Addendum to Hydrologic and Hydraulic Study for Leucadia Drainage Improvement Alternatives

Encinitas, California

January 28, 2005

Prepared for

City of Encinitas
Incorporated 1986

Prepared by

RICK
ENGINEERING COMPANY

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ADDENDUM TO

HYDROLOGIC AND HYDRAULIC STUDY

FOR

LEUCADIA DRAINAGE IMPROVEMENT ALTERNATIVES

Job Number 14413

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INTRODUCTION

Rick Engineering Company conducted a detailed hydrologic and hydraulic study under the direction of the City of Encinitas (City) to analyze inundation of City streets and private properties in Leucadia during varying return frequency storm events. The June 14, 2004 report titled, "Hydrologic and Hydraulic Study for Leucadia Drainage Improvement Alternatives," presents several solutions to improve drainage within the Leucadia area. The findings of this report were presented to Encinitas City Council on June 16, 2004. Subsequently, Rick Engineering Company was contracted to analyze additional drainage improvement alternatives as well as provide supplemental information for the previously analyzed alternatives at the request of City Council. This report presents the additional analyses and information described below, and is an addendum to the June 2004 report. The contents of this report were presented at the City Council meeting on November 16, 2004.

Additional Alternatives

- Alternative 4: Construct a 10-year storm drain facility along Highway 101
- Alternative 5: Construct a storm drain outfall from Leucadia Park to Beacons Beach in combination with grading a portion of Highway 101 (Construct both Alternatives 1 and 2c from the June 2004 report)

Supplemental Information

- Floodplain and photo-simulation exhibits for Alternative 1
- Cost estimate for Alternative 3 assuming 3-phase construction
- Impact of Alternatives 2 and 5 to existing trees along Highway 101
- Cistern Analysis
- Infiltration System
- Quantify parcels removed from 10-year and 100-year floodplains for each alternative
- Summary table of benefits and costs for each alternative

ADDITIONAL ALTERNATIVES

Alternative 4: Construct 10-year Storm Drain Facility

Construct an underground storm drain system along Highway 101 with the capacity to convey the peak flow rate from the 10-year frequency storm event. This option includes the utilization of the existing 24" storm drain as a low flow system discharging to the detention basins located north of La Costa Avenue to preserve water quality benefits. This storm drain system would remove the 10-year floodplain from the study area because storm runoff would be conveyed in the storm drain system, however runoff exceeding the 10-year storm would be conveyed overland along Hwy 101 and outlet to the NCTD right-of-way as it does today.

Environmental permitting of the outlet has not been investigated but is expected to present a significant challenge in the feasibility of this project.

Hydrologic analyses for Alternative 4 included preparation of the following HEC-1 models:

- 10-year undetained HEC-1 model to determine peak discharge rates within each drainage basin and preliminary pipe sizes. A copy of the HEC-1 is provided in Appendix B of the June 2004 report.
- 100-year detained HEC-1 model diverting the 10-year flow rate into the storm drain system. The peak flow rates calculated in this model were used in the HEC-RAS model to determine floodplain elevations. A copy of the Alternative 4 100-year HEC-1 is provided in Attachment 1 of this addendum.

Normal depth calculations were performed to determine preliminary required pipe sizes for both the main storm drain line and the tributary lateral lines using Manning's equation. A hydraulic model of the main storm drain line was created in WSPGW to confirm the capacity requirements for the storm drain system. The WSPGW model verified that the proposed pipe sizes have the capacity to convey the peak runoff from the 10-year storm event. However, further analyses and design is required if this alternative is selected.

Flooding patterns including floodplain elevations were determined using HEC-RAS. A copy of the Alternative 4 100-year HEC-RAS is provided in Attachment 2 of this addendum. Refer to the HEC-RAS Workmap in Map Pocket 1 in the June 2004 report for the locations of the cross-sections.

Preliminary results show a 3.5-foot diameter pipe at the upstream end of the watershed near Basil Street, transitioning to a 5-foot diameter pipe at the outlet into the lagoon is required to convey the 10-year storm event peak discharge within the storm drain system. Preliminary storm drain pipe sizes are presented in Table 1 shown below.

Table 1. 10-Year Capacity Storm Drain System Pipe Sizes

BASIN*	PEAK Q (cfs**)	DIAMETER (FT)
3	11	3.5
4	48	4
5	57	4
7	79	4
8	83	4
9A	91	4.5
9	105	4.5
9B	115	5
10	117	5
11	136	5

* Only basins along Highway 101 were included in analysis.
** cubic feet per second

Alternative 4 removes approximately 10 parcels from the 100-year floodplain and 116 parcels from the 10-year floodplain. The implementation of Alternative 4 reduces existing 100-year floodplain water surface elevations a maximum of 0.4 feet. Table 2 presents a summary of the 100-year floodplain elevations. Exhibit 1 shows the existing and proposed 100-year floodplains.

Table 2. 100-year Floodplain Elevations for Existing Condition and Alternative 4

FLOW DIRECTION	DRAINAGE BASIN	HIGHWAY 101 CROSS-STREET	HEC-RAS CROSS-SECTION NO.	EXISTING HWY 101 100-YEAR WSEL (ft)	ALT. 4 WSEL (ft)
UPSTREAM ------------>>>>>>>> DOWNSTREAM	11	LA COSTA	30	47.1	46.9
		MOORGATE	35	50.6	50.5
			40	54.7	54.5
		BISHOPSGATE	45	55.4	55.1
			50	55.4	55.1
	10	GRANDVIEW	55	55.5	55.2
	9B	AVOCADO	60	55.5	55.2
		EDGEBURT	65	55.5	55.2
		RANGE	70	55.5	55.2
	9	JUPITER	75	55.6	55.2
			80	55.6	55.2
		W. JASON	85	55.6	55.2
	9A	PHOEBE	90	55.6	55.2
		W. GLAUCUS	95	55.6	55.2
			100	55.8	55.6
	8	DIANA	105	56.0	55.8
			110	56.1	55.8
			115	56.1	55.8
	7	JASPER	120	56.1	55.8
			125	56.1	55.8
			130	56.1	55.8
			135	56.1	55.8
		LEUCADIA	140	56.1	55.8

Estimated Cost: $18-22 million for tunneling technologies

$36 million for conventional methods

(Separate cost estimates prepared by Haley & Aldrich [Attachment 6 - dated August 13, 2004] and Rick Engineering Company [Attachment 5])

Haley & Aldrich prepared a preliminary geotechnical feasibility study to evaluate trenchless techniques for storm drain pipeline installation, which included the recommendation of using TBM methods. Costs include equipment mobilization, excavation and spoils disposal, casing or initial tunnel support, shaft construction, grouting, final product pipe, gaskets and fittings, 11 cleanout structures, and 35% design cost.

Legend

- Proposed Stormdrains
- Existing Stormdrains
- Parcels
- Proposed 100-Year Floodplain
- Existing 100-Year Floodplain

Location Map

Exhibit 1: ALTERNATIVE 4 100-YEAR FLOODPLAIN

1 inch equals 800 feet

0 800 1,600 3,200 Feet

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Alternative 5: Leucadia Park Overflow and Re-grade a Portion of Hwy 101

Construct an overflow storm drain system to collect runoff from the upper watershed (Basins 1, 2, 3, 4, 5, and 7) at Leucadia Park and re-grade the northbound lanes of Highway 101 from approximately Jupiter Street to Moorgate Road (approximately 3,170 linear feet). This alternative is essentially a combination of Alternative 1 and Alternative 2, Option C, both of which are outlined in the June 2004 report.

In the upper portion of the watershed, storm runoff would be diverted from the main storm drain system at Leucadia Park to an overflow system that would extend from the park through the bluffs at Beacons Beach. Runoff would be conveyed to Leucadia Park through the existing storm drain system and via overland flow. Since the existing storm drain system does not have capacity to convey runoff from storms greater than an estimated 5-year frequency, this alternative would only function efficiently if the storm drain system upstream of the diversion were upsized. If the storm drain system is not upsized, flooding patterns similar to the existing condition would continue because runoff would have to pond until it reached elevations high enough to allow it to pass from sump to sump until reaching the park.

Hydrologic analyses for Alternative 5 included preparation of two HEC-1 models: a 10-year HEC-1 and a 100-year HEC-1 that modeled Basins 9B, 10, and 11 undetained (due to proposed grading of Hwy 101) and modeled all basins upstream as detained, to determine peak discharge rates within each drainage basin for use in the HEC-RAS. Copies of the HEC-1 analyses are provided in Attachment 3 of this addendum.

Flooding patterns including floodplain elevations were determined using HEC-RAS. Copies of the Alternative 5, 10-year and 100-year HEC-RAS analyses are provided in Attachment 4 of this addendum. Refer to the HEC-RAS Workmap in Map Pocket 1 in the June 2004 report for the locations of the cross-sections.

Alternative 5 removes approximately 87 parcels from the 10-year floodplain and 47 parcels from the 100-year floodplain. Alternative 5 reduces existing 10- and 100-year floodplain water surface elevations by a maximum of 3.7 feet and 2.2 feet, respectively. Tables 3 and 4 present a summary of the 10- and 100-year floodplain elevations for Alternative 5, respectively. Exhibit 2 shows the existing and proposed 10-year and 100-year floodplains.

Table 3. 10-year Floodplain Elevations for Existing Condition and Alternative 5

FLOW DIRECTION	DRAINAGE BASIN	HIGHWAY 101 CROSS-STREET	HEC-RAS CROSS-SECTION NO.	EXISTING HWY 101 10-YEAR WSEL (ft)	ALT. 5 WSEL (ft)
UPSTREAM ------------->>>>>>>> DOWNSTREAM	11	LA COSTA	30	46.3	46.3
		MOORGATE	35	49.7	49.9
			40	53.7	51.0
		BISHOPSGATE	45	54.0	51.4
			50	53.9	51.8
	10	GRANDVIEW	55	54.1	52.1
	9B	AVOCADO	60	54.1	52.3
		EDGEBURT	65	54.2	52.6
		RANGE	70	54.4	52.9
	9	JUPITER	75	54.6	53.4
			80	54.6	53.4
		W. JASON	85	54.6	53.4
	9A	PHOEBE	90	54.6	53.8
		W. GLAUCUS	95	54.6	54.5
			100	55.3	55.3
	8	DIANA	105	55.3	55.4
			110	55.3	55.4
			115	55.3	55.4
	7	JASPER	120	55.3	55.4
			125	55.3	55.4
			130	55.3	55.4
			135	55.3	55.4
		LEUCADIA	140	55.3	55.4

Table 4. 100-year Floodplain Elevations for Existing Condition and Alternative 5

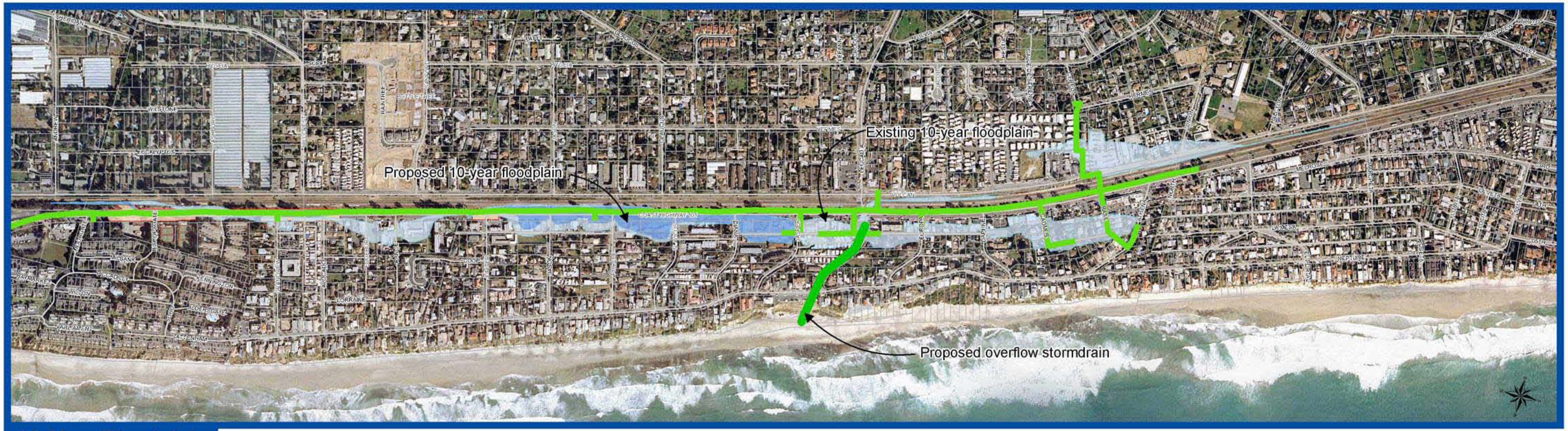
FLOW DIRECTION	DRAINAGE BASIN	HIGHWAY 101 CROSS-STREET	HEC-RAS CROSS-SECTION NO.	EXISTING HWY 101 100-YEAR WSEL (ft)	ALT. 5 WSEL (ft)
UPSTREAM ------------->>>>>>>> DOWNSTREAM	11	LA COSTA	30	47.1	47.1
		MOORGATE	35	50.6	51.3
			40	54.7	52.6
		BISHOPSGATE	45	55.4	53.2
			50	55.4	53.4
	10	GRANDVIEW	55	55.5	54.0
	9B	AVOCADO	60	55.5	54.1
		EDGEBURT	65	55.5	54.3
		RANGE	70	55.5	54.4
	9	JUPITER	75	55.6	54.8
			80	55.6	54.9
		W. JASON	85	55.6	54.9
	9A	PHOEBE	90	55.6	54.9
		W. GLAUCUS	95	55.6	54.9
			100	55.8	55.9
	8	DIANA	105	56.0	56.0
			110	56.1	56.0
			115	56.1	56.0
	7	JASPER	120	56.1	56.0
			125	56.1	56.0
			130	56.1	56.0
			135	56.1	56.0
		LEUCADIA	140	56.1	56.0

Estimated Cost: $1.5 – $2 million for conventional tunneling (recommended)

$4.5 million for regrading Hwy 101

These costs include 35% for design. Excluded are costs associated with the improvements to the storm drain system necessary to convey the 10-year flow to Leucadia Park.

(Separate cost estimates prepared by Haley & Aldrich [dated June 8, 2004, Attachment 6] and Rick Engineering Company [Attachment 5])



10-Year Floodplain

100-Year Floodplain

Legend

- Proposed Stormdrains
- Existing Stormdrains
- Parcels
- Proposed 10-Year Flooplain
- Existing 10-Year Flooplain
- Limits of Grading

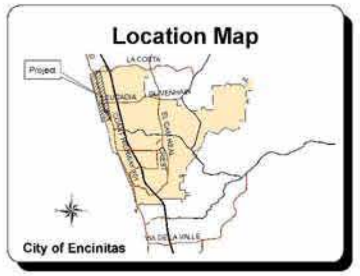


Exhibit 2: ALTERNATIVE 5 10-YEAR AND 100-YEAR FLOODPLAINS

1 inch equals 800 feet

0 — 800 — 1,600 — 3,200 Feet

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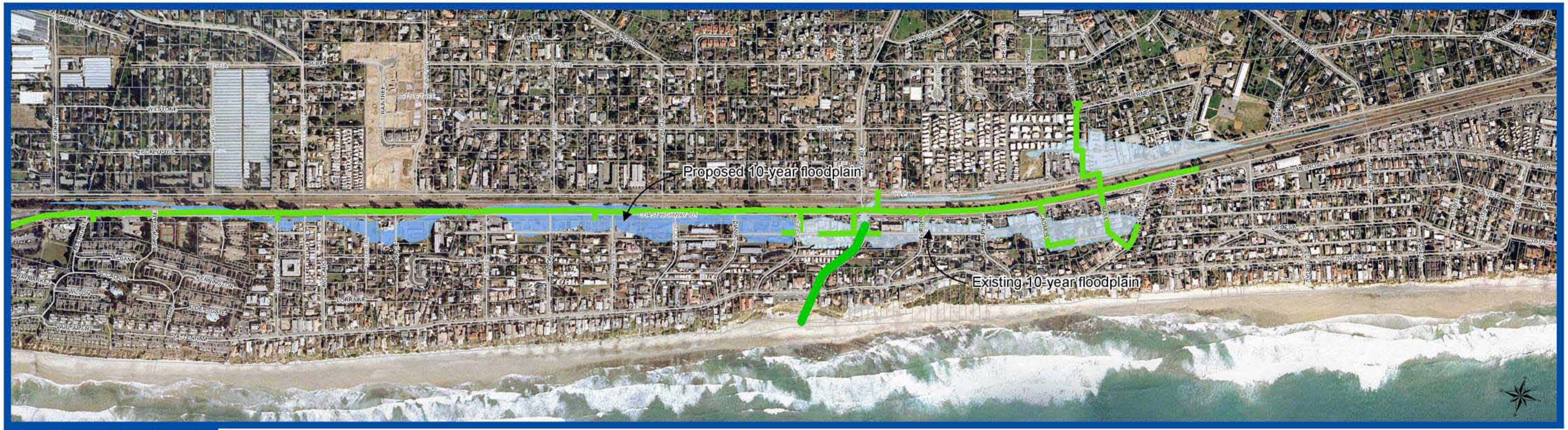
SUPPLEMENTAL INFORMATION

Floodplain Exhibit for Alternative 1

Alternative 1 proposes the construction of an overflow storm drain system to collect runoff from the upper watershed at Leucadia Park, where the runoff would be diverted from the main storm drain line to an overflow system that would discharge over the bluffs at Beacons Beach. The overflow could potentially divert up to 90% of the 10-year runoff and relieve the downstream main storm drain system during smaller storms. It would also eliminate the necessity for pumping at Leucadia Park during storm events smaller than 10-year frequency, which includes the types of storms frequently experienced in Encinitas. This alternative would improve flooding conditions in the upper basins and do little to nothing for the downstream basins. The overflow system is not expected to significantly reduce 100-year floodplain elevations, or affect the size of pipes or cost of installing the ultimate 100-year storm drain system. Exhibit 3 shows the 10-year and 100-year floodplains for Alternative 1.

An example of the proposed outlet structure was created and superimposed on a photograph of Beacons Beach to show generally what aesthetic impact the structure would have to the beachfront. The photo-simulation of the Beacons Beach outlet structure is shown on Exhibit 4.



10-Year Floodplain

100-Year Floodplain

Legend

- Proposed Stormdrains
- Existing Stormdrains
- Parcels
- Proposed 10-Year Floodplain
- Existing 10-Year Floodplain

Location Map

1 inch equals 800 feet

0 — 800 — 1,600 — 3,200 Feet

Exhibit 3: ALTERNATIVE 1 10-YEAR AND 100-YEAR FLOODPLAINS

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Existing View

Proposed View

Exhibit 4:
ALTERNATIVES 1 AND 5
PHOTO SIMULATION OF
OVERFLOW OUTLET
AT BEACONS BEACH

RICK ENGINEERING COMPANY™

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Exhibit Date: 11/28/05
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Cost Estimate for Alternative 3 Assuming 3-Phase Construction

A cost estimate was prepared for constructing the 100-year ultimate storm drain system along Highway 101 in three separate construction periods to spread the cost out over several years. Cost estimates to construct the ultimate storm drain system in one phase, as well as estimated construction costs for three separate phases are summarized below in Table 5. Because the ultimate phased construction schedule is unknown at this time, no consideration for time related escalation was taken.

Table 5. 100-Year Cost Estimates for Phased Trenchless Construction Methods

Proposed Trenchless Method 100-Year Storm Event	Estimated Cost[1] for Construction Performed During One Mobilization	Estimated Cost[1] for Phased Construction (August 13, 2004)
TBM only[2]	$30 to 34 million	$34 to 39 million
TBM and Shield Tunnel[2]	$31 to 35 million	$35 to 41 million
Conventional Methods[3]	$40 million	$42 million

1. Estimated costs include equipment mobilization, excavation and spoils disposal, casing or initial tunnel support, shaft construction, grouting, final product pipe, gaskets and fittings, 11 cleanout structures, and 35% for design costs.
2. Cost estimate prepared by Haley & Aldrich (Attachment 6)
3. Cost estimate prepared by Rick Engineering Company (Attachment 5)

As the above table indicates, the cost associated with phased construction is significantly more expensive than the cost associated with construction performed during one mobilization. However, factors such as inflation, depreciation of equipment, and financing costs may make phased construction more cost effective or feasible over time.

Impact of Alternatives 2 and 5 to Existing Trees Along Highway 101

Grading activities associated with Alternatives 2 and 5 require the removal or relocation (if possible) of several established trees, some of which are large and highly unstable eucalyptus trees. Construction of these alternatives involves grading within the median and Highway 101 right-of-way east of the traffic lanes. An arborist report titled "Assessment of Trees in the Highway 101 Right-Of-Way," dated October 7, 2002, was prepared by Michael T. Mahoney. This report was referenced to determine the impact to trees within the right-of-way of Highway 101 for each of the grading alternatives (Alternatives 2 and 5).

The arborist report summarizes recommendations to mitigate concern for the stability of 278 trees of various species. The trees are located in the public right-of-way along Highway 101 between La Costa Avenue and A Street. Many are large and mature eucalyptus trees that have suffered injury due to encroachments onto adjacent roadways. Trees are recommended for removal based on their instability. Factors that determine a tree's stability include anchoring capacity, load bearing and leverage, canopy density, and other conditions and combination of conditions. The report recommends the removal of 32 large trees and 9 smaller trees that are either dead, damaged, or defective. Table 6 presents a summary of the number of trees to be removed or relocated for each grading alternative. The table also summarizes the percentage of those trees to be removed or relocated that were previously recommended for removal by the arborist report.

Table 6. Trees to be Removed/Relocated by Various Grading Alternatives

	Number of Trees to be Removed/Relocated by Grading Alternative	Number of Trees Recommended for Removal by Arborist Report	Percent of Number of Trees to be Removed/Relocated that are Recommended for Removal by Arborist Report
Alternative 2			
Option A	20	5	25%
Option B	44	6	14%
Option C	134	24	18%
Alternative 5 *(Grading Option 2c)*	134	24	18%

Cistern Analysis

Some Leucadia residents have expressed interest in the use of cisterns to contain the 100-year flood instead of constructing a 100-year capacity storm drain system. Cisterns are typically used to collect runoff from rooftops into one or more barrels, where it is stored and used as needed to irrigate landscape.

Since cisterns are most widely used as runoff collection systems for individual parcels, it is not surprising that the size of one cistern to store runoff from a 100-year flood for a watershed of this size would be prohibitively large. The dimensions of one cistern that would contain the total volume of runoff for a 100-year storm were calculated. This calculation is based on the 100-year, 24-hour precipitation data in the San Diego County Hydrology Manual and uses the following assumptions:

- Precipitation = 4",
- Area of the watershed = 0.86 mi^2,
- Runoff coefficient = 0.65 (65% of rainfall becomes runoff, 35% of rainfall infiltrates),
- Assumes capture and containment of all runoff – if all of the runoff is not captured there would still be flooding in Leucadia.

Volume = Precipitation * Runoff Coefficient * Area
Volume = (4")(0.65)(0.86 mi^2)
Volume = 5,194,675 ft^3 or approximately 39 million gallons

Dimensions of one cistern = height * width * length
Dimensions of one cistern = Volume
Assume height = 8', width = 80', Volume = 5,194,675 ft^3
Find length

Volume = (8')(80')(length)
Length = 5,194,675/[(8')(80')]
Length = 8117 ft, or 1.5 mi.

Dimensions = 8-ft. deep x 8-ft. wide x 1.5-mi. long

The use of one cistern (or many cisterns) to contain the runoff from the 100-year, 24-hour storm is not a feasible flood control structure. Rick Engineering Company has not analyzed in detail the feasibility of using cisterns to contain smaller, more frequent events (less than 2-year). However, based on preliminary investigation there are several obstacles concerning the logistics of using cisterns including:

- Mobilization of large tanks – the tanks are normally scheduled for delivery in advance, not in emergency (flooding) situations
- Difficult negotiations with NCTD to place the tanks within their right-of-way

- Mobilization of vactor trucks to pump runoff from flooded areas and dispose into tanks
- Mobilization of vactor trucks to empty tanks after the storm. The tanks must be emptied after each storm to be available for the next storm. With the rains experienced in Leucadia this season there would be a constant effort to empty the tanks.
- Disposal of water in filled tanks after the storm – once the water is contained it either has to be pumped into the sanitary sewer or environmental permits must be obtained to pump it into the lagoon
- Removal of tanks after each storm
- Each mobilization requires availability of personnel
- Significant costs would be incurred with each storm that includes tank rental, personnel, pumping costs, disposal costs, etc.

The City of Encinitas has implemented an emergency response program to address the small, frequent storm events. This program, combined with upgrades to the existing storm drain system, has proven to protect the residents in Leucadia from structural damage due to flooding in the 2004-2005 rainy season to date. The use of cisterns as a short-term solution would be more costly and inefficient than the current program.

Infiltration System

Implementation of an infiltration system to address flooding issues in Leucadia was considered but not analyzed. Infiltration is the downward entry of water into the surface of the soil, commonly used in hydrology to denote the flow of water into soil material. The system would consist of large underground containment structures that would allow runoff to infiltrate into the soil. There has previously been concern expressed by residents living along the coastal bluffs about infiltration causing bluff failures. While studies have indicated that this is not the case with natural infiltration, it may be difficult to make a definitive assessment about this concern relative to large scale induced infiltration. Due to these concerns, implementation of an infiltration system was eliminated from further analysis.

Quantify Parcels Removed from 10-year and 100-year Floodplains for Each Alternative

Various drainage improvement alternatives are proposed in Leucadia in the City of Encinitas to relieve flooding in the area. Only Alternative 3 removes all parcels from the 100-year floodplain, however, floodplain depths are reduced in the other alternatives. The number of parcels removed from the 10- and 100-year floodplains for each of the proposed alternatives is summarized below in Tables 7 and 8.

Table 7. Number of Parcels Removed from the 10-year Floodplain

	10-Year Study				
Alternative	**Existing Parcels in Floodplain**	**Parcels Removed**	**Parcels Remaining**	**% Parcels Removed**	**Approximate Reduction in Flood Depth (ft)**
Alt 1	116	69	47	60%	1.5
Alt 2 – Option A	116	0	116	0%	1.1
Alt 2 – Option B	116	2	114	2%	2.3
Alt 2 – Option C	116	18	98	16%	2.7
Alt 3	116	116	0	100%	N/A
Alt 4	116	116	0	100%	N/A
Alt 5	116	87	29	75%	3.7

Table 8. Number of Parcels Removed from the 100-year Floodplain

	100-Year Study				
Alternative	**Existing Parcels in Floodplain**	**Parcels Removed**	**Parcels Remaining**	**% Parcels Removed**	**Approximate Reduction in Flood Depth (ft)**
Alt 1	152	5	147	3%	0.1
Alt 2 – Option A	152	25	127	16%	1.1
Alt 2 – Option B	152	28	124	18%	2.1
Alt 2 – Option C	152	43	109	28%	2.2
Alt 3	152	152	0	100%	N/A
Alt 4	152	10	142	7%	0.4
Alt 5	152	47	105	31%	2.2

Summary Table of Benefits and Costs for Each Alternative

Table 9 shows the number of parcels removed from the 10-year and 100-year floodplains, the percent of parcels removed from the 10-year and 100-year floodplains, the floodplain depth reduction, and the cost estimate for each alternative.

Table 9. Summary of Benefits and Costs for Each Alternative

Alternative	Existing Parcels in 10-year Floodplain	% Parcels Removed 10-year Storm	Existing Parcels in 100-year Floodplain	% Parcels Removed 100-year Storm	Approximate Reduction in Flood Depth 100-year (ft)	Cost Estimate
Alt 1 Leucadia Overflow	116	60%	152	3%	0.1	$1.5 – $2.5 M
Alt 2 – Option A NCTD Grading	116	0%	152	16%	1.1	$1 M
Alt 2 – Option B Hwy 101 Grading	116	2%	152	18%	2.1	$3.5 M
Alt 2 – Option C Hwy 101 Grading	116	16%	152	28%	2.2	$4.5 M
Alt 3 100-yr Storm Drain System	116	100%	152	100%	N/A	$30-34 M (tunneling methods) $34-39 M (3-phase tunneling) $40 M (conventional methods) $42 M (3-phase conventional)
Alt 4 10-yr Storm Drain System	116	100%	152	7%	0.4	$18-22M (tunneling methods) $36 M (conventional methods)
Alt 5 Alt 1 + Alt 2 Option C	116	75%	152	31%	2.2	$6 – $7 M

RECOMMENDATIONS

Based on the analyses of the hydrologic and hydraulic characteristics of the Leucadia area, Rick Engineering Company recommends proceeding with the design of Alternative 3, construction of a 100-year capacity storm drain system, which was described in the June 2004 report. Although other alternatives would provide flooding relief for some residents during small, frequent storm events, they do not provide equal protection to the entire area affected by flooding. In addition, new development and redevelopment projects within the City of Encinitas are required to design the finished floor elevations of insurable structures above the 100-year floodplain elevation (where applicable), in accordance with Federal Management Flood Agency's (FEMA) requirement. Not only is construction of any other alternative costly, it would not adequately protect Leucadia from flooding during the 100-year flood and would be considered a "short-term" solution.

ATTACHMENT 1

ALTERNATIVE 4

100-YEAR HEC-1 ANALYSIS

ATTACHMENT 2

ALTERNATIVE 4

100-YEAR HEC-RAS ANALYSIS

ATTACHMENT 3

ALTERNATIVE 5
10-YEAR AND 100-YEAR
HEC-1 ANALYSES

ALTERNATIVE 5

10-YEAR HEC-1 ANALYSIS

ALTERNATIVE 5

100-YEAR HEC-1 ANALYSIS

ATTACHMENT 4

ALTERNATIVE 5
10-YEAR AND 100-YEAR
HEC-RAS ANALYSES

ALTERNATIVE 5

10-YEAR HEC-RAS ANALYSIS

ALTERNATIVE 5
100-YEAR HEC-RAS ANALYSIS

ATTACHMENT 5

RICK ENGINEERING COMPANY
COST ESTIMATES FOR
ALTERNATIVE 3 – PHASED CONSTRUCTION
AND ALTERNATIVE 4

ATTACHMENT 6

HALEY & ALDRICH COST ESTIMATES:

JUNE 8, 2004

AUGUST 13, 2004

HALEY & ALDRICH COST ESTIMATE – JUNE 8, 2004
"GEOTECHNICAL FEASIBILITY STUDY"

HALEY & ALDRICH COST ESTIMATE – AUGUST 13, 2004
"SUPPLEMENTAL GEOTECHNICAL FEASIBILITY STUDY"

ATTACHMENT 1

ALTERNATIVE 4
100-YEAR HEC-1 ANALYSIS

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*****************************************                          **************************************
*                                       *                          *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                          *   U.S. ARMY CORPS OF ENGINEERS
*               JUN   1998              *                          *   HYDROLOGIC ENGINEERING CENTER
*              VERSION 4.1              *                          *          609 SECOND STREET
*                                       *                          *       DAVIS, CALIFORNIA 95616
*  RUN DATE   17AUG04  TIME  14:40:45   *                          *            (916) 756-1104
*                                       *                          *
*****************************************                          **************************************
```

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

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

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

ENCINITAS 14413
100-yr AH.4
100A4.hcl

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

*DIAGRAM
ID   **********************************************************
ID   ENCINITAS COAST HWY 101         J-14413           7-13-04
ID   SAME AS BELOW EXCPET 100-YEAR DETAINED
ID   DIVERTED 10-YEAR STORM TO STORM DRAIN
ID   CHANGED FILE NAME
ID   FN: 100A4.HC1
ID   **********************************************************
ID   ENCINITAS COAST HWY 101         J-14413           7-13-04
ID   100-YEAR UNDETAINED W/PIPE ROUTING BETWEEN BASINS
ID   SAME AS BELOW BUT DIVERTED 10-YEAR STORM TO STORM DRAIN
ID   CHANGED FILE NAME
ID   FN: 100UDTDV.HC1
ID   **********************************************************
ID   ENCINITAS COAST HWY 101         J-14413           5-27-04
ID   100-YEAR UNDETAINED W/PIPE ROUTING BETWEEN BASINS
ID   FN: 100UD.HC1
ID   **********************************************************
ID   ENCINITAS COAST HWY 101         J-14413           3-24-04
ID   REMOVED STORAGE IN BASINS 1 &2
ID   FN: 100UD.HC1
ID   **********************************************************
ID   ENCINITAS COAST HWY 101         J-14413           1-08-04
ID   SAME AS BELOW BUT CHANGED ROUTING TO MATCH DETAINED 100-YR
ID   RUN (100DET3.HC1) BUT WITHOUT DETENTION
ID   FN: 100UD.HC1
ID   **********************************************************
ID   ENCINITAS COAST HWY 101         J-14413           1-07-04
ID   SAME AS BELOW BUT CHANGED PI CARDS (INCREASED BASIN AREA)
ID   FN: 100R.HC1
ID   **********************************************************
ID   ENCINITAS COAST HWY 101         J-14413           12/29/03
ID   100-YEAR RUN WITH BASIN AREAS EXTENDED TO THE RIDGE EAST OF
ID   THE RR TRACKS. PI CARDS CHANGED FOR 100-YR BASED ON FN: E100.HC1
ID   LAG AND CURVE NUMBERS CHANGED FOR 100-YEAR.
ID   BASIN AREAS ALSO CHANGED FOR 7 THROUGH 11.
ID   **********************************************************
ID   ENCINITAS COAST HWY 101
ID   J-14413
ID   SEPT 25, 2003
ID   MODIFIED EXISTING RUN TO MODEL PROPOSED DETENTION OF BASINS
ID   1A, 1B, 1, 2, 3, 4, 5, 6, AND 8
ID   DETENTION CARDS SA/SV, SQ, SE OBTAINED FROM FN: DSI_5R.HC1
ID   **********************************************************
ID   ENCINITAS- COAST HIGHWAY 101
ID   JOB # 14413
ID   09-12-03
ID   MODIFIED PUMP Q TO 1.7 CFS, AND ROUTING OF BASINS 9A, 9B, AND 9
ID   FROM PUMP STATION THROUGH 10" LATERAL, CONFLUENCING
ID   WITH MAIN LINE AT AT CONNECTION 3 INSTEAD OF CONNECTION 2
ID   ALSO CHANGED ROUTING THROUGH MAIN LINE FROM LINE G TO CONNECTION
ID   2, TO LINE G TO CONNECTION 3
ID   **********************************************************
ID   ENCINITAS- COAST HIGHWAY 101
ID   JOB # 14413
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LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 55            ID   09-04-03
 56            ID   MODIFIED CURVE NUMBER AND REMOVED % IMPERVIOUS
 57            ID   ***********************************************************
 58            ID   ENCINITAS- COAST HIGHWAY 101
 59            ID   JOB # 14413
 60            ID   06-03-03
 61            ID   POST-IMPROVEMENT (EXISTING) CONDITION       FN: 101EX_5.HC1
 62            ID   5-YEAR, 24-HR STORM EVENT
 63            ID   LAG CALCULATION ARE BASED OFF OF NRCS METHOD
 64            ID   AND ARE A FUNCTION OF RUNOFF COEF. AND VELOCITY
 65            ID   NESTED STORM PER COUNTY OF SAN DIEGO HYDROLOGY MANUAL
 66            ID   COPYRIGHT 2003 RICK ENGINEERING COMPANY
 67            ID   6HR RAINFALL IS  1.6  INCHES
 68            ID   24HR RAINFALL IS  2.5  INCHES
 69            ID   TOTAL BASIN AREA IS  .5  SQUARE MILES
*** FREE ***
 70            IT       5 01JAN90    1200     300
 71            IO       5

 72            KK      1A
 73            KO       0       0       0       0      21
 74            KM   NESTED STORM PER COUNTY OF SAN DIEGO HYDROLOGY MANUAL
 75            KM   COPYRIGHT 2003 RICK ENGINEERING COMPANY
 76            KM   THE FOLLOWING IT CARD MUST BE USED IN YOUR DATA SET
 77            KM   IT 5 01JAN90 1200 300
 78            KM   6HR RAINFALL IS  2.5  INCHES
 79            KM   24HR RAINFALL IS  4  INCHES
 80            KM   DAR30 =  .989908
 81            KM   DAR60 =  .99478
 82            KM   DAR180 =  .99652
 83            KM   DAR360 =  .99739
 84            KM   DAR1440 =  .99826
 85            KM   BASIN AREA IS  .87  SQUARE MILES
 86            IN       5 01JAN90    1200     300
 87            PI   .0047  .00473  .00474  .00476  .00477  .00479  .00481  .00483  .00484  .00486
 88            PI  .00488    .0049  .00491  .00494  .00495  .00497  .00499  .00501  .00502  .00505
 89            PI  .00506  .00509   .0051  .00513  .00514  .00517  .00518  .00521  .00522  .00525
 90            PI  .00527    .0053  .00531  .00534  .00536  .00539   .0054  .00543  .00545  .00548
 91            PI   .0055  .00553  .00554  .00558  .00559  .00563  .00565  .00568   .0057  .00573
 92            PI  .00575  .00579  .00581  .00584  .00586   .0059  .00592  .00596  .00598  .00602
 93            PI  .00604  .00608   .0061  .00614  .00616  .00621  .00623  .00627   .0063  .00634
 94            PI  .00636  .00641  .00643  .00648  .00651  .00656  .00658  .00663  .00666   .0067
 95            PI  .00674  .00679  .00682  .00688   .0069  .00696  .00699  .00705  .00708  .00714
 96            PI  .00717  .00724  .00727  .00733  .00737  .00743  .00747  .00754  .00758   .0076
 97            PI  .00768  .00776   .0078  .00788  .00792    .008  .00804  .00812  .00817  .00826
 98            PI   .0083  .00839  .00844  .00853  .00858  .00868  .00873  .00884  .00889    .009
 99            PI  .00906  .00917  .00923  .00935  .00941  .00954   .0096  .00973   .0098  .00994
100            PI  .01001  .01016  .01024  .01039  .01047  .01064  .01072   .0109  .01099  .01118
101            PI  .01127  .01147  .01158  .01244  .01255  .01278   .0129  .01315  .01328  .01355
102            PI  .01369  .01398  .01414  .01446  .01462  .01497  .01515  .01553  .01573   .0161
103            PI  .01638  .01684  .01709  .01761  .01789  .01848   .0188  .01956  .01992  .02069
104            PI  .02111  .02201   .0225  .02357  .02415  .02544  .02616  .02777  .02867  .03072
105            PI   .0319  .03466  .03629  .04117  .04353  .04959  .05361  .06433  .07327  .10759
106            PI  .15159  .54336  .08629  .05863   .0463  .03812  .03321  .02965  .02693  .02478
107            PI  .02302  .02155   .0203  .01913  .01818  .01735  .01661  .01594  .01534  .01479
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LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 108           PI  .01429  .01384  .01342  .01303  .01266  .01168  .01137  .01108  .01081   .0105
 109           PI  .01031  .01009  .00987  .00967  .00947  .00929  .00911  .00895  .00879   .0086
 110           PI  .00849  .00835  .00821  .00808  .00796  .00784  .00772  .00761   .0075   .0074
 111           PI   .0073   .0072  .00711  .00702  .00693  .00685  .00676  .00669  .00661  .00653
 112           PI  .00646  .00639  .00632  .00625  .00619  .00612  .00606    .006  .00594  .00588
 113           PI  .00582  .00577  .00572  .00566  .00561  .00556  .00551  .00546  .00542   .0053
 114           PI  .00533  .00528  .00524   .0052  .00516  .00512  .00507  .00504    .005  .00496
 115           PI  .00492  .00489  .00485  .00482  .00478  .00475  .00472       0       0       0
 116           PI       0       0       0       0       0       0       0       0       0       0
 117           PI       0       0
 118           BA    0.01
 119           LS       0      69
 120           UD   0.139

 121           KK    RT1A
 122           KM   ROUTE RUNOFF FROM BASIN 1A THROUGH BASIN 1 (ALONG HW 101)
 123           RS       3    STOR      -1
 124           RC    0.02    0.02    0.02    3225  0.0068
 125           RX       0       5      10      15      20      25      30      35
 126           RY       2       2     1.5       1       1     1.5       2       2

 127           KK      1B
 128           BA    0.03
 129           LS       0      74
 130           UD   0.163

 131           KK    RT1B
 132           KM   ROUTE RUNOFF FROM BASIN 1B THROUGH BASIN 1 (ALONG ORPHEUS ST.)
 133           RS       1    STOR      -1
 134           RC    0.02    0.02    0.02    1125
 135           RX       0       5      10      15      20      25      30      35
 136           RY       2       2     1.5       1       1     1.5       2       2

 137           KK    RT1B
 138           KM   ROUTE RUNOFF FROM BASIN 1B THROUGH BASIN 1 (ALONG HW 101)
 139           RS       1    STOR      -1
 140           RC    0.02    0.02    0.02    1250
 141           RX       0       5      10      15      20      25      30      35
 142           RY       2       2     1.5       1       1     1.5       2       2

 143           KK       1
 144           BA    0.09
 145           LS       0      71
 146           UD   0.282

 147           KK     Q&1
 148           KM   COMBINE BASINS 1A, 1B AND BASIN 1
 149           HC       3

 150           KKQ1_in101
 151           KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 152           DT 10YR_SD
 153           DI       0      15      70
 154           DQ       0      15      15
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ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK   DET_11A,1B
KM   DETAIN RUNOFF FROM BASIN 1, 1B AND 1A
RS       1    STOR      -1
SV    2.01    3.34    4.01    5.84    9.54   11.85
SQ       1      50     100     250     500     750
SE   68.47   69.39   69.85   70.76   71.75   72.27

KK       2
BA    0.06
LS       0      76
UD   0.145

KK     Q&2
KM   COMBINE BASIN 1A AND BASIN 1 WITH BASIN 2
HC       2

KKQ2_in101
KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
DT 10YR_SD
DI       0      19     130
DQ       0      19      19

KK   DET_2
KM   DETAIN BASINS 1A, 1 AND 2
RS       1    STOR      -1
SV    2.17    4.58    5.69    7.93    10.6   13.16
SQ       1      50     100     250     500     750
SE   66.73   67.37   67.63   68.09   68.54   68.92

KK       6
BA    0.06
LS       0      81
UD   0.323

KK     Q@6
KM   COMBINE BASIN 1A,1B, 1 & 2 WITH BASIN 6
HC       2

KKQ6_in101
KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
DT 10YR_SD
DI       0      16     250
DQ       0      16      16

KK   DET_6
KO       0       0       0       0      21
KM   DETAIN 6
RS       1    STOR      -1
SV     .02     .27     .43      .8     1.4    1.99
SQ       1      50     100     250     500     750
SE   64.16   65.03   65.31   65.81   66.38   66.85
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            KK      B3
            BA    0.02
            LS       0      78
            UD   0.093

            KKQ3_in101
            KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
            DT 10YR_SD
            DI       0      11      30
            DQ       0      11      11

            KK    DET3
            KM   DETAIN BASIN 3
            KO       0       0       0       0      21
            RS       1    STOR      -1
            SV     .46     .84    1.04    1.58     2.4    3.15
            SQ       1      50     100     250     500     750
            SE   59.68   60.38   60.70   61.45   62.34   63.05

            KK      B4
            BA    0.02
            LS       0      73
            UD   0.072

            KK     3+4
            KM   COMBINE BASIN 3 WITH BASIN 4
            HC       2

            KKQ4_in101
            KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
            DT 10YR_SD
            DI       0       7     160
            DQ       0       7       7

            KK    DET4
            KM   DETAIN BASIN 4
            KO       0       0       0       0      21
            RS       1    STOR      -1
            SV    3.27    4.48    5.05    6.36    8.01     9.4
            SQ       1      50     100     250     500     750
            SE   59.54   60.36   60.71   61.47   62.35   63.05

            KK      B5
            KM   BASIN 5
            BA    0.02
            LS       0      77
            UD   0.084

            KK     Q@5
            KM   COMBINE B4-B5
            HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 241          KKQ5_in101
 242          KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 243          DT 10YR_SD
 244          DI       0       9     190
 245          DQ       0       9       9

 246          KK    DET5
 247          KM   DETAIN BASIN 5
 248          KO       0       0       0       0      21
 249          RS       1    STOR      -1
 250          SV    1.35    2.32     2.8    3.92    5.58     7.1
 251          SQ       1      50     100     250     500     750
 252          SE   57.76   58.39   58.64   59.17   59.81   60.31

 253          KK      B7
 254          KM   BASIN 7
 255          BA    0.04
 256          LS       0      75
 257          UD   0.300

 258          KK     5+7
 259          KM   COMBINE BASIN 5 WITH BASIN 7
 260          HC       2

 261          KKQ7_in101
 262          KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 263          DT 10YR_SD
 264          DI       0       6     250
 265          DQ       0       6       6

 266          KK     Q@7
 267          KM   COMBINE 3,4,5,7 AND 1,2,6 (EAST OF TRACKS)
 268          HC       2

 269          KK    DET7
 270          KM   DETAIN AT BASIN 7
 271          KO       0       0       0       0      21
 272          RS       1    STOR      -1
 273          SV    1.37    2.26    2.71    3.74    5.47    6.99
 274          SQ       1      50     100     250     500     750
 275          SE   55.22   55.79   56.03   56.49   57.15   57.66

 276          KK      B8
 277          KM   BASIN 8
 278          BA    0.06
 279          LS       0      71
 280          UD   0.090

 281          KK     Q@8
 282          KM   COMBINE ALL BASINS UP TO AND INCLUDING 8
 283          HC       2
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

284           KKQ8_in101
285           KM    100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
286           DT 10YR_SD
287           DI         0       4     300
288           DQ         0       4       4

289           KK    DET8
290           KM    DETAIN BASIN 8
291           KO         0       0       0       0      21
292           RS         1    STOR      -1
293           SV      0.72    1.44    1.79     2.6    3.97     5.1
294           SQ         1      50     100     250     500     750
295           SE     55.22   55.78   55.99   56.40   57.03   57.52

296           KK      9A
297           KM    BASIN 9A
298           BA      0.10
299           LS         0      71
300           UD     0.110

301           KK    Q@9A
302           KM    COMBINE ALL BASINS UP TO AND INCLUDING 9A
303           HC         2

304           KKQ9A_in101
305           KM    100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
306           DT 10YR_SD
307           DI         0       8     405
308           DQ         0       8       8

309           KK    DET9A
310           KM    DETAIN AT BASIN 9A
311           KO         0       0       0       0      21
312           RS         1    STOR      -1
313           SV      1.31    3.19    4.13    6.62   10.46   13.34
314           SQ         1      50     100     250     500     750
315           SE     54.63   55.26   55.51   56.09   56.81   57.33

316           KK      B9
317           KM    BASIN 9
318           BA      0.10
319           LS         0      73
320           UD      0.11

321           KK     Q@9
322           KM    COMBINE ALL BASINS UP TO AND INCLUDING 9
323           HC         2

324           KKQ9_in101
325           KM    100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
326           DT 10YR_SD
327           DI         0      14     500
328           DQ         0      14      14
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


 329          KK    DET9
 330          KM   DETAIN AT BASIN 9
 331          KO       0       0       0       0      21
 332          RS       1    STOR      -1
 333          SV     2.1    4.34    5.45    8.83   13.19   16.35
 334          SQ       1      50     100     250     500     750
 335          SE   54.36   55.07   55.36   56.01   56.76   57.26

 336          KK      9B
 337          KM   BASIN 9B
 338          BA    0.09
 339          LS       0      74
 340          UD    0.12

 341          KK    Q@9B
 342          KM   COMBINE ALL BASINS UP TO AND INCLUDING 9B
 343          HC       2

 344          KKQ9B_in101
 345          KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 346          DT 10YR_SD
 347          DI       0      10     595
 348          DQ       0      10      10

 349          KK   DET9B
 350          KM   DETAIN AT BASIN 9B
 351          KO       0       0       0       0      21
 352          RS       1    STOR      -1
 353          SV    0.18    2.06    3.55    7.78   12.26    15.3
 354          SQ       1      50     100     250     500     750
 355          SE   54.03   54.63   54.98   55.85   56.63   57.12

 356          KK     B10
 357          KM   BASIN 10
 358          BA    0.05
 359          LS       0      73
 360          UD    0.09

 361          KK    Q@10
 362          KM   COMBINE ALL BASINS UP TO AND INCLUDING 10
 363          HC       2

 364          KKQ10_in101
 365          KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 366          DT 10YR_SD
 367          DI       0       2     625
 368          DQ       0       2       2

 369          KK   DET10
 370          KM   DETAIN AT BASIN 10
 371          KO       0       0       0       0      21
 372          RS       1    STOR      -1
 373          SV    0.22    1.16    1.86    3.83    5.97    7.37
 374          SQ       1      50     100     250     500     750
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 375          SE   53.59   54.46   54.88   55.75   56.50   56.97

 376          KK     B11
 377          KM   BASIN 11
 378          BA    0.12
 379          LS       0      76
 380          UD    0.15

 381          KK    Q@11
 382          KM   COMBINE ALL BASINS UP TO AND INCLUDING 11
 383          HC       2

 384          KKQ11_in101
 385          KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 386          DT 10YR_SD
 387          DI       0      19     765
 388          DQ       0      19      19

 389          KK   DET11
 390          KM   DETAIN AT BASIN 11
 391          KO       0       0       0       0      21
 392          RS       1    STOR      -1
 393          SV     .12     .68    1.07    1.96    3.17    4.72
 394          SQ       1      50     100     250     500     750
 395          SE   50.21   51.23   51.56   52.18   52.85   53.37
 396          ZZ
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                 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   72          1A
                V
                V
  121        RT1A
                .
                .
  127           .         1B
                .          V
                .          V
  131           .       RT1B
                .          V
                .          V
  137           .       RT1B
                .          .
                .          .
  143           .          .          1
                .          .          .
                .          .          .
  147         Q&1......................
                .
                .
  152           .-------> 10YR_SD
  150     Q1_in101
                V
                V
  155       DET_1
                .
                .
  161           .          2
                .          .
                .          .
  165         Q&2...........
                .
                .
  170           .-------> 10YR_SD
  168     Q2_in101
                V
                V
  173       DET_2
                .
                .
  179           .          6
                .          .
                .          .
  183         Q@6...........
                .
                .
  188           .-------> 10YR_SD
  186     Q6_in101
                V
                V
  191       DET_6
                .
```

```
               .
198            .         B3
               .          .
               .          .
204            .          .-------> 10YR_SD
202            .   Q3_in101
               .          V
               .          V
207            .     DET3
               .          .
               .          .
214            .          .            B4
               .          .             .
               .          .             .
218            .       3+4............
               .          .
               .          .
223            .          .-------> 10YR_SD
221            .   Q4_in101
               .          V
               .          V
226            .     DET4
               .          .
               .          .
233            .          .            B5
               .          .             .
               .          .             .
238            .       Q@5............
               .          .
               .          .
243            .          .-------> 10YR_SD
241            .   Q5_in101
               .          V
               .          V
246            .     DET5
               .          .
               .          .
253            .          .            B7
               .          .             .
               .          .             .
258            .       5+7............
               .          .
               .          .
263            .          .-------> 10YR_SD
261            .   Q7_in101
               .          .
               .          .
266          Q@7............
               V
               V
269          DET7
               .
               .
276            .         B8
               .          .
               .          .
281          Q@8............
               .
               .
286            .-------> 10YR_SD
```

```
284    Q8_in101
             V
             V
289       DET8
             .
             .
296          .           9A
             .            .
             .            .
301       Q@9A............
             .
             .
306          .-------> 10YR_SD
304    Q9A_in10
             V
             V
309      DET9A
             .
             .
316          .           B9
             .            .
             .            .
321        Q@9............
             .
             .
326          .-------> 10YR_SD
324    Q9_in101
             V
             V
329       DET9
             .
             .
336          .           9B
             .            .
             .            .
341       Q@9B............
             .
             .
346          .-------> 10YR_SD
344    Q9B_in10
             V
             V
349      DET9B
             .
             .
356          .          B10
             .            .
             .            .
361       Q@10............
             .
             .
366          .-------> 10YR_SD
364    Q10_in10
             V
             V
369      DET10
             .
             .
376          .          B11
             .            .
```

```
                .           .
 381        Q@11............
                .
                .
 386            .-------> 10YR_SD
 384    Q11_in10
                V
                V
 389       DET11
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************                                   *************************************
*                                      *                                   *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                   *   U.S. ARMY CORPS OF ENGINEERS
*              JUN   1998              *                                   *   HYDROLOGIC ENGINEERING CENTER
*           VERSION 4.1                *                                   *         609 SECOND STREET
*                                      *                                   *      DAVIS, CALIFORNIA 95616
*  RUN DATE   17AUG04  TIME  14:40:45  *                                   *          (916) 756-1104
*                                      *                                   *
****************************************                                   *************************************
```

```
**********************************************************
ENCINITAS COAST HWY 101         J-14413          7-13-04
SAME AS BELOW EXCPET 100-YEAR DETAINED
DIVERTED 10-YEAR STORM TO STORM DRAIN
CHANGED FILE NAME
FN: 100A4.HC1
**********************************************************
ENCINITAS COAST HWY 101         J-14413          7-13-04
100-YEAR UNDETAINED W/PIPE ROUTING BETWEEN BASINS
SAME AS BELOW BUT DIVERTED 10-YEAR STORM TO STORM DRAIN
CHANGED FILE NAME
FN: 100UDTDV.HC1
**********************************************************
ENCINITAS COAST HWY 101         J-14413          5-27-04
100-YEAR UNDETAINED W/PIPE ROUTING BETWEEN BASINS
FN: 100UD.HC1
**********************************************************
ENCINITAS COAST HWY 101         J-14413          3-24-04
REMOVED STORAGE IN BASINS 1 &2
FN: 100UD.HC1
**********************************************************
ENCINITAS COAST HWY 101         J-14413          1-08-04
SAME AS BELOW BUT CHANGED ROUTING TO MATCH DETAINED 100-YR
RUN (100DET3.HC1) BUT WITHOUT DETENTION
FN: 100UD.HC1
**********************************************************
ENCINITAS COAST HWY 101         J-14413          1-07-04
SAME AS BELOW BUT CHANGED PI CARDS (INCREASED BASIN AREA)
FN: 100R.HC1
**********************************************************
ENCINITAS COAST HWY 101         J-14413          12/29/03
100-YEAR RUN WITH BASIN AREAS EXTENDED TO THE RIDGE EAST OF
THE RR TRACKS. PI CARDS CHANGED FOR 100-YR BASED ON FN: E100.HC1
LAG AND CURVE NUMBERS CHANGED FOR 100-YEAR.
BASIN AREAS ALSO CHANGED FOR 7 THROUGH 11.
**********************************************************
ENCINITAS COAST HWY 101
J-14413
SEPT 25, 2003
MODIFIED EXISTING RUN TO MODEL PROPOSED DETENTION OF BASINS
1A, 1B, 1, 2, 3, 4, 5, 6, AND 8
DETENTION CARDS SA/SV, SQ, SE OBTAINED FROM FN: DSI_5R.HC1
**********************************************************
ENCINITAS- COAST HIGHWAY 101
JOB # 14413
09-12-03
```

```
                 MODIFIED PUMP Q TO 1.7 CFS, AND ROUTING OF BASINS 9A, 9B, AND 9
                 FROM PUMP STATION THROUGH 10" LATERAL, CONFLUENCING
                 WITH MAIN LINE AT AT CONNECTION 3 INSTEAD OF CONNECTION 2
                 ALSO CHANGED ROUTING THROUGH MAIN LINE FROM LINE G TO CONNECTION
                 2, TO LINE G TO CONNECTION 3
                 ***********************************************************
                 ENCINITAS- COAST HIGHWAY 101
                 JOB # 14413
                 09-04-03
                 MODIFIED CURVE NUMBER AND REMOVED % IMPERVIOUS
                 ***********************************************************
                 ENCINITAS- COAST HIGHWAY 101
                 JOB # 14413
                 06-03-03
                 POST-IMPROVEMENT (EXISTING) CONDITION      FN: 101EX_5.HC1
                 5-YEAR, 24-HR STORM EVENT
                 LAG CALCULATION ARE BASED OFF OF NRCS METHOD
                 AND ARE A FUNCTION OF RUNOFF COEF. AND VELOCITY
                 NESTED STORM PER COUNTY OF SAN DIEGO HYDROLOGY MANUAL
                 COPYRIGHT 2003 RICK ENGINEERING COMPANY
                 6HR RAINFALL IS  1.6  INCHES
                 24HR RAINFALL IS  2.5  INCHES
                 TOTAL BASIN AREA IS  .5  SQUARE MILES

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

  IT         HYDROGRAPH TIME DATA
                  NMIN           5  MINUTES IN COMPUTATION INTERVAL
                  IDATE     1JAN90  STARTING DATE
                  ITIME       1200  STARTING TIME
                     NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                 NDDATE     2JAN90  ENDING DATE
                 NDTIME       1255  ENDING TIME
                  ICENT         19  CENTURY MARK

             COMPUTATION INTERVAL    .08 HOURS
                  TOTAL TIME BASE  24.92 HOURS

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

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

          **************
          *            *
72 KK     *        1A  *
          *            *
          **************
```

```
 73 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

           **************
           *            *
191 KK     *    DET_6   *
           *            *
           **************

192 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

           **************
           *            *
207 KK     *     DET3   *
           *            *
           **************

209 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **
```

```
          **************
          *            *
 226 KK   *    DET4    *
          *            *
          **************

 228 KO        OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

          **************
          *            *
 246 KK   *    DET5    *
          *            *
          **************

 248 KO        OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

          **************
          *            *
 269 KK   *    DET7    *
          *            *
          **************

 271 KO        OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

           **************
           *            *
 289 KK    *     DET8   *
           *            *
           **************

 291 KO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

           **************
           *            *
 309 KK    *    DET9A   *
           *            *
           **************

 311 KO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE
                      IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                       IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT        .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

           **************
           *            *
 329 KK    *     DET9   *
           *            *
           **************

 331 KO         OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
```

```
                QSCAL          0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

          **************
          *            *
349 KK    *    DET9B   *
          *            *
          **************

351 KO         OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL          0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

          **************
          *            *
369 KK    *    DET10   *
          *            *
          **************

371 KO         OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          0  PLOT CONTROL
                QSCAL          0.  HYDROGRAPH PLOT SCALE
                IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                 IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
               TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

          **************
          *            *
389 KK    *    DET11   *
```

```
*                *
**************

391 KO         OUTPUT CONTROL VARIABLES
                    IPRNT            5  PRINT CONTROL
                    IPLOT            0  PLOT CONTROL
                    QSCAL           0.  HYDROGRAPH PLOT SCALE
                    IPNCH            0  PUNCH COMPUTED HYDROGRAPH
                     IOUT           21  SAVE HYDROGRAPH ON THIS UNIT
                    ISAV1            1  FIRST ORDINATE PUNCHED OR SAVED
                    ISAV2          300  LAST ORDINATE PUNCHED OR SAVED
                   TIMINT         .083  TIME INTERVAL IN HOURS
```

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	1A	9.	16.08	1.	0.	0.	.01		
ROUTED TO	RT1A	6.	16.42	1.	0.	0.	.01	1.31	16.42
HYDROGRAPH AT	1B	31.	16.08	4.	1.	1.	.03		
ROUTED TO	RT1B	0.	.00	0.	0.	0.	.03	5.63	24.92
ROUTED TO	RT1B	0.	.00	0.	0.	0.	.03	2.00	.00
HYDROGRAPH AT	1	62.	16.25	11.	3.	3.	.09		
3 COMBINED AT	Q&1	67.	16.25	12.	4.	4.	.13		
DIVERSION TO	10YR_SD	15.	16.25	8.	3.	3.	.13		
HYDROGRAPH AT	Q1_in101	52.	16.25	4.	1.	1.	.13		
ROUTED TO	DET_1	13.	16.67	2.	1.	1.	.13	68.70	16.67
HYDROGRAPH AT	2	72.	16.08	9.	3.	3.	.06		
2 COMBINED AT	Q&2	73.	16.08	11.	4.	4.	.19		
DIVERSION TO	10YR_SD	19.	16.08	9.	3.	3.	.19		
HYDROGRAPH AT	Q2_in101	54.	16.08	3.	1.	1.	.19		
ROUTED TO	DET_2	1.	.08	1.	1.	1.	.19	66.73	.00
HYDROGRAPH AT	6	55.	16.25	11.	3.	3.	.06		
2 COMBINED AT	Q@6	56.	16.25	12.	4.	4.	.25		
DIVERSION TO	10YR_SD	16.	16.25	8.	4.	4.	.25		
HYDROGRAPH AT	Q6_in101	40.	16.25	3.	1.	1.	.25		
ROUTED TO	DET_6	38.	16.33	4.	2.	2.	.25	64.82	16.33
HYDROGRAPH AT	B3	30.	16.08	3.	1.	1.	.02		
DIVERSION TO	10YR_SD	11.	16.08	3.	1.	1.	.02		
HYDROGRAPH AT	Q3_in101	19.	16.08	1.	0.	0.	.02		
ROUTED TO	DET3	1.	.08	1.	1.	1.	.02	59.68	.00
HYDROGRAPH AT	B4	27.	16.00	3.	1.	1.	.02		
2 COMBINED AT	3+4	28.	16.00	4.	2.	2.	.04		

