 County model was extracted from topography dated February 2, 1992. Cross section data for the updated existing conditions model was obtained from topography dated February 1998 [3]. The proposed improvements were incorporated into the updated existing condition model. A peak 100-year flow of 30,000 cubic feet per second (cfs) was used for this study and is consistent with the peak flow used in the FEMA Flood Insurance Study (FIS) dated June 1997.

The proposed SR76 improvements follow the existing road alignment. Portions of the existing SR76 road lie within the 100-year floodplain boundary. The proposed improvements would raise the road height above 100-year flood elevations and will encroach on the existing 100-year floodplain. However, this encroachment is minimal and will not impact the 100-year flood elevations or velocities.

The proposed landfill access road crosses the San Luis Rey River extending across the old dairy site from SR76 to the south bank of the river, and then follows an easterly alignment to the proposed Gregory Canyon Landfill. The proposed road elevations are above 100-year flood elevations and therefore will not be inundated.

Although the proposed access road's surface elevations are above 100-year flood elevations, the access road alignment does pass through the 100-year floodplain as it crosses the San Luis Rey River. A preliminary bridge concept was developed to convey the 100-year flood discharge under the proposed landfill access road. The minimum bridge length was determined to be 638 feet, 17.5 feet from the low-flow channel bottom to the bridge soffit, and a channel bottom width of 500 feet. The bridge dimensions given are minimum dimensions necessary to convey the 100-year storm discharge.

The proposed landfill access road will impact the hydraulic properties of the river channel by restricting the storm flow through the bridge opening when crossing the San Luis Rey River. Grading a portion of the existing riverbed will mitigate increases in 100-year flood elevations

resulting from the proposed river crossing. Proposed grading includes a graded shelf along the right overbank (looking upstream) extending approximately 300 feet downstream of the proposed river crossing and continuing upstream, through the bridge opening, for approximately 450 feet.

The 100-year flood channel velocities resulting from the proposed channel will be less than 11 feet per second and are consistent with 100-year velocities associated with existing conditions. The differences on the predicted maximum scour depths between the respective cases with and without the bridge project are not significant in consideration of the modeling accuracy. The scour processes at the SDCWA pipeline will not be impacted by the construction of the proposed bridge. All of the existing and proposed channel velocities have a medium to high potential to erode the river channel and bridge crossing. Riprap scour protection, or other protective measures, should be placed at the bridge abutments.

Minor increases to the San Luis Rey River's 100-year flood elevations and velocities from the proposed improvements, will dissipate approximately 400 feet upstream of the proposed river crossing, provided that the proposed grading and proposed minimum bridge opening area are met. The closest facility to the proposed improvements is the San Diego County Water Authority's (SDCWA) First Aqueduct Crossing approximately 500 feet upstream of the proposed access road crossing. Therefore, no impact on the 100-year flood elevations and velocities are expected in the vicinity of SDCWA's Aqueduct Crossing.

1.0 INTRODUCTION

1.1 Background and Purpose

Nolte Associates was retained by Gregory Canyon Ltd. to prepare a hydraulic analysis of the San Luis Rey River in the vicinity of the proposed Gregory Canyon Landfill project. The purpose of this study is to evaluate impacts to the San Luis Rey River's 100-year flood elevations and channel velocities resulting from the proposed Gregory Canyon Landfill project. Proposed improvements include: realignment of Pala Road/State Route 76 (SR76); a landfill access road from SR76 to the proposed Gregory Canyon Landfill; an access bridge crossing the San Luis Rey River; and the construction of the landfill.

The County of San Diego (County) prepared an HEC-2 model for the San Luis Rey River within the study reach in February 1996 [1]. This model was modified to incorporate changed channel conditions since 1996 and then used to evaluate impacts resulting from the proposed improvements.

1.2 Study Area

The study reach begins approximately 3.0 miles upstream of the Interstate 15/San Luis Rey River crossing and continues upstream for roughly 0.7 miles. It is bounded by SR76 on the north and existing hills on the south. The study area includes the old dairy site north of the main river channel and south of SR76. Figure 1 shows the location of the study site.

1.3 Scope of Work

The following tasks describe the scope of work for this study.

1.3.1 Hydraulic Analysis

Hydraulic analyses were performed for the 100-year flood frequency within the study reach using the HEC-2 Water Surface Profiles computer program [2]. This task included evaluating existing HEC-2 studies, HEC-2 cross-section delineation for existing and proposed conditions, identification of hydraulic parameters (n-values, loss coefficients, reach lengths, etc.), input preparation, HEC-2 editing, running and "debugging" for the flood event. The 1999 Nolte HEC-2 model incorporated cross-section data for the proposed improvements to SR76, proposed landfill access road, and the proposed San Luis Rey River crossing.

1.3.2 Data Collection

The existing limits of the 100-year floodplain are shown on the FEMA Flood Insurance Rate

Maps (FIRMs) dated June 19, 1997 [5]. These limits are designated as 100-year special flood hazard area with no Base Flood Elevations (100-year). The County of San Diego's "equilibrium invert" HEC-2 model dated February 5, 1996 was used as the base condition model for our hydraulic analyses. Cross section data for the 1996 County model was extracted from topography dated February 2, 1992. Cross section data was extracted from topography dated February 1998 [3] to create an updated existing condition model. The proposed improvements were incorporated into this model to create the proposed condition model.

1.3.3 Field Reconnaissance

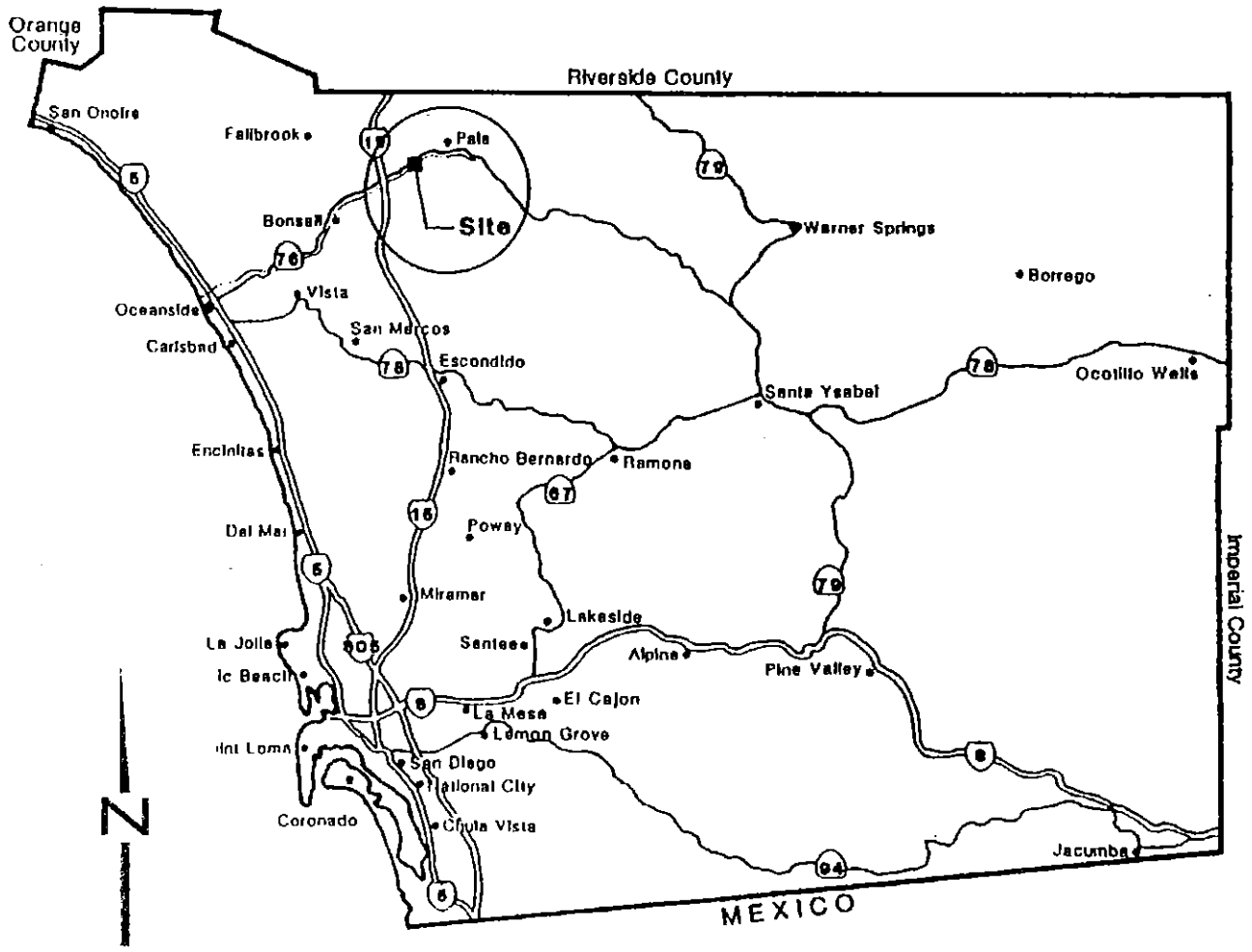
Field investigations were conducted in July 1998 to evaluate existing physical conditions for the study reach of the San Luis Rey River. Photographs and measurements of pertinent hydraulic characteristics were taken for use in the computer analyses.

1.3.4 Channel Concept

A proposed channel concept was developed to ensure that 100-year flood elevations from the existing conditions HEC-2 model were not increased due to the proposed improvements. The channel grading was developed to minimize impacts to the existing wetland and riparian habitat and to the existing river channel.

1.3.5 Assess Impacts

The results of the hydraulic analyses were used to determine any impacts to structures within and upstream of the proposed project. Possible impacts from backwater effects, erosion, aggradation, and increased flood elevations were also assessed. Sediment transport modeling was performed as part of this task.



NOT TO SCALE

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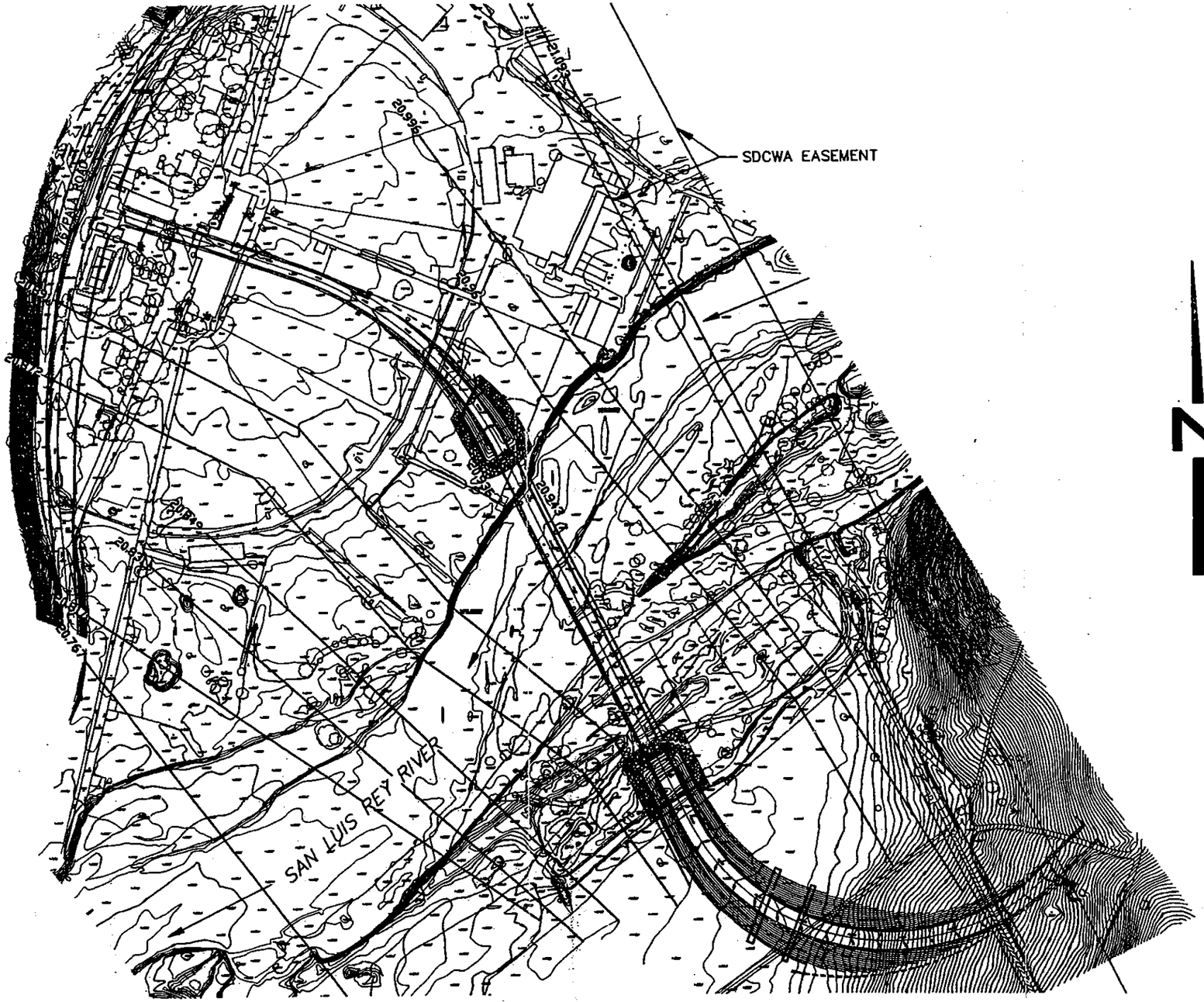
FIGURE 1
VICINITY MAP



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DESIGNER: RPH PROJ. MGR: SBL				

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

NOLTE
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GREGORY CANYON ROAD AND BRIDGE
HEC-2 CROSS SECTION MAP
FIGURE 2

PREPARED FOR: COUNTY OF SAN DIEGO

DATE SUBMITTED: 09/28/99

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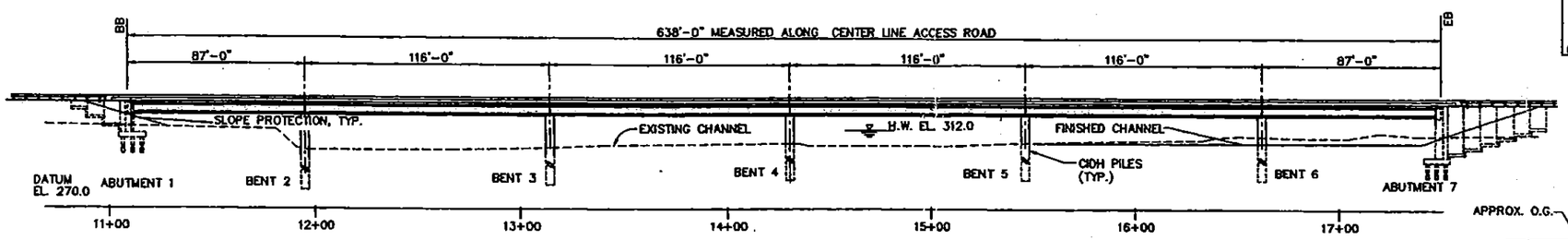

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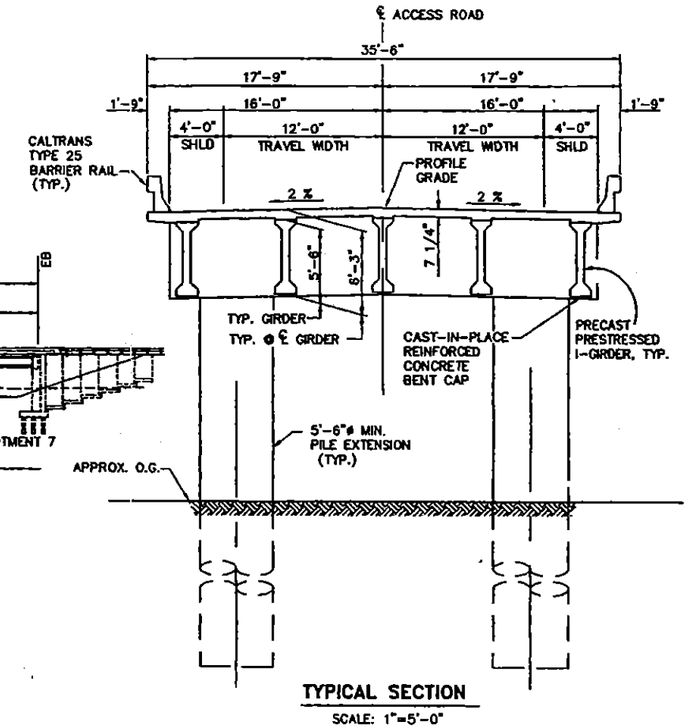

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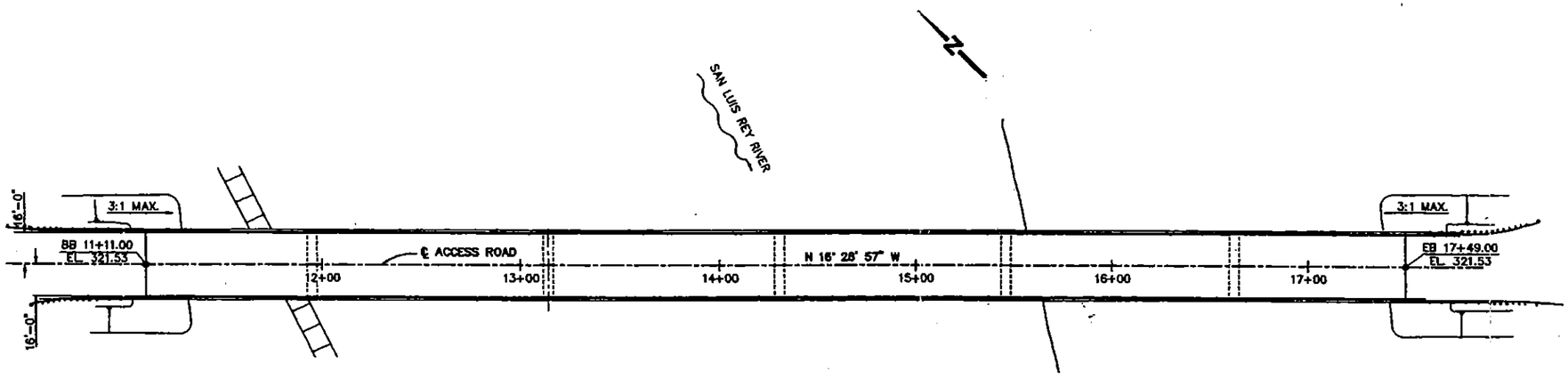

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DESIGNER: NONE PROJ. MGR: SBL

NO.	BY	DATE	REVISIONS

CAUTION: The engineer preparing these plans will not be responsible for, or liable for, unauthorized changes to or uses of these plans. All changes to the plans must be in writing and must be approved by the preparer of these plans.

NOLTE
BEYOND ENGINEERING
15090 AVENUE OF SCIENCE, SUITE 101 SAN DIEGO, CA. 92128
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GREGORY CANYON ROAD AND BRIDGE
GENERAL PLAN
FIGURE 3

PREPARED FOR: COUNTY OF SAN DIEGO

DATE SUBMITTED: 09/28/99

SHEET NUMBER 1 OF 1 SHEETS
SCALE VERTICAL: 1"= 1' HORIZONTAL: 1"= 100'
JOB NUMBER SD0030

2.0 HYDROLOGY OF THE STUDY AREA

The San Luis Rey River watershed has its origin on Bucksnort Mountain in the Anza-Borrego Desert Park at an elevation of about 5,500 feet mean sea level (msl). The San Luis Rey River basin drains approximately 560 square miles. The basin is about 50 miles long and 16 miles wide and is divided by Henshaw Dam into two hydrologic units. Henshaw reservoir controls all runoff from the upper 206 square miles of the basin. Mean annual precipitation ranges from 11 to 30 inches, increasing landward to higher elevations. Vegetation is dominated by chaparral, with some coastal sagebrush and oak woodland.

The river reach examined in this study is approximately 27 miles below Lake Henshaw. The only major tributary below Lake Henshaw and above the study reach is Pauma Creek [4]. There are no significant tributaries within the study area.

3.0 HYDRAULIC ANALYSIS

3.1 Methodology

The hydraulic performance of the study reach was analyzed using the ACOE HEC-2 Water Surface Profiles computer program [2]. This program is a fixed-bed model which is used to calculate water surface profiles for steady, gradually varied flow in natural or man-made channels. It assumes no river bed aggradation or deposition occurs during a storm event. The following information is generally required to compute the flow profile:

- The flood discharge for the reach in which the flow profile is desired. The discharge can be determined for various flood frequencies by using hydrological parameters to calculate the theoretical flow, or by using measured data.

- The known or estimated starting water surface elevation or energy slope. A known starting water surface elevation is the preferred starting elevation and can be obtained from measured data or adjacent HEC-2 analysis.

- Cross-sectional geometry at representative locations throughout the study reach. These cross-sections should be located where changes occur in discharge, slope, channel shape, or roughness, and where obstructions affect the flow (i.e. bridges).

- The channel roughness (Manning's *n*) at various sections for the channel and floodplain. Manning's *n* is determined from the following flow conditions: ground surface roughness, channel irregularity, changes in cross section, flow obstructions, vegetation, alignment, and rivers stage and discharge.

3.2 Study Parameters

3.2.1 River Discharge

A peak 100-year discharge of 30,000 cubic feet per second (cfs) was used for this study. This peak flow is listed in the FEMA Flood Insurance Study (FIS) [5] and is consistent with the peak 100-year discharge used in the 1996 County study.

3.2.2 Cross Sections

Cross section locations from the 1996 County study were evaluated to determine if their locations would provide a good model for this study. Where appropriate, cross sections for this study were located at approximately the same locations used in the 1996 County study. Additional cross sections were added to better define the proposed improvements.

Cross sections 20.767 through 21.093 incorporate topographic data from aerial surveys performed in February 1998 [3]. Cross sections 20.936 and 20.943 represent, respectively, the downstream and upstream faces of the proposed bridge. Refer to Figure 2 (map pocket) for cross section locations.

3.2.3 Manning's *n*

Manning's roughness coefficient (*n*) used for the existing conditions and proposed conditions studies were evaluated during a July 1998 field investigation. Manning's *n* values for "average" flow conditions for the study reach were determined to be:

Main Channel $n = 0.05$
Left (North) Overbank $n = 0.05$
Right (South) Overbank $n = 0.04$

These values are consistent with the 1996 County study.

3.3 Results

3.3.1 Existing Conditions

The 1996 County "equilibrium invert" HEC-2 model (dated 2/5/96) incorporates topographic survey data from February 1992. This model was modified to include topographic data from February 1998. The minimum sediment elevations input into the 1996 County model were duplicated in the modified model. This modified model represents the existing conditions through the project reach.

The existing conditions model matches the 1996 County model 100-year water surface elevations at its upstream and downstream limits. Within the project limits, the existing conditions 100-year water surface elevations are consistently lower than the County model. This difference can be attributed to slightly different riverbed topography. The San Luis Rey River is a very dynamic river making the river bed morphology subject to change with any significant storm event (five-year storm or greater). This change in river topography will affect the 100-year flood elevations and velocities. Table 1 lists the 1996 County study and existing (based on February 1998 topography) 100-year flood elevations and corresponding velocities. It should be noted that water velocities in excess of 5 feet per second (fps) have the potential to erode the river channel and overbanks unless adequately protected.

TABLE 1
HYDRAULIC SUMMARY OF 1996 AND 1998 HEC-2 MODELS
(100-YEAR Q=30,000 CFS)

	1996 COUNTY SAN DIEGO		1998 EXISTING CONDITIONS	
HEC-2 CROSS SECTION	100-YEAR WSEL (msl)	100-YEAR VELOCITY (fps)	100-YEAR WSEL (msl)	100-YEAR VELOCITY (fps)
20.655 (20.655)	305.3	6.8	305.3	7.2
20.749 (20.767)	308.2	6.1	308.1	6.1
20.852 (20.817)	310.0	5.8	308.9	6.0
20.953 (20.831)	312.2	7.8	309.1	6.1
(20.849)			309.3	6.6
(20.872)			309.7	6.4
(20.891)			310.0	6.5
(20.936)			310.5	6.2
(20.943)			310.7	6.1
(20.960)			311.1	5.7
(20.996)			311.4	5.7
21.040 (21.093)	314.5	5.1	311.9	6.2
21.137	315.7	6.5	314.1	10.5
21.246	317.4	4.0	317.5	4.2
21.359	318.3	5.0	318.3	5.6

Note: Cross sections in parentheses ( ) represent 1998 existing conditions HEC-2 model.

3.3.2 Proposed Improvements

The proposed SR76 improvements follow the existing road alignment and would raise the road height above the existing condition 100-year flood elevations. The proposed widening of SR76 will encroach into the 100-year floodplain [6] at its western limits and was assumed to utilize 2:1 cut and fill slopes. This encroachment is minimal and will not impact the 100-year flood elevations or channel velocities.

The proposed landfill access road extends southerly from State Route 76, crossing the San Luis Rey River before reaching the south bank of the river. The proposed access road then follows an easterly alignment to the proposed Gregory Canyon Landfill. All cut and fill slopes were assumed to have 2:1 (horizontal:vertical) side slopes. The proposed road elevations are above the proposed conditions 100-year flood elevations and therefore will not be inundated. The lowest elevation on the proposed access road/bridge is 312.0 while the proposed 100-year water surface elevation at the upstream face of the bridge is 310.7.

Although the proposed road is above 100-year flood elevations, the road alignment bisects the 100-year floodplain as it crosses the San Luis Rey River. In order to convey the 100-year flood discharge under the proposed landfill access road, a preliminary bridge concept was developed. The proposed bridge was modeled assuming a trapezoidal opening with vertical abutments, a channel bottom width of 500 feet, five 5.5-foot piers spaced 116 feet on center, a bridge width of 35.5 feet, a bridge length of 638 feet, and a bridge height (channel invert to the bridge soffit) of 17.5 feet. Figure 3 (see second map pocket) shows the General Plan of the proposed bridge.

The proposed landfill access road will impact the hydraulic properties of the San Luis Rey River by funneling 100-year flows through the bridge opening. In order to mitigate increased 100-year flood elevations resulting from the proposed improvements, a channel concept was developed to maintain the 100-year flood elevations at or below the existing conditions 100-year elevations. The proposed channel grading minimizes impacts to wetland and riparian habitat and to the existing river bed topography.

The channel concept proposes a graded shelf along the right overbank (looking upstream). The natural low flow channel bottom width is approximately 150 feet and the higher terraced channel bottom is approximately 350 feet wide. Limits of the proposed channel modifications are shown in Figure 2. The proposed conditions HEC-2 model includes a 4-foot blocked obstruction on each pier to simulate anticipated debris loading. Minimum sediment elevations input into the "equilibrium invert" model were duplicated in the proposed conditions model.

Table 2 summarizes the 100-year flood elevations and channel velocities for the proposed river channel modifications.

3.3.3 Floodway Analyses

Floodway analyses were performed for all conditions. The County of San Diego maximum allowable surcharge is 0.2 feet for the 100-year floodway. The HEC-2 results show that the proposed conditions floodway widths and elevations will match existing conditions floodway widths and elevations at the upstream and downstream limits of the project (see Appendices).

TABLE 2

HYDRAULIC SUMMARY OF 1998 AND 1999 HEC-2 MODELS
(100-YEAR Q=30,000 cfs)

	EXISTING CONDITIONS 1998		PROPOSED CONDITIONS 1999	
CROSS-SECTION	100-YEAR WSEL (msl)	100-YEAR VELOCITY (fps)	100-YEAR WSEL (msl)	100-YEAR VELOCITY (fps)
20.655	305.3	7.2	305.3	7.2
20.767	308.1	6.1	308.1	6.1
20.817	308.9	6.0	308.9	6.0
20.831	309.1	6.1	309.1	6.5
20.849	309.3	6.6	309.3	6.9
20.872	309.7	6.4	309.8	6.1
20.891	310.0	6.5	310.1	6.5
20.936	310.5	6.2	310.6	6.9
20.943	310.7	6.1	310.7	6.8
20.960	311.1	5.7	311.4	4.9
20.996	311.4	5.7	311.5	5.6
21.093	311.8	6.2	311.9	6.1
21.137	314.1	10.5	314.1	10.6
21.246	317.5	4.2	317.5	4.2
21.359	318.3	5.6	318.3	5.6

4.0 SCOUR ANALYSES

The report "Fluvial Study and Bridge Scour Analysis for the Proposed Gregory Canyon Bridge on the San Luis Rey River" by Howard Chang [7] summarizes sediment transport analyses performed for the San Luis Rey River at the proposed project location. This study shows that there will be significant long-term degradation (up to 20 feet of scour at peak flow) in the channel bottom during a flood series for existing conditions. These scour processes would also occur with the reconfigured channel. The differences on the predicted maximum scour depths between the respective cases with and without the bridge project are not significant in consideration of the modeling accuracy. The scour processes at the SDCWA pipeline will not be exacerbated by the construction of the proposed bridge.

Riprap protection will be placed along the toe of both bridge abutments. The Federal Highway Administration equation [8] was used to determine the rock size for abutment protection. These calculations show that ½-ton rock should be placed on the bridge abutments and extended to at least one foot above the 100-year water surface elevation. See Appendix D for riprap calculations.

5.0 IMPACTS TO PROPOSED IMPROVEMENTS AND ADJACENT FACILITIES

The proposed landfill access bridge has a medium to high potential of being damaged during a 100-year storm because of erosive flood waters. The erosive water velocities (Table 2) have the potential to undermine the bridge piers and abutments during the 100-year flood. The bridge design proposes to construct the piers and abutments below potential scour depths. In addition, riprap protection will be placed at the abutment toes to reduce potential local scour at those locations.

The closest existing facilities to the proposed landfill access road crossing is the San Diego County Water Authority's (CWA) First Aqueduct Crossing, located about 500 feet upstream of the proposed road crossing. Impacts to the San Luis Rey River's 100-year flood elevations and channel velocities will dissipate approximately 400 feet upstream of the proposed river crossing. Therefore, no impact to the 100-year flood elevations and velocities are expected in the vicinity of the Aqueduct Crossing.

6.0 CONCLUSIONS AND RECOMMENDATIONS

This study evaluated impacts on the San Luis Rey River's 100-year flood elevations and channel velocities resulting from proposed improvements to Pala Road/State Route 76 (SR76), a proposed landfill access road, and a proposed landfill access bridge. The SR76 improvements follow the existing SR76 alignment. The proposed landfill access road extends southerly from

SR76, crosses the San Luis Rey River, and then takes an easterly route to the proposed Gregory Canyon Landfill. Both proposed improvements will encroach on the 100-year floodplain boundary delineated by the 1997 Flood Insurance Rate Map (FIRM).

February 1998 topography was used as the topographic base for the existing condition portion of this study. The proposed road improvements were incorporated into the topographic base to analyze impacts on the 100-year flood elevations and channel velocities. The existing conditions and proposed conditions were compared with the 1996 County study. A channel concept was developed to maintain the 100-year flood elevations resulting from the proposed improvements at or below the existing condition values.

The existing conditions model matches the 1996 County model 100-year water surface elevations at its upstream and downstream limits. Within the project limits, the existing conditions 100-year water surface elevations are consistently lower than the County model. This difference can be attributed to the dynamics of river morphology since 1996.

The proposed improvements to SR76 will not impact the existing conditions 100-year flood elevations or channel velocities. The portion of the landfill access road that is within the 100-year floodplain also will not impact the 100-year flood elevations or channel velocities. All proposed road elevations are above the updated existing 100-year flood elevations and therefore will not be inundated. At the time this report was being formulated, the low chord elevation of the proposed bridge was tentatively established at 315.6 feet. This would provide the bridge with 4.7 feet clearance between soffit and water surface.

The differences on the predicted maximum scour depths between the respective cases with and without the bridge project are not significant in consideration of the modeling accuracy. The scour processes at the SDCWA pipeline will not be impacted by the construction of the proposed bridge. The 1996 County, existing conditions, and proposed conditions 100-year flood channel velocities have a medium to high potential to erode the river channel and overbanks. We recommend that the toe of the bridge abutments be protected from the erosive velocities with riprap or other suitable material.

The proposed project impact on the 100-year flood elevations and velocities will dissipate approximately 400 feet upstream of the Gregory Canyon Bridge crossing. The San Diego First Aqueduct Crossing is approximately 500 feet upstream and will not be impacted by the proposed improvements.

7.0 REFERENCES

1. County of San Diego, HEC-2 Computer Model "Equilibrium Invert, Upper San Luis Rey River, San Diego County, California, modified February 5, 1996.

2. U. S. Department of the Army, Corps of Engineers, Hydrologic Engineering Center, Generalized Computer Program, HEC-2 Water Surface Profiles, Version 4.6.2, May 1991.

3. Topo Source, San-Lo Aerial, 1" = 40', 1' Contour Interval., February 1998.

4. United States Army Corps of Engineers, Los Angles District, San Luis Rey River, San Diego County, California, Draft Phase I GDM Main Report and Supplemental Environmental Impact Statement, October 1980.

5. Federal Emergency Management Agency, Flood Insurance Study, San Diego County, California, Unincorporated Areas, June 19,1997.

6. Federal Emergency Management Agency, Flood Insurance Rate Map, San Diego County, California (Unincorporated Areas), Scale 1:6000, June 19, 1997.

7. Howard H. Chang Consultants, Fluvial Study and Bridge Scour Analysis for the Proposed Gregory Canyon Bridge on the San Luis Rey River, November 1999.

8. U.S. Department of Transportation Federal Highway Administration, Evaluating Scour at Bridges HEC-18, Revised April 1993.