DIVERSION TO	10YR_SD	7.	16.00	3.	2.	2.	.04		
HYDROGRAPH AT	Q4_in101	21.	16.00	1.	0.	0.	.04		
ROUTED TO	DET4	1.	.08	1.	1.	1.	.04	59.54	.00
HYDROGRAPH AT	B5	28.	16.08	3.	1.	1.	.02		
2 COMBINED AT	Q@5	29.	16.08	4.	2.	2.	.06		
DIVERSION TO	10YR_SD	9.	16.08	3.	2.	2.	.06		
HYDROGRAPH AT	Q5_in101	20.	16.08	1.	0.	0.	.06		
ROUTED TO	DET5	1.	.08	1.	1.	1.	.06	57.76	.00
HYDROGRAPH AT	B7	31.	16.25	6.	2.	2.	.04		
2 COMBINED AT	5+7	32.	16.25	7.	3.	3.	.10		
DIVERSION TO	10YR_SD	6.	16.25	4.	2.	2.	.10		
HYDROGRAPH AT	Q7_in101	26.	16.25	2.	1.	1.	.10		
2 COMBINED AT	Q@7	62.	16.33	6.	2.	2.	.35		
ROUTED TO	DET7	47.	16.50	6.	2.	2.	.35	55.75	16.50
HYDROGRAPH AT	B8	69.	16.08	7.	2.	2.	.06		
2 COMBINED AT	Q@8	78.	16.08	14.	5.	4.	.41		
DIVERSION TO	10YR_SD	4.	16.08	4.	2.	2.	.41		
HYDROGRAPH AT	Q8_in101	74.	16.08	10.	2.	2.	.41		
ROUTED TO	DET8	50.	16.58	9.	3.	3.	.41	55.78	16.58
HYDROGRAPH AT	9A	114.	16.08	12.	4.	4.	.10		
2 COMBINED AT	Q@9A	136.	16.08	21.	7.	6.	.51		
DIVERSION TO	10YR_SD	8.	16.08	7.	3.	3.	.51		
HYDROGRAPH AT	Q9A_in10	128.	16.08	14.	4.	3.	.51		
ROUTED TO	DET9A	51.	16.67	12.	4.	4.	.51	55.27	16.67
HYDROGRAPH AT	B9	123.	16.08	13.	4.	4.	.10		
2 COMBINED AT	Q@9	130.	16.08	25.	8.	8.	.61		
DIVERSION TO	10YR_SD	14.	16.08	10.	4.	4.	.61		
HYDROGRAPH AT	Q9_in101	116.	16.08	15.	4.	4.	.61		
ROUTED TO	DET9	44.	16.92	13.	4.	4.	.61	54.98	16.92
HYDROGRAPH AT	9B	111.	16.08	12.	4.	4.	.09		

2 COMBINED AT	Q@9B	112.	16.08	25.	8.	8.	.70		
DIVERSION TO	10YR_SD	10.	16.08	9.	4.	4.	.70		
HYDROGRAPH AT	Q9B_in10	102.	16.08	17.	4.	4.	.70		
ROUTED TO	DET9B	46.	16.50	17.	5.	5.	.70	54.58	16.50
HYDROGRAPH AT	B10	62.	16.08	7.	2.	2.	.05		
2 COMBINED AT	Q@10	86.	16.08	23.	7.	7.	.75		
DIVERSION TO	10YR_SD	2.	16.08	2.	2.	1.	.75		
HYDROGRAPH AT	Q10_in10	84.	16.08	21.	5.	5.	.75		
ROUTED TO	DET10	56.	16.33	21.	6.	6.	.75	54.51	16.33
HYDROGRAPH AT	B11	141.	16.08	18.	6.	5.	.12		
2 COMBINED AT	Q@11	179.	16.08	39.	12.	11.	.87		
DIVERSION TO	10YR_SD	19.	16.08	15.	6.	6.	.87		
HYDROGRAPH AT	Q11_in10	160.	16.08	23.	6.	6.	.87		
ROUTED TO	DET11	138.	16.25	23.	7.	6.	.87	51.72	16.25

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

ATTACHMENT 2

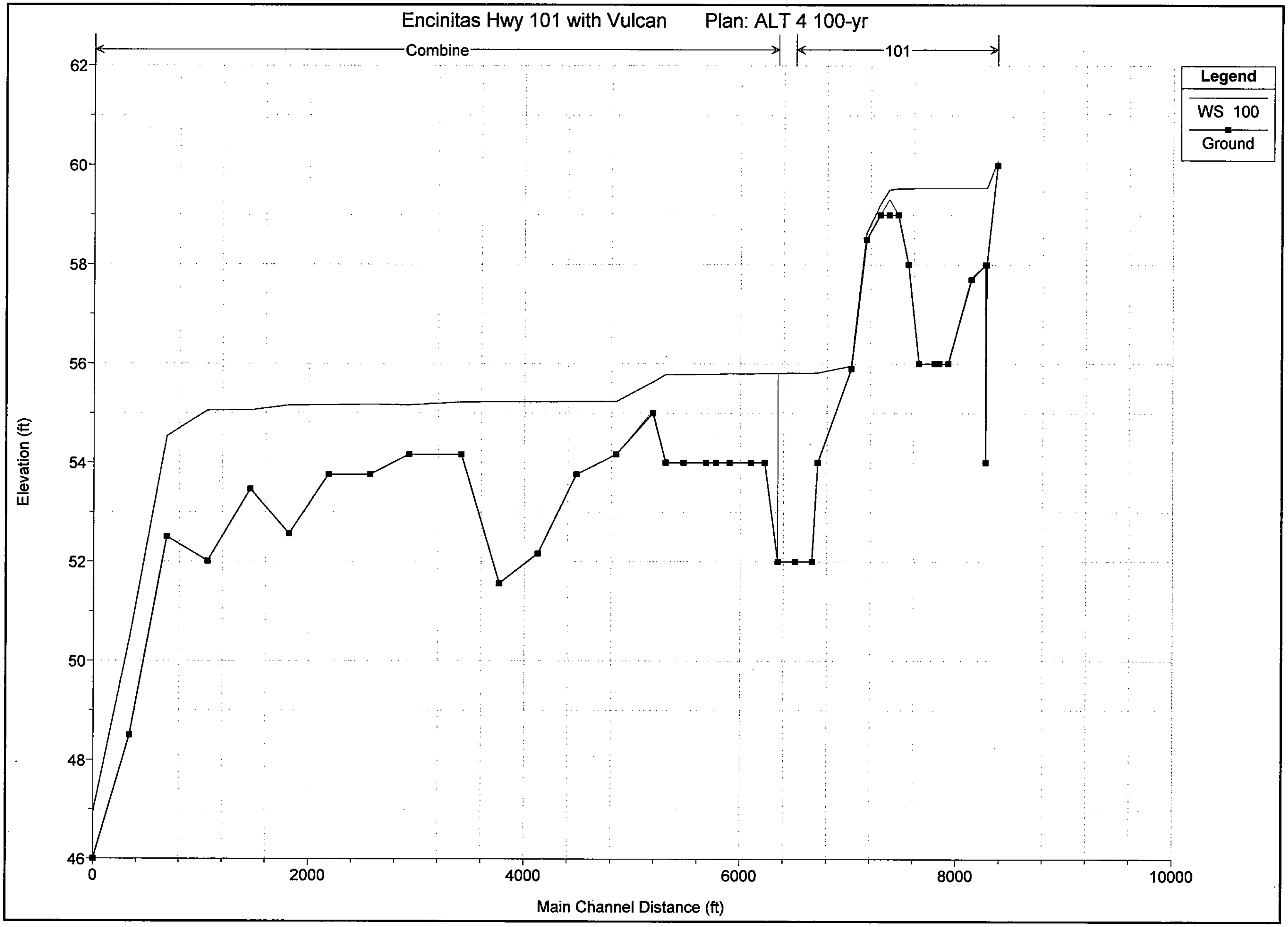
ALTERNATIVE 4
100-YEAR HEC-RAS ANALYSIS

HEC-RAS Plan: 100A4 Profile: 100

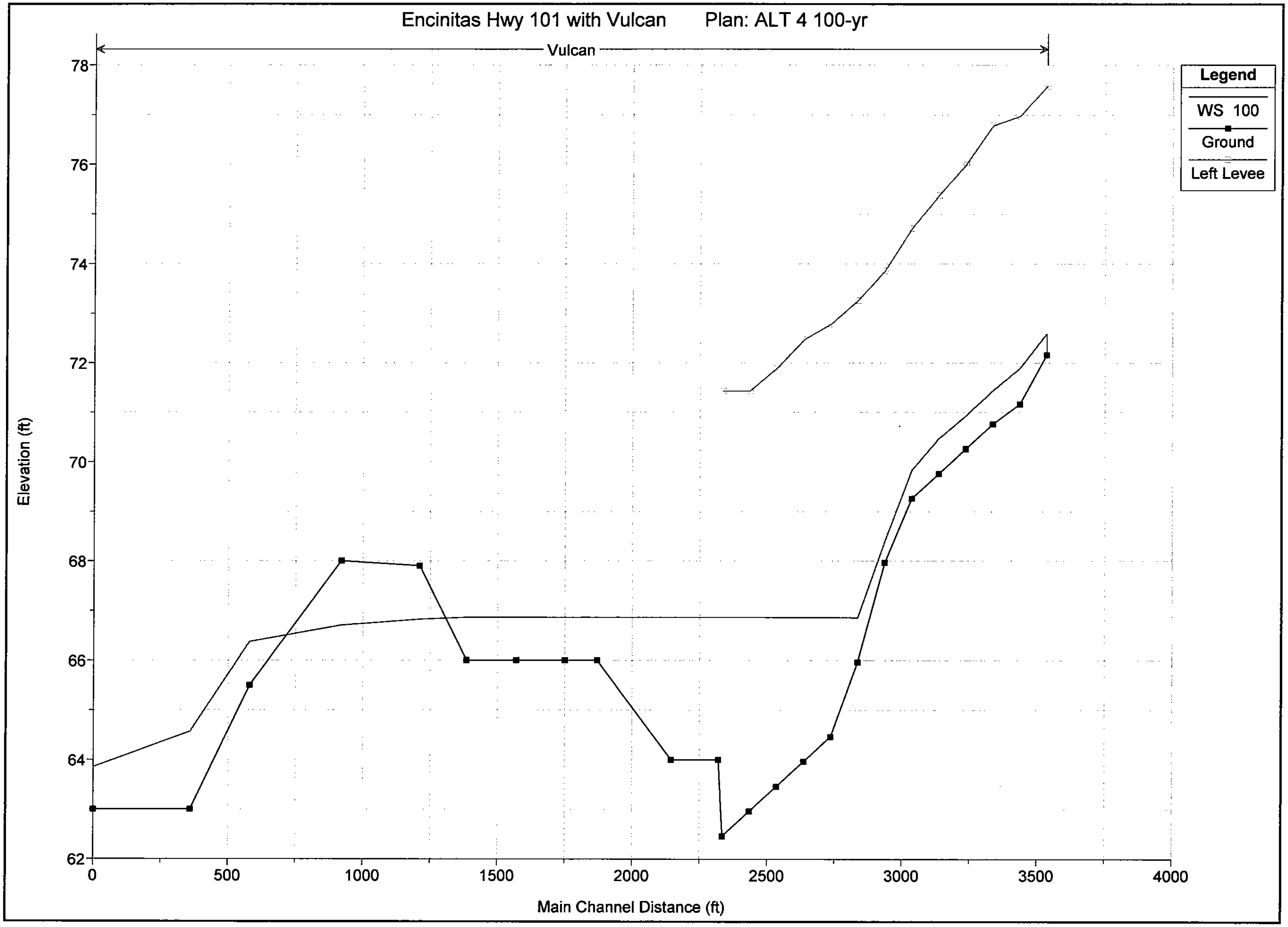
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Vulcan	3300.14	13.00	72.16	72.59	72.59	72.79	0.023812	3.71	3.58	8.85	1.00
Vulcan	3200.15	13.00	71.16	71.88	71.58	71.95	0.003891	2.14	6.30	9.40	0.44
Vulcan	3100.16	13.00	70.76	71.44	71.19	71.51	0.004919	2.29	5.86	9.35	0.49
Vulcan	3000.17	13.00	70.26	70.93	70.69	71.01	0.005168	2.33	5.77	9.33	0.50
Vulcan	2900.18	13.00	69.76	70.47	70.19	70.54	0.004234	2.19	6.14	9.41	0.46
Vulcan	2800.19	13.00	69.26	69.83	69.69	69.94	0.008797	2.74	4.88	9.14	0.64
Vulcan	2700.20	13.00	67.96	68.39	68.39	68.59	0.022845	3.66	3.63	8.86	0.98
Vulcan	2600.21	13.00	65.96	66.85	66.39	66.90	0.001875	1.71	7.95	9.79	0.32
Vulcan	2500.22	13.00	64.46	66.86	64.89	66.87	0.000057	0.58	25.01	12.81	0.07
Vulcan	2400.23	13.00	63.96	66.86	64.39	66.87	0.000029	0.46	31.66	13.81	0.05
Vulcan	2300.24	13.00	63.46	66.86	63.89	66.87	0.000016	0.38	38.81	14.81	0.04
Vulcan	2200.25	13.00	62.96	66.86	63.39	66.87	0.000012	0.36	46.96	32.44	0.03
Vulcan	2100.26	13.00	62.46	66.86	62.89	66.86	0.000002	0.16	129.37	82.28	0.01
Vulcan	245	13.00	64.00	66.86		66.86	0.000003	0.15	118.42	81.57	0.02
Vulcan	240	1.00	64.00	66.86		66.86	0.000000	0.01	160.35	114.77	0.00
Vulcan	235	1.00	66.00	66.86		66.86	0.000000	0.01	121.00	155.23	0.00
Vulcan	230	1.00	66.00	66.86		66.86	0.000000	0.01	132.43	171.70	0.00
Vulcan	225	1.00	66.00	66.86		66.86	0.000000	0.01	93.65	119.89	0.00
Vulcan	220	1.00	66.00	66.86		66.86	0.000000	0.00	271.66	333.13	0.00
Vulcan	215	1.00	67.90	66.83	66.83	66.86	0.014435		0.68	9.90	0.00
Vulcan	195	38.00	68.00	66.71	66.27	66.72	0.000260		47.12	84.98	0.00
Vulcan	175	38.00	65.50	66.37	66.37	66.48	0.004576	3.64	18.56	85.07	0.81
Vulcan	165	38.00	63.00	64.57	64.02	64.62	0.000608	1.90	21.04	24.51	0.33
Vulcan	150	38.00	63.00	63.86	63.86	64.07	0.007780	3.71	10.24	23.94	1.00
101	230	1.00	60.00	60.08	60.08	60.10	0.017075	1.12	0.89	22.55	1.00
101	225.3	1.00	58.00	59.54	58.03	59.54	0.000000	0.01	79.95	70.52	0.00
101	225.2	1.00	54.64	59.54		59.54	0.000000	0.01	158.06	70.52	0.00
101	225.1	1.00	58.00	59.54		59.54	0.000000	0.01	79.94	70.52	0.00
101	220	1.00	57.75	59.54		59.54	0.000000	0.01	141.80	110.60	0.00
101	215	1.00	56.00	59.54		59.54	0.000000	0.00	402.07	160.61	0.00
101	210	1.00	56.00	59.54		59.54	0.000000	0.00	286.25	92.35	0.00
101	205	1.00	56.00	59.54		59.54	0.000000	0.00	354.55	114.90	0.00
101	195	1.00	56.00	59.54		59.54	0.000000	0.01	188.18	102.50	0.00
101	190	1.00	58.00	59.54		59.54	0.000000	0.01	122.09	90.00	0.00
101	185	1.00	59.00	59.54		59.54	0.000002	0.05	18.44	50.00	0.02
101	180	1.00	59.32	59.51	59.49	59.54	0.008400	1.38	0.73	7.81	0.80

HEC-RAS Plan: 100A4 Profile: 100 (Continued)

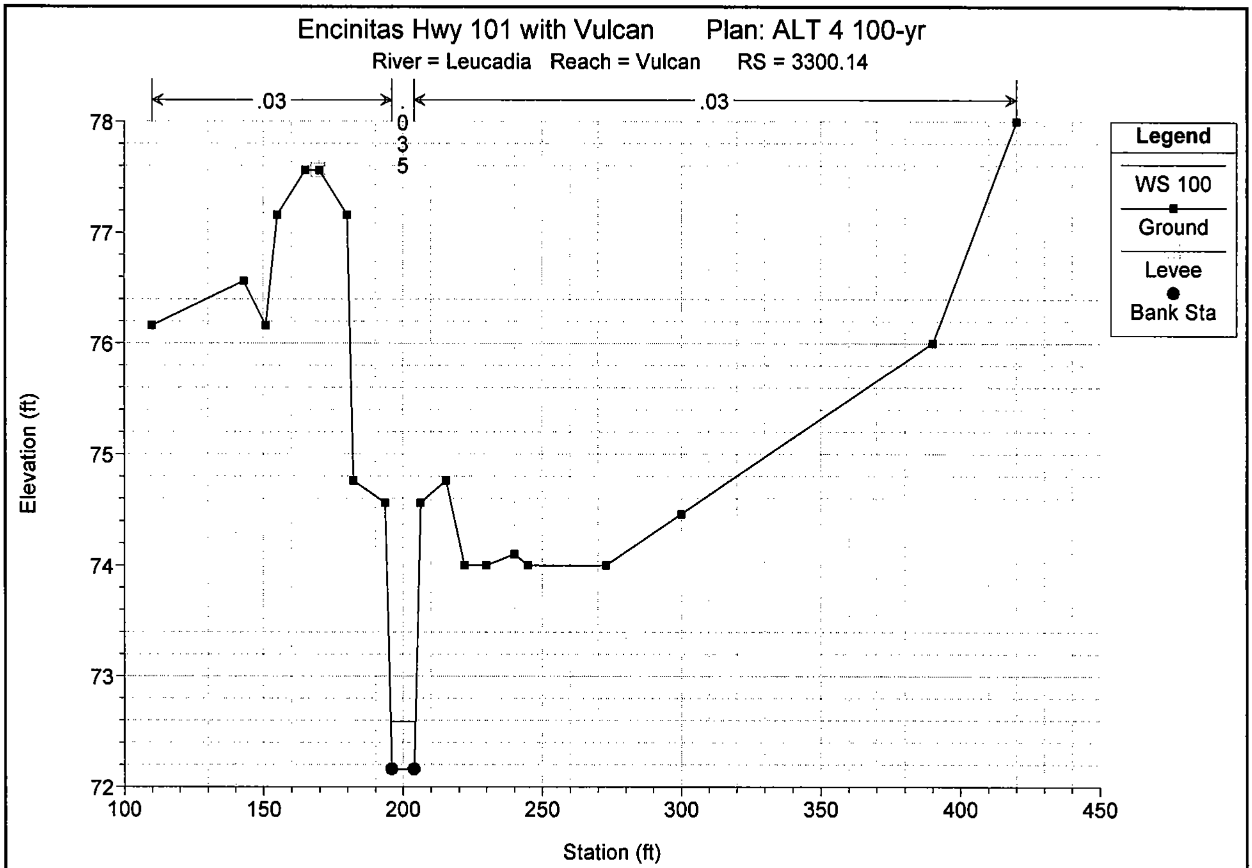
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
101	175	1.00	59.00	59.21	59.14	59.22	0.002048	0.80	1.25	10.64	0.41
101	170	1.00	58.50	58.64	58.64	58.68	0.014397	1.53	0.65	9.21	1.01
101	165	1.00	55.90	55.96	55.96	55.98	0.028200	1.16	0.86	30.15	1.22
101	160	1.00	54.00	55.82	54.15	55.82	0.000000	0.01	93.12	92.91	0.00
101	150	1.00	52.00	55.82		55.82	0.000000	0.00	258.07	123.56	0.00
101	145	1.00	52.00	55.81		55.81	0.000000	0.01	140.95	60.00	0.00
Combine	140	47.00	52.00	55.81	52.75	55.81	0.000006	0.37	129.31	51.80	0.04
Combine	135	47.00	54.00	55.81		55.81	0.000004	0.22	253.27	197.37	0.03
Combine	130	47.00	54.00	55.80		55.81	0.000055	0.81	68.16	62.33	0.11
Combine	125	47.00	54.00	55.80		55.80	0.000005	0.26	213.84	151.85	0.03
Combine	120	50.00	54.00	55.79		55.80	0.000047	0.70	83.49	87.54	0.09
Combine	115	50.00	54.00	55.79		55.80	0.000045	0.69	84.01	93.24	0.09
Combine	110	50.00	54.00	55.79		55.79	0.000011	0.34	179.19	154.71	0.04
Combine	105	51.00	54.00	55.78		55.78	0.000047	0.71	106.18	139.97	0.09
Combine	100	51.00	55.06	55.63	55.63	55.75	0.009946	2.80	18.22	77.65	1.02
Combine	95	51.00	54.16	55.23	54.63	55.24	0.000162	0.80	68.85	103.07	0.16
Combine	90	44.00	53.76	55.23		55.23	0.000006	0.24	210.10	174.50	0.03
Combine	85	44.00	52.16	55.23		55.23	0.000001	0.17	314.20	158.78	0.02
Combine	80	44.00	51.56	55.23		55.23	0.000002	0.20	297.66	185.32	0.02
Combine	75	46.00	54.16	55.22		55.23	0.000036	0.41	115.34	143.68	0.08
Combine	70	46.00	54.16	55.17		55.18	0.000390	1.04	50.38	148.08	0.24
Combine	65	46.00	53.76	55.17		55.17	0.000003	0.16	303.16	274.84	0.03
Combine	60	56.00	53.76	55.16		55.17	0.000091	0.77	78.12	89.81	0.13
Combine	55	56.00	52.56	55.16		55.16	0.000011	0.41	197.50	187.99	0.05
Combine	50	138.00	53.46	55.06		55.13	0.000569	2.09	68.67	61.11	0.33
Combine	45	138.00	52.01	55.06		55.06	0.000048	1.08	195.69	142.19	0.11
Combine	40	138.00	52.50	54.53	54.53	54.96	0.006610	5.27	26.18	30.75	1.01
Combine	35	138.00	48.50	50.45	50.72	51.34	0.018364	7.57	18.22	27.28	1.63
Combine	30	138.00	46.00	46.94	47.02	47.51	0.007407	6.15	23.06	25.94	1.12

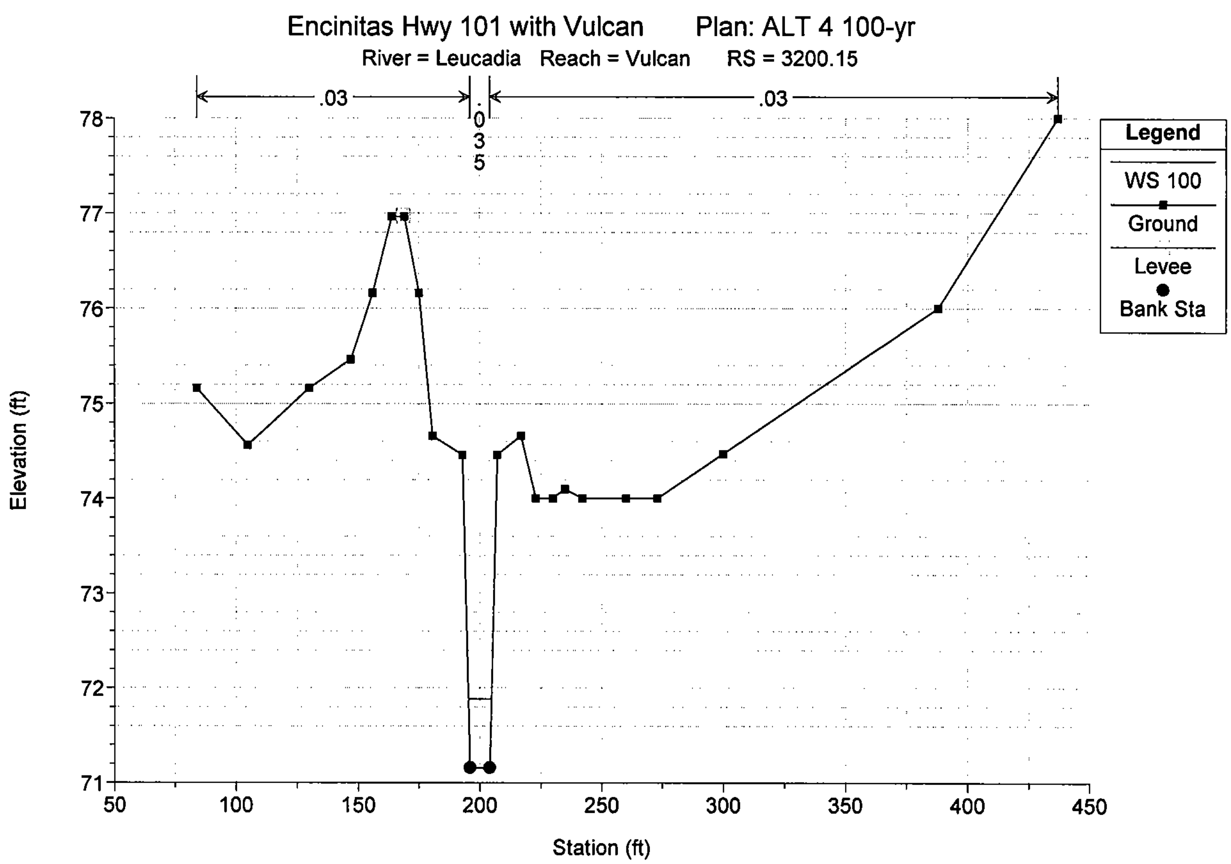


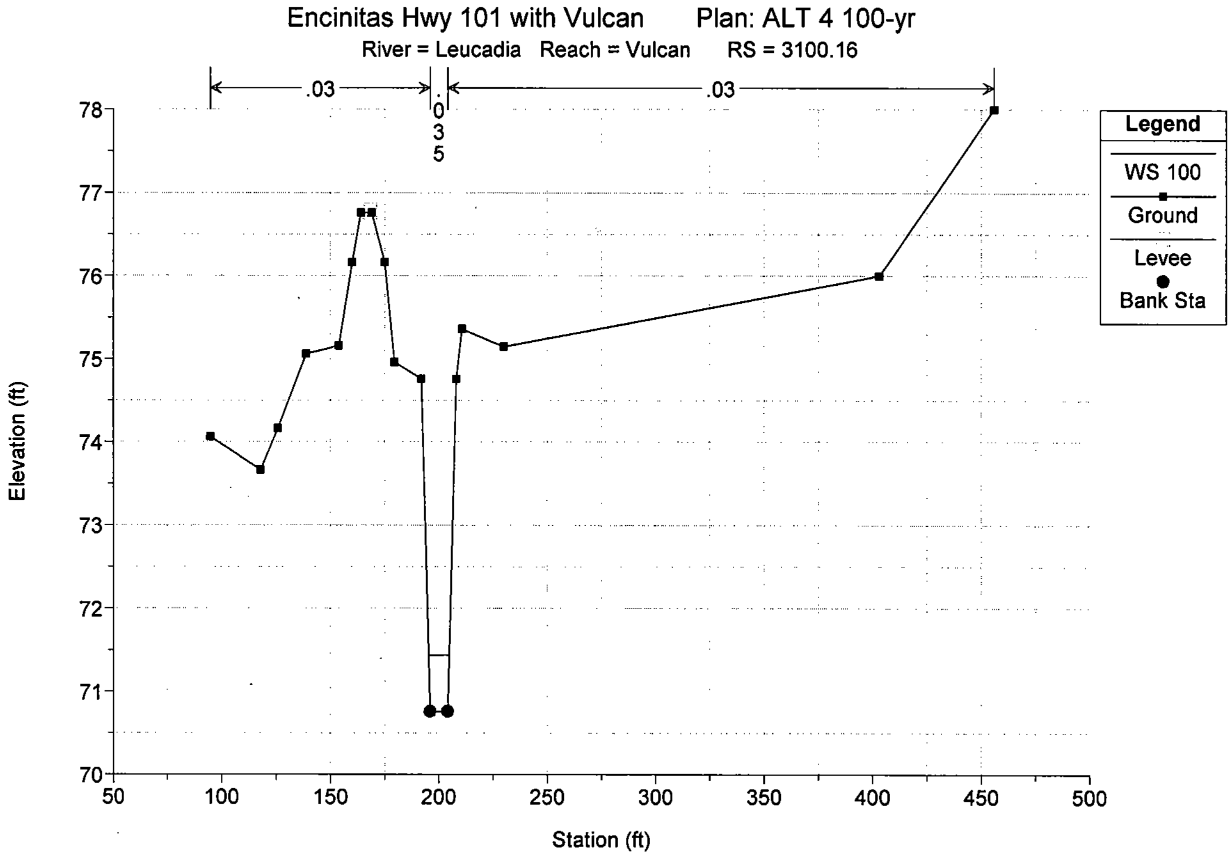
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
Combine
101
Legend
WS 100
Ground
Elevation (ft)
62
60
58
56
54
52
50
48
46
0
2000
4000
6000
8000
10000
Main Channel Distance (ft)

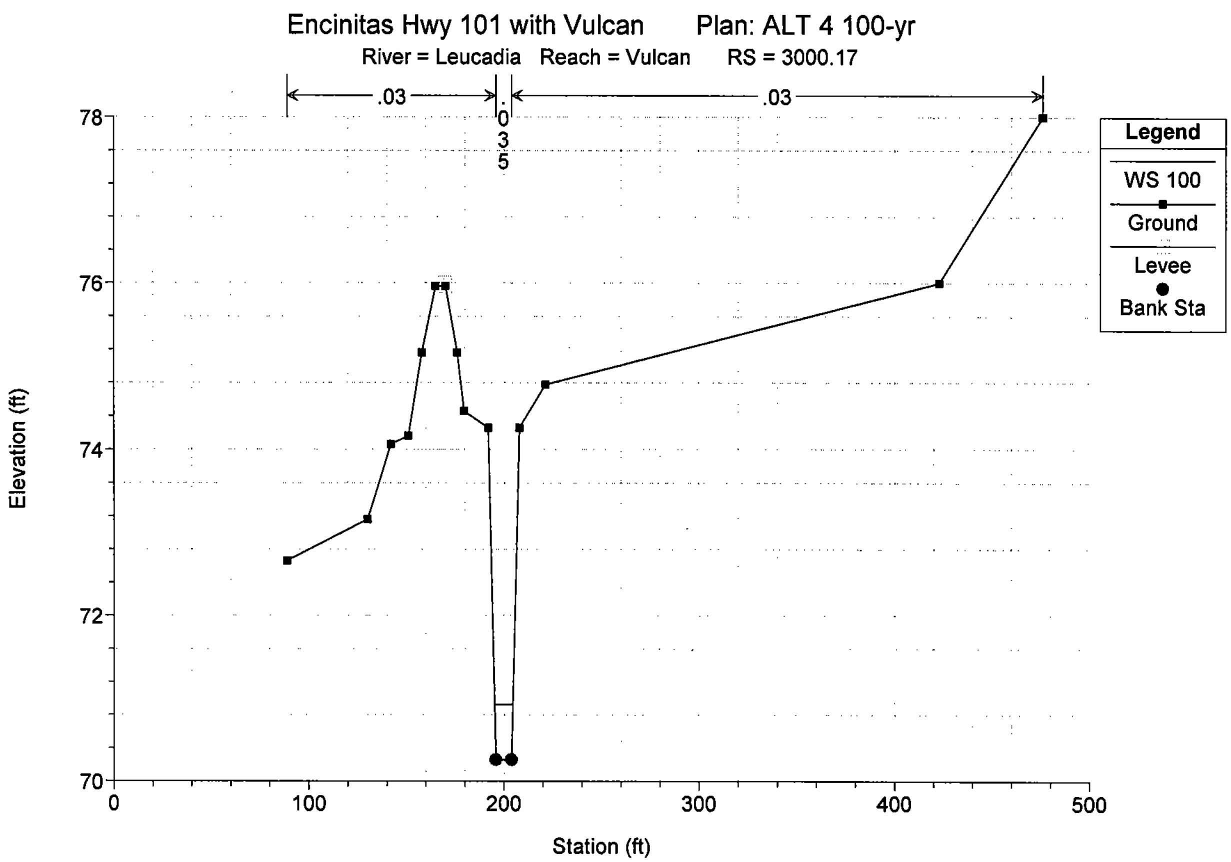


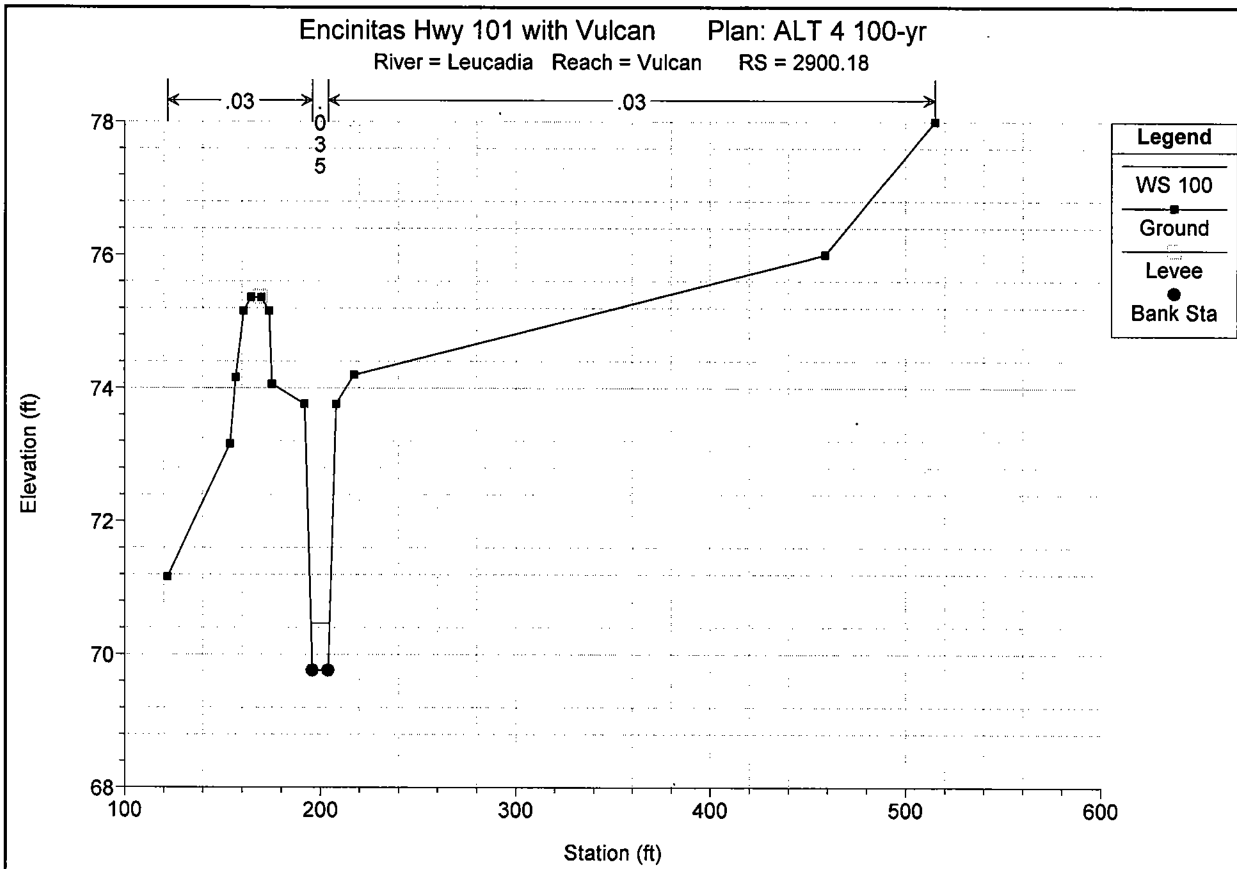
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
Vulcan
Legend
WS 100
Ground
Left Levee
Elevation (ft)
78
76
74
72
70
68
66
64
62
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)

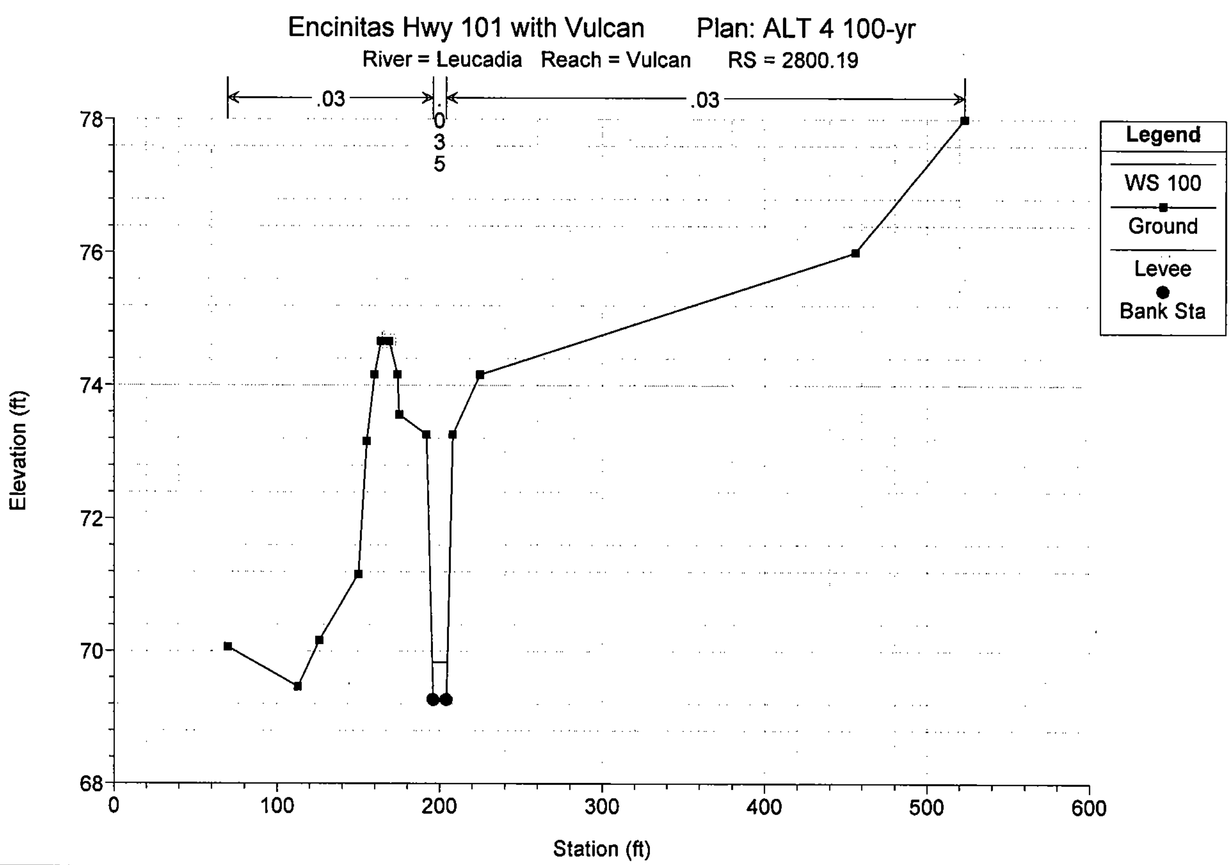

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 3300.14
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

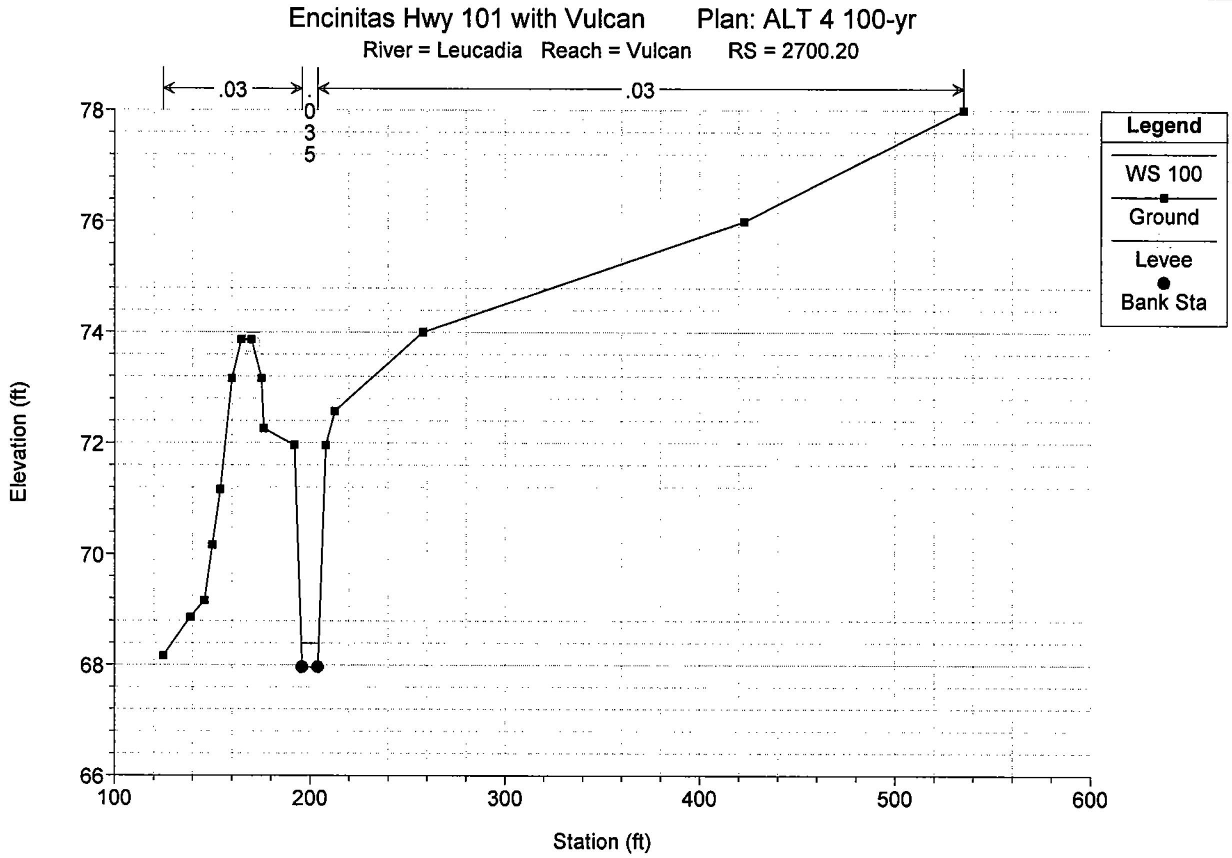

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 3200.15
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

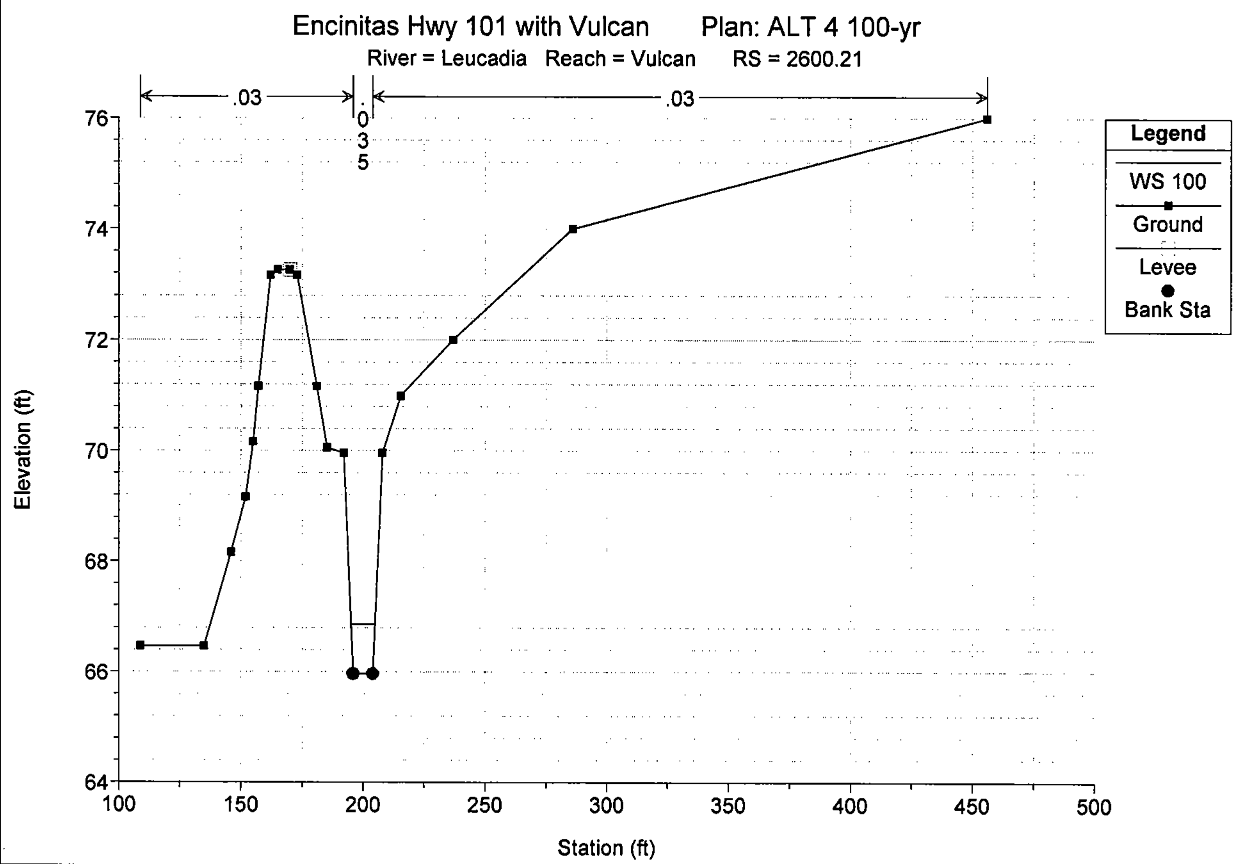

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 3100.16
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

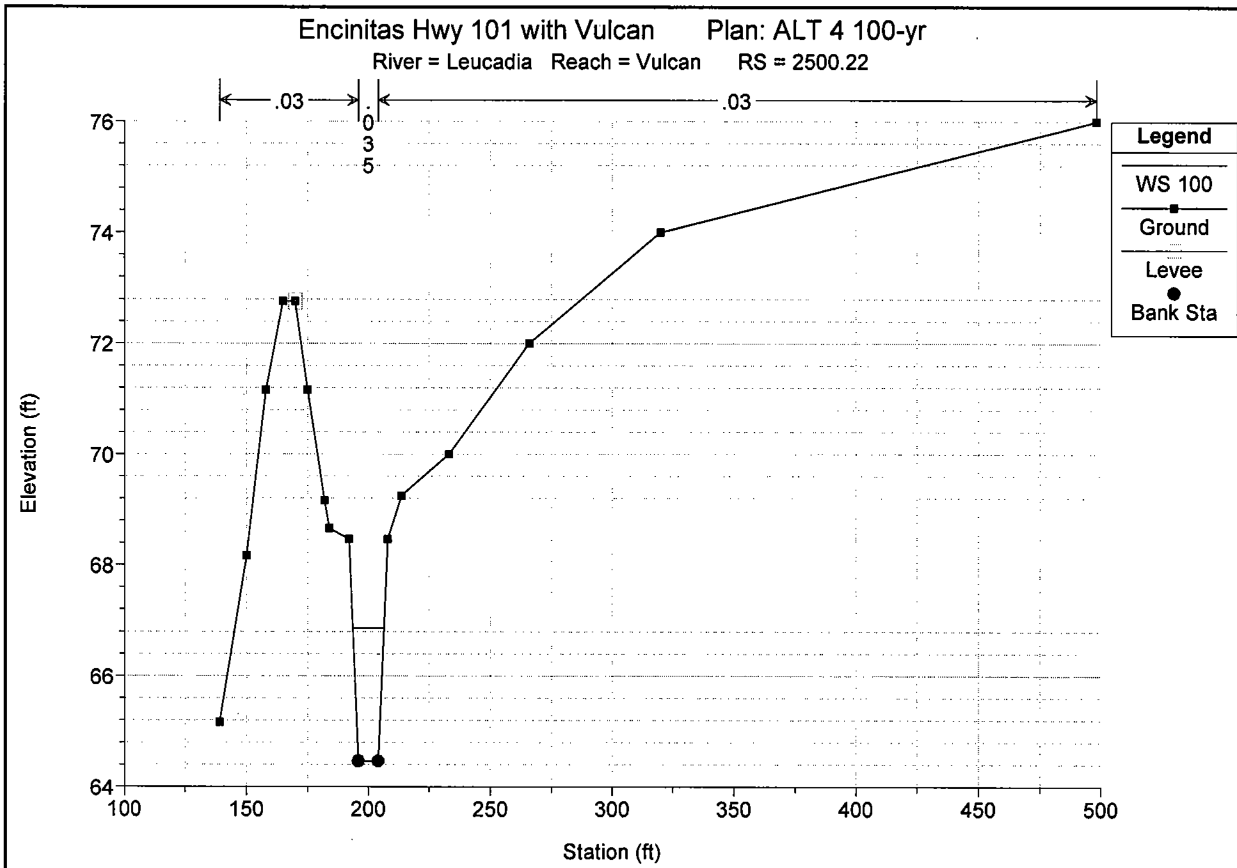

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 3000.17
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

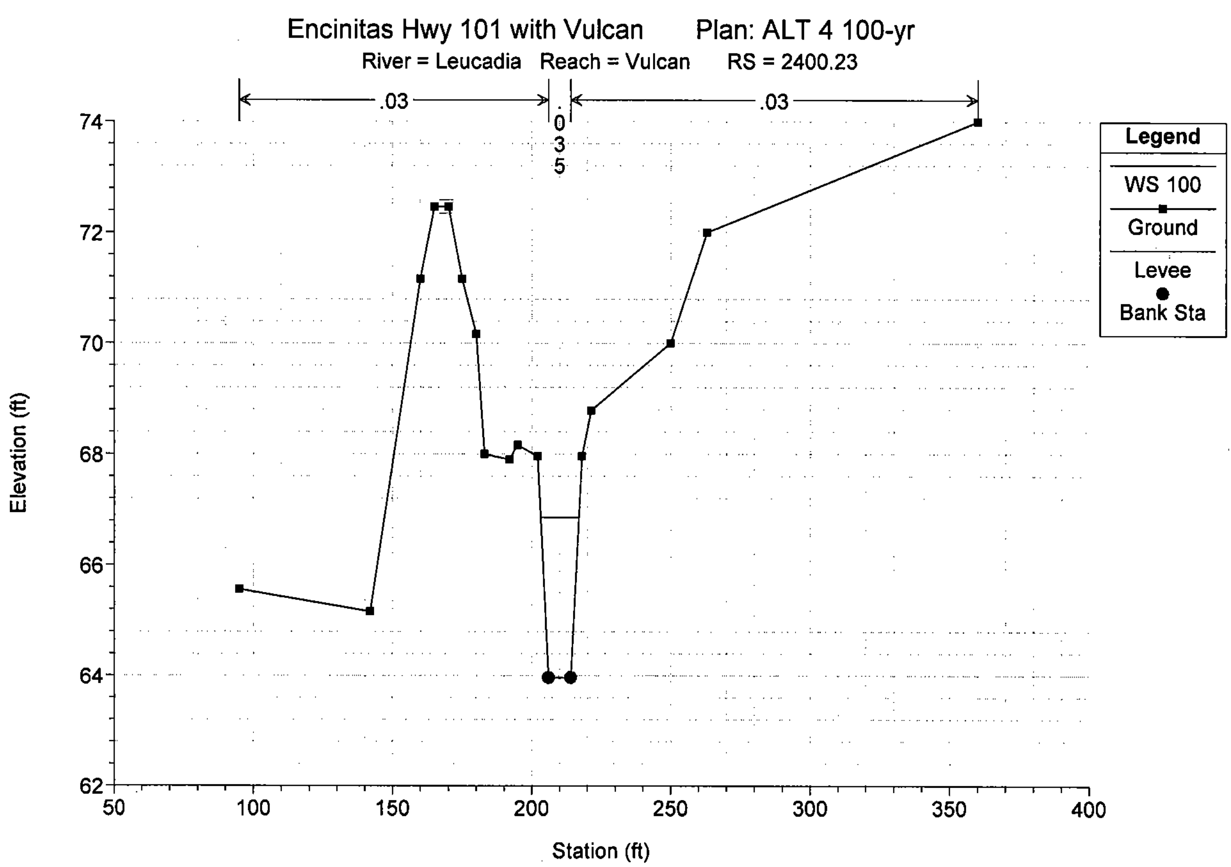

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 2900.18
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
78
76
74
72
70
68
100
200
300
400
500
600

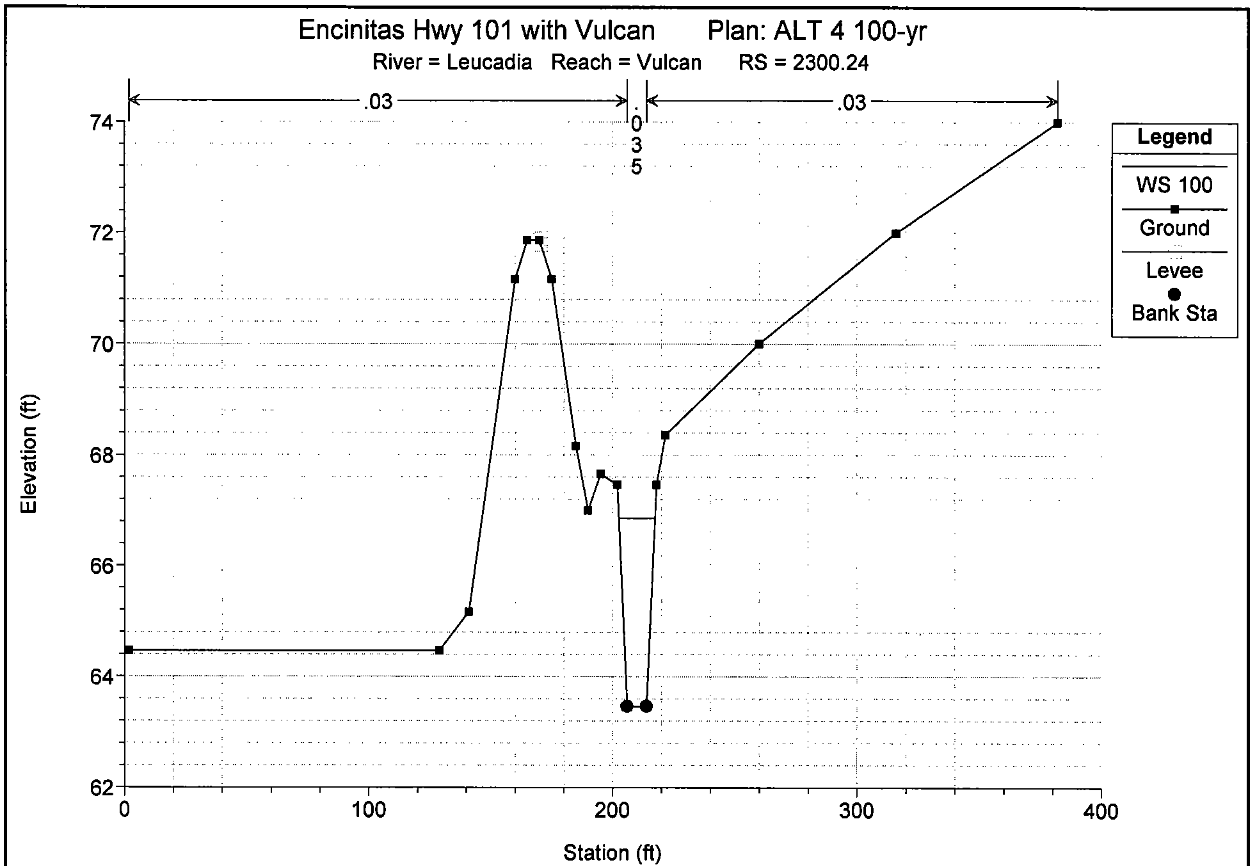

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 2800.19
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
78
76
74
72
70
68
0
100
200
300
400
500
600

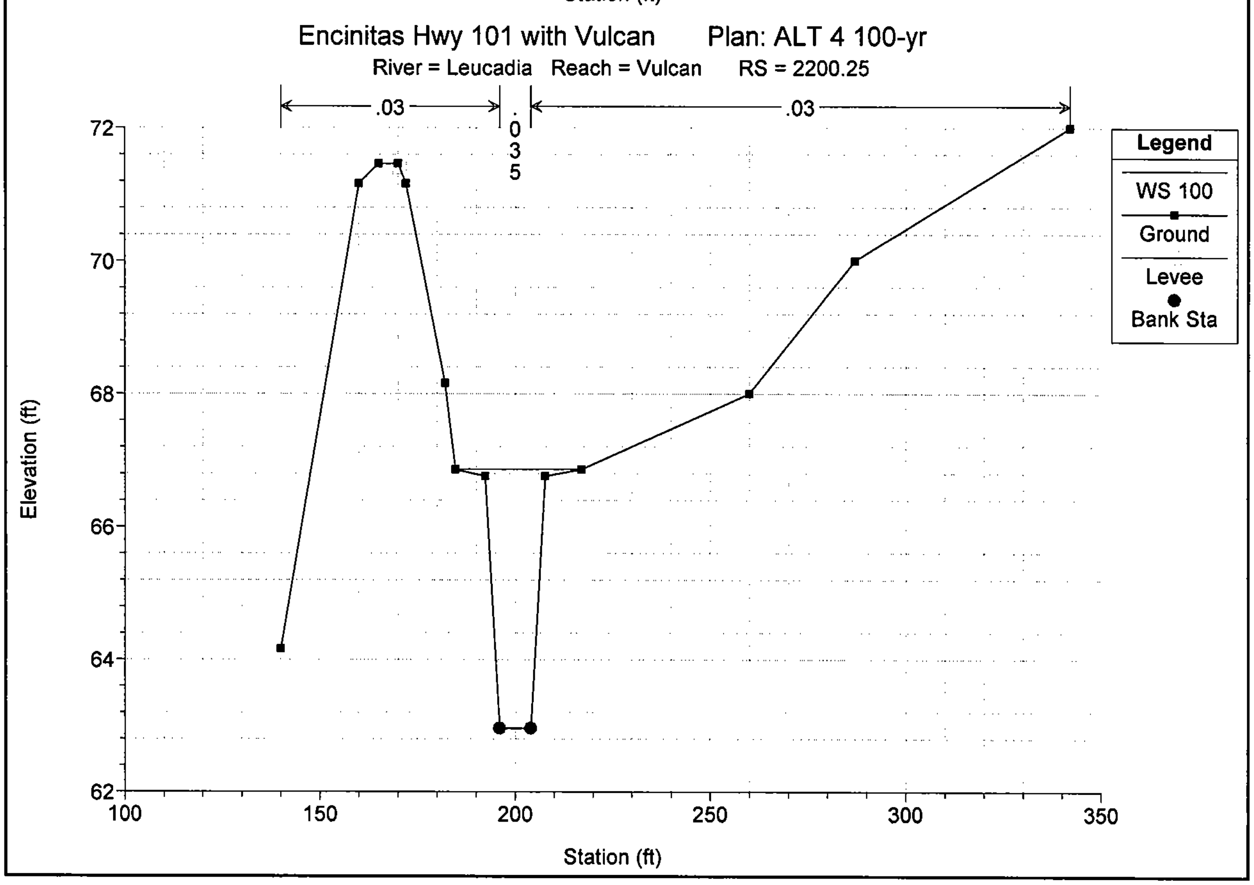

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 2700.20
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
78
76
74
72
70
68
66
100
200
300
400
500
600