APPENDIX A

HEC-2 ANALYSIS

COUNTY OF SAN DIEGO "EQUILIBRIUM INVERT"

FEBRUARY 1996

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1*********************************************                                    ****************************************
 *  HEC-2 WATER SURFACE PROFILES             *                                    *  U.S. ARMY CORPS OF ENGINEERS        *
 *                                           *                                    *  HYDROLOGIC ENGINEERING CENTER       *
 *  Version   4.6.2;  May 1991               *                                    *  609 SECOND STREET, SUITE D          *
 *                                           *                                    *  DAVIS, CALIFORNIA 95616-4687        *
 *  RUN DATE    17MAR99    TIME   11:18:41   *                                    *          (916) 756-1104              *
 *********************************************                                    ****************************************


                                          X     X  XXXXXXX   XXXXX              XXXXX
                                          X     X  X        X     X            X     X
                                          X     X  X        X                        X
                                          XXXXXXX  XXXX     X          XXXXX    XXXXX
                                          X     X  X        X                  X
                                          X     X  X        X     X            X
                                          X     X  XXXXXXX   XXXXX             XXXXXXX
1
   17MAR99      11:18:41                                                                                    PAGE    1


                                                                                  THIS RUN EXECUTED 17MAR99    11:18:41
 ************************************
  HEC-2 WATER SURFACE PROFILES

  Version   4.6.2;  May 1991
 ************************************


 T1      SAN LUIS REY RIVER STUDY      FLOODWAY
 T2      FOR SD COUNTY WATER AUTHORITY AND COUNTY OF SAN DIEGO
 T3      100-YR FLOOD, FEBRUARY 1994   MODIFIED 2-5-96 BY COUNTY OF SAN DIEGO
 T4      MODIFIED JANUARY 1998 BY NOLTE FOR GREGORY CANYON ANALYSIS
 T5      ORIGINAL FILE : SLR.DHS   NOLTE FILE : GRCYNFW.DAT

 J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

       0         2         0         0         0         0       0.0   30000.0    305.28

 J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN       ALLDC     IBW       CHNIM     ITRACE

       1         0        -1       0.0       0.0       0.0       0.0      -6.0       0.0        15


 J3  VARIABLE CODES FOR SUMMARY PRINTOUT

      38         1        50        43        42        21        22        27        28        53
      54         4                 150                 200
```

ET			9.1						87	1100
NC	0.05	0.04	0.05	0.1	0.3					
X1	20.655	82	143.0	881.0	500.0	600.0	550.0	1.0	0.0	0
X3	0	299.7	0.0	0.0	0.0	1100.0	0.0	0.0	0.0	
GR	313.6	0.0	312.4	5.0	311.0	12.0	306.5	19.0	307.3	26.0
GR	309.0	38.0	309.4	52.0	310.2	63.0	300.9	110.0	300.1	143.0
GR	298.6	147.0	298.8	165.0	300.4	169.0	300.0	188.0	299.4	230.0
GR	298.0	234.0	298.1	254.0	298.8	262.0	298.8	305.0	299.7	439.0
GR	304.7	458.0	305.0	470.0	304.7	482.0	303.7	495.0	302.4	513.0
GR	301.0	536.0	300.3	560.0	299.9	571.0	299.6	582.0	299.6	599.0
GR	298.7	637.0	302.2	881.0	302.9	893.0	301.7	897.0	301.8	944.0
GR	302.0	1001.0	303.4	1020.0	305.0	1036.0	305.5	1050.0	305.1	1099.0
GR	305.2	1270.0	305.6	1307.0	305.6	1314.0	306.2	1315.0	306.3	1330.0
GR	305.6	1334.0	305.3	1386.0	306.3	1394.0	306.3	1407.0	306.8	1433.0
GR	307.2	1435.0	307.2	1442.0	306.2	1452.0	306.5	1494.0	305.9	1515.0
GR	305.1	1517.0	305.1	1529.0	305.8	1538.0	305.1	1594.0	305.6	1613.0
GR	305.7	1639.0	304.8	1646.0	304.5	1660.0	304.5	1673.0	304.0	1685.0
GR	303.5	1695.0	303.3	1710.0	303.4	1722.0	303.7	1738.0	303.8	1787.0
GR	304.7	1807.0	305.1	1826.0	306.2	1866.0	308.6	1904.0	311.8	1939.0
GR	315.8	1969.0	318.7	1981.0	318.6	1998.0	320.6	2006.0	324.9	2020.0
GR	323.8	2029.0	324.6	2029.0						

1

ET			9.1						125	1050
X1	20.749	71	321.0	1014.0	400.0	750.0	500.0	1.0	0.0	0
X3	0	300.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GR	310.3	0.0	309.5	17.0	309.1	25.0	302.8	30.0	303.2	36.0
GR	303.3	42.0	306.6	49.0	305.9	67.0	305.8	89.0	305.0	125.0
GR	305.2	155.0	304.7	182.0	303.4	186.0	303.6	198.0	304.6	215.0
GR	304.9	227.0	304.8	250.0	304.7	278.0	304.8	321.0	300.5	328.0
GR	301.0	342.0	301.6	348.0	301.6	353.0	301.3	357.0	300.3	360.0
GR	301.1	393.0	302.7	403.0	302.4	409.0	301.5	416.0	301.5	438.0
GR	304.6	447.0	304.0	472.0	302.1	576.0	302.1	599.0	302.1	628.0
GR	301.1	632.0	301.3	641.0	301.3	650.0	302.7	658.0	302.6	668.0
GR	301.9	764.0	302.2	793.0	303.1	1014.0	305.6	1085.0	307.6	1101.0
GR	309.1	1111.0	309.3	1116.0	308.5	1117.0	309.1	1125.0	311.0	1132.0
GR	311.0	1136.0	310.3	1139.0	310.4	1162.0	310.8	1194.0	310.8	1248.0
GR	310.2	1293.0	309.8	1351.0	309.0	1431.0	308.7	1526.0	308.2	1596.0
GR	308.1	1627.0	308.2	1645.0	308.4	1654.0	308.4	1752.0	307.3	1806.0
GR	307.3	1850.0	308.9	1886.0	311.4	1934.0	314.4	1971.0	315.5	1986.0
GR	316.3	1986.0								

NC	0.035	0.04	0.05	0.0	0.0					
ET		7.1	9.1				0	1200	250	1200
X1	20.852	75	641.0	1078.0	450.0	700.0	540.0	1.0	0.0	0
X3	0	300.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GR	312.4	0.0	312.4	2.0	312.3	14.0	304.9	26.0	304.9	36.0
GR	307.7	41.0	308.0	79.0	308.6	96.0	308.6	112.0	308.1	138.0
GR	307.9	188.0	307.9	210.0	309.1	216.0	310.1	224.0	307.6	229.0
GR	306.9	238.0	306.1	250.0	306.7	277.0	306.7	297.0	306.7	322.0

GR	305.0	324.0	305.0	330.0	305.8	333.0	305.1	364.0	305.2	402.0
GR	304.7	470.0	304.8	538.0	304.9	552.0	304.4	560.0	304.4	571.0
GR	305.2	580.0	305.4	593.0	305.4	605.0	304.9	622.0	305.1	641.0
GR	303.5	680.0	303.5	844.0	303.5	903.0	307.5	910.0	308.0	916.0
GR	307.6	924.0	307.7	932.0	307.6	939.0	303.0	965.0	303.0	1016.0
GR	303.0	1031.0	303.0	1071.0	305.3	1078.0	305.9	1099.0	306.4	1123.0
GR	306.1	1151.0	306.3	1162.0	306.4	1187.0	306.0	1221.0	305.9	1242.0
GR	305.9	1268.0	306.8	1291.0	306.8	1318.0	307.3	1343.0	307.3	1381.0
GR	308.2	1400.0	307.9	1423.0	307.5	1444.0	308.0	1477.0	307.5	1522.0
GR	307.5	1558.0	307.5	1581.0	308.1	1598.0	309.3	1619.0	311.6	1696.0
GR	312.6	1735.0	315.9	1760.0	319.8	1782.0	324.0	1796.0	323.5	1797.0
ET		7.1	9.1				0	1754.0	986	1754
X1	20.953	98	1117.0	1754.0	650.0	400.0	535.0	1.0	0.0	0
X3	0	301.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GR	319.0	0.0	318.8	3.0	316.8	18.0	316.6	36.0	315.6	55.0
GR	314.1	86.0	314.1	114.0	314.1	203.0	314.7	218.0	314.7	228.0
GR	314.6	266.0	314.7	287.0	314.3	330.0	313.9	346.0	313.5	369.0
GR	313.9	401.0	313.5	433.0	313.5	463.0	313.6	473.0	313.6	505.0
GR	313.2	549.0	312.7	598.0	311.7	638.0	311.2	657.0	311.2	662.0
GR	311.5	665.0	311.3	694.0	311.5	742.0	311.2	777.0	311.6	795.0
GR	312.3	803.0	312.7	811.0	312.3	820.0	312.1	833.0	311.6	845.0
GR	311.5	864.0	310.6	891.0	309.9	933.0	309.5	986.0	309.2	1032.0
GR	309.0	1063.0	309.1	1082.0	308.6	1117.0	307.8	1170.0	307.0	1204.0
GR	306.6	1217.0	305.8	1226.0	305.1	1233.0	305.4	1242.0	306.1	1251.0
GR	306.1	1261.0	305.9	1278.0	306.1	1295.0	306.3	1308.0	306.3	1316.0

1

GR	306.7	1327.0	306.6	1335.0	313.9	1341.0	314.0	1347.0	313.6	1354.0
GR	311.0	1358.0	311.0	1372.0	311.0	1384.0	304.9	1399.0	304.6	1413.0
GR	304.9	1414.0	304.9	1501.0	304.9	1572.0	308.6	1585.0	308.8	1597.0
GR	307.0	1658.0	308.1	1689.0	308.0	1705.0	308.0	1722.0	308.0	1729.0
GR	308.1	1737.0	308.1	1754.0	308.1	1775.0	308.1	1797.0	307.5	1829.0
GR	307.7	1865.0	308.1	1883.0	307.9	1897.0	307.5	1913.0	308.2	1944.0
GR	308.9	1967.0	309.0	1995.0	309.0	2018.0	309.7	2037.0	310.2	2057.0
GR	311.0	2076.0	313.1	2094.0	315.4	2119.0	317.1	2146.0	319.9	2178.0
GR	321.7	2199.0	322.6	2208.0	322.8	2208.0				

FIRST SAN DEIGO AQUEDUCT CROSSING

ET		7.1	9.1				0	1530	616	1530
X1	21.040	68	825.0	1530.0	650.0	380.0	460.0	1.0	0.0	0
X3	0	302.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GR	316.0	0.0	316.2	0.0	316.3	0.0	315.4	54.0	315.0	82.0
GR	315.1	104.0	314.7	126.0	314.7	153.0	314.8	172.0	314.2	192.0
GR	314.1	216.0	314.0	234.0	314.5	238.0	314.4	249.0	314.4	258.0
GR	313.9	263.0	313.6	309.0	312.8	349.0	312.8	393.0	312.8	439.0
GR	311.9	467.0	312.0	477.0	313.4	481.0	313.4	506.0	313.3	537.0
GR	311.8	584.0	312.5	616.0	312.4	629.0	311.8	645.0	310.8	664.0
GR	311.5	685.0	311.1	704.0	310.1	714.0	310.8	752.0	310.4	788.0
GR	309.9	825.0	309.4	874.0	308.6	927.0	308.7	970.0	308.5	1003.0

GR	308.2	1033.0	308.1	1063.0	307.5	1080.0	307.3	1094.0	307.3	1111.0
GR	307.3	1116.0	311.4	1122.0	311.4	1130.0	311.4	1141.0	311.6	1168.0
GR	307.9	1186.0	305.6	1209.0	304.3	1218.0	304.3	1291.0	304.3	1365.0
GR	305.2	1367.0	305.1	1385.0	305.8	1408.0	306.1	1428.0	307.3	1437.0
GR	308.2	1449.0	308.2	1472.0	309.3	1530.0	311.5	1622.0	315.9	1689.0
GR	320.0	1720.0	321.3	1727.0	316.3	1727.0				
ET			9.1						560	1490
X1	21.137	77	990.0	1485.0	450.0	530.0	510.0	1.0	0.0	0
X3	0	306.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GR	323.7	0.0	323.9	3.0	322.8	20.0	323.9	24.0	324.6	29.0
GR	323.6	31.0	316.9	41.0	316.9	54.0	319.3	57.0	320.4	61.0
GR	320.4	64.0	318.5	66.0	318.3	81.0	317.4	99.0	317.1	117.0
GR	317.1	141.0	316.5	150.0	315.7	206.0	315.7	256.0	315.3	318.0
GR	314.8	410.0	314.3	426.0	314.3	437.0	313.5	474.0	313.4	540.0
GR	313.4	626.0	314.1	681.0	316.9	691.0	318.7	697.0	318.6	700.0
GR	318.5	703.0	316.0	707.0	313.0	714.0	313.0	733.0	313.6	745.0
GR	313.4	759.0	313.4	770.0	313.4	782.0	317.3	788.0	317.3	794.0
GR	317.3	800.0	315.1	808.0	313.2	814.0	312.4	860.0	312.1	919.0
GR	311.8	990.0	311.2	1035.0	311.2	1044.0	310.5	1048.0	310.5	1053.0
GR	310.5	1059.0	310.3	1071.0	310.4	1090.0	310.7	1112.0	310.7	1125.0
GR	311.1	1139.0	310.9	1162.0	310.8	1185.0	310.3	1214.0	310.0	1264.0
GR	309.3	1272.0	306.1	1290.0	306.4	1316.0	306.5	1344.0	306.5	1359.0
GR	306.5	1379.0	306.5	1393.0	306.5	1412.0	307.1	1416.0	307.5	1424.0
GR	307.6	1434.0	307.0	1448.0	307.0	1476.0	307.0	1485.0	338.8	1531.0
GR	342.2	1539.0	342.5	1540.0						

D/S OF FENTON'S LARGE PIT

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ET			9.1						33	1461
X1	21.246	90	613.0	1216.0	450.0	650.0	575.0	1.0	0.0	0
X3	0	309.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
GR	320.4	0.0	318.6	7.0	318.6	22.0	318.6	31.0	314.1	39.0
GR	314.1	49.0	314.1	56.0	314.1	75.0	314.1	95.0	314.3	120.0
GR	314.3	156.0	314.3	187.0	314.2	211.0	313.6	236.0	313.7	265.0
GR	313.5	283.0	313.5	304.0	313.5	327.0	313.5	354.0	313.4	379.0
GR	313.3	405.0	312.5	428.0	312.6	449.0	312.2	459.0	312.0	478.0
GR	311.9	501.0	311.3	515.0	313.1	523.0	311.9	527.0	311.9	539.0
GR	313.1	543.0	313.4	556.0	313.7	575.0	313.5	595.0	313.5	613.0
GR	307.5	640.0	307.7	682.0	307.9	744.0	310.5	875.0	310.4	896.0
GR	310.4	916.0	310.4	935.0	311.1	939.0	311.0	945.0	310.7	949.0
GR	310.7	958.0	310.7	968.0	311.3	973.0	311.5	986.0	311.9	998.0
GR	313.2	1004.0	313.3	1009.0	313.3	1013.0	313.3	1017.0	311.9	1020.0
GR	311.9	1026.0	311.8	1032.0	311.4	1051.0	310.9	1079.0	310.9	1105.0
GR	310.9	1143.0	310.8	1187.0	314.6	1216.0	314.6	1238.0	314.9	1262.0
GR	314.8	1305.0	314.4	1346.0	317.6	1355.0	315.8	1368.0	312.8	1374.0
GR	312.8	1415.0	312.8	1456.0	318.3	1462.0	321.9	1472.0	321.9	1479.0
GR	323.2	1484.0	324.8	1489.0	324.9	1490.0	324.0	1496.0	322.9	1506.0
GR	320.5	1517.0	319.7	1528.0	318.2	1540.0	318.3	1562.0	318.9	1580.0

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GR    319.3     1594.0      319.8     1610.0       319.6      1619.0       320.1      1633.0       321.6      1649.0

ET                            9.1                                                                  32        1543
NC     0.04       0.04       0.03        0.0         0.0
X1   21.359         80      689.0     1549.0       380.0       800.0       600.0         1.0         0.0          0
X3        0      313.0        0.0        0.0         0.0         0.0         0.0         0.0         0.0
GR    338.9        0.0      331.1        8.0       316.6        35.0       316.6        57.0       316.6        66.0
GR    314.7       71.0      314.8       85.0       314.9       127.0       314.9       150.0       315.5       175.0
GR    315.5      197.0      319.9      204.0       321.8       211.0       321.8       222.0       321.8       235.0
GR    316.7      246.0      313.4      258.0       313.6       279.0       313.6       296.0       313.6       318.0
GR    313.2      330.0      313.3      350.0       312.9       377.0       311.5       395.0       310.3       415.0
GR    309.8      429.0      309.8      443.0       309.8       461.0       309.8       494.0       312.0       509.0
GR    311.9      538.0      314.6      580.0       317.6       586.0       320.4       590.0       320.7       596.0
GR    317.3      600.0      314.6      604.0       314.3       618.0       315.3       638.0       315.8       647.0
GR    317.0      655.0      317.4      669.0       317.3       689.0       316.8       701.0       316.8       713.0
GR    317.5      725.0      317.5      748.0       317.9       773.0       318.0       793.0       317.6       811.0
GR    318.0      828.0      317.8      844.0       316.8       855.0       315.7       875.0       315.2       893.0
GR    315.3      911.0      319.4      915.0       314.9       923.0       312.8       925.0       294.0       965.0
GR    292.8      980.0      293.8     1040.0       294.0      1110.0       294.0      1180.0       294.0      1240.0
GR    294.0     1310.0      294.0     1420.0       294.0      1500.0       321.7      1549.0       324.5      1555.0
GR    328.7     1561.0      332.0     1565.0       331.9      1569.0       331.9      1573.0       326.8      1577.0
GR    323.1     1586.0      320.9     1595.0       321.6      1609.0       321.3      1632.0       320.4      1632.0
1
   17MAR99      11:18:41                                                                                    PAGE    5

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

 *PROF 1
0

 CCHV=     .100 CEHV=     .300
 *SECNO 20.655

 3265 DIVIDED FLOW

 3470 ENCROACHMENT STATIONS=          .0     1100.0  TYPE=       1  TARGET=      1099.999
    20.655      5.58    305.28       .00    305.28    306.07       .79       .00       .00    300.10
   30000.0    1345.4   25415.4    3239.2     206.2    3522.9     472.8        .0        .0    302.20
       .00      6.52      7.21      6.85      .050      .050      .040      .000    299.70     87.86
   .007344      500.      550.      600.         0         0         0       .00    979.02   1100.00

 FLOW DISTRIBUTION FOR SECNO=     20.66          CWSEL=    305.28

 STA=      88.     110.     143.     881.     893.     897.     944.    1001.    1020.    1036.    1100.
   PER Q=       .7      3.8     84.7       .7       .3      4.1      4.6      1.0       .2       .0
    AREA=     48.5    157.7   3522.9     32.8     11.9    165.9    192.7     49.0     17.3      3.3
     VEL=      4.2      7.2      7.2      6.2      6.4      7.4      7.2      6.0      3.3       .7
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  DEPTH=      2.2       4.8       4.8       2.7       3.0       3.5       3.4       2.6       1.1        .1

*SECNO 20.749

3265 DIVIDED FLOW

    20.749      7.84    308.24       .00       .00    308.74       .50      2.64       .03    304.80
   30000.0    4083.0   24130.5    1786.5     981.4    4058.9     381.2      56.3      13.7    303.10
      .03      4.16      5.95      4.69      .050      .050      .040      .000    300.40     25.68
   .003807     400.      500.      750.         3         0         0       .00   1247.18   1871.14


FLOW DISTRIBUTION FOR SECNO=     20.75          CWSEL=    308.24

STA=      26.      125.      198.      278.      321.     1014.     1085.     1871.
  PER Q=      3.7       3.7       4.1       2.1      80.4       5.2        .7
   AREA=    286.8     256.6     287.9     150.1    4058.9     276.2     105.1
    VEL=      3.8       4.3       4.3       4.2       5.9       5.7       2.1
  DEPTH=      2.9       3.5       3.6       3.5       5.9       3.9        .1

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    17MAR99      11:18:41                                                                    PAGE     6

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


*SECNO 20.852

3265 DIVIDED FLOW

    20.852      6.98    309.98       .00       .00    310.46       .48      1.72       .00    305.10
   30000.0   13816.3   14152.2    2031.5    2325.7    2666.2     420.7     121.5      28.3    305.30
      .05      5.94      5.31      4.83      .035      .050      .040      .000    303.00     17.76
   .002878     450.      540.      700.         3         0         0       .00   1168.04   1187.00


FLOW DISTRIBUTION FOR SECNO=     20.85          CWSEL=    309.98

STA=      18.       96.      250.      322.      364.      402.      470.      538.      571.      605.      641.     1078.     1123.
  PER Q=      3.0       3.6       4.2       4.0       4.0       7.6       8.1       4.1       3.5       3.9      47.2       3.1
   AREA=    199.6     293.2     244.3     192.3     183.5     342.1     355.7     175.8     162.4     176.7    2666.2     183.9
    VEL=      4.6       3.7       5.1       6.2       6.5       6.7       6.9       7.0       6.5       6.6       5.3       5.1
  DEPTH=      2.6       1.9       3.4       4.6       4.8       5.0       5.2       5.3       4.8       4.9       6.1       4.1

STA=    1123.     1187.
  PER Q=      3.6
   AREA=    236.8
    VEL=      4.6
  DEPTH=      3.7
```

*SECNO 20.953

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .64

20.953	7.56	312.16	.00	.00	313.01	.85	2.43	.11	308.60
30000.0	4823.4	25176.6	.0	782.3	3310.0	.0	183.3	43.5	308.10
.07	6.17	7.61	6.95	.035	.050	.040	.000	304.60	619.60
.007099	650.	535.	400.	2	0	0	.00	1090.05	1754.00

FLOW DISTRIBUTION FOR SECNO= 20.95 CWSEL= 312.16

STA=	620.	933.	1032.	1082.	1117.	1754.
PER Q=	3.2	5.9	3.9	3.1	83.9	
AREA=	252.9	259.6	153.9	115.8	3310.0	
VEL=	3.8	6.8	7.6	7.9	7.6	
DEPTH=	.8	2.6	3.1	3.3	5.3	

1

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

*SECNO 21.040

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.80

21.040	10.16	314.46	.00	.00	314.84	.37	1.78	.05	309.90
30000.0	5090.4	24909.6	.1	1312.4	4912.8	.0	242.4	58.7	309.30
.10	3.88	5.07	4.61	.035	.050	.040	.000	304.30	183.22
.002196	650.	460.	380.	2	0	0	.00	1342.47	1530.00

FLOW DISTRIBUTION FOR SECNO= 21.04 CWSEL= 314.46

STA=	183.	481.	664.	752.	825.	1530.	1530.
PER Q=	3.0	3.8	5.1	5.1	83.0	.0	
AREA=	343.8	349.2	320.8	298.7	4912.8	.0	
VEL=	2.7	3.3	4.7	5.1	5.1	4.6	
DEPTH=	1.2	1.9	3.6	4.1	7.0	2.6	

*SECNO 21.137

3265 DIVIDED FLOW

21.137	9.63	315.73	.00	.00	316.36	.62	1.45	.08	311.80
30000.0	7339.6	22354.9	305.4	1446.9	3327.5	55.2	305.2	73.0	307.00
.12	5.07	6.72	5.53	.035	.050	.040	.000	306.10	203.50
.004032	450.	510.	530.	2	0	0	.00	1253.27	1497.64

FLOW DISTRIBUTION FOR SECNO= 21.14 CWSEL= 315.73

STA=	203.	540.	626.	745.	860.	919.	990.	1485.	1498.
PER Q=	4.1	3.2	3.1	4.0	4.2	5.9	74.5	1.0	
AREA=	333.0	200.9	203.9	234.5	205.7	268.8	3327.5	55.2	
VEL=	3.7	4.7	4.5	5.1	6.2	6.5	6.7	5.5	
DEPTH=	1.0	2.3	1.7	2.0	3.5	3.8	6.7	4.4	

*SECNO 21.246

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

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.60

21.246	7.82	317.42	.00	.00	317.69	.27	1.30	.04	313.50
30000.0	9911.5	17408.9	2679.6	2296.8	4104.7	783.4	379.9	89.0	314.60
.16	4.32	4.24	3.42	.035	.050	.040	.000	309.60	33.10
.001583	450.	575.	650.	2	0	0	.00	1426.12	1461.04

FLOW DISTRIBUTION FOR SECNO= 21.25 CWSEL= 317.42

STA=	33.	120.	211.	283.	354.	428.	478.	515.	556.	613.	1216.	1346.	1456.
PER Q=	3.4	3.4	3.6	3.9	4.5	4.2	3.7	3.3	3.1	58.0	3.4	5.5	
AREA=	276.1	285.0	266.0	278.2	308.9	253.5	207.2	201.5	220.4	4104.7	352.1	419.7	
VEL=	3.7	3.6	4.0	4.2	4.4	5.0	5.3	4.9	4.2	4.2	2.9	3.9	
DEPTH=	3.2	3.1	3.7	3.9	4.2	5.1	5.6	4.9	3.9	6.8	2.7	3.8	

STA=	1456.	1461.
PER Q=	.1	
AREA=	11.6	
VEL=	2.1	
DEPTH=	2.3	

*SECNO 21.359

3265 DIVIDED FLOW

21.359	5.25	318.25	.00	.00	318.68	.42	.94	.05	317.30
30000.0	10338.0	19662.0	.0	2358.4	3498.4	.0	459.7	106.4	321.70
.19	4.38	5.62	.00	.040	.030	.000	.000	313.00	31.93
.001968	380.	600.	800.	2	0	0	.00	1454.53	1542.89

FLOW DISTRIBUTION FOR SECNO= 21.36 CWSEL= 318.25

STA=	32.	150.	279.	330.	370.	415.	461.	509.	555.	638.	689.	1549.
PER Q=	3.9	3.6	3.7	3.3	3.9	4.0	4.2	4.0	3.4	.6	65.5	
AREA=	335.2	283.3	239.4	203.2	234.8	241.4	251.9	242.0	255.7	71.7	3498.4	
VEL=	3.5	3.8	4.6	4.8	5.0	5.0	5.0	5.0	4.0	2.3	5.6	
DEPTH=	2.8	2.2	4.7	5.0	5.2	5.2	5.2	5.2	3.1	1.4	4.1	

1

T1 SAN LUIS REY RIVER STUDY FLOODWAY
T2 FOR SD COUNTY WATER AUTHORITY AND COUNTY OF SAN DIEGO
T3 100-YR FLOOD, FEBRUARY 1994 MODIFIED 2-5-96 BY COUNTY OF SAN DIEGO
T4 MODIFIED JANUARY 1998 BY NOLTE FOR GREGORY CANYON ANALYSIS
T5 ORIGINAL FILE : SLR.DHS NOLTE FILE : GRCYNFW.DAT

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0	3	0	0	0	0	0.0	30000.0	305.47	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	15	0	-1	0.0	0.0	0.0	0.0	-6.0	0.0	

1

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

*PROF 2
0

CCHV= .100 CEHV= .300
*SECNO 20.655

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= .0 1100.0 TYPE= 1 TARGET= 1099.999

20.655	5.77	305.47	.00	305.28	306.20	.73	.00	.00	300.10
30000.0	1349.8	25309.2	3341.0	216.8	3663.1	510.8	.0	.0	302.20
.00	6.23	6.91	6.54	.050	.050	.040	.000	299.70	86.90
.006394	500.	550.	600.	0	0	0	.00	1008.58	1100.00

*SECNO 20.749

3470 ENCROACHMENT STATIONS= 125.0 1050.0 TYPE= 1 TARGET= 925.000

20.749	7.87	308.27	.00	308.24	308.86	.59	2.65	.01	304.80
30000.0	3176.0	25809.0	1015.1	700.1	4078.4	163.2	54.4	11.5	303.10
.02	4.54	6.33	6.22	.050	.050	.040	.000	300.40	125.00
.004286	400.	500.	750.	3	0	0	.00	925.00	1050.00

*SECNO 20.852

3470 ENCROACHMENT STATIONS= 250.0 1200.0 TYPE= 1 TARGET= 950.000

20.852	7.16	310.16	.00	309.98	310.70	.55	1.84	.00	305.10
30000.0	12598.1	14952.2	2449.7	1901.7	2743.1	489.7	115.4	22.8	305.30
.05	6.62	5.45	5.00	.035	.050	.040	.000	303.00	250.00
.002921	450.	540.	700.	3	0	0	.00	950.00	1200.00

*SECNO 20.953

3265 DIVIDED FLOW

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .63

3470 ENCROACHMENT STATIONS= 986.0 1754.0 TYPE= 1 TARGET= 768.000

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
20.953	7.73	312.33	.00	312.16	313.28	.95	2.45	.12	308.60
30000.0	3288.2	26711.8	.0	421.0	3413.7	.0	172.8	33.8	100000.00
.07	7.81	7.82	.00	.035	.050	.000	.000	304.60	986.00
.007283	650.	535.	400.	2	0	0	.00	751.75	1754.00

*SECNO 21.040

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.82

3470 ENCROACHMENT STATIONS= 616.0 1530.0 TYPE= 1 TARGET= 914.000

21.040	10.39	314.69	.00	314.46	315.10	.41	1.77	.05	309.90
30000.0	3875.7	26124.3	.0	790.8	5072.1	.0	226.6	43.3	100000.00
.09	4.90	5.15	.00	.035	.050	.000	.000	304.30	616.00
.002193	650.	460.	380.	2	0	0	.00	914.00	1530.00

*SECNO 21.137

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 560.0 1490.0 TYPE= 1 TARGET= 930.000

21.137	9.85	315.95	.00	315.73	316.62	.67	1.44	.08	311.80
30000.0	6519.1	23301.0	179.9	1148.9	3431.4	36.1	286.7	53.5	307.00
.12	5.67	6.79	4.99	.035	.050	.040	.000	306.10	560.00
.003954	450.	510.	530.	2	0	0	.00	891.45	1490.00

*SECNO 21.246

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.68

3470 ENCROACHMENT STATIONS= 33.0 1461.0 TYPE= 1 TARGET= 1428.000

21.246	8.00	317.60	.00	317.42	317.86	.25	1.20	.04	313.50
30000.0	10071.2	17174.8	2753.9	2404.2	4216.4	828.6	361.9	67.6	314.60
.15	4.19	4.07	3.32	.035	.050	.040	.000	309.60	33.00
.001409	450.	575.	650.	2	0	0	.00	1428.00	1461.00

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

*SECNO 21.359

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 32.0 1543.0 TYPE= 1 TARGET= 1511.000

21.359	5.35	318.35	.00	318.25	318.76	.40	.85	.04	317.30
30000.0	10330.3	19669.7	.0	2417.9	3582.3	.0	444.3	85.0	100000.00
.18	4.27	5.49	.00	.040	.030	.000	.000	313.00	32.00
.001821	380.	600.	800.	2	0	0	.00	1455.47	1543.00

1

THIS RUN EXECUTED 17MAR99 11:18:42

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

100-YR FLOOD, FEBRUARY 1

SUMMARY PRINTOUT

	SECNO	CWSEL	DIFWSP	Q	ELMIN	STCHL	STCHR	STENCL	STENCR	SSTA	ENDST	TOPWID
	20.655	305.28	.00	30000.00	299.70	143.00	881.00	.00	1100.00	87.86	1100.00	979.02
	20.655	305.47	.19	30000.00	299.70	143.00	881.00	.00	1100.00	86.90	1100.00	1008.58
	20.749	308.24	.00	30000.00	300.40	321.00	1014.00	.00	.00	25.68	1871.14	1247.18
	20.749	308.27	.03	30000.00	300.40	321.00	1014.00	125.00	1050.00	125.00	1050.00	925.00
	20.852	309.98	.00	30000.00	303.00	641.00	1078.00	.00	1200.00	17.76	1187.00	1168.04
	20.852	310.16	.18	30000.00	303.00	641.00	1078.00	250.00	1200.00	250.00	1200.00	950.00
*	20.953	312.16	.00	30000.00	304.60	1117.00	1754.00	.00	1754.00	619.60	1754.00	1090.05
*	20.953	312.33	.17	30000.00	304.60	1117.00	1754.00	986.00	1754.00	986.00	1754.00	751.75
*	21.040	314.46	.00	30000.00	304.30	825.00	1530.00	.00	1530.00	183.22	1530.00	1342.47
*	21.040	314.69	.23	30000.00	304.30	825.00	1530.00	616.00	1530.00	616.00	1530.00	914.00
	21.137	315.73	.00	30000.00	306.10	990.00	1485.00	.00	.00	203.50	1497.64	1253.27
	21.137	315.95	.21	30000.00	306.10	990.00	1485.00	560.00	1490.00	560.00	1490.00	891.45
*	21.246	317.42	.00	30000.00	309.60	613.00	1216.00	.00	.00	33.10	1461.04	1426.12
*	21.246	317.60	.19	30000.00	309.60	613.00	1216.00	33.00	1461.00	33.00	1461.00	1428.00
	21.359	318.25	.00	30000.00	313.00	689.00	1549.00	.00	.00	31.93	1542.89	1454.53
	21.359	318.35	.10	30000.00	313.00	689.00	1549.00	32.00	1543.00	32.00	1543.00	1455.47

100-YR FLOOD, FEBRUARY 1

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	20.655	.00	.00	.00	299.70	30000.00	305.28	.00	306.07	73.44	7.21	4201.89	3500.63
	20.655	.00	.00	.00	299.70	30000.00	305.47	.00	306.20	63.94	6.91	4390.72	3751.61
	20.749	500.00	.00	.00	300.40	30000.00	308.24	.00	308.74	38.07	5.95	5421.50	4861.98
	20.749	500.00	.00	.00	300.40	30000.00	308.27	.00	308.86	42.86	6.33	4941.73	4582.25
	20.852	540.00	.00	.00	303.00	30000.00	309.98	.00	310.46	28.78	5.31	5412.59	5592.50
	20.852	540.00	.00	.00	303.00	30000.00	310.16	.00	310.70	29.21	5.45	5134.56	5550.37
*	20.953	535.00	.00	.00	304.60	30000.00	312.16	.00	313.01	70.99	7.61	4092.35	3560.71
*	20.953	535.00	.00	.00	304.60	30000.00	312.33	.00	313.28	72.83	7.82	3834.68	3515.39
*	21.040	460.00	.00	.00	304.30	30000.00	314.46	.00	314.84	21.96	5.07	6225.24	6402.46
*	21.040	460.00	.00	.00	304.30	30000.00	314.69	.00	315.10	21.93	5.15	5862.90	6405.72
	21.137	510.00	.00	.00	306.10	30000.00	315.73	.00	316.36	40.32	6.72	4829.60	4724.51
	21.137	510.00	.00	.00	306.10	30000.00	315.95	.00	316.62	39.54	6.79	4616.37	4770.85
*	21.246	575.00	.00	.00	309.60	30000.00	317.42	.00	317.69	15.83	4.24	7184.87	7540.72
*	21.246	575.00	.00	.00	309.60	30000.00	317.60	.00	317.86	14.09	4.07	7449.22	7993.28
	21.359	600.00	.00	.00	313.00	30000.00	318.25	.00	318.68	19.68	5.62	5856.73	6763.25
	21.359	600.00	.00	.00	313.00	30000.00	318.35	.00	318.76	18.21	5.49	6000.19	7030.26

100-YR FLOOD, FEBRUARY 1

SUMMARY PRINTOUT TABLE 150

SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
20.655	30000.00	305.28	.00	.00	.00	979.02	.00
20.655	30000.00	305.47	.19	.00	.19	1008.58	.00
20.749	30000.00	308.24	.00	2.96	.00	1247.18	500.00
20.749	30000.00	308.27	.03	2.80	.03	925.00	500.00
20.852	30000.00	309.98	.00	1.74	.00	1168.04	540.00
20.852	30000.00	310.16	.18	1.89	.18	950.00	540.00

*	20.953	30000.00	312.16	.00	2.18	.00	1090.05	535.00
*	20.953	30000.00	312.33	.17	2.17	.17	751.75	535.00
*	21.040	30000.00	314.46	.00	2.31	.00	1342.47	460.00
*	21.040	30000.00	314.69	.23	2.36	.23	914.00	460.00
	21.137	30000.00	315.73	.00	1.27	.00	1253.27	510.00
	21.137	30000.00	315.95	.21	1.26	.21	891.45	510.00
*	21.246	30000.00	317.42	.00	1.68	.00	1426.12	575.00
*	21.246	30000.00	317.60	.19	1.66	.19	1428.00	575.00
	21.359	30000.00	318.25	.00	.84	.00	1454.53	600.00
	21.359	30000.00	318.35	.10	.75	.10	1455.47	600.00

SUMMARY OF ERRORS AND SPECIAL NOTES

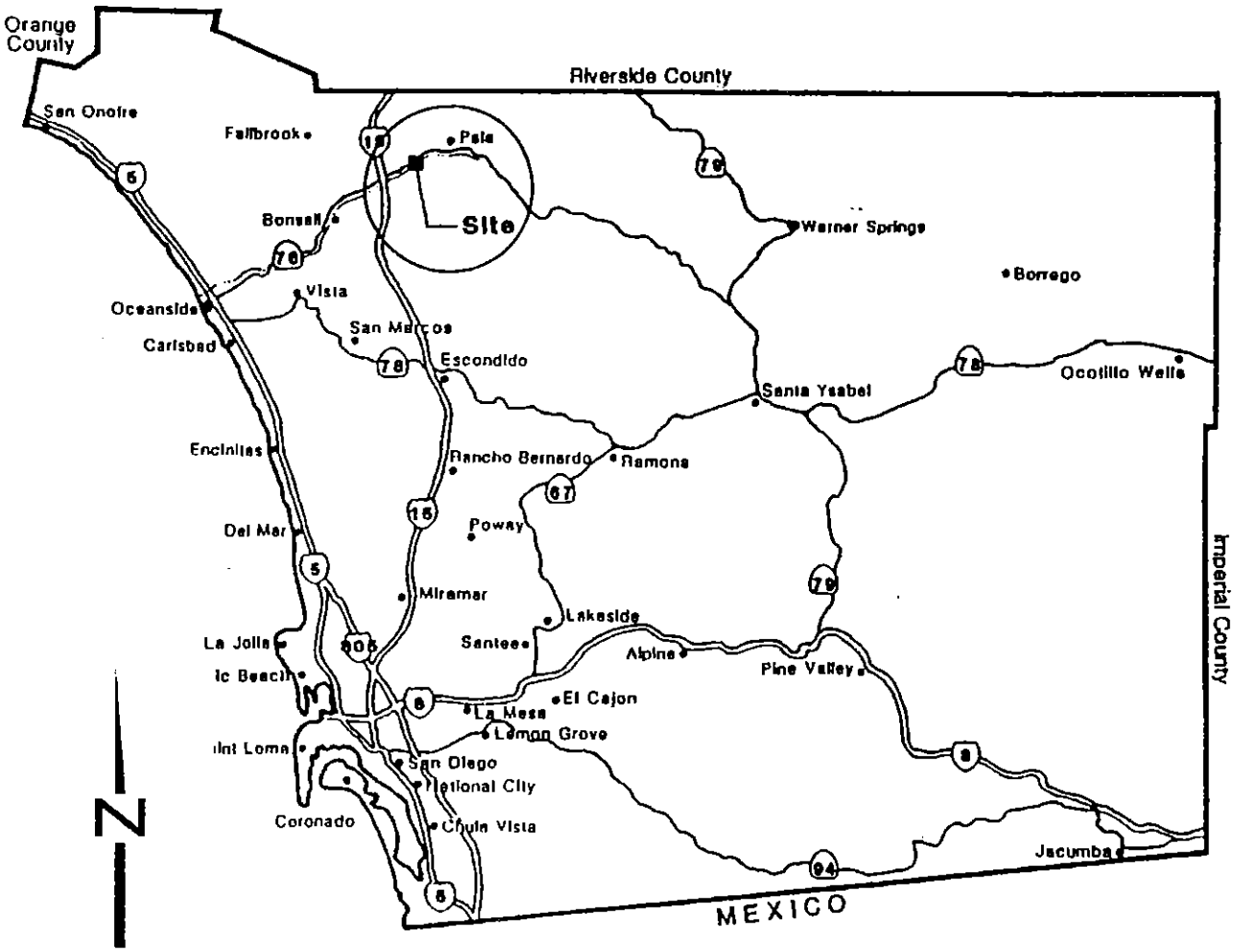
WARNING SECNO= 20.953 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 20.953 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 21.040 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 21.040 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 21.246 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 21.246 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

FLOODWAY DATA, 100-YR FLOOD, FEBRUARY 1
PROFILE NO. 2

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
20.655	1013.	4391.	6.8	305.5	305.3	.2
20.749	925.	4942.	6.1	308.2	308.2	.0
20.852	950.	5135.	5.8	310.2	310.0	.2
20.953	768.	3835.	7.8	312.4	312.2	.2
21.040	914.	5863.	5.1	314.7	314.5	.2
21.137	930.	4616.	6.5	315.9	315.7	.2

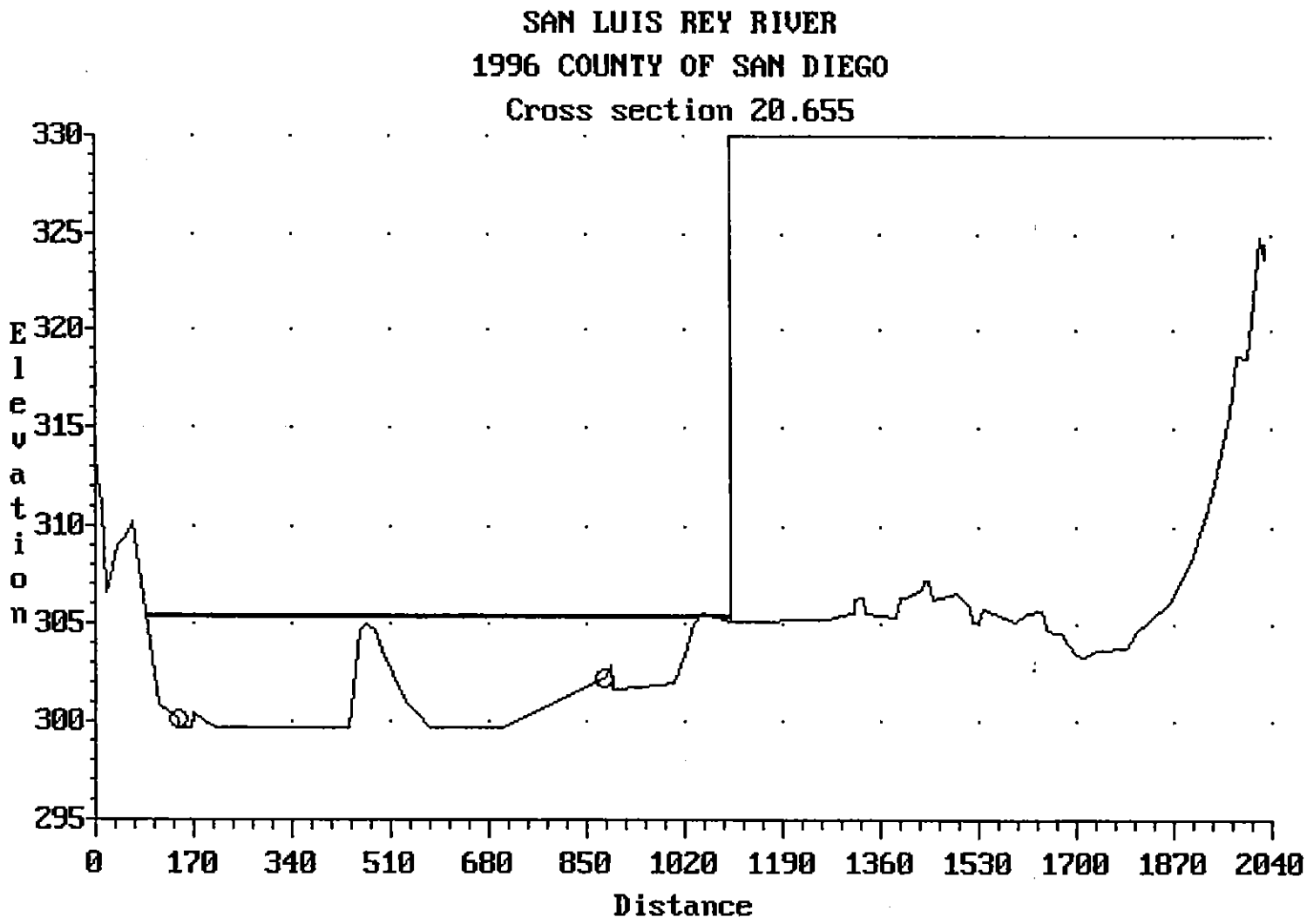


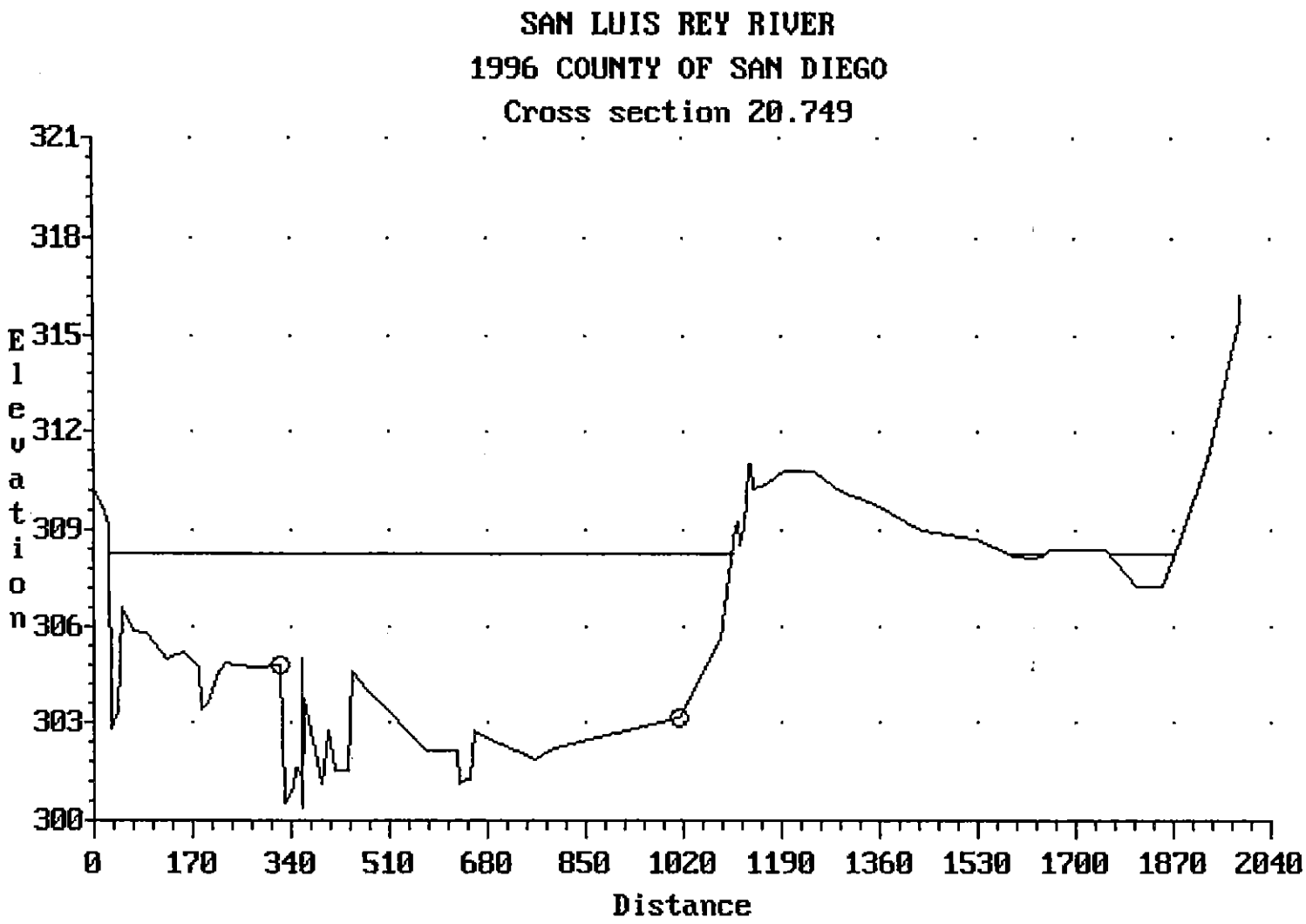
NOT TO SCALE

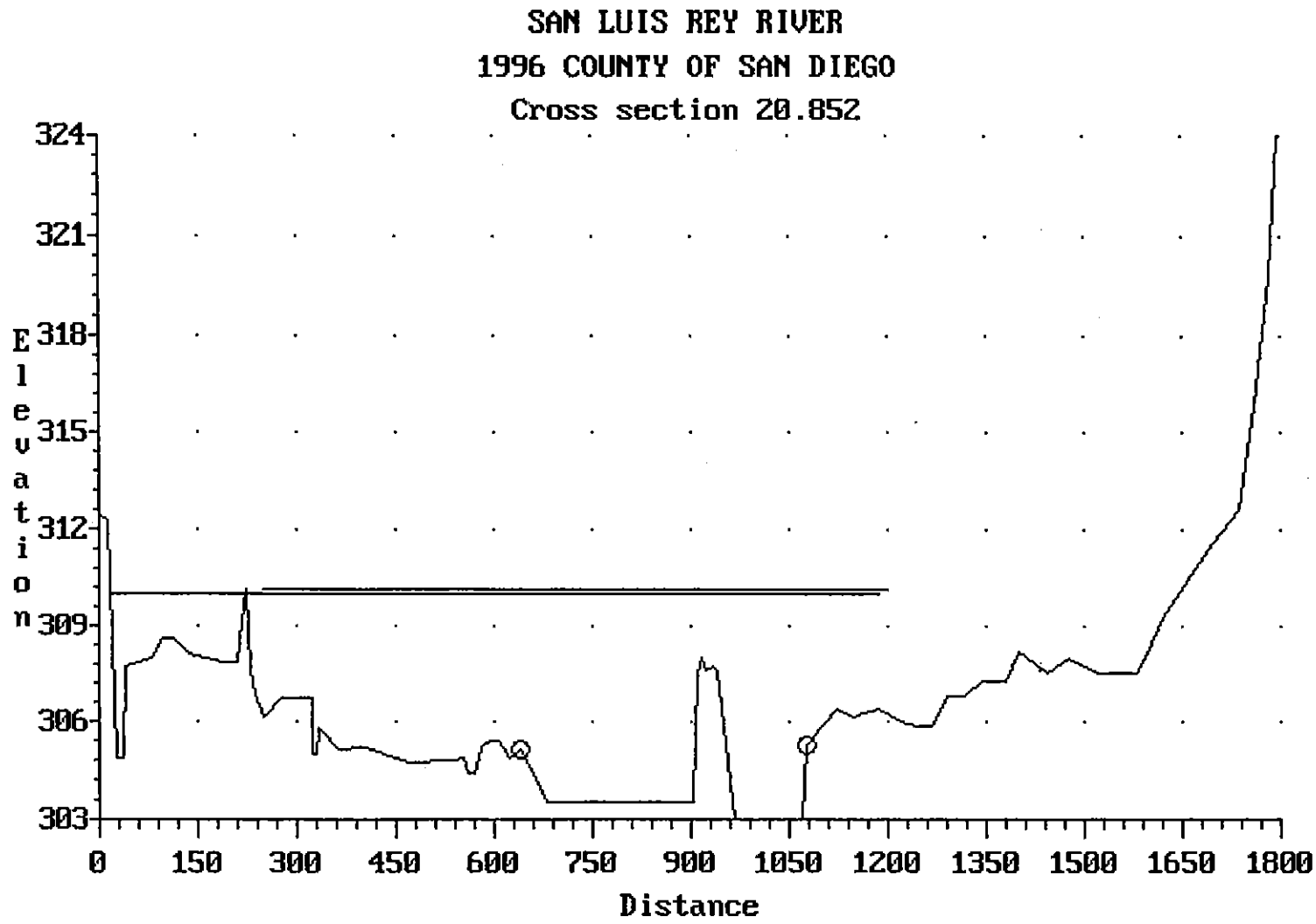
NOLTE
BEYOND ENGINEERING

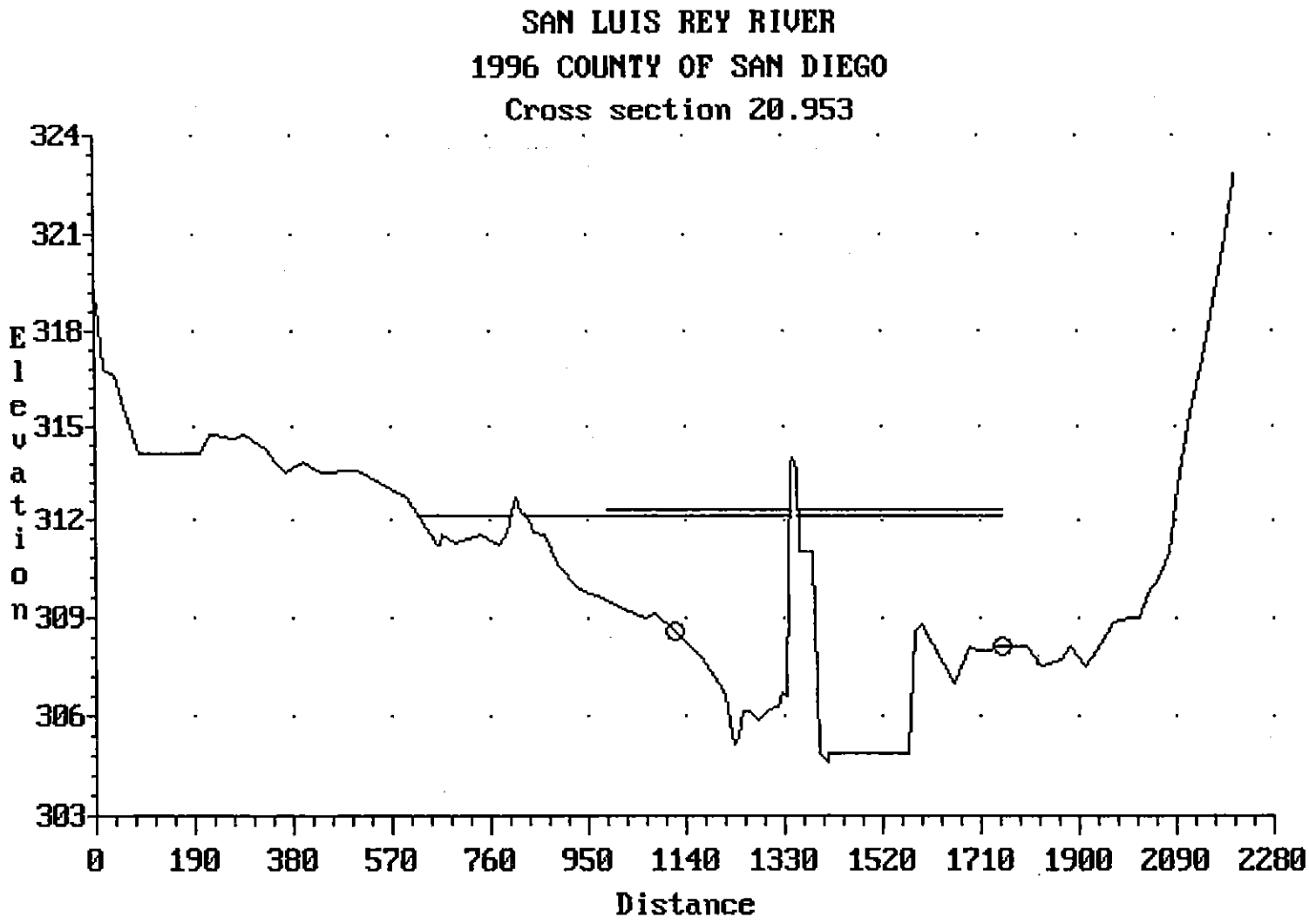
FIGURE 1
VICINITY MAP

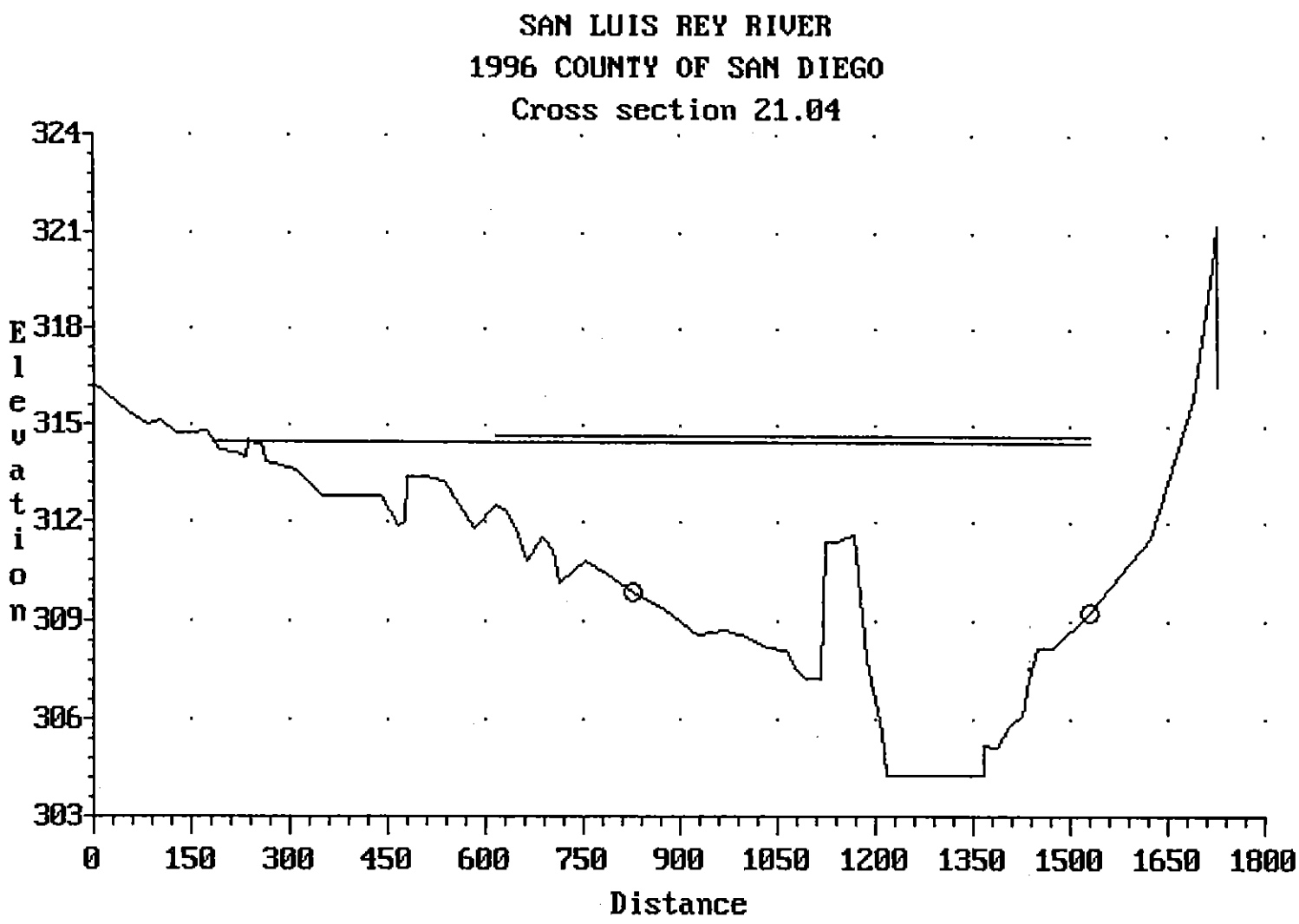
21.246	1428.	7449.	4.0	317.6	317.4	.2
21.359	1511.	6000.	5.0	318.4	318.3	.1

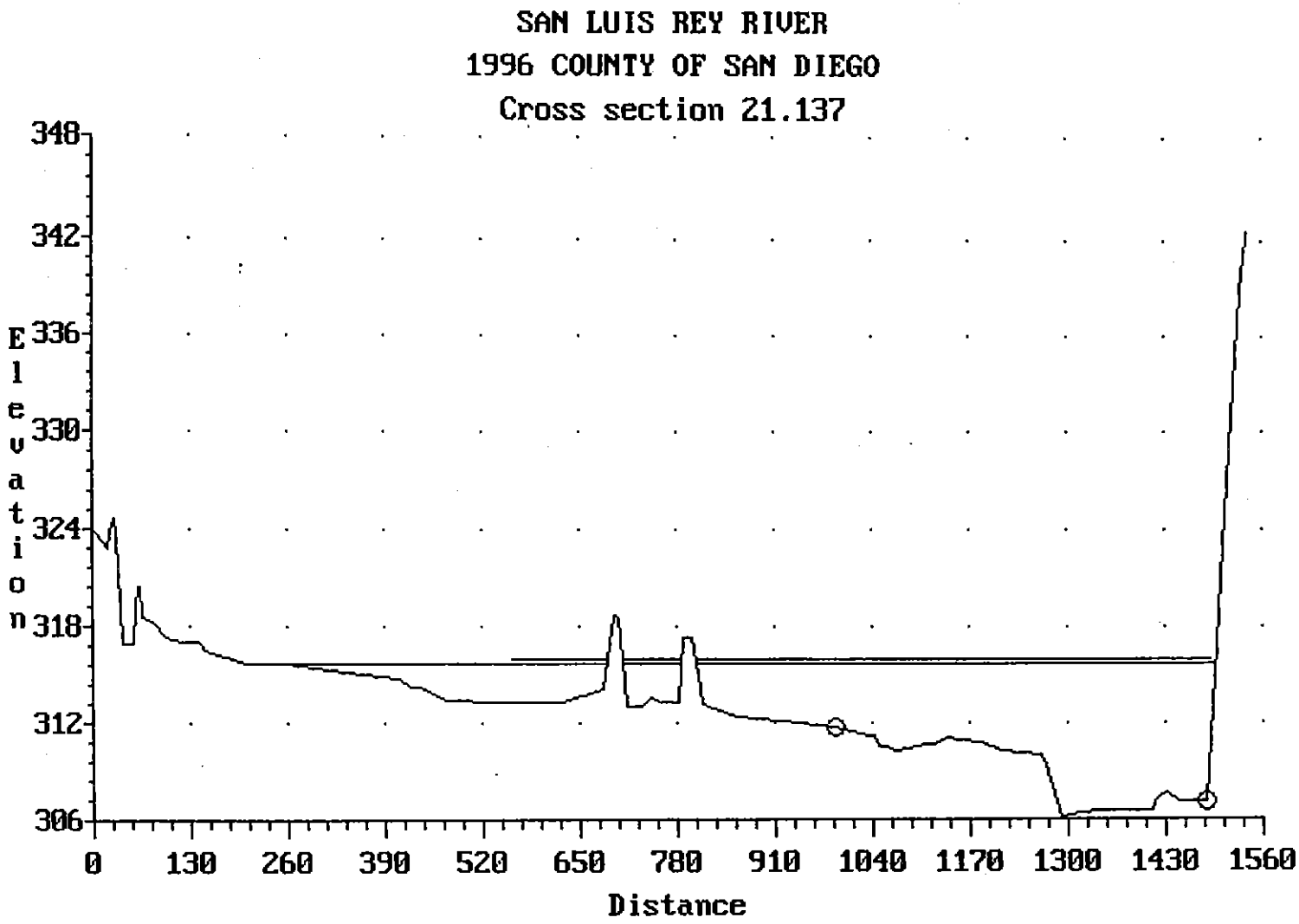

SAN LUIS REY RIVER
1996 COUNTY OF SAN DIEGO
Cross section 20.655
Elevation
330
325
320
315
310
305
300
295
0
170
340
510
680
850
1020
1190
1360
1530
1700
1870
2040
Distance

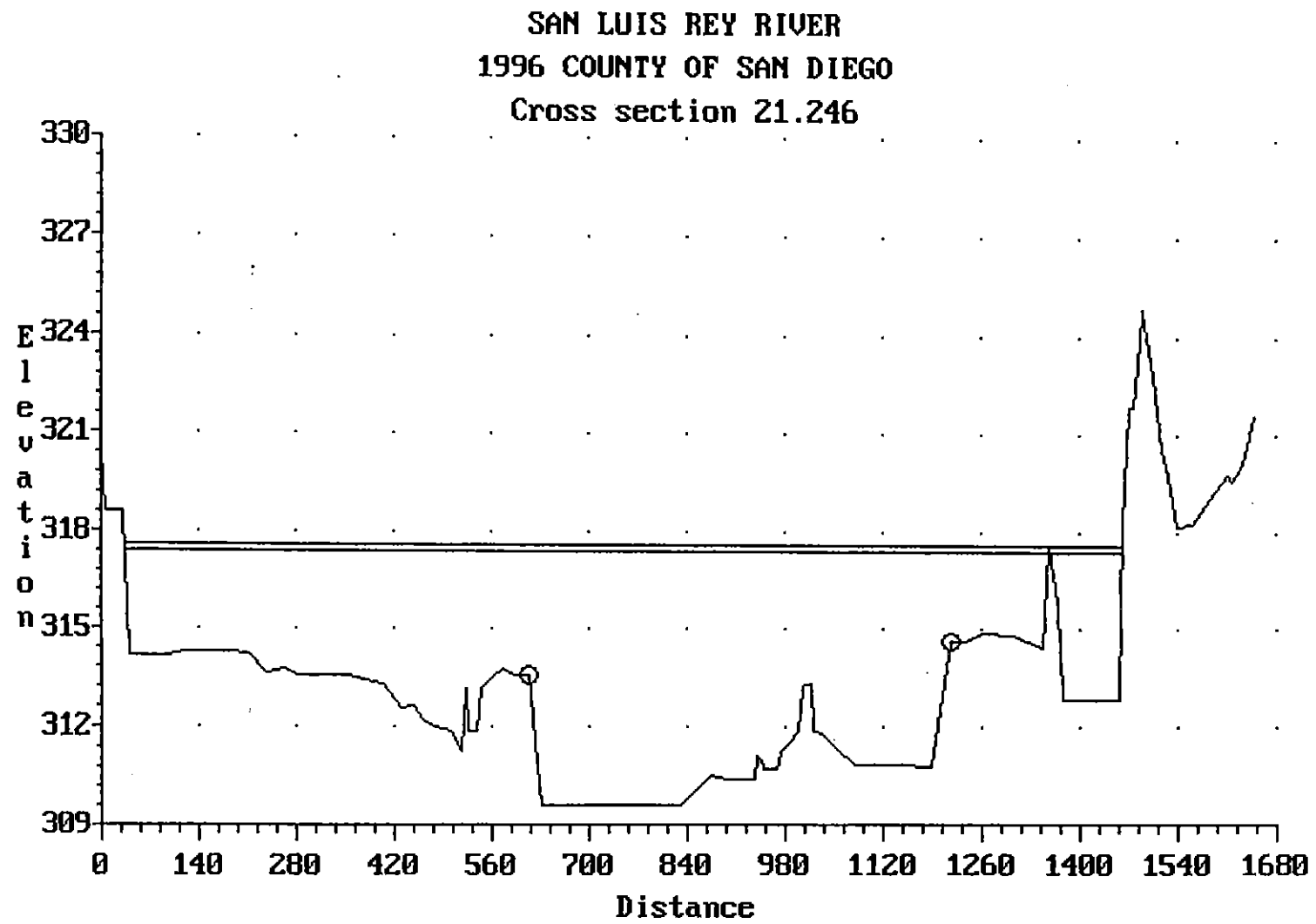

SAN LUIS REY RIVER
1996 COUNTY OF SAN DIEGO
Cross section 20.749
Elevation
321
318
315
312
309
306
303
300
0
170
340
510
680
850
1020
1190
1360
1530
1700
1870
2040
Distance


SAN LUIS REY RIVER
1996 COUNTY OF SAN DIEGO
Cross section 20.852
Elevation
324
321
318
315
312
309
306
303
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
Distance


SAN LUIS REY RIVER
1996 COUNTY OF SAN DIEGO
Cross section 20.953
Elevation
324
321
318
315
312
309
306
303
0
190
380
570
760
950
1140
1330
1520
1710
1900
2090
2280
Distance


SAN LUIS REY RIVER
1996 COUNTY OF SAN DIEGO
Cross section 21.04
Elevation
324
321
318
315
312
309
306
303
0
150
300
450
600
750
900
1050
1200
1350
1500
1650
1800
Distance


SAN LUIS REY RIVER
1996 COUNTY OF SAN DIEGO
Cross section 21.137
Elevation
348
342
336
330
324
318
312
306
0
130
260
390
520
650
780
910
1040
1170
1300
1430
1560
Distance


SAN LUIS REY RIVER
1996 COUNTY OF SAN DIEGO
Cross section 21.246
Elevation
330
327
324
321
318
315
312
309
0
140
280
420
560
700
840
980
1120
1260
1400
1540
1680
Distance

APPENDIX B

HEC-2 ANALYSIS

EXISTING CONDITION

FEBRUARY 1998

```
1*****************************************
 *  HEC-2 WATER SURFACE PROFILES           *
 *                                         *
 *  Version   4.6.2;  May 1991             *
 *                                         *
 *  RUN DATE    05AUG99    TIME   10:02:18  *
 *****************************************
```

```
*************************************
*  U.S. ARMY CORPS OF ENGINEERS     *
*  HYDROLOGIC ENGINEERING CENTER    *
*  609 SECOND STREET, SUITE D       *
*  DAVIS, CALIFORNIA 95616-4687     *
*           (916) 756-1104          *
*************************************
```

```
X     X  XXXXXXX   XXXXX          XXXXX
X     X  X        X     X        X    .X
X     X  X        X                   X
XXXXXXX  XXXX     X        XXXXX   XXXXX
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX  XXXXX          XXXXXXX
```


THIS RUN EXECUTED 05AUG99 10:02:18

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

 Version   4.6.2;  May 1991
************************************
```

```
T1      GREGORY CANYON LANDFILL ACCESS ROAD & BRIDGE
T2      100-YR FLOOD, MODIFIED FEB 98 BY NOLTE
T3      SAN LUIS REY RIVER      EXISTING CONDITIONS (2/98 TOPO)
T4      JOB NO. SD0030          FILE : HECTOPO2.DAT
T5      CROSS SECTIONS TAKEN LOOKING UPSTREAM.

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                                                         30000    305.28

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

      1                 -1                                                -6                  15

J3  VARIABLE CODES FOR SUMMARY PRINTOUT

                150                   200

    COUNTY OF SAN DIEGO/SDCWA 1993 TOPO.