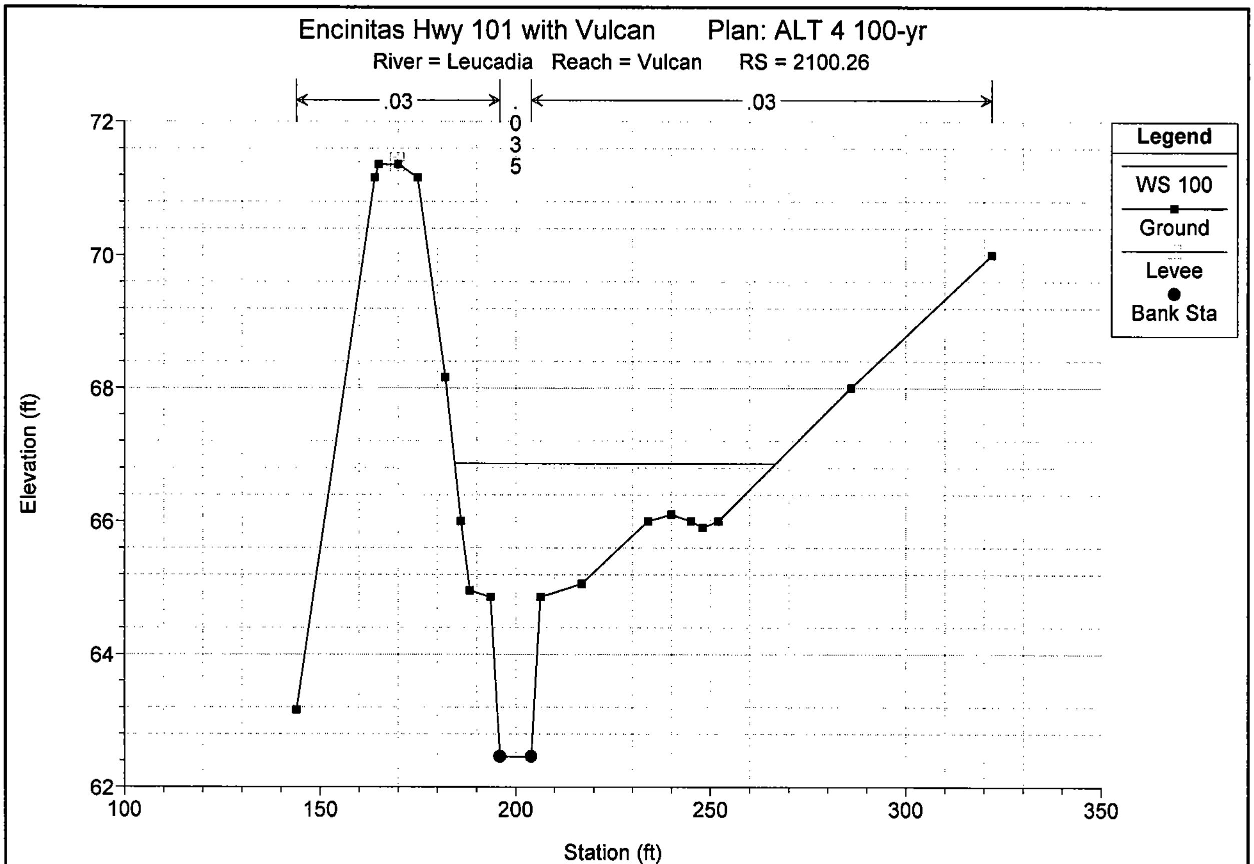

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 2600.21
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
76
74
72
70
68
66
64
100
150
200
250
300
350
400
450
500


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 2500.22
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

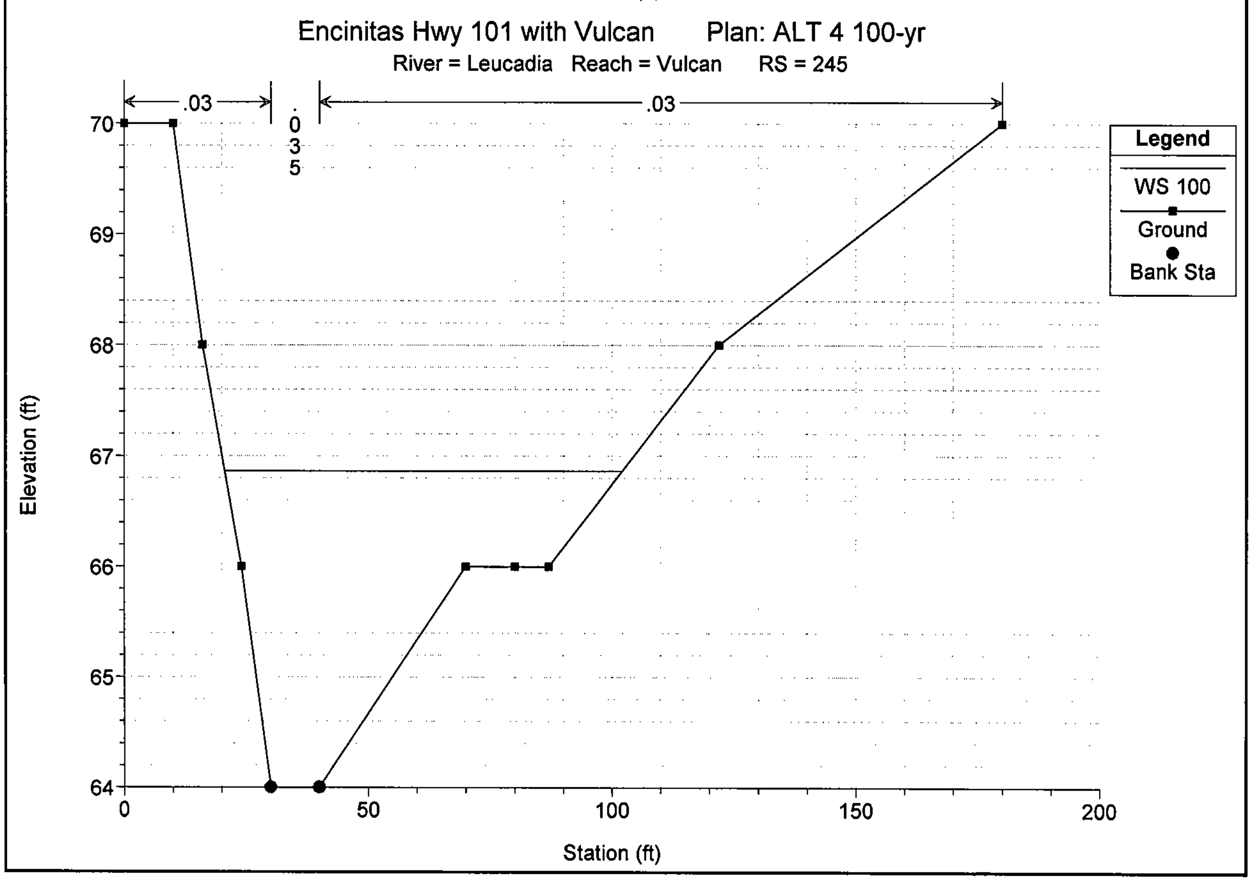

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 2400.23
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 2300.24
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
74
72
70
68
66
64
62
0
100
200
300
400

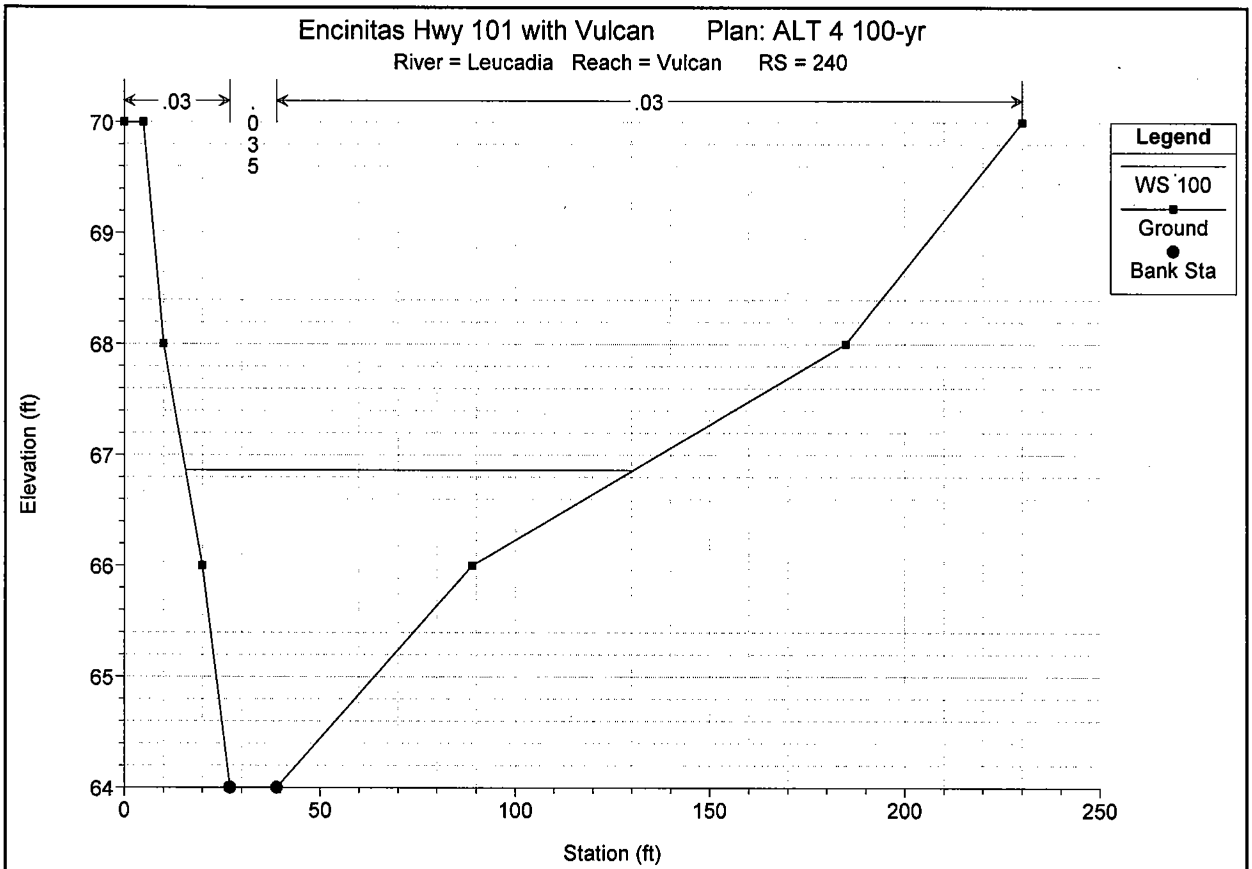

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 2200.25
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
72
70
68
66
64
62
100
150
200
250
300
350

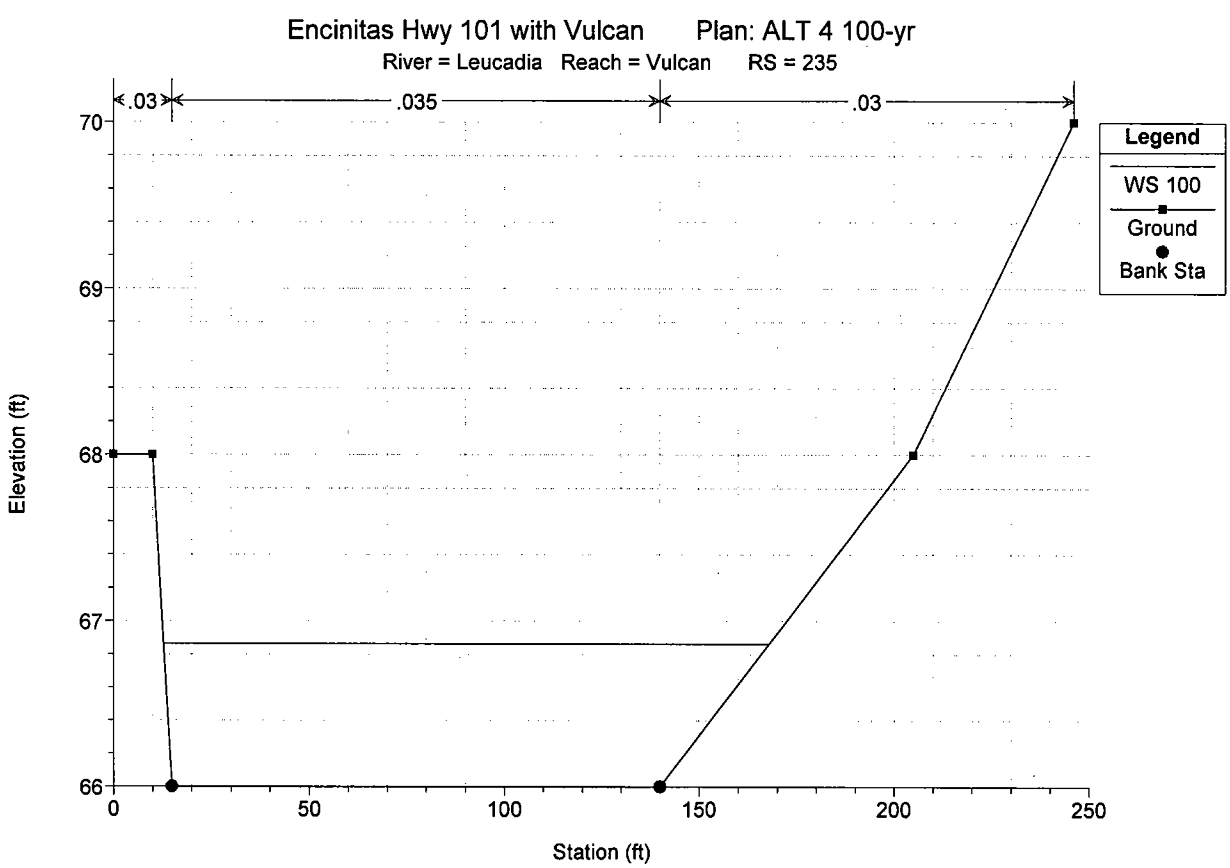


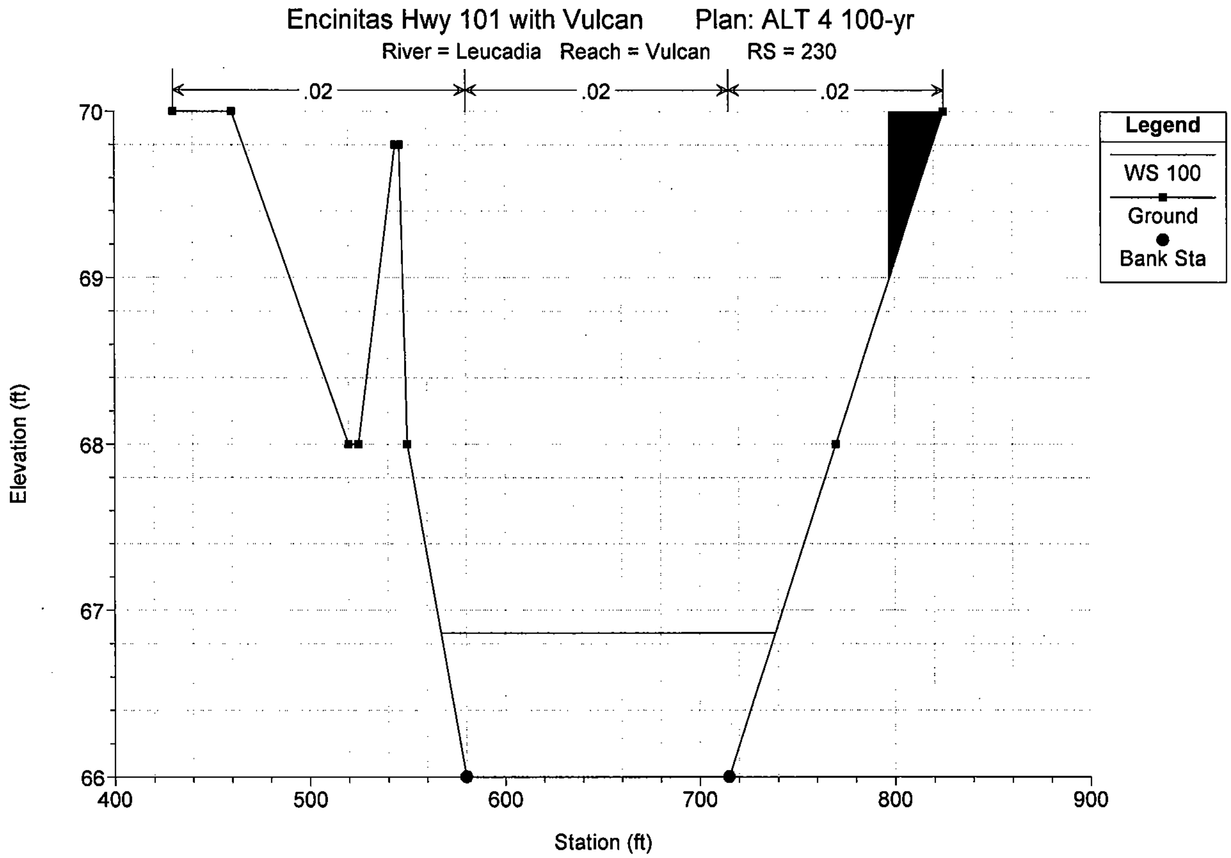
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 2100.26
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
72
70
68
66
64
62
100
150
200
250
300
350
Station (ft)

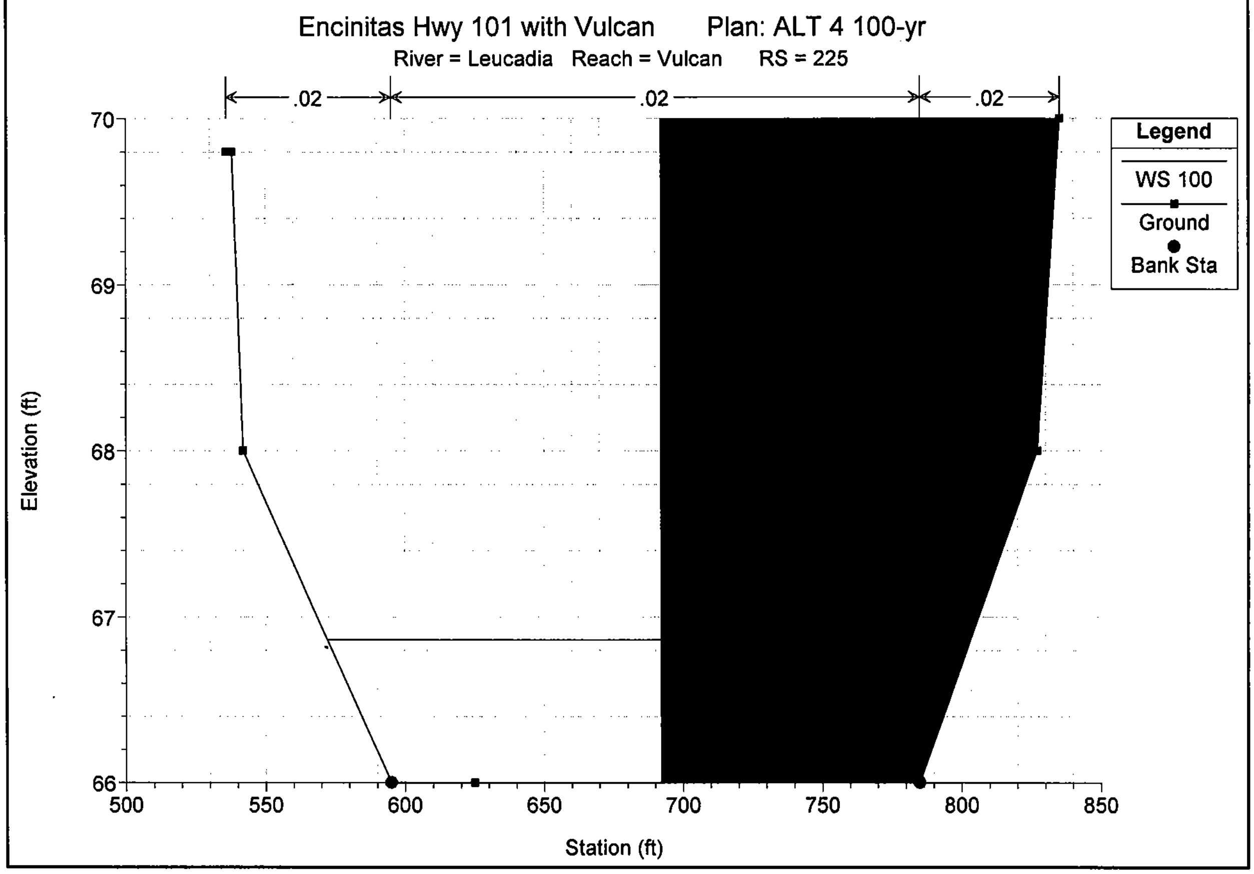


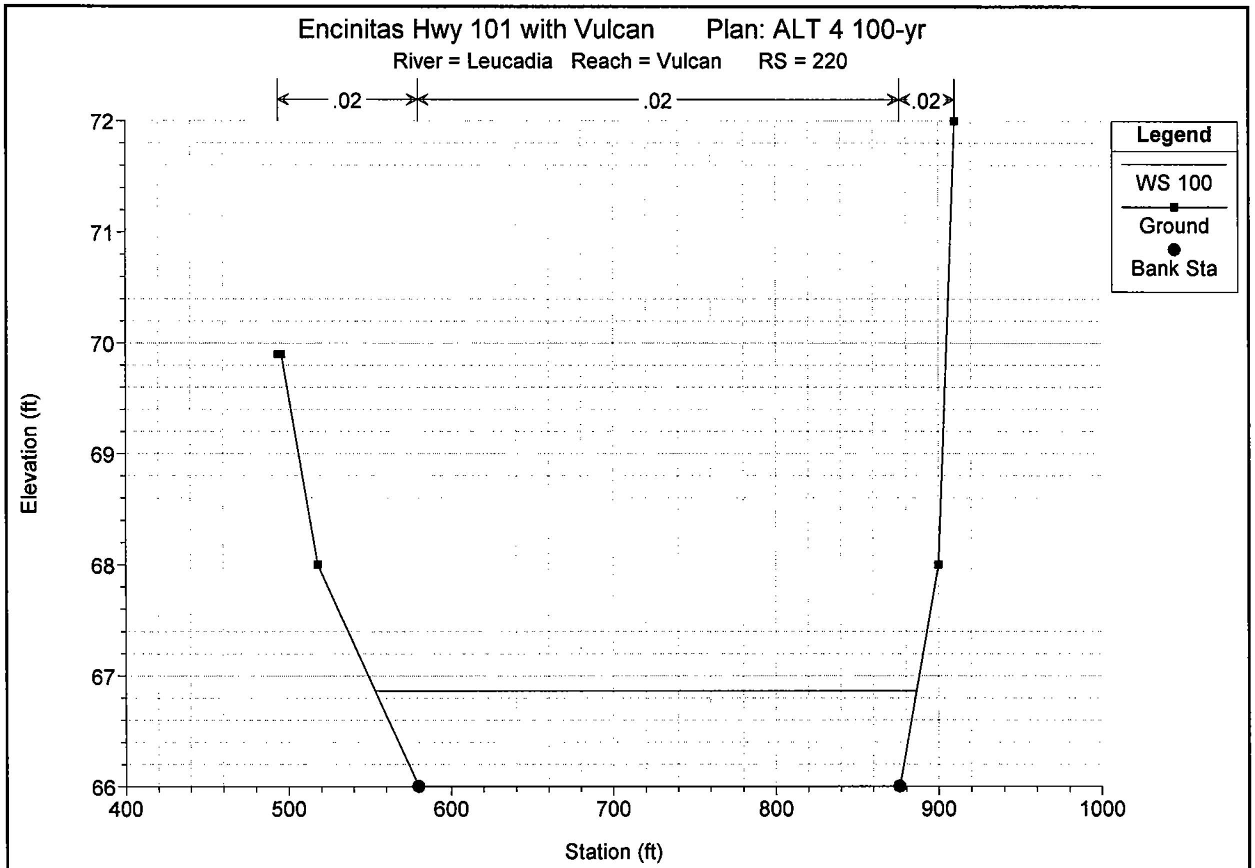
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 245
.03
.035
.03
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
70
69
68
67
66
65
64
0
50
100
150
200
Station (ft)

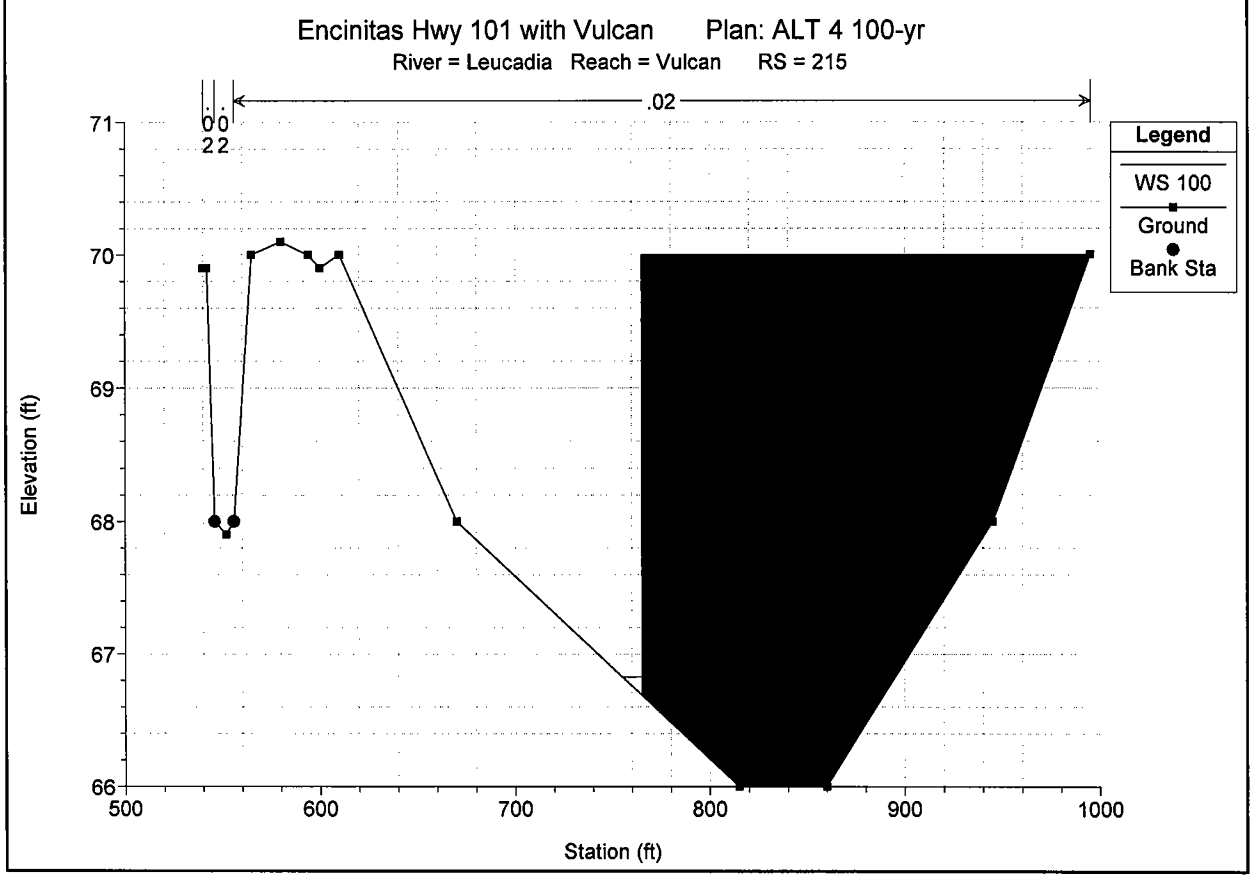

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 240
.03
.035
.03
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
70
69
68
67
66
65
64
0
50
100
150
200
250

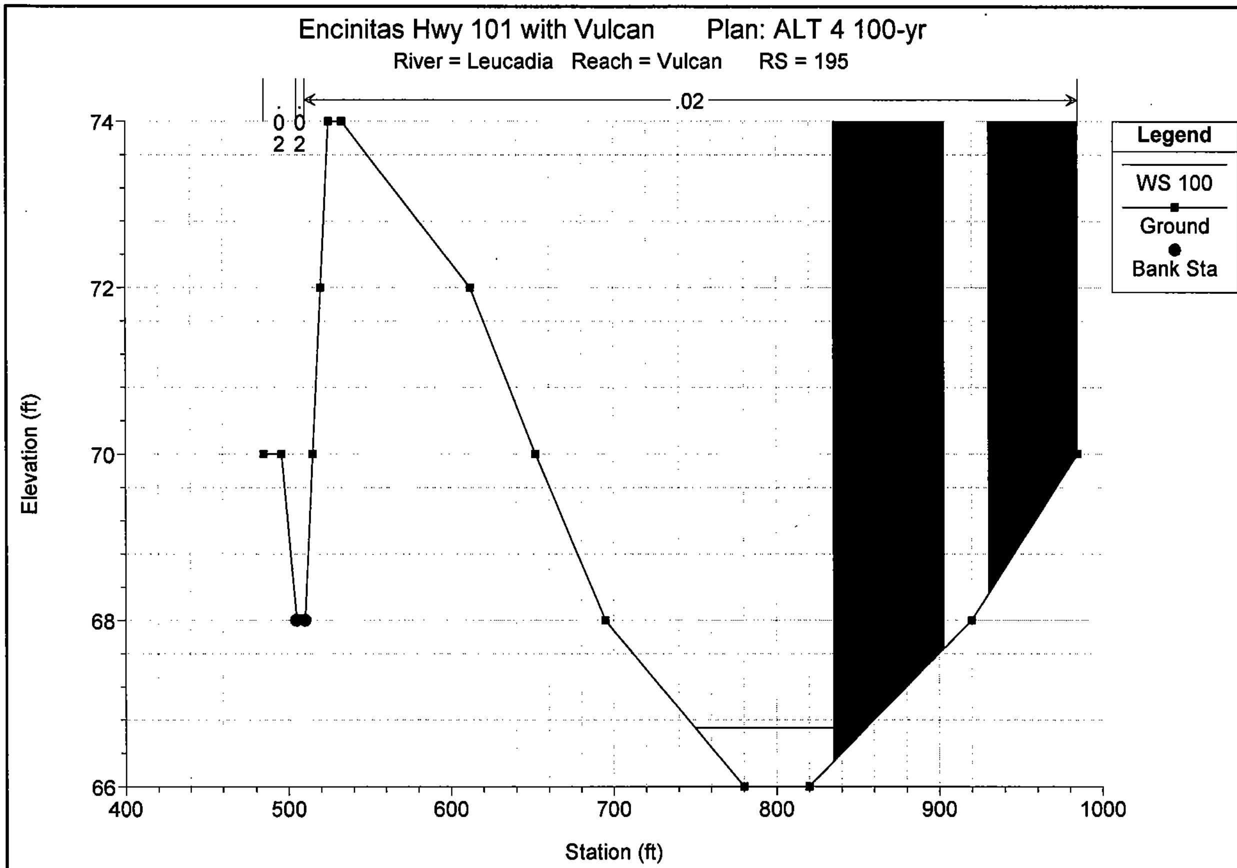

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 235
.03
.035
.03
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
70
69
68
67
66
0
50
100
150
200
250

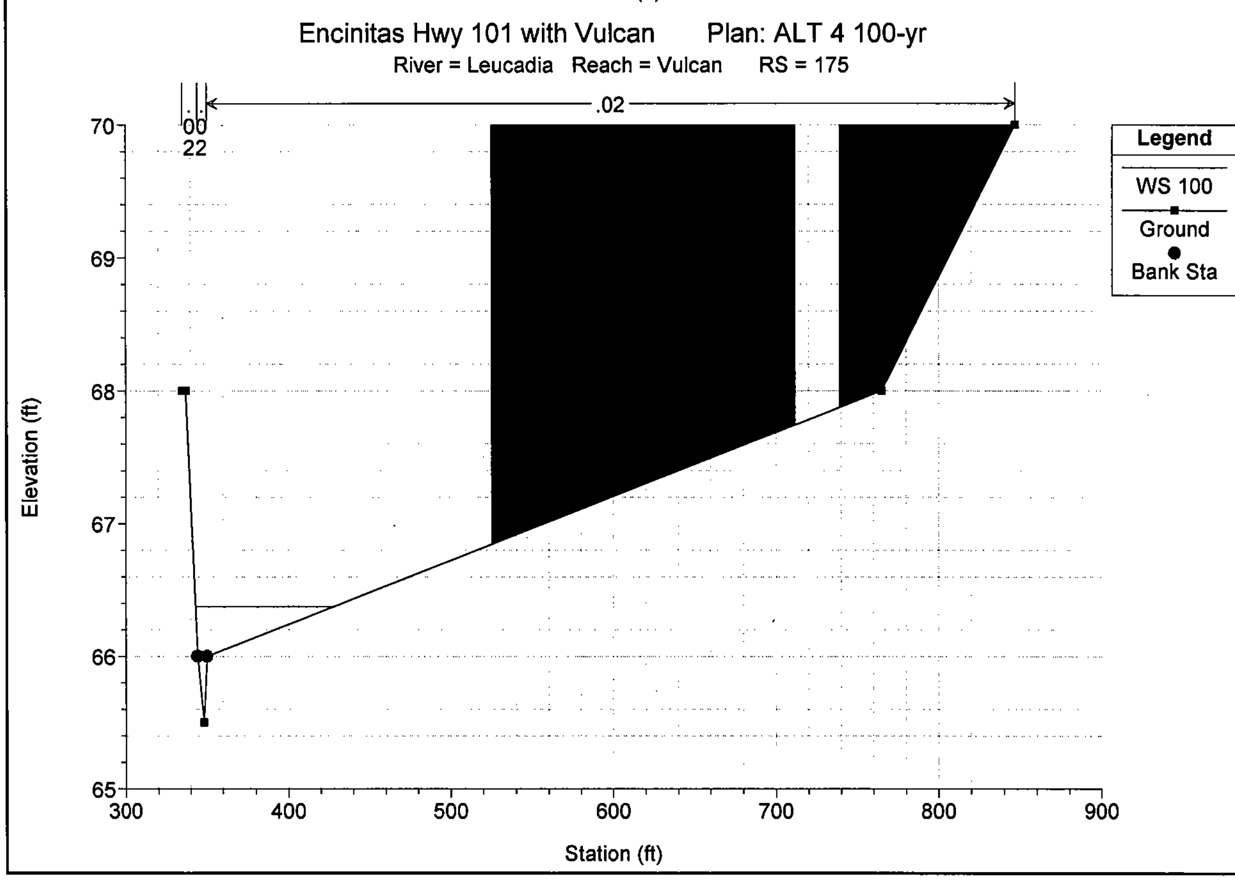

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 230
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
70
69
68
67
66
400
500
600
700
800
900

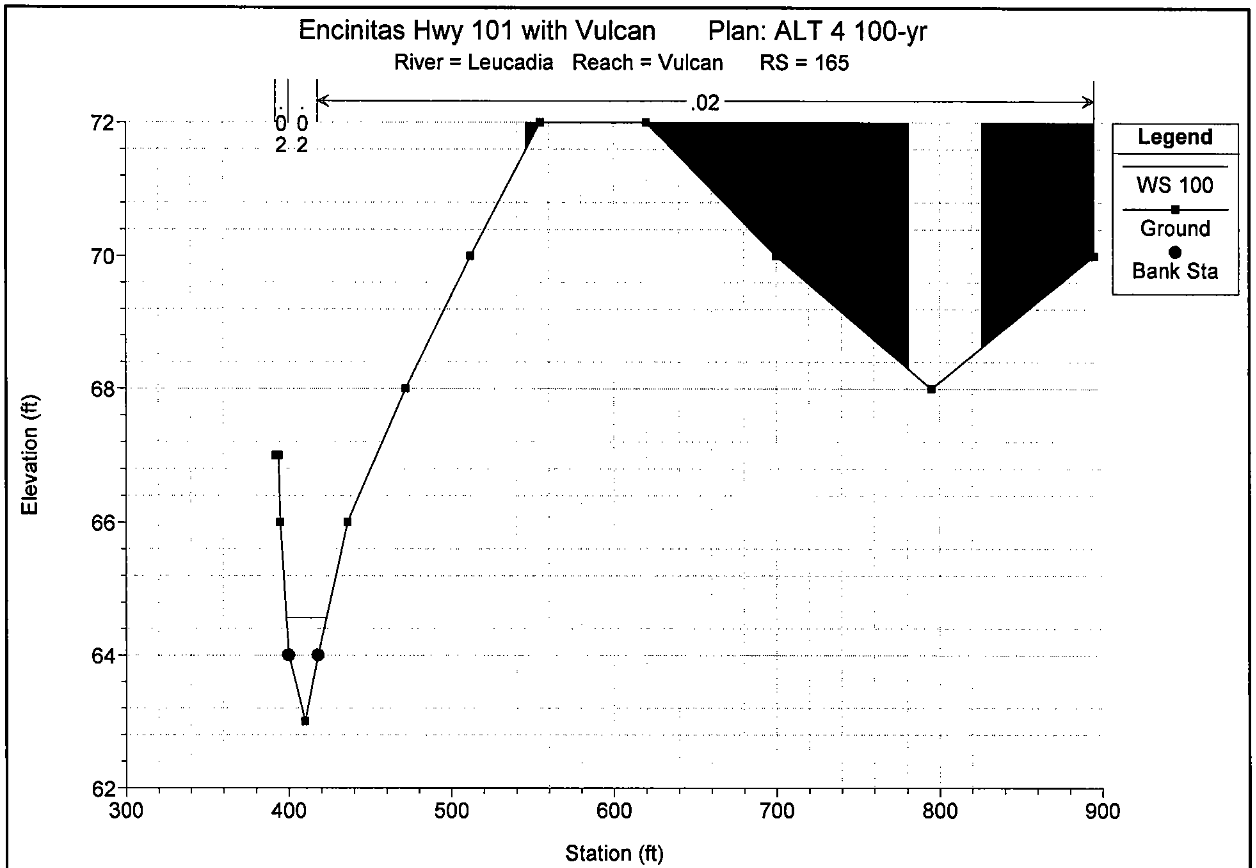

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 225
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
70
69
68
67
66
500
550
600
650
700
750
800
850

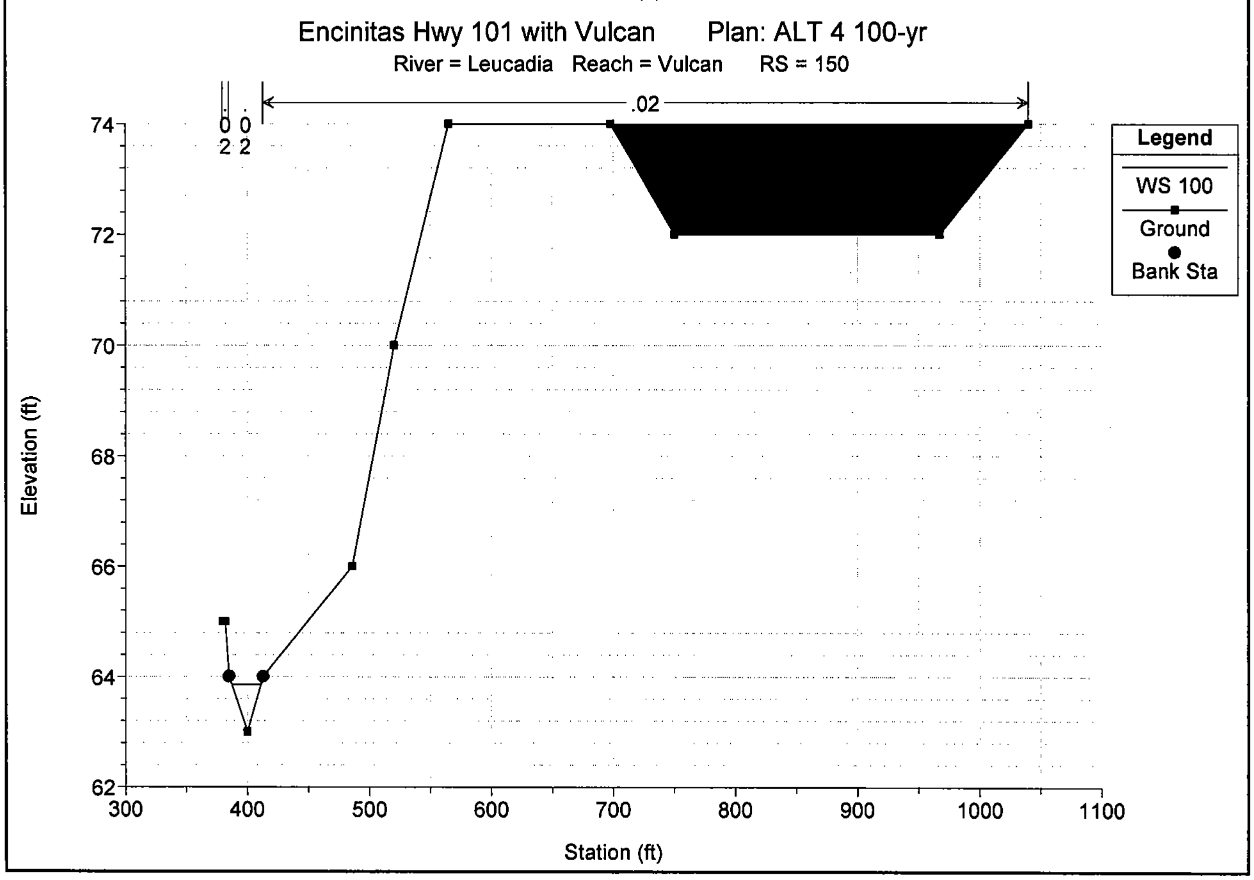

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 220
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
72
71
70
69
68
67
66
Elevation (ft)
400
500
600
700
800
900
1000
Station (ft)

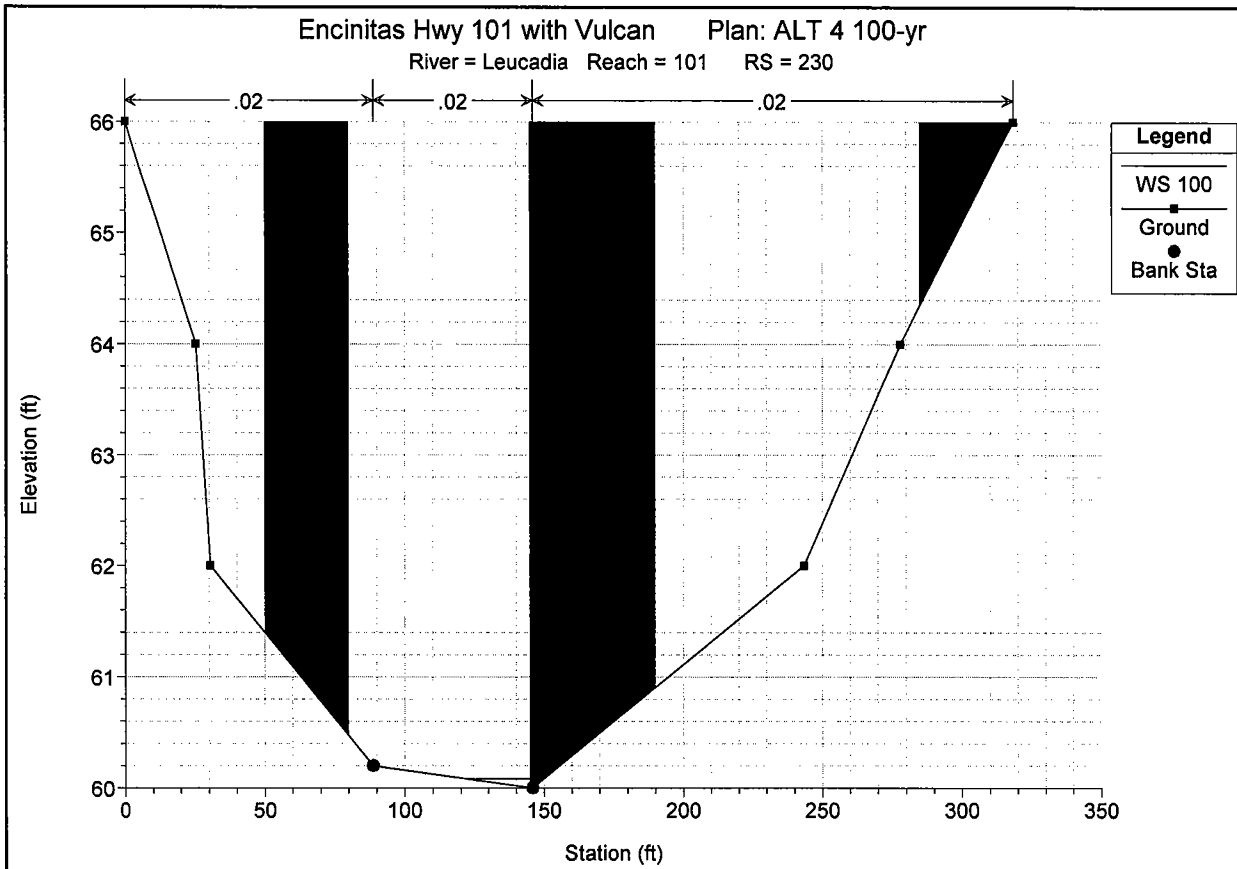

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 215
.02
Legend
WS 100
Ground
Bank Sta
71
70
69
68
67
66
Elevation (ft)
500
600
700
800
900
1000
Station (ft)

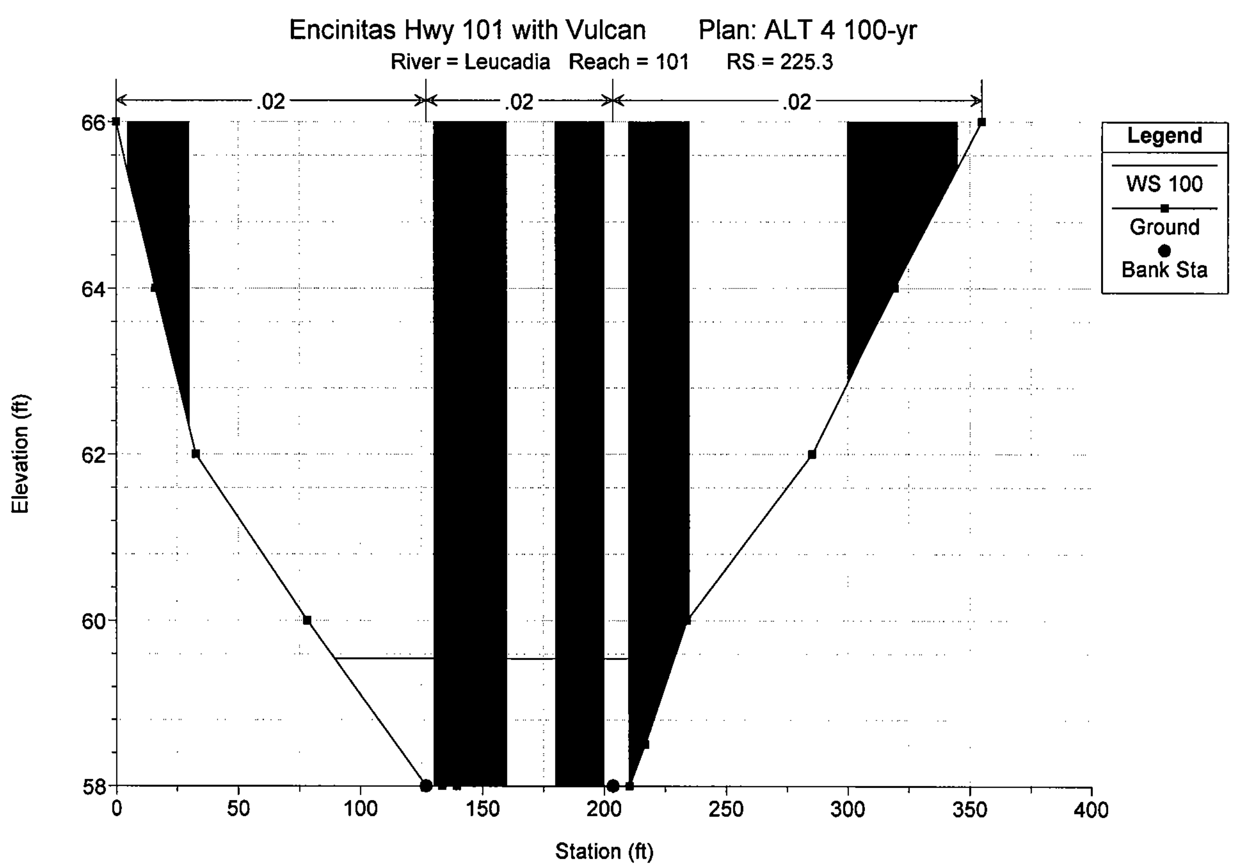

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 195
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

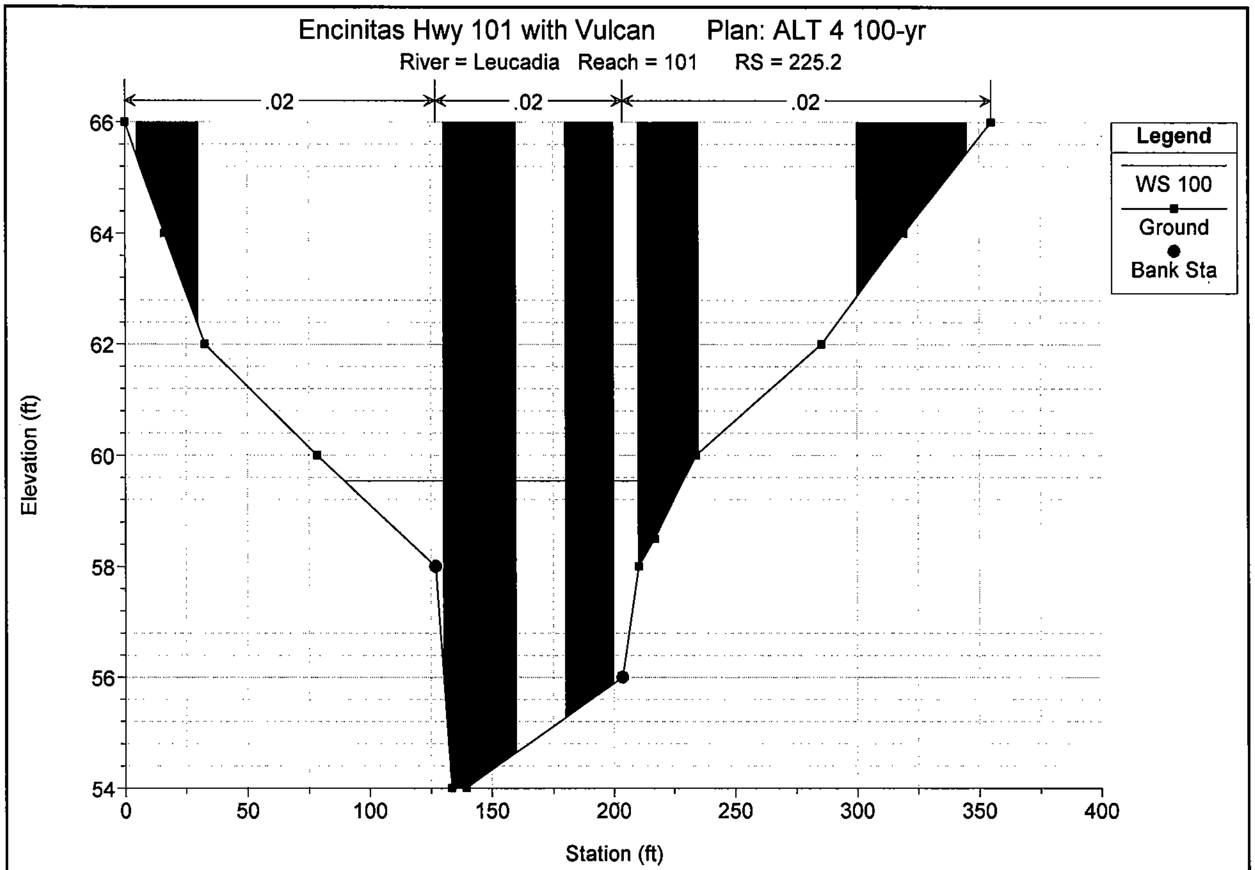

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 175
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

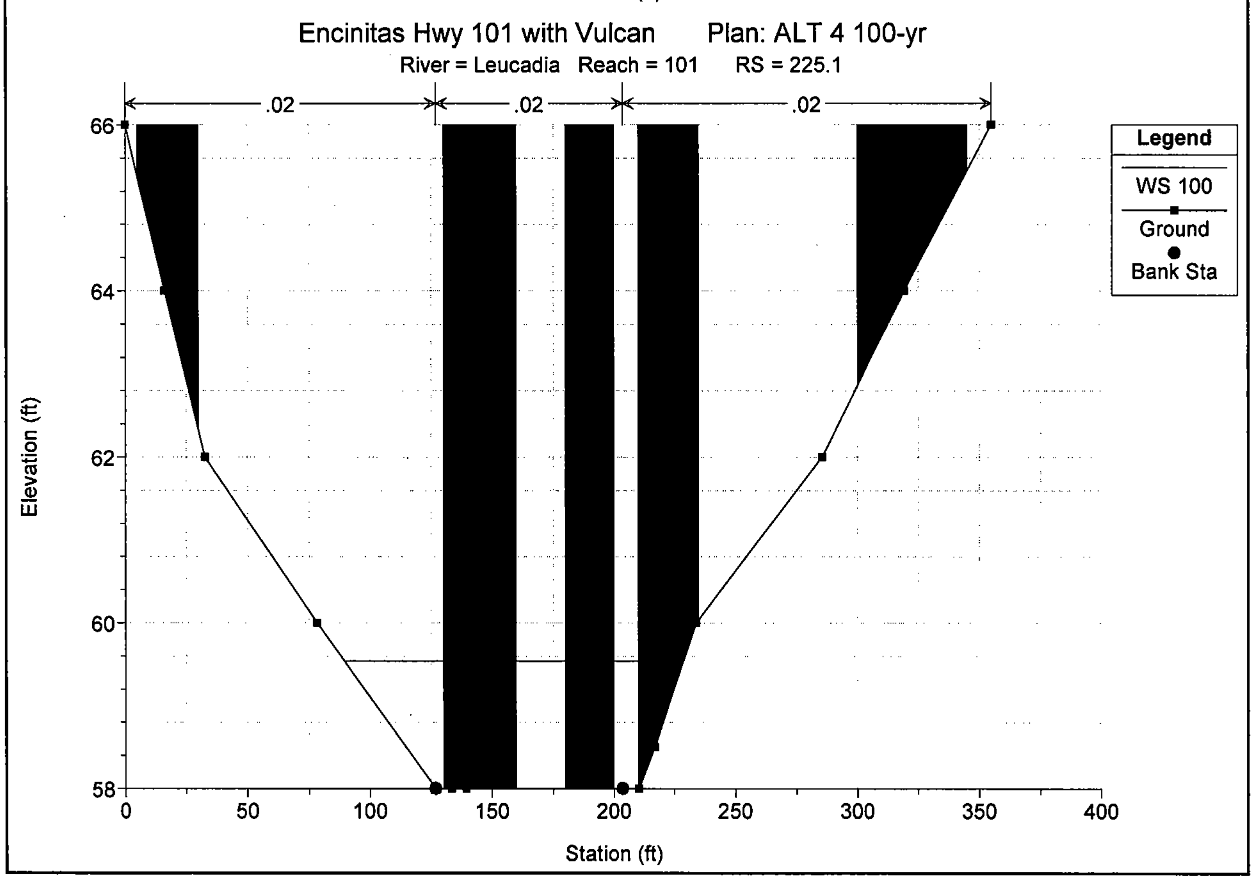

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 165
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

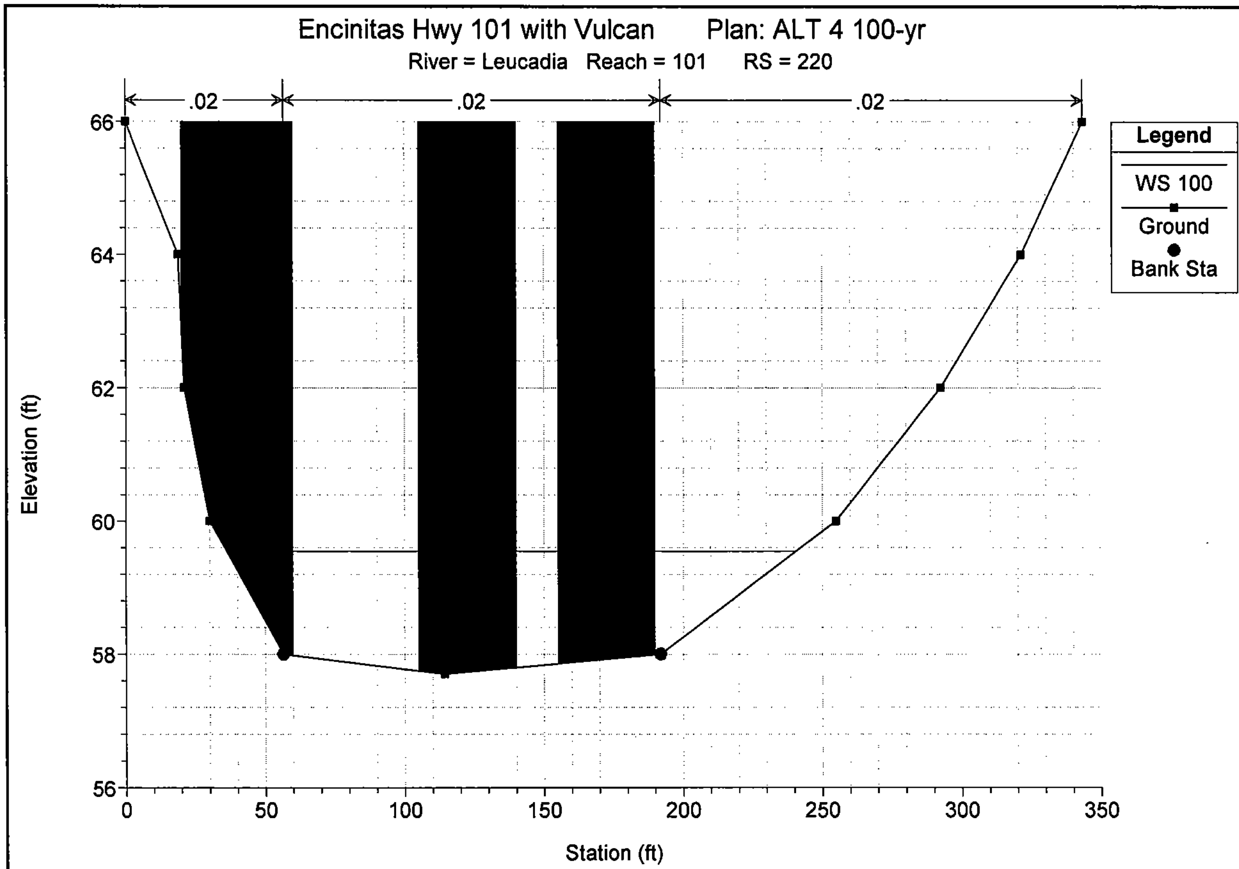

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Vulcan RS = 150
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 230
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
66
65
64
63
62
61
60
0
50
100
150
200
250
300
350
Station (ft)

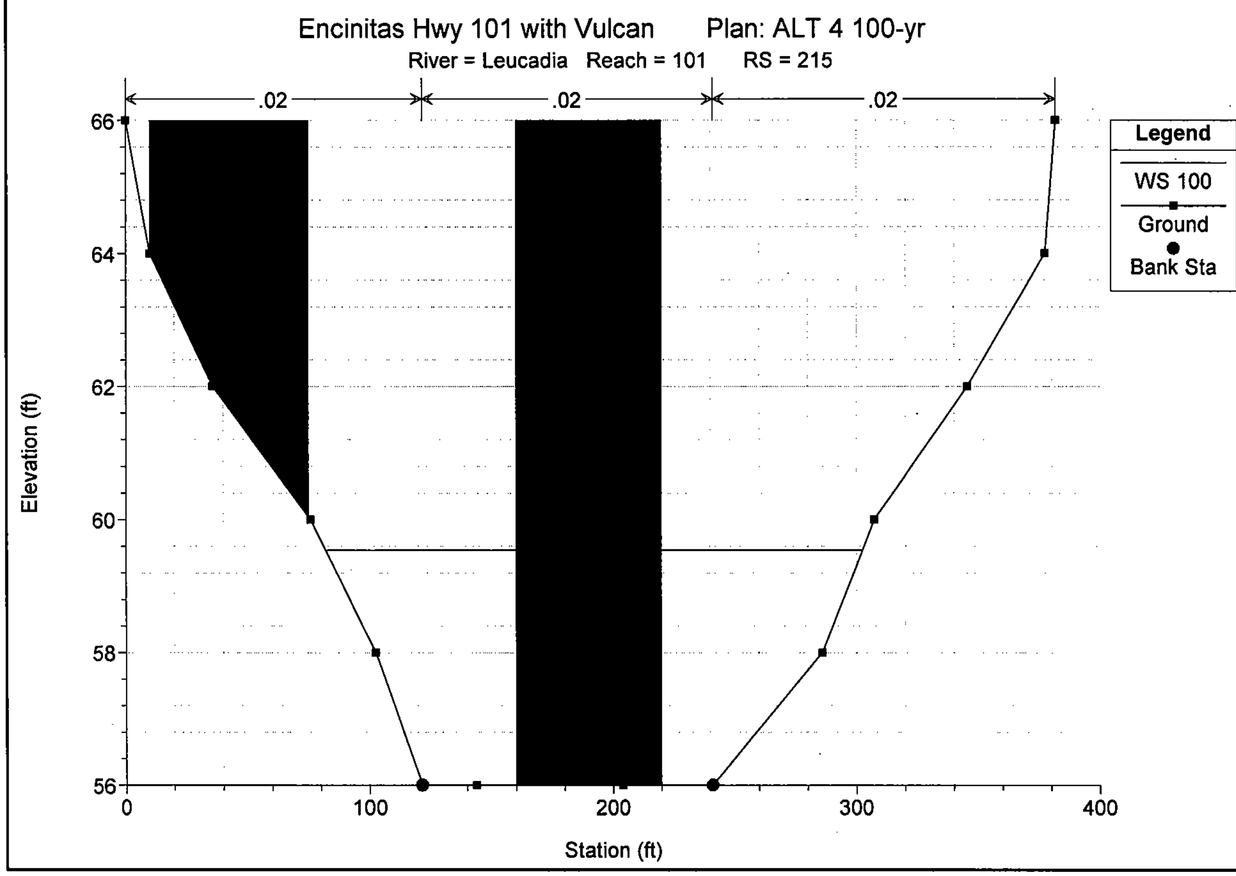

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 225.3
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
66
64
62
60
58
0
50
100
150
200
250
300
350
400
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 225.2
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
56
54
0
50
100
150
200
250
300
350
400

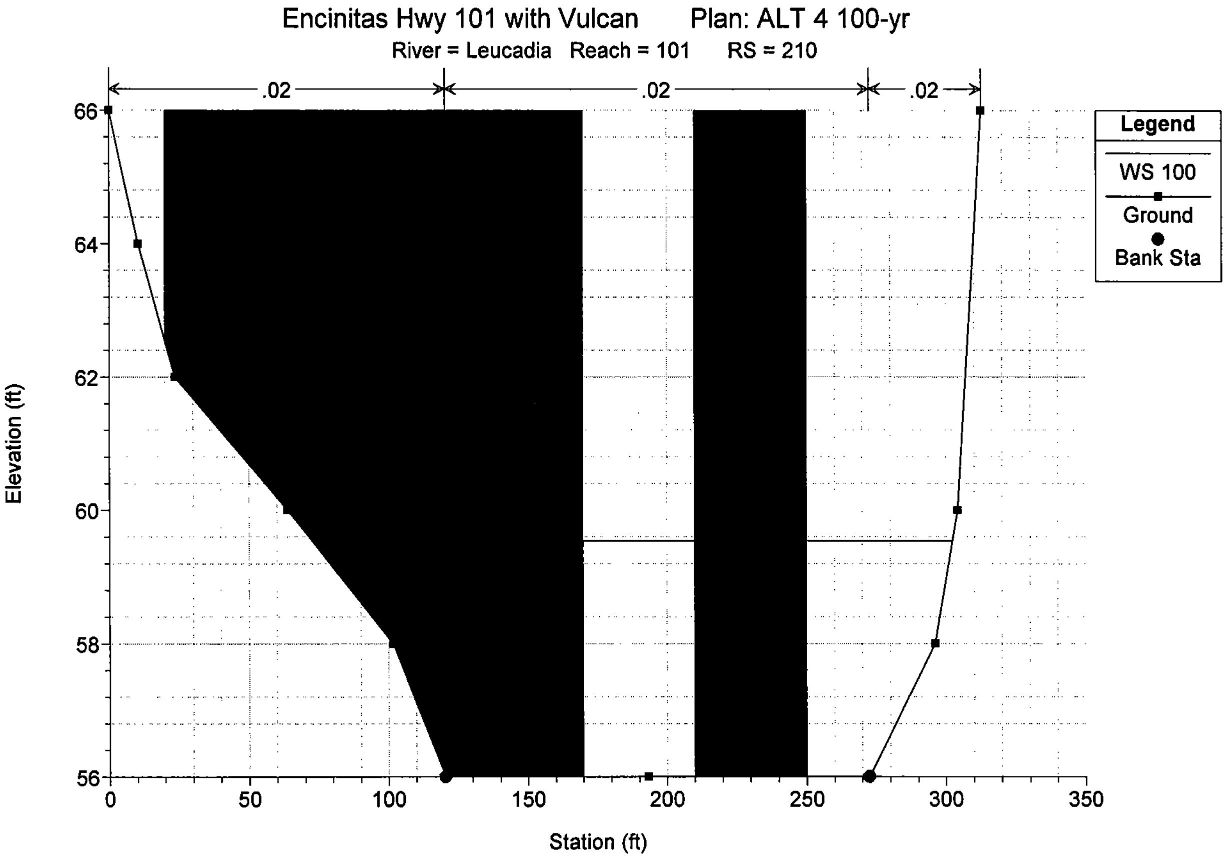

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 225.1
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
0
50
100
150
200
250
300
350
400



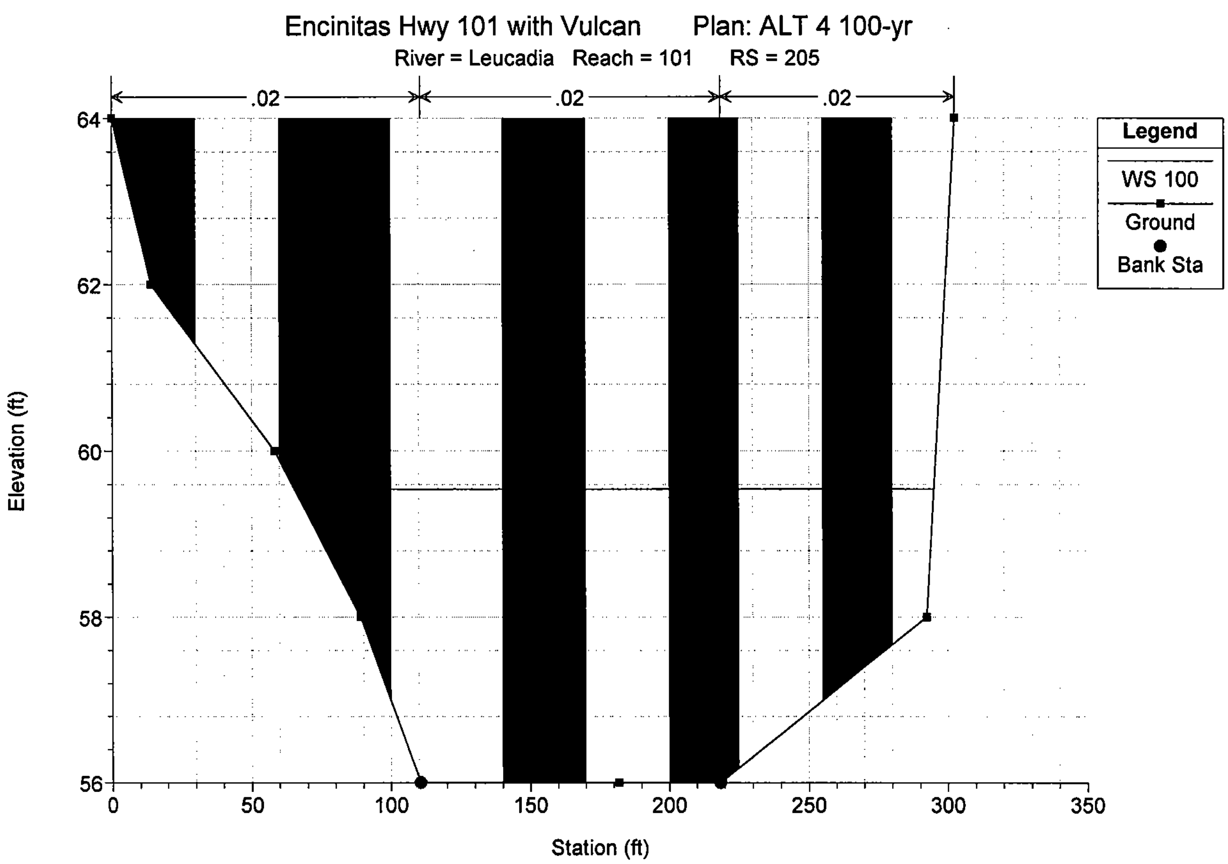
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 220
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)



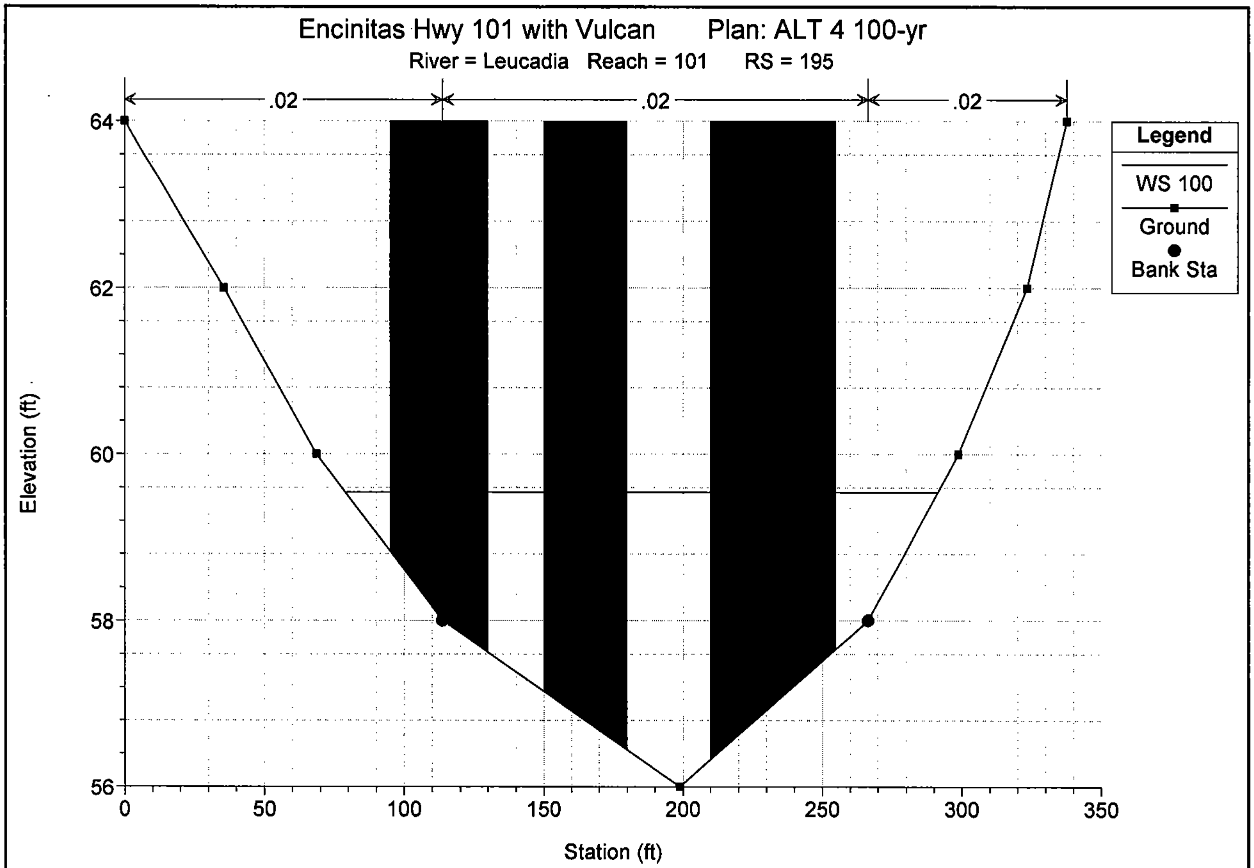
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 215
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)



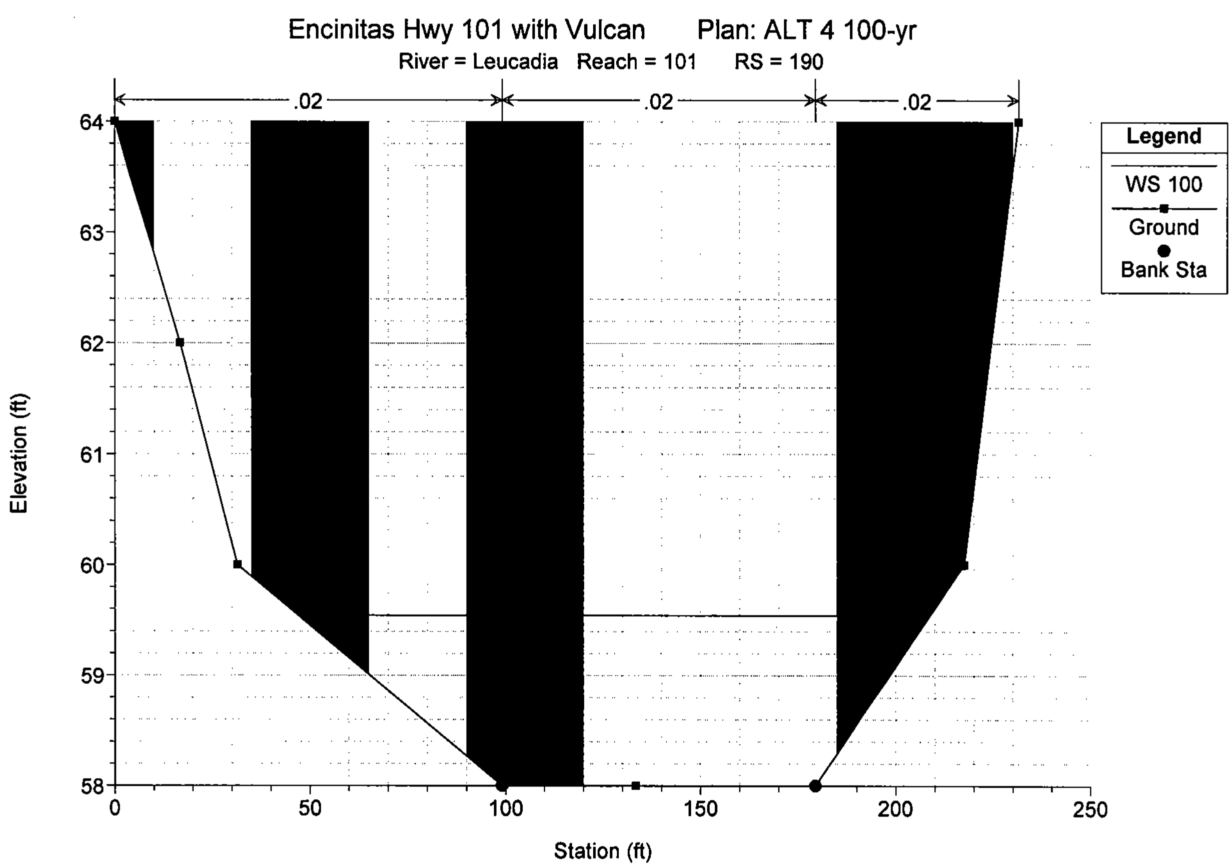
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 210
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
56
0
50
100
150
200
250
300
350



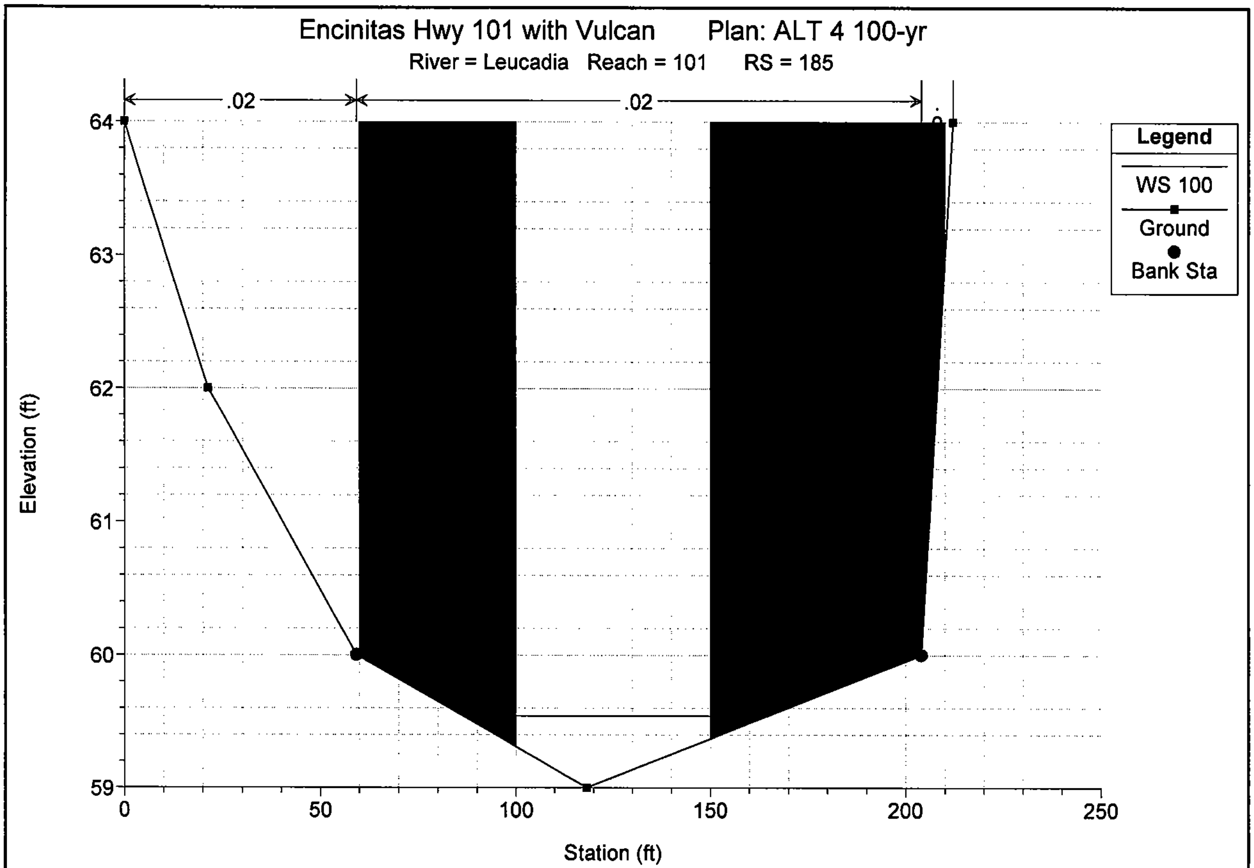
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 205
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
0
50
100
150
200
250
300
350

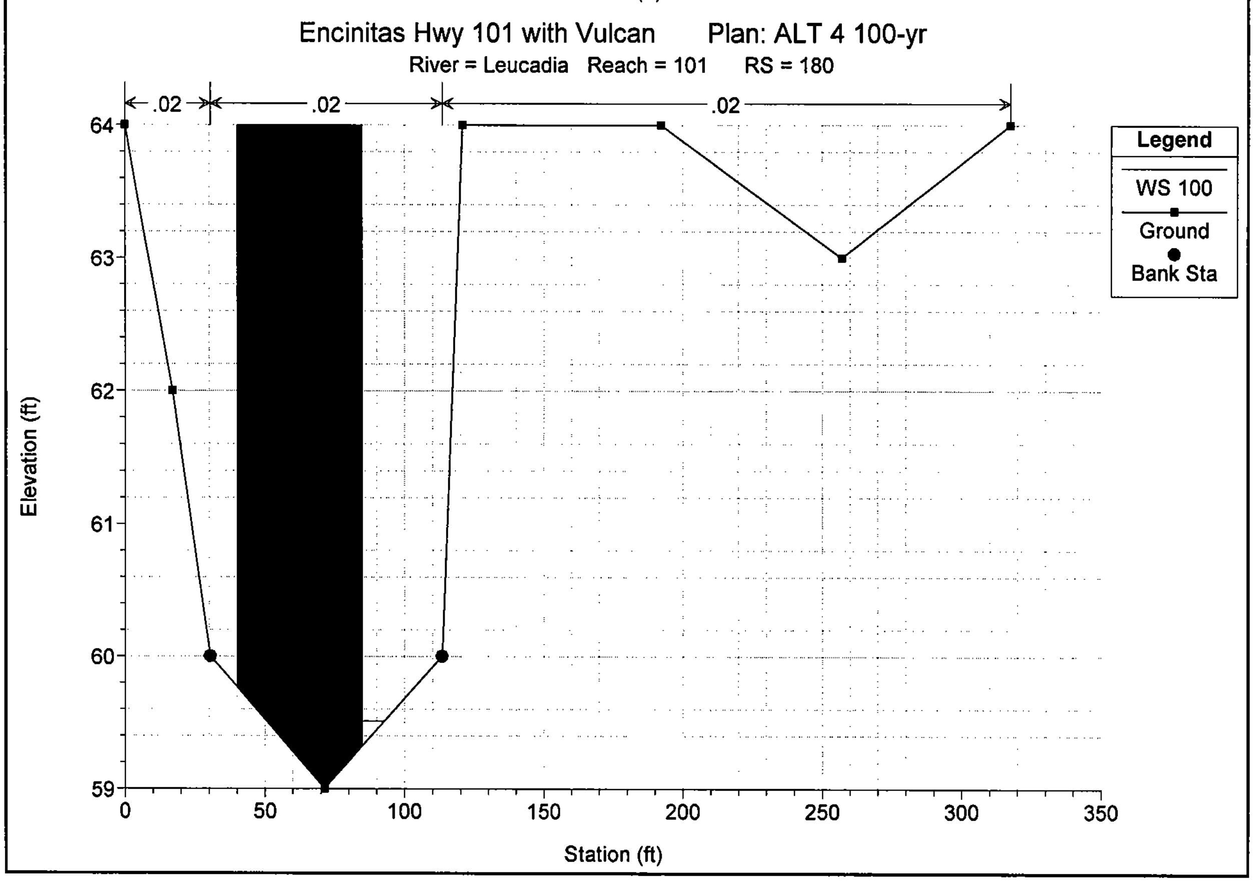


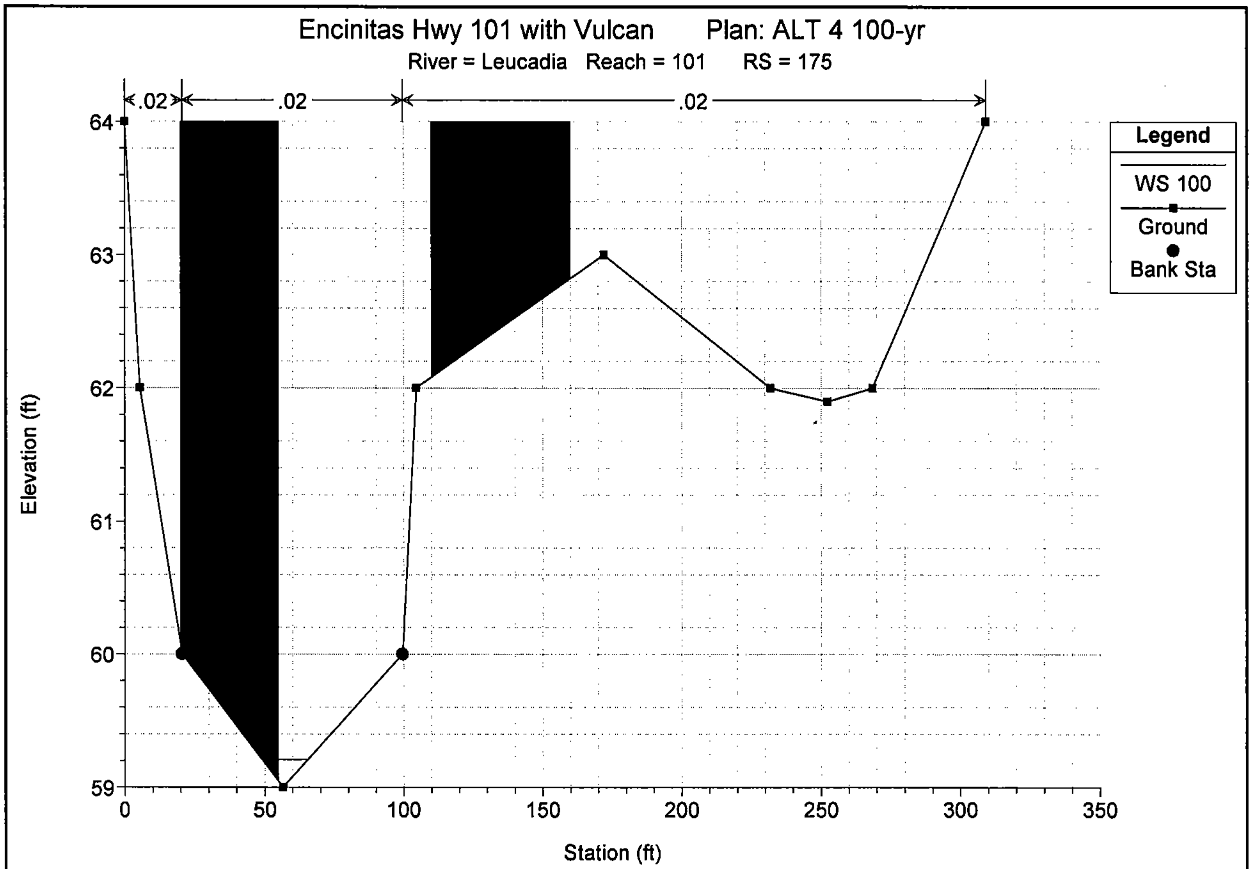
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 195
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
0
50
100
150
200
250
300
350



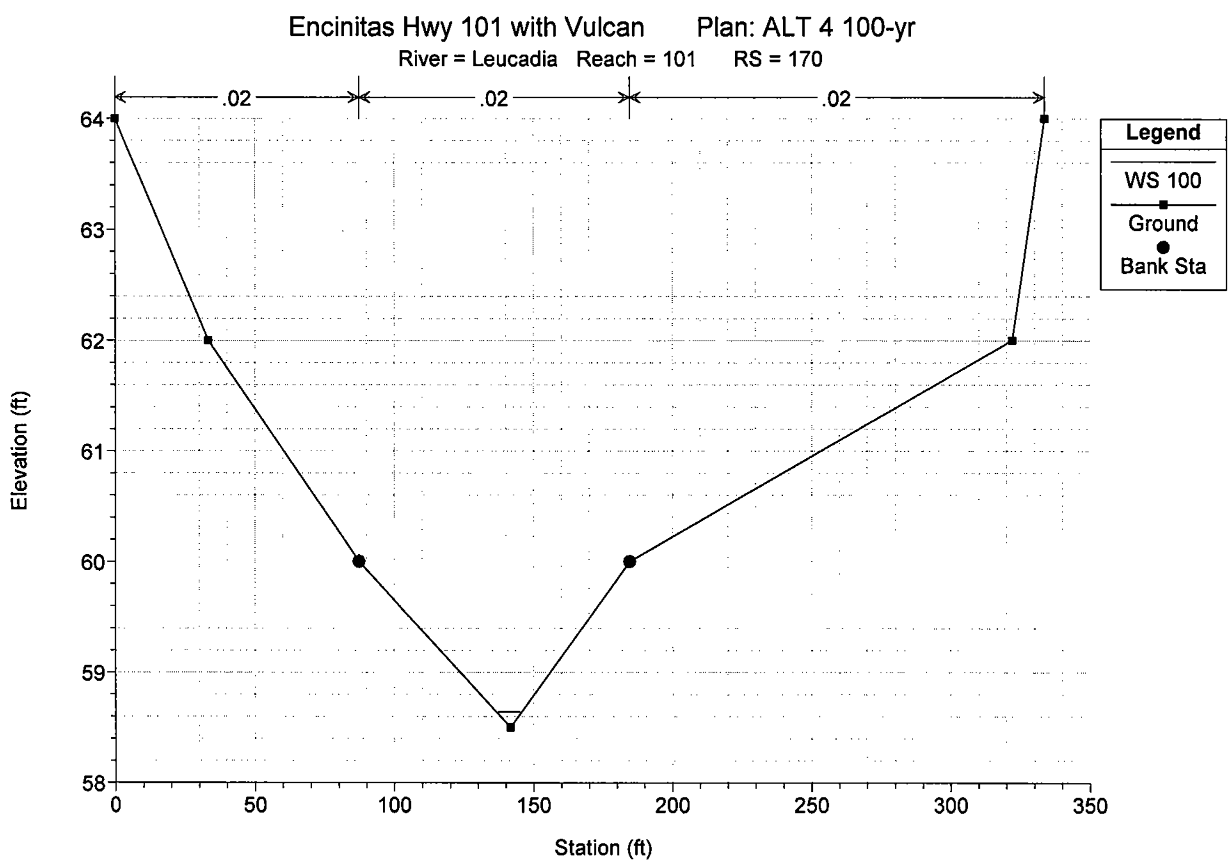
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 190
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
63
62
61
60
59
58
0
50
100
150
200
250


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 185
.02
.02
Elevation (ft)
64
63
62
61
60
59
0
50
100
150
200
250
Station (ft)
Legend
WS 100
Ground
Bank Sta

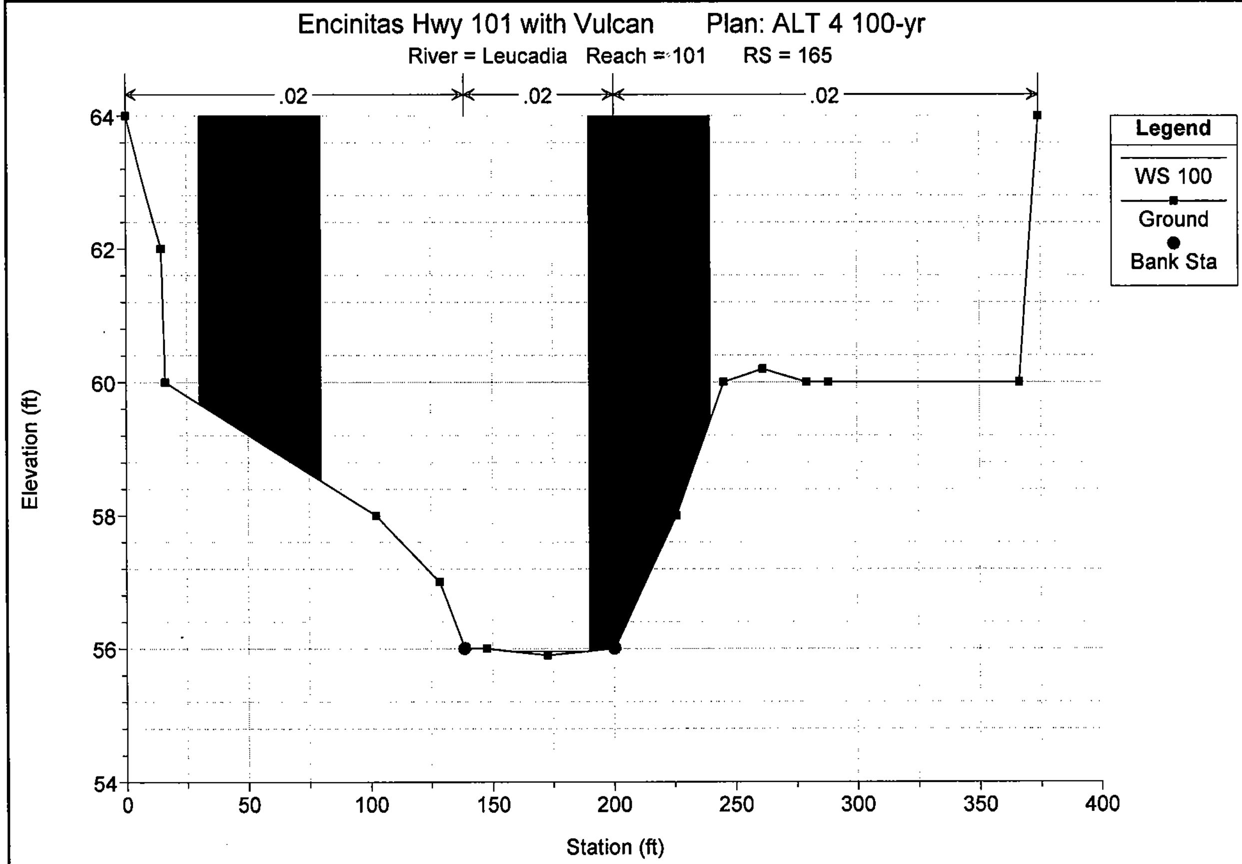

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 180
.02
.02
.02
Elevation (ft)
64
63
62
61
60
59
0
50
100
150
200
250
300
350
Station (ft)
Legend
WS 100
Ground
Bank Sta

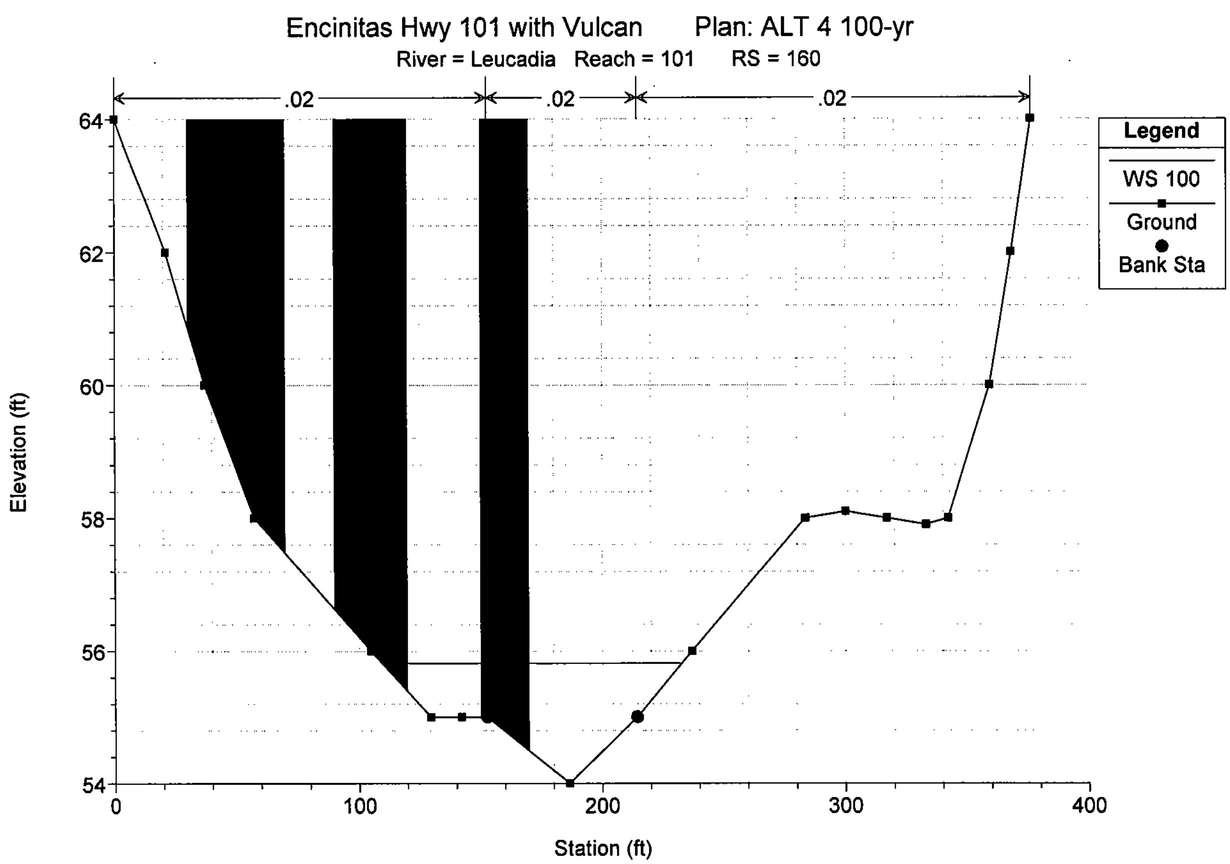


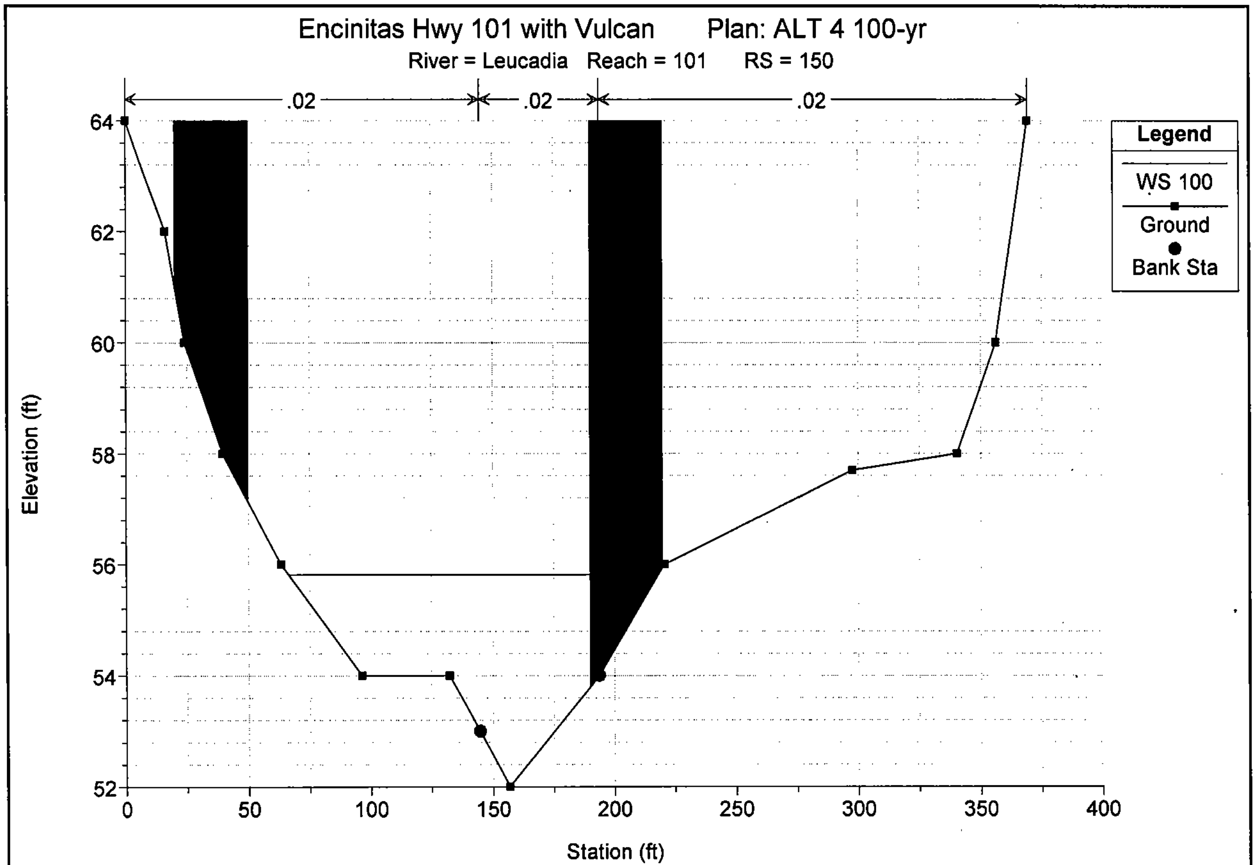
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 175
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
63
62
61
60
59
0
50
100
150
200
250
300
350

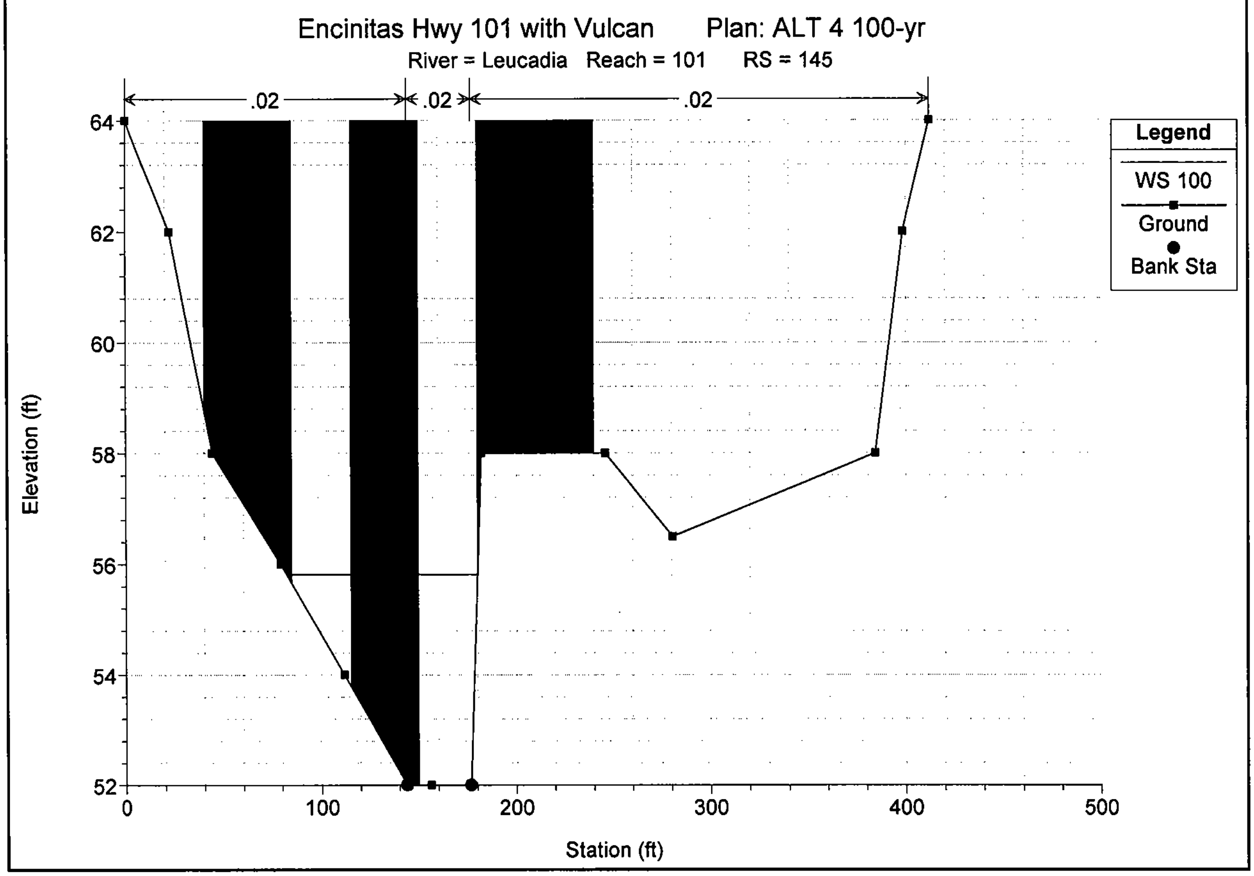


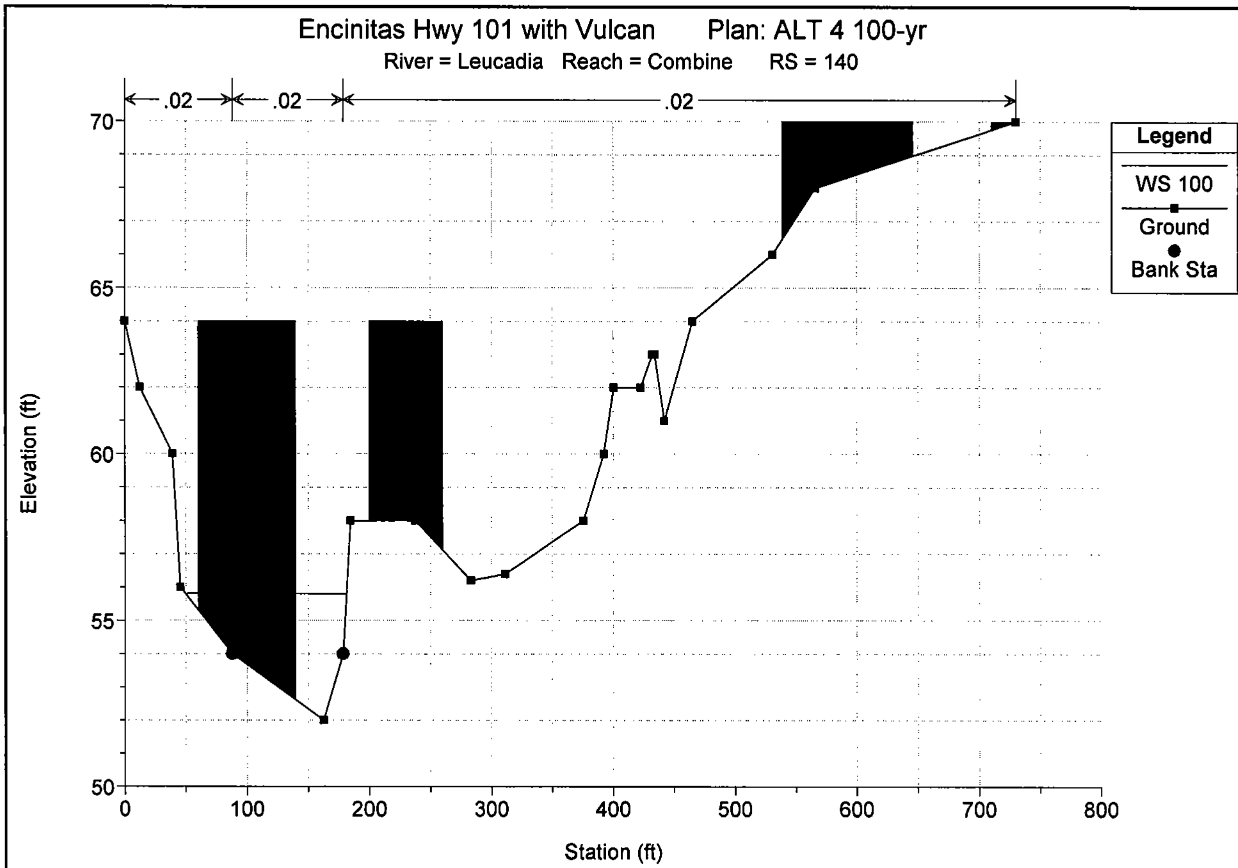
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 170
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
63
62
61
60
59
58
0
50
100
150
200
250
300
350

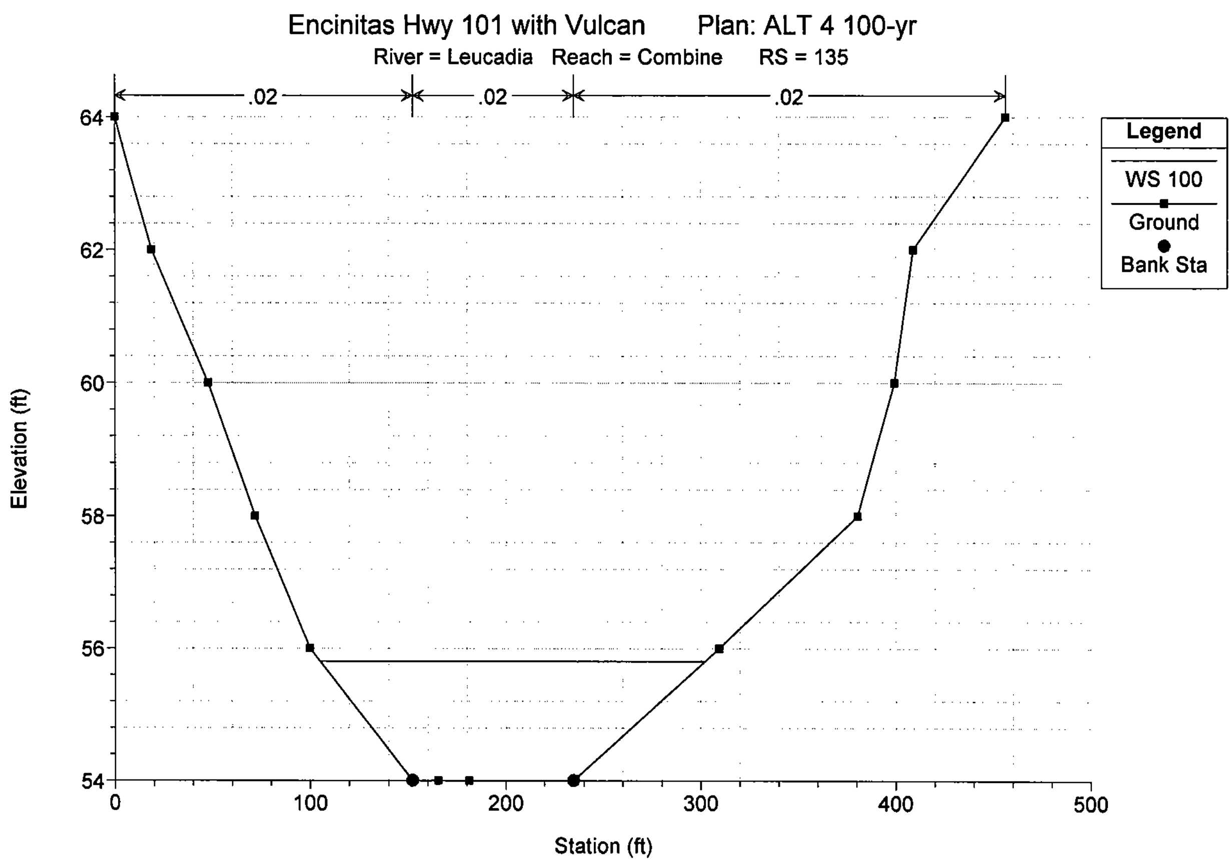

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 165
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
0
50
100
150
200
250
300
350
400

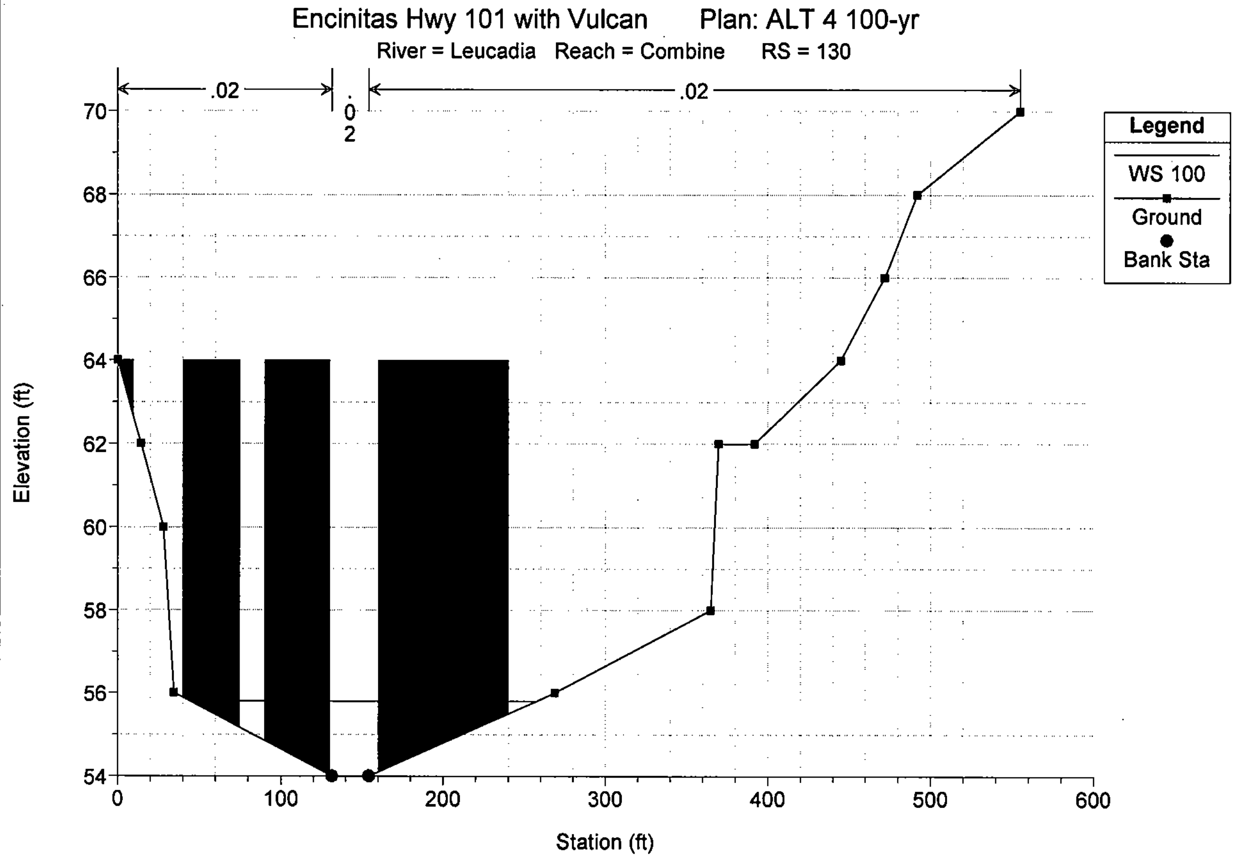

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 160
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
0
100
200
300
400

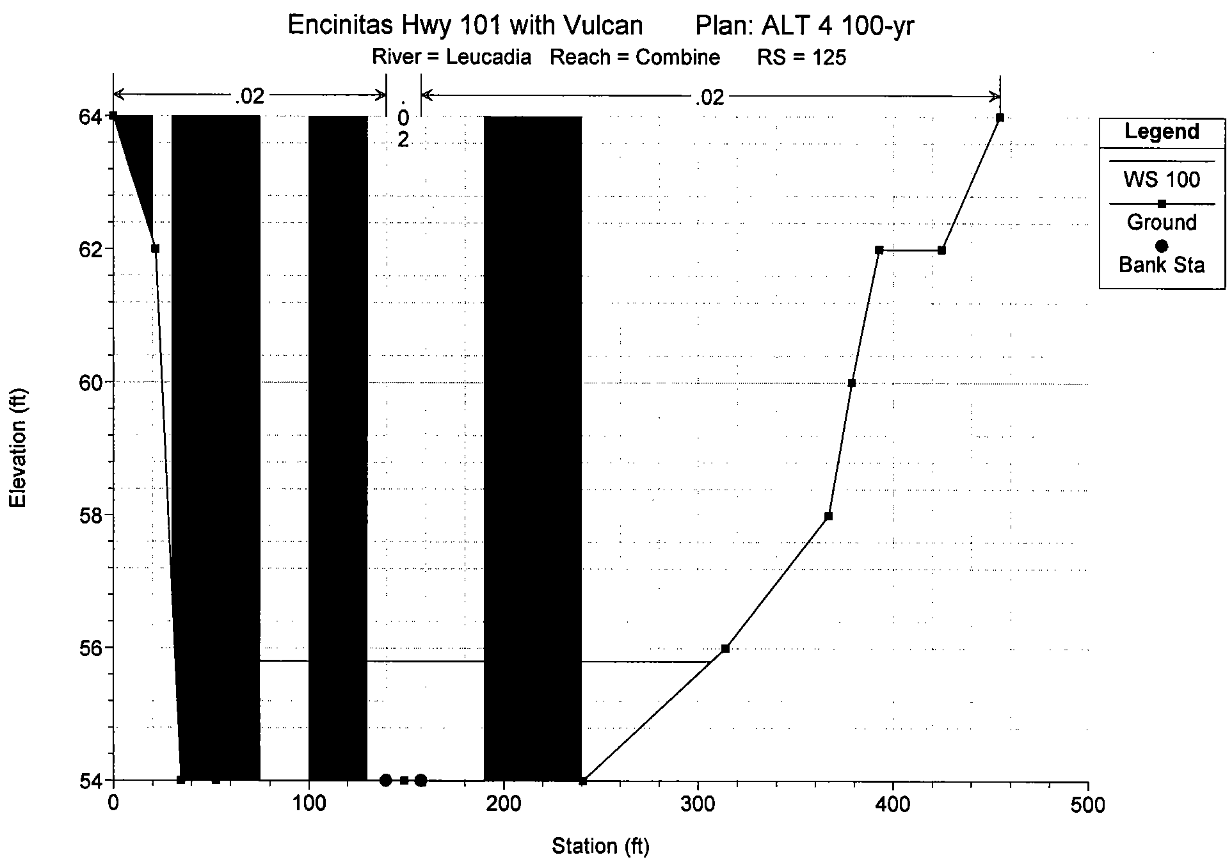

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 150
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
52
0
50
100
150
200
250
300
350
400