NC      0.05        0.04        0.05        0.1         0.3
ET                              7.1                                       87        1100
X1    20.655         82         143         881
```

X3	0	299.7				1100				
GR	313.6	0	312.4	5	311	12	306.5	19	307.3	26
GR	309	38	309.4	52	310.2	63	300.9	110	300.1	143
GR	298.6	147	298.8	165	300.4	169	300	188	299.4	230
GR	298	234	298.1	254	298.8	262	298.8	305	299.7	439
GR	304.7	458	305	470	304.7	482	303.7	495	302.4	513
GR	301	536	300.3	560	299.9	571	299.6	582	299.6	599
GR	298.7	637	302.2	881	302.9	893	301.7	897	301.8	944
GR	302	1001	303.4	1020	305	1036	305.5	1050	305.1	1099
GR	305.2	1270	305.6	1307	305.6	1314	306.2	1315	306.3	1330
GR	305.6	1334	305.3	1386	306.3	1394	306.3	1407	306.8	1433
GR	307.2	1435	307.2	1442	306.2	1452	306.5	1494	305.9	1515
GR	305.1	1517	305.1	1529	305.8	1538	305.1	1594	305.6	1613
GR	305.7	1639	304.8	1646	304.5	1660	304.5	1673	304	1685
GR	303.5	1695	303.3	1710	303.4	1722	303.7	1738	303.8	1787
GR	304.7	1807	305.1	1826	306.2	1866	308.6	1904	311.8	1939
GR	315.8	1969	318.7	1981	318.6	1998	320.6	2006	324.9	2020
GR	323.8	2029	324.6	2029						

NOLTE TOPO (2/98) USED FOR SECTIONS 20.767 THROUGH 21.093.

1

ET			2.4							
X1	20.767	30	434.9	722.25	591	591	591			
X3	0	300.4								
GR	305	0	306	4.29	307	51.88	306	133.51	305	258.89
GR	304	260.95	303	262.99	302	264.93	301	267.26	300	314.54
GR	299	429.82	298	432.3	297	434.9	296	443.48	296	649.01
GR	297	653.25	297	680.45	297	712.29	298	718.19	299	722.25
GR	300	734.94	301	741.38	302	743.92	303	746.32	303	746.32
GR	303	767.11	302	774.39	302	886.9	302	893.01	302	900.83

ET			2.4							
X1	20.817	43	556.79	874.35	225	330	263			
X3		300.5								
GR	307	0	307	98.01	307	146.43	308	148.78	309	150.95
GR	310	161.04	310	177.28	310	184.42	310	198.04	309	202.46
GR	308	205.83	307	208.88	306	211.66	305	343.29	304	354.32
GR	303	412.21	302	417.1	301	423.26	297	556.79	297	578.23
GR	297	604.23	297	783.41	298	803.83	299	828.79	300	830.32
GR	301	831.84	302	833.31	303	834.85	304	836.37	304	836.37
GR	305	838.25	306	841.96	307	845.86	307	868.7	306	874.35
GR	305	881.82	304	892.68	303	901.8	303	926	304	930.85
GR	305	996.43	306	1056.93	306	1056.94				

ET			2.4							
X1	20.831	52	525.67	830.53	85	55	75			
X3		300.5								
GR	308	0	307	16.06	306	46.45	306	78.03	306	86.42
GR	306	87.78	307	91.33	308	94.1	309	96.42	309	98.24
GR	307	109.41	306	113.96	306	244.73	306	252.1	305	270.97
GR	305	344.67	305	413.6	304	430.47	303	433.94	302	440.52
GR	301	508.49	300	525.67	299	531.57	298	535.89	298	535.89
GR	297	545.26	297	681.9	297	695.84	297	730.32	298	744

GR	299	803.1	302	807.26	303	808.54	304	809.86	306	818.94
GR	307	824.32	308	830.53	308	846.6	307	850.49	306	854.3
GR	305	858.02	304	862.29	303	877.73	302	883.52	302	893.71
GR	303	897.86	304	900.27	305	947.54	305	967.46	305	992.9
GR	306	1016.3	306	1117.47						

NC	.035	.04	.05							
ET			2.4							
X1	20.849	52	463.72	799.07	102	88	97			
X3		300.6								
GR	309	0	309	91.45	308	146.14	307	153.29	307	165
GR	307	216.33	306	324.6	305	336.12	304	375	304	380.87
GR	305	396.61	304	412.5	303	414.68	302	417.26	302	429.11
GR	303	449.78	303	463.72	302	476.91	301	485.68	300	492.59
GR	299	496.44	298	504.01	298	684.98	299	713.93	299	727.94
GR	299	758.28	300	761.97	301	764	302	765.97	303	775.56
GR	304	785.81	305	791.33	306	795.68	307	799.07	308	802.36
GR	308	835.8	308	835.8	307	865.14	306	890.85	305	893.2

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GR	304	897.92	304	912.55	305	923.73	306	930.06	306	933.59
GR	306	946.94	306	964.45	305	967.73	305	989.77	306	992.87
GR	306	1098.99	306	1099.04						

ET			2.4							
X1	20.872	52	455.45	800.49	105	162	124			
X3		300.7								
GR	309	0	309	78.25	310	105.76	310	136.17	309	175.32
GR	308	217.11	307	292.47	306	341.93	305	419.4	305	426.87
GR	305	431.97	304	449.05	303	455.45	301	476.8	300	478.55
GR	299	480.32	298	481.92	298	600.77	299	653.73	300	663.47
GR	300	716.93	300	763.2	301	765.47	302	767.74	303	772.07
GR	304	800.49	304	811.49	305	837.01	306	842.08	307	846.36
GR	308	854.8	308	858.18	308	858.21	307	866.1	306	871.68
GR	305	877.15	305	877.19	304	904.44	304	916.53	305	927.52
GR	306	938.42	306	941.64	306	966.01	307	982.24	307	994.68
GR	306	997.14	305	999.57	305	1013.02	306	1017.46	307	1020.48
GR	307	1027.75	307	1180.69						

ET			2.4							
X1	20.891	53	450.87	760	115	95	110			
X3		301.0								
GR	310	0	310	126.43	310	174.16	309	205.17	308	242.49
GR	307	348.49	306	445.51	305	447.34	304	449.37	303	450.87
GR	302	452.63	301	454.39	300	456.45	299	458.44	298	460.55
GR	298	545.64	299	567.35	300	618.1	301	760	302	766.74
GR	303	777.34	304	785.4	305	826.59	305	829.47	304	848.87
GR	304	858.75	306	864.76	307	868.97	307	878.06	306	885.94
GR	305	889.69	304	898.11	303	905.86	303	905.87	303	912.34
GR	304	915.88	305	920.09	306	927.59	306	946.25	306	962.87
GR	307	967.31	307	999.26	307	1013.34	307	1013.72	306	1016.94
GR	305	1021.02	305	1026.75	306	1036.78	307	1039.29	307	1056.09
GR	307	1087.17	307	1133.15	307	1181.67				

ET			2.4							
NC	.035	.04	.05							
	Downstream Face									
X1	20.936	43	302.11	646.58	240	240	240			
X3	0	301.5	0	0	0	0	0	0	0	
GR	311.6	25	311	60	310	125	309	180	308	298
GR	303	300	302	302.11	301	303.97	300	305.96	299	312.87
GR	299	401.85	300	456.9	301	482.11	301	562.66	301	574.12
GR	301	603.21	301	633.67	302	646.58	303	689.46	303	702.93
GR	303	711.27	304	716.81	305	722.27	305	747.42	305	760.06
GR	305	768.82	305	800.09	306	807.01	307	816.99	307	819.55
GR	306	823.31	306	840.39	307	847.29	306	865.01	306	885.84
GR	307	892.69	307	929.73	307	941.31	307	952.49	306	955.12
GR	305	957.68	305	962.41	306	973.58				

ET			2.4							
	Upstream Face									
X1	20.943	43	300	651.86	50	50	50			
X3	0	301.6	0	0	0	0	0	0	0	
GR	311.9	0	311	55	310	115	309	175	309	290
GR	301	300	300	301.81	299	306.75	299	391.38	300	408.79
GR	300	419.39	300	456.73	301	467.25	302	547.23	302	551.23
GR	301	567.05	301	583.87	301	623.79	301	628.21	302	651.86
GR	303	692.22	304	728.05	305	734.75	306	741.12	306	753.66
GR	305	782.72	305	805.9	306	813.23	307	819.43	308	828.36
GR	308	835.77	307	838.75	306	842.02	306	851.1	306	865.06
GR	306	875.76	307	883.55	307	891.29	307	905.2	307	962.4
GR	306	964.8	306	964.8	306	987.89				

ET			2.4							
X1	20.96	73	259.4	667.95	140	235	140			
X3		301.8								
GR	312	0	311	122.42	310	222.86	309	254.28	308	255.53
GR	307	256.74	306	258	305	259.4	304	260.63	303	261.89
GR	302	264.49	301	267.17	300	273.24	299	315.77	299	409.33
GR	300	417.85	301	435.38	302	444.39	303	466.06	304	475.46
GR	304	558.18	304	614.97	305	616.81	306	618.58	307	619.65
GR	308	620.42	309	621.32	310	622.21	311	623.31	312	624.03
GR	312	625.46	312	625.47	311	627.53	310	628.74	309	630.35
GR	308	632.2	303	640.06	302	642.01	302	667.95	303	704.09
GR	303	717	303	732.04	304	735.97	305	742.45	306	768.8
GR	306	772.53	306	797.79	307	804.52	308	834.83	308	841.13
GR	307	868	306	871.65	305	875.19	305	880.2	306	884.32
GR	307	906.5	308	927	308	959.11	307	961.68	306	964.5
GR	306	979.28	307	981.72	308	983.99	309	1000	309	1139.03
GR	310	1185.56	311	1236.19	312	1289.73	313	1312.19	314	1325.77
GR	316	1343.68	317	1351.36	318	1358.92				

ET			2.4							
NC	.035	.04	.05	.1	.3					
X1	20.996	97	1119.84	1528.44	108	95	115			
X3		302.1								
GR	333	0	332	4.9	331	16.66	329	55.87	328	63.81

GR	326	78.89	324	94.12	321	117.01	320	127.87	319	138.7
GR	318	167.08	317	186.99	316	228.97	315	284.71	314	380.19
GR	313	617.58	313	797.19	312	875.69	311	1003.89	310	1104.74
GR	309	1105.96	309	1105.96	309	1105.96	308	1107.19	304	1112.7
GR	303	1114.62	302	1117.04	301	1119.84	300	1146.87	300	1161.04
GR	300	1236.62	301	1280.07	302	1286.91	303	1306.05	304	1323.36
GR	305	1329.33	305	1417.35	305	1418.57	304	1451.11	306	1472.91
GR	309	1475.94	310	1476.6	311	1477.15	312	1477.78	313	1486.37
GR	313	1489.39	312	1491.74	312	1491.74	311	1494.12	309	1498.82
GR	308	1508.09	306	1519.72	305	1523.99	304	1526.21	303	1528.44
GR	303	1528.44	302	1537.63	302	1554.08	302	1554.14	302	1563.05
GR	302	1577.5	303	1593.75	304	1615.2	305	1619.02	306	1630.85
GR	307	1677.92	307	1677.97	308	1753.62	308	1771.72	308	1787.21

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GR	308	1837.32	307	1839.25	306	1841.18	306	1856.5	307	1862.65
GR	308	1877.26	309	1884.92	310	1971.42	311	2006.73	312	2032.47
GR	313	2059.21	314	2087.95	316	2128.87	317	2166.25	317	2175.98
GR	317	2186.08	318	2197.73	319	2207.85	321	2228.72	322	2242.58
GR	323	2251.3	325	2267.33	330	2311.09	332	2326.72	333	2334.87
GR	334	2342.92	335	2351.41						

FIRST SAN DIEGO AQUEDUCT CROSSING.

ET			7.1				1052	1807		
X1	21.093	97	1052.13	1379.03	227	135	215			
X3		304.4								
GR	340	0.0	339	5.09	337	16.76	336	21.22	334	25.
GR	330	32.81	329	34.34	327	37.35	325	40.68	325	46.38
GR	325	66.61	323	88.26	320	96.58	318	103.58	316	114.45
GR	315	119.8	315	124.17	316	131.3	316	250.41	315	376.16
GR	314	475.5	314	476.89	314	560.94	314	707.39	313	830.5
GR	312	865.76	311	942.15	311	967.34	311	975.48	310	1042.99
GR	310	1043	309	1045.35	307	1049.76	306	1052.13	305	1053.89
GR	302	1059.03	301	1060.65	301	1184.73	304	1237.65	305	1273.88
GR	305	1273.88	305	1377.63	305	1379.03	306	1392.25	308	1395.71
GR	310	1397.52	311	1398.39	312	1399.25	310	1442.7	307	1459.02
GR	306	1480.59	306	1482.85	307	1491.78	307	1495.54	306	1506.18
GR	305	1518.37	304	1539.9	303	1569.33	303	1595.08	306	1602.21
GR	307	1605.27	307	1607.67	306	1629.98	306	1648.02	308	1665.28
GR	309	1671.41	309	1674.58	308	1718.65	306	1754.19	306	1797.56
GR	307	1805.89	308	1813.55	310	1866.69	311	1898.21	314	1953.97
GR	315	1964.61	317	1990.22	318	2013.31	320	2064.96	322	2132.23
GR	324	2178.1	326	2202.71	328	2223.62	328	2229.08	329	2246.84
GR	331	2268.27	333	2277.58	335	2291.65	337	2309.84	340	2331.28
GR	341	2339.93	343	2360.15	345	2379.37	347	2399.82	349	2419.16
GR	350	2428.09	353	2456.99						

COUNTY OF SAN DIEGO/SDCWA 1993 TOPO.

ET			7.1				442	1495		
X1	21.137	77	990	1485	450	530	510			
X3		306.0								
GR	323.7	0	323.9	3	322.8	20	323.9	24	324.6	29
GR	323.6	31	316.9	41	316.9	54	319.3	57	320.4	61
GR	320.4	64	318.5	66	318.3	81	317.4	99	317.1	117

GR	317.1	141	316.5	150	315.7	206	315.7	256	315.3	318
GR	314.8	410	314.3	426	314.3	437	313.5	474	313.4	540
GR	313.4	626	314.1	681	316.9	691	318.7	697	318.6	700
GR	318.5	703	316	707	313	714	313	733	313.6	745
GR	313.4	759	313.4	770	313.4	782	317.3	788	317.3	794
GR	317.3	800	315.1	808	313.2	814	312.4	860	312.1	919
GR	311.8	990	311.2	1035	311.2	1044	310.5	1048	310.5	1053
GR	310.5	1059	310.3	1071	310.4	1090	310.7	1112	310.7	1125
GR	311.1	1139	310.9	1162	310.8	1185	310.3	1214	310	1264
GR	309.3	1272	306.1	1290	306.4	1316	306.5	1344	306.5	1359
GR	306.5	1379	306.5	1393	306.5	1412	307.1	1416	307.5	1424

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GR	307.6	1434	307	1448	307	1476	307	1485	338.8	1531
GR	342.2	1539	342.5	1540						
ET		5.1	7.1		33	1461	49	1456		
X1	21.246	90	613	1216	450	650	575			
X3	0	309.6								
GR	320.4	0	318.6	7	318.6	22	318.6	31	314.1	39
GR	314.1	49	314.1	56	314.1	75	314.1	95	314.3	120
GR	314.3	156	314.3	187	314.2	211	313.6	236	313.7	265
GR	313.5	283	313.5	304	313.5	327	313.5	354	313.4	379
GR	313.3	405	312.5	428	312.6	449	312.2	459	312	478
GR	311.9	501	311.3	515	313.1	523	311.9	527	311.9	539
GR	313.1	543	313.4	556	313.7	575	313.5	595	313.5	613
GR	307.5	640	307.7	682	307.9	744	310.5	875	310.4	896
GR	310.4	916	310.4	935	311.1	939	311	945	310.7	949
GR	310.7	958	310.7	968	311.3	973	311.5	986	311.9	998
GR	313.2	1004	313.3	1009	313.3	1013	313.3	1017	311.9	1020
GR	311.9	1026	311.8	1032	311.4	1051	310.9	1079	310.9	1105
GR	310.9	1143	310.8	1187	314.6	1216	314.6	1238	314.9	1262
GR	314.8	1305	314.4	1346	317.6	1355	315.8	1368	312.8	1374
GR	312.8	1415	312.8	1456	318.3	1462	321.9	1472	321.9	1479
GR	323.2	1484	324.8	1489	324.9	1490	324	1496	322.9	1506
GR	320.5	1517	319.7	1528	318.2	1540	318.3	1562	318.9	1580
GR	319.3	1594	319.8	1610	319.6	1619	320.1	1633	321.6	1649
NC	0.04	0.04	0.03							
ET			7.1				32	1543		
X1	21.359	80	689	1549	380	800	600			
X3	0	313								
GR	338.9	0	331.1	8	316.6	35	316.6	57	316.6	66
GR	314.7	71	314.8	85	314.9	127	314.9	150	315.5	175
GR	315.5	197	319.9	204	321.8	211	321.8	222	321.8	235
GR	316.7	246	313.4	258	313.6	279	313.6	296	313.6	318
GR	313.2	330	313.3	350	312.9	377	311.5	395	310.3	415
GR	309.8	429	309.8	443	309.8	461	309.8	494	312	509
GR	311.9	538	314.6	580	317.6	586	320.4	590	320.7	596
GR	317.3	600	314.6	604	314.3	618	315.3	638	315.8	647
GR	317	655	317.4	669	317.3	689	316.8	701	316.8	713
GR	317.5	725	317.5	748	317.9	773	318	793	317.6	811
GR	318	828	317.8	844	316.8	855	315.7	875	315.2	893
GR	315.3	911	319.4	915	314.9	923	312.8	925	294	965
GR	292.8	980	293.8	1040	294	1110	294	1180	294	1240
GR	294	1310	294	1420	294	1500	321.7	1549	324.5	1555
GR	328.7	1561	332	1565	331.9	1569	331.9	1573	326.8	1577
GR	323.1	1586	320.9	1595	321.6	1609	321.3	1632	320.4	1632

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

*PROF 1
0

CCHV= .100 CEHV= .300
*SECNO 20.655

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= .0 1100.0 TYPE= 1 TARGET= 1099.999

20.655	5.58	305.28	.00	305.28	306.07	.79	.00	.00	300.10
30000.0	1345.4	25415.4	3239.2	206.2	3522.9	472.8	.0	.0	302.20
.00	6.52	7.21	6.85	.050	.050	.040	.000	299.70	87.86
.007344	0.	0.	0.	0	0	0	.00	979.02	1100.00

FLOW DISTRIBUTION FOR SECNO= 20.66 CWSEL= 305.28

STA=	88.	110.	143.	881.	893.	897.	944.	1001.	1020.	1036.	1100.
PER Q=	.7	3.8	84.7	.7	.3	4.1	4.6	1.0	.2	.0	
AREA=	48.5	157.7	3522.9	32.8	11.9	165.9	192.7	49.0	17.3	3.3	
VEL=	4.2	7.2	7.2	6.2	6.4	7.4	7.2	6.0	3.3	.7	
DEPTH=	2.2	4.8	4.8	2.7	3.0	3.5	3.4	2.6	1.1	.1	

*SECNO 20.767
3280 CROSS SECTION 20.77 EXTENDED 6.08 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.62

20.767	7.68	308.08	.00	.00	308.62	.54	2.53	.03	300.40
30000.0	9402.9	13503.9	7093.3	1862.5	2208.2	1091.7	63.5	12.8	300.40
.03	5.05	6.12	6.50	.050	.050	.040	.000	300.40	.00
.002792	591.	591.	591.	3	0	0	.00	900.83	900.83

FLOW DISTRIBUTION FOR SECNO= 20.77 CWSEL= 308.08

STA=	0.	259.	296.	430.	435.	722.	741.	774.	887.	901.
PER Q=	4.7	4.8	21.0	.8	45.0	3.7	3.5	14.9	1.5	
AREA=	539.9	252.4	1031.2	39.0	2208.2	145.8	176.5	684.6	84.8	
VEL=	2.6	5.7	6.1	6.1	6.1	7.6	6.0	6.5	5.4	
DEPTH=	2.1	6.9	7.7	7.7	7.7	7.6	5.3	6.1	6.1	

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV

TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*SECNO 20.817

3265 DIVIDED FLOW

3280 CROSS SECTION 20.82 EXTENDED 2.88 FEET

20.817	8.38	308.88	.00	.00	309.35	.47	.72	.01	300.50
30000.0	11450.3	14470.6	4079.1	2288.6	2420.6	782.4	95.3	18.4	306.00
.04	5.00	5.98	5.21	.050	.050	.040	.000	300.50	.00
.002715	225.	263.	330.	2	0	0	.00	1004.78	1056.94

FLOW DISTRIBUTION FOR SECNO= 20.82 CWSEL= 308.88

STA=	0.	343.	412.	440.	557.	874.	926.	996.	1057.
PER Q=	7.4	5.6	4.3	20.9	48.2	5.1	5.5	3.0	
AREA=	737.0	359.9	212.4	979.3	2420.6	264.3	313.5	204.6	
VEL=	3.0	4.7	6.0	6.4	6.0	5.8	5.2	4.4	
DEPTH=	2.1	5.2	7.7	8.4	7.6	5.1	4.5	3.4	

*SECNO 20.831

3280 CROSS SECTION 20.83 EXTENDED 3.10 FEET

20.831	8.60	309.10	.00	.00	309.55	.45	.20	.00	300.50
30000.0	9254.5	15318.2	5427.2	2155.9	2497.2	1106.1	105.1	20.2	308.00
.05	4.29	6.13	4.91	.050	.050	.040	.000	300.50	.00
.002597	85.	75.	55.	2	0	0	.00	1117.47	1117.47

FLOW DISTRIBUTION FOR SECNO= 20.83 CWSEL= 309.10

STA=	0.	245.	345.	414.	508.	526.	831.	884.	948.	993.	1117.
PER Q=	6.9	5.0	3.7	12.2	3.1	51.1	3.4	6.3	3.0	5.4	
AREA=	677.6	393.0	282.6	657.0	145.6	2497.2	191.5	330.7	186.0	397.9	
VEL=	3.1	3.8	3.9	5.6	6.3	6.1	5.3	5.7	4.9	4.1	
DEPTH=	2.8	3.9	4.1	6.9	8.5	8.2	3.6	5.2	4.1	3.2	

*SECNO 20.849

3280 CROSS SECTION 20.85 EXTENDED 3.27 FEET

20.849	8.67	309.27	.00	.00	309.86	.59	.27	.04	303.00
30000.0	7560.4	18161.7	4278.0	1278.5	2762.5	936.1	117.0	22.7	307.00
.05	5.91	6.57	4.57	.035	.050	.040	.000	300.60	.00
.002951	102.	97.	88.	2	0	0	.00	1099.04	1099.04

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

FLOW DISTRIBUTION FOR SECNO= 20.85 CWSEL= 309.27

STA=	0.	325.	375.	413.	429.	450.	464.	799.	913.	964.	1099.	1099.
PER Q=	7.0	4.9	4.0	3.2	3.9	2.3	60.5	4.0	3.1	7.2	.0	
AREA=	523.7	229.1	182.0	116.3	140.0	87.5	2762.5	280.3	189.8	465.7	.2	
VEL=	4.0	6.4	6.6	8.4	8.3	7.8	6.6	4.3	4.9	4.6	.3	
DEPTH=	1.6	4.5	4.9	7.0	6.8	6.3	8.2	2.5	3.7	3.5	3.3	

*SECNO 20.872

3265 DIVIDED FLOW

3280 CROSS SECTION 20.87 EXTENDED 2.69 FEET

20.872	8.99	309.69	.00	.00	310.22	.53	.35	.01	303.00
30000.0	4628.7	19089.3	6282.0	954.3	2984.9	1352.7	132.1	26.0	304.00
.06	4.85	6.40	4.64	.035	.050	.040	.000	300.70	.00
.002613	105.	124.	162.	2	0	0	.00	1129.63	1180.69

FLOW DISTRIBUTION FOR SECNO= 20.87 CWSEL= 309.69

STA=	0.	342.	419.	449.	455.	800.	837.	904.	938.	1013.	1181.
PER Q=	5.3	6.1	3.1	1.0	63.6	3.8	4.3	3.2	4.0	5.6	
AREA=	442.5	324.6	147.6	39.6	2984.9	195.0	258.8	171.5	268.2	459.2	
VEL=	3.6	5.6	6.3	7.3	6.4	5.8	4.9	5.6	4.5	3.7	
DEPTH=	1.3	4.2	5.0	6.2	8.7	5.3	3.8	5.0	3.6	2.7	

*SECNO 20.891

3280 CROSS SECTION 20.89 EXTENDED 2.96 FEET

20.891	8.96	309.96	.00	.00	310.50	.55	.28	.00	303.00
30000.0	3020.0	17956.4	9023.6	693.3	2765.3	1751.6	145.0	28.6	301.00
.06	4.36	6.49	5.15	.035	.050	.040	.000	301.00	175.50
.002576	115.	110.	95.	2	0	0	.00	1006.17	1181.67

FLOW DISTRIBUTION FOR SECNO= 20.89 CWSEL= 309.96

STA=	175.	348.	446.	451.	760.	777.	827.	859.	906.	946.	1013.	1087.	1182.
PER Q=	4.0	5.5	.6	59.9	3.4	5.5	3.5	3.7	3.7	3.0	3.7	3.5	
AREA=	329.0	335.4	28.9	2765.3	136.0	276.8	179.0	211.2	198.1	217.2	253.8	279.4	
VEL=	3.6	4.9	6.1	6.5	7.4	6.0	5.9	5.3	5.6	4.2	4.4	3.8	
DEPTH=	1.9	3.5	5.4	8.9	7.8	5.6	5.6	4.5	4.9	3.2	3.4	3.0	

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

*SECNO 20.936

3280 CROSS SECTION 20.94 EXTENDED 4.54 FEET

Downstream Face

20.936	9.04	310.54	.00	.00	311.09	.54	.58	.00	302.00

30000.0	1078.4	19231.7	9689.9	335.0	3113.1	1729.7	173.6	33.8	302.00
.07	3.22	6.18	5.60	.035	.050	.040	.000	301.50	89.71
.002296	240.	240.	240.	2	0	0	.00	883.87	973.58

FLOW DISTRIBUTION FOR SECNO= 20.94 CWSEL= 310.54

STA=	90.	298.	302.	647.	689.	711.	747.	800.	847.	893.	955.	974.
PER Q=	3.1	.5	64.1	8.2	3.8	4.1	5.4	3.2	3.0	3.1	1.5	
AREA=	308.0	27.1	3113.1	344.9	164.5	211.4	291.9	205.0	194.0	222.5	95.5	
VEL=	3.0	5.9	6.2	7.1	6.8	5.8	5.6	4.7	4.7	4.1	4.7	
DEPTH=	1.5	6.6	9.0	8.0	7.5	5.8	5.5	4.3	4.3	3.6	5.2	

*SECNO 20.943

3280 CROSS SECTION 20.94 EXTENDED 4.66 FEET

Upstream Face

20.943	9.07	310.67	.00	.00	311.20	.53	.11	.00	301.60
30000.0	1030.9	19464.3	9504.8	331.0	3178.3	1731.5	179.6	34.8	302.00
.07	3.11	6.12	5.49	.035	.050	.040	.000	301.60	75.13
.002257	50.	50.	50.	0	0	0	.00	912.76	987.89

FLOW DISTRIBUTION FOR SECNO= 20.94 CWSEL= 310.67

STA=	75.	299.	300.	652.	692.	728.	783.	813.	865.	962.	988.
PER Q=	3.2	.2	64.9	7.9	5.6	5.0	3.1	3.1	5.4	1.7	
AREA=	324.2	6.8	3178.3	329.5	256.7	282.8	169.2	204.3	371.3	117.7	
VEL=	3.0	8.8	6.1	7.2	6.6	5.3	5.5	4.5	4.3	4.4	
DEPTH=	1.4	9.1	9.0	8.2	7.2	5.2	5.5	3.9	3.8	4.6	

*SECNO 20.960

3265 DIVIDED FLOW

20.960	-9.33	311.13	.00	.00	311.60	.47	.39	.01	305.00
30000.0	341.0	18956.1	10702.9	137.4	3313.7	2101.8	201.1	39.1	302.00
.08	2.48	5.72	5.09	.035	.050	.040	.000	301.80	106.15
.002292	140.	140.	235.	2	0	0	.00	1133.30	1243.30

1

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

FLOW DISTRIBUTION FOR SECNO= 20.96 CWSEL= 311.13

STA=	106.	259.	668.	704.	732.	769.	805.	868.	907.	979.	1139.	1243.
PER Q=	1.1	63.2	7.8	5.5	4.4	3.1	3.2	3.4	4.0	3.7	.8	
AREA=	137.4	3313.7	312.0	227.3	221.4	180.0	227.5	193.5	273.3	358.2	108.5	
VEL=	2.5	5.7	7.5	7.2	5.9	5.2	4.2	5.2	4.4	3.1	2.1	
DEPTH=	.9	8.2	8.6	8.1	6.0	5.0	3.6	5.0	3.8	2.2	1.0	

CCHV= .100 CEHV= .300

*SECNO 20.996

3265 DIVIDED FLOW

20.996	9.26	311.36	.00	.00	311.87	.51	.26	.01	302.10
30000.0	911.9	17084.7	12003.4	193.9	2980.6	2064.2	214.4	41.7	303.00
.09	4.70	5.73	5.82	.035	.050	.040	.000	302.10	956.87
.002528	108.	115.	95.	1	0	0	.00	1043.43	2016.17

FLOW DISTRIBUTION FOR SECNO= 21.00 CWSEL= 311.36

STA=	957.	1120.	1528.	1554.	1578.	1594.	1615.	1678.	1754.	1837.	1877.	2016.
PER Q=	3.0	56.9	6.4	6.0	3.8	4.2	6.1	4.5	3.9	3.2	2.0	
AREA=	193.9	2980.6	233.9	217.0	144.0	168.7	324.7	292.7	281.8	185.5	215.8	
VEL=	4.7	5.7	8.1	8.2	8.0	7.4	5.6	4.6	4.2	5.2	2.7	
DEPTH=	1.2	7.6	9.1	9.3	8.9	7.9	5.2	3.9	3.4	4.6	1.6	

*SECNO 21.093

3265 DIVIDED FLOW

21.093	7.40	311.80	.00	.00	312.41	.61	.51	.03	306.00
30000.0	537.2	14637.4	14825.4	173.7	2347.3	2338.0	235.3	45.9	305.00
.10	3.09	6.24	6.34	.035	.050	.040	.000	304.40	881.01
.003183	227.	215.	135.	2	0	0	.00	1027.57	1913.09

FLOW DISTRIBUTION FOR SECNO= 21.09 CWSEL= 311.80

1

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

STA=	881.	1052.	1379.	1459.	1492.	1518.	1540.	1569.	1595.	1630.	1665.	1754.	1798.
PER Q=	1.8	48.8	3.4	3.7	3.4	4.1	5.8	5.1	4.3	4.0	6.1	5.7	
AREA=	173.7	2347.3	195.4	174.8	151.2	155.5	217.8	190.6	195.7	187.5	345.2	251.6	
VEL=	3.1	6.2	5.2	6.4	6.7	7.8	8.0	8.0	6.6	6.4	5.3	6.8	
DEPTH=	1.0	7.2	2.4	5.3	5.7	7.2	7.4	7.4	5.6	5.3	3.9	5.8	

STA=	1798.	1867.	1913.
PER Q=	3.6	.4	
AREA=	225.9	46.9	
VEL=	4.8	2.3	
DEPTH=	3.3	1.0	

*SECNO 21.137

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .47

21.137	8.02	314.12	314.09	.00	315.70	1.59	3.00	.29	311.80
30000.0	3234.6	26434.6	330.8	513.3	2520.8	36.5	281.8	57.4	307.00
.11	6.30	10.49	9.06	.035	.050	.040	.000	306.10	445.97
.014226	450.	510.	530.	5	8	0	.00	990.86	1495.28

FLOW DISTRIBUTION FOR SECNO= 21.14 CWSEL= 314.12

STA=	446.	860.	990.	1485.	1495.
PER Q=	3.7	7.1	88.1	1.1	
AREA=	250.7	262.6	2520.8	36.5	
VEL=	4.4	8.1	10.5	9.1	
DEPTH=	.6	2.0	5.1	3.6	

*SECNO 21.246

3265 DIVIDED FLOW

1

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

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 3.05

3470 ENCROACHMENT STATIONS= 33.0 1461.0 TYPE= 1 TARGET= 1428.000

21.246	7.87	317.47	.00	.00	317.74	.27	1.91	.13	313.50
30000.0	9963.2	17333.3	2703.5	2330.7	4140.0	797.6	346.6	72.0	314.60
.15	4.27	4.19	3.39	.035	.050	.040	.000	309.60	33.00
.001525	450.	575.	650.	3	0	0	.00	1426.76	1461.00

FLOW DISTRIBUTION FOR SECNO= 21.25 CWSEL= 317.47

STA=	33.	120.	211.	283.	354.	428.	478.	515.	556.	613.	1216.	1346.	1456.
PER Q=	3.4	3.5	3.6	3.9	4.5	4.2	3.7	3.3	3.1	57.8	3.4	5.5	
AREA=	281.2	290.3	270.2	282.4	313.2	256.4	209.4	203.9	223.7	4140.0	359.7	426.0	
VEL=	3.7	3.6	4.0	4.2	4.3	4.9	5.3	4.8	4.1	4.2	2.9	3.9	
DEPTH=	3.2	3.2	3.8	4.0	4.2	5.1	5.7	5.0	3.9	6.9	2.8	3.9	

STA=	1456.	1461.
PER Q=	.1	
AREA=	11.9	
VEL=	2.1	
DEPTH=	2.4	

*SECNO 21.359

3265 DIVIDED FLOW

21.359	5.28	318.28	.00	.00	318.69	.42	.91	.04	317.30
30000.0	10335.0	19665.0	.0	2381.0	3530.3	.0	427.3	89.4	321.70
.18	4.34	5.57	.00	.040	.030	.000	.000	313.00	31.86
.001910	380.	600.	800.	3	0	0	.00	1455.01	1542.96

FLOW DISTRIBUTION FOR SECNO= 21.36 CWSEL= 318.28

STA=	32.	150.	279.	330.	370.	415.	461.	509.	555.	638.	689.	1549.
PER Q=	3.9	3.6	3.7	3.3	3.9	4.0	4.2	4.0	3.4	.6	65.6	
AREA=	339.6	286.5	241.3	204.7	236.5	243.1	253.7	243.7	258.3	73.6	3530.3	
VEL=	3.4	3.8	4.6	4.8	4.9	4.9	4.9	4.9	4.0	2.3	5.6	
DEPTH=	2.9	2.2	4.7	5.1	5.3	5.3	5.3	5.3	3.1	1.4	4.1	

1

T1 GREGORY CANYON LANDFILL ACCESS ROAD & BRIDGE
T2 100-YR FLOOD, MODIFIED FEB 98 BY NOLTE
T3 SAN LUIS REY RIVER EXISTING CONDITIONS

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		3						30000	305.47	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	15		-1					-6		15

1

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

*PROF 2
0

CCHV= .100 CEHV= .300
*SECNO 20.655

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= .0 1100.0 TYPE= 1 TARGET= 1099.999

20.655	5.77	305.47	.00	305.28	306.20	.73	.00	.00	300.10
30000.0	1349.8	25309.2	3341.0	216.8	3663.1	510.8	.0	.0	302.20
.00	6.23	6.91	6.54	.050	.050	.040	.000	299.70	86.90
.006394	0.	0.	0.	0	0	0	.00	1008.58	1100.00

FLOW DISTRIBUTION FOR SECNO= 20.66 CWSEL= 305.47

STA=	87.	110.	143.	881.	893.	897.	944.	1001.	1020.	1036.	1049.	1099.	1100.
PER Q=	.7	3.8	84.4	.7	.3	4.2	4.7	1.0	.2	.0	.0	.0	
AREA=	52.8	164.0	3663.1	35.0	12.7	174.8	203.5	52.6	20.3	3.1	8.4	.4	
VEL=	4.1	6.9	6.9	6.1	6.2	7.1	6.9	5.8	3.5	1.1	1.0	1.2	
DEPTH=	2.3	5.0	5.0	2.9	3.2	3.7	3.6	2.8	1.3	.2	.2	.4	

*SECNO 20.767
2800 NAT Q1= 5677.87 WSELK= 308.08 ENC Q1= 5677.87 WSEL= 308.28 RATIO= .0000
NAT Q1= 5971. RATIOS LOB, CH, ROB= .3163 .4467 .2370 WSEL= 308.28
3280 CROSS SECTION 20.77 EXTENDED 6.11 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.45

3470 ENCROACHMENT STATIONS= 163.5 884.0 TYPE= 4 TARGET= .049

20.767	7.71	308.11	.00	308.08	308.72	.61	2.52	.01	300.40
30000.0	9181.1	14144.1	6674.8	1586.2	2214.1	992.3	62.3	11.7	300.40
.03	5.79	6.39	6.73	.050	.050	.040	.000	300.40	163.50
.003035	591.	591.	591.	0	0	0	.00	720.45	883.95

FLOW DISTRIBUTION FOR SECNO= 20.77 CWSEL= 308.11

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

STA=	163.	265.	296.	315.	430.	435.	722.	738.	767.	884.
PER Q=	3.1	4.6	3.1	18.9	.8	47.1	3.1	3.5	15.6	
AREA=	287.6	225.5	145.7	888.3	39.1	2214.1	117.6	165.0	709.7	
VEL=	3.3	6.2	6.4	6.4	6.4	6.4	8.0	6.4	6.6	
DEPTH=	2.8	7.3	7.7	7.7	7.7	7.7	7.7	5.6	6.1	

*SECNO 20.817
2800 NAT Q1= 5757.14 WSELK= 308.88 ENC Q1= 5757.14 WSEL= 309.08 RATIO= .0000
NAT Q1= 6069. RATIOS LOB, CH, ROB= .3838 .4775 .1388 WSEL= 309.08
3280 CROSS SECTION 20.82 EXTENDED 2.96 FEET

3470 ENCROACHMENT STATIONS= 210.2 1006.0 TYPE= 4 TARGET= .051

20.817	8.46	308.96	.00	308.88	309.50	.54	.77	.01	300.50
30000.0	11327.0	15156.1	3516.8	2027.9	2445.7	624.4	91.8	16.3	306.00
.04	5.59	6.20	5.63	.050	.050	.040	.000	300.50	210.22
.002878	225.	263.	330.	2	0	0	.00	795.73	1005.95

FLOW DISTRIBUTION FOR SECNO= 20.82 CWSEL= 308.96

STA=	210.	343.	412.	440.	557.	874.	926.	996.	1006.
PER Q=	5.6	5.9	4.5	21.8	50.5	5.4	5.8	.5	

AREA=	459.4	365.3	214.6	988.6	2445.7	268.4	319.0	37.0
VEL=	3.6	4.9	6.2	6.6	6.2	6.1	5.5	3.9
DEPTH=	3.5	5.3	7.7	8.5	7.7	5.2	4.5	3.9

*SECNO 20.831
2800 NAT Q1= 5886.55 WSELK= 309.10 ENC Q1= 5886.55 WSEL= 309.30 RATIO= .0000
NAT Q1= 6229. RATIOS LOB, CH, ROB= .3128 .5023 .1849 WSEL= 309.30
3280 CROSS SECTION 20.83 EXTENDED 3.21 FEET

3470 ENCROACHMENT STATIONS= 112.3 1054.1 TYPE= 4 TARGET= .055

20.831	8.71	309.21	.00	309.10	309.72	.51	.21	.00	300.50
30000.0	9010.5	16040.9	4948.6	1934.4	2531.1	934.4	101.0	17.8	308.00
.04	4.66	6.34	5.30	.050	.050	.040	.000	300.50	112.33
.002723	85.	75.	55.	2	0	0	.00	941.74	1054.07

1

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

FLOW DISTRIBUTION FOR SECNO= 20.83 CWSEL= 309.21

STA=	112.	245.	345.	414.	508.	526.	831.	884.	948.	993.	1054.
PER Q=	4.8	5.3	3.9	12.9	3.2	53.5	3.6	6.7	3.2	3.0	
AREA=	424.9	404.1	290.3	667.6	147.5	2531.1	197.4	337.8	191.0	208.1	
VEL=	3.4	3.9	4.0	5.8	6.5	6.3	5.5	6.0	5.1	4.3	
DEPTH=	3.2	4.0	4.2	7.0	8.6	8.3	3.7	5.3	4.2	3.4	

*SECNO 20.849
2800 NAT Q1= 5522.21 WSELK= 309.27 ENC Q1= 5522.21 WSEL= 309.47 RATIO= .0000
NAT Q1= 5861. RATIOS LOB, CH, ROB= .2584 .5936 .1479 WSEL= 309.47
3280 CROSS SECTION 20.85 EXTENDED 3.38 FEET

3470 ENCROACHMENT STATIONS= 217.1 1043.9 TYPE= 4 TARGET= .058

20.849	8.78	309.38	.00	309.27	310.05	.67	.28	.05	303.00
30000.0	7255.0	19026.8	3718.2	1079.5	2798.1	781.4	112.2	19.7	307.00
.05	6.72	6.80	4.76	.035	.050	.040	.000	300.60	217.10
.003104	102.	97.	88.	2	0	0	.00	826.76	1043.86

FLOW DISTRIBUTION FOR SECNO= 20.85 CWSEL= 309.38

STA=	217.	325.	375.	413.	429.	450.	464.	799.	913.	964.	1044.
PER Q=	4.9	5.2	4.3	3.4	4.1	2.4	63.4	4.3	3.3	4.8	
AREA=	310.0	234.4	185.9	118.0	142.2	88.9	2798.1	292.4	195.3	293.6	
VEL=	4.7	6.6	6.9	8.7	8.6	8.1	6.8	4.4	5.1	4.9	
DEPTH=	2.9	4.7	5.0	7.1	6.9	6.4	8.3	2.6	3.8	3.7	

*SECNO 20.872
2800 NAT Q1= 5868.87 WSELK= 309.69 ENC Q1= 5868.87 WSEL= 309.89 RATIO= .0000
NAT Q1= 6221. RATIOS LOB, CH, ROB= .1613 .6236 .2152 WSEL= 309.89
3280 CROSS SECTION 20.87 EXTENDED 2.83 FEET

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3470 ENCROACHMENT STATIONS=      281.4    1099.7  TYPE=      4  TARGET=          .057
    20.872      9.13    309.83       .00    309.69    310.42       .59       .37       .01    303.00
   30000.0    4185.1   19923.6    5891.3     722.4    3032.1    1175.8     126.3      22.2    304.00
       .05      5.79      6.57      5.01      .035      .050      .040      .000    300.70    281.42
   .002701       105.      124.      162.         2         0         0       .00    818.26   1099.68
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

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FLOW DISTRIBUTION FOR SECNO=     20.87          CWSEL=    309.83

STA=     281.     342.     419.     449.     455.     800.     837.     904.     938.     997.    1100.
  PER Q=     3.1      6.5      3.3      1.0     66.4      4.0      4.6      3.4      3.0      4.6
   AREA=   195.0    335.2    151.7     40.5   3032.1    200.0    268.0    176.2    202.9    328.6
    VEL=     4.7      5.9      6.6      7.5      6.6      6.0      5.1      5.8      4.4      4.2
  DEPTH=     3.2      4.3      5.1      6.3      8.8      5.5      4.0      5.2      3.5      3.2

*SECNO 20.891
 2800 NAT Q1=    5910.74  WSELK=     309.96  ENC Q1=    5910.74  WSEL=     310.16  RATIO=    .0000
 NAT Q1=    6253.  RATIOS LOB, CH, ROB=     .1072    .5870    .3058  WSEL=     310.16
3280 CROSS SECTION     20.89 EXTENDED      3.10 FEET


3470 ENCROACHMENT STATIONS=      306.5    1113.8  TYPE=      4  TARGET=          .055
    20.891      9.11    310.11       .00    309.96    310.71       .60       .29       .00    303.00
   30000.0    2501.4   18704.1    8794.5     501.0    2810.1    1602.3     138.3      24.2    301.00
       .06      4.99      6.66      5.49      .035      .050      .040      .000    301.00    306.51
   .002649       115.      110.       95.         1         0         0       .00    807.33   1113.84


FLOW DISTRIBUTION FOR SECNO=     20.89          CWSEL=    310.11

STA=     307.     446.     451.     760.     777.     827.     859.     906.     946.    1013.    1087.    1114.
  PER Q=     7.7       .6     62.3      3.5      5.8      3.7      4.0      3.9      3.3      4.0      1.0
   AREA=   471.3     29.7   2810.1    138.6    283.9    183.7    218.0    204.0    226.9    264.5     82.7
    VEL=     4.9      6.3      6.7      7.6      6.2      6.1      5.5      5.8      4.3      4.6      3.8
  DEPTH=     3.4      5.5      9.1      8.0      5.8      5.7      4.6      5.0      3.4      3.6      3.1

*SECNO 20.936
 2800 NAT Q1=    6260.75  WSELK=     310.54  ENC Q1=    6260.75  WSEL=     310.74  RATIO=    .0000
 NAT Q1=    6572.  RATIOS LOB, CH, ROB=     .0403    .6334    .3263  WSEL=     310.74
3280 CROSS SECTION     20.94 EXTENDED      4.72 FEET


3470 ENCROACHMENT STATIONS=      260.8     940.6  TYPE=      4  TARGET=          .047
        Downstream Face
    20.936      9.22    310.72       .00    310.54    311.30       .58       .59       .00    302.00
   30000.0     518.9   19962.2    9518.9     123.3    3175.5    1634.6     165.4      28.3    302.00
       .07      4.21      6.29      5.82      .035      .050      .040      .000    301.50    260.80
   .002316       240.      240.      240.         2         0         0       .00    679.77    940.57
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SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= 20.94 CWSEL= 310.72

STA=	261.	302.	647.	689.	711.	747.	800.	840.	886.	941.
PER Q=	1.7	66.5	8.6	3.9	4.3	5.7	3.0	3.3	2.9	
AREA=	123.3	3175.5	352.6	168.5	218.0	301.5	184.4	202.4	207.3	
VEL=	4.2	6.3	7.3	7.0	5.9	5.7	4.9	4.8	4.2	
DEPTH=	3.0	9.2	8.2	7.7	6.0	5.7	4.6	4.5	3.8	

*SECNO 20.943
2800 NAT Q1= 6314.75 WSELK= 310.67 ENC Q1= 6314.75 WSEL= 310.87 RATIO= .0000
NAT Q1= 6638. RATIOS LOB, CH, ROB= .0389 .6407 .3204 WSEL= 310.87
3280 CROSS SECTION 20.94 EXTENDED 4.84 FEET

3470 ENCROACHMENT STATIONS= 268.4 952.0 TYPE= 4 TARGET= .049

Upstream Face

20.943	9.25	310.85	.00	310.67	311.42	.57	.12	.00	301.60
30000.0	453.0	20227.4	9319.7	97.9	3240.2	1628.5	171.1	29.0	302.00
.07	4.62	6.24	5.72	.035	.050	.040	.000	301.60	268.39
.002286	50.	50.	50.	1	0	0	.00	683.60	952.00

FLOW DISTRIBUTION FOR SECNO= 20.94 CWSEL= 310.85

STA=	268.	300.	652.	692.	728.	783.	813.	865.	952.
PER Q=	1.5	67.4	8.2	5.9	5.3	3.3	3.3	5.1	
AREA=	97.9	3240.2	336.6	263.0	292.4	174.5	213.5	348.5	
VEL=	4.6	6.2	7.3	6.7	5.4	5.7	4.6	4.4	
DEPTH=	3.1	9.2	8.3	7.3	5.3	5.7	4.1	4.0	

*SECNO 20.960
2800 NAT Q1= 6266.23 WSELK= 311.13 ENC Q1= 6266.23 WSEL= 311.33 RATIO= .0000
NAT Q1= 6609. RATIOS LOB, CH, ROB= .0139 .6230 .3632 WSEL= 311.33

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 259.4 1015.2 TYPE= 4 TARGET= .052

20.960	9.50	311.30	.00	311.13	311.82	.52	.40	.00	305.00
30000.0	.0	19670.6	10329.4	.0	3380.9	1786.8	191.1	32.1	302.00
.08	.00	5.82	5.78	.000	.050	.040	.000	301.80	259.40
.002360	140.	140.	235.	2	0	0	.00	752.39	1015.18

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

FLOW DISTRIBUTION FOR SECNO= 20.96 CWSEL= 311.30

STA=	259.	668.	704.	732.	769.	805.	868.	907.	979.	1015.
PER Q=	65.6	8.2	5.7	4.6	3.4	3.5	3.6	4.3	1.2	
AREA=	3380.9	318.0	232.0	227.5	185.9	238.0	199.9	285.4	100.0	
VEL=	5.8	7.7	7.4	6.1	5.4	4.4	5.4	4.6	3.5	
DEPTH=	8.3	8.8	8.3	6.2	5.2	3.7	5.2	3.9	2.8	

CCHV= .100 CEHV= .300
*SECNO 20.996
2800 NAT Q1= 5966.67 WSELK= 311.36 ENC Q1= 5966.67 WSEL= 311.56 RATIO= .0000
NAT Q1= 6278. RATIOS LOB, CH, ROB= .0325 .5637 .4039 WSEL= 311.56
2750 NUMBER OF COMPUTED POINTS EXCEED 100

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 1115.0 1875.1 TYPE= 4 TARGET= .050

20.996	9.43	311.53	.00	311.36	312.10	.56	.26	.01	302.10
30000.0	322.2	17751.0	11926.7	45.4	3048.6	1901.1	203.7	33.9	303.00
.08	7.10	5.82	6.27	.035	.050	.040	.000	302.10	1114.96
.002537	108.	115.	95.	1	0	0	.00	744.84	1875.14

FLOW DISTRIBUTION FOR SECNO= 21.00 CWSEL= 311.53

STA=	1115.	1120.	1528.	1554.	1578.	1594.	1615.	1678.	1754.	1837.	1875.
PER Q=	1.1	59.2	6.6	6.2	4.0	4.3	6.4	4.8	4.3	3.2	
AREA=	45.4	3048.6	238.3	221.1	146.8	172.5	335.6	305.8	296.3	184.8	
VEL=	7.1	5.8	8.3	8.4	8.1	7.5	5.7	4.7	4.3	5.2	
DEPTH=	9.3	7.8	9.3	9.4	9.0	8.0	5.4	4.0	3.5	4.9	

*SECNO 21.093
2750 NUMBER OF COMPUTED POINTS EXCEED 100
2750 NUMBER OF COMPUTED POINTS EXCEED 100
2750 NUMBER OF COMPUTED POINTS EXCEED 100
2750 NUMBER OF COMPUTED POINTS EXCEED 100

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 1052.0 1807.0 TYPE= 1 TARGET= 755.000

21.093	7.57	311.97	.00	311.80	312.64	.66	.51	.03	306.00
30000.0	.5	15286.4	14713.1	.8	2404.0	2188.3	223.6	36.9	305.00
.09	.61	6.36	6.72	.035	.050	.040	.000	304.40	1052.00
.003206	227.	215.	135.	2	0	0	.00	754.40	1807.00

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV

TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

FLOW DISTRIBUTION FOR SECNO= 21.09 CWSEL= 311.97

STA=	1052.	1052.	1379.	1459.	1492.	1518.	1540.	1569.	1595.	1630.	1665.	1754.	1798.
PER Q=	.0	51.0	3.7	3.9	3.6	4.2	6.0	5.3	4.5	4.2	6.5	6.0	
AREA=	.8	2404.0	208.9	180.4	155.9	159.2	222.9	195.0	201.8	193.6	360.6	259.1	
VEL=	.6	6.4	5.3	6.6	6.9	8.0	8.1	8.1	6.8	6.6	5.4	6.9	
DEPTH=	5.9	7.4	2.6	5.5	5.9	7.4	7.6	7.6	5.8	5.5	4.1	6.0	

STA=	1798.	1807.
PER Q=	1.0	
AREA=	51.0	
VEL=	6.0	
DEPTH=	5.4	

*SECNO 21.137

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

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

3470 ENCROACHMENT STATIONS= 442.0 1495.0 TYPE= 1 TARGET= 1053.000

21.137	8.21	314.31	.00	314.12	315.70	1.39	2.85	.22	311.80
30000.0	3782.4	.25886.9	330.8	613.1	2621.8	38.5	269.7	46.9	307.00
.11	6.17	9.87	8.58	.035	.050	.040	.000	306.10	442.00
.011969	450.	510.	530.	4	0	0	.00	996.71	1495.00

FLOW DISTRIBUTION FOR SECNO= 21.14 CWSEL= 314.31

STA=	442.	745.	919.	990.	1485.	1495.
PER Q=	3.1	4.9	4.6	86.3	1.1	
AREA=	219.7	225.8	167.6	2621.8	38.5	
VEL=	4.2	6.6	8.2	9.9	8.6	
DEPTH=	.7	1.3	2.4	5.3	3.9	

1

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

*SECNO 21.246

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.74

3470 ENCROACHMENT STATIONS= 49.0 1456.0 TYPE= 1 TARGET= 1407.000

21.246	7.83	317.43	.00	317.47	317.70	.28	1.89	.11	313.50
30000.0	9833.4	17540.0	2626.6	2258.9	4110.1	773.9	335.0	61.4	314.60
.14	4.35	4.27	3.39	.035	.050	.040	.000	309.60	49.00
.001600	450.	575.	650.	3	0	0	.00	1405.27	1456.00

FLOW DISTRIBUTION FOR SECNO= 21.25 CWSEL= 317.43

STA=	49.	156.	236.	304.	379.	428.	478.	515.	556.	613.	1216.	1346.	1456.
PER Q=	4.2	3.3	3.6	4.2	3.1	4.2	3.7	3.3	3.1	58.5	3.4	5.3	
AREA=	346.3	261.4	260.9	295.8	210.1	253.9	207.6	201.9	220.9	4110.1	353.2	420.7	
VEL=	3.7	3.7	4.2	4.2	4.5	5.0	5.4	4.9	4.2	4.3	2.9	3.8	
DEPTH=	3.2	3.3	3.8	3.9	4.3	5.1	5.6	4.9	3.9	6.8	2.7	3.8	

*SECNO 21.359

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 32.0 1543.0 TYPE= 1 TARGET= 1511.000

21.359	5.26	318.26	.00	318.28	318.68	.42	.94	.04	317.30
30000.0	10336.2	19663.8	.0	2372.0	3517.6	.0	414.9	78.7	100000.00
.17	4.36	5.59	.00	.040	.030	.000	.000	313.00	32.00
.001933	380.	600.	800.	3	0	0	.00	1454.71	1542.93

FLOW DISTRIBUTION FOR SECNO= 21.36 CWSEL= 318.26

STA=	32.	150.	279.	330.	370.	415.	461.	509.	555.	638.	689.	1549.
PER Q=	3.9	3.6	3.7	3.3	3.9	4.0	4.2	4.0	3.4	.6	65.5	
AREA=	337.9	285.2	240.6	204.1	235.8	242.4	252.9	243.0	257.3	72.8	3517.6	
VEL=	3.4	3.8	4.6	4.8	4.9	4.9	4.9	4.9	4.0	2.3	5.6	
DEPTH=	2.9	2.2	4.7	5.1	5.3	5.3	5.3	5.3	3.1	1.4	4.1	

THIS RUN EXECUTED 05AUG99 10:02:19

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HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

SAN LUIS REY RIVER

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	20.655	.00	.00	.00	299.70	30000.00	305.28	.00	306.07	73.44	7.21	4201.89	3500.63
	20.655	.00	.00	.00	299.70	30000.00	305.47	.00	306.20	63.94	6.91	4390.72	3751.61
*	20.767	591.00	.00	.00	300.40	30000.00	308.08	.00	308.62	27.92	6.12	5162.37	5677.87
*	20.767	591.00	.00	.00	300.40	30000.00	308.11	.00	308.72	30.35	6.39	4792.65	5445.25
	20.817	263.00	.00	.00	300.50	30000.00	308.88	.00	309.35	27.15	5.98	5491.57	5757.14
	20.817	263.00	.00	.00	300.50	30000.00	308.96	.00	309.50	28.78	6.20	5098.03	5592.04
	20.831	75.00	.00	.00	300.50	30000.00	309.10	.00	309.55	25.97	6.13	5759.09	5886.55
	20.831	75.00	.00	.00	300.50	30000.00	309.21	.00	309.72	27.23	6.34	5399.90	5749.20
	20.849	97.00	.00	.00	300.60	30000.00	309.27	.00	309.86	29.51	6.57	4977.07	5522.21
	20.849	97.00	.00	.00	300.60	30000.00	309.38	.00	310.05	31.04	6.80	4658.91	5384.63
	20.872	124.00	.00	.00	300.70	30000.00	309.69	.00	310.22	26.13	6.40	5291.94	5868.87
	20.872	124.00	.00	.00	300.70	30000.00	309.83	.00	310.42	27.01	6.57	4930.26	5772.21
	20.891	110.00	.00	.00	301.00	30000.00	309.96	.00	310.50	25.76	6.49	5210.31	5910.74
	20.891	110.00	.00	.00	301.00	30000.00	310.11	.00	310.71	26.49	6.66	4913.40	5828.31
	20.936	240.00	.00	.00	301.50	30000.00	310.54	.00	311.09	22.96	6.18	5177.84	6260.75
	20.936	240.00	.00	.00	301.50	30000.00	310.72	.00	311.30	23.16	6.29	4933.40	6234.45
	20.943	50.00	.00	.00	301.60	30000.00	310.67	.00	311.20	22.57	6.12	5240.80	6314.75
	20.943	50.00	.00	.00	301.60	30000.00	310.85	.00	311.42	22.86	6.24	4966.57	6274.93
	20.960	140.00	.00	.00	301.80	30000.00	311.13	.00	311.60	22.92	5.72	5552.78	6266.23
	20.960	140.00	.00	.00	301.80	30000.00	311.30	.00	311.82	23.60	5.82	5167.67	6175.46
	20.996	115.00	.00	.00	302.10	30000.00	311.36	.00	311.87	25.28	5.73	5238.71	5966.67
	20.996	115.00	.00	.00	302.10	30000.00	311.53	.00	312.10	25.37	5.82	4995.08	5956.12

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	21.093	215.00	.00	.00	304.40	30000.00	311.80	.00	312.41	31.83	6.24	4859.03	5317.34
	21.093	215.00	.00	.00	304.40	30000.00	311.97	.00	312.64	32.06	6.36	4593.09	5298.08
*	21.137	510.00	.00	.00	306.10	30000.00	314.12	314.09	315.70	142.26	10.49	3070.62	2515.27
*	21.137	510.00	.00	.00	306.10	30000.00	314.31	.00	315.70	119.69	9.87	3273.44	2742.19
*	21.246	575.00	.00	.00	309.60	30000.00	317.47	.00	317.74	15.25	4.19	7268.40	7682.49
*	21.246	575.00	.00	.00	309.60	30000.00	317.43	.00	317.70	16.00	4.27	7142.82	7500.74
	21.359	600.00	.00	.00	313.00	30000.00	318.28	.00	318.69	19.10	5.57	5911.29	6864.24
	21.359	600.00	.00	.00	313.00	30000.00	318.26	.00	318.68	19.33	5.59	5889.62	6824.07

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	20.655	30000.00	305.28	.00	.00	.00	979.02	.00
	20.655	30000.00	305.47	.19	.00	.19	1008.58	.00
*	20.767	30000.00	308.08	.00	2.80	.00	900.83	591.00
*	20.767	30000.00	308.11	.03	2.64	.03	720.45	591.00
	20.817	30000.00	308.88	.00	.80	.00	1004.78	263.00
	20.817	30000.00	308.96	.08	.85	.08	795.73	263.00
	20.831	30000.00	309.10	.00	.22	.00	1117.47	75.00
	20.831	30000.00	309.21	.11	.25	.11	941.74	75.00
	20.849	30000.00	309.27	.00	.17	.00	1099.04	97.00
	20.849	30000.00	309.38	.11	.17	.11	826.76	97.00
	20.872	30000.00	309.69	.00	.42	.00	1129.63	124.00
	20.872	30000.00	309.83	.14	.45	.14	818.26	124.00
	20.891	30000.00	309.96	.00	.27	.00	1006.17	110.00
	20.891	30000.00	310.11	.15	.28	.15	807.33	110.00
	20.936	30000.00	310.54	.00	.59	.00	883.87	240.00
	20.936	30000.00	310.72	.18	.61	.18	679.77	240.00
	20.943	30000.00	310.67	.00	.13	.00	912.76	50.00
	20.943	30000.00	310.85	.18	.13	.18	683.60	50.00
	20.960	30000.00	311.13	.00	.46	.00	1133.30	140.00
	20.960	30000.00	311.30	.17	.45	.17	752.39	140.00
	20.996	30000.00	311.36	.00	.23	.00	1043.43	115.00
	20.996	30000.00	311.53	.18	.24	.18	744.84	115.00
	21.093	30000.00	311.80	.00	.44	.00	1027.57	215.00
	21.093	30000.00	311.97	.17	.44	.17	754.40	215.00
*	21.137	30000.00	314.12	.00	2.31	.00	990.86	510.00
*	21.137	30000.00	314.31	.20	2.34	.20	996.71	510.00
*	21.246	30000.00	317.47	.00	3.36	.00	1426.76	575.00
*	21.246	30000.00	317.43	-.05	3.12	-.05	1405.27	575.00
	21.359	30000.00	318.28	.00	.81	.00	1455.01	600.00
	21.359	30000.00	318.26	-.01	.84	-.01	1454.71	600.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 20.767 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 20.767 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 21.137 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 21.137 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 21.246 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 21.246 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

1

FLOODWAY DATA. SAN LUIS REY RIVER
PROFILE NO. 2

STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
20.655	1013.	4391.	6.8	305.5	305.3	.2
20.767	720.	4793.	6.3	308.1	308.1	.0
20.817	796.	5098.	5.9	309.0	308.9	.1
20.831	942.	5400.	5.6	309.2	309.1	.1
20.849	827.	4659.	6.4	309.4	309.3	.1
20.872	818.	4930.	6.1	309.8	309.7	.1
20.891	807.	4913.	6.1	310.2	310.0	.2
20.936	680.	4933.	6.1	310.7	310.5	.2
20.943	684.	4967.	6.0	310.9	310.7	.2
20.960	756.	5168.	5.8	311.3	311.1	.2
20.996	760.	4995.	6.0	311.6	311.4	.2
21.093	755.	4593.	6.5	312.0	311.8	.2
21.137	1053.	3273.	9.2	314.3	314.1	.2
21.246	1407.	7143.	4.2	317.5	317.5	.0
21.359	1511.	5890.	5.1	318.3	318.3	.0

APPENDIX C

HEC-2 ANALYSIS

PROPOSED ROAD IMPROVEMENTS AND CHANNEL MODIFICATION

August 1999

```
1*****************************************
 *  HEC-2 WATER SURFACE PROFILES           *
 *                                         *
 *  Version   4.6.2;  May 1991             *
 *                                         *
 *  RUN DATE    05AUG99    TIME   09:31:31  *
 *****************************************
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****************************************
*  U.S. ARMY CORPS OF ENGINEERS        *
*  HYDROLOGIC ENGINEERING CENTER       *
*  609 SECOND STREET, SUITE D          *
*  DAVIS, CALIFORNIA 95616-4687        *
*          (916) 756-1104              *
****************************************
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X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X           X     X
X     X  X        X                       X
XXXXXXX  XXXX     X         XXXXX    XXXXX
X     X  X        X                 X
X     X  X        X     X           X
X     X  XXXXXXX  XXXXX             XXXXXXX
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1

05AUG99 09:31:31 PAGE 1

THIS RUN EXECUTED 05AUG99 09:31:31

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

 Version   4.6.2;  May 1991
************************************
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T1      GREGORY CANYON LANDFILL ACCESS ROAD & BRIDGE
T2      100-YR FLOOD
T3      SAN LUIS REY RIVER      TOPO DATED 2/98
T4      JOB NO. SD0030          FILE : MINGRALT.DAT
T5      SECTIONS TAKEN LOOKING UPSTREAM
T6      PROPOSED 638' BRIDGE W/ MIN CHANNEL GRADING (6/99 SRL).

J1  ICHECK    INQ       NINV      IDIR      STRT      METRIC    HVINS     Q         WSEL      FQ

                2                                                         30000     305.28

J2  NPROF     IPLOT     PRFVS     XSECV     XSECH     FN        ALLDC     IBW       CHNIM     ITRACE

      1                 -1                                                -6                  15


J3  VARIABLE CODES FOR SUMMARY PRINTOUT

              150                 200

    COUNTY OF SAN DIEGO/SDCWA 1993 TOPO.