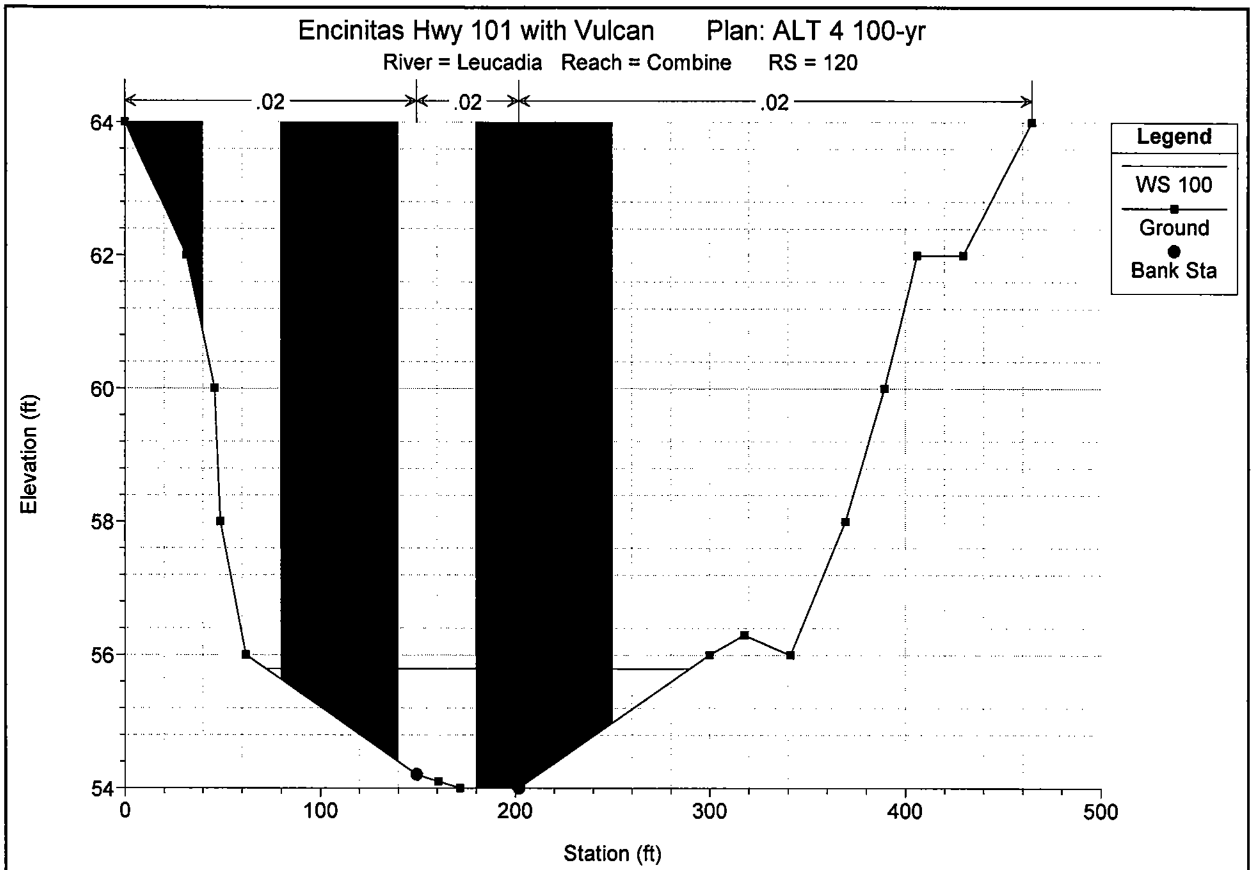

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = 101 RS = 145
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
52
0
100
200
300
400
500


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 140
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
70
65
60
55
50
0
100
200
300
400
500
600
700
800

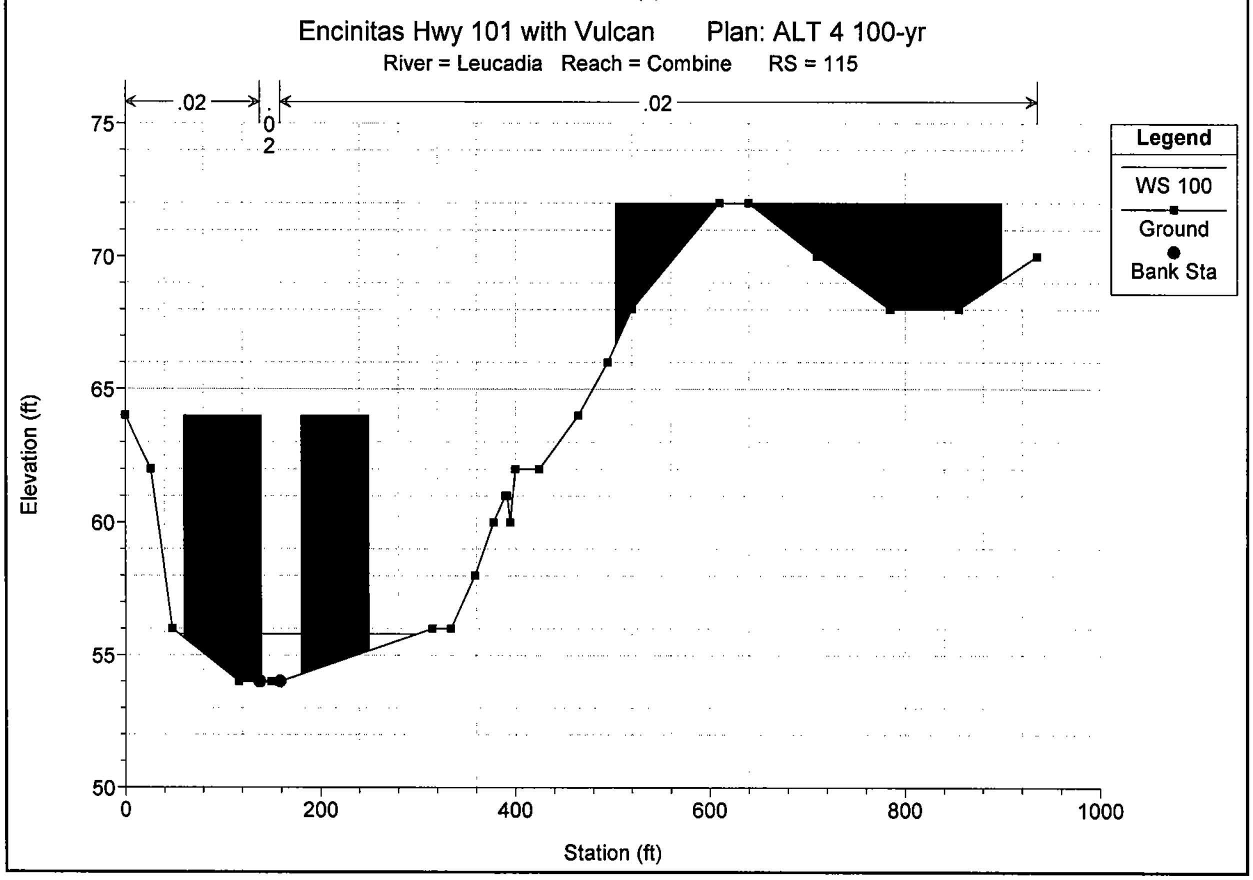

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 135
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
0
100
200
300
400
500


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 130
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

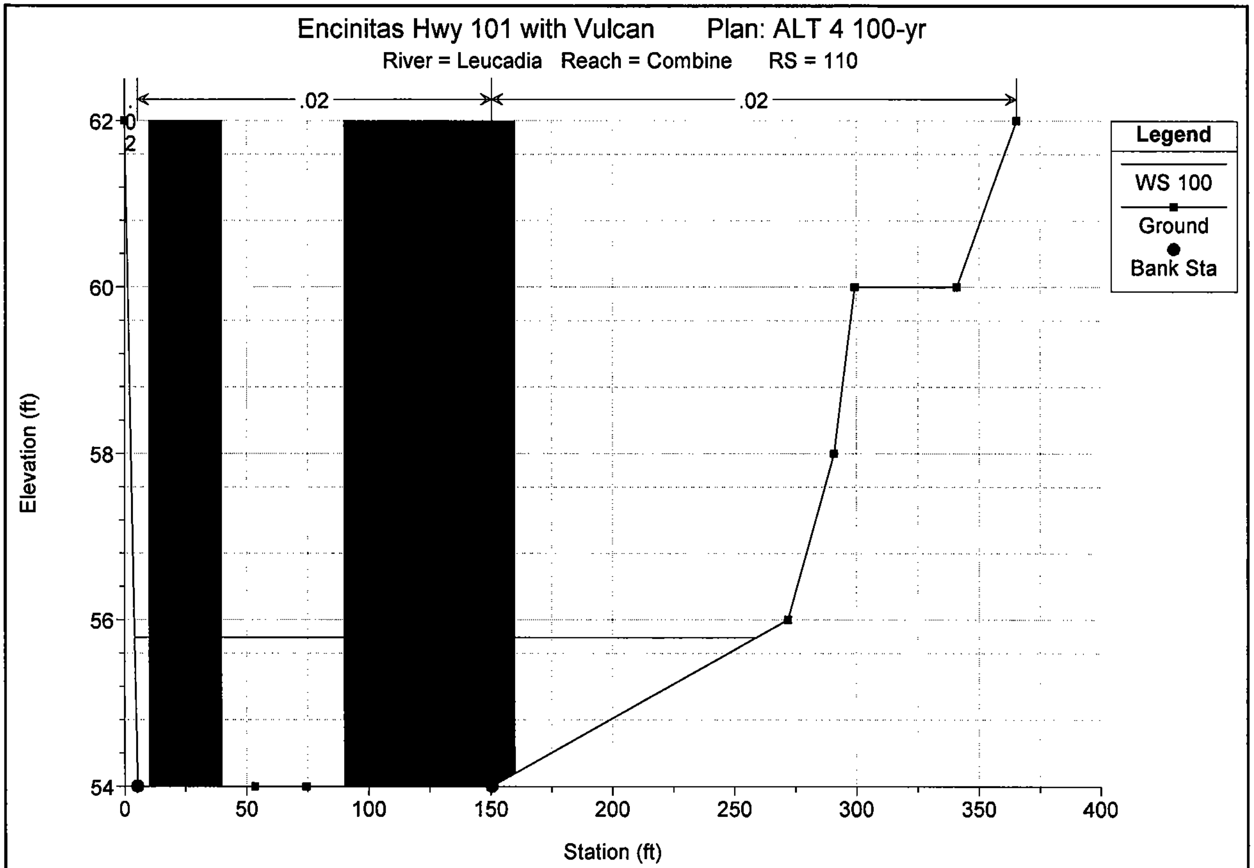

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 125
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)



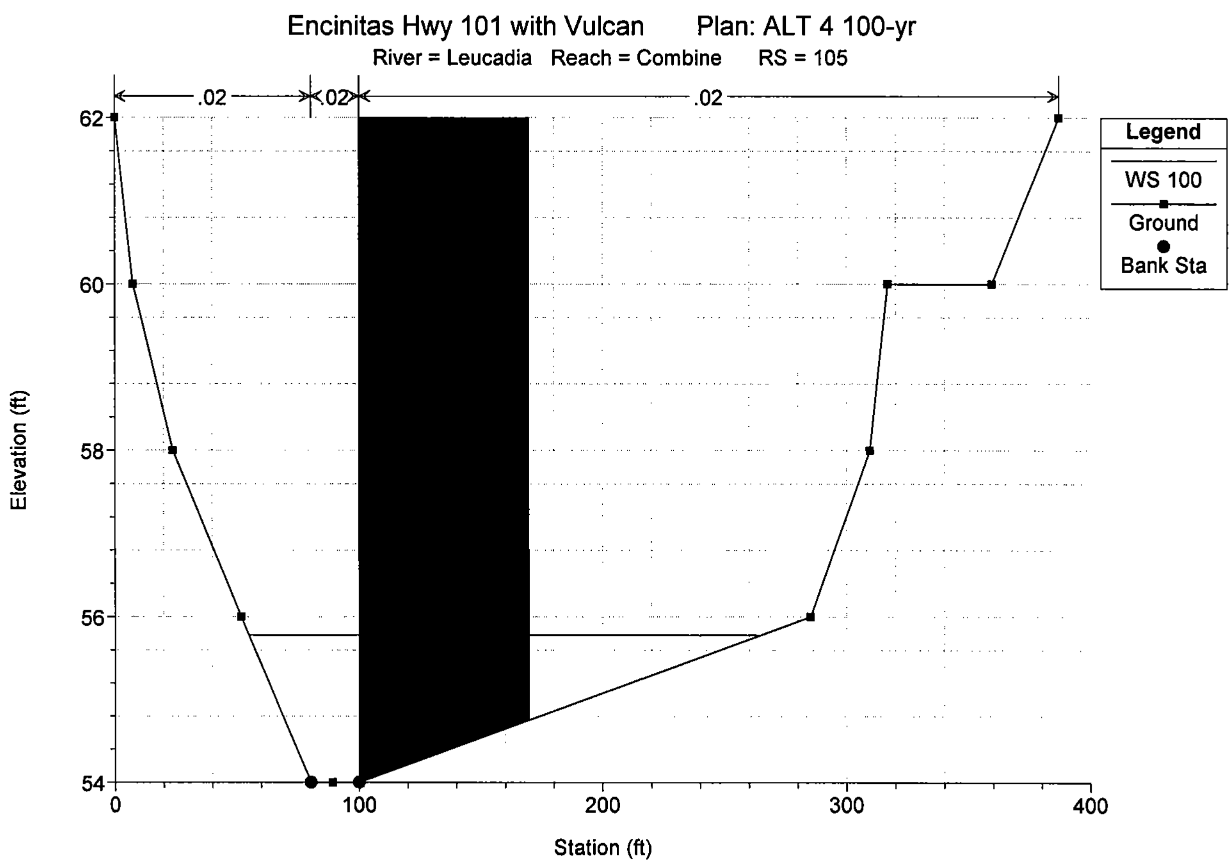
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 120
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
0
100
200
300
400
500



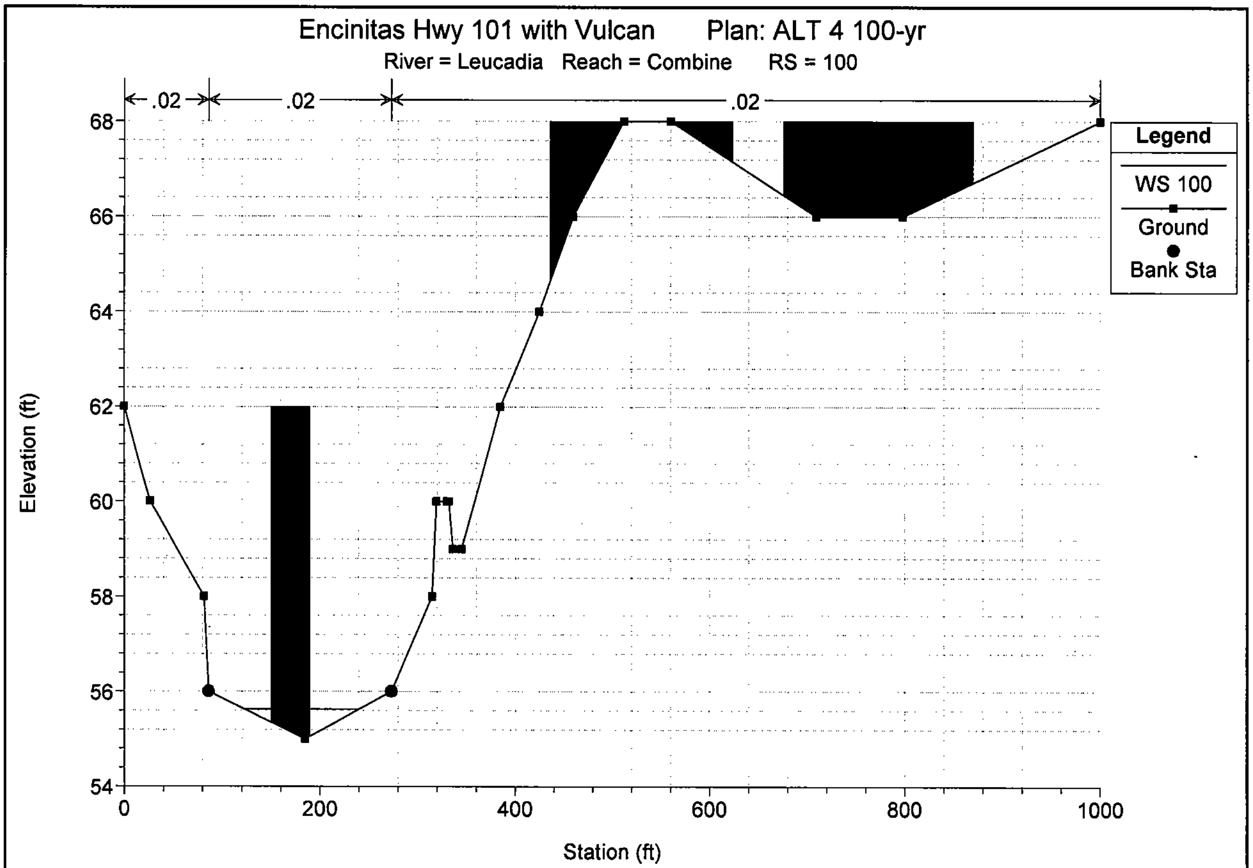
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 115
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
75
70
65
60
55
50
0
200
400
600
800
1000

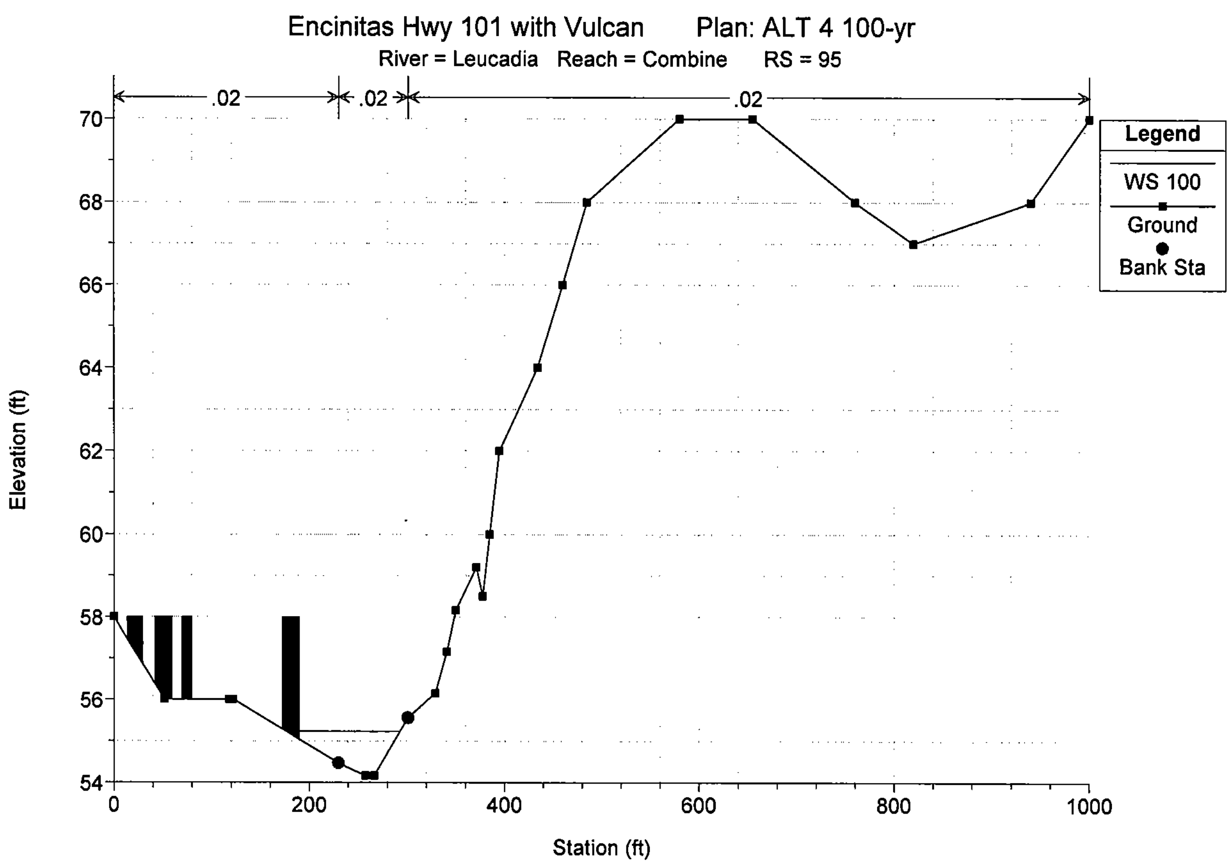


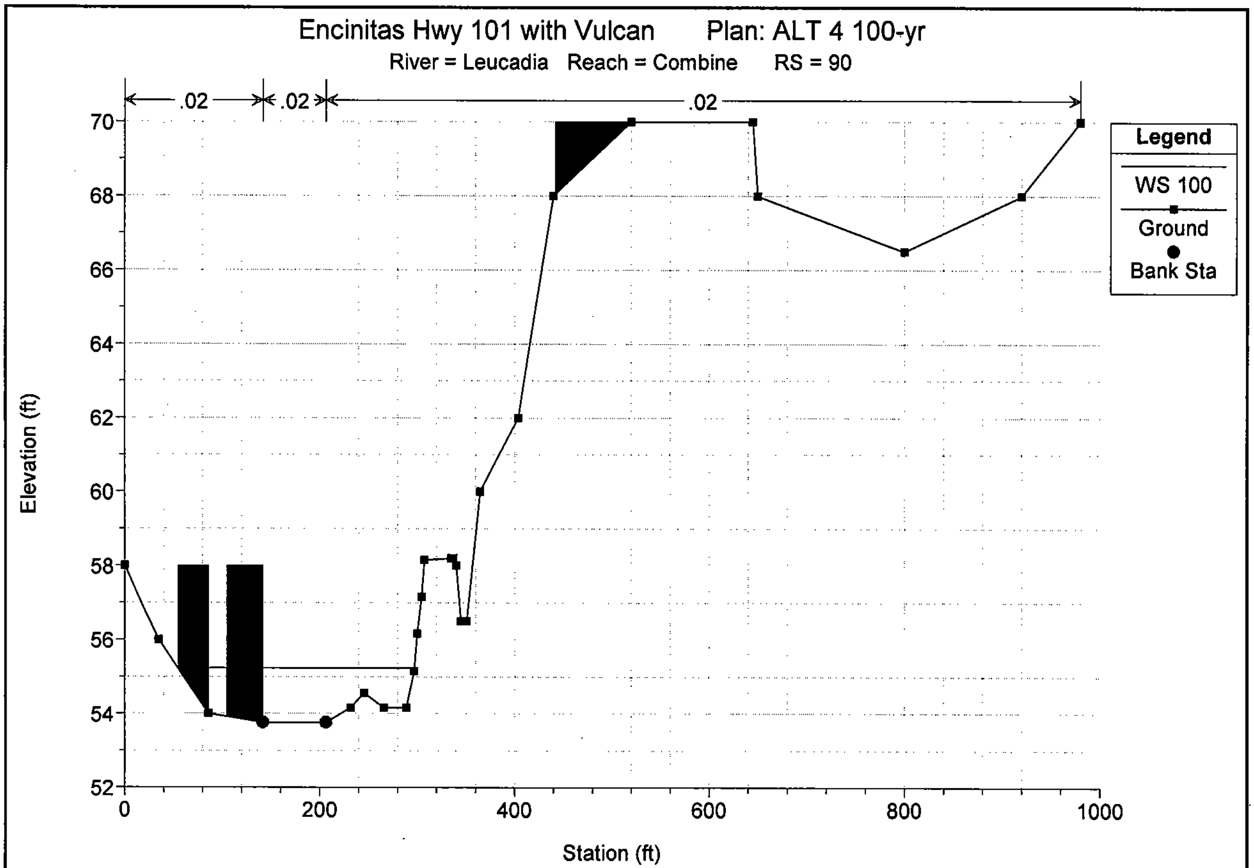
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 110
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

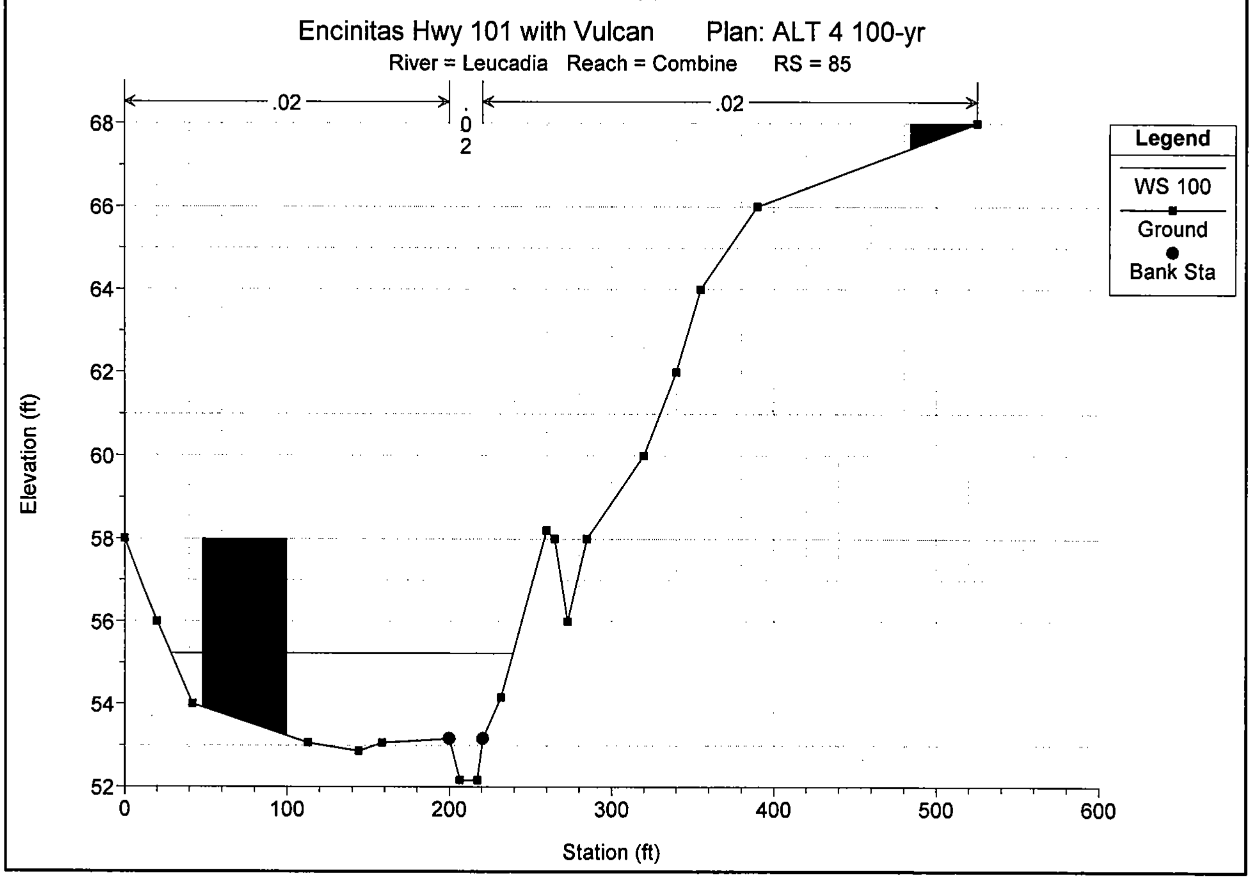


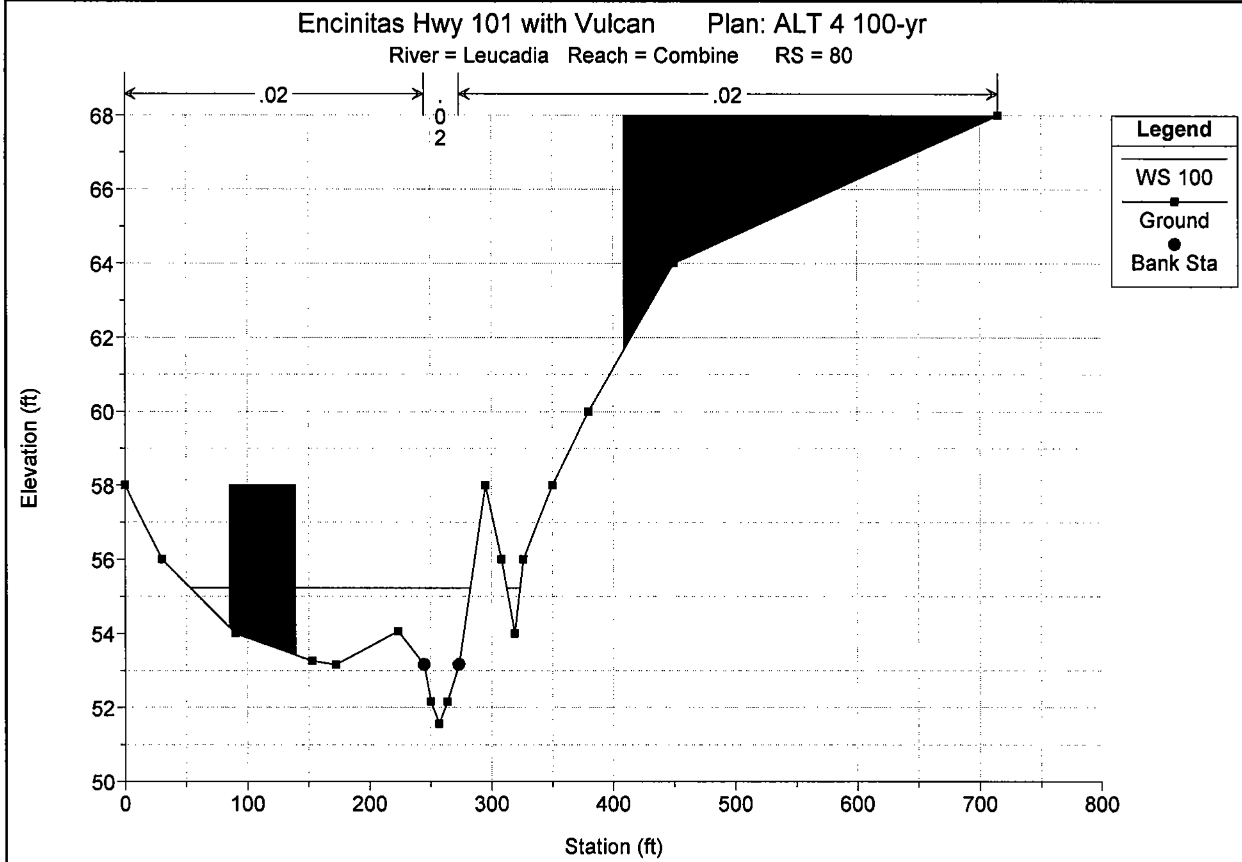
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 105
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 100
.02
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta

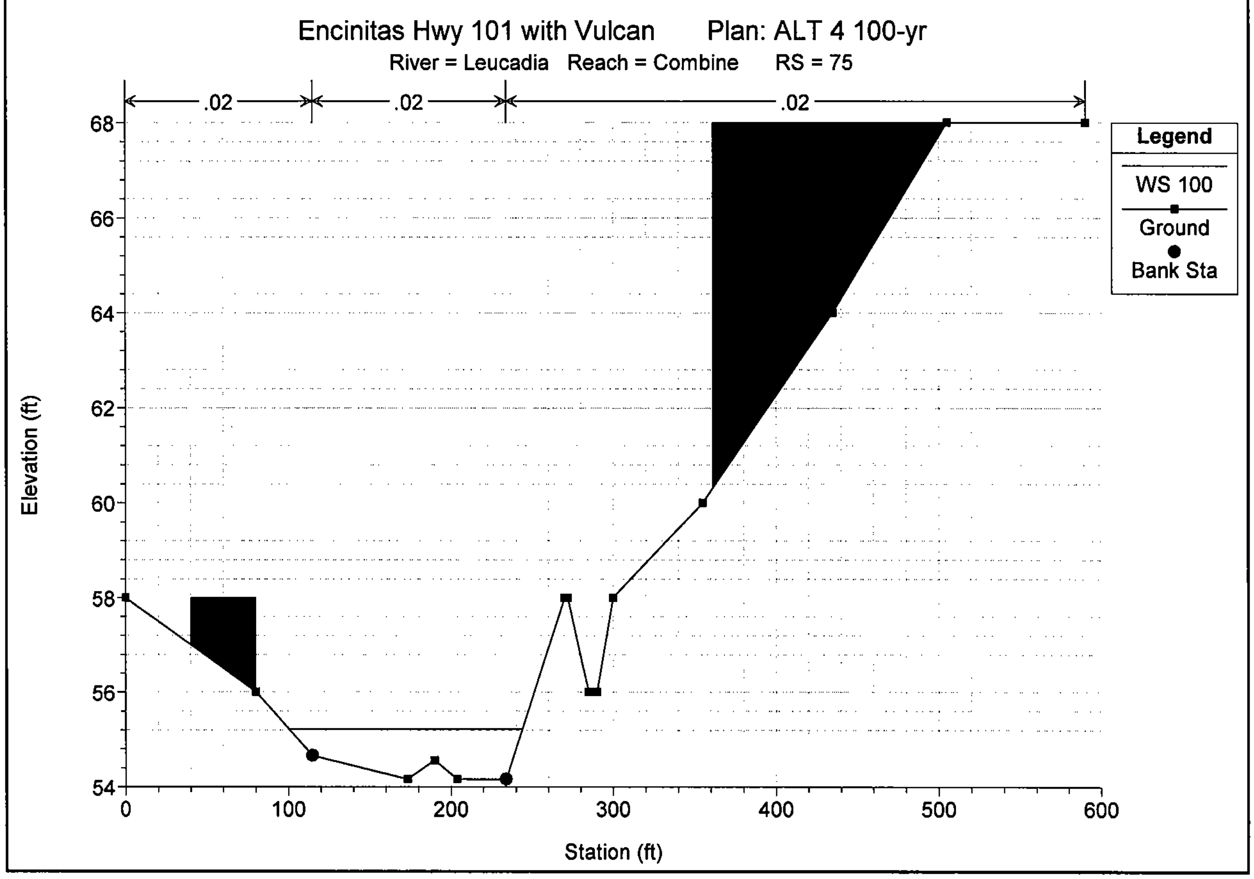

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 95
.02
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 90
.02
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta

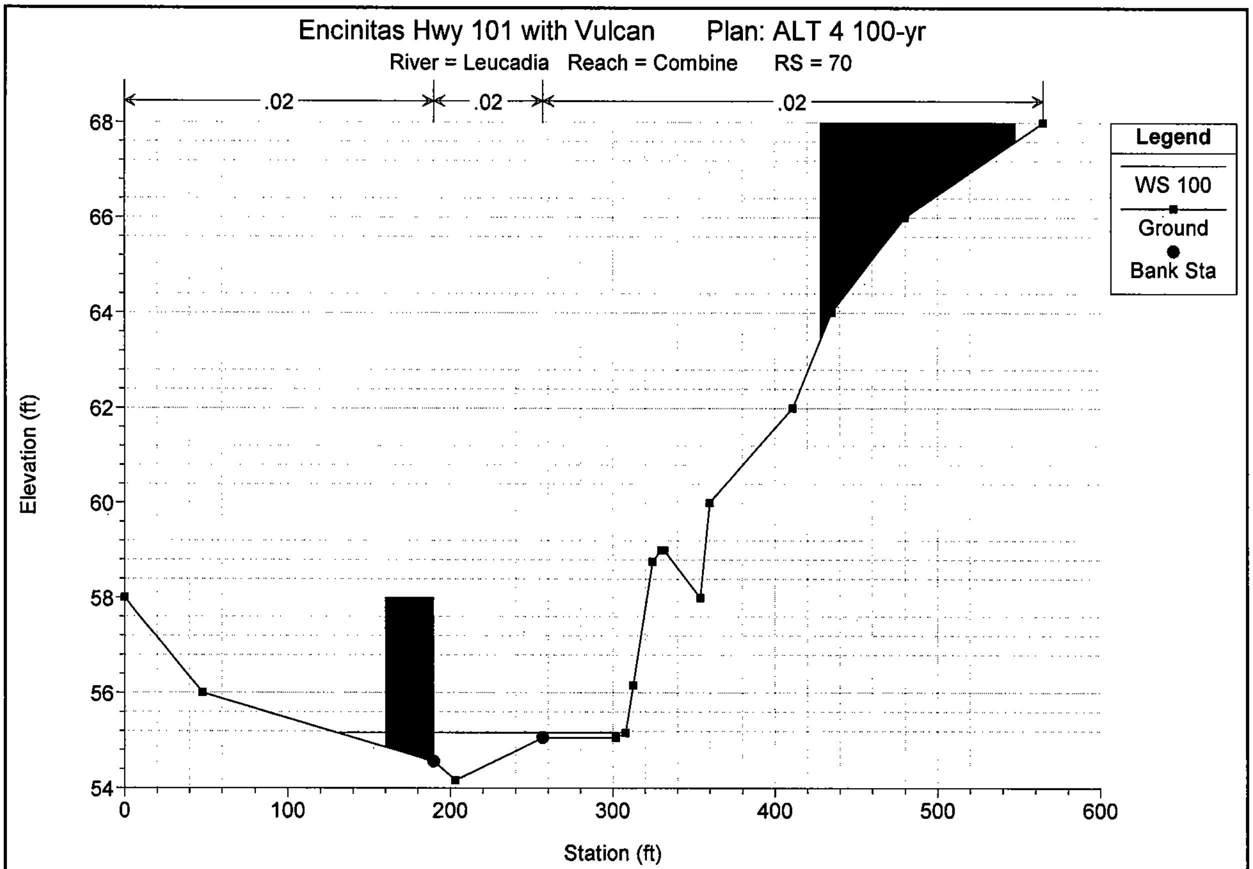

Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 85
.02
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta

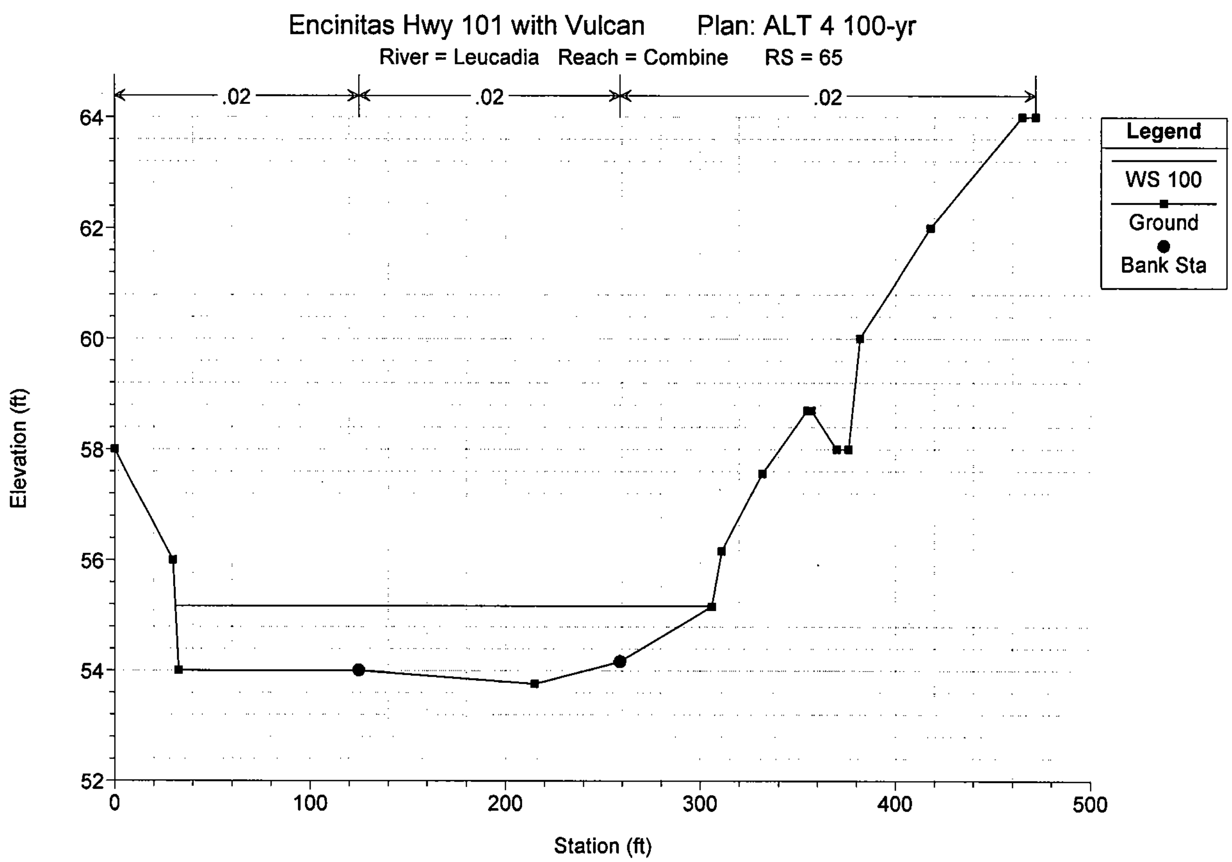


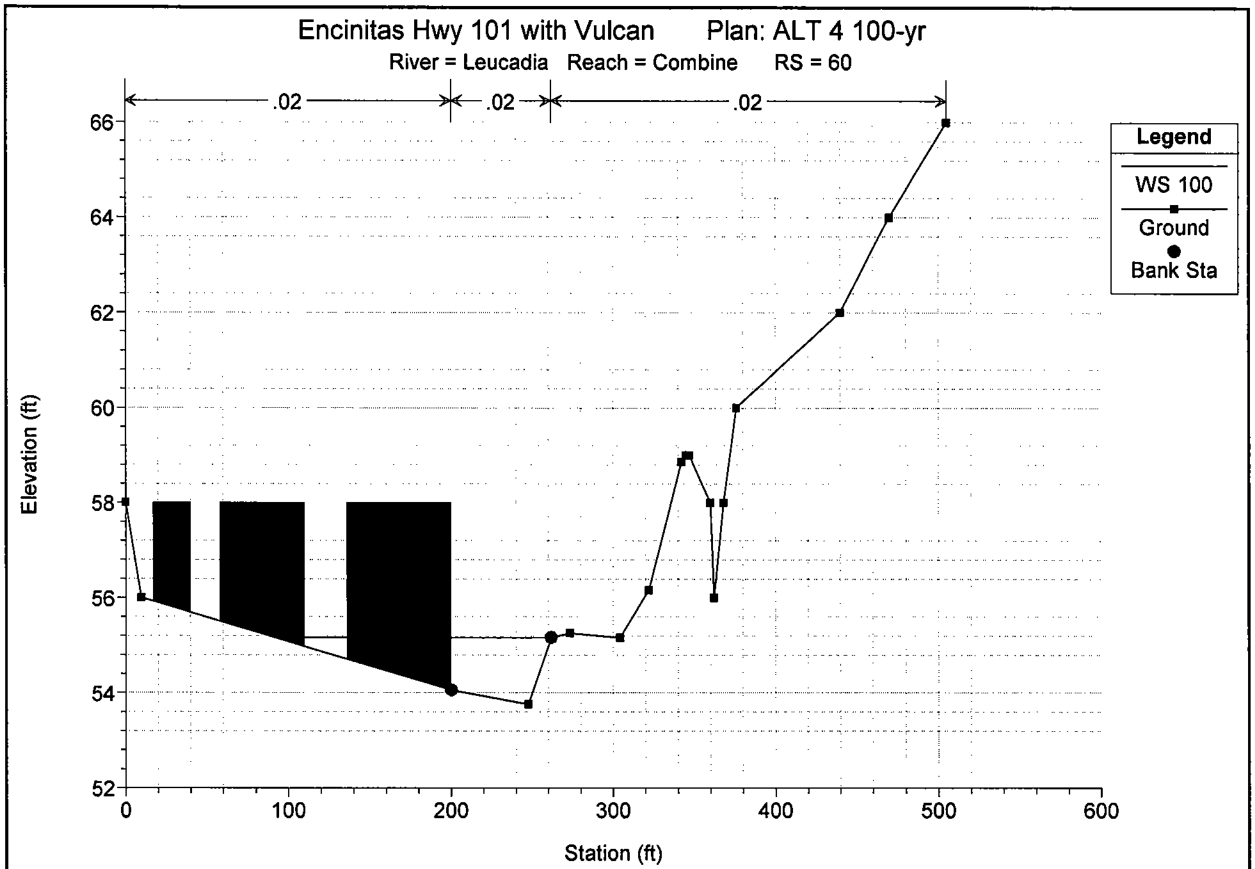
Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 80
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

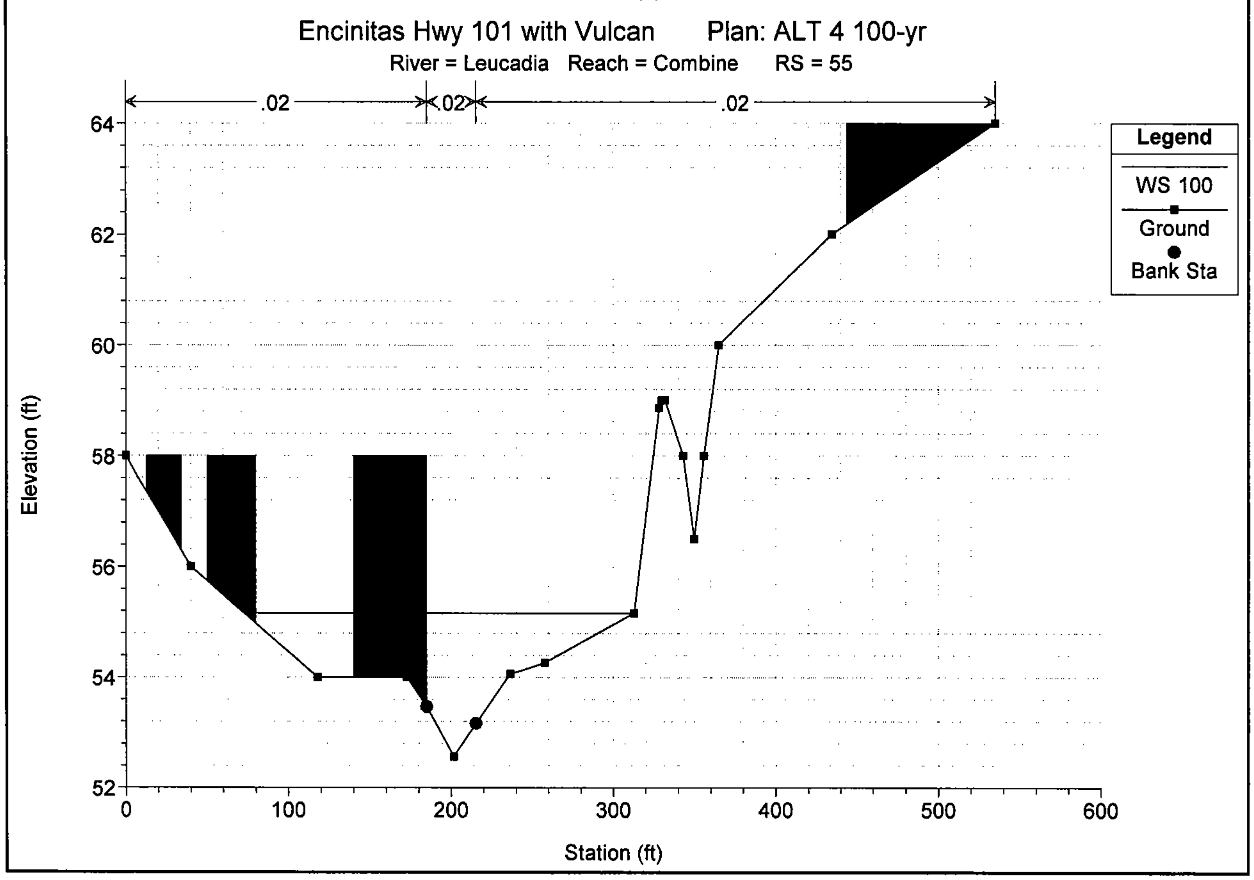


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 75
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 70
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 65
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 60
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
56
54
52
0
100
200
300
400
500
600


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 55
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
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52
0
100
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300
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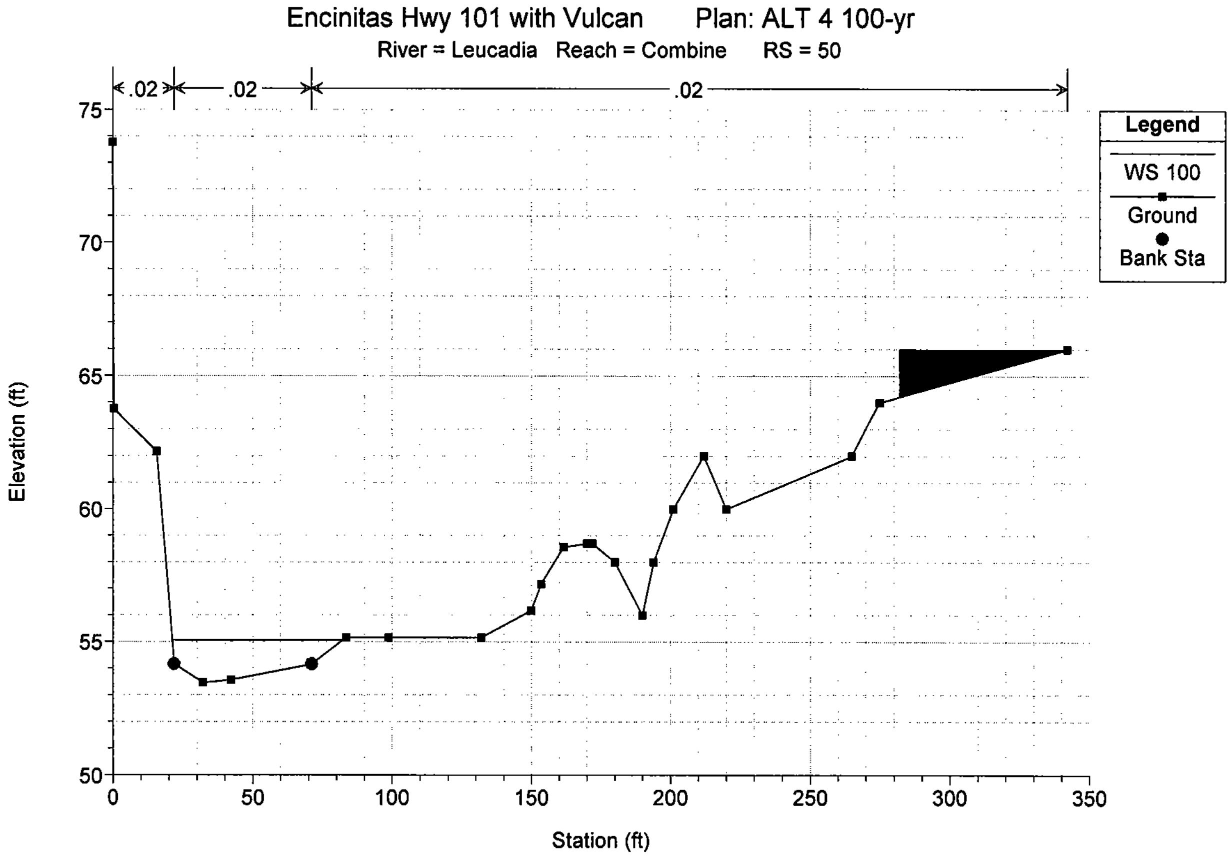
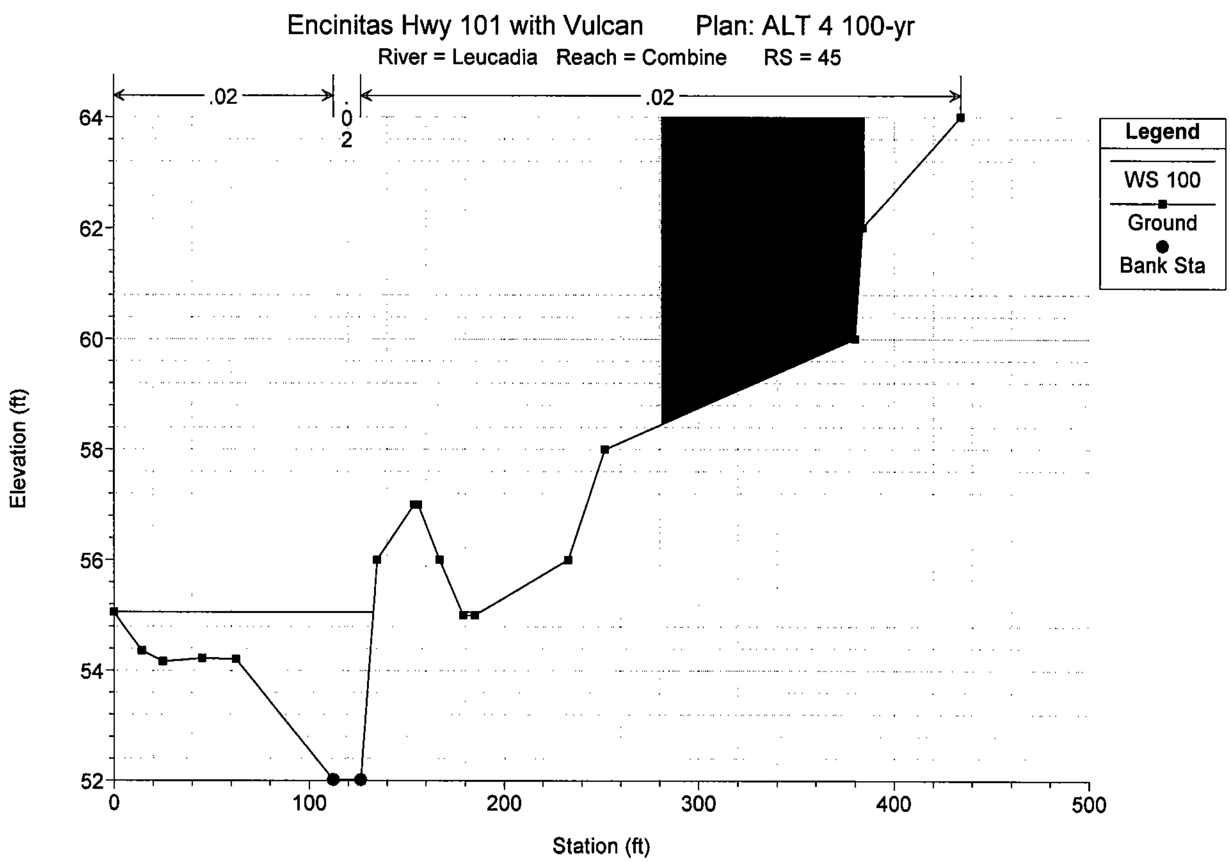
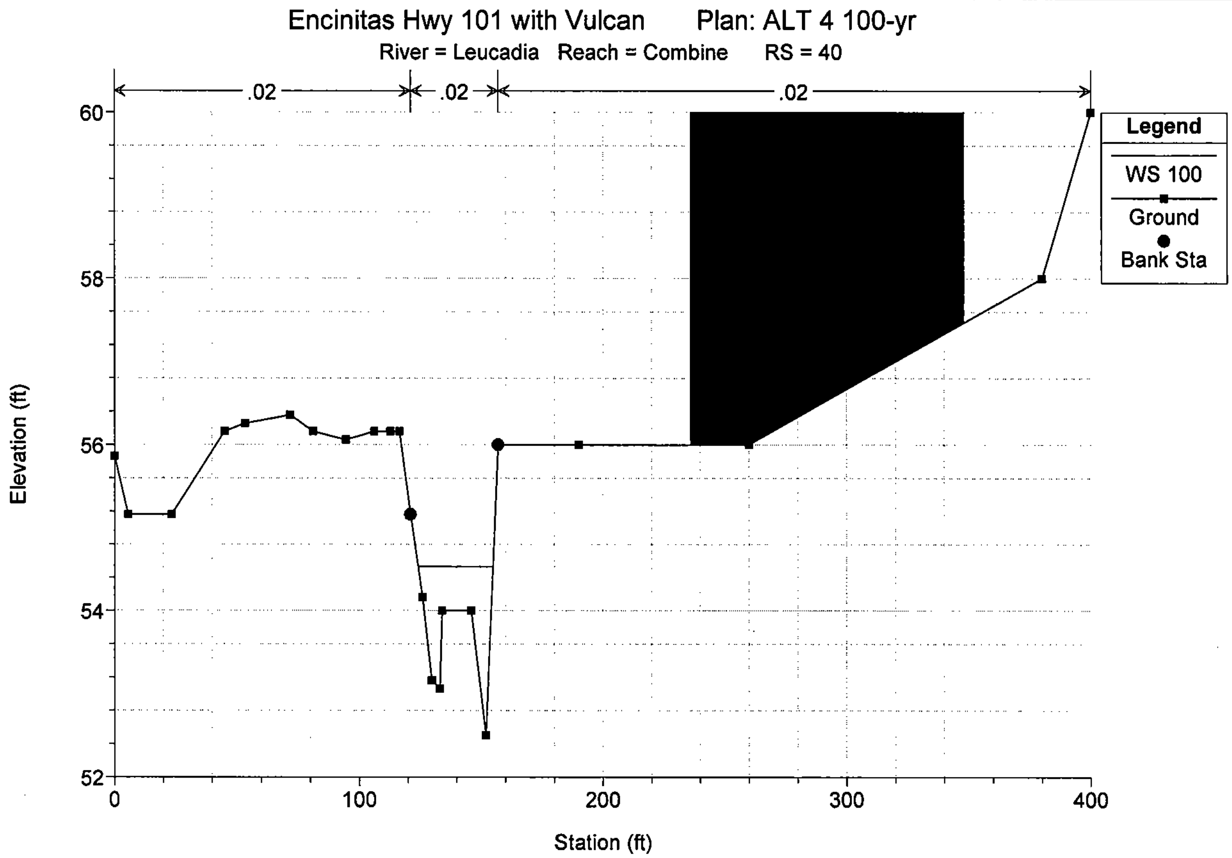
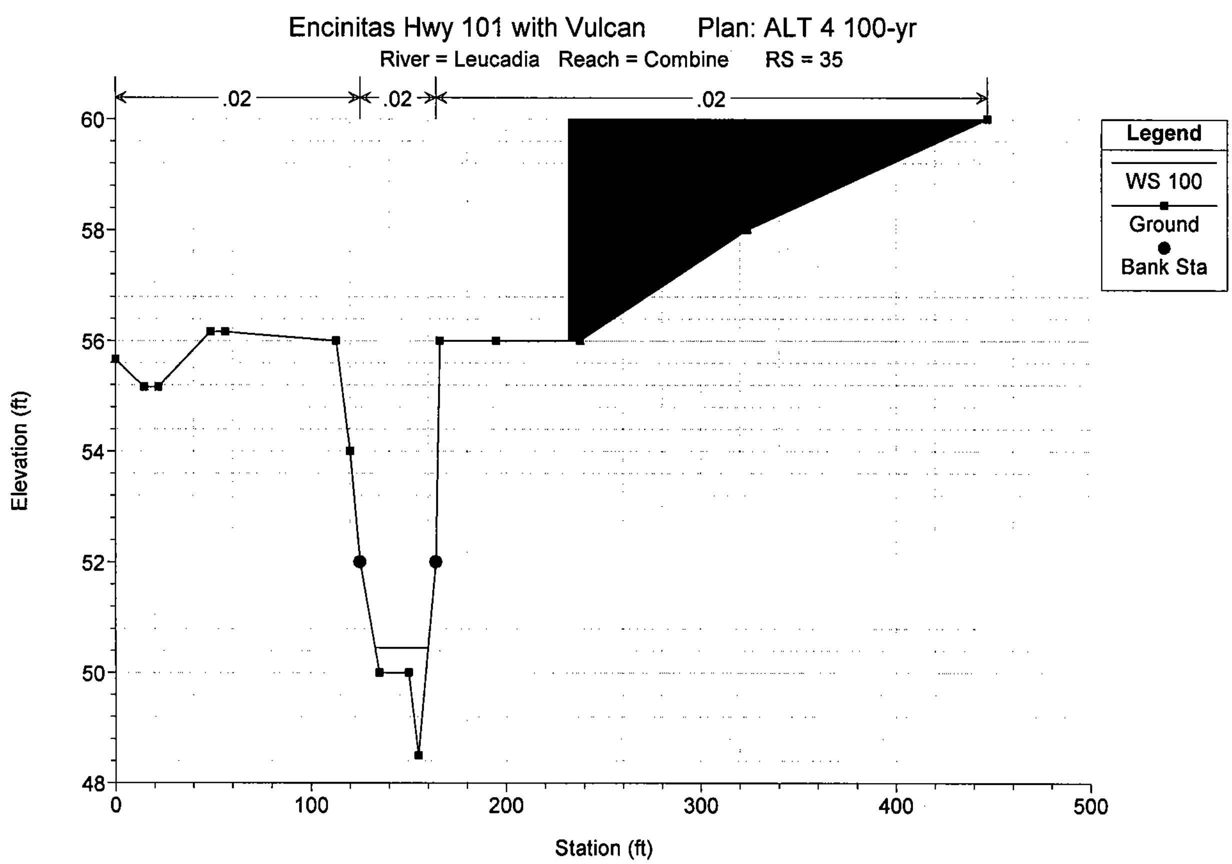
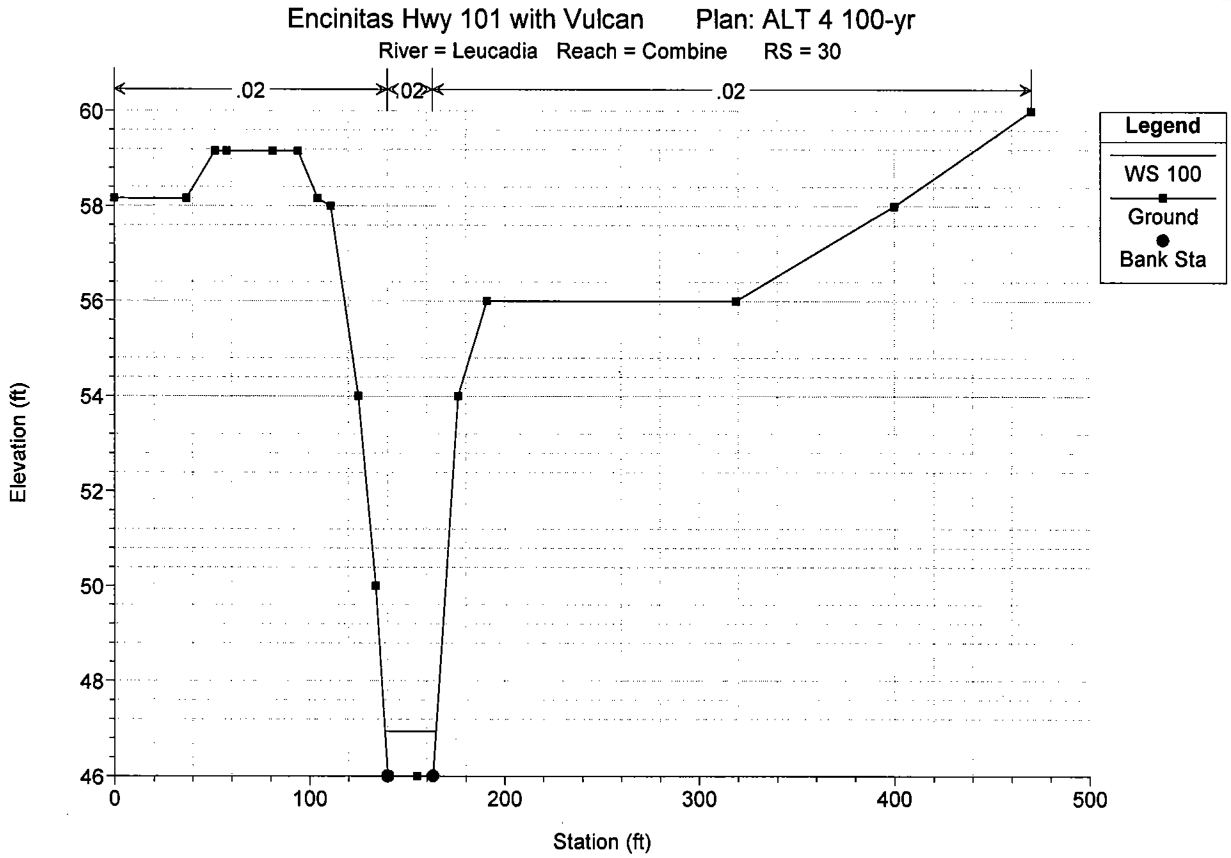
500
600