NC     0.05       0.04       0.05       0.1        0.3
ET                 5.1        7.1                   87        1100          87        1100
```

X1	20.655	82	143	881						
X3	0	299.7								
GR	313.6	0	312.4	5	311	12	306.5	19	307.3	26
GR	309	38	309.4	52	310.2	63	300.9	110	300.1	143
GR	298.6	147	298.8	165	300.4	169	300	188	299.4	230
GR	298	234	298.1	254	298.8	262	298.8	305	299.7	439
GR	304.7	458	305	470	304.7	482	303.7	495	302.4	513
GR	301	536	300.3	560	299.9	571	299.6	582	299.6	599
GR	298.7	637	302.2	881	302.9	893	301.7	897	301.8	944
GR	302	1001	303.4	1020	305	1036	305.5	1050	305.1	1099
GR	305.2	1270	305.6	1307	305.6	1314	306.2	1315	306.3	1330
GR	305.6	1334	305.3	1386	306.3	1394	306.3	1407	306.8	1433
GR	307.2	1435	307.2	1442	306.2	1452	306.5	1494	305.9	1515
GR	305.1	1517	305.1	1529	305.8	1538	305.1	1594	305.6	1613
GR	305.7	1639	304.8	1646	304.5	1660	304.5	1673	304	1685
GR	303.5	1695	303.3	1710	303.4	1722	303.7	1738	303.8	1787
GR	304.7	1807	305.1	1826	306.2	1866	308.6	1904	311.8	1939
GR	315.8	1969	318.7	1981	318.6	1998	320.6	2006	324.9	2020
GR	323.8	2029	324.6	2029						

NOLTE TOPO (2/98) USED FOR SECTIONS 20.767 THROUGH 21.093.

1

ET			7.1				163	884		
X1	20.767	30	434.9	722.25	591	591	591			
X3	0	300.4								
GR	305	0	306	4.29	307	51.88	306	133.51	305	258.89
GR	304	260.95	303	262.99	302	264.93	301	267.26	300	314.54
GR	299	429.82	298	432.3	297	434.9	296	443.48	296	649.01
GR	297	653.25	297	680.45	297	712.29	298	718.19	299	722.25
GR	300	734.94	301	741.38	302	743.92	303	746.32	303	746.32
GR	303	767.11	302	774.39	302	886.9	302	893.01	302	900.83

ET			7.1				210	1006		
X1	20.817	43	556.79	874.35	225	330	263			
X3		300.5								
GR	307	0	307	98.01	307	146.43	308	148.78	309	150.95
GR	310	161.04	310	177.28	310	184.42	310	198.04	309	202.46
GR	308	205.83	307	208.88	306	211.66	305	343.29	304	354.32
GR	303	412.21	302	417.1	301	423.26	297	556.79	297	578.23
GR	297	604.23	297	783.41	298	803.83	299	828.79	300	830.32
GR	301	831.84	302	833.31	303	834.85	304	836.37	304	836.37
GR	305	838.25	306	841.96	307	845.86	307	868.7	306	874.35
GR	305	881.82	304	892.68	303	901.8	303	926	304	930.85
GR	305	996.43	306	1056.93	306	1056.94				

ET		5.1	7.1		112	1054	225	980		
X1	20.831	52	525.67	830.53	85	55	75			
X3		300.5								
GR	308	0	307	16.06	306	46.45	306	78.03	306	86.42
GR	306	87.78	307	91.33	308	94.1	309	96.42	309	98.24
GR	307	109.41	306	113.96	306	244.73	306	252.1	305	270.97
GR	305	344.67	305	413.6	304	430.47	303	433.94	302	440.52
GR	301	508.49	300	525.67	299	531.57	298	535.89	298	535.89

GR	297	545.26	297	681.9	297	695.84	297	730.32	298	744
GR	299	803.1	302	807.26	303	808.54	304	809.86	306	818.94
GR	307	824.32	308	830.53	308	846.6	307	850.49	306	854.3
GR	305	858.02	304	862.29	303	877.73	302	883.52	302	893.71
GR	303	897.86	304	900.27	305	947.54	305	967.46	305	992.9
GR	306	1016.3	306	1117.47						

NC	.035	.04	.05	.3	.5					
ET		5.1	7.1		217	1044	217	935		
X1	20.849	52	463.72	799.07	102	88	97			
X3		300.6								
GR	309	0	309	91.45	308	146.14	307	153.29	307	165
GR	307	216.33	306	324.6	305	336.12	304	375	304	380.87
GR	305	396.61	304	412.5	303	414.68	302	417.26	302	429.11
GR	303	449.78	303	463.72	302	476.91	301	485.68	300	492.59
GR	299	496.44	298	504.01	298	684.98	299	713.93	299	727.94
GR	299	758.28	300	761.97	301	764	302	765.97	303	775.56
GR	304	785.81	305	791.33	306	795.68	307	799.07	308	802.36
GR	308	835.8	308	835.8	307	865.14	306	890.85	305	893.2

GR	304	897.92	304	912.55	305	923.73	306	930.06	306	933.59
GR	306	946.94	306	964.45	305	967.73	305	989.77	306	992.87
GR	306	1098.99	306	1099.04						

301.5 PAD ON RIGHT OVERBANK

ET		5.1	7.1		157	960	250	960		
X1	20.872	38	455.45	916.53	105	162	124			
X3	0	300.7	0	0	0	0	0	0	0	
GR	309	0	309	78.25	310	105.76	310	136.17	309	175.32
GR	308	217.11	307	292.47	306	341.93	305	419.4	305	426.87
GR	305	431.97	304	449.05	303	455.45	301	476.8	300	478.55
GR	299	480.32	298	481.92	298	600.77	299	653.73	300	663.47
GR	300	716.93	300	763.2	301.5	770	301.5	904.44	304	916.53
GR	305	927.52	306	938.42	306	941.64	306	966.01	307	982.24
GR	307	994.68	306	997.14	305	999.57	305	1013.02	306	1017.46
GR	307	1020.48	307	1027.75	307	1180.69				

302.0 PAD ON RIGHT OVERBANK

ET		5.1	7.1		242	950	280	950		
X1	20.891	40	450.87	915.88	115	95	110			
X3	0	301	0	0	0	0	0	0	0	
GR	310	0	310	126.43	310	174.16	309	205.17	308	242.49
GR	307	348.49	306	445.51	305	447.34	304	449.37	303	450.87
GR	302	452.63	301	454.39	300	456.45	299	458.44	298	460.55
GR	298	545.64	299	567.35	300	618.1	301	734	302	766.74
GR	302.0	777.34	302.0	912.34	304	915.88	305	920.09	306	927.59
GR	306	946.25	306	962.87	307	967.31	307	999.26	307	1013.34
GR	307	1013.72	306	1016.94	305	1021.02	305	1026.75	306	1036.78
GR	307	1039.29	307	1056.09	307	1087.17	307	1133.15	307	1181.67

2:1 SLOPE ON RIGHT ABUTMENT (EL 316 TO 301.5)
302.5 PAD ON RIGHT OVERBANK.

ET			7.1				244.82	861.18		

NC	.035	.04	.04							
	Downstream Face - Proposed 638' Bridge w/ Riprap on Abutments									
	Pier Width=5.5' with 4' debris blockage on each pier.									
X1	20.936	51	302.11	646.58	240	240	240			
X3	0	301.5	0	0	0	0	0	0	0	
GR	316	234	308.5	249	308	298	303	300	302	302.11
GR	301	303.97	300	305.96	299	312.87	299	316.24	316	316.25
GR	316	325.75	299	325.76	299	401.85	300	432.24	316	432.25
GR	316	441.75	300	441.76	300	456.9	301	482.11	301	548.24
GR	316	548.25	316	557.75	301	557.76	301	562.66	301	574.12
GR	301	603.21	301	633.67	302.0	646.58	302.2	664.24	316	664.25
GR	316	673.75	302.2	673.76	302.5	689.46	302.5	702.93	302.5	711.27
GR	302.5	716.81	302.5	722.27	302.5	747.42	302.5	760.06	302.5	768.82
GR	302.5	780.24	316	780.25	316	789.75	302.5	789.76	302.5	800.09
GR	302.5	807.01	302.5	816.99	302.5	819.55	302.5	823.31	302.5	845
GR	316	872								

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ET			7.1				244.58	861.42		
	Upstream Face									
X1	20.943				50	50	50	0	0	0
X3		301.6								

EL 304.5 PAD ON ROB

NC	.035	.04	.05	.1	.3					
ET		5.1	7.1		254	1058	254	1000		
X1	20.96	63	259.4	667.95	140	235	140			
X3		301.8								
GR	312	0	311	122.42	310	222.86	309	254.28	308	255.53
GR	307	256.74	306	258	305	259.4	304	260.63	303	261.89
GR	302	264.49	301	267.17	300	273.24	299	315.77	299	409.33
GR	300	417.85	301	435.38	302	444.39	303	466.06	304	475.46
GR	304	558.18	304	614.97	305	616.81	306	618.58	307	619.65
GR	308	620.42	309	621.32	310	622.21	311	623.31	312	624.03
GR	312	625.46	312	625.47	311	627.53	310	628.74	309	630.35
GR	308	632.2	303	640.06	302	642.01	302	667.95	303	704.09
GR	303	717	303	732.04	304	735.97	304.5	742.45	304.5	768.8
GR	304.5	906.5	304.5	927	304.5	959.11	304.5	961.68	304.5	964.5
GR	306	979.28	307	981.72	308	983.99	309	1000	309	1139.03
GR	310	1185.56	311	1236.19	312	1289.73	313	1312.19	314	1325.77
GR	316	1343.68	317	1351.36	318	1358.92				

ET		5.1	7.1		1026	2060	1115	1875		
NC	.035	.04	.05	.1	.3					
X1	20.996	97	1119.84	1528.44	108	95	115			
X3		302.1								
GR	333	0	332	4.9	331	16.66	329	55.87	328	63.81
GR	326	78.89	324	94.12	321	117.01	320	127.87	319	138.7
GR	318	167.08	317	186.99	316	228.97	315	284.71	314	380.19
GR	313	617.58	313	797.19	312	875.69	311	1003.89	310	1104.74
GR	309	1105.96	309	1105.96	309	1105.96	308	1107.19	304	1112.7
GR	303	1114.62	302	1117.04	301	1119.84	300	1146.87	300	1161.04
GR	300	1236.62	301	1280.07	302	1286.91	303	1306.05	304	1323.36
GR	305	1329.33	305	1417.35	305	1418.57	304	1451.11	306	1472.91

GR	309	1475.94	310	1476.6	311	1477.15	312	1477.78	313	1486.37
GR	313	1489.39	312	1491.74	312	1491.74	311	1494.12	309	1498.82
GR	308	1508.09	306	1519.72	305	1523.99	304	1526.21	303	1528.44
GR	303	1528.44	302	1537.63	302	1554.08	302	1554.14	302	1563.05
GR	302	1577.5	303	1593.75	304	1615.2	305	1619.02	306	1630.85
GR	307	1677.92	307	1677.97	308	1753.62	308	1771.72	308	1787.21
GR	308	1837.32	307	1839.25	306	1841.18	306	1856.5	307	1862.65
GR	308	1877.26	309	1884.92	310	1971.42	311	2006.73	312	2032.47
GR	313	2059.21	314	2087.95	316	2128.87	317	2166.25	317	2175.98
GR	317	2186.08	318	2197.73	319	2207.85	321	2228.72	322	2242.58
GR	323	2251.3	325	2267.33	330	2311.09	332	2326.72	333	2334.87
GR	334	2342.92	335	2351.41						

FIRST SAN DIEGO AQUEDUCT CROSSING.

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ET			7.1				1052	1807		
X1	21.093	97	1052.13	1379.03	227	135	215			
X3		304.4								
GR	340	0	339	5.09	337	16.76	336	21.22	334	25.96
GR	330	32.81	329	34.34	327	37.35	325	40.68	325	46.38
GR	325	66.61	323	88.26	320	96.58	318	103.58	316	114.45
GR	315	119.8	315	124.17	316	131.3	316	250.41	315	376.16
GR	314	475.5	314	476.89	314	560.94	314	707.39	313	830.5
GR	312	865.76	311	942.15	311	967.34	311	975.48	310	1042.99
GR	310	1043	309	1045.35	307	1049.76	306	1052.13	305	1053.89
GR	302	1059.03	301	1060.65	301	1184.73	304	1237.65	305	1273.88
GR	305	1273.88	305	1377.63	305	1379.03	306	1392.25	308	1395.71
GR	310	1397.52	311	1398.39	312	1399.25	310	1442.7	307	1459.02
GR	306	1480.59	306	1482.85	307	1491.78	307	1495.54	306	1506.18
GR	305	1518.37	304	1539.9	303	1569.33	303	1595.08	306	1602.21
GR	307	1605.27	307	1607.67	306	1629.98	306	1648.02	308	1665.28
GR	309	1671.41	309	1674.58	308	1718.65	306	1754.19	306	1797.56
GR	307	1805.89	308	1813.55	310	1866.69	311	1898.21	314	1953.97
GR	315	1964.61	317	1990.22	318	2013.31	320	2064.96	322	2132.23
GR	324	2178.1	326	2202.71	328	2223.62	328	2229.08	329	2246.84
GR	331	2268.27	333	2277.58	335	2291.65	337	2309.84	340	2331.28
GR	341	2339.93	343	2360.15	345	2379.37	347	2399.82	349	2419.16
GR	350	2428.09	353	2456.99						

COUNTY OF SAN DIEGO/SDCWA 1993 TOPO.

ET			7.1				442	1495		
X1	21.137	77	990	1485	450	530	510			
X3		306.0								
GR	323.7	0	323.9	3	322.8	20	323.9	24	324.6	29
GR	323.6	31	316.9	41	316.9	54	319.3	57	320.4	61
GR	320.4	64	318.5	66	318.3	81	317.4	99	317.1	117
GR	317.1	141	316.5	150	315.7	206	315.7	256	315.3	318
GR	314.8	410	314.3	426	314.3	437	313.5	474	313.4	540
GR	313.4	626	314.1	681	316.9	691	318.7	697	318.6	700
GR	318.5	703	316	707	313	714	313	733	313.6	745
GR	313.4	759	313.4	770	313.4	782	317.3	788	317.3	794
GR	317.3	800	315.1	808	313.2	814	312.4	860	312.1	919
GR	311.8	990	311.2	1035	311.2	1044	310.5	1048	310.5	1053

GR	310.5	1059	310.3	1071	310.4	1090	310.7	1112	310.7	1125
GR	311.1	1139	310.9	1162	310.8	1185	310.3	1214	310	1264
GR	309.3	1272	306.1	1290	306.4	1316	306.5	1344	306.5	1359
GR	306.5	1379	306.5	1393	306.5	1412	307.1	1416	307.5	1424
GR	307.6	1434	307	1448	307	1476	307	1485	338.8	1531
GR	342.2	1539	342.5	1540						
ET		5.1	7.1		33	1461	49	1456		
X1	21.246	90	613	1216	450	650	575			
X3	0	309.6								
GR	320.4	0	318.6	7	318.6	22	318.6	31	314.1	39
GR	314.1	49	314.1	56	314.1	75	314.1	95	314.3	120
GR	314.3	156	314.3	187	314.2	211	313.6	236	313.7	265

1

GR	313.5	283	313.5	304	313.5	327	313.5	354	313.4	379
GR	313.3	405	312.5	428	312.6	449	312.2	459	312	478
GR	311.9	501	311.3	515	313.1	523	311.9	527	311.9	539
GR	313.1	543	313.4	556	313.7	575	313.5	595	313.5	613
GR	307.5	640	307.7	682	307.9	744	310.5	875	310.4	896
GR	310.4	916	310.4	935	311.1	939	311	945	310.7	949
GR	310.7	958	310.7	968	311.3	973	311.5	986	311.9	998
GR	313.2	1004	313.3	1009	313.3	1013	313.3	1017	311.9	1020
GR	311.9	1026	311.8	1032	311.4	1051	310.9	1079	310.9	1105
GR	310.9	1143	310.8	1187	314.6	1216	314.6	1238	314.9	1262
GR	314.8	1305	314.4	1346	317.6	1355	315.8	1368	312.8	1374
GR	312.8	1415	312.8	1456	318.3	1462	321.9	1472	321.9	1479
GR	323.2	1484	324.8	1489	324.9	1490	324	1496	322.9	1506
GR	320.5	1517	319.7	1528	318.2	1540	318.3	1562	318.9	1580
GR	319.3	1594	319.8	1610	319.6	1619	320.1	1633	321.6	1649
NC	0.04	0.04	0.03							
ET			7.1				32	1543		
X1	21.359	80	689	1549	380	800	600			
X3	0	313								
GR	338.9	0	331.1	8	316.6	35	316.6	57	316.6	66
GR	314.7	71	314.8	85	314.9	127	314.9	150	315.5	175
GR	315.5	197	319.9	204	321.8	211	321.8	222	321.8	235
GR	316.7	246	313.4	258	313.6	279	313.6	296	313.6	318
GR	313.2	330	313.3	350	312.9	377	311.5	395	310.3	415
GR	309.8	429	309.8	443	309.8	461	309.8	494	312	509
GR	311.9	538	314.6	580	317.6	586	320.4	590	320.7	596
GR	317.3	600	314.6	604	314.3	618	315.3	638	315.8	647
GR	317	655	317.4	669	317.3	689	316.8	701	316.8	713
GR	317.5	725	317.5	748	317.9	773	318	793	317.6	811
GR	318	828	317.8	844	316.8	855	315.7	875	315.2	893
GR	315.3	911	319.4	915	314.9	923	312.8	925	294	965
GR	292.8	980	293.8	1040	294	1110	294	1180	294	1240
GR	294	1310	294	1420	294	1500	321.7	1549	324.5	1555
GR	328.7	1561	332	1565	331.9	1569	331.9	1573	326.8	1577
GR	323.1	1586	320.9	1595	321.6	1609	321.3	1632	320.4	1632

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA

SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST

*PROF 1

0

CCHV= . .100 CEHV= .300

*SECNO 20.655

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 87.0 1100.0 TYPE= 1 TARGET= 1013.000

20.655	5.58	305.28	.00	.00	306.07	.79	.00	.00	300.10
30000.0	1345.4	25415.4	3239.2	206.2	3522.9	472.8	.0	.0	302.20
.00	6.52	7.21	6.85	.050	.050	.040	.000	299.70	87.86
.007344	0.	0.	0.	0	0	0	.00	979.02	1100.00

FLOW DISTRIBUTION FOR SECNO= 20.66 CWSEL= 305.28

STA=	88.	110.	143.	881.	893.	897.	944.	1001.	1020.	1036.	1100.
PER Q=	.7	3.8	84.7	.7	.3	4.1	4.6	1.0	.2	.0	
AREA=	48.5	157.7	3522.9	32.8	11.9	165.9	192.7	49.0	17.3	3.3	
VEL=	4.2	7.2	7.2	6.2	6.4	7.4	7.2	6.0	3.3	.7	
DEPTH=	2.2	4.8	4.8	2.7	3.0	3.5	3.4	2.6	1.1	.1	

*SECNO 20.767

3280 CROSS SECTION 20.77 EXTENDED 6.08 FEET

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 1.62

20.767	7.68	308.08	.00	.00	308.62	.54	2.53	.03	300.40
30000.0	9402.9	13503.9	7093.3	1862.5	2208.2	1091.7	63.5	12.8	300.40
.03	5.05	6.12	6.50	.050	.050	.040	.000	300.40	.00
.002792	591.	591.	591.	3	0	0	.00	900.83	900.83

FLOW DISTRIBUTION FOR SECNO= 20.77 CWSEL= 308.08

STA=	0.	259.	296.	430.	435.	722.	741.	774.	887.	901.
PER Q=	4.7	4.8	21.0	.8	45.0	3.7	3.5	14.9	1.5	
AREA=	539.9	252.4	1031.2	39.0	2208.2	145.8	176.5	684.6	84.8	
VEL=	2.6	5.7	6.1	6.1	6.1	7.6	6.0	6.5	5.4	
DEPTH=	2.1	6.9	7.7	7.7	7.7	7.6	5.3	6.1	6.1	

1

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

*SECNO 20.817

3265 DIVIDED FLOW

3280 CROSS SECTION 20.82 EXTENDED 2.88 FEET

20.817	8.38	308.88	.00	.00	309.35	.47	.72	.01	300.50
30000.0	11450.3	14470.6	4079.1	2288.6	2420.6	782.4	95.3	18.4	306.00
.04	5.00	5.98	5.21	.050	.050	.040	.000	300.50	.00
.002715	225.	263.	330.	2	0	0	.00	1004.78	1056.94

FLOW DISTRIBUTION FOR SECNO= 20.82 CWSEL= 308.88

STA=	0.	343.	412.	440.	557.	874.	926.	996.	1057.
PER Q=	7.4	5.6	4.3	20.9	48.2	5.1	5.5	3.0	
AREA=	737.0	359.9	212.4	979.3	2420.6	264.3	313.5	204.6	
VEL=	3.0	4.7	6.0	6.4	6.0	5.8	5.2	4.4	
DEPTH=	2.1	5.2	7.7	8.4	7.6	5.1	4.5	3.4	

*SECNO 20.831
3280 CROSS SECTION 20.83 EXTENDED 3.05 FEET

3470 ENCROACHMENT STATIONS= 112.0 1054.0 TYPE= 1 TARGET= 942.000

20.831	8.55	309.05	.00	.00	309.59	.54	.21	.02	300.50
30000.0	8921.6	16215.0	4863.4	1867.9	2481.3	897.7	104.7	20.1	308.00
.04	4.78	6.53	5.42	.050	.050	.040	.000	300.50	112.00
.002973	85.	75.	55.	2	0	0	.00	942.00	1054.00

FLOW DISTRIBUTION FOR SECNO= 20.83 CWSEL= 309.05

STA=	112.	245.	345.	414.	508.	526.	831.	884.	948.	993.	1054.
PER Q=	4.6	5.2	3.8	12.9	3.2	54.1	3.5	6.7	3.1	2.9	
AREA=	404.2	387.8	279.0	652.1	144.7	2481.3	188.8	327.4	183.6	197.9	
VEL=	3.4	4.0	4.1	5.9	6.7	6.5	5.6	6.1	5.1	4.3	
DEPTH=	3.0	3.9	4.0	6.9	8.4	8.1	3.6	5.1	4.0	3.2	

CCHV= .300 CEHV= .500

1

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

*SECNO 20.849
3280 CROSS SECTION 20.85 EXTENDED 3.27 FEET

3470 ENCROACHMENT STATIONS= 217.0 1044.0 TYPE= 1 TARGET= 827.000

20.849	8.67	309.27	.00	.00	309.97	.70	.30	.08	303.00
30000.0	7192.2	19170.6	3637.1	1053.3	2762.2	755.6	115.6	22.0	307.00
.05	6.83	6.94	4.81	.035	.050	.040	.000	300.60	217.00
.003290	102.	97.	88.	2	0	0	.00	827.00	1044.00

FLOW DISTRIBUTION FOR SECNO= 20.85 CWSEL= 309.27

STA=	217.	325.	375.	413.	429.	450.	464.	799.	913.	964.	1044.
PER Q=	4.7	5.1	4.2	3.4	4.1	2.4	63.9	4.2	3.2	4.7	
AREA=	298.7	229.0	181.9	116.2	140.0	87.4	2762.2	280.2	189.8	285.6	
VEL=	4.7	6.7	7.0	8.8	8.7	8.3	6.9	4.5	5.1	4.9	
DEPTH=	2.8	4.5	4.9	7.0	6.8	6.3	8.2	2.5	3.7	3.6	

*SECNO 20.872

3280 CROSS SECTION 20.87 EXTENDED 2.82 FEET

3470 ENCROACHMENT STATIONS=			157.0	960.0	TYPE=	1	TARGET=	803.000		
20.872	9.12	309.82	.00	.00	310.35	.54	.34	.05	303.00	
30000.0	4536.3	24599.1	864.6	930.6	4042.0	187.9	129.4	24.3	304.00	
.05	4.87	6.09	4.60	.035	.050	.040	.000	300.70	157.00	
.002323	105.	124.	162.	2	0	0	.00	803.00	960.00	

FLOW DISTRIBUTION FOR SECNO= 20.87 CWSEL= 309.82

STA=	157.	342.	419.	449.	455.	917.	960.
PER Q=	5.1	6.0	3.1	.9	82.0	2.9	
AREA=	404.4	334.4	151.4	40.4	4042.0	187.9	
VEL=	3.8	5.4	6.1	6.9	6.1	4.6	
DEPTH=	2.2	4.3	5.1	6.3	8.8	4.3	

*SECNO 20.891

3280 CROSS SECTION 20.89 EXTENDED 3.05 FEET

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

3470 ENCROACHMENT STATIONS=			242.0	950.0	TYPE=	1	TARGET=	708.000		
20.891	9.05	310.05	.00	.00	310.67	.62	.27	.04	303.00	
30000.0	3060.9	26206.0	733.1	645.5	4036.5	148.3	142.1	26.3	304.00	
.06	4.74	6.49	4.94	.035	.050	.040	.000	301.00	242.00	
.002683	115.	110.	95.	2	0	0	.00	708.00	950.00	

FLOW DISTRIBUTION FOR SECNO= 20.89 CWSEL= 310.05

STA=	242.	348.	446.	447.	449.	451.	916.	920.	928.	946.	950.
PER Q=	3.7	5.9	.2	.2	.2	87.4	.5	.6	1.2	.2	
AREA=	271.5	344.6	8.3	11.3	9.8	4036.5	23.4	34.1	75.6	15.2	
VEL=	4.1	5.1	5.5	6.4	6.8	6.5	5.9	5.3	4.9	3.0	
DEPTH=	2.5	3.6	4.6	5.6	6.6	8.7	5.6	4.6	4.1	4.1	

*SECNO 20.936

3265 DIVIDED FLOW

Downstream Face - Proposed 638' Bridge w/ Riprap on Abutments

Pier Width=5.5' with 4' debris blockage on each pier.

20.936	9.10	310.60	.00	.00	311.29	.69	.58	.04	302.00
30000.0	574.6	19665.9	9759.5	146.8	2872.9	1528.0	167.9	29.8	302.00
.07	3.91	6.85	6.39	.035	.040	.040	.000	301.50	244.80
.002213	240.	240.	240.	2	0	0	.00	568.86	861.20

FLOW DISTRIBUTION FOR SECNO= 20.94 CWSEL= 310.60

STA=	245.	302.	647.	689.	711.	747.	769.	807.	823.	845.	861.
PER Q=	1.9	65.6	5.1	4.2	6.9	4.1	4.2	3.1	4.1	.9	
AREA=	146.8	2872.9	279.7	176.6	292.8	173.3	232.3	132.0	175.7	65.6	
VEL=	3.9	6.8	5.5	7.0	7.0	7.0	5.4	7.0	7.0	4.1	
DEPTH=	2.6	9.1	6.5	8.1	8.1	8.1	6.1	8.1	8.1	4.0	

*SECNO 20.943

3265 DIVIDED FLOW

Upstream Face

1

SECNO	DEPTH	CWSEL	CRIWS	WSELK	EG	HV	HL	OLOSS	L-BANK ELEV
Q	QLOB	QCH	QROB	ALOB	ACH	AROB	VOL	TWA	R-BANK ELEV
TIME	VLOB	VCH	VROB	XNL	XNCH	XNR	WTN	ELMIN	SSTA
SLOPE	XLOBL	XLCH	XLOBR	ITRIAL	IDC	ICONT	CORAR	TOPWID	ENDST
20.943	9.12	310.72	.00	.00	311.40	.68	.11	.00	302.00
30000.0	609.0	19511.5	9879.5	153.8	2880.7	1551.9	173.1	30.4	302.00
.07	3.96	6.77	6.37	.035	.040	.040	.000	301.60	244.56
.002160	50.	50.	50.	0	0	0	.00	569.35	861.44

FLOW DISTRIBUTION FOR SECNO= 20.94 CWSEL= 310.72

STA=	245.	302.	647.	689.	711.	747.	769.	807.	823.	845.	861.
PER Q=	2.0	65.0	5.2	4.2	7.0	4.1	4.2	3.1	4.2	.9	
AREA=	153.8	2880.7	283.7	179.3	297.2	175.9	235.8	134.0	178.3	67.6	
VEL=	4.0	6.8	5.5	7.0	7.0	7.0	5.4	7.0	7.0	4.1	
DEPTH=	2.7	9.1	6.6	8.2	8.2	8.2	6.2	8.2	8.2	4.1	

CCHV= .100 CEHV= .300

*SECNO 20.960

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 254.0 1058.0 TYPE= 1 TARGET= 804.000

20.960	9.55	311.35	.00	.00	311.76	.41	.33	.03	305.00
30000.0	92.7	16709.9	13197.4	23.2	3401.0	2443.2	194.3	33.3	302.00
.08	4.00	4.91	5.40	.035	.050	.040	.000	301.80	254.00
.001637	140.	140.	235.	2	0	0	.00	800.75	1058.00

FLOW DISTRIBUTION FOR SECNO= 20.96 CWSEL= 311.35

STA=	254.	259.	668.	704.	732.	769.	907.	959.	1058.
PER Q=	.3	55.7	6.9	4.8	4.7	17.0	6.5	4.1	

AREA=	23.2	3401.0	319.8	233.3	257.3	943.1	360.3	329.4
VEL=	4.0	4.9	6.4	6.2	5.5	5.4	5.4	3.7
DEPTH=	4.3	8.4	8.8	8.3	7.0	6.8	6.8	3.3

CCHV= .100 CEHV= .300

*SECNO 20.996

2750 NUMBER OF COMPUTED POINTS EXCEED 100

3265 DIVIDED FLOW

1

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

3470 ENCROACHMENT STATIONS= 1026.0 2060.0 TYPE= 1 TARGET= 1034.000

20.996	9.40	311.50	.00	.00	311.99	.49	.21	.02	302.10
30000.0	925.3	16980.8	12093.9	187.2	3032.8	2129.1	208.0	35.4	303.00
.09	4.94	5.60	5.68	.035	.050	.040	.000	302.10	1026.00
.002361	108.	115.	95.	2	0	0	.00	978.12	2019.58

FLOW DISTRIBUTION FOR SECNO= 21.00 CWSEL= 311.50

STA=	1026.	1120.	1528.	1554.	1578.	1594.	1615.	1678.	1754.	1837.	1877.	2020.
PER Q=	3.1	56.6	6.3	5.9	3.8	4.1	6.1	4.6	4.1	3.3	2.2	
AREA=	187.2	3032.8	237.3	220.1	146.2	171.6	333.0	302.8	292.9	190.8	234.4	
VEL=	4.9	5.6	8.0	8.0	7.8	7.2	5.5	4.5	4.2	5.1	2.8	
DEPTH=	2.0	7.7	9.3	9.4	9.0	8.0	5.3	4.0	3.5	4.8	1.6	

*SECNO 21.093

3265 DIVIDED FLOW

21.093	7.51	311.91	.00	.00	312.49	.58	.47	.03	306.00
30000.0	590.0	14538.9	14871.1	193.1	2383.4	2396.8	229.4	39.5	305.00
.09	3.06	6.10	6.20	.035	.050	.040	.000	304.40	872.57
.002985	227.	215.	135.	2	0	0	.00	1040.56	1915.14

FLOW DISTRIBUTION FOR SECNO= 21.09 CWSEL= 311.91

STA=	873.	1052.	1379.	1459.	1492.	1518.	1540.	1569.	1595.	1630.	1665.	1754.	1798.
PER Q=	2.0	48.5	3.4	3.7	3.4	4.0	5.7	5.0	4.3	4.0	6.2	5.7	
AREA=	193.1	2383.4	203.9	178.4	154.2	157.8	221.0	193.4	199.6	191.4	355.0	256.4	
VEL=	3.1	6.1	5.1	6.3	6.6	7.7	7.8	7.8	6.5	6.3	5.2	6.6	
DEPTH=	1.1	7.3	2.5	5.4	5.8	7.3	7.5	7.5	5.7	5.4	4.0	5.9	

STA=	1798.	1867.	1915.
PER Q=	3.7	.4	
AREA=	233.5	52.2	
VEL=	4.7	2.4	
DEPTH=	3.4	1.1	

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

*SECNO 21.137

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

7185 MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED

21.137	7.98	314.08	314.08	.00	315.69	1.61	2.89	.31	311.80
30000.0	3176.8	26492.0	331.2	502.7	2510.0	36.3	276.4	51.0	307.00
.11	6.32	10.55	9.12	.035	.050	.040	.000	306.10	446.98
.014494	450.	510.	530.	4	8	0	.00	988.39	1495.25

FLOW DISTRIBUTION FOR SECNO= 21.14 CWSEL= 314.08

STA=	447.	860.	990.	1485. 1495.
PER Q=	3.5	7.0	88.3	1.1
AREA=	242.9	259.7	2510.0	36.3
VEL=	4.4	8.1	10.6	9.1
DEPTH=	.6	2.0	5.1	3.5

*SECNO 21.246

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 3.08

3470 ENCROACHMENT STATIONS= 33.0 1461.0 TYPE= 1 TARGET= 1428.000

21.246	7.88	317.48	.00	.00	317.74	.27	1.92	.13	313.50
30000.0	9962.4	17334.4	2703.2	2330.3	4139.5	797.4	341.2	65.7	314.60
.15	4.28	4.19	3.39	.035	.050	.040	.000	309.60	33.00
.001526	450.	575.	650.	5	0	0	.00	1426.76	1461.00

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

FLOW DISTRIBUTION FOR SECNO= 21.25 CWSEL= 317.48

STA=	33.	120.	211.	283.	354.	428.	478.	515.	556.	613.	1216.	1346.	1456.
PER Q=	3.4	3.5	3.6	3.9	4.5	4.2	3.7	3.3	3.1	57.8	3.4	5.5	
AREA=	281.1	290.2	270.1	282.3	313.2	256.4	209.4	203.9	223.7	4139.5	359.6	426.0	
VEL=	3.7	3.6	4.0	4.2	4.3	4.9	5.3	4.8	4.1	4.2	2.9	3.9	
DEPTH=	3.2	3.2	3.8	4.0	4.2	5.1	5.7	5.0	3.9	6.9	2.8	3.9	

STA=	1456.	1461.
PER Q=	.1	
AREA=	11.9	
VEL=	2.1	
DEPTH=	2.4	

*SECNO 21.359

3265 DIVIDED FLOW

21.359	5.28	318.28	.00	.00	318.70	.42	.91	.04	317.30
30000.0	10334.7	19665.3	.0	2383.1	3533.3	.0	421.9	83.1	321.70
.17	4.34	5.57	.00	.040	.030	.000	.000	313.00	31.86
.001905	380.	600.	800.	3	0	0	.00	1455.05	1542.96

FLOW DISTRIBUTION FOR SECNO= 21.36 CWSEL= 318.28

STA=	32.	150.	279.	330.	370.	415.	461.	509.	555.	638.	689.	1549.
PER Q=	3.9	3.6	3.7	3.3	3.9	4.0	4.2	4.0	3.4	.6	65.6	
AREA=	340.0	286.9	241.5	204.8	236.6	243.3	253.8	243.8	258.6	73.7	3533.3	
VEL=	3.4	3.7	4.6	4.8	4.9	4.9	4.9	4.9	4.0	2.3	5.6	
DEPTH=	2.9	2.2	4.7	5.1	5.3	5.3	5.3	5.3	3.1	1.4	4.2	

T1 GREGORY CANYON LANDFILL ACCESS ROAD & BRIDGE
T2 100-YR FLOOD, MODIFIED FEB 98 BY NOLTE
T3 SAN LUIS REY RIVER EXISTING CONDITIONS

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
		3						30000	305.47	

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	15		-1					-6		15

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

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*PROF 2
0

CCHV=      .100 CEHV=      .300
*SECNO 20.655

3265 DIVIDED FLOW


3470 ENCROACHMENT STATIONS=        87.0     1100.0  TYPE=       1  TARGET=      1013.000
    20.655       5.77     305.47        .00     305.28     306.20        .73        .00        .00     300.10
   30000.0     1350.3    25308.8     3341.0      216.8     3663.1      510.8         .0         .0     302.20
       .00       6.23       6.91       6.54       .050       .050       .040       .000     299.70      87.00
   .006394         0.         0.         0.          0          0          0        .00    1008.48    1100.00


FLOW DISTRIBUTION FOR SECNO=      20.66          CWSEL=     305.47

STA=       87.      110.      143.      881.      893.      897.      944.     1001.     1020.     1036.     1049.     1099.     1100.
  PER Q=        .7       3.8      84.4        .7        .3       4.2       4.7       1.0        .2        .0        .0        .0
   AREA=      52.8     164.0    3663.1      35.0      12.7     174.8     203.5      52.6      20.3       3.1       8.4        .4
    VEL=       4.1       6.9       6.9       6.1       6.2       7.1       6.9       5.8       3.5       1.1       1.0       1.2
  DEPTH=       2.3       5.0       5.0       2.9       3.2       3.7       3.6       2.8       1.3        .2        .2        .4

*SECNO 20.767
3280 CROSS SECTION      20.77 EXTENDED       6.11 FEET


3302 WARNING:  CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE,  KRATIO =  1.45


3470 ENCROACHMENT STATIONS=       163.0      884.0  TYPE=       1  TARGET=       721.000
    20.767       7.71     308.11        .00     308.08     308.72        .61       2.51        .01     300.40
   30000.0     9183.2    14140.8     6676.1     1588.1     2214.8      993.0       62.3       11.7     300.40
       .03       5.78       6.38       6.72       .050       .050       .040       .000     300.40     163.00
   .003031       591.       591.       591.          3          0          0        .00     721.00     884.00


FLOW DISTRIBUTION FOR SECNO=      20.77          CWSEL=     308.11

STA=      163.      265.      296.      315.      430.      435.      722.      738.      767.      884.
  PER Q=       3.1       4.6       3.1      18.9        .8      47.1       3.1       3.5      15.6
   AREA=     289.0     225.5     145.8     888.5      39.2    2214.8     117.7     165.1     710.3
    VEL=       3.2       6.2       6.4       6.4       6.4       6.4       8.0       6.4       6.6
  DEPTH=       2.8       7.3       7.7       7.7       7.7       7.7       7.7       5.6       6.1

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


*SECNO 20.817
3280 CROSS SECTION      20.82 EXTENDED       2.96 FEET
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3470 ENCROACHMENT STATIONS=      210.0    1006.0  TYPE=      1  TARGET=      796.000
    20.817      8.46    308.96       .00    308.88    309.50       .54       .77       .01    300.50
   30000.0   11327.3   15155.8    3516.9    2027.9    2445.2     624.3      91.9      16.3    306.00
       .04      5.59      6.20      5.63      .050      .050      .040      .000    300.50    210.00
   .002880      225.      263.      330.         2         0         0       .00    796.00   1006.00


FLOW DISTRIBUTION FOR SECNO=     20.82          CWSEL=    308.96

STA=     210.     343.     412.     440.     557.     874.     926.     996.    1006.
  PER Q=      5.6      5.9      4.5     21.8     50.5      5.4      5.8       .5
   AREA=    459.8    365.2    214.6    988.4   2445.2    268.3    318.9     37.1
    VEL=      3.6      4.9      6.2      6.6      6.2      6.1      5.5      3.9
  DEPTH=      3.4      5.3      7.7      8.5      7.7      5.2      4.5      3.9

*SECNO 20.831
3280 CROSS SECTION     20.83 EXTENDED      3.12 FEET


3470 ENCROACHMENT STATIONS=      225.0     980.0  TYPE=      1  TARGET=      755.000
    20.831      8.62    309.12       .00    309.05    309.77       .65       .24       .03    300.50
   30000.0    8426.7   17539.0    4034.3    1544.0    2501.8     657.6     100.4      17.6    308.00
       .04      5.46      7.01      6.13      .050      .050      .040      .000    300.50    225.00
   .003384        85.       75.       55.         2         0         0       .00    755.00    980.00


FLOW DISTRIBUTION FOR SECNO=     20.83          CWSEL=    309.12

STA=     225.     345.     414.     508.     526.     831.     884.     948.     980.
  PER Q=      6.4      4.2     14.0      3.5     58.5      3.9      7.3      2.3
   AREA=    456.0    283.7    658.5    145.9   2501.8    192.3    331.7    133.6
    VEL=      4.2      4.4      6.4      7.2      7.0      6.0      6.6      5.2
  DEPTH=      3.8      4.1      6.9      8.5      8.2      3.6      5.2      4.1

CCHV=      .300 CEHV=      .500
*SECNO 20.849
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    SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS     L-BANK ELEV
    Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA       R-BANK ELEV
    TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN     SSTA
    SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID    ENDST


3280 CROSS SECTION     20.85 EXTENDED      3.39 FEET


3470 ENCROACHMENT STATIONS=      217.0     935.0  TYPE=      1  TARGET=      718.000
    20.849      8.79    309.39       .00    309.27    310.17       .78       .34       .06    303.00
   30000.0    7752.8   20306.2    1941.0    1081.6    2800.6     389.2     110.4      19.3    307.00
       .05      7.17      7.25      4.99      .035      .050      .040      .000    300.60    217.00
   .003525       102.       97.       88.         2         0         0       .00    718.00    935.00


FLOW DISTRIBUTION FOR SECNO=     20.85          CWSEL=    309.39
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STA=	217.	325.	375.	413.	429.	450.	464.	799.	913.	935.
PER Q=	5.2	5.5	4.6	3.6	4.3	2.6	67.7	4.6	1.8	
AREA=	311.0	234.8	186.2	118.1	142.4	89.0	2800.6	293.2	96.0	
VEL=	5.0	7.1	7.3	9.2	9.1	8.7	7.3	4.7	5.7	
DEPTH=	2.9	4.7	5.0	7.1	6.9	6.4	8.4	2.6	4.3	

*SECNO 20.872

3280 CROSS SECTION 20.87 EXTENDED 3.06 FEET

3470 ENCROACHMENT STATIONS= 250.0 960.0 TYPE= 1 TARGET= 710.000

20.872	9.36	310.06	.00	309.82	310.58	.52	.33	.08	303.00
30000.0	4390.4	24704.9	904.7	847.2	4152.5	198.3	123.8	21.3	304.00
.05	5.18	5.95	4.56	.035	.050	.040	.000	300.70	250.00
.002141	105.	124.	162.	2	0	0	.00	710.00	960.00

FLOW DISTRIBUTION FOR SECNO= 20.87 CWSEL= 310.06

STA=	250.	292.	342.	419.	427.	432.	449.	455.	917.	928.	938.	942.	960.
PER Q=	1.5	2.7	6.4	.7	.5	1.9	1.0	82.3	1.1	.8	.2	1.0	
AREA=	117.8	175.9	353.0	37.8	25.8	94.9	42.0	4152.5	61.1	49.7	13.1	74.5	
VEL=	3.7	4.6	5.4	5.8	5.8	6.2	6.8	5.9	5.4	4.7	4.4	3.8	
DEPTH=	2.8	3.6	4.6	5.1	5.1	5.6	6.6	9.0	5.6	4.6	4.1	4.1	

*SECNO 20.891

3280 CROSS SECTION 20.89 EXTENDED 3.27 FEET

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

3470 ENCROACHMENT STATIONS= 280.0 950.0 TYPE= 1 TARGET= 670.000

20.891	9.27	310.27	.00	310.05	310.87	.60	.25	.04	303.00
30000.0	2926.8	26308.1	765.2	598.8	4139.7	155.9	136.5	23.0	304.00
.06	4.89	6.36	4.91	.035	.050	.040	.000	301.00	280.00
.002485	115.	110.	95.	2	0	0	.00	670.00	950.00

FLOW DISTRIBUTION FOR SECNO= 20.89 CWSEL= 310.27

STA=	280.	348.	446.	447.	449.	451.	916.	920.	928.	946.	950.
PER Q=	2.9	6.3	.2	.2	.2	87.7	.5	.6	1.3	.2	
AREA=	202.1	366.1	8.7	11.7	10.2	4139.7	24.3	35.8	79.7	16.0	
VEL=	4.2	5.1	5.5	6.3	6.7	6.4	5.9	5.2	4.9	2.9	
DEPTH=	3.0	3.8	4.8	5.8	6.8	8.9	5.8	4.8	4.3	4.3	

*SECNO 20.936

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 244.8 861.2 TYPE= 1 TARGET= 616.360

Downstream Face - Proposed 638' Bridge w/ Riprap on Abutments
Pier Width=5.5' with 4' debris blockage on each pier.

20.936	9.29	310.79	.00	310.60	311.44	.66	.54	.03	302.00
30000.0	617.0	19602.3	9780.8	157.5	2931.7	1564.4	162.8	26.4	302.00
.07	3.92	6.69	6.25	.035	.040	.040	.000	301.50	244.82
.002063	240.	240.	240.	2	0	0	.00	568.82	861.18

FLOW DISTRIBUTION FOR SECNO= 20.94 CWSEL= 310.79

STA=	245.	302.	647.	689.	711.	747.	769.	807.	823.	845.	861.
PER Q=	2.1	65.3	5.1	4.2	6.9	4.1	4.2	3.1	4.1	.9	
AREA=	157.5	2931.7	285.9	180.7	299.5	177.3	237.6	135.1	179.7	68.6	
VEL=	3.9	6.7	5.4	6.9	6.9	6.9	5.3	6.9	6.9	4.1	