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 50
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
75
70
65
60
55
50
0
50
100
150
200
250
300
350


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 45
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
52
0
100
200
300
400
500


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 40
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
60
58
56
54
52
0
100
200
300
400


Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 35
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
60
58
56
54
52
50
48
0
100
200
300
400
500



Encinitas Hwy 101 with Vulcan Plan: ALT 4 100-yr
River = Leucadia Reach = Combine RS = 30
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
60
58
56
54
52
50
48
46
0
100
200
300
400
500

HEC-RAS Version 3.0.1 Mar 2001
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Hydrologic Engineering Center
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Davis, California 95616-4687
(916) 756-1104

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

PROJECT DATA
Project Title: Encinitas Hwy 101 with Vulcan
Project File : 101Vul.prj
Run Date and Time: 8/30/2004 6:43:46 AM

Project in English units

Project Description:
ENCINITAS COAST HIGHWAY 101 -100-YR & 10-YR ANALYSIS
JN: 14413 DECEMBER 23,
2003
BASED ON HEC-2 FILENAME: ENC_1.HC2
X-SECTIONS LEFT TO RIGHT LOOKING
DOWNSTREAM

PLAN DATA

Plan Title: ALT 4 100-yr
Plan File : w:\14413\Hec-Ras 101\101Vul.p01

Geometry Title: 101/Vulcan Combined
Geometry File : w:\14413\Hec-Ras 101\101Vul.g07

Flow Title   : 101/Vulcan 100yr Qs 10yr diverted
Flow File   : w:\14413\Hec-Ras 101\101Vul.f21

Plan Description:
10-YEAR RUN** Includes blocked obstructions in alley
Varying Qs based on HEC-1
FN: 100det8.hc1
Extended XS from 95 down to encompas 100-yr
floodplain
Vertical Datum NAVD 88

Plan Summary Information:

Number of:	Cross Sections =	65	Mulitple Openings =	0
	Culverts =	0	Inline Weirs =	0
	Bridges =	0		

Computational Information
- Water surface calculation tolerance = 0.003
- Critical depth calculaton tolerance = 0.003
- Maximum number of interations = 20
- Maximum difference tolerance = 0.1
- Flow tolerance factor = 0.001

Computation Options
- Critical depth computed only where necessary
- Conveyance Calculation Method: At breaks in n values only
- Friction Slope Method: Average Conveyance
- Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: 101/Vulcan 100yr Qs 10yr diverted
Flow File : w:\14413\Hec-Ras 101\101Vul.f21

Flow Data (cfs)

River	Reach	RS	100
Leucadia	Vulcan	3300.14	13
Leucadia	Vulcan	240	1
Leucadia	Vulcan	195	38
Leucadia	101	230	1
Leucadia	101	225.3	1
Leucadia	101	190	1
Leucadia	Combine	140	47
Leucadia	Combine	120	50
Leucadia	Combine	105	51
Leucadia	Combine	90	44
Leucadia	Combine	75	46
Leucadia	Combine	60	56
Leucadia	Combine	50	138

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Leucadia	Vulcan	100	Critical	
Leucadia	101	100	Critical	
Leucadia	Combine	100		Normal S = .01

GEOMETRY DATA

Geometry Title: 101/Vulcan Combined
Geometry File : w:\14413\Hec-Ras 101\101Vul.g07

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
Leucadia	Vulcan		Junction
Leucadia	101		Junction
Leucadia	Combine	Junction	

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3300.14

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	76.16	143	76.56	151	76.16	155	77.16	165	77.56
170	77.56	180	77.16	182.3	74.76	193.6	74.56	196	72.16
204	72.16	206.4	74.56	215.5	74.76	222	74	230	74
240	74.1	245	74	273	74	300	74.46	390	76
420	78								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 169.51 Elevation= 77.58

CROSS SECTION RIVER: Leucadia

REACH: Vulcan RS: 3200.15

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
84	75.16	105	74.56	130	75.16	147	75.46	156	76.16
164	76.96	169	76.96	175	76.16	180.6	74.66	192.8	74.46
196	71.16	204	71.16	207.2	74.46	217	74.66	223	74
230	74	235	74.1	242	74	260	74	273	74
300	74.47	388	76	437	78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
84	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 168.69 Elevation= 76.98

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3100.16

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
95	74.06	118	73.66	126	74.16	139	75.06	154	75.16
160	76.16	164	76.76	169	76.76	175	76.16	179.6	74.96
192	74.76	196	70.76	204	70.76	208	74.76	210.7	75.36
230	75.15	403	76	456	78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
95	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 168.28 Elevation= 76.79

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3000.17

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
89	72.66	130	73.16	142	74.06	151	74.16	158	75.16
165	75.96	170	75.96	176	75.16	179.6	74.46	192	74.26
196	70.26	204	70.26	208	74.26	221.38	74.78	423	76
476	78								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
89	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 169.98 Elevation= 76

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2900.18

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
122	71.16	154	73.16	157	74.16	161	75.16	165	75.36
170	75.36	174	75.16	175.4	74.06	192	73.76	196	69.76
204	69.76	208	73.76	217.41	74.2	459	76	515	78

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
122	.03	196	.035	204	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

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         196     204                100      100      100               .1        .3
Left Levee      Station=  169.51      Elevation=   75.38

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 2800.19

INPUT
Description:
Station Elevation Data     num=       17
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      70    70.06      113    69.46      126    70.16      150    71.16      155    73.16
     160    74.16      164    74.66      169    74.66      174    74.16    175.1    73.56
     192    73.26      196    69.26      204    69.26      208    73.26      225    74.16
     456       76      523       78

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
      70      .03      196     .035      204      .03

Bank Sta: Left    Right    Lengths: Left Channel    Right      Coeff Contr.    Expan.
         196     204                100      100      100               .1        .3
Left Levee      Station=  168.93      Elevation=   74.71

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 2700.20

INPUT
Description:
Station Elevation Data     num=       18
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     125    68.16      139    68.86      146    69.16      150    70.16      154    71.16
     160    73.16      165    73.86      170    73.86      175    73.16    176.2    72.26
     192    71.96      196    67.96      204    67.96      208    71.96   212.73    72.57
     258       74      423       76      535       78

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     125      .03      196     .035      204      .03

Bank Sta: Left    Right    Lengths: Left Channel    Right      Coeff Contr.    Expan.
         196     204                100      100      100               .1        .3
Left Levee      Station=  170.68      Elevation=   73.86

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 2600.21

INPUT
Description:
Station Elevation Data     num=       20
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     109    66.46      135    66.46      146    68.16      152    69.16      155    70.16
     157    71.16      162    73.16      165    73.26      170    73.26      173    73.16
     181    71.16    185.1    70.06      192    69.96      196    65.96      204    65.96
     208    69.96   215.42    70.99      237       72      286       74      456       76

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     109      .03      196     .035      204      .03

Bank Sta: Left    Right    Lengths: Left Channel    Right      Coeff Contr.    Expan.
         196     204                100      100      100               .1        .3
Left Levee      Station=  170.09      Elevation=   73.26

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 2500.22

INPUT
Description:
Station Elevation Data     num=       17
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     139    65.16      150    68.16      158    71.16      165    72.76      170    72.76
     175    71.16      182    69.16      184    68.66      192    68.46      196    64.46
     204    64.46      208    68.46   213.55    69.25      233       70      266       72
     320       74      498       76

Manning's n Values         num=        3
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     Sta    n Val      Sta    n Val      Sta    n Val
     139      .03      196     .035      204      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
           196      204                 100      100     100                 .1         .3
Left Levee        Station=  170.09        Elevation=    72.78

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 2400.23

INPUT
Description:
Station Elevation Data     num=        18
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
      95    65.56      142    65.16      160    71.16      165    72.46      170    72.46
     175    71.16      180    70.16      183       68      192     67.9    194.8    68.16
     202    67.96      206    63.96      214    63.96      218    67.96   221.32    68.78
     250       70      263       72      360       74

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
      95      .03      206     .035      214      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
           206      214                 100      100     100                 .1         .3
Left Levee        Station=  169.39        Elevation=    72.47

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 2300.24

INPUT
Description:
Station Elevation Data     num=        18
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       2    64.46      129    64.46      141    65.16      160    71.16      165    71.86
     170    71.86      175    71.16      185    68.16      190       67    195.2    67.66
     202    67.46      206    63.46      214    63.46      218    67.46    221.7    68.36
     260       70      316       72      382       74

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       2      .03      206     .035      214      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
           206      214                 100      100     100                 .1         .3
Left Levee        Station=  170.56        Elevation=    71.89

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 2200.25

INPUT
Description:
Station Elevation Data     num=        15
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     140    64.16      160    71.16      165    71.46      170    71.46      172    71.16
     182    68.16    184.7    66.86    192.3    66.76      196    62.96      204    62.96
   207.7    66.76      217    66.86      260       68      287       70      342       72

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     140      .03      196     .035      204      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
           196      204                 100      100     100                 .1         .3
Left Levee        Station=  170.39        Elevation=    71.43

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 2100.26

INPUT
Description:
Station Elevation Data     num=        20
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     144    63.16      164    71.16      165    71.36      170    71.36      175    71.16
     182    68.16      186       66    188.3    64.96    193.6    64.86      196    62.46
     204    62.46    206.4    64.86      217    65.06      234       66      240     66.1
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     245      66     248    65.9     252      66     286      68     322      70

Manning's n Values        num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
     144     .03      196    .035      204     .03

Bank Sta: Left    Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
            196     204                15      15      15               .1        .3
Left Levee       Station=   169.8     Elevation=   71.43

CROSS SECTION          RIVER: Leucadia
REACH: Vulcan             RS: 245

INPUT
Description:
Station Elevation Data    num=      11
     Sta     Elev     Sta    Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0       70      10      70      16       68      24       66      30       64
      40       64      70      66      80       66      87       66     122       68
     180       70

Manning's n Values        num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
       0     .03       30    .035       40     .03

Bank Sta: Left    Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
             30      40               175     175     175               .1        .3

CROSS SECTION          RIVER: Leucadia
REACH: Vulcan             RS: 240

INPUT
Description:
Station Elevation Data    num=       9
     Sta     Elev     Sta    Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0       70       5      70      10       68      20       66      27       64
      39       64      89      66     185       68     230       70

Manning's n Values        num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
       0     .03       27    .035       39     .03

Bank Sta: Left    Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
             27      39               275     275     275               .1        .3

CROSS SECTION          RIVER: Leucadia
REACH: Vulcan             RS: 235

INPUT
Description:
Station Elevation Data    num=       6
     Sta     Elev     Sta    Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0       68      10      68      15       66     140       66     205       68
     246       70

Manning's n Values        num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
       0     .03       15    .035      140     .03

Bank Sta: Left    Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
             15     140               120     120     120               .1        .3

CROSS SECTION          RIVER: Leucadia
REACH: Vulcan             RS: 230

INPUT
Description:
Station Elevation Data    num=      11
     Sta     Elev     Sta    Elev     Sta     Elev     Sta     Elev     Sta     Elev
     430       70     460      70     520       68     525       68     544     69.8
     546     69.8     550      68     580       66     715       66     770       68
     825       70

Manning's n Values        num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
     430     .02      580     .02      715     .02
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           580     715             175     180     185                .1       .3
Blocked Obstructions     num=       1
   Sta L    Sta R    Elev
     797      825      70

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 225

INPUT
Description:
Station Elevation Data    num=       8
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     536     69.8      538     69.8      542       68      595       66      625       66
     785       66      827       68      835       70

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
     536      .02      595      .02      785      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           595     785             190     185     185                .1       .3
Blocked Obstructions     num=       1
   Sta L    Sta R    Elev
     692      835      70

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 220

INPUT
Description:
Station Elevation Data    num=       7
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     494     69.9      496     69.9      518       68      580       66      876       66
     900       68      910       72

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
     494      .02      580      .02      876      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           580     876             175     175     175                .1       .3

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 215

INPUT
Description:
Station Elevation Data    num=      15
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     540     69.9      542     69.9      546       68      552     67.9      556       68
     565       70      580     70.1      594       70      600     69.9      610       70
     670       68      815       66      860       66      945       68      995       70

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
     540      .02      546      .02      556      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           546     556             290     290     290                .1       .3
Blocked Obstructions     num=       1
   Sta L    Sta R    Elev
     765      995      70

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 195

INPUT
Description:
Station Elevation Data    num=      15
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     485       70      496       70      505       68      510       68      515       70
     520       72      525       74      533       74      612       72      652       70
     695       68      780       66      820       66      920       68      985       70
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Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     485     .02       505     .02       510     .02

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
           505     510               340      340     340                .1        .3
Blocked Obstructions       num=       2
   Sta L    Sta R     Elev   Sta L    Sta R     Elev
     835      903       74     930      985       74

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 175

INPUT
Description:
Station Elevation Data      num=        7
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     335       68      337       68      344       66      348     65.5      350       66
     765       68      847       70

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     335     .02       344     .02       350     .02

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
           344     350               225      220     220                .1        .3
Blocked Obstructions       num=       2
   Sta L    Sta R     Elev   Sta L    Sta R     Elev
     525      712       70     739      847       70

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 165

INPUT
Description:
Station Elevation Data      num=       14
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     392       67      394       67      395       66      400       64      410       63
     418       64      436       66      472       68      512       70      555       72
     620       72      700       70      795       68      895       70

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     392     .02       400     .02       418     .02

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
           400     418               360      360     360                .1        .3
Blocked Obstructions       num=       2
   Sta L    Sta R     Elev   Sta L    Sta R     Elev
     546      781       72     826      895       72

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 150

INPUT
Description:
Station Elevation Data      num=       12
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     380       65      382       65      385       64      400       63      413       64
     486       66      520       70      565       74      698       74      750       72
     967       72     1040       74

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     380     .02       385     .02       413     .02

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.    Expan.
           385     413               305      305     305                .1        .3
Blocked Obstructions       num=       1
   Sta L    Sta R     Elev
     606     1040       74

CROSS SECTION            RIVER: Leucadia
REACH: 101                  RS: 230

INPUT
```

Description:

Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	25.4	64	30.5	62	88.9	60.2	146	60
243.4	62	278	64	318.4	66				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	88.9	.02	146	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
88.9	146	104.1	100.2	136.3	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
50	80	66	145	190	66	285	350	66

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 225.3

INPUT
Description:

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	16	64	32.6	62	78.4	60	126.9	58
133.4	58	139.4	58	203.7	58	210.3	58	216.8	58.5
233.9	60	285.5	62	319.2	64	355	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	126.9	.02	203.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
126.9	203.7	5	5	5	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
5	30	66	130	160	66	180	200	66
210	235	66	300	345	66			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 225.2

INPUT
Description:

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	16	64	32.6	62	78.4	60	126.9	58
133.4	54	139.4	54	203.7	56	210.3	58	216.8	58.5
233.9	60	285.5	62	319.2	64	355	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	126.9	.02	203.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
126.9	203.7	5	5	5	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
5	30	66	130	160	66	180	200	66
210	235	66	300	345	66			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 225.1

INPUT
Description:

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	16	64	32.6	62	78.4	60	126.9	58
133.4	58	139.4	58	203.7	58	210.3	58	216.8	58.5
233.9	60	285.5	62	319.2	64	355	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	126.9	.02	203.7	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

```
        126.9   203.7            134.2    131.9    133.3              .1        .3
Blocked Obstructions      num=       5
   Sta L    Sta R     Elev   Sta L    Sta R     Elev    Sta L    Sta R     Elev
       5       30       66     130      160       66      180      200       66
     210      235       66     300      345       66

CROSS SECTION           RIVER: Leucadia
REACH: 101                 RS: 220

INPUT
Description:
Station Elevation Data     num=       11
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       66     18.9       64       21       62     30.1       60     56.5       58
   114.4     57.7      192       58      255       60    292.4       62    321.2       64
   343.3       66

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .02     56.5      .02      192      .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
         56.5     192              222.7    215.1    206.1              .1        .3
Blocked Obstructions      num=       3
   Sta L    Sta R     Elev   Sta L    Sta R     Elev    Sta L    Sta R     Elev
      20       60       66     105      140       66      155      190       66

CROSS SECTION           RIVER: Leucadia
REACH: 101                 RS: 215

INPUT
Description:
Station Elevation Data     num=       14
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       66       10       64     35.7       62     75.9       60    102.5       58
   121.6       56    143.9       56    204.1       56      241       56      286       58
   307.5       60    345.4       62    377.3       64    381.6       66

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .02    121.6      .02      241      .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
       121.6      241               78.2     80.6     89.6              .1        .3
Blocked Obstructions      num=       2
   Sta L    Sta R     Elev   Sta L    Sta R     Elev
      10       75       66     160      220       66

CROSS SECTION           RIVER: Leucadia
REACH: 101                 RS: 210

INPUT
Description:
Station Elevation Data     num=       11
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       66     10.4       64     23.6       62     63.8       60    101.7       58
   120.4       56    193.3       56    272.5       56    296.1       58    304.2       60
   312.7       66

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .02    120.4      .02    272.5      .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
       120.4    272.5               47.1     45.4     64.5              .1        .3
Blocked Obstructions      num=       2
   Sta L    Sta R     Elev   Sta L    Sta R     Elev
      20      170       66     210      250       66

CROSS SECTION           RIVER: Leucadia
REACH: 101                 RS: 205

INPUT
Description:
Station Elevation Data     num=        9
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
```

0	64	14	62	58.3	60	89	58	110.7	56
182	56	218.5	56	292.3	58	302.4	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	110.7	.02	218.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
110.7	218.5	141.2	142.6	152.6	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	30	64	60	100	64	140	170	64
200	225	64	255	280	64			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 195

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	35.6	62	68.6	60	113.8	58	198.9	56
266.6	58	298.8	60	323.4	62	337.5	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	113.8	.02	266.6	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
113.8	266.6	143.6	102.4	81.7	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
95	130	64	150	180	64	210	255	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 190

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	16.8	62	31.4	60	99.1	58	133.4	58
179.5	58	217.5	60	231.5	64				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	99.1	.02	179.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
99.1	179.5	109.2	93.8	106	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	10	64	35	65	64	90	120	64
185	230	64						

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 185

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	21.3	62	59.2	60	118.2	59	204.1	60
212.1	64								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	59.2	.02	204.1	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
59.2	204.1	56.4	82.7	111.4	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
60	100	64	150	210	64

CROSS SECTION RIVER: Leucadia

```
REACH: 101              RS: 180

INPUT
Description:
Station Elevation Data    num=       9
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0      64      17      62    30.5      60    71.4      59   113.4      60
   120.7      64   192.2      64   257.1      63   317.6      64

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .02    30.5     .02   113.4     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
          30.5   113.4             83.8    85.3    85.6              .1        .3
Blocked Obstructions     num=      2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
      40      85      64     130     190      64

CROSS SECTION          RIVER: Leucadia
REACH: 101              RS: 175

INPUT
Description:
Station Elevation Data    num=      11
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0      64     5.6      62    20.6      60    56.6      59    99.6      60
   104.6      62     172      63     232      62   252.5    61.9   268.5      62
   309.1      64

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .02    20.6     .02    99.6     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
          20.6    99.6            120.2   124.8   122.1              .1        .3
Blocked Obstructions     num=      2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
      20      55      64     110     160      64

CROSS SECTION          RIVER: Leucadia
REACH: 101              RS: 170

INPUT
Description:
Station Elevation Data    num=       7
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0      64    33.4      62    87.4      60   141.8    58.5   184.7      60
     322      62   333.5      64

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .02    87.4     .02   184.7     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
          87.4   184.7            137.5   137.6   138.7              .1        .3

CROSS SECTION          RIVER: Leucadia
REACH: 101              RS: 165

INPUT
Description:
Station Elevation Data    num=      16
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0      64    14.5      62      16      60   102.4      58   128.4      57
   138.5      56   147.5      56   172.9    55.9   200.4      56   225.9      58
   245.3      60   261.4    60.2   279.4      60   288.3      60   366.3      60
   374.3      64

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .02   138.5     .02   200.4     .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.    Expan.
         138.5   200.4            309.6   309.5   308.6              .1        .3
Blocked Obstructions     num=      2
```

Sta L	Sta R	Elev	Sta L	Sta R	Elev
30	80	64	190	240	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 160

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	21	62	37	60	57.5	58	105	56
129.5	55	142.1	55	152.6	55	186.5	54	214.5	55
237	56	283.6	58	300.1	58.1	317	58	333	57.9
342	58	359	60	368	62	376	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	152.6	.02	214.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
152.6	214.5	48.6	52.6	51.9	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
30	70	64	90	120	64	150	170	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 150

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	16	62	24	60	39.5	58	63.4	56
96.4	54	132.3	54	144.8	53	156.9	52	193.8	54
220.8	56	297.7	57.7	340.3	58	356.3	60	369.2	64

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	144.8	.02	193.8	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
144.8	193.8	151.2	154.7	157.7	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
20	50	64	190	220	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 145

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	22.3	62	44.3	58	79.3	56	111.6	54
143.9	52	156.1	52	176.6	52	182.1	58	246	58
280.5	56.5	384.4	58	398.4	62	411.9	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	143.9	.02	176.6	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
143.9	176.6	175.6	160.5	160.3	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
40	85	64	115	150	64	180	240	64

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 140

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	12.5	62	39	60	45.5	56	88	54
162.6	52	178.6	54	184.6	58	237.6	58	283.1	56.2

311.6	56.4	375.5	58	392.5	60	400.6	62	422.6	62
432	63	434	63	442	61	465	64	531	66
566	68	730	70						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	88	.02	178.6	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
88	178.6	141.5	123.2	117.1	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
60	140	64	200	260	64	539	646	70
710	730	70						

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 135

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	18.7	62	47.7	60	71.8	58	99.9	56
152.2	54	165.3	54	181.2	54	234.9	54	309.4	56
380.6	58	399.2	60	408.7	62	456.1	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	152.2	.02	234.9	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
152.2	234.9	122.2	126.9	132.7	.1	.3

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 130

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	14.5	62	28	60	34.5	56	131.4	54
154.3	54	268.8	56	365.1	58	370	62	392	62
445	64	472	66	492	68	555	70		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	131.4	.02	154.3	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
131.4	154.3	197.5	197.3	196.3	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	10	64	40	75	64	90	130	64
160	240	64						

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 125

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	21.6	62	34.6	54	52.6	54	139.7	54
149.2	54	157.7	54	240.8	54	314.2	56	366.8	58
378.8	60	392.8	62	424.8	62	454.4	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	139.7	.02	157.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
139.7	157.7	131.2	129.8	132.3	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	20	64	30	75	64	100	130	64
190	240	64						

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 120

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	31.6	62	46	60	49.1	58	62.2	56
149.5	54.2	160.5	54.1	171.6	54	202.1	54	299.9	56
317.9	56.3	341.4	56	369.5	58	389.6	60	406.1	62
429.6	62	464.8	64						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	149.5	.02	202.1	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
149.5	202.1	86.1	88.2	95.5	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	40	64	80	140	64	180	250	64

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 115

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	26.5	62	48	56	117	54	138	54
149.5	54	158.5	54	314.9	56	333.9	56	358.8	58
377.9	60	390	61	392	61	395	60	400	62
425	62	465	64	495	66	520	68	610	72
640	72	710	70	785	68	855	68	935	70

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	138	.02	158.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
138	158.5	218.8	211.7	222.6	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
60	140	64	180	250	64	503	899	72

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 110

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	62	5.5	54	53.5	54	74.5	54	150.5	54
271.9	56	290.9	58	299.4	60	340.9	60	365.4	62

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	5.5	.02	150.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
5.5	150.5	180.1	165.1	173.7	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
10	40	62	90	160	62

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 105

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	62	7.6	60	23.8	58	51.8	56	80.4	54
89.2	54	100.1	54	285.3	56	309.6	58	316.9	60
359.4	60	387	62						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	80.4	.02	100.1	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
80.4	100.1	106.7	119.5	229.1	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
100	170	62

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 100

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	62	26.6	60	81.5	58	86.5	56	185	55
273.2	56	314.6	58	319.3	60	330	60	332	60
336	59	345	59	385	62	425	64	460	66
512	68	560	68	710	66	798	66	1000	68

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	86.5	.02	273.2	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
86.5	273.2	360	340	360	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
150	190	62	436	624	68	676	870	68

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 95

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	52	56	118	56	122	56	230	54.46
257.9	54.16	266.8	54.16	301.1	55.56	329.4	56.16	341.1	57.16
350.3	58.16	371	59.2	378	58.5	385	60	395	62
434	64	460	66	485	68	580	70	655	70
760	68	820	67	940	68	1000	70		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	230	.02	301.1	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
230	301.1	365.1	364.9	363	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
14	30	58	42	60	58	70	80	58
172	190	58						

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 90

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	35	56	86	54	142	53.76	206.7	53.76
231.7	54.16	245.3	54.56	265.7	54.16	288.9	54.16	296.9	55.16
299.9	56.16	304.4	57.16	307.3	58.16	335	58.2	337	58.2
340	58	345	56.5	351	56.5	365	60	404	62
440	68	520	70	645	70	650	68	800	66.5
920	68	980	70						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	142	.02	206.7	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

142	206.7	356.3	355.5	353.7	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
55	86	58	105	142	58	442	625	70

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 85

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	20	56	42	54	113	53.06	144.1	52.86
158.7	53.06	199.9	53.16	206.4	52.16	217.1	52.16	220.7	53.16
231.8	54.16	260	58.2	265	58	273	56	285	58
320	60	340	62	355	64	390	66	525	68

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	199.9	.02	220.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
199.9	220.7	353.7	357.5	356.9	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
48	100	58	484	525	68

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 80

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	30	56	90	54	153	53.26	172.5	53.16
223.6	54.06	244.7	53.16	250.2	52.16	256.8	51.56	263.6	52.16
273.1	53.16	295	58	308	56	319	54	326	56
350	58	380	60	450	64	715	68		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	244.7	.02	273.1	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
244.7	273.1	357.5	355.1	356.2	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
85	140	58	409	715	68

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 75

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	80	56	115	54.66	173.4	54.16	189.9	54.56
203.6	54.16	234	54.16	270	58	272	58	285	56
290	56	300	58	355	60	435	64	505	68
590	68								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	115	.02	234	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
115	234	488	485	489	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
40	80	58	361	590	68

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 70

INPUT
Description:

Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	48	56	190	54.56	203	54.16	257	55.06
301.9	55.06	308.1	55.16	312.8	56.16	324.7	58.76	330	59
332	59	354	58	360	60	411	62	435	64
480	66	565	68						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	190	.02	257	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
190	257	360	359.8	358.2	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
160	190	58	428	548	68

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 65

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	30	56	33	54	125	54	215	53.76
258.9	54.16	306	55.16	311.1	56.16	331.9	57.56	355	58.7
357	58.7	370	58	376	58	382	60	418	62
465	64	472	64						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	125	.02	258.9	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
125	258.9	384.7	386.9	384.1	.1	.3

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 60

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	10	56	200.3	54.06	247.7	53.76	262.1	55.16
273.3	55.26	304.3	55.16	322.1	56.16	342.1	58.86	345	59
347	59	360	58	362	56	368	58	376	60
440	62	470	64	505	66				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	200.3	.02	262.1	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
200.3	262.1	364.2	363.7	367	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
17	40	58	58	110	58	136	200	58

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 55

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	40	56	118	54	173	54	185	53.46
201.7	52.56	215.5	53.16	236.6	54.06	257.9	54.26	313	55.16
328.4	58.86	330	59	332	59	343	58	350	56.5
356	58	365	60	435	62	535	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	185	.02	215.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
185	215.5	354.4	358.2	348.8	.1	.3

```
Blocked Obstructions      num=       4
   Sta L   Sta R     Elev   Sta L   Sta R     Elev    Sta L   Sta R     Elev
      13      34       58      50      80       58      140     185       58
     444     535       64

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 50

INPUT
Description:
Station Elevation Data     num=       24
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    73.76.3000031   63.7615.60001   62.1621.90001   54.1632.20001   53.46
    42.3    53.56     71.2   54.1683.50001   55.16     98.8    55.16      132    55.16
   149.9    56.16    153.5    57.16    161.6    58.56      170     58.7      172     58.7
     180       58      190       56      194       58      201       60      212       62
     220       60      265       62      275       64      342       66

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .0221.90001      .02     71.2      .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
     21.90001     71.2               393.5   397.9    398.7               .1        .3
Blocked Obstructions      num=       1
   Sta L   Sta R     Elev
     282     342       66

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 45

INPUT
Description:
Station Elevation Data     num=       18
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    55.0614.40001    54.36     25.2    54.16    45.21    54.22    62.73     54.2
   112.5    52.01   126.52    52.01      135       56      154       57      156       57
     167       56      179       55      185       55      233       56      252       58
     380       60      384       62      434       64

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .02    112.5      .02   126.52      .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
        112.5   126.52                 375     380      385               .1        .3
Blocked Obstructions      num=       1
   Sta L   Sta R     Elev
     281     385       64

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 40

INPUT
Description:
Station Elevation Data     num=       23
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0    55.86      5.8    55.16     23.5    55.16     45.2    56.16     53.5    56.26
    71.9    56.36     81.2    56.16     94.6    56.06    106.1    56.16   112.85    56.16
   116.5    56.16      121    55.16      126    54.16    129.8    53.16      133    53.06
     134       54      146       54      152     52.5      157       56      190       56
     260       56      380       58      400       60

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .02      121      .02      157      .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
          121      157               343.5   344.8    345.4               .1        .3
Blocked Obstructions      num=       1
   Sta L   Sta R     Elev
     236     348       60

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 35
```

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	55.66	14.7	55.16	22.1	55.16	48.8	56.16	56.3	56.16
113	56	120	54	125	52	135	50	150	50
155	48.5	164	52	166	56	195	56	238	56
324	58	447	60						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	125	.02	164	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
125	164	345.5	336.8	337.3	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
232	447	60

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 30

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58.16	36.8	58.1651.59999		59.1657.59999		59.16	81.3	59.16
94.39999	59.16	104.2	58.16	111	58	125	54	134	50
140	46	155	46	163	46	176	54	191	56
319	56	400	58	470	60				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	140	.02	163	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
140	163	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Leucadia

Reach	River Sta.	n1	n2	n3
Vulcan	3300.14	.03	.035	.03
Vulcan	3200.15	.03	.035	.03
Vulcan	3100.16	.03	.035	.03
Vulcan	3000.17	.03	.035	.03
Vulcan	2900.18	.03	.035	.03
Vulcan	2800.19	.03	.035	.03
Vulcan	2700.20	.03	.035	.03
Vulcan	2600.21	.03	.035	.03
Vulcan	2500.22	.03	.035	.03
Vulcan	2400.23	.03	.035	.03
Vulcan	2300.24	.03	.035	.03
Vulcan	2200.25	.03	.035	.03
Vulcan	2100.26	.03	.035	.03
Vulcan	245	.03	.035	.03
Vulcan	240	.03	.035	.03
Vulcan	235	.03	.035	.03
Vulcan	230	.02	.02	.02
Vulcan	225	.02	.02	.02
Vulcan	220	.02	.02	.02
Vulcan	215	.02	.02	.02
Vulcan	195	.02	.02	.02
Vulcan	175	.02	.02	.02
Vulcan	165	.02	.02	.02
Vulcan	150	.02	.02	.02
101	230	.02	.02	.02
101	225.3	.02	.02	.02
101	225.2	.02	.02	.02
101	225.1	.02	.02	.02
101	220	.02	.02	.02
101	215	.02	.02	.02

101	210	.02	.02	.02
101	205	.02	.02	.02
101	195	.02	.02	.02
101	190	.02	.02	.02
101	185	.02	.02	.02
101	180	.02	.02	.02
101	175	.02	.02	.02
101	170	.02	.02	.02
101	165	.02	.02	.02
101	160	.02	.02	.02
101	150	.02	.02	.02
101	145	.02	.02	.02
Combine	140	.02	.02	.02
Combine	135	.02	.02	.02
Combine	130	.02	.02	.02
Combine	125	.02	.02	.02
Combine	120	.02	.02	.02
Combine	115	.02	.02	.02
Combine	110	.02	.02	.02
Combine	105	.02	.02	.02
Combine	100	.02	.02	.02
Combine	95	.02	.02	.02
Combine	90	.02	.02	.02
Combine	85	.02	.02	.02
Combine	80	.02	.02	.02
Combine	75	.02	.02	.02
Combine	70	.02	.02	.02
Combine	65	.02	.02	.02
Combine	60	.02	.02	.02
Combine	55	.02	.02	.02
Combine	50	.02	.02	.02
Combine	45	.02	.02	.02
Combine	40	.02	.02	.02
Combine	35	.02	.02	.02
Combine	30	.02	.02	.02

SUMMARY OF REACH LENGTHS

River: Leucadia

Reach	River Sta.	Left	Channel	Right
Vulcan	3300.14	100	100	100
Vulcan	3200.15	100	100	100
Vulcan	3100.16	100	100	100
Vulcan	3000.17	100	100	100
Vulcan	2900.18	100	100	100
Vulcan	2800.19	100	100	100
Vulcan	2700.20	100	100	100
Vulcan	2600.21	100	100	100
Vulcan	2500.22	100	100	100
Vulcan	2400.23	100	100	100
Vulcan	2300.24	100	100	100
Vulcan	2200.25	100	100	100
Vulcan	2100.26	15	15	15
Vulcan	245	175	175	175
Vulcan	240	275	275	275
Vulcan	235	120	120	120
Vulcan	230	175	180	185
Vulcan	225	190	185	185
Vulcan	220	175	175	175
Vulcan	215	290	290	290
Vulcan	195	340	340	340
Vulcan	175	225	220	220
Vulcan	165	360	360	360
Vulcan	150	305	305	305
101	230	104.1	100.2	136.3
101	225.3	5	5	5
101	225.2	5	5	5
101	225.1	134.2	131.9	133.3
101	220	222.7	215.1	206.1
101	215	78.2	80.6	89.6
101	210	47.1	45.4	64.5

101	205	141.2	142.6	152.6
101	195	143.6	102.4	81.7
101	190	109.2	93.8	106
101	185	56.4	82.7	111.4
101	180	83.8	85.3	85.6
101	175	120.2	124.8	122.1
101	170	137.5	137.6	138.7
101	165	309.6	309.5	308.6
101	160	48.6	52.6	51.9
101	150	151.2	154.7	157.7
101	145	175.6	160.5	160.3
Combine	140	141.5	123.2	117.1
Combine	135	122.2	126.9	132.7
Combine	130	197.5	197.3	196.3
Combine	125	131.2	129.8	132.3
Combine	120	86.1	88.2	95.5
Combine	115	218.8	211.7	222.6
Combine	110	180.1	165.1	173.7
Combine	105	106.7	119.5	229.1
Combine	100	360	340	360
Combine	95	365.1	364.9	363
Combine	90	356.3	355.5	353.7
Combine	85	353.7	357.5	356.9
Combine	80	357.5	355.1	356.2
Combine	75	488	485	489
Combine	70	360	359.8	358.2
Combine	65	384.7	386.9	384.1
Combine	60	364.2	363.7	367
Combine	55	354.4	358.2	348.8
Combine	50	393.5	397.9	398.7
Combine	45	375	380	385
Combine	40	343.5	344.8	345.4
Combine	35	345.5	336.8	337.3
Combine	30	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Leucadia

Reach	River Sta.	Contr.	Expan.
Vulcan	3300.14	.1	.3
Vulcan	3200.15	.1	.3
Vulcan	3100.16	.1	.3
Vulcan	3000.17	.1	.3
Vulcan	2900.18	.1	.3
Vulcan	2800.19	.1	.3
Vulcan	2700.20	.1	.3
Vulcan	2600.21	.1	.3
Vulcan	2500.22	.1	.3
Vulcan	2400.23	.1	.3
Vulcan	2300.24	.1	.3
Vulcan	2200.25	.1	.3
Vulcan	2100.26	.1	.3
Vulcan	245	.1	.3
Vulcan	240	.1	.3
Vulcan	235	.1	.3
Vulcan	230	.1	.3
Vulcan	225	.1	.3
Vulcan	220	.1	.3
Vulcan	215	.1	.3
Vulcan	195	.1	.3
Vulcan	175	.1	.3
Vulcan	165	.1	.3
Vulcan	150	.1	.3
101	230	.1	.3
101	225.3	.1	.3
101	225.2	.1	.3
101	225.1	.1	.3
101	220	.1	.3
101	215	.1	.3
101	210	.1	.3
101	205	.1	.3

101	195	.1	.3
101	190	.1	.3
101	185	.1	.3
101	180	.1	.3
101	175	.1	.3
101	170	.1	.3
101	165	.1	.3
101	160	.1	.3
101	150	.1	.3
101	145	.1	.3
Combine	140	.1	.3
Combine	135	.1	.3
Combine	130	.1	.3
Combine	125	.1	.3
Combine	120	.1	.3
Combine	115	.1	.3
Combine	110	.1	.3
Combine	105	.1	.3
Combine	100	.1	.3
Combine	95	.1	.3
Combine	90	.1	.3
Combine	85	.1	.3
Combine	80	.1	.3
Combine	75	.1	.3
Combine	70	.1	.3
Combine	65	.1	.3
Combine	60	.1	.3
Combine	55	.1	.3
Combine	50	.1	.3
Combine	45	.1	.3
Combine	40	.1	.3
Combine	35	.1	.3
Combine	30	.1	.3

ATTACHMENT 3

ALTERNATIVE 5
10-YEAR AND 100-YEAR
HEC-1 ANALYSES

ALTERNATIVE 5
10-YEAR HEC-1 ANALYSIS

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN   1998               *
*           VERSION 4.1                 *
*                                       *
* RUN DATE   18AUG04  TIME   07:38:46   *
*                                       *
*****************************************
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**************************************
*
*    U.S. ARMY CORPS OF ENGINEERS
*    HYDROLOGIC ENGINEERING CENTER
*          609 SECOND STREET
*       DAVIS, CALIFORNIA 95616
*           (916) 756-1104
*
**************************************
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```
X     X  XXXXXXX   XXXXX          X
X     X  X        X     X        XX
X     X  X        X               X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X               X
X     X  X        X     X         X
X     X  XXXXXXX   XXXXX         XXX
```

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

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

ENCINITAS 14413
10-YR ALT 5
10A5.hcl

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

              *DIAGRAM
              ID    *********************************************************
              ID    ENCINITAS COAST HWY 101         J-14413           8-17-04
              ID    ALTERNATIVE 5 - COMBO ALT 1 + ALT 2C
              ID    10-YR GRADE NORTHBOUND LANES OF HWY 101
              ID    FROM APPROXIMATELY JUPITER TO MOOREGATE
              ID    AT A CONSTANT SLOPE OF 0.1%
              ID    BASINS 9B, 10,AND 11 ARE UNDETAINED AND ROUTED VIA TRAP
              ID    CHANNEL. ALL BASINS U/S ARE DETAINED.
              ID    FN: 10A5.HC1
              ID    *********************************************************
              ID    ENCINITAS COAST HWY 101         J-14413           5-25-04
              ID    ALTERNATIVE 2 OPTION C - 10-YR GRADE NORTHBOUND LANES OF
              ID    HWY 101 FROM APPROXIMATELY JUPITER TO MOOREGATE
              ID    AT A CONSTANT SLOPE OF 0.1%
              ID    BASINS 9B, 10,AND 11 ARE UNDETAINED AND ROUTED VIA TRAP
              ID    CHANNEL. ALL BASINS U/S ARE DETAINED.
              ID    FN: 10A2C.HC1
              ID    *********************************************************
              ID    ENCINITAS COAST HWY 101         J-14413           3-19-04
              ID    INCLUDES DIVERSION INTO STORM DRAIN BASED ON ORIFICE PLATE
              ID    Qs
              ID    FN: 10DET5R.HC1
              ID    *********************************************************
              ID    ENCINITAS COAST HWY 101         J-14413           01/12/04
              ID    SAME AS BELOW EXCEPT CHANGED SV,SQ,SE CARDS BASED ON
              ID    HEC-RAS FN: 101.PRJ (PLAN 12)
              ID    INCLUDES ROUTING THROUGH ALLEY AT UPSTREAM OF END OF STUDY
              ID    FN: 10DET5.HC1
              ID    *********************************************************
              ID    ENCINITAS COAST HWY 101         J-14413           01/05/04
              ID    SAME AS BELOW EXCEPT 10-YEAR (CN CHANGED FOR PZN=1.5),
              ID    RATING CURVE SV,SQ,SE CARDS CHANGED BASED ON HEC-RAS FN:
              ID    101.PRJ (PLAN 101 R7)
              ID    BASIN AREAS FOR 7-11 CHANGED BACK TO ORIGINGAL (2,5,10-YR)
              ID    SIZE THAT DOES NOT INCLUDE AREA EAST OF THE RR TRACKS;
              ID    LAG CHANGED BACK TO ORIGINAL, CN CHANGED BACK TO ORIGINAL
              ID    BASED ON HEC-1 FN:PRO5R1.HC1
              ID    FN: 10DET3.HC1
              ID    *********************************************************
              ID    ENCINITAS COAST HWY 101         J-14413           12/31/03
              ID    SAME AS BELOW EXCEPT MOVED LOCATION OF CONFLUENCE BTWN
              ID    EAST SIDE OF RR TRACKS (BASINS 1A,1,1B,2,&6) TO BASIN 4,
              ID    WHICH WAS ORIGINALLY MODELED AT BASIN 7 (LEUCADIA)
              ID    FN: 100DET3.HC1
              ID    *********************************************************
              ID    ENCINITAS COAST HWY 101         J-14413           12/29/03
              ID    100-YEAR RUN WITH BASIN AREAS EXTENDED TO THE RIDGE EAST OF
              ID    THE RR TRACKS. PI CARDS CHANGED FOR 100-YR BASED ON FN: E100.HC1
              ID    LAG AND CURVE NUMBERS CHANGED FOR 100-YEAR.
              ID    FN:100DET.HC1
              ID    BASIN AREAS ALSO CHANGED FOR 7 THROUGH 11. STORAGE RATING
              ID    CURVES BASED ON HEC-RAS OUTPUT FN: 101.PRJ (PLAN 101 R3)
              ID    *********************************************************
              ID    ENCINITAS COAST HWY 101
```

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

ID   J-14413
ID   SEPT 25, 2003
ID   MODIFIED EXISTING RUN TO MODEL PROPOSED DETENTION OF BASINS
ID   1A, 1B, 1, 2, 3, 4, 5, 6, AND 8
ID   DETENTION CARDS SA/SV, SQ, SE OBTAINED FROM FN: DSI_5R.HC1
ID   **********************************************************
ID   ENCINITAS- COAST HIGHWAY 101
ID   JOB # 14413
ID   09-12-03
ID   MODIFIED PUMP Q TO 1.7 CFS, AND ROUTING OF BASINS 9A, 9B, AND 9
ID   FROM PUMP STATION THROUGH 10" LATERAL, CONFLUENCING
ID   WITH MAIN LINE AT AT CONNECTION 3 INSTEAD OF CONNECTION 2
ID   ALSO CHANGED ROUTING THROUGH MAIN LINE FROM LINE G TO CONNECTION
ID   2, TO LINE G TO CONNECTION 3
ID   **********************************************************
ID   ENCINITAS- COAST HIGHWAY 101
ID   JOB # 14413
ID   09-04-03
ID   MODIFIED CURVE NUMBER AND REMOVED % IMPERVIOUS
ID   **********************************************************
ID   ENCINITAS- COAST HIGHWAY 101
ID   JOB # 14413
ID   06-03-03
ID   POST-IMPROVEMENT (EXISTING) CONDITION       FN: 101EX_5.HC1
ID   5-YEAR, 24-HR STORM EVENT
ID   LAG CALCULATION ARE BASED OFF OF NRCS METHOD
ID   AND ARE A FUNCTION OF RUNOFF COEF. AND VELOCITY
ID   NESTED STORM PER COUNTY OF SAN DIEGO HYDROLOGY MANUAL
ID   COPYRIGHT 2003 RICK ENGINEERING COMPANY
ID   6HR RAINFALL IS  1.6  INCHES
ID   24HR RAINFALL IS  2.5  INCHES
ID   TOTAL BASIN AREA IS  .5  SQUARE MILES
*** FREE ***
IT       5 01JAN90    1200     300
IO       5

KK      1A
KO       0       0       0       0      21
KM   NESTED STORM PER COUNTY OF SAN DIEGO HYDROLOGY MANUAL
KM   COPYRIGHT 2003 RICK ENGINEERING COMPANY
KM   THE FOLLOWING IT CARD MUST BE USED IN YOUR DATA SET
KM   IT 5 01JAN90 1200 300
KM   6HR RAINFALL IS  1.8  INCHES
KM   24HR RAINFALL IS  3  INCHES
KM   DAR30 =  .9942
KM   DAR60 =  .997
KM   DAR180 =  .998
KM   DAR360 =  .9985
KM   DAR1440 =  .999
KM   BASIN AREA IS  .5  SQUARE MILES
KM   ***10-YR PRECIP. DATA*******
IN       5 01JAN90    1200     300
PI  .00384  .00385  .00386  .00388  .00389   .0039  .00391  .00393  .00394  .00396
PI  .00397  .00399    .004  .00401  .00402  .00404  .00405  .00407  .00408   .0041
PI  .00411  .00413  .00414  .00416  .00418   .0042  .00421  .00423  .00424  .00426
```

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

 108          PI  .00427   .0043  .00431  .00433  .00434  .00437  .00438   .0044  .00441  .00444
 109          PI  .00445  .00448  .00449  .00451  .00453  .00455  .00457  .00459  .00461   .0046
 110          PI  .00465  .00468  .00469  .00472  .00473  .00476  .00478  .00481  .00482   .0048
 111          PI  .00487   .0049  .00492  .00495  .00497    .005  .00502  .00505  .00507   .0051
 112          PI  .00512  .00516  .00517  .00521  .00523  .00527  .00529  .00533  .00535   .0053
 113          PI  .00541  .00545  .00547  .00551  .00553  .00558   .0056  .00565  .00567  .00572
 114          PI  .00574  .00579  .00581  .00586  .00589  .00594  .00597  .00602  .00605   .0061
 115          PI  .00613  .00619  .00622  .00628  .00631  .00637   .0064  .00647   .0065  .00657
 116          PI   .0066  .00667   .0067  .00678  .00681  .00689  .00693  .00701  .00705  .00713
 117          PI  .00717  .00726   .0073  .00739  .00744  .00754  .00759  .00769  .00774  .00784
 118          PI   .0079  .00801  .00806  .00818  .00824  .00837  .00843  .00856  .00863  .00877
 119          PI  .00884  .00899  .00907  .00895  .00903  .00919  .00928  .00946  .00956   .0097
 120          PI  .00985  .01006  .01017   .0104  .01052  .01078  .01091  .01118  .01133  .01163
 121          PI  .01179  .01213  .01231  .01269  .01289  .01331  .01354  .01406  .01432   .0148
 122          PI  .01518  .01583  .01619  .01696  .01738  .01832  .01884  .01999  .02065   .0221
 123          PI  .02299  .02498  .02615  .02939  .03111  .03554  .03846  .04652  .05299   .0778
 124          PI  .10962  .39292   .0624  .04212  .03313  .02748  .02393  .02136  .01939  .01783
 125          PI  .01656   .0155   .0146  .01378  .01309  .01249  .01196  .01148  .01104  .01065
 126          PI  .01029  .00996  .00965  .00937  .00911  .00915  .00892   .0087   .0085   .0083
 127          PI  .00812  .00795  .00779  .00763  .00749  .00735  .00722  .00709  .00697   .0068
 128          PI  .00674  .00663  .00653  .00643  .00634  .00625  .00616  .00607  .00599   .0059
 129          PI  .00584  .00576  .00569  .00562  .00556  .00549  .00543  .00537  .00531   .0052
 130          PI  .00519  .00514  .00508  .00503  .00498  .00493  .00488  .00484  .00479   .0047
 131          PI   .0047  .00466  .00462  .00458  .00454   .0045  .00446  .00443  .00439  .00435
 132          PI  .00432  .00428  .00425  .00422  .00419  .00415  .00412  .00409  .00406   .0040
 133          PI  .00401  .00398  .00395  .00392   .0039  .00387  .00384       0       0       0
 134          PI       0       0       0       0       0       0       0       0       0       0
 135          PI       0       0
 136          BA    0.01
 137          LS       0      60
 138          UD   0.139

 139          KK    RT1A
 140          KM  ROUTE RUNOFF FROM BASIN 1A THROUGH BASIN 1 (ALONG HW 101)
 141          RS       3    STOR      -1
 142          RC    0.02    0.02    0.02    3225  0.0068
 143          RX       0       5      10      15      20      25      30      35
 144          RY       2       2     1.5       1       1     1.5       2       2

 145          KK      1B
 146          BA    0.03
 147          LS       0      65
 148          UD   0.163

 149          KK    RT1B
 150          KM  ROUTE RUNOFF FROM BASIN 1B THROUGH BASIN 1 (ALONG ORPHEUS ST.)
 151          RS       1    STOR      -1
 152          RC    0.02    0.02    0.02    1125
 153          RX       0       5      10      15      20      25      30      35
 154          RY       2       2     1.5       1       1     1.5       2       2
```

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


KK    RT1B
KM    ROUTE RUNOFF FROM BASIN 1B THROUGH BASIN 1 (ALONG HW 101)
RS       1    STOR      -1
RC    0.02    0.02    0.02    1250
RX       0       5      10      15      20      25      30      35
RY       2       2     1.5       1       1     1.5       2       2

KK      B1
BA    0.09
LS       0      61
UD   0.282

KK     Q@1
KM    COMBINE BASINS 1A, 1B AND BASIN 1
HC       3

KKQ1_in101
KM    10-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
DT 10YR_SD
DI       0      15      70
DQ       0      15      15

KK    DET_11A,1B
KM    DETAIN RUNOFF FROM BASIN 1, 1B AND 1A
RS       1    STOR      -1
SV    2.01    3.34    4.01    5.84    9.54   11.85
SQ       1      50     100     250     500     750
SE   68.47   69.39   69.85   70.76   71.75   72.27

KK      B2
BA    0.06
LS       0      67
UD   0.145

KK     Q@2
KM    COMBINE BASIN 1A, 1B AND BASIN 1 WITH BASIN 2
HC       2

KKQ2_in101
KM    10-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
DT 10YR_SD
DI       0      19     130
DQ       0      19      19

KK    DET_2
KM    DETAIN BASINS 1A, 1 AND 2
RS       1    STOR      -1
SV    2.17    4.58    5.69    7.93    10.6   13.16
SQ       1      50     100     250     500     750
SE   66.73   67.37   67.63   68.09   68.54   68.92
```

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


 197          KK      B6
 198          BA    0.06
 199          LS       0      73
 200          UD   0.323

 201          KK     Q@6
 202          KM   COMBINE BASIN 1A,1B, 1 & 2 WITH BASIN 6
 203          HC       2

 204          KKQ6_in101
 205          KM   10-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 206          DT 10YR_SD
 207          DI       0      16     250
 208          DQ       0      16      16

 209          KK   DET_6
 210          KO       0       0       0       0      21
 211          KM   DETAIN 6
 212          RS       1    STOR      -1
 213          SA       0   0.032   0.551   1.561    3.42
 214          SE    61.5      62      64      66      68
 215          SQ       0     7.4
 216          SE    61.5   63.91

 217          KK      B3
 218          BA    0.02
 219          LS       0      69
 220          UD   0.093

 221          KKQ3_in101
 222          KM   10-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 223          DT 10YR_SD
 224          DI       0      11      30
 225          DQ       0      11      11

 226          KK    DET3
 227          KM   DETAIN BASIN 3
 228          KO       0       0       0       0      21
 229          RS       1    STOR      -1
 230          SV     .69    1.13     1.3    1.41    1.52     1.6
 231          SQ     0.1      20      40      60      80     100
 232          SE   59.37   59.87   60.05   60.17   60.26   60.35

 233          KK      B4
 234          BA    0.02
 235          LS       0      64
 236          UD   0.072

 237          KK     Q@4
 238          KM   COMBINE BASINS 3,&4 ALONG 101
 239          HC       2
```

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

                KKQ4_in101
                KM    10-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
                DT 10YR_SD
                DI         0       7     160
                DQ         0       7       7

                KK     DET4
                KM    DETAIN BASIN 4
                KO         0       0       0       0      21
                RS         1    STOR      -1
                SV      4.98    6.46    6.98    7.34    7.62    7.88
                SQ       0.1      20      40      60      80     100
                SE     59.14   59.75   59.95   60.09   60.20   60.29

                KK        B5
                BA      0.02
                LS         0      68
                UD     0.084

                KK       Q@5
                KM    COMBINE 3,4,&5
                HC         2

                KKQ5_in101
                KM    10-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
                DT 10YR_SD
                DI         0       9     190
                DQ         0       9       9

                KK      DET5
                KM    DETAIN BASIN 5
                KO         0       0       0       0      21
                RS         1    STOR      -1
                SV      2.31    3.34    3.78    4.14    4.47     4.8
                SQ       0.1      20      40      60      80     100
                SE     57.52   57.97   58.13   58.24   58.34   58.43

                KK        B7
                KM    BASIN 7
                BA      0.02
                LS         0      66
                UD     0.129

                KK       5+7
                KM    COMBINE BASINS 5 WITH 7
                HC         2
                * HC 3

                KKQ7_in101
                KM    10-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
                DT 10YR_SD
                DI         0       6     250
                DQ         0       6       6
```

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


 284          KK     Q@7
 285          KM    COMBINE 3,4,5,7 AND 1,2,6 (EAST OF TRACKS)
 286          HC        2
              * KK COMBINE
              * KM DIVERT 1 CFS TO LINE E STORM DRAIN
              * DT DIVE 0 1
              * DI 0 1 200
              * DQ 0 1 1

 287          KK     DET7
 288          KM    DETAIN AT BASIN 7
 289          KO        0       0       0       0      21
 290          RS        1    STOR      -1
 291          SV      2.2    3.16    3.57     3.9    4.29    4.69
 292          SQ      0.1      20      40      60      80     100
 293          SE    55.05   55.40   55.54   55.64   55.76   55.88

 294          KK      B8
 295          BA     0.01
 296          LS        0      71
 297          UD    0.128

 298          KK     Q@8
 299          KM    COMBINE BASINS 1A,1,1B,2,6,3,4,5,&7 WITH BASIN 8
 300          HC        2
              * KM DIVERT 1 CFS TO LINE G OF STORM DRAIN
              * DT DIVG 0 1
              * DI 0 1 200
              * DQ 0 1 1

 301          KK     DET8
 302          KM    DETAIN BASIN 8
 303          KO        0       0       0       0      21
 304          RS        1    STOR      -1
 305          SV      1.4    2.14    2.46    2.71    3.03    3.38
 306          SQ      0.1      20      40      60      80     100
 307          SE    55.05   55.40   55.53   55.63   55.75   55.87

 308          KK     B9A
 309          BA     0.02
 310          LS        0      69
 311          UD    0.120

 312          KK     Q@9A
 313          KM    COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,&8 WITH BASIN 9A
 314          HC        2

 315          KK    DET9A
 316          KM    DETAIN AT BASIN 9A
 317          KO        0       0       0       0      21
 318          RS        1    STOR      -1
 319          SV      .95    2.17    2.72    3.22    3.64    4.11
 320          SQ      0.1      20      40      60      80     100
 321          SE    54.51   54.99   55.18   55.35   55.50   55.66
```

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

 322           KK      B9
 323           BA    0.04
 324           LS       0      69
 325           UD    0.20

 326           KK     Q@9
 327           KM   COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,8,&9A WITH BASIN 9
 328           HC       2

 329           KKDVPHOEBE
 330           KM   DIVERT 3.5 CFS AT PHOEBE PUMP STATION
 331           DT    PUMP       0     3.5
 332           DI       0     3.5     200
 333           DQ       0     3.5     3.5

 334           KK    DET9
 335           KM   DETAIN AT BASIN 9
 336           KO       0       0       0       0      21
 337           RS       1    STOR      -1
 338           SV    1.65    3.16    3.86    4.51    5.02    5.61
 339           SQ     0.1      20      40      60      80     100
 340           SE   54.24   54.83   55.06   55.26   55.41   55.58

 341           KK     B9B
 342           BA    0.03
 343           LS       0      68
 344           UD   0.123

 345           KK    Q@9B
 346           KM   COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,8,9A,&9 WITH BASIN 9B
 347           HC       2
               * KK DET9B
               * KM DETAIN AT BASIN 9B
               * KO 0 0 0 0 21
               * RS 1 STOR -1
               * SV .09 .64 1.13 1.58 2.02 2.55
               * SQ 0.1 20 40 60 80 100
               * SE 53.97 54.48 54.77 55.00 55.19 55.39

 348           KK    RT9B
 349           KM   ROUTE BASIN 9B ALONG 101
 350           RC    .018    .018    .018    1000    .001
 351           RX       0      10      15      20      25      30      30      30
 352           RY       2     0.4     0.3     0.2     0.1       0       1       2

 353           KK     B10
 354           BA    0.02
 355           LS       0      71
 356           UD   0.061
```

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

357      KK    Q@10
358      KM    COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,8,9A,9,&9B WITH BASIN 10
359      HC       2
         * KK DET10
         * KM DETAIN AT BASIN 10
         * KO 0 0 0 0 21
         * RS 1 STOR -1
         * SV .08 .51 .89 1.21 1.52 1.89
         * SQ 0.1 20 40 60 80 100
         * SE 53.51 54.19 54.55 54.80 55.01 55.23

360      KK    RT10
361      KM    ROUTE BASIN 10 ALONG 101
362      RC     .018    .018    .018     600    .001
363      RX        0      10      15      20      25      30      30      30
364      RY        2     0.4     0.3     0.2     0.1       0       1       2

365      KK     B11
366      BA    0.04
367      LS        0      71
368      UD   0.133

369      KK    Q@11
370      KM    COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,8,9A,9,9B&10 WITH BASIN 11
371      HC       2
         * KK DET11
         * KM DETAIN AT BASIN 11
         * KO 0 0 0 0 21
         * RS 1 STOR -1
         * SV .01 .24 .39 .54 .69 .84
         * SQ 0.1 20 40 60 80 100
         * SE 52.13 53.06 53.34 53.56 53.74 53.91

372      KK    RT11
373      KM    ROUTE BASIN 11 ALONG 101
374      RC     .018    .018    .018    1650    .001
375      RX        0      10      15      20      25      30      30      30
376      RY        2     0.4     0.3     0.2     0.1       0       1       2
377      ZZ
```

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

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

   89          1A
               V
               V
  139        RT1A
               .
               .
  145          .          1B
               .           V
               .           V
  149          .         RT1B
               .           V
               .           V
  155          .         RT1B
               .           .
               .           .
  161          .           .          B1
               .           .           .
               .           .           .
  165         Q@1.......................
               .
               .
  170          .-------> 10YR_SD
  168     Q1_in101
               V
               V
  173       DET_1
               .
               .
  179          .          B2
               .           .
               .           .
  183         Q@2...........
               .
               .
  188          .-------> 10YR_SD
  186     Q2_in101
               V
               V
  191       DET_2
               .
               .
  197          .          B6
               .           .
               .           .
  201         Q@6...........
               .
               .
  206          .-------> 10YR_SD
  204     Q6_in101
               V
               V
  209       DET_6
               .
```

```
              .
217           .        B3
              .         .
              .         .
223           .         .-------> 10YR_SD
221           .    Q3_in101
              .         V
              .         V
226           .      DET3
              .         .
              .         .
233           .         .          B4
              .         .           .
              .         .           .
237           .       Q@4............
              .         .
              .         .
242           .         .-------> 10YR_SD
240           .    Q4_in101
              .         V
              .         V
245           .      DET4
              .         .
              .         .
252           .         .          B5
              .         .           .
              .         .           .
256           .       Q@5............
              .         .
              .         .
261           .         .-------> 10YR_SD
259           .    Q5_in101
              .         V
              .         V
264           .      DET5
              .         .
              .         .
271           .         .          B7
              .         .           .
              .         .           .
276           .       5+7............
              .         .
              .         .
281           .         .-------> 10YR_SD
279           .    Q7_in101
              .         .
              .         .
284         Q@7............
              V
              V
287         DET7
              .
              .
294           .        B8
              .         .
              .         .
298         Q@8............
              V
              V
301         DET8
```

```
                .
                .
  308           .         B9A
                .           .
                .           .
  312        Q@9A............
                V
                V
  315       DET9A
                .
                .
  322           .          B9
                .           .
                .           .
  326         Q@9............
                .
                .
  331           .------->    PUMP
  329    DVPHOEBE
                V
                V
  334        DET9
                .
                .
  341           .         B9B
                .           .
                .           .
  345        Q@9B............
                V
                V
  348        RT9B
                .
                .
  353           .         B10
                .           .
                .           .
  357        Q@10............
                V
                V
  360        RT10
                .
                .
  365           .         B11
                .           .
                .           .
  369        Q@11............
                V
                V
  372        RT11
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
****************************************                    *************************************
*                                      *                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                    *   U.S. ARMY CORPS OF ENGINEERS
*              JUN   1998              *                    *   HYDROLOGIC ENGINEERING CENTER
*           VERSION 4.1                *                    *         609 SECOND STREET
*                                      *                    *      DAVIS, CALIFORNIA 95616
*  RUN DATE   18AUG04  TIME  07:38:46  *                    *          (916) 756-1104
*                                      *                    *
****************************************                    *************************************
```

```
***********************************************************
ENCINITAS COAST HWY 101         J-14413           8-17-04
ALTERNATIVE 5 - COMBO ALT 1 + ALT 2C
10-YR GRADE NORTHBOUND LANES OF HWY 101
FROM APPROXIMATELY JUPITER TO MOOREGATE
AT A CONSTANT SLOPE OF 0.1%
BASINS 9B, 10,AND 11 ARE UNDETAINED AND ROUTED VIA TRAP
CHANNEL. ALL BASINS U/S ARE DETAINED.
FN: 10A5.HC1
***********************************************************
ENCINITAS COAST HWY 101         J-14413           5-25-04
ALTERNATIVE 2 OPTION C - 10-YR GRADE NORTHBOUND LANES OF
HWY 101 FROM APPROXIMATELY JUPITER TO MOOREGATE
AT A CONSTANT SLOPE OF 0.1%
BASINS 9B, 10,AND 11 ARE UNDETAINED AND ROUTED VIA TRAP
CHANNEL. ALL BASINS U/S ARE DETAINED.
FN: 10A2C.HC1
***********************************************************
ENCINITAS COAST HWY 101         J-14413           3-19-04
INCLUDES DIVERSION INTO STORM DRAIN BASED ON ORIFICE PLATE
Qs
FN: 10DET5R.HC1
***********************************************************
ENCINITAS COAST HWY 101         J-14413           01/12/04
SAME AS BELOW EXCEPT CHANGED SV,SQ,SE CARDS BASED ON
HEC-RAS FN: 101.PRJ (PLAN 12)
INCLUDES ROUTING THROUGH ALLEY AT UPSTREAM OF END OF STUDY
FN: 10DET5.HC1
***********************************************************
ENCINITAS COAST HWY 101         J-14413           01/05/04
SAME AS BELOW EXCEPT 10-YEAR (CN CHANGED FOR PZN=1.5),
RATING CURVE SV,SQ,SE CARDS CHANGED BASED ON HEC-RAS FN:
101.PRJ (PLAN 101 R7)
BASIN AREAS FOR 7-11 CHANGED BACK TO ORIGINGAL (2,5,10-YR)
SIZE THAT DOES NOT INCLUDE AREA EAST OF THE RR TRACKS;
LAG CHANGED BACK TO ORIGINAL, CN CHANGED BACK TO ORIGINAL
BASED ON HEC-1 FN:PRO5R1.HC1
FN: 10DET3.HC1
***********************************************************
ENCINITAS COAST HWY 101         J-14413           12/31/03
SAME AS BELOW EXCEPT MOVED LOCATION OF CONFLUENCE BTWN
EAST SIDE OF RR TRACKS (BASINS 1A,1,1B,2,&6) TO BASIN 4,
WHICH WAS ORIGINALLY MODELED AT BASIN 7 (LEUCADIA)
FN: 100DET3.HC1
***********************************************************
ENCINITAS COAST HWY 101         J-14413           12/29/03
```

```
          100-YEAR RUN WITH BASIN AREAS EXTENDED TO THE RIDGE EAST OF
          THE RR TRACKS. PI CARDS CHANGED FOR 100-YR BASED ON FN: E100.HC1
          LAG AND CURVE NUMBERS CHANGED FOR 100-YEAR.
          FN:100DET.HC1
          BASIN AREAS ALSO CHANGED FOR 7 THROUGH 11. STORAGE RATING
          CURVES BASED ON HEC-RAS OUTPUT FN: 101.PRJ (PLAN 101 R3)
          **********************************************************
          ENCINITAS COAST HWY 101
          J-14413
          SEPT 25, 2003
          MODIFIED EXISTING RUN TO MODEL PROPOSED DETENTION OF BASINS
          1A, 1B, 1, 2, 3, 4, 5, 6, AND 8
          DETENTION CARDS SA/SV, SQ, SE OBTAINED FROM FN: DSI_5R.HC1
          **********************************************************
          ENCINITAS- COAST HIGHWAY 101
          JOB # 14413
          09-12-03
          MODIFIED PUMP Q TO 1.7 CFS, AND ROUTING OF BASINS 9A, 9B, AND 9
          FROM PUMP STATION THROUGH 10" LATERAL, CONFLUENCING
          WITH MAIN LINE AT AT CONNECTION 3 INSTEAD OF CONNECTION 2
          ALSO CHANGED ROUTING THROUGH MAIN LINE FROM LINE G TO CONNECTION
          2, TO LINE G TO CONNECTION 3
          **********************************************************
          ENCINITAS- COAST HIGHWAY 101
          JOB # 14413
          09-04-03
          MODIFIED CURVE NUMBER AND REMOVED % IMPERVIOUS
          **********************************************************
          ENCINITAS- COAST HIGHWAY 101
          JOB # 14413
          06-03-03
          POST-IMPROVEMENT (EXISTING) CONDITION      FN: 101EX_5.HC1
          5-YEAR, 24-HR STORM EVENT
          LAG CALCULATION ARE BASED OFF OF NRCS METHOD
          AND ARE A FUNCTION OF RUNOFF COEF. AND VELOCITY
          NESTED STORM PER COUNTY OF SAN DIEGO HYDROLOGY MANUAL
          COPYRIGHT 2003 RICK ENGINEERING COMPANY
          6HR RAINFALL IS  1.6  INCHES
          24HR RAINFALL IS  2.5  INCHES
          TOTAL BASIN AREA IS  .5  SQUARE MILES

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

   IT       HYDROGRAPH TIME DATA
                  NMIN          5  MINUTES IN COMPUTATION INTERVAL
                 IDATE     1JAN90  STARTING DATE
                 ITIME       1200  STARTING TIME
                    NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                NDDATE     2JAN90  ENDING DATE
                NDTIME       1255  ENDING TIME
                ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL    .08 HOURS
                   TOTAL TIME BASE  24.92 HOURS

      ENGLISH UNITS
           DRAINAGE AREA         SQUARE MILES
```

```
           PRECIPITATION DEPTH   INCHES
           LENGTH, ELEVATION     FEET
           FLOW                  CUBIC FEET PER SECOND
           STORAGE VOLUME        ACRE-FEET
           SURFACE AREA          ACRES
           TEMPERATURE           DEGREES FAHRENHEIT


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **


        **************
        *            *
 89 KK  *        1A  *
        *            *
        **************

 90 KO         OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **


        **************
        *            *
209 KK  *     DET_6  *
        *            *
        **************

210 KO         OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **


        **************
        *            *
226 KK  *      DET3  *
        *            *
```

```
          **************

228 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **


          **************
          *            *
245 KK    *     DET4   *
          *            *
          **************

247 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **


          **************
          *            *
264 KK    *     DET5   *
          *            *
          **************

266 KO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE
                      IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                       IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **
```

```
          **************
          *            *
287 KK    *    DET7    *
          *            *
          **************

289 KO         OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **


          **************
          *            *
301 KK    *    DET8    *
          *            *
          **************

303 KO         OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT        .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **


          **************
          *            *
315 KK    *   DET9A    *
          *            *
          **************

317 KO         OUTPUT CONTROL VARIABLES
                     IPRNT           5  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                     IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                      IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2         300  LAST ORDINATE PUNCHED OR SAVED
```

```
                    TIMINT        .083  TIME INTERVAL IN HOURS




*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **


           **************
           *            *
 334 KK    *     DET9   *
           *            *
           **************

 336 KO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS
```

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	1A	2.	16.08	0.	0.	0.	.01		
ROUTED TO	RT1A	1.	16.58	0.	0.	0.	.01	1.12	16.58
HYDROGRAPH AT	1B	10.	16.17	1.	0.	0.	.03		
ROUTED TO	RT1B	0.	.00	0.	0.	0.	.03	2.88	24.92
ROUTED TO	RT1B	0.	.00	0.	0.	0.	.03	2.00	.00
HYDROGRAPH AT	B1	15.	16.25	3.	1.	1.	.09		
3 COMBINED AT	Q@1	15.	16.25	3.	1.	1.	.13		
DIVERSION TO	10YR_SD	15.	16.25	3.	1.	1.	.13		
HYDROGRAPH AT	Q1_in101	0.	16.25	0.	0.	0.	.13		
ROUTED TO	DET_1	1.	.08	1.	1.	1.	.13	68.47	.00
HYDROGRAPH AT	B2	25.	16.08	3.	1.	1.	.06		
2 COMBINED AT	Q@2	26.	16.08	4.	2.	2.	.19		
DIVERSION TO	10YR_SD	19.	16.08	4.	2.	2.	.19		
HYDROGRAPH AT	Q2_in101	7.	16.08	0.	0.	0.	.19		
ROUTED TO	DET_2	1.	.08	1.	1.	1.	.19	66.73	.00
HYDROGRAPH AT	B6	23.	16.25	5.	1.	1.	.06		
2 COMBINED AT	Q@6	24.	16.25	6.	2.	2.	.25		
DIVERSION TO	10YR_SD	16.	16.25	5.	2.	2.	.25		
HYDROGRAPH AT	Q6_in101	8.	16.25	0.	0.	0.	.25		
ROUTED TO	DET_6	3.	16.50	0.	0.	0.	.25	62.45	16.50
HYDROGRAPH AT	B3	11.	16.08	1.	0.	0.	.02		
DIVERSION TO	10YR_SD	11.	16.08	1.	0.	0.	.02		
HYDROGRAPH AT	Q3_in101	0.	16.08	0.	0.	0.	.02		
ROUTED TO	DET3	0.	.08	0.	0.	0.	.02	59.37	.00
HYDROGRAPH AT	B4	8.	16.00	1.	0.	0.	.02		
2 COMBINED AT	Q@4	8.	16.00	1.	0.	0.	.04		

DIVERSION TO	10YR_SD	7.	16.00	1.	0.	0.	.04		
HYDROGRAPH AT	Q4_in101	1.	16.00	0.	0.	0.	.04		
ROUTED TO	DET4	0.	.08	0.	0.	0.	.04	59.14	.00
HYDROGRAPH AT	B5	10.	16.08	1.	0.	0.	.02		
2 COMBINED AT	Q@5	10.	16.08	1.	0.	0.	.06		
DIVERSION TO	10YR_SD	9.	16.08	1.	0.	0.	.06		
HYDROGRAPH AT	Q5_in101	1.	16.08	0.	0.	0.	.06		
ROUTED TO	DET5	0.	.08	0.	0.	0.	.06	57.52	.00
HYDROGRAPH AT	B7	8.	16.08	1.	0.	0.	.02		
2 COMBINED AT	5+7	8.	16.08	1.	0.	0.	.08		
DIVERSION TO	10YR_SD	6.	16.08	1.	0.	0.	.08		
HYDROGRAPH AT	Q7_in101	2.	16.08	0.	0.	0.	.08		
2 COMBINED AT	Q@7	3.	16.50	0.	0.	0.	.33		
ROUTED TO	DET7	1.	17.08	0.	0.	0.	.33	55.07	17.08
HYDROGRAPH AT	B8	6.	16.08	1.	0.	0.	.01		
2 COMBINED AT	Q@8	6.	16.08	1.	0.	0.	.34		
ROUTED TO	DET8	3.	16.25	1.	0.	0.	.34	55.09	16.25
HYDROGRAPH AT	B9A	11.	16.08	1.	0.	0.	.02		
2 COMBINED AT	Q@9A	12.	16.08	2.	1.	1.	.36		
ROUTED TO	DET9A	5.	16.42	2.	1.	1.	.36	54.62	16.42
HYDROGRAPH AT	B9	16.	16.17	2.	1.	1.	.04		
2 COMBINED AT	Q@9	20.	16.17	4.	1.	1.	.40		
DIVERSION TO	PUMP	4.	16.17	3.	1.	1.	.40		
HYDROGRAPH AT	DVPHOEBE	16.	16.17	2.	0.	0.	.40		
ROUTED TO	DET9	4.	16.67	1.	0.	0.	.40	54.36	16.67
HYDROGRAPH AT	B9B	15.	16.08	2.	1.	0.	.03		
2 COMBINED AT	Q@9B	15.	16.08	3.	1.	1.	.43		
ROUTED TO	RT9B	10.	16.25	3.	1.	1.	.43	.57	16.25
HYDROGRAPH AT	B10	16.	16.00	1.	0.	0.	.02		
2 COMBINED AT	Q@10	19.	16.00	4.	1.	1.	.45		

ROUTED TO	RT10	16.	16.17	4.	1.	1.	.45	.70	16.17
HYDROGRAPH AT	B11	23.	16.08	3.	1.	1.	.04		
2 COMBINED AT	Q@11	39.	16.08	7.	2.	2.	.49		
ROUTED TO	RT11	27.	16.25	7.	2.	2.	.49	.87	16.25

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

ALTERNATIVE 5
100-YEAR HEC-1 ANALYSIS

```
*****************************************                    **************************************
*                                       *                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS
*              JUN   1998               *                    *   HYDROLOGIC ENGINEERING CENTER
*             VERSION 4.1               *                    *         609 SECOND STREET
*                                       *                    *      DAVIS, CALIFORNIA 95616
*  RUN DATE   17AUG04  TIME  14:41:36   *                    *          (916) 756-1104
*                                       *                    *
*****************************************                    **************************************
```

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

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

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

ENCINITAS 14413
100-YR ALT 5
100A5.hcl

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

              *DIAGRAM
              ID     **********************************************************
              ID     ENCINITAS COAST HWY 101         J-14413           7-14-04
              ID     COMBO OF ALTERNATIVE 1 + ALTERNAVE 2C - SAME AS BELOW EXCEPT
              ID     GRADE NORTHBOUND LANES OF HWY 101 FROM APPROXIMATELY
              ID     JUPITER TO MOOREGATE AT A CONSTANT SLOPE OF 0.1% AND
              ID     OVERFLOW STORM DRAIN SYSTEM TO DIVERT 10-YEAR FLOW AT BASIN 7
              ID     BASINS 9B, 10,AND 11 ARE UNDETAINED AND ROUTED VIA TRAP
              ID     CHANNEL. ALL BASINS U/S ARE DETAINED.
              ID     FN: 100A5.HC1
              ID     **********************************************************
              ID     ENCINITAS COAST HWY 101         J-14413           5-25-04
              ID     ALTERNATIVE 2 OPTION C - GRADE NORTHBOUND LANES OF
              ID     HWY 101 FROM APPROXIMATELY JUPITER TO MOOREGATE
              ID     AT A CONSTANT SLOPE OF 0.1%
              ID     BASINS 9B, 10,AND 11 ARE UNDETAINED AND ROUTED VIA TRAP
              ID     CHANNEL. ALL BASINS U/S ARE DETAINED.
              ID     FN: 100A2C.HC1
              ID     **********************************************************
              ID     ENCINITAS COAST HWY 101         J-14413           03-04-04
              ID     INCLUDES DIVERSION AT EACH INLET (Q=1 CFS DUE TO ORIFICE
              ID     PLATES) AND DIVERSION AT PHOEBE PUMP STATION
              ID     STORAGE RATING CURVES FOR BASINS 1, 2, AND 6 ARE BASED ON
              ID     VULCAN ONLY HEC-RAS RUN
              ID     STORAGE RATING CURVES FOR BASINS 7-11 ARE BASED ON THE
              ID     101/VULCAN COMBINED HEC-RAS RUN
              ID     BLOCKED OBSTRUCTIONS ARE INCLUDED FOR THE ALLEY AND VULCAN
              ID     **********************************************************
              ID     ENCINITAS COAST HWY 101         J-14413           12/29/03
              ID     100-YEAR RUN WITH BASIN AREAS EXTENDED TO THE RIDGE EAST OF
              ID     THE RR TRACKS. PI CARDS CHANGED FOR 100-YR BASED ON FN: E100.HC1
              ID     LAG AND CURVE NUMBERS CHANGED FOR 100-YEAR.
              ID     FN:100DET.HC1
              ID     BASIN AREAS ALSO CHANGED FOR 7 THROUGH 11. STORAGE RATING
              ID     CURVES BASED ON HEC-RAS OUTPUT FN: 101.PRJ (PLAN 101 R3)
              ID     **********************************************************
              ID     ENCINITAS COAST HWY 101
              ID     J-14413
              ID     SEPT 25, 2003
              ID     MODIFIED EXISTING RUN TO MODEL PROPOSED DETENTION OF BASINS
              ID     1A, 1B, 1, 2, 3, 4, 5, 6, AND 8
              ID     DETENTION CARDS SA/SV, SQ, SE OBTAINED FROM FN: DSI_5R.HC1
              ID     **********************************************************
              ID     ENCINITAS- COAST HIGHWAY 101
              ID     JOB # 14413
              ID     09-12-03
              ID     MODIFIED PUMP Q TO 1.7 CFS, AND ROUTING OF BASINS 9A, 9B, AND 9
              ID     FROM PUMP STATION THROUGH 10" LATERAL, CONFLUENCING
              ID     WITH MAIN LINE AT AT CONNECTION 3 INSTEAD OF CONNECTION 2
              ID     ALSO CHANGED ROUTING THROUGH MAIN LINE FROM LINE G TO CONNECTION
              ID     2, TO LINE G TO CONNECTION 3
              ID     **********************************************************
              ID     ENCINITAS- COAST HIGHWAY 101
              ID     JOB # 14413
              ID     09-04-03
```

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

ID   MODIFIED CURVE NUMBER AND REMOVED % IMPERVIOUS
ID   ***********************************************************
ID   ENCINITAS- COAST HIGHWAY 101
ID   JOB # 14413
ID   06-03-03
ID   POST-IMPROVEMENT (EXISTING) CONDITION       FN: 101EX_5.HC1
ID   5-YEAR, 24-HR STORM EVENT
ID   LAG CALCULATION ARE BASED OFF OF NRCS METHOD
ID   AND ARE A FUNCTION OF RUNOFF COEF. AND VELOCITY
ID   NESTED STORM PER COUNTY OF SAN DIEGO HYDROLOGY MANUAL
ID   COPYRIGHT 2003 RICK ENGINEERING COMPANY
ID   6HR RAINFALL IS  1.6  INCHES
ID   24HR RAINFALL IS  2.5  INCHES
ID   TOTAL BASIN AREA IS  .5  SQUARE MILES
*** FREE ***
IT       5 01JAN90    1200     300
IO       5

KK      1A
KO       0       0       0       0      21
KM   NESTED STORM PER COUNTY OF SAN DIEGO HYDROLOGY MANUAL
KM   COPYRIGHT 2003 RICK ENGINEERING COMPANY
KM   THE FOLLOWING IT CARD MUST BE USED IN YOUR DATA SET
KM   IT 5 01JAN90 1200 300
KM   6HR RAINFALL IS  2.5  INCHES
KM   24HR RAINFALL IS  4  INCHES
KM   DAR30 =  .989908
KM   DAR60 =  .99478
KM   DAR180 =  .99652
KM   DAR360 =  .99739
KM   DAR1440 =  .99826
KM   BASIN AREA IS  .87  SQUARE MILES
IN       5 01JAN90    1200     300
PI   .0047  .00473  .00474  .00476  .00477  .00479  .00481  .00483  .00484  .00486
PI  .00488   .0049  .00491  .00494  .00495  .00497  .00499  .00501  .00502  .00505
PI  .00506  .00509   .0051  .00513  .00514  .00517  .00518  .00521  .00522  .00525
PI  .00527   .0053  .00531  .00534  .00536  .00539   .0054  .00543  .00545  .00548
PI   .0055  .00553  .00554  .00558  .00559  .00563  .00565  .00568   .0057  .00573
PI  .00575  .00579  .00581  .00584  .00586   .0059  .00592  .00596  .00598  .00602
PI  .00604  .00608   .0061  .00614  .00616  .00621  .00623  .00627   .0063  .00634
PI  .00636  .00641  .00643  .00648  .00651  .00656  .00658  .00663  .00666   .0067
PI  .00674  .00679  .00682  .00688   .0069  .00696  .00699  .00705  .00708  .00714
PI  .00717  .00724  .00727  .00733  .00737  .00743  .00747  .00754  .00758   .0076
PI  .00768  .00776   .0078  .00788  .00792    .008  .00804  .00812  .00817  .00826
PI   .0083  .00839  .00844  .00853  .00858  .00868  .00873  .00884  .00889    .009
PI  .00906  .00917  .00923  .00935  .00941  .00954   .0096  .00973   .0098  .00994
PI  .01001  .01016  .01024  .01039  .01047  .01064  .01072   .0109  .01099  .01118
PI  .01127  .01147  .01158  .01244  .01255  .01278   .0129  .01315  .01328  .01355
PI  .01369  .01398  .01414  .01446  .01462  .01497  .01515  .01553  .01573   .0161
PI  .01638  .01684  .01709  .01761  .01789  .01848   .0188  .01956  .01992  .02069
PI  .02111  .02201   .0225  .02357  .02415  .02544  .02616  .02777  .02867  .03072
PI   .0319  .03466  .03629  .04117  .04353  .04959  .05361  .06433  .07327  .10759
PI  .15159  .54336  .08629  .05863   .0463  .03812  .03321  .02965  .02693  .02478
PI  .02302  .02155   .0203  .01913  .01818  .01735  .01661  .01594  .01534  .01479
PI  .01429  .01384  .01342  .01303  .01266  .01168  .01137  .01108  .01081   .0105
```

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

PI  .01031  .01009  .00987  .00967  .00947  .00929  .00911  .00895  .00879   .0086
PI  .00849  .00835  .00821  .00808  .00796  .00784  .00772  .00761   .0075   .0074
PI   .0073   .0072  .00711  .00702  .00693  .00685  .00676  .00669  .00661  .00653
PI  .00646  .00639  .00632  .00625  .00619  .00612  .00606    .006  .00594  .00588
PI  .00582  .00577  .00572  .00566  .00561  .00556  .00551  .00546  .00542   .0053
PI  .00533  .00528  .00524   .0052  .00516  .00512  .00507  .00504    .005  .00496
PI  .00492  .00489  .00485  .00482  .00478  .00475  .00472       0       0       0
PI       0       0       0       0       0       0       0       0       0       0
PI       0       0
BA    0.01
LS       0      69
UD   0.139

KK    RT1A
KM  ROUTE RUNOFF FROM BASIN 1A THROUGH BASIN 1 (ALONG HW 101)
RS       3    STOR      -1
RC    0.02    0.02    0.02    3225  0.0068
RX       0       5      10      15      20      25      30      35
RY       2       2     1.5       1       1     1.5       2       2

KK      1B
BA    0.03
LS       0      74
UD   0.163

KK    RT1B
KM  ROUTE RUNOFF FROM BASIN 1B THROUGH BASIN 1 (ALONG ORPHEUS ST.)
RS       1    STOR      -1
RC    0.02    0.02    0.02    1125
RX       0       5      10      15      20      25      30      35
RY       2       2     1.5       1       1     1.5       2       2

KK    RT1B
KM  ROUTE RUNOFF FROM BASIN 1B THROUGH BASIN 1 (ALONG HW 101)
RS       1    STOR      -1
RC    0.02    0.02    0.02    1250
RX       0       5      10      15      20      25      30      35
RY       2       2     1.5       1       1     1.5       2       2

KK       1
BA    0.09
LS       0      71
UD   0.282

KK     Q&1
KM  COMBINE BASINS 1A, 1B AND BASIN 1
HC       3

KKQ1_in101
KM  100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
DT 10YR_SD
DI       0      15      70
DQ       0      15      15
```

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

KK   DET_11A,1B
KM   DETAIN RUNOFF FROM BASIN 1, 1B AND 1A
RS       1    STOR      -1
SV    2.01    3.34    4.01    5.84    9.54   11.85
SQ       1      50     100     250     500     750
SE   68.47   69.39   69.85   70.76   71.75   72.27

KK       2
BA    0.06
LS       0      76
UD   0.145

KK     Q&2
KM   COMBINE BASIN 1A AND BASIN 1 WITH BASIN 2
HC       2

KKQ2_in101
KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
DT 10YR_SD
DI       0      19     130
DQ       0      19      19

KK   DET_2
KM   DETAIN BASINS 1A, 1 AND 2
RS       1    STOR      -1
SV    2.17    4.58    5.69    7.93    10.6   13.16
SQ       1      50     100     250     500     750
SE   66.73   67.37   67.63   68.09   68.54   68.92

KK       6
BA    0.06
LS       0      81
UD   0.323

KK     Q@6
KM   COMBINE BASIN 1A,1B, 1 & 2 WITH BASIN 6
HC       2

KKQ6_in101
KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
DT 10YR_SD
DI       0      16     250
DQ       0      16      16

KK   DET_6
KO       0       0       0       0      21
KM   DETAIN 6
RS       1    STOR      -1
SV     .02     .27     .43      .8     1.4    1.99
SQ       1      50     100     250     500     750
SE   64.16   65.03   65.31   65.81   66.38   66.85
```

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

KK      B3
BA    0.02
LS       0      78
UD   0.093

KKQ3_in101
KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
DT 10YR_SD
DI       0      11      30
DQ       0      11      11

KK    DET3
KM   DETAIN BASIN 3
KO       0       0       0       0      21
RS       1    STOR      -1
SV     .46     .84    1.04    1.58     2.4    3.15
SQ       1      50     100     250     500     750
SE   59.68   60.38   60.70   61.45   62.34   63.05

KK      B4
BA    0.02
LS       0      73
UD   0.072

KK     3+4
KM   COMBINE BASIN 3 WITH BASIN 4
HC       2

KKQ4_in101
KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
DT 10YR_SD
DI       0       7     160
DQ       0       7       7

KK    DET4
KM   DETAIN BASIN 4
KO       0       0       0       0      21
RS       1    STOR      -1
SV    3.27    4.48    5.05    6.36    8.01     9.4
SQ       1      50     100     250     500     750
SE   59.54   60.36   60.71   61.47   62.35   63.05

KK      B5
KM   BASIN 5
BA    0.02
LS       0      77
UD   0.084

KK     Q@5
KM   COMBINE B4-B5
HC       2
```

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

 240          KKQ5_in101
 241          KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 242          DT 10YR_SD
 243          DI        0       9     190
 244          DQ        0       9       9

 245          KK     DET5
 246          KM   DETAIN BASIN 5
 247          KO        0       0       0       0      21
 248          RS        1    STOR      -1
 249          SV     1.35    2.32     2.8    3.92    5.58     7.1
 250          SQ        1      50     100     250     500     750
 251          SE    57.76   58.39   58.64   59.17   59.81   60.31

 252          KK       B7
 253          KM   BASIN 7
 254          BA     0.04
 255          LS        0      75
 256          UD    0.300

 257          KK      5+7
 258          KM   COMBINE BASIN 5 WITH BASIN 7
 259          HC        2

 260          KKQ7_in101
 261          KM   100-YEAR FLOW IN HYW 101 WITH 10-YR FLOWS DIVERTED TO STORM DRAIN
 262          DT 10YR_SD
 263          DI        0       6     250
 264          DQ        0       6       6

 265          KK      Q@7
 266          KM   COMBINE 3,4,5,7 AND 1,2,6 (EAST OF TRACKS)
 267          HC        2

 268          KK     DET7
 269          KM   DETAIN AT BASIN 7
 270          KO        0       0       0       0      21
 271          RS        1    STOR      -1
 272          SV     1.37    2.26    2.71    3.74    5.47    6.99
 273          SQ        1      50     100     250     500     750
 274          SE    55.22   55.79   56.03   56.49   57.15   57.66

 275          KK       B8
 276          BA     0.06
 277          LS        0      71
 278          UD    0.090

 279          KK      Q@8
 280          KM   COMBINE BASINS 1A,1,1B,2,6,3,4,5,&7 WITH BASIN 8
 281          HC        2
```

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

         KK    DET8
         KM    DETAIN BASIN 8
         KO       0       0       0       0      21
         RS       1    STOR      -1
         SV    0.72    1.44    1.79     2.6    3.97     5.1
         SQ       1      50     100     250     500     750
         SE   55.22   55.78   55.99   56.40   57.03   57.52

         KK     B9A
         BA    0.10
         LS       0      71
         UD   0.110

         KK    Q@9A
         KM    COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,&8 WITH BASIN 9A
         HC       2

         KK   DET9A
         KM    DETAIN AT BASIN 9A
         KO       0       0       0       0      21
         RS       1    STOR      -1
         SV    1.31    3.19    4.13    6.62   10.46   13.34
         SQ       1      50     100     250     500     750
         SE   54.63   55.26   55.51   56.09   56.81   57.33

         KK      B9
         BA    0.10
         LS       0      73
         UD    0.11

         KK     Q@9
         KM    COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,8,&9A WITH BASIN 9
         HC       2

         KK COMBINE
         KM    DIVERT 5 CFS AT PHOEBE PUMP STATION
         DT    PUMP       0     3.5
         DI       0     3.5     200
         DQ       0     3.5     3.5

         KK    DET9
         KM    DETAIN AT BASIN 9
         KO       0       0       0       0      21
         RS       1    STOR      -1
         SV     2.1    4.34    5.45    8.83   13.19   16.35
         SQ       1      50     100     250     500     750
         SE   54.36   55.07   55.36   56.01   56.76   57.26

         KK     B9B
         BA    0.09
         LS       0      74
         UD    0.12
```

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

 326          KK    Q@9B
 327          KM    COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,8,9A,&9 WITH BASIN 9B
 328          HC       2
              * KK DET9B
              * KM DETAIN AT BASIN 9B
              * KO 0 0 0 0 21
              * RS 1 STOR -1
              * SV .09 2.55 4.43 5.54 6.69 7.45
              * SQ .1 100 200 300 400 500
              * SE 53.97 55.39 56.05 56.43 56.80 57.05

 329          KK    RT9B
 330          KM    ROUTE BASIN 9B ALONG 101
 331          RC    .018    .018    .018    1000    .001
 332          RX       0      10      15      20      25      30      30      30
 333          RY       2     0.4     0.3     0.2     0.1       0       1       2

 334          KK     B10
 335          BA    0.05
 336          LS       0      73
 337          UD    0.09

 338          KK    Q@10
 339          KM    COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,8,9A,9,&9B WITH BASIN 10
 340          HC       2
              * KK DET10
              * KM DETAIN AT BASIN 10
              * KO 0 0 0 0 21
              * RS 1 STOR -1
              * SV .08 1.89 3.47 4.3 5.19 5.74
              * SQ .1 100 200 300 400 500
              * SE 53.51 55.23 55.94 56.30 56.68 56.92

 341          KK    RT10
 342          KM    ROUTE BASIN 10 ALONG 101
 343          RC    .018    .018    .018     600    .001
 344          RX       0      10      15      20      25      30      30      30
 345          RY       2     0.4     0.3     0.2     0.1       0       1       2

 346          KK     B11
 347          BA    0.12
 348          LS       0      76
 349          UD    0.15

 350          KK    Q@11
 351          KM    COMBINE BASINS 1A,1,1B,2,6,3,4,5,7,8,9A,9,9B&10 WITH BASIN 11
 352          HC       2
              * KK DET11
              * KM DETAIN AT BASIN 11
              * KO 0 0 0 0 21
              * RS 1 STOR -1
              * SV .01 .84 1.5 2.09 2.79 3.32
              * SQ .1 100 200 300 400 500
              * SE 52.13 53.91 54.56 55.10 55.56 55.85
```

LINE	ID	1	2	3	4	5	6	7	8	9	10
353	KK	RT11									
354	KM	ROUTE BASIN 11 ALONG 101									
355	RC	.018	.018	.018	1650	.001					
356	RX	0	10	15	20	25	30	30	30		
357	RY	2	0.4	0.3	0.2	0.1	0	1	2		
358	ZZ										

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

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

  71          1A
              V
              V
 120        RT1A
              .
              .
 126          .          1B
              .          V
              .          V
 130          .        RT1B
              .          V
              .          V
 136          .        RT1B
              .          .
              .          .
 142          .          .          1
              .          .          .
              .          .          .
 146         Q&1.......................
              .
              .
 151          .-------> 10YR_SD
 149     Q1_in101
              V
              V
 154        DET_1
              .
              .
 160          .          2
              .          .
              .          .
 164         Q&2...........
              .
              .
 169          .-------> 10YR_SD
 167     Q2_in101
              V
              V
 172        DET_2
              .
              .
 178          .          6
              .          .
              .          .
 182         Q@6...........
              .
              .
 187          .-------> 10YR_SD
 185     Q6_in101
              V
              V
 190        DET_6
              .
```

```
                .
197             .        B3
                .         .
                .         .
203             .         .-------> 10YR_SD
201             .   Q3_in101
                .         V
                .         V
206             .      DET3
                .         .
                .         .
213             .         .          B4
                .         .           .
                .         .           .
217             .       3+4............
                .         .
                .         .
222             .         .-------> 10YR_SD
220             .   Q4_in101
                .         V
                .         V
225             .      DET4
                .         .
                .         .
232             .         .          B5
                .         .           .
                .         .           .
237             .       Q@5............
                .         .
                .         .
242             .         .-------> 10YR_SD
240             .   Q5_in101
                .         V
                .         V
245             .      DET5
                .         .
                .         .
252             .         .          B7
                .         .           .
                .         .           .
257             .       5+7............
                .         .
                .         .
262             .         .-------> 10YR_SD
260             .   Q7_in101
                .         .
                .         .
265           Q@7............
                V
                V
268          DET7
                .
                .
275             .        B8
                .         .
                .         .
279           Q@8............
                V
                V
282          DET8
```

```
                  .
                  .
  289             .          B9A
                  .            .
                  .            .
  293          Q@9A............
                  V
                  V
  296         DET9A
                  .
                  .
  303             .           B9
                  .            .
                  .            .
  307           Q@9............
                  .
                  .
  312             .------->     PUMP
  310       COMBINE
                  V
                  V
  315          DET9
                  .
                  .
  322             .          B9B
                  .            .
                  .            .
  326          Q@9B............
                  V
                  V
  329          RT9B
                  .
                  .
  334             .          B10
                  .            .
                  .            .
  338          Q@10............
                  V
                  V
  341          RT10
                  .
                  .
  346             .          B11
                  .            .
                  .            .
  350          Q@11............
                  V
                  V
  353          RT11

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

```
****************************************                                      *************************************
*                                      *                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                      *   U.S. ARMY CORPS OF ENGINEERS
*               JUN  1998              *                                      *   HYDROLOGIC ENGINEERING CENTER
*              VERSION 4.1             *                                      *         609 SECOND STREET
*                                      *                                      *      DAVIS, CALIFORNIA 95616
*  RUN DATE   17AUG04  TIME  14:41:36  *                                      *           (916) 756-1104
*                                      *                                      *
****************************************                                      *************************************
```

```
**********************************************************
ENCINITAS COAST HWY 101         J-14413          7-14-04
COMBO OF ALTERNATIVE 1 + ALTERNAVE 2C - SAME AS BELOW EXCEPT
GRADE NORTHBOUND LANES OF HWY 101 FROM APPROXIMATELY
JUPITER TO MOOREGATE AT A CONSTANT SLOPE OF 0.1% AND
OVERFLOW STORM DRAIN SYSTEM TO DIVERT 10-YEAR FLOW AT BASIN 7
BASINS 9B, 10,AND 11 ARE UNDETAINED AND ROUTED VIA TRAP
CHANNEL. ALL BASINS U/S ARE DETAINED.
FN: 100A5.HC1
**********************************************************
ENCINITAS COAST HWY 101         J-14413          5-25-04
ALTERNATIVE 2 OPTION C - GRADE NORTHBOUND LANES OF
HWY 101 FROM APPROXIMATELY JUPITER TO MOOREGATE
AT A CONSTANT SLOPE OF 0.1%
BASINS 9B, 10,AND 11 ARE UNDETAINED AND ROUTED VIA TRAP
CHANNEL. ALL BASINS U/S ARE DETAINED.
FN: 100A2C.HC1
**********************************************************
ENCINITAS COAST HWY 101         J-14413          03-04-04
INCLUDES DIVERSION AT EACH INLET (Q=1 CFS DUE TO ORIFICE
PLATES) AND DIVERSION AT PHOEBE PUMP STATION
STORAGE RATING CURVES FOR BASINS 1, 2, AND 6 ARE BASED ON
VULCAN ONLY HEC-RAS RUN
STORAGE RATING CURVES FOR BASINS 7-11 ARE BASED ON THE
101/VULCAN COMBINED HEC-RAS RUN
BLOCKED OBSTRUCTIONS ARE INCLUDED FOR THE ALLEY AND VULCAN
**********************************************************
ENCINITAS COAST HWY 101         J-14413          12/29/03
100-YEAR RUN WITH BASIN AREAS EXTENDED TO THE RIDGE EAST OF
THE RR TRACKS. PI CARDS CHANGED FOR 100-YR BASED ON FN: E100.HC1
LAG AND CURVE NUMBERS CHANGED FOR 100-YEAR.
FN:100DET.HC1
BASIN AREAS ALSO CHANGED FOR 7 THROUGH 11. STORAGE RATING
CURVES BASED ON HEC-RAS OUTPUT FN: 101.PRJ (PLAN 101 R3)
**********************************************************
ENCINITAS COAST HWY 101
J-14413
SEPT 25, 2003
MODIFIED EXISTING RUN TO MODEL PROPOSED DETENTION OF BASINS
1A, 1B, 1, 2, 3, 4, 5, 6, AND 8
DETENTION CARDS SA/SV, SQ, SE OBTAINED FROM FN: DSI_5R.HC1
**********************************************************
ENCINITAS- COAST HIGHWAY 101
JOB # 14413
09-12-03
MODIFIED PUMP Q TO 1.7 CFS, AND ROUTING OF BASINS 9A, 9B, AND 9
```

```
                 FROM PUMP STATION THROUGH 10" LATERAL, CONFLUENCING
                 WITH MAIN LINE AT AT CONNECTION 3 INSTEAD OF CONNECTION 2
                 ALSO CHANGED ROUTING THROUGH MAIN LINE FROM LINE G TO CONNECTION
                 2, TO LINE G TO CONNECTION 3
                 ***********************************************************
                 ENCINITAS- COAST HIGHWAY 101
                 JOB # 14413
                 09-04-03
                 MODIFIED CURVE NUMBER AND REMOVED % IMPERVIOUS
                 ***********************************************************
                 ENCINITAS- COAST HIGHWAY 101
                 JOB # 14413
                 06-03-03
                 POST-IMPROVEMENT (EXISTING) CONDITION      FN: 101EX_5.HC1
                 5-YEAR, 24-HR STORM EVENT
                 LAG CALCULATION ARE BASED OFF OF NRCS METHOD
                 AND ARE A FUNCTION OF RUNOFF COEF. AND VELOCITY
                 NESTED STORM PER COUNTY OF SAN DIEGO HYDROLOGY MANUAL
                 COPYRIGHT 2003 RICK ENGINEERING COMPANY
                 6HR RAINFALL IS  1.6  INCHES
                 24HR RAINFALL IS  2.5  INCHES
                 TOTAL BASIN AREA IS  .5  SQUARE MILES

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

   IT         HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE     1JAN90  STARTING DATE
                    ITIME       1200  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE     2JAN90  ENDING DATE
                   NDTIME       1255  ENDING TIME
                    ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    .08 HOURS
                     TOTAL TIME BASE  24.92 HOURS

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

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

          **************
          *            *
 71 KK    *         1A *
          *            *
          **************
```

```
 72 KO          OUTPUT CONTROL VARIABLES
                      IPRNT            5  PRINT CONTROL
                      IPLOT            0  PLOT CONTROL
                      QSCAL           0.  HYDROGRAPH PLOT SCALE
                      IPNCH            0  PUNCH COMPUTED HYDROGRAPH
                       IOUT           21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1            1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2          300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT         .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

            **************
            *            *
190 KK      *    DET_6   *
            *            *
            **************

191 KO          OUTPUT CONTROL VARIABLES
                      IPRNT            5  PRINT CONTROL
                      IPLOT            0  PLOT CONTROL
                      QSCAL           0.  HYDROGRAPH PLOT SCALE
                      IPNCH            0  PUNCH COMPUTED HYDROGRAPH
                       IOUT           21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1            1  FIRST ORDINATE PUNCHED OR SAVED
                      ISAV2          300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT         .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

            **************
            *            *
206 KK      *     DET3   *
            *            *
            **************

208 KO          OUTPUT CONTROL VARIABLES
                      IPRNT            5  PRINT CONTROL
                      IPLOT            0  PLOT CONTROL
                      QSCAL           0.  HYDROGRAPH PLOT SCALE
                      IPNCH            0  PUNCH COMPUTED HYDROGRAPH
                       IOUT           21  SAVE HYDROGRAPH ON THIS UNIT
                      ISAV1            1  FIRST ORDINATE'PUNCHED OR SAVED
                      ISAV2          300  LAST ORDINATE PUNCHED OR SAVED
                     TIMINT         .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **
```

```
          **************
          *            *
225 KK    *    DET4    *
          *            *
          **************

227 KO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

          **************
          *            *
245 KK    *    DET5    *
          *            *
          **************

247 KO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

          **************
          *            *
268 KK    *    DET7    *
          *            *
          **************

270 KO         OUTPUT CONTROL VARIABLES
                     IPRNT          5  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL         0.  HYDROGRAPH PLOT SCALE
                     IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                      IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                     ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                     ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                    TIMINT       .083  TIME INTERVAL IN HOURS
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

            **************
            *            *
 282 KK     *    DET8    *
            *            *
            **************

 284 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
                       IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                        IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                       ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                       ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                      TIMINT       .083  TIME INTERVAL IN HOURS

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

            **************
            *            *
 296 KK     *   DET9A    *
            *            *
            **************

 298 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
                       IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                        IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                       ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                       ISAV2        300  LAST ORDINATE PUNCHED OR SAVED
                      TIMINT       .083  TIME INTERVAL IN HOURS

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** **

            **************
            *            *
 315 KK     *    DET9    *
            *            *
            **************

 317 KO          OUTPUT CONTROL VARIABLES
                       IPRNT          5  PRINT CONTROL
                       IPLOT          0  PLOT CONTROL
                       QSCAL         0.  HYDROGRAPH PLOT SCALE
```

```
              IPNCH            0  PUNCH COMPUTED HYDROGRAPH
               IOUT           21  SAVE HYDROGRAPH ON THIS UNIT
              ISAV1            1  FIRST ORDINATE PUNCHED OR SAVED
              ISAV2          300  LAST ORDINATE PUNCHED OR SAVED
             TIMINT         .083  TIME INTERVAL IN HOURS


WARNING --- ROUTED OUTFLOW (    152.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    151.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    159.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    186.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    178.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    162.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    150.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    190.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    260.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    276.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    255.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    225.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    198.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    178.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    163.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE

WARNING --- ROUTED OUTFLOW (    152.) IS GREATER THAN MAXIMUM OUTFLOW (    145.) IN STORAGE-OUTFLOW TABLE
```

RUNOFF SUMMARY

FLOW IN CUBIC FEET PER SECOND

TIME IN HOURS, AREA IN SQUARE MILES

OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
HYDROGRAPH AT	1A	9.	16.08	1.	0.	0.	.01		
ROUTED TO	RT1A	6.	16.42	1.	0.	0.	.01	1.31	16.42
HYDROGRAPH AT	1B	31.	16.08	4.	1.	1.	.03		
ROUTED TO	RT1B	0.	.00	0.	0.	0.	.03	5.63	24.92
ROUTED TO	RT1B	0.	.00	0.	0.	0.	.03	2.00	.00
HYDROGRAPH AT	1	62.	16.25	11.	3.	3.	.09		
3 COMBINED AT	Q&1	67.	16.25	12.	4.	4.	.13		
DIVERSION TO	10YR_SD	15.	16.25	8.	3.	3.	.13		
HYDROGRAPH AT	Q1_in101	52.	16.25	4.	1.	1.	.13		
ROUTED TO	DET_1	13.	16.67	2.	1.	1.	.13	68.70	16.67
HYDROGRAPH AT	2	72.	16.08	9.	3.	3.	.06		
2 COMBINED AT	Q&2	73.	16.08	11.	4.	4.	.19		
DIVERSION TO	10YR_SD	19.	16.08	9.	3.	3.	.19		
HYDROGRAPH AT	Q2_in101	54.	16.08	3.	1.	1.	.19		
ROUTED TO	DET_2	1.	.08	1.	1.	1.	.19	66.73	.00
HYDROGRAPH AT	6	55.	16.25	11.	3.	3.	.06		
2 COMBINED AT	Q@6	56.	16.25	12.	4.	4.	.25		
DIVERSION TO	10YR_SD	16.	16.25	8.	4.	4.	.25		
HYDROGRAPH AT	Q6_in101	40.	16.25	3.	1.	1.	.25		
ROUTED TO	DET_6	38.	16.33	4.	2.	2.	.25	64.82	16.33
HYDROGRAPH AT	B3	30.	16.08	3.	1.	1.	.02		
DIVERSION TO	10YR_SD	11.	16.08	3.	1.	1.	.02		
HYDROGRAPH AT	Q3_in101	19.	16.08	1.	0.	0.	.02		
ROUTED TO	DET3	1.	.08	1.	1.	1.	.02	59.68	.00
HYDROGRAPH AT	B4	27.	16.00	3.	1.	1.	.02		
2 COMBINED AT	3+4	28.	16.00	4.	2.	2.	.04		

DIVERSION TO	10YR_SD	7.	16.00	3.	2.	2.	.04		
HYDROGRAPH AT	Q4_in101	21.	16.00	1.	0.	0.	.04		
ROUTED TO	DET4	1.	.08	1.	1.	1.	.04	59.54	.00
HYDROGRAPH AT	B5	28.	16.08	3.	1.	1.	.02		
2 COMBINED AT	Q@5	29.	16.08	4.	2.	2.	.06		
DIVERSION TO	10YR_SD	9.	16.08	3.	2.	2.	.06		
HYDROGRAPH AT	Q5_in101	20.	16.08	1.	0.	0.	.06		
ROUTED TO	DET5	1.	.08	1.	1.	1.	.06	57.76	.00
HYDROGRAPH AT	B7	31.	16.25	6.	2.	2.	.04		
2 COMBINED AT	5+7	32.	16.25	7.	3.	3.	.10		
DIVERSION TO	10YR_SD	6.	16.25	4.	2.	2.	.10		
HYDROGRAPH AT	Q7_in101	26.	16.25	2.	1.	1.	.10		
2 COMBINED AT	Q@7	62.	16.33	6.	2.	2.	.35		
ROUTED TO	DET7	47.	16.50	6.	2.	2.	.35	55.75	16.50
HYDROGRAPH AT	B8	69.	16.08	7.	2.	2.	.06		
2 COMBINED AT	Q@8	78.	16.08	14.	5.	4.	.41		
ROUTED TO	DET8	57.	16.50	14.	5.	4.	.41	55.81	16.50
HYDROGRAPH AT	B9A	114.	16.08	12.	4.	4.	.10		
2 COMBINED AT	Q@9A	158.	16.08	26.	8.	8.	.51		
ROUTED TO	DET9A	90.	16.33	26.	8.	8.	.51	55.46	16.33
HYDROGRAPH AT	B9	123.	16.08	13.	4.	4.	.10		
2 COMBINED AT	Q@9	173.	16.08	39.	12.	12.	.61		
DIVERSION TO	PUMP	4.	16.08	4.	2.	2.	.61		
HYDROGRAPH AT	COMBINE	170.	16.08	36.	10.	10.	.61		
ROUTED TO	DET9	106.	16.42	34.	10.	10.	.61	55.39	16.42
HYDROGRAPH AT	B9B	111.	16.08	12.	4.	4.	.09		
2 COMBINED AT	Q@9B	159.	16.08	46.	14.	13.	.70		
ROUTED TO	RT9B	152.	16.17	46.	14.	13.	.70	2.05	16.17
HYDROGRAPH AT	B10	62.	16.08	7.	2.	2.	.05		
2 COMBINED AT	Q@10	186.	16.17	53.	16.	15.	.75		

ROUTED TO	RT10	186.	16.17	53.	16.	15.	.75	2.29	16.17
HYDROGRAPH AT	B11	141.	16.08	18.	6.	5.	.12		
2 COMBINED AT	Q@11	313.	16.17	70.	21.	21.	.87		
ROUTED TO	RT11	276.	16.25	70.	21.	21.	.87	2.94	16.25

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

ATTACHMENT 4

ALTERNATIVE 5
10-YEAR AND 100-YEAR
HEC-RAS ANALYSES

ALTERNATIVE 5

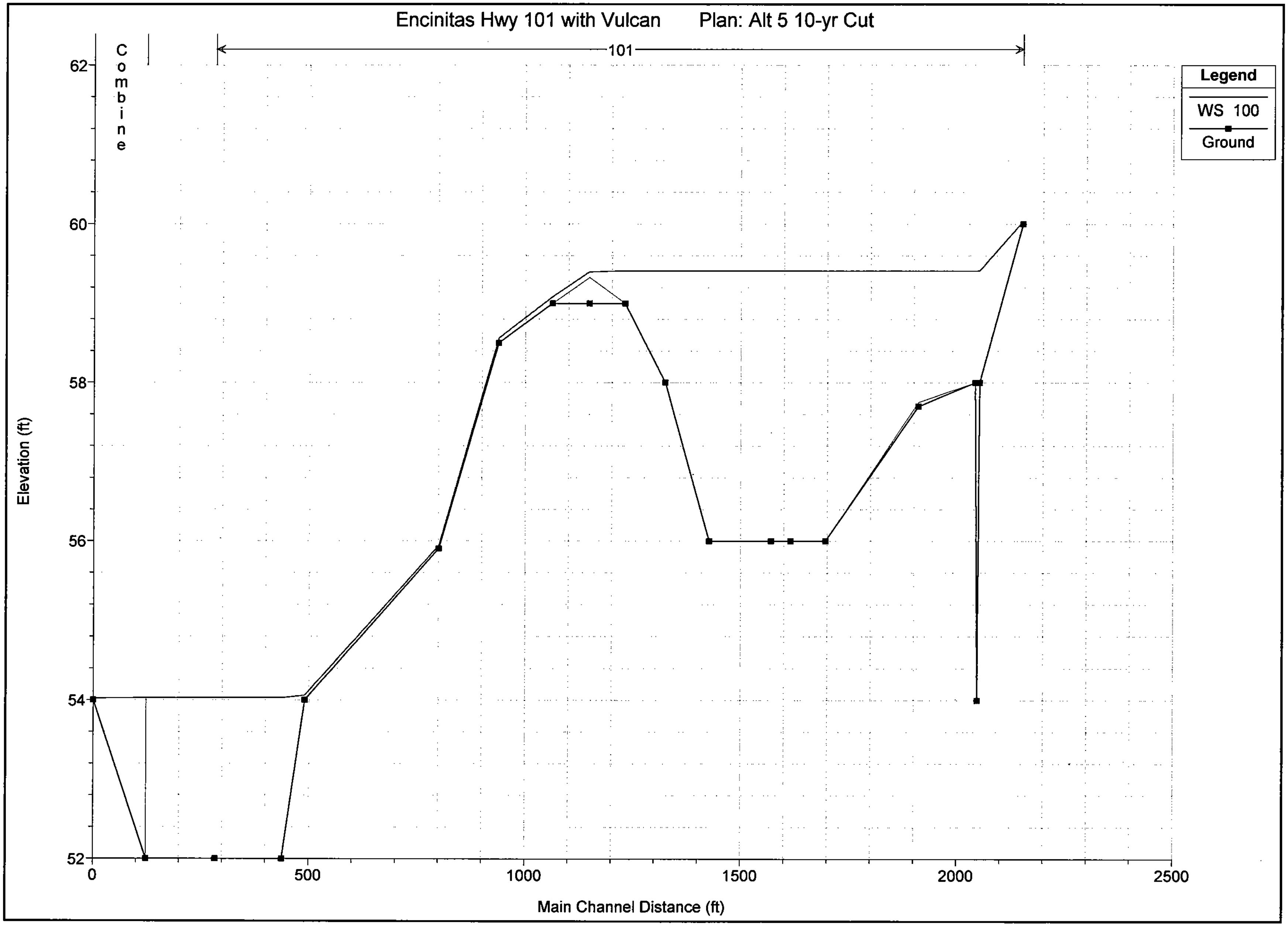
10-YEAR HEC-RAS ANALYSIS

HEC-RAS Plan: 105cut Profile: 100

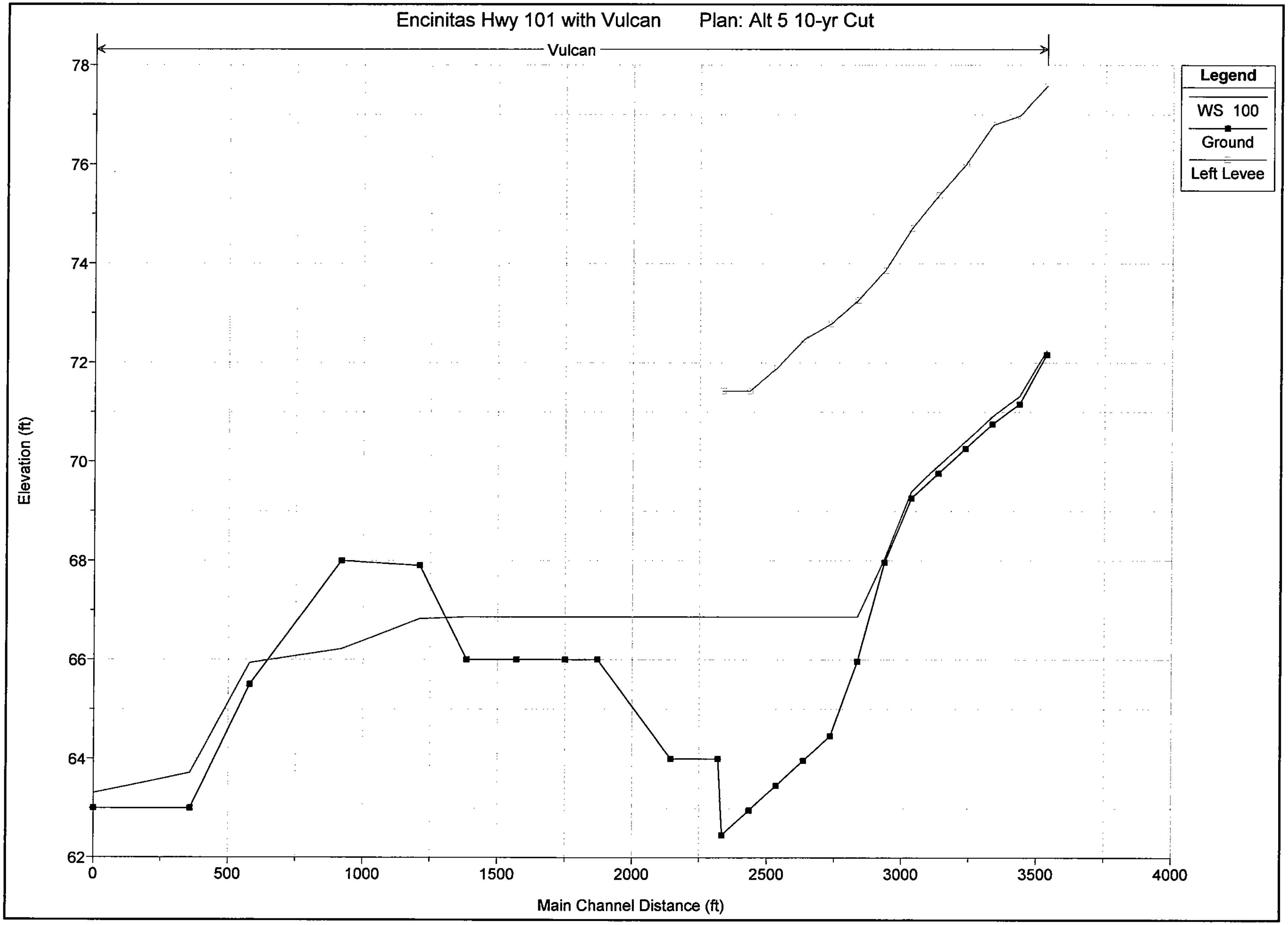
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Vulcan	3300.14	1.00	72.16	72.24	72.24	72.28	0.042115	1.59	0.63	8.16	1.00
Vulcan	3200.15	1.00	71.16	71.32	71.24	71.33	0.003637	0.76	1.32	8.31	0.33
Vulcan	3100.16	1.00	70.76	70.91	70.84	70.92	0.004658	0.82	1.23	8.30	0.37
Vulcan	3000.17	1.00	70.26	70.40	70.34	70.41	0.005501	0.86	1.17	8.29	0.40
Vulcan	2900.18	1.00	69.76	69.91	69.84	69.92	0.004387	0.81	1.25	8.31	0.36
Vulcan	2800.19	1.00	69.26	69.40	69.34	69.41	0.006034	0.89	1.14	8.28	0.42
Vulcan	2700.20	1.00	67.96	68.03	68.03	68.08	0.050347	1.68	0.60	8.15	1.09
Vulcan	2600.21	1.00	65.96	66.86	66.04	66.86	0.000011	0.13	8.05	9.81	0.02
Vulcan	2500.22	1.00	64.46	66.86	64.54	66.86	0.000000	0.04	25.01	12.81	0.01
Vulcan	2400.23	1.00	63.96	66.86	64.04	66.86	0.000000	0.04	31.66	13.81	0.00
Vulcan	2300.24	1.00	63.46	66.86	63.54	66.86	0.000000	0.03	38.81	14.81	0.00
Vulcan	2200.25	1.00	62.96	66.86	63.04	66.86	0.000000	0.03	46.96	32.44	0.00
Vulcan	2100.26	1.00	62.46	66.86	62.54	66.86	0.000000	0.01	129.37	82.28	0.00
Vulcan	245	1.00	64.00	66.86		66.86	0.000000	0.01	118.42	81.57	0.00
Vulcan	240	1.00	64.00	66.86		66.86	0.000000	0.01	160.35	114.77	0.00
Vulcan	235	1.00	66.00	66.86		66.86	0.000000	0.01	121.00	155.23	0.00
Vulcan	230	1.00	66.00	66.86		66.86	0.000000	0.01	132.43	171.70	0.00
Vulcan	225	1.00	66.00	66.86		66.86	0.000000	0.01	93.65	119.89	0.00
Vulcan	220	1.00	66.00	66.86		66.86	0.000000	0.00	271.66	333.13	0.00
Vulcan	215	1.00	67.90	66.83	66.83	66.86	0.014435		0.68	9.90	0.00
Vulcan	195	3.00	68.00	66.21	66.05	66.21	0.000146		10.58	59.64	0.00
Vulcan	175	3.00	65.50	65.93	65.93	66.04	0.010203	2.68	1.12	5.19	1.01
Vulcan	165	3.00	63.00	63.71	63.37	63.72	0.000307	0.65	4.60	12.86	0.19
Vulcan	150	3.00	63.00	63.31	63.31	63.39	0.011229	2.26	1.33	8.63	1.01
101	230	0.10	60.00	60.03	60.03	60.04	0.028192	0.76	0.13	8.65	1.09
101	225.3	0.10	58.00	59.41	58.01	59.41	0.000000	0.00	70.79	67.30	0.00
101	225.2	0.10	54.64	59.41		59.41	0.000000	0.00	148.91	67.30	0.00
101	225.1	0.10	58.00	59.41		59.41	0.000000	0.00	70.79	67.30	0.00
101	220	0.10	57.75	59.41		59.41	0.000000	0.00	127.41	106.42	0.00
101	215	0.10	56.00	59.41		59.41	0.000000	0.00	380.98	157.42	0.00
101	210	0.10	56.00	59.41		59.41	0.000000	0.00	274.05	91.81	0.00
101	205	0.10	56.00	59.41		59.41	0.000000	0.00	339.34	114.67	0.00
101	195	0.10	56.00	59.41		59.41	0.000000	0.00	174.94	97.38	0.00
101	190	0.10	58.00	59.41		59.41	0.000000	0.00	110.17	90.00	0.00
101	185	0.10	59.00	59.41		59.41	0.000000	0.01	11.82	50.00	0.00
101	180	0.10	59.32	59.40	59.39	59.41	0.013313	0.92	0.11	3.02	0.85