DEPTH=	2.7	9.3	6.7	8.3	8.3	8.3	6.2	8.3	8.3	4.2	

*SECNO 20.943

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

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 244.6 861.4 TYPE= 1 TARGET= 616.840
Upstream Face

20.943	9.30	310.90	.00	310.72	311.55	.65	.10	.00	302.00
30000.0	649.5	19453.5	9897.0	164.0	2936.7	1586.7	168.2	27.1	302.00
.07	3.96	6.62	6.24	.035	.040	.040	.000	301.60	244.58
.002021	50.	50.	50.	0	0	0	.00	569.30	861.42

FLOW DISTRIBUTION FOR SECNO= 20.94 CWSEL= 310.90

STA=	245.	302.	647.	689.	711.	747.	769.	807.	823.	845.	861.
PER Q=	2.2	64.8	5.2	4.2	7.0	4.1	4.2	3.1	4.2	1.0	
AREA=	164.0	2936.7	289.7	183.2	303.6	179.7	240.9	136.9	182.2	70.5	
VEL=	4.0	6.6	5.3	6.9	6.9	6.9	5.2	6.9	6.9	4.1	
DEPTH=	2.9	9.3	6.8	8.4	8.4	8.4	6.3	8.4	8.4	4.3	

CCHV= .100 CEHV= .300
*SECNO 20.960

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 254.0 1000.0 TYPE= 1 TARGET= 746.000

20.960	9.67	311.47	.00	311.35	311.89	.42	.32	.02	305.00
30000.0	95.5	16879.0	13025.5	23.8	3449.4	2346.6	189.4	29.8	302.00
.08	4.01	4.89	5.55	.035	.050	.040	.000	301.80	254.00
.001596	140.	140.	235.	2	0	0	.00	743.08	1000.00

FLOW DISTRIBUTION FOR SECNO= 20.96 CWSEL= 311.47

STA=	254.	259.	668.	704.	732.	769.	907.	959.	1000.
PER Q=	.3	56.3	6.9	4.9	4.8	17.3	6.6	2.9	
AREA=	23.8	3449.4	324.1	236.7	261.7	959.5	366.6	198.1	
VEL=	4.0	4.9	6.4	6.2	5.5	5.4	5.4	4.4	
DEPTH=	4.4	8.5	9.0	8.5	7.1	7.0	7.0	4.8	

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

CCHV= .100 CEHV= .300
*SECNO 20.996
2750 NUMBER OF COMPUTED POINTS EXCEED 100

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 1115.0 1875.0 TYPE= 1 TARGET= 760.000

20.996	9.48	311.58	.00	311.50	312.14	.56	.21	.04	302.10
30000.0	319.8	17734.7	11945.5	45.2	3064.7	1914.7	202.7	31.6	303.00
.08	7.07	5.79	6.24	.035	.050	.040	.000	302.10	1115.00
.002490	108.	115.	95.	2	0	0	.00	744.78	1875.00

FLOW DISTRIBUTION FOR SECNO= 21.00 CWSEL= 311.58

STA=	1115.	1120.	1528.	1554.	1578.	1594.	1615.	1678.	1754.	1837.	1875.
PER Q=	1.1	59.1	6.6	6.1	4.0	4.3	6.4	4.9	4.3	3.2	
AREA=	45.2	3064.7	239.4	222.0	147.5	173.3	338.1	308.9	299.7	185.8	
VEL=	7.1	5.8	8.2	8.3	8.1	7.5	5.7	4.7	4.3	5.2	
DEPTH=	9.3	7.8	9.3	9.5	9.1	8.1	5.4	4.1	3.6	4.9	

*SECNO 21.093
2750 NUMBER OF COMPUTED POINTS EXCEED 100
2750 NUMBER OF COMPUTED POINTS EXCEED 100
2750 NUMBER OF COMPUTED POINTS EXCEED 100
2750 NUMBER OF COMPUTED POINTS EXCEED 100

3470 ENCROACHMENT STATIONS= 1052.0 1807.0 TYPE= 1 TARGET= 755.000

21.093	7.61	312.01	.00	311.91	312.67	.66	.50	.03	306.00
30000.0	.5	15267.8	14731.8	.8	2416.3	2204.4	222.7	34.6	305.00
.09	.60	6.32	6.68	.035	.050	.040	.000	304.40	1052.00
.003145	227.	215.	135.	2	0	0	.00	755.00	1807.00

FLOW DISTRIBUTION FOR SECNO= 21.09 CWSEL= 312.01

STA=	1052.	1052.	1379.	1459.	1492.	1518.	1540.	1569.	1595.	1630.	1665.	1754.	1798.
PER Q=	.0	50.9	3.7	3.9	3.6	4.2	6.0	5.3	4.6	4.2	6.6	6.0	
AREA=	.8	2416.3	211.9	181.7	156.9	160.0	224.0	196.0	203.1	194.9	363.9	260.7	
VEL=	.6	6.3	5.2	6.5	6.8	7.9	8.1	8.1	6.7	6.5	5.4	6.9	
DEPTH=	6.0	7.4	2.6	5.5	5.9	7.4	7.6	7.6	5.8	5.5	4.1	6.0	

STA= 1798. 1807.
PER Q= 1.0
AREA= 51.4
VEL= 6.0
DEPTH= 5.4

1

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

*SECNO 21.137

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = .51

3470 ENCROACHMENT STATIONS= 442.0 1495.0 TYPE= 1 TARGET= 1053.000

21.137	8.21	314.31	.00	314.08	315.70	1.40	2.81	.22	311.80
30000.0	3772.6	25896.6	330.8	611.4	2620.0	38.5	269.0	44.6	307.00
.11	6.17	9.88	8.59	.035	.050	.040	.000	306.10	442.00
.012005	450.	510.	530.	4	0	0	.00	996.67	1495.00

FLOW DISTRIBUTION FOR SECNO= 21.14 CWSEL= 314.31

STA=	442.	745.	919.	990.	1485.	1495.
PER Q=	3.0	4.9	4.6	86.3	1.1	
AREA=	218.7	225.3	167.3	2620.0	38.5	
VEL=	4.2	6.6	8.2	9.9	8.6	
DEPTH=	.7	1.3	2.4	5.3	3.8	

*SECNO 21.246

3265 DIVIDED FLOW

3301 HV CHANGED MORE THAN HVINS

3302 WARNING: CONVEYANCE CHANGE OUTSIDE OF ACCEPTABLE RANGE, KRATIO = 2.74

3470 ENCROACHMENT STATIONS= 49.0 1456.0 TYPE= 1 TARGET= 1407.000

21.246	7.83	317.43	.00	317.48	317.70	.28	1.89	.11	313.50
30000.0	9834.1	17538.9	2626.9	2259.3	4110.6	774.1	334.3	59.1	314.60
.14	4.35	4.27	3.39	.035	.050	.040	.000	309.60	49.00
.001599	450.	575.	650.	3	0	0	.00	1405.28	1456.00

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

FLOW DISTRIBUTION FOR SECNO= 21.25 CWSEL= 317.43

STA=	49.	156.	236.	304.	379.	428.	478.	515.	556.	613.	1216.	1346.	1456.
PER Q=	4.2	3.3	3.6	4.2	3.1	4.2	3.7	3.3	3.1	58.5	3.4	5.3	
AREA=	346.4	261.5	261.0	295.9	210.2	254.0	207.6	201.9	221.0	4110.6	353.3	420.7	
VEL=	3.7	3.7	4.2	4.2	4.5	5.0	5.4	4.9	4.2	4.3	2.9	3.8	
DEPTH=	3.2	3.3	3.8	3.9	4.3	5.1	5.6	4.9	3.9	6.8	2.7	3.8	

*SECNO 21.359

3265 DIVIDED FLOW

3470 ENCROACHMENT STATIONS= 32.0 1543.0 TYPE= 1 TARGET= 1511.000

21.359	5.27	318.27	.00	318.28	318.68	.42	.94	.04	317.30
30000.0	10336.1	19663.9	.0	2372.3	3518.0	.0	414.2	76.4	100000.00
.17	4.36	5.59	.00	.040	.030	.000	.000	313.00	32.00
.001932	380.	600.	800.	3	0	0	.00	1454.71	1542.93

FLOW DISTRIBUTION FOR SECNO= 21.36 CWSEL= 318.27

STA=	32.	150.	279.	330.	370.	415.	461.	509.	555.	638.	689.	1549.
PER Q=	3.9	3.6	3.7	3.3	3.9	4.0	4.2	4.0	3.4	.6	65.5	
AREA=	337.9	285.3	240.6	204.1	235.8	242.4	253.0	243.0	257.3	72.8	3518.0	
VEL=	3.4	3.8	4.6	4.8	4.9	4.9	4.9	4.9	4.0	2.3	5.6	
DEPTH=	2.9	2.2	4.7	5.1	5.3	5.3	5.3	5.3	3.1	1.4	4.1	

THIS RUN EXECUTED 05AUG99 09:31:32

****
HEC-2 WATER SURFACE PROFILES

Version 4.6.2; May 1991
****

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

SAN LUIS REY RIVER

SUMMARY PRINTOUT TABLE 150

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	20.655	.00	.00	.00	299.70	30000.00	305.28	.00	306.07	73.44	7.21	4201.89	3500.63
	20.655	.00	.00	.00	299.70	30000.00	305.47	.00	306.20	63.94	6.91	4390.72	3751.67
*	20.767	591.00	.00	.00	300.40	30000.00	308.08	.00	308.62	27.92	6.12	5162.37	5677.87
*	20.767	591.00	.00	.00	300.40	30000.00	308.11	.00	308.72	30.31	6.38	4795.88	5449.41
	20.817	263.00	.00	.00	300.50	30000.00	308.88	.00	309.35	27.15	5.98	5491.57	5757.14
	20.817	263.00	.00	.00	300.50	30000.00	308.96	.00	309.50	28.80	6.20	5097.49	5590.28
	20.831	75.00	.00	.00	300.50	30000.00	309.05	.00	309.59	29.73	6.53	5246.93	5502.45
	20.831	75.00	.00	.00	300.50	30000.00	309.12	.00	309.77	33.84	7.01	4703.43	5157.25
	20.849	97.00	.00	.00	300.60	30000.00	309.27	.00	309.97	32.90	6.94	4571.20	5230.60
	20.849	97.00	.00	.00	300.60	30000.00	309.39	.00	310.17	35.25	7.25	4271.43	5053.03
	20.872	124.00	.00	.00	300.70	30000.00	309.82	.00	310.35	23.23	6.09	5160.50	6224.54
	20.872	124.00	.00	.00	300.70	30000.00	310.06	.00	310.58	21.41	5.95	5197.98	6482.82
	20.891	110.00	.00	.00	301.00	30000.00	310.05	.00	310.67	26.83	6.49	4830.23	5792.04
	20.891	110.00	.00	.00	301.00	30000.00	310.27	.00	310.87	24.85	6.36	4894.37	6017.56
	20.936	240.00	.00	.00	301.50	30000.00	310.60	.00	311.29	22.13	6.85	4547.75	6377.18
	20.936	240.00	.00	.00	301.50	30000.00	310.79	.00	311.44	20.63	6.69	4653.59	6604.29
	20.943	50.00	.00	.00	301.60	30000.00	310.72	.00	311.40	21.60	6.77	4586.45	6455.23
	20.943	50.00	.00	.00	301.60	30000.00	310.90	.00	311.55	20.21	6.62	4687.44	6673.04
	20.960	140.00	.00	.00	301.80	30000.00	311.35	.00	311.76	16.37	4.91	5867.43	7414.54
	20.960	140.00	.00	.00	301.80	30000.00	311.47	.00	311.89	15.96	4.89	5819.88	7510.08
	20.996	115.00	.00	.00	302.10	30000.00	311.50	.00	311.99	23.61	5.60	5349.03	6173.96
	20.996	115.00	.00	.00	302.10	30000.00	311.58	.00	312.14	24.90	5.79	5024.56	6012.40

	SECNO	XLCH	ELTRD	ELLC	ELMIN	Q	CWSEL	CRIWS	EG	10*KS	VCH	AREA	.01K
	21.093	215.00	.00	.00	304.40	30000.00	311.91	.00	312.49	29.85	6.10	4973.30	5491.38
	21.093	215.00	.00	.00	304.40	30000.00	312.01	.00	312.67	31.45	6.32	4621.42	5349.76
*	21.137	510.00	.00	.00	306.10	30000.00	314.08	314.08	315.69	144.94	10.55	3048.96	2491.88
*	21.137	510.00	.00	.00	306.10	30000.00	314.31	.00	315.70	120.05	9.88	3269.82	2738.03
*	21.246	575.00	.00	.00	309.60	30000.00	317.48	.00	317.74	15.26	4.19	7267.22	7680.49
*	21.246	575.00	.00	.00	309.60	30000.00	317.43	.00	317.70	15.99	4.27	7143.98	7502.70
	21.359	600.00	.00	.00	313.00	30000.00	318.28	.00	318.70	19.05	5.57	5916.40	6873.73
	21.359	600.00	.00	.00	313.00	30000.00	318.27	.00	318.68	19.32	5.59	5890.24	6825.22

SAN LUIS REY RIVER

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
	20.655	30000.00	305.28	.00	.00	.00	979.02	.00
	20.655	30000.00	305.47	.19	.00	.19	1008.48	.00
*	20.767	30000.00	308.08	.00	2.80	.00	900.83	591.00
*	20.767	30000.00	308.11	.02	2.64	.02	721.00	591.00
	20.817	30000.00	308.88	.00	.80	.00	1004.78	263.00
	20.817	30000.00	308.96	.08	.85	.08	796.00	263.00
	20.831	30000.00	309.05	.00	.17	.00	942.00	75.00
	20.831	30000.00	309.12	.07	.16	.07	755.00	75.00
	20.849	30000.00	309.27	.00	.22	.00	827.00	97.00
	20.849	30000.00	309.39	.11	.27	.11	718.00	97.00
	20.872	30000.00	309.82	.00	.54	.00	803.00	124.00
	20.872	30000.00	310.06	.24	.67	.24	710.00	124.00
	20.891	30000.00	310.05	.00	.23	.00	708.00	110.00
	20.891	30000.00	310.27	.22	.22	.22	670.00	110.00
	20.936	30000.00	310.60	.00	.55	.00	568.86	240.00
	20.936	30000.00	310.79	.19	.51	.19	568.82	240.00
	20.943	30000.00	310.72	.00	.13	.00	569.35	50.00
	20.943	30000.00	310.90	.18	.12	.18	569.30	50.00
	20.960	30000.00	311.35	.00	.62	.00	800.75	140.00
	20.960	30000.00	311.47	.12	.57	.12	743.08	140.00
	20.996	30000.00	311.50	.00	.15	.00	978.12	115.00
	20.996	30000.00	311.58	.08	.11	.08	744.78	115.00
	21.093	30000.00	311.91	.00	.41	.00	1040.56	215.00
	21.093	30000.00	312.01	.10	.43	.10	755.00	215.00
*	21.137	30000.00	314.08	.00	2.17	.00	988.39	510.00
*	21.137	30000.00	314.31	.22	2.30	.22	996.67	510.00
*	21.246	30000.00	317.48	.00	3.39	.00	1426.76	575.00
*	21.246	30000.00	317.43	-.05	3.12	-.05	1405.28	575.00
	21.359	30000.00	318.28	.00	.80	.00	1455.05	600.00
	21.359	30000.00	318.27	-.02	.84	-.02	1454.71	600.00

SUMMARY OF ERRORS AND SPECIAL NOTES

WARNING SECNO= 20.767 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

WARNING SECNO= 20.767 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

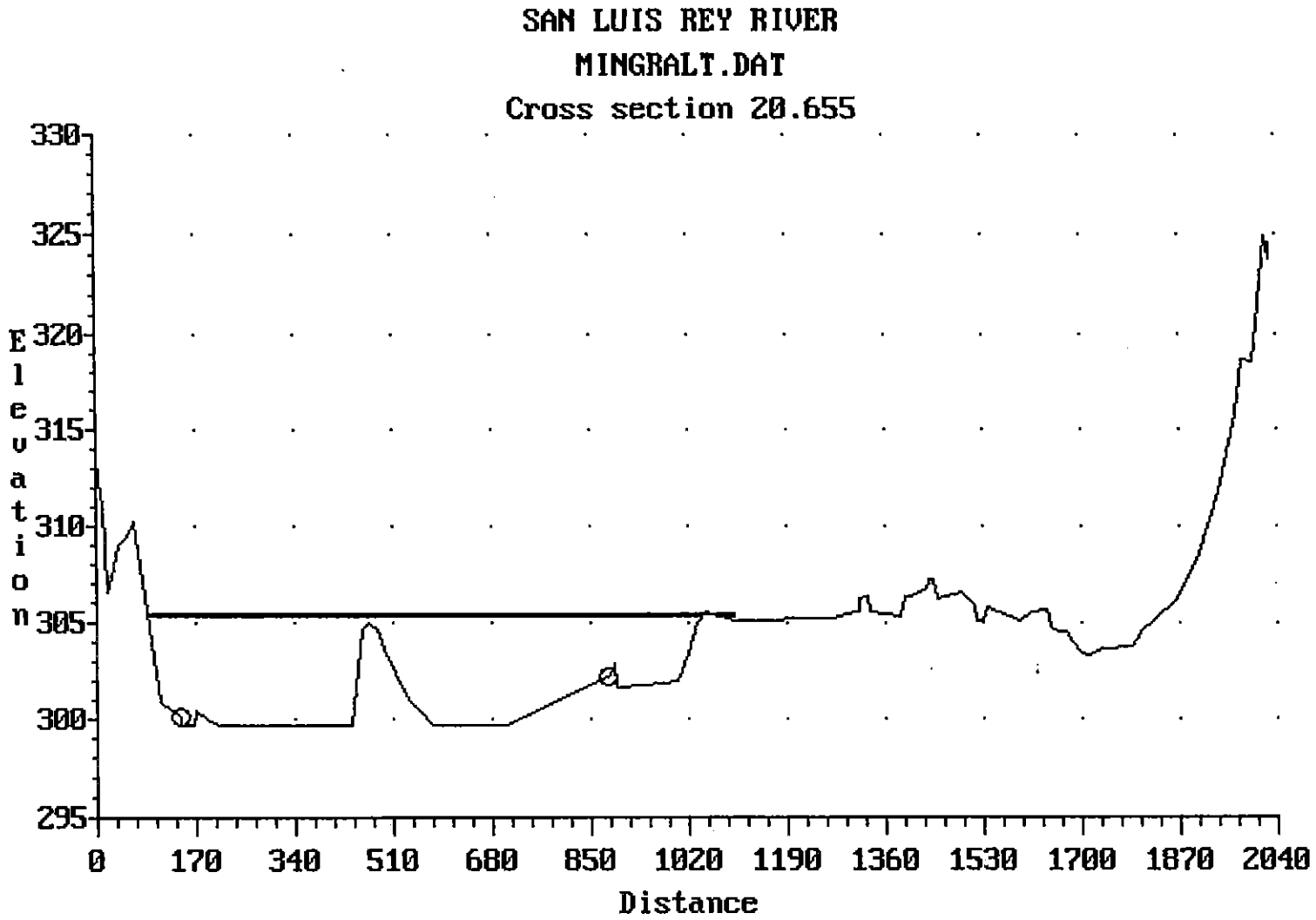
CAUTION SECNO= 21.137 PROFILE= 1 CRITICAL DEPTH ASSUMED
CAUTION SECNO= 21.137 PROFILE= 1 MINIMUM SPECIFIC ENERGY
WARNING SECNO= 21.137 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

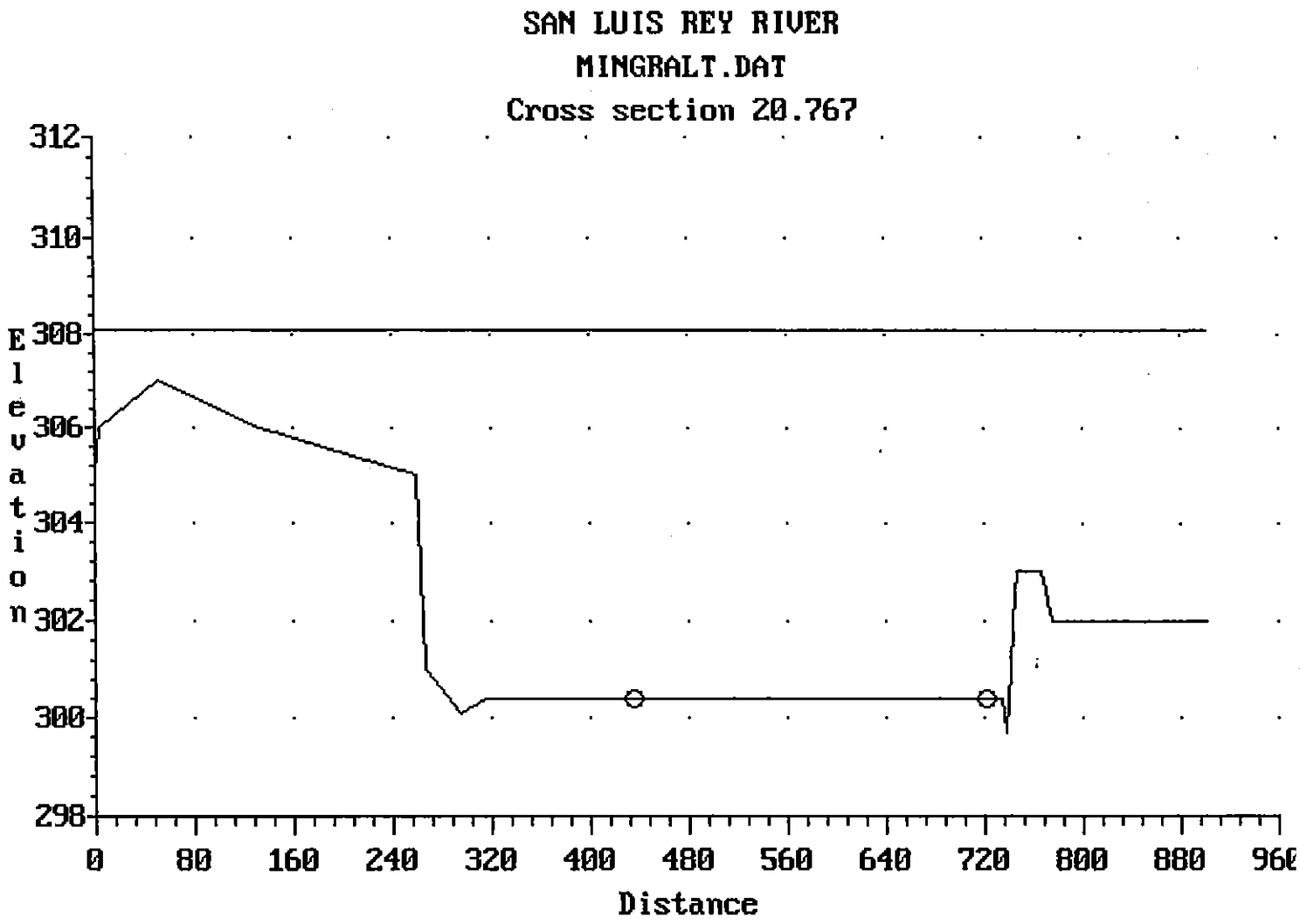
WARNING SECNO= 21.246 PROFILE= 1 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE
WARNING SECNO= 21.246 PROFILE= 2 CONVEYANCE CHANGE OUTSIDE ACCEPTABLE RANGE

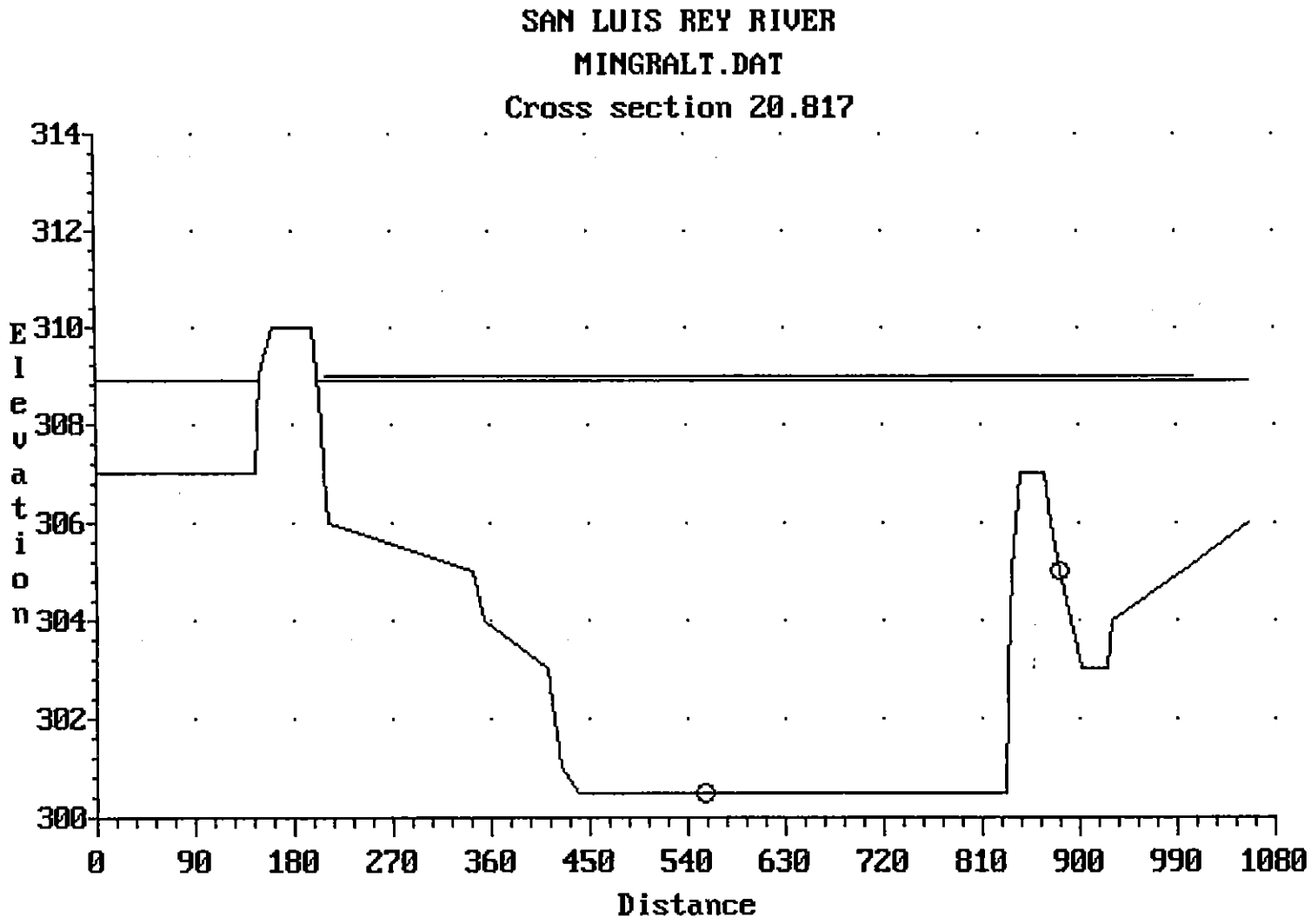
1

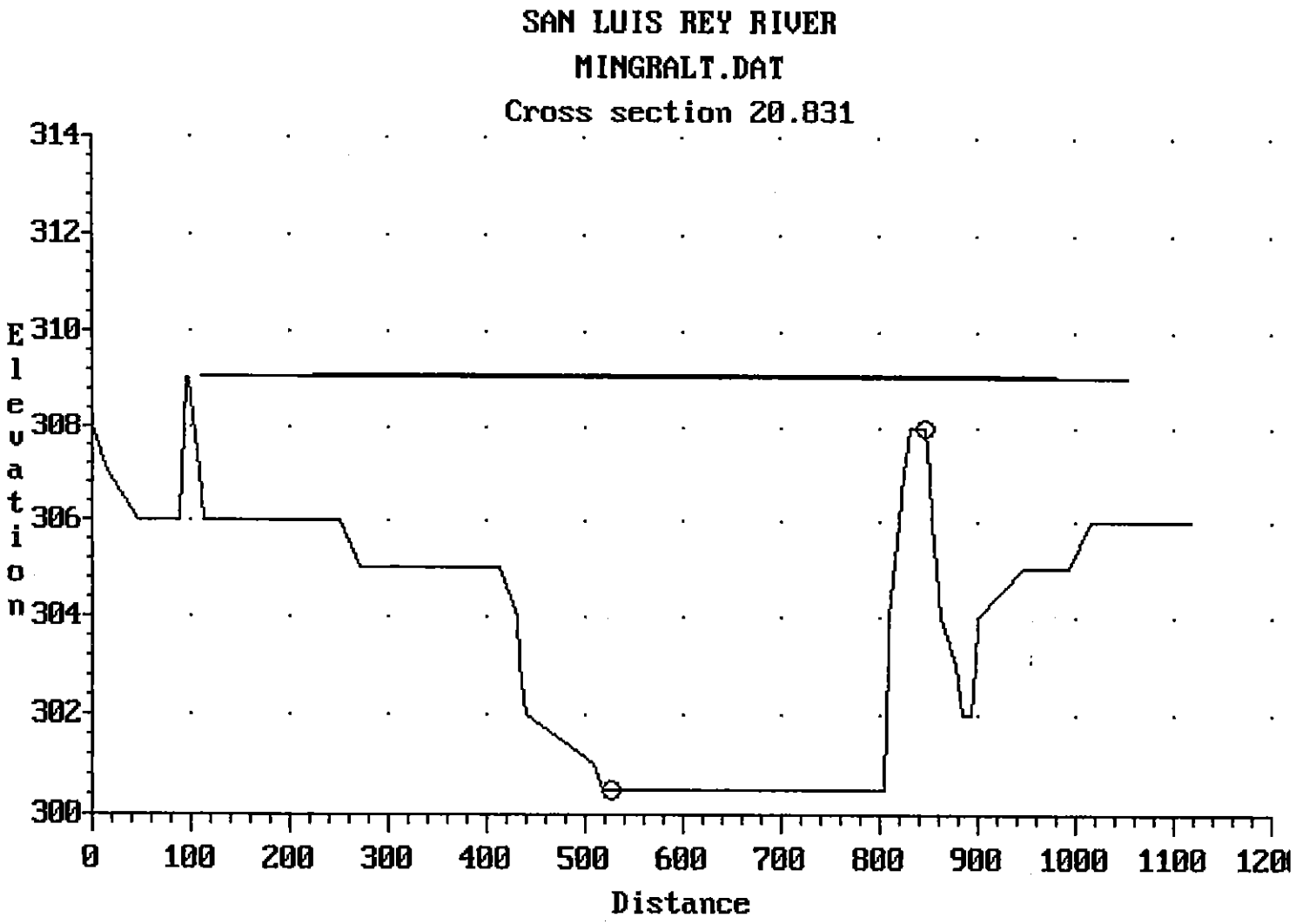
FLOODWAY DATA, SAN LUIS REY RIVER
PROFILE NO. 2

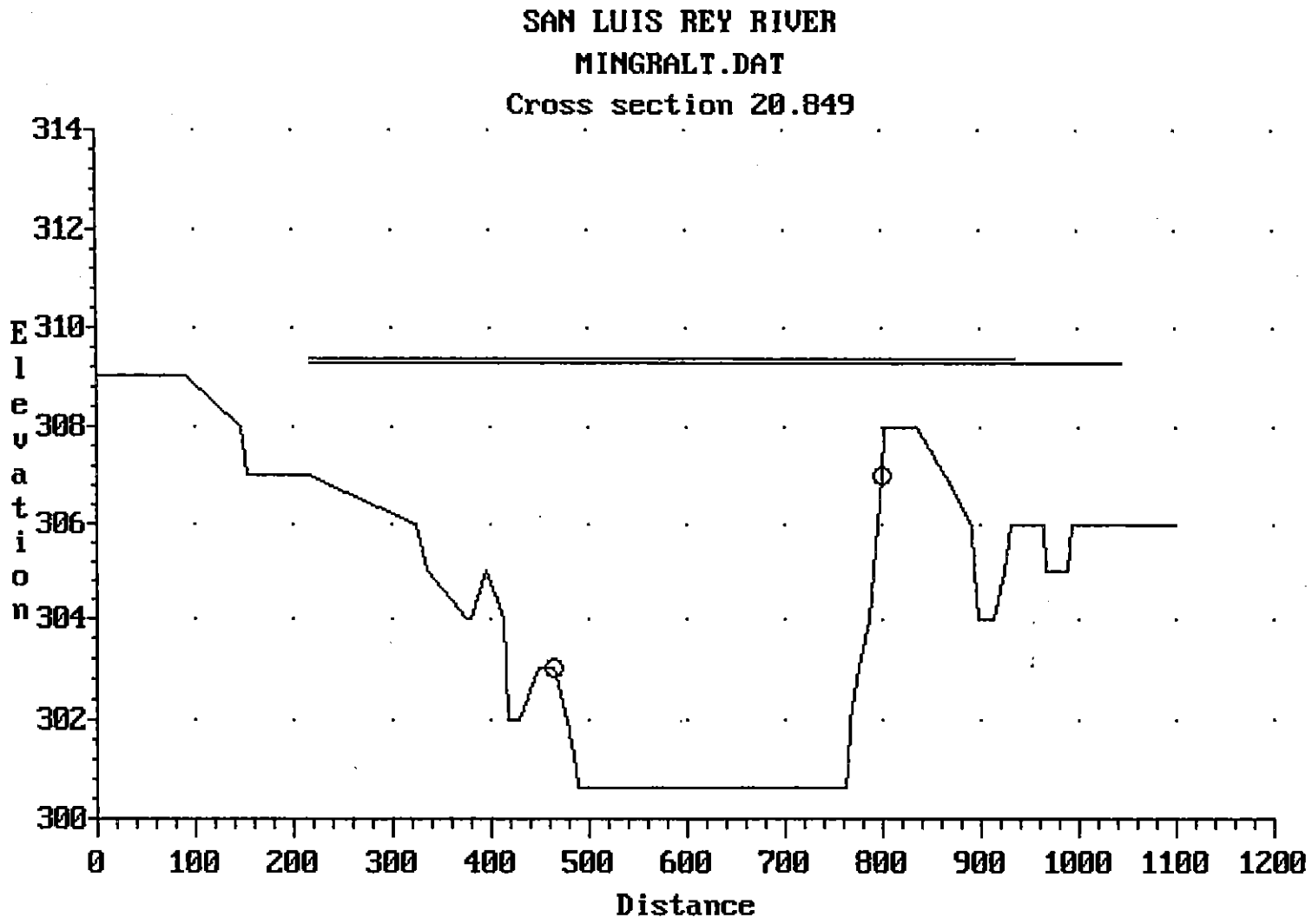
STATION	FLOODWAY WIDTH	FLOODWAY SECTION AREA	FLOODWAY MEAN VELOCITY	WATER SURFACE ELEVATION WITH FLOODWAY	WITHOUT FLOODWAY	DIFFERENCE
20.655	1013.	4391.	6.8	305.5	305.3	.2
20.767	721.	4796.	6.3	308.1	308.1	.0
20.817	796.	5097.	5.9	309.0	308.9	.1
20.831	755.	4703.	6.4	309.1	309.0	.1
20.849	718.	4271.	7.0	309.4	309.3	.1
20.872	710.	5198.	5.8	310.0	309.8	.2
20.891	670.	4894.	6.1	310.3	310.1	.2
20.936	616.	4654.	6.4	310.8	310.6	.2
20.943	617.	4687.	6.4	310.9	310.7	.2
20.960	746.	5820.	5.2	311.4	311.3	.1
20.996	760.	5025.	6.0	311.6	311.5	.1
21.093	755.	4621.	6.5	312.0	311.9	.1
21.137	1053.	3270.	9.2	314.3	314.1	.2
21.246	1407.	7144.	4.2	317.5	317.5	.0
21.359	1511.	5890.	5.1	318.3	318.3	.0

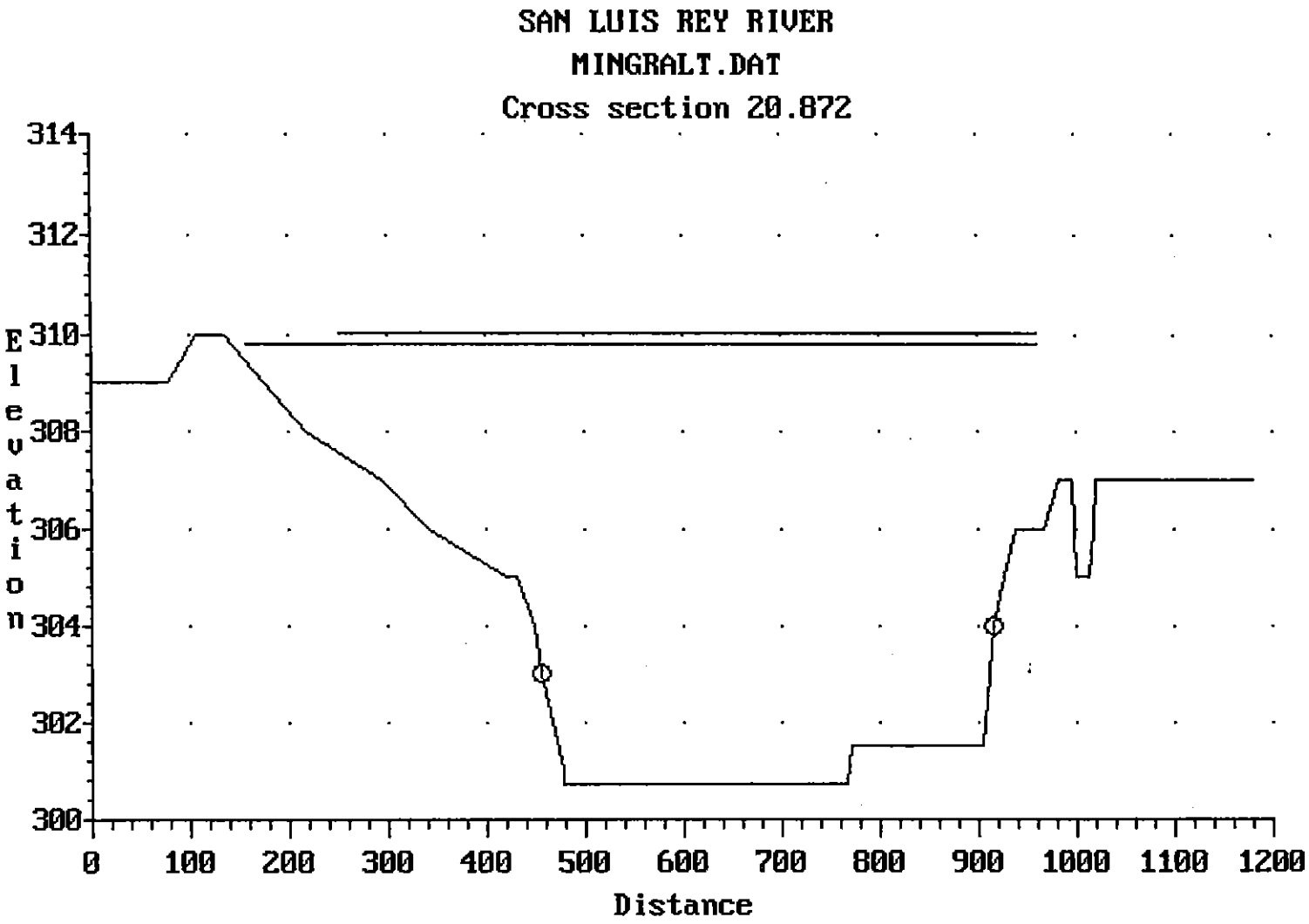

SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.655
Elevation
330
325
320
315
310
305
300
295
0
170
340
510
680
850
1020
1190
1360
1530
1700
1870
2040
Distance

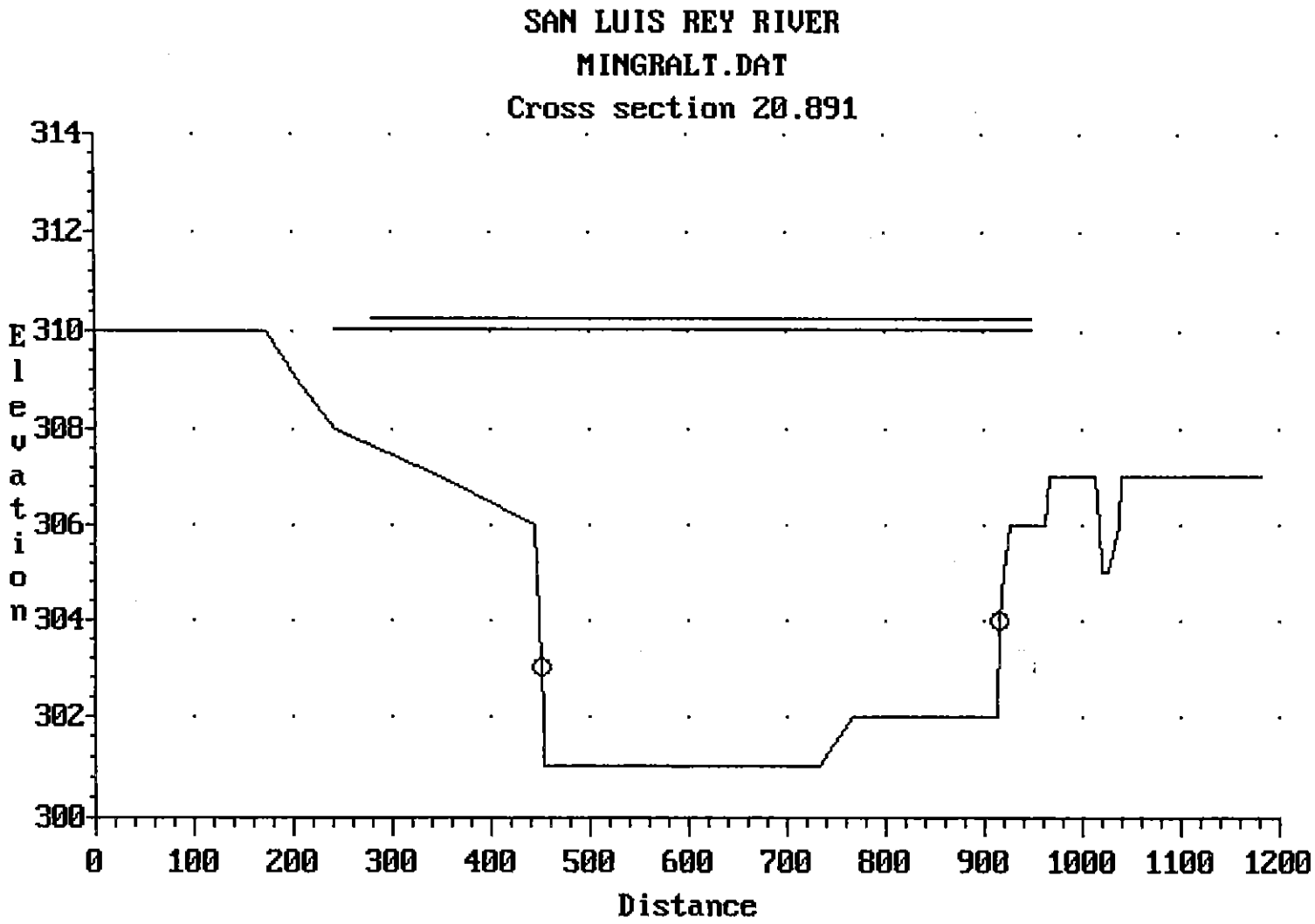

SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.767
312
310
308
306
304
302
300
298
Elevation
0
80
160
240
320
400
480
560
640
720
800
880
960
Distance

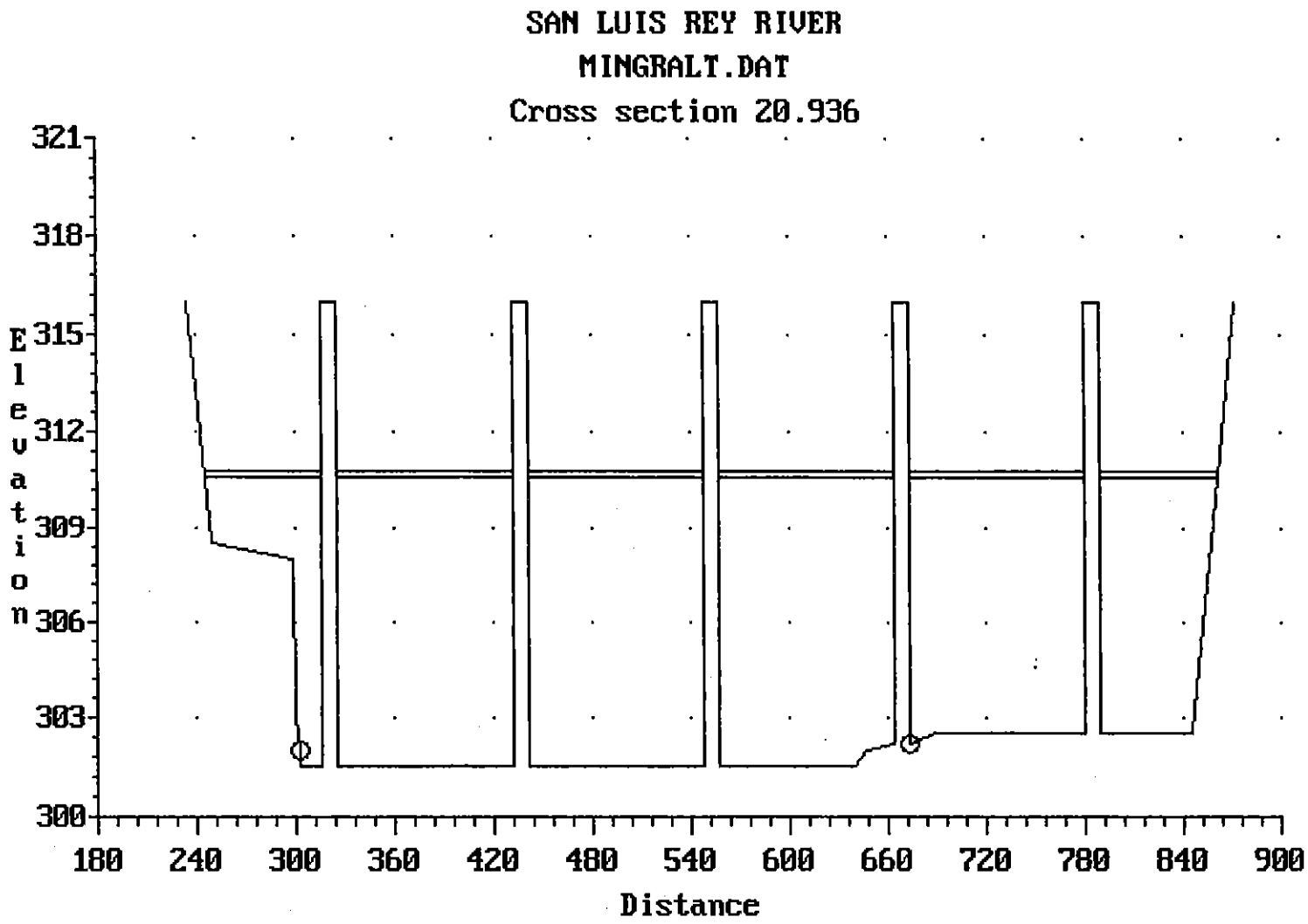

SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.817
Elevation
314
312
310
308
306
304
302
300
0
90
180
270
360
450
540
630
720
810
900
990
1080
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.831
Elevation
314
312
310
308
306
304
302
300
0
100
200
300
400
500
600
700
800
900
1000
1100
120
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.849
Elevation
314
312
310
308
306
304
302
300
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.872
Elevation
314
312
310
308
306
304
302
300
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.891
Elevation
314
312
310
308
306
304
302
300
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.936
Elevation
321
318
315
312
309
306
303
300
180
240
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540
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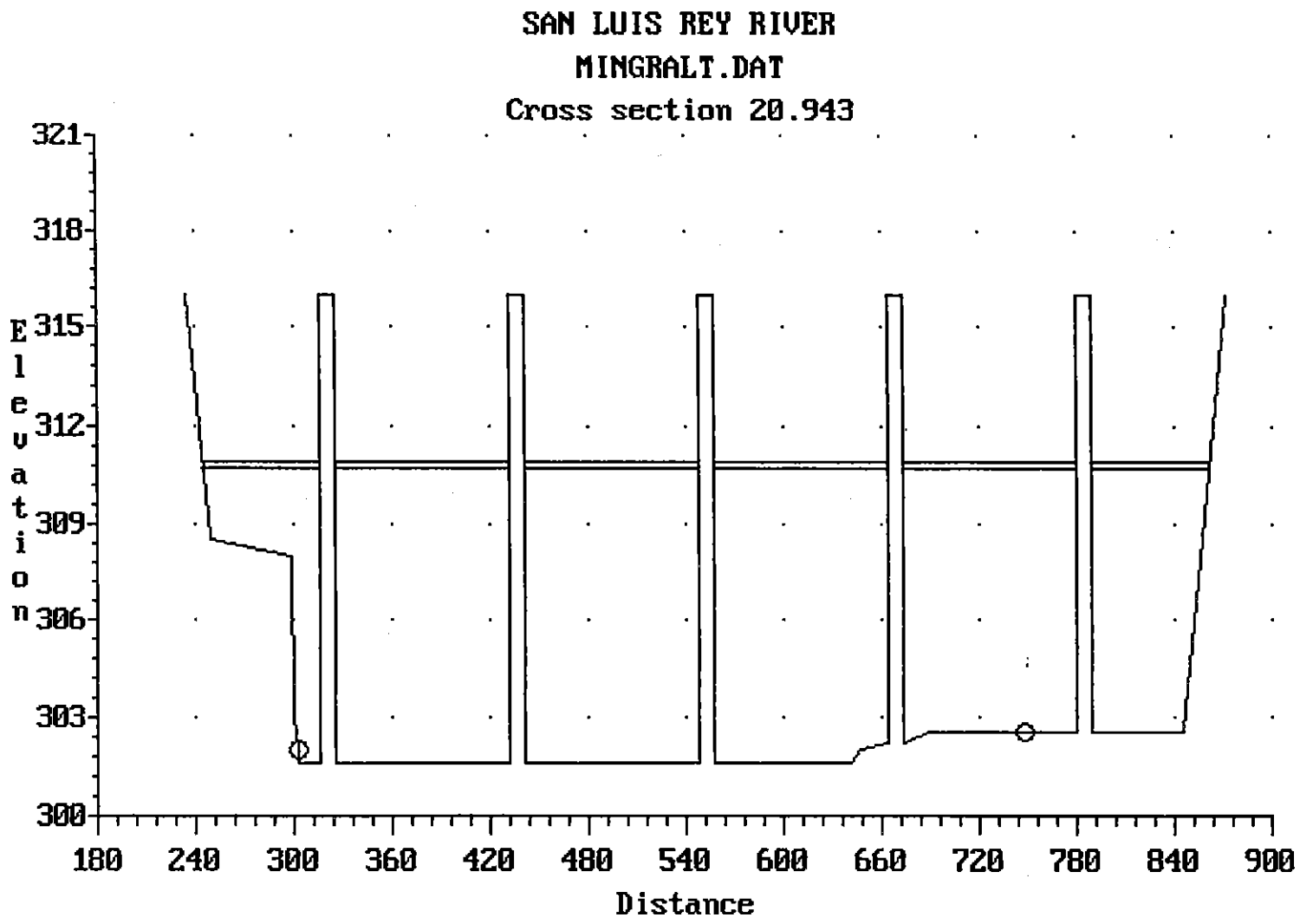
660
720
780
840
900
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.943
Elevation
321
318
315
312
309
306
303
300
180
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360
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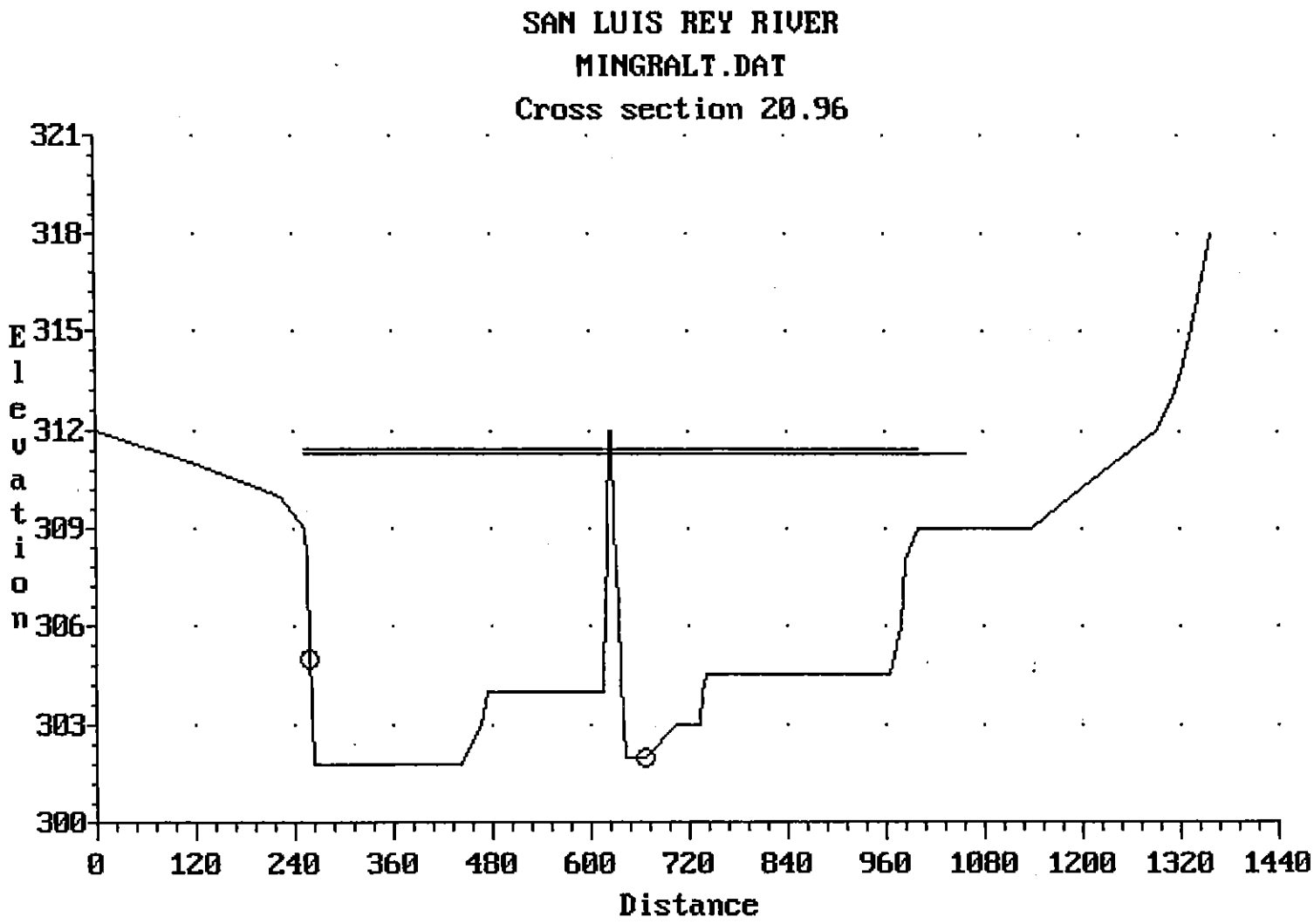
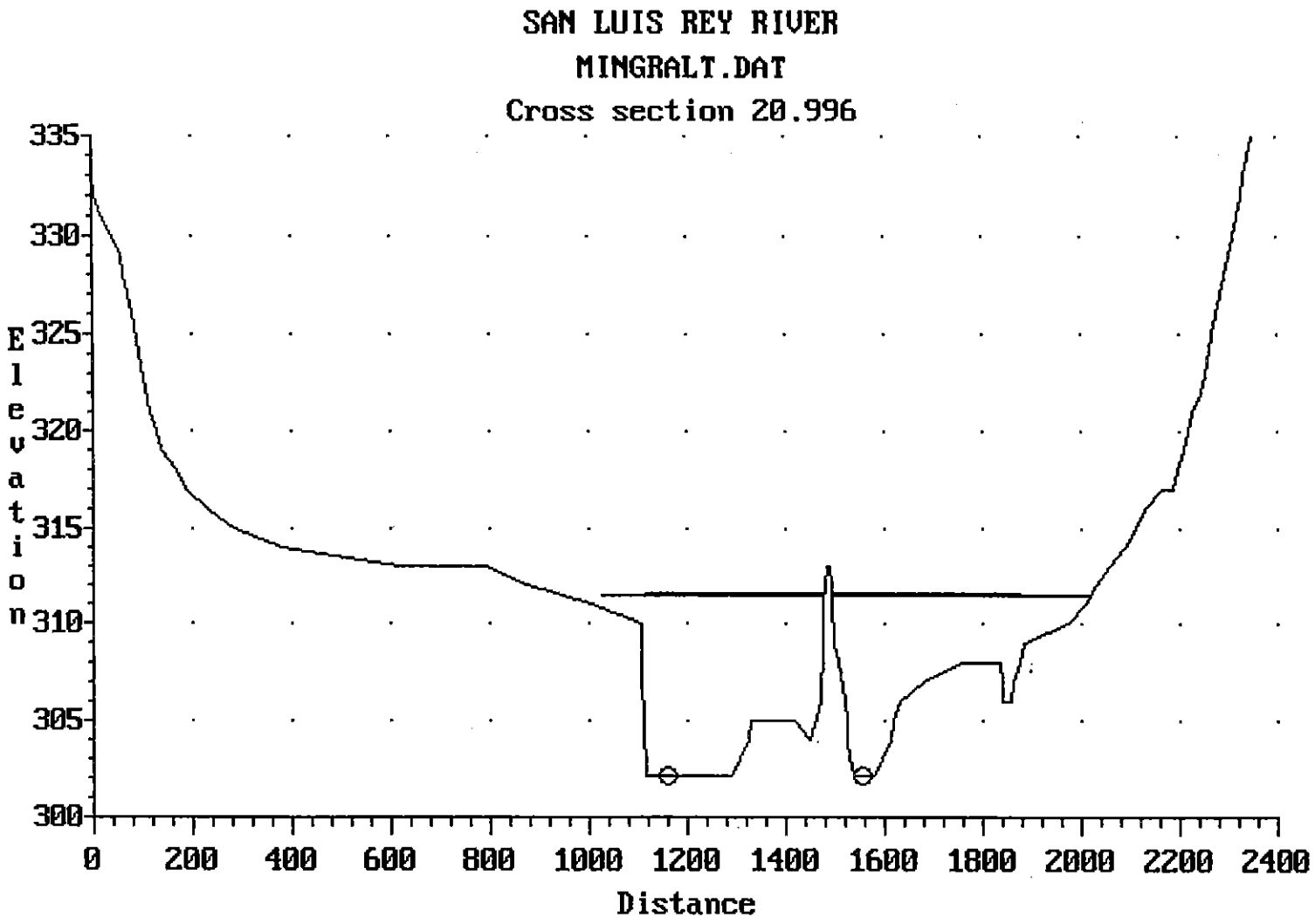
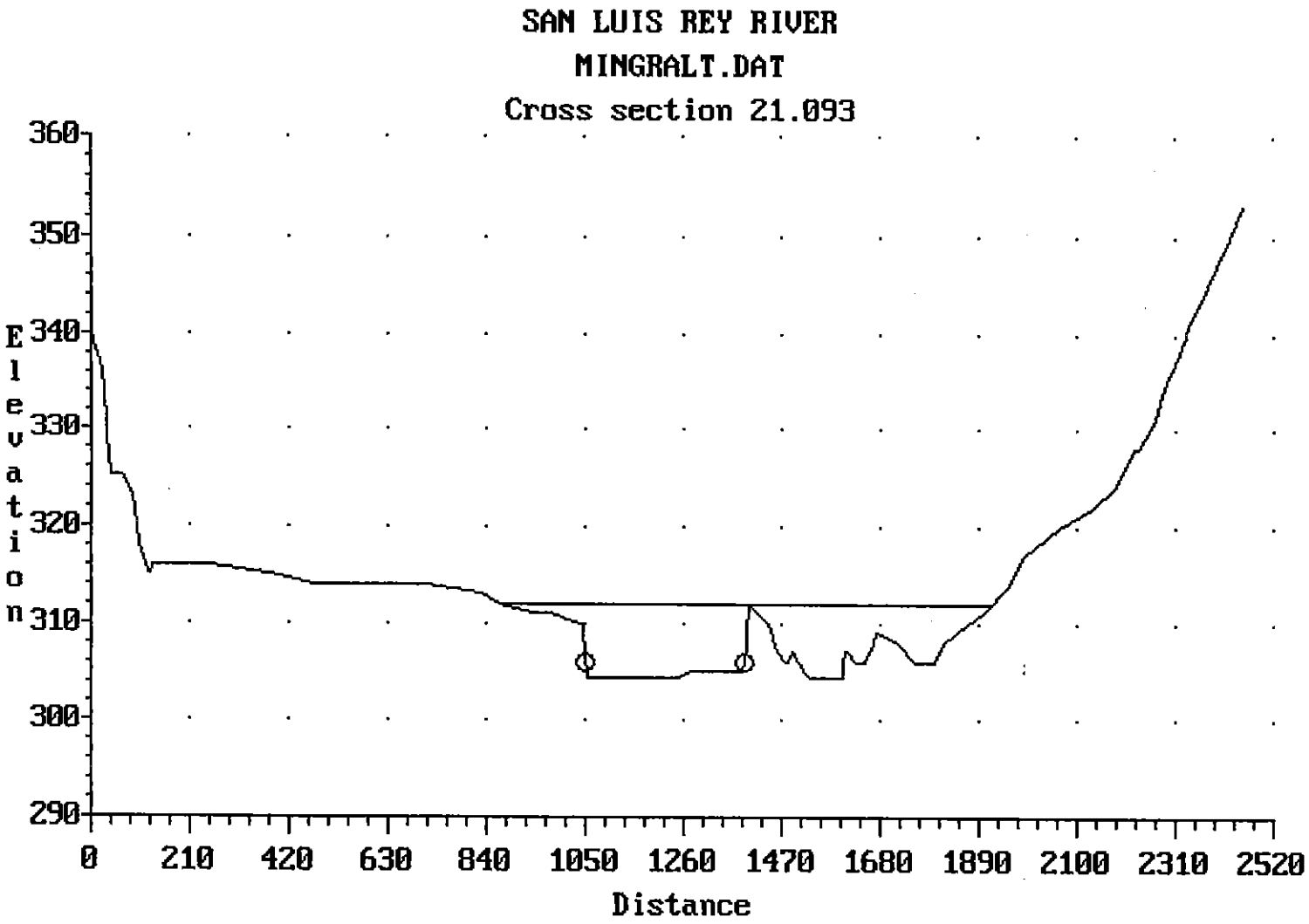
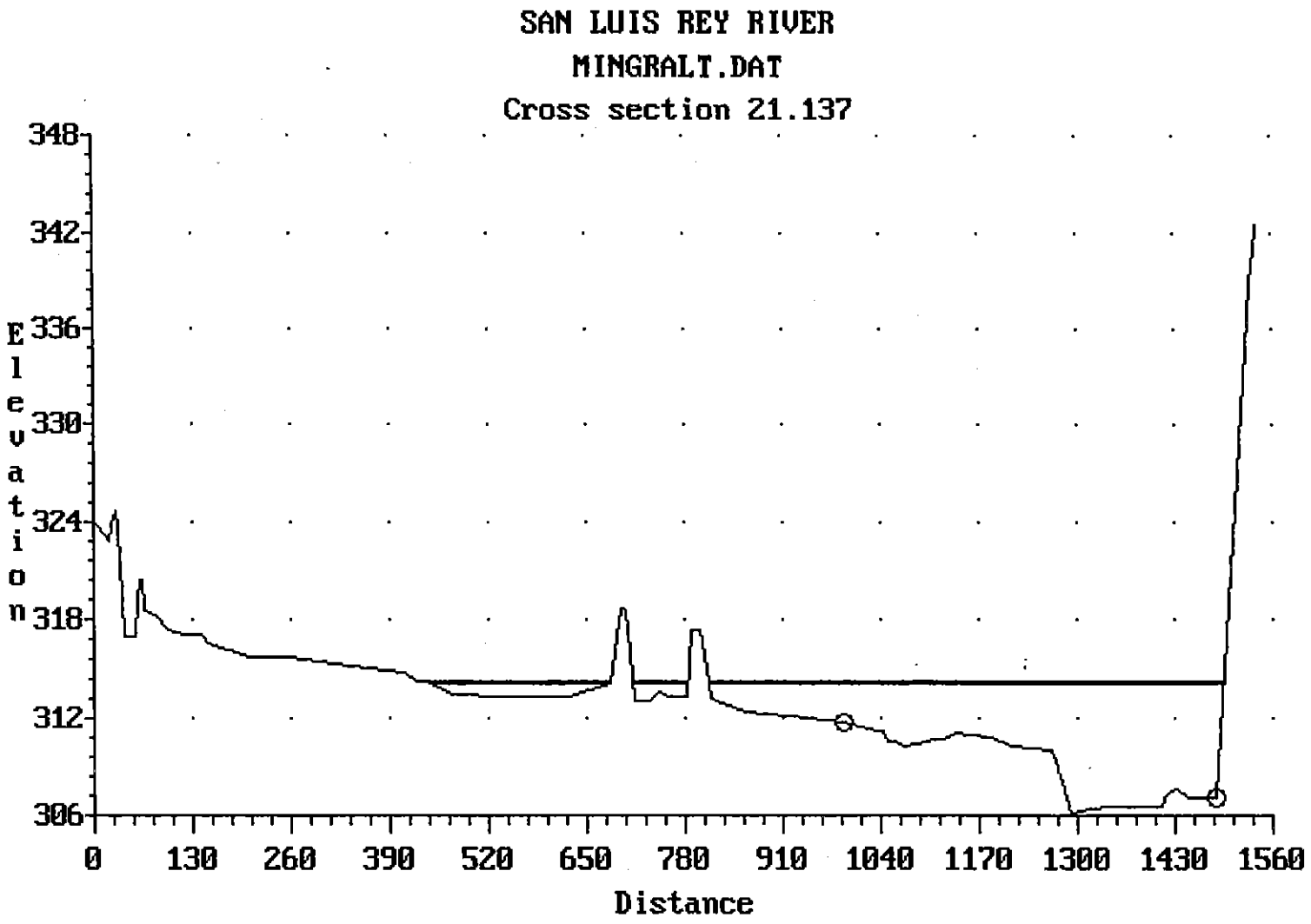
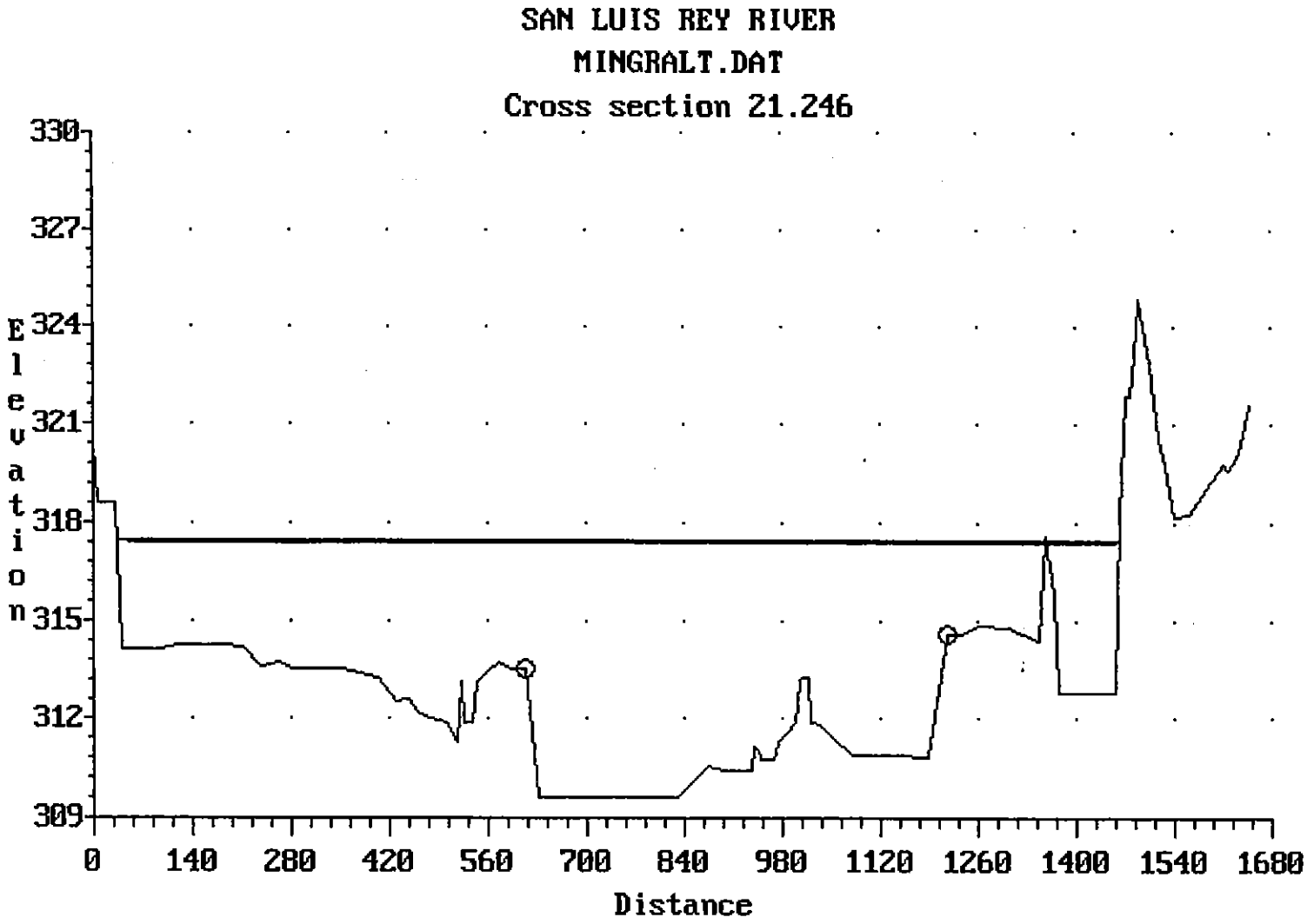
660
720
780
840
900
Distance

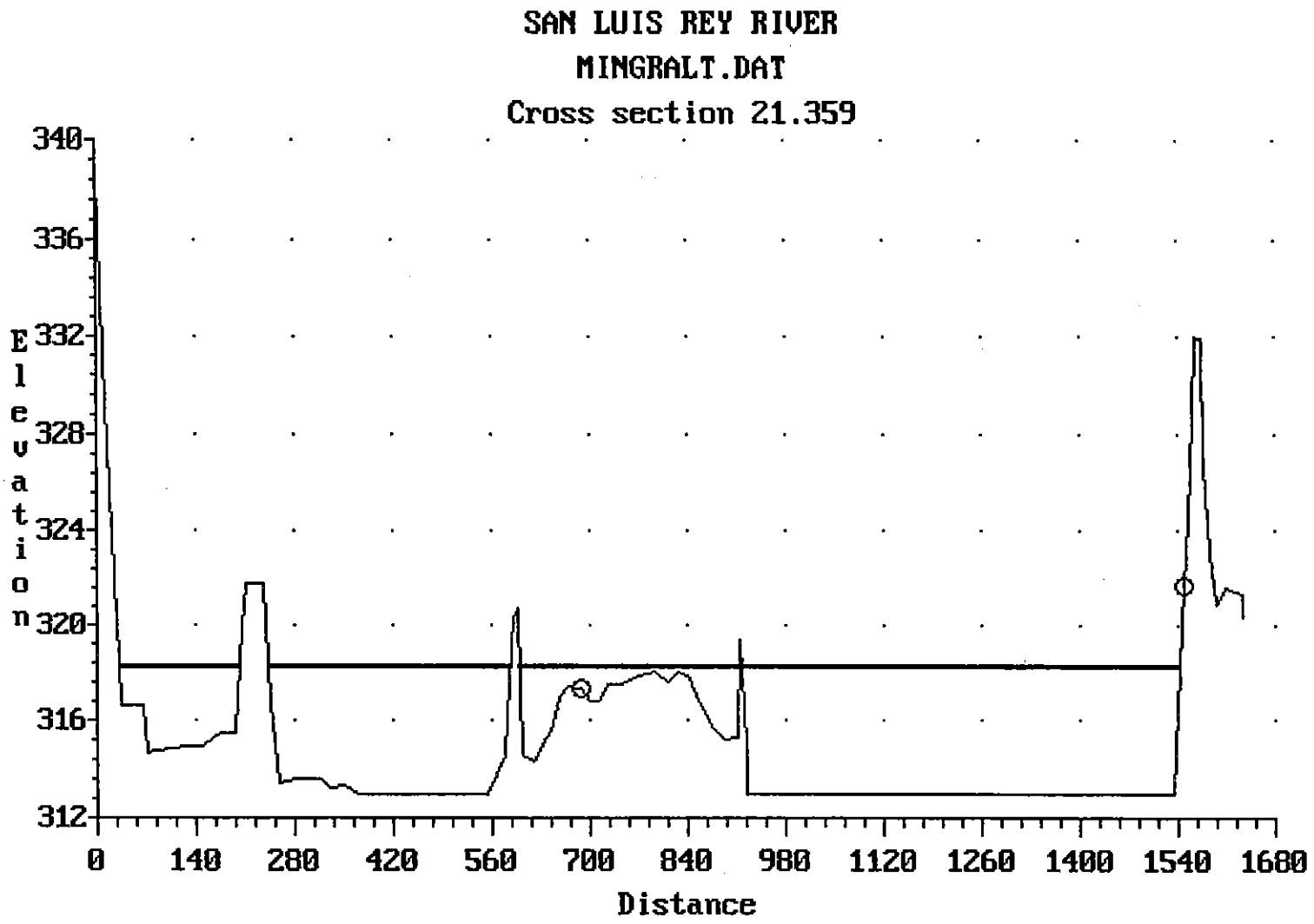

SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.96
Elevation
321
318
315
312
309
306
303
300
0
120
240
360
480
600
720
840
960
1080
1200
1320
1440
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 20.996
Elevation
335
330
325
320
315
310
305
300
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 21.093
Elevation
360
350
340
330
320
310
300
290
0
210
420
630
840
1050
1260
1470
1680
1890
2100
2310
2520
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 21.137
Elevation
348
342
336
330
324
318
312
306
0
130
260
390
520
650
780
910
1040
1170
1300
1430
1560
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 21.246
Elevation
330
327
324
321
318
315
312
309
0
140
280
420
560
700
840
980
1120
1260
1400
1540
1680
Distance


SAN LUIS REY RIVER
MINGRALT.DAT
Cross section 21.359
Elevation
340
336
332
328
324
320
316
312
0
140
280
420
560
700
840
980
1120
1260
1400
1540
1680
Distance

APPENDIX D

SCOUR CALCULATIONS

GREGORY CANYON BRIDGE – ABUTMENT RIPRAP CALCS
SUBJECT

S00030 | SRL
JOB NO. | DESIGNED BY

8-26-99 |
DATE | CHECKED BY

NOLTE

REFERENCES: EVALUATING SCOUR AT BRIDGES (HEC-18), FHWA, FEB. 1993

p. 118 SIZING ROCK RIPRAP AT ABUTMENTS

$$\text{FROUDE NO.} = V/(gy)^{1/2} = 6.5/(32.2 \times 9.3)^{1/2} = 0.39$$

USE FHWA EQN: $\frac{D_{50}}{y} = \frac{K}{(S_s - 1)}\left[\frac{V^2}{gy}\right]$

$$D_{50} = \frac{K}{(S_s - 1)}\left[\frac{V^2}{g}\right], \quad K = 1.02 \text{ FOR VERTICAL WALL ABUTMENTS}$$

$$D_{50} = \frac{1.02}{(1.65 - 1)}\left[\frac{(6.3)^2}{32.2}\right]$$

$$D_{50} = 2.25'$$

∴ USE 1/2-TON ROCK, T = 3.4'

3. Determine extent of rock riprap

a. The apron at the toe of the abutment slope should extend along the entire length of the abutment toe, around the curved portions of the abutment to the point of tangency with the plane of the embankment slopes.

b. The apron should extend from the toe of the abutment into the bridge waterway a distance equal to twice the flow depth in the overbank area near the embankment, but need not exceed 25 feet (see **Figure 24**).[58]

c. The abutment slope should be protected with rock riprap size computed from Equations 93 or 94. Coverage should agree with Step 3a.

d. The rock riprap thickness should not be less than the larger of either 1.5 times D_{50} or D_{100}. The rock riprap thickness should be increased by 50 percent when it is placed under water to provide for the uncertainties associated with this type of placement.

e. The rock riprap gradation and the potential need for underlying filter material must be considered.

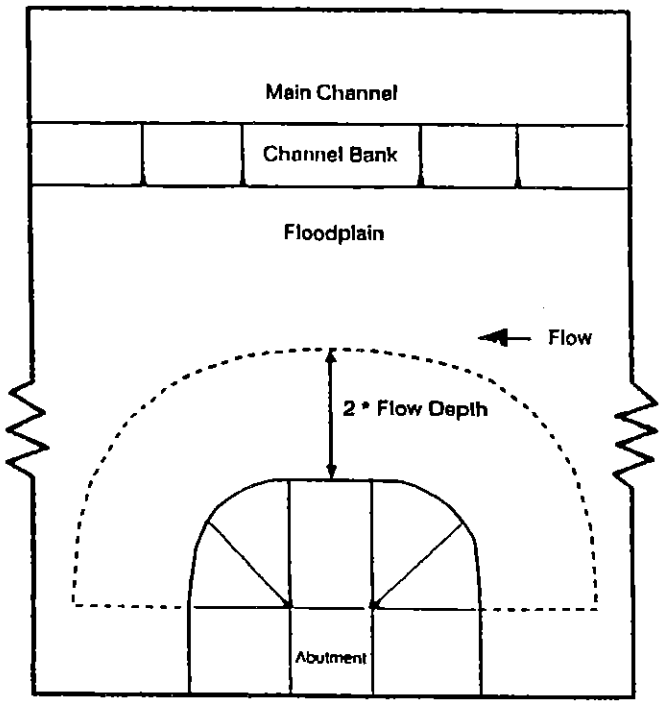


Figure 24. Plan View of the Extension of Rock Riprap Apron.

REF: EVALUATING SCOUR AT BRIDGES, FHWA, FEB 93