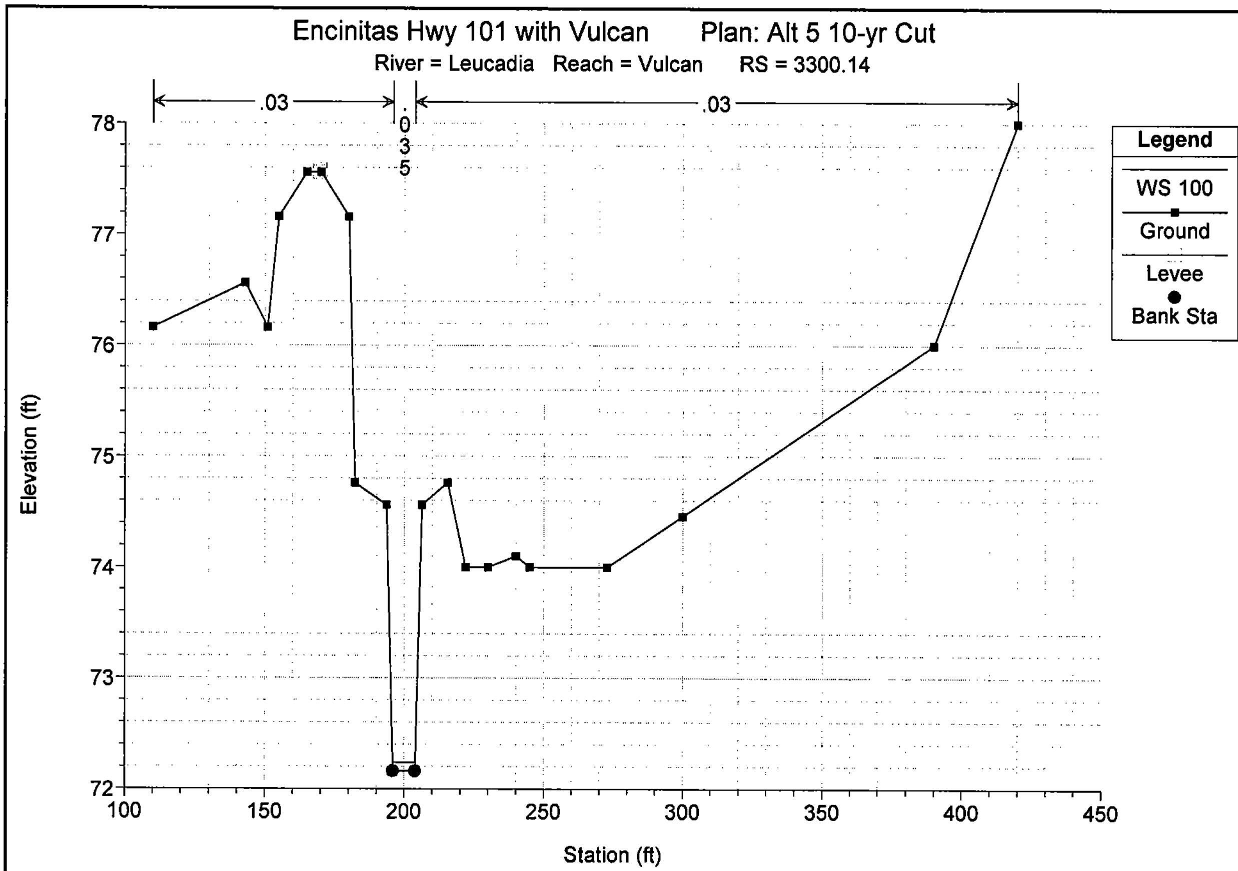
HEC-RAS Plan: 105cut Profile: 100 (Continued)

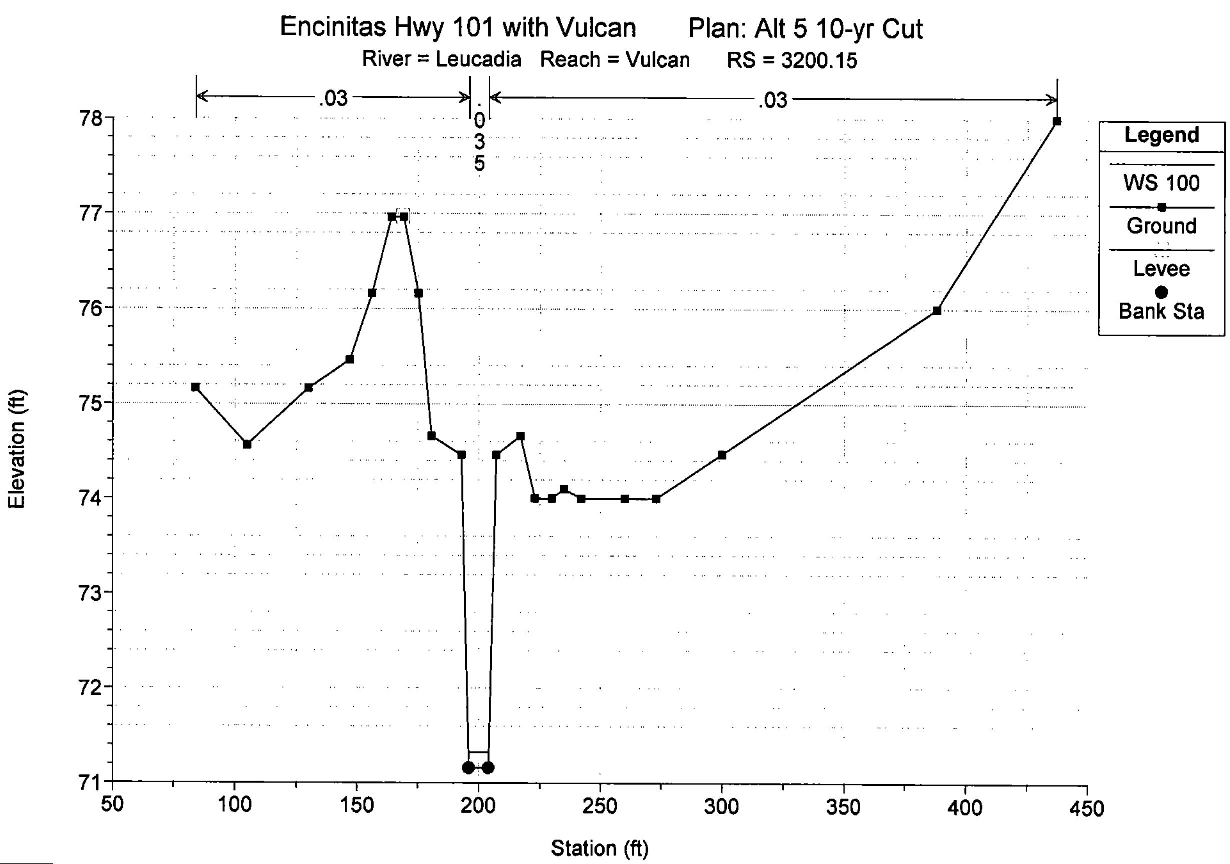
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
101	175	0.10	59.00	59.08		59.09	0.001738	0.41	0.25	5.18	0.33
101	170	0.10	58.50	58.56	58.56	58.57	0.019285	0.96	0.10	3.68	1.00
101	165	0.10	55.90	55.94	55.92	55.94	0.002926	0.28	0.36	19.44	0.36
101	160	0.10	54.00	54.06	54.06	54.07	0.018859	0.96	0.10	3.59	1.00
101	150	0.10	52.00	54.03	52.08	54.03	0.000000	0.00	63.65	94.08	0.00
101	145	0.10	52.00	54.03		54.03	0.000000	0.00	56.28	32.31	0.00
Combine	140	1.00	52.00	54.03	52.16	54.03	0.000000	0.02	55.36	38.64	0.00
Combine	135	1.00	54.00	54.02	54.02	54.03	0.009999	0.57	1.76	84.04	0.69

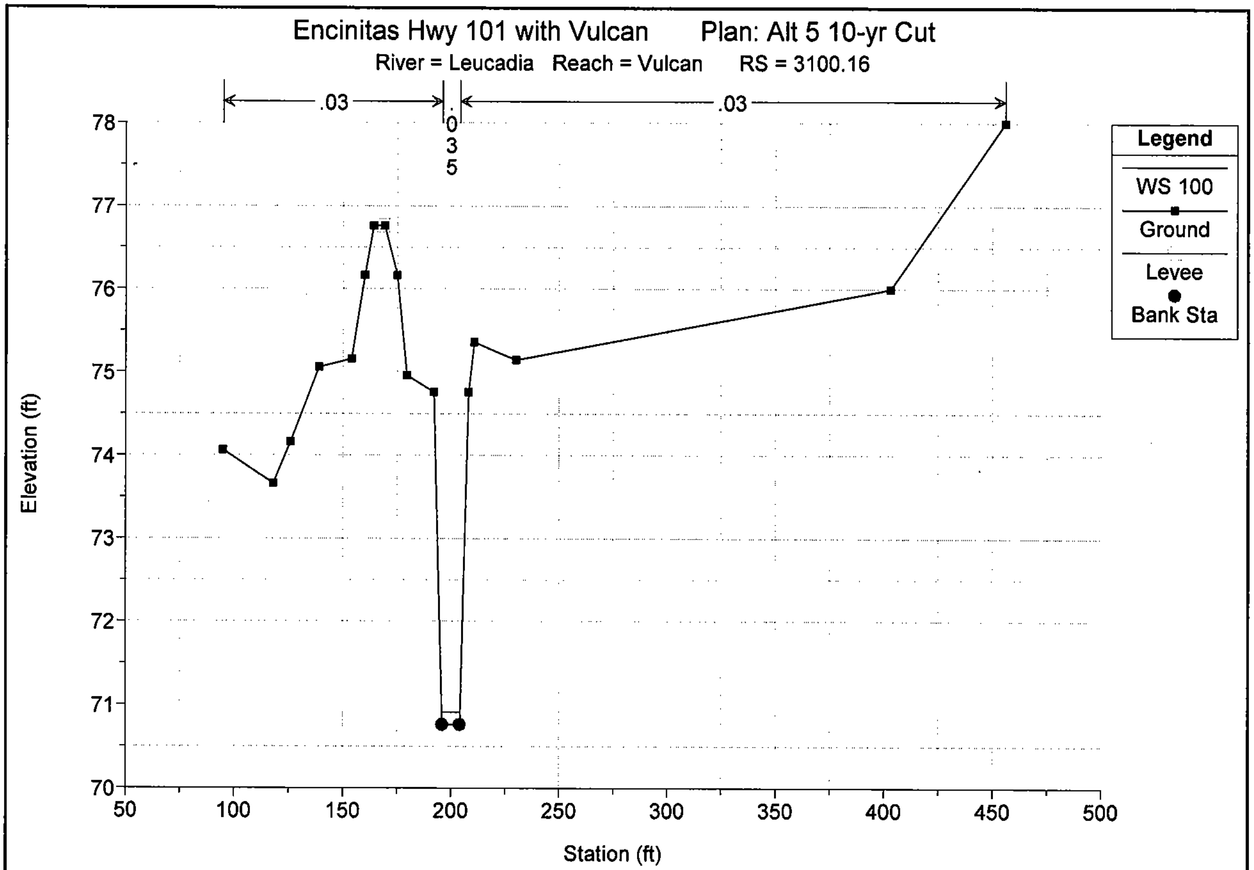


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
Combine
101
Legend
WS 100
Ground
Elevation (ft)
62
60
58
56
54
52
0
500
1000
1500
2000
2500
Main Channel Distance (ft)

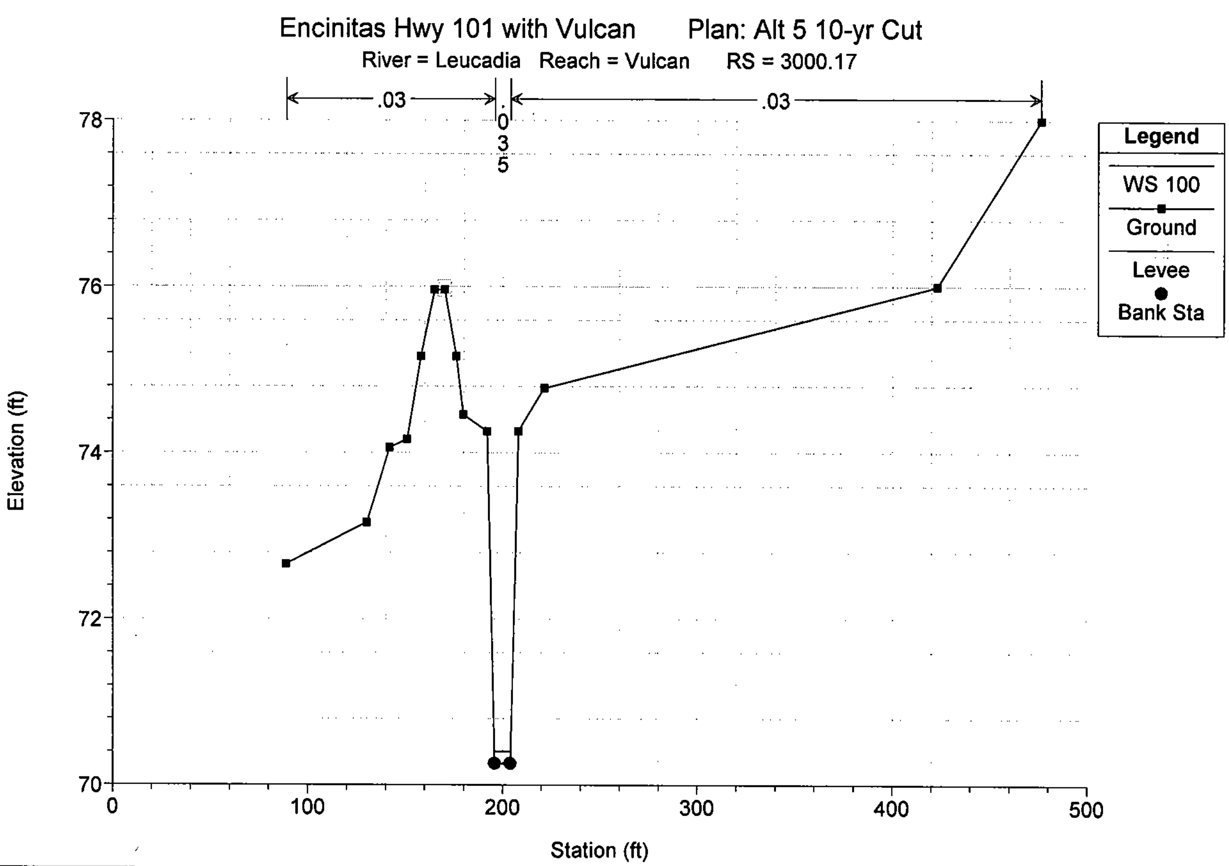

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
Vulcan
Legend
WS 100
Ground
Left Levee
Elevation (ft)
78
76
74
72
70
68
66
64
62
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 3300.14
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

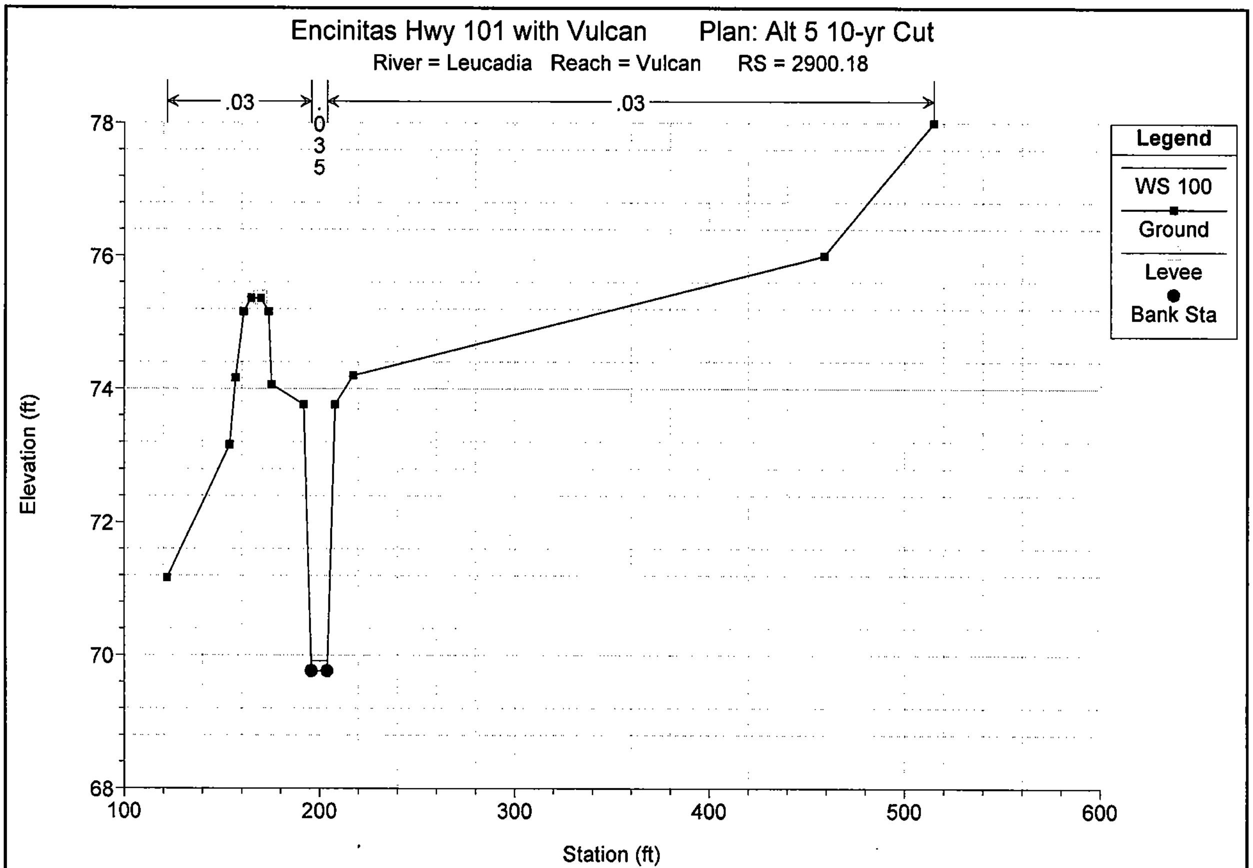

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 3200.15
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

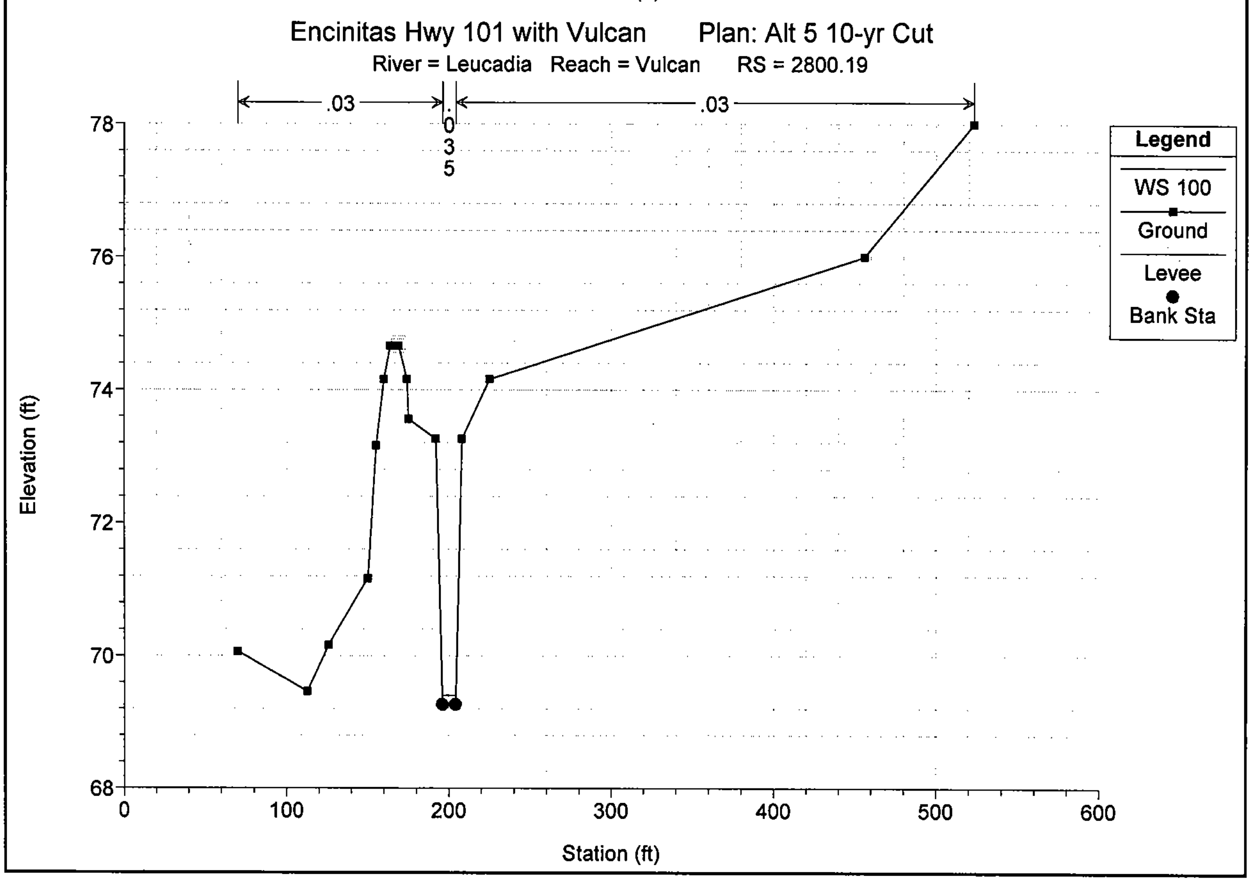


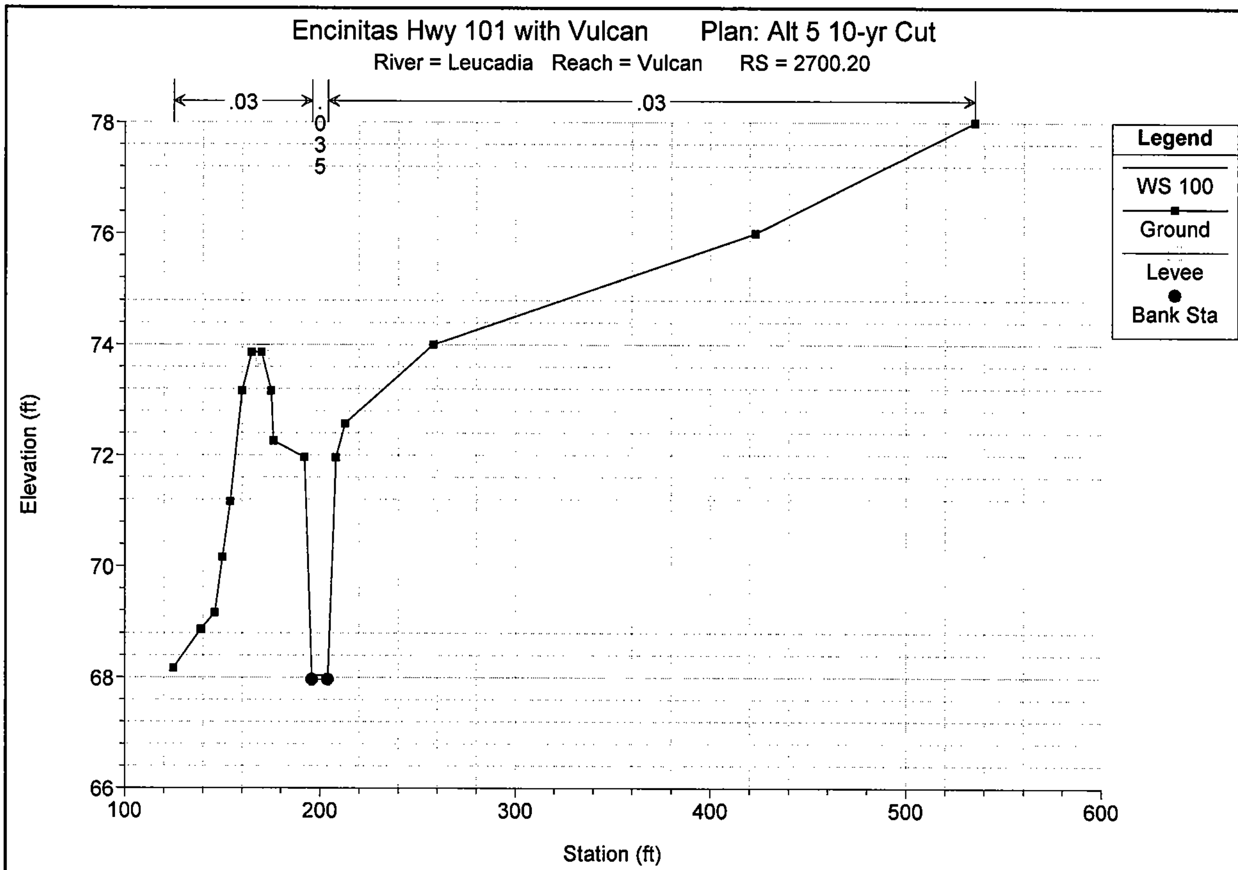
Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 3100.16
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

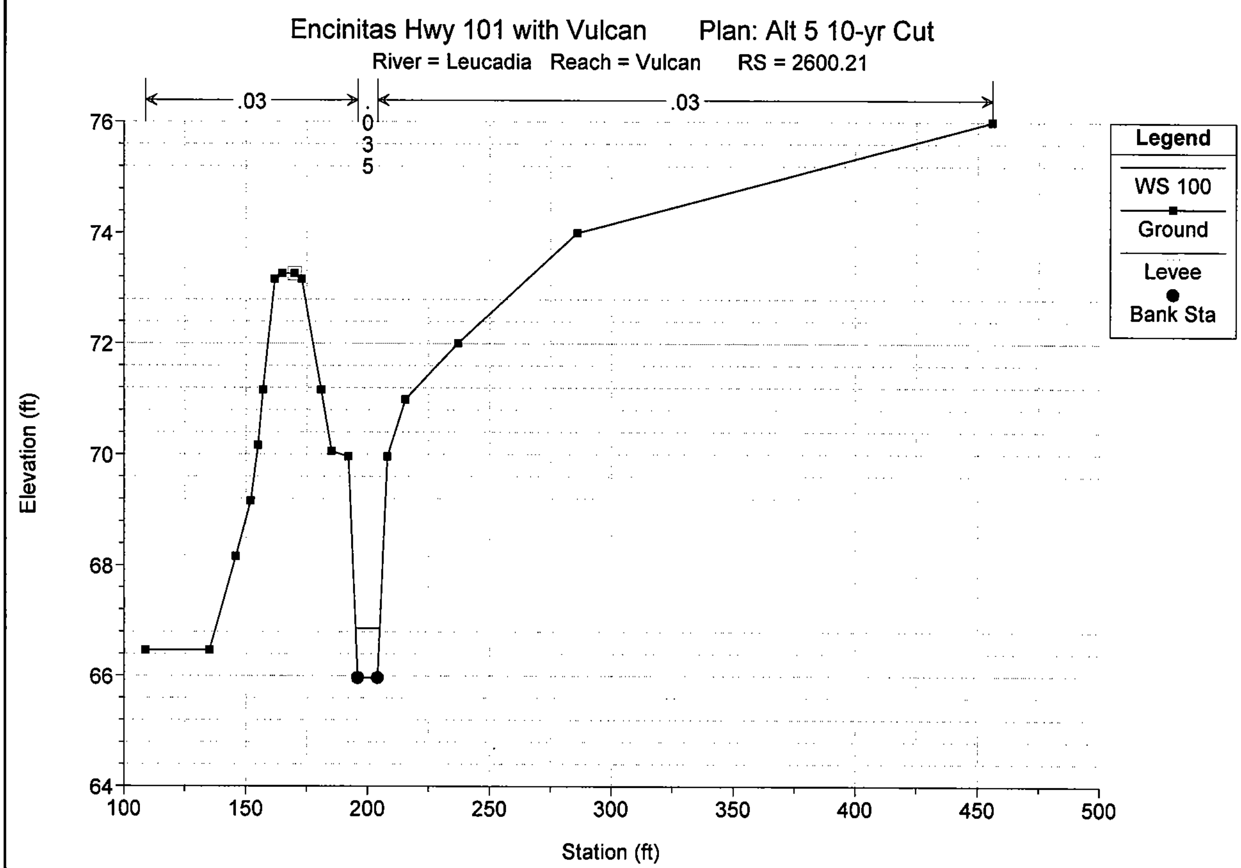


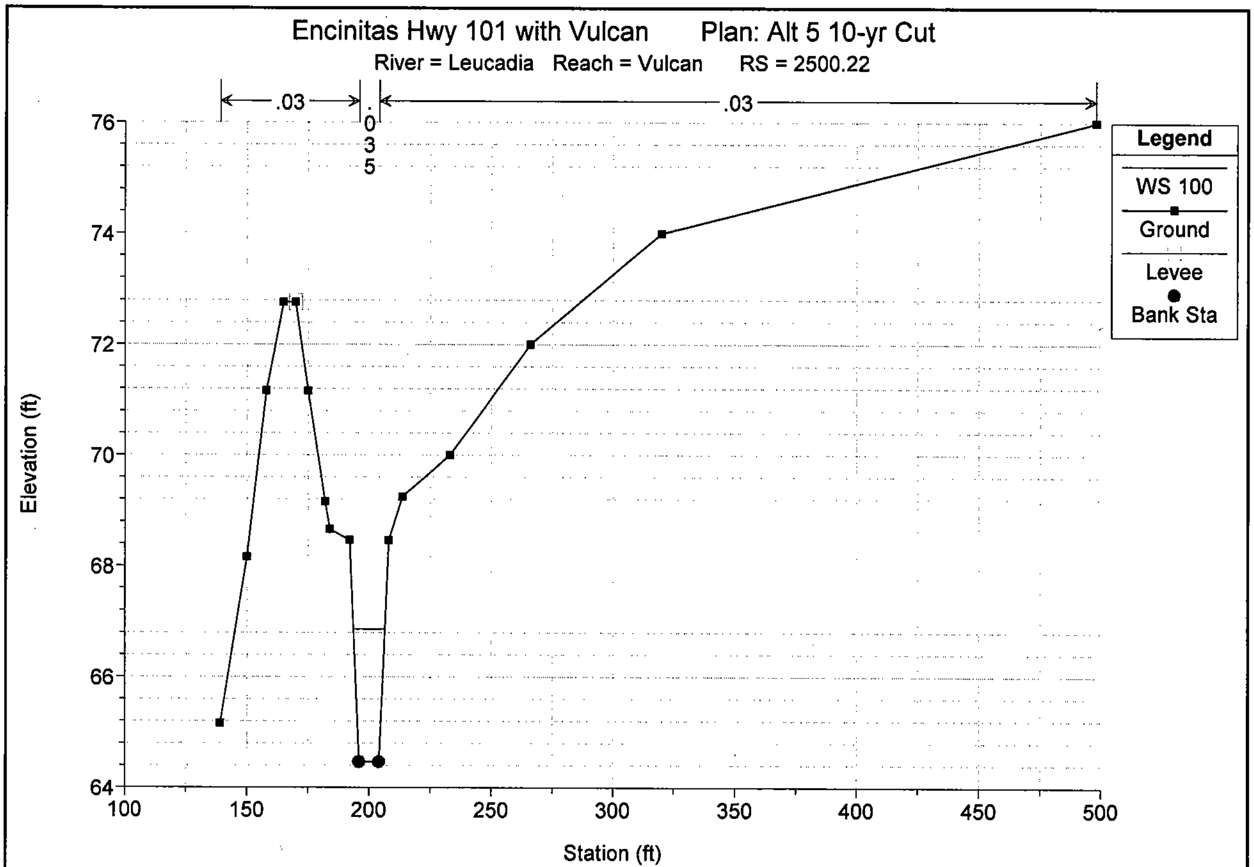
Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 3000.17
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

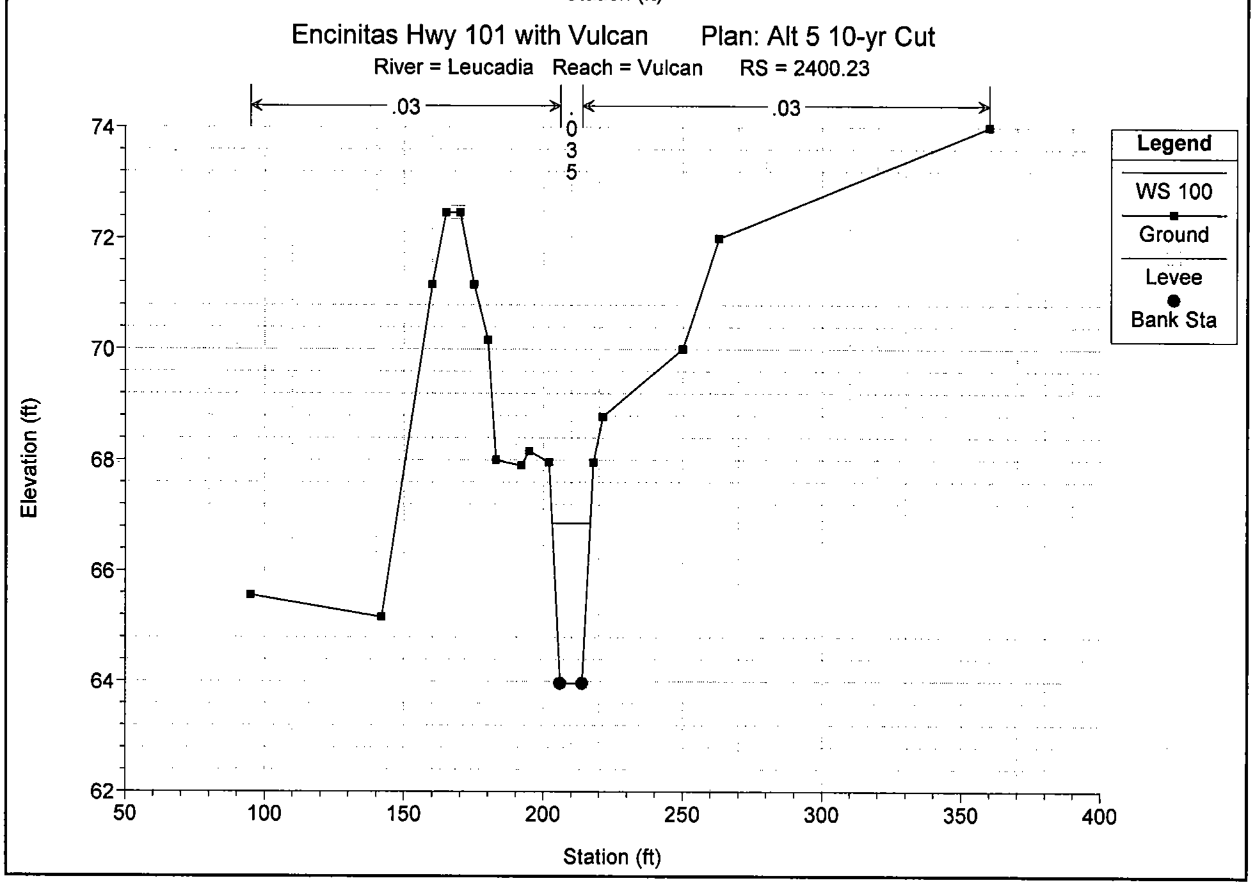

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 2900.18
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Levee
Bank Sta

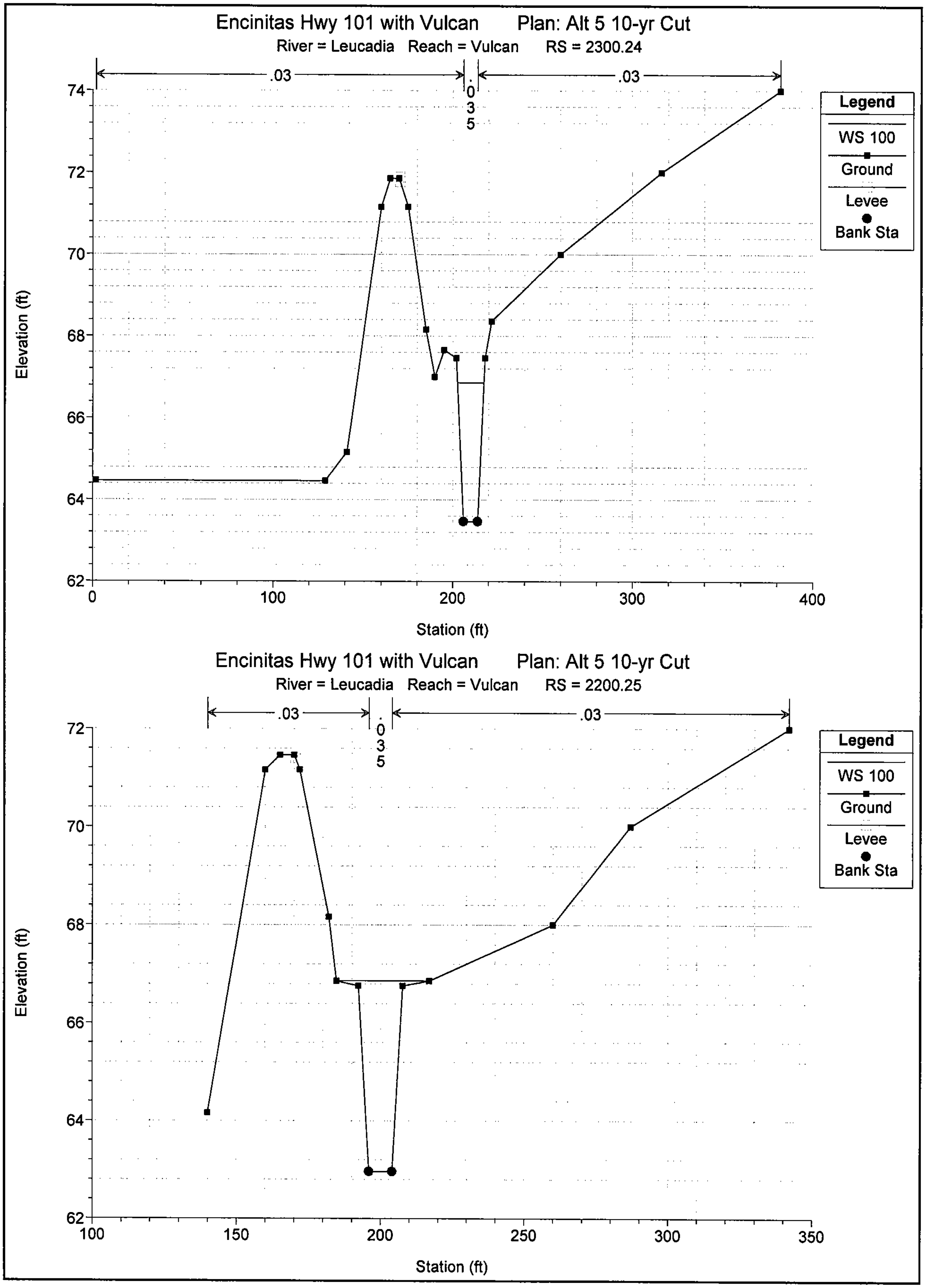

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 2800.19
.03
.035
.03
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Levee
Bank Sta

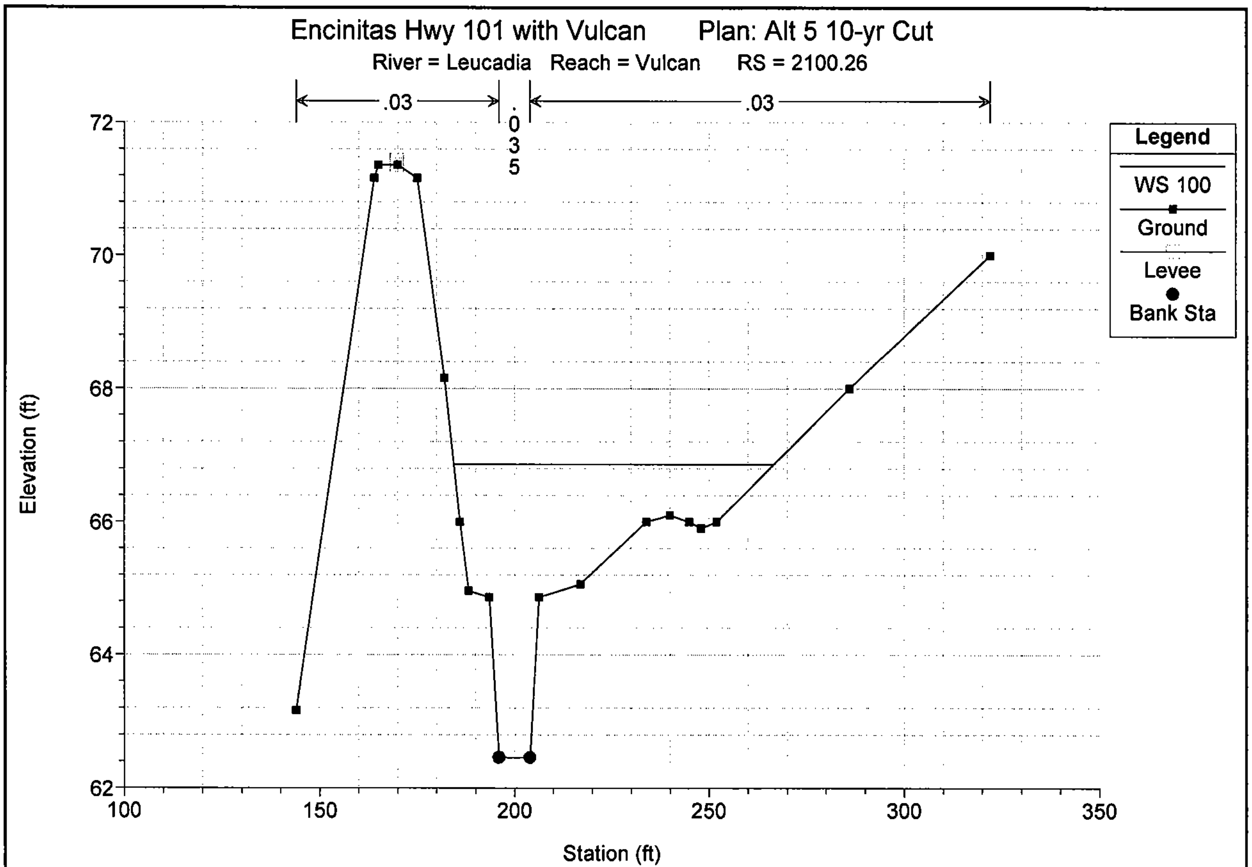

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 2700.20
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

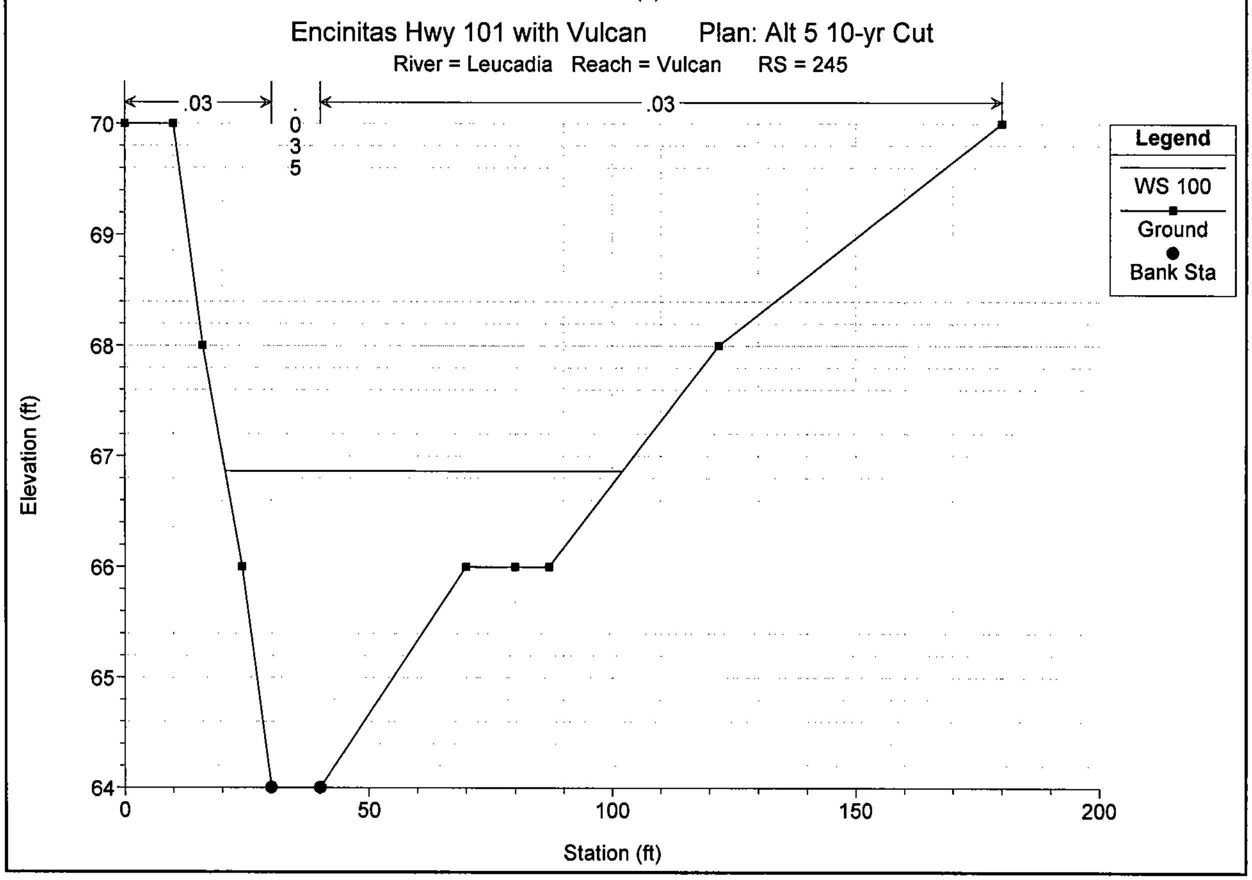

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 2600.21
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

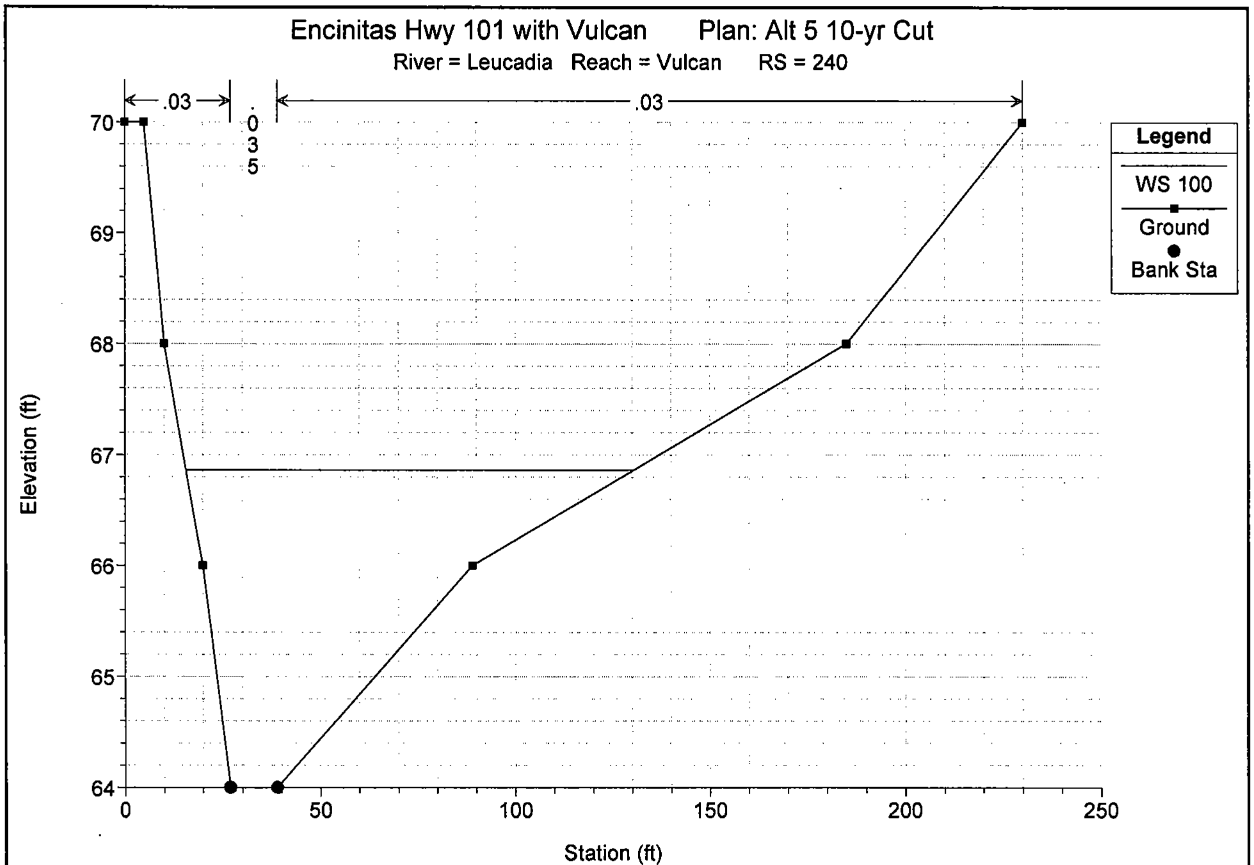

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 2500.22
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

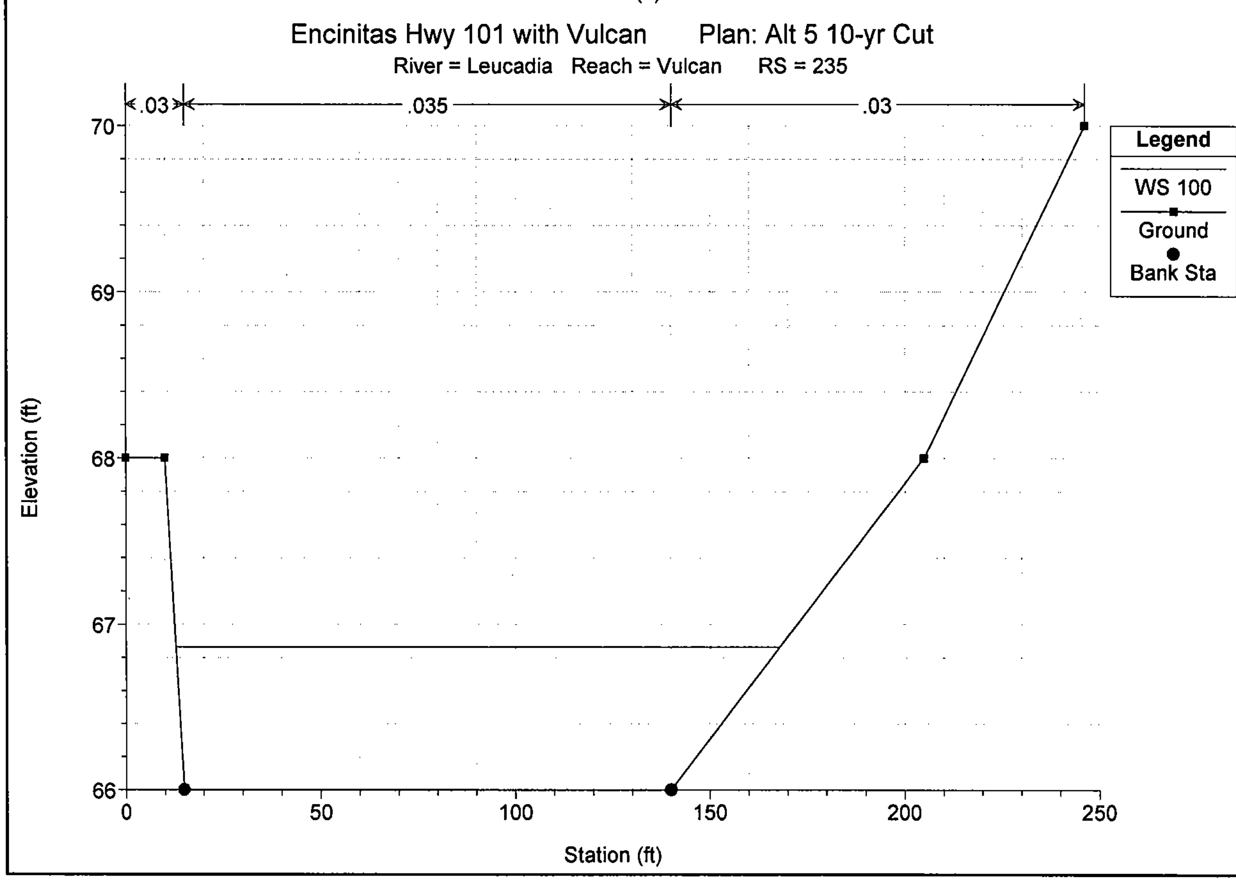

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 2400.23
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

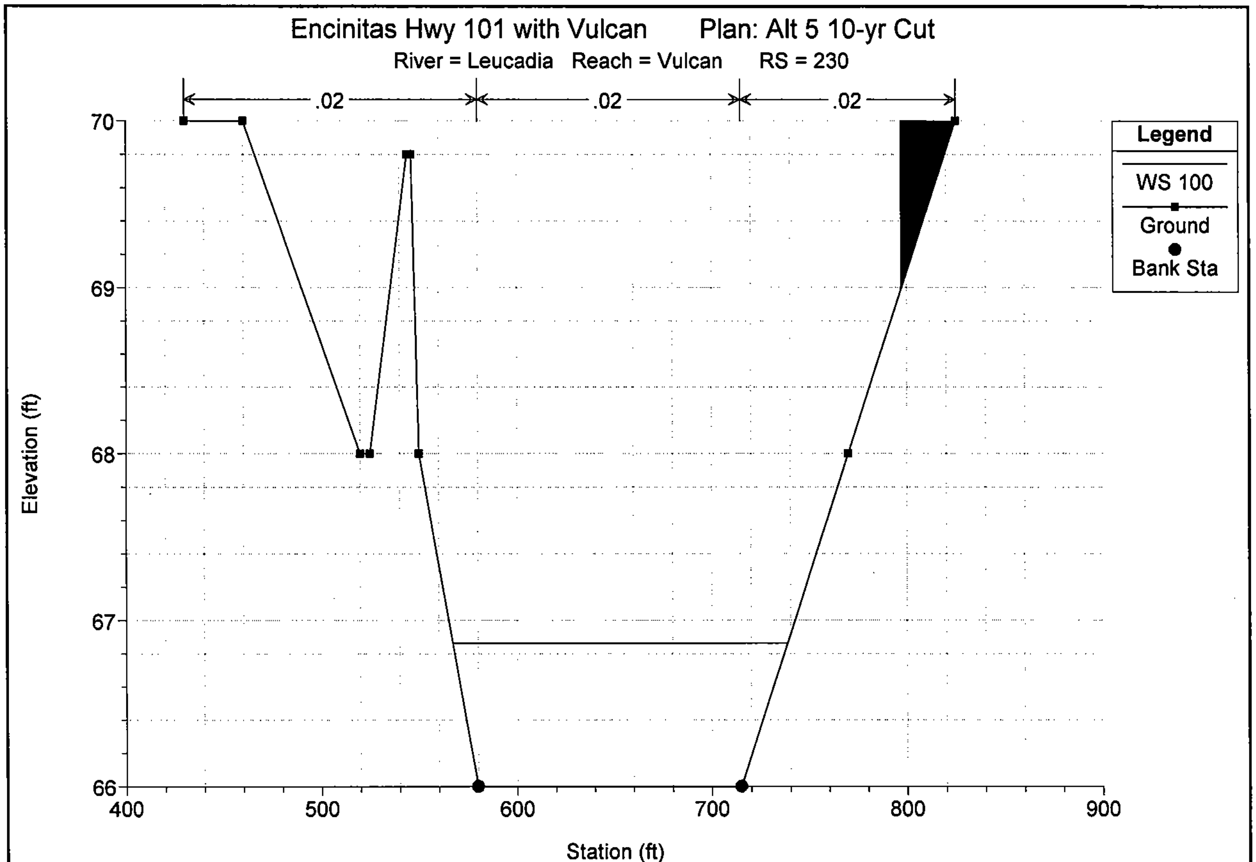

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 2300.24
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 2200.25
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 2100.26
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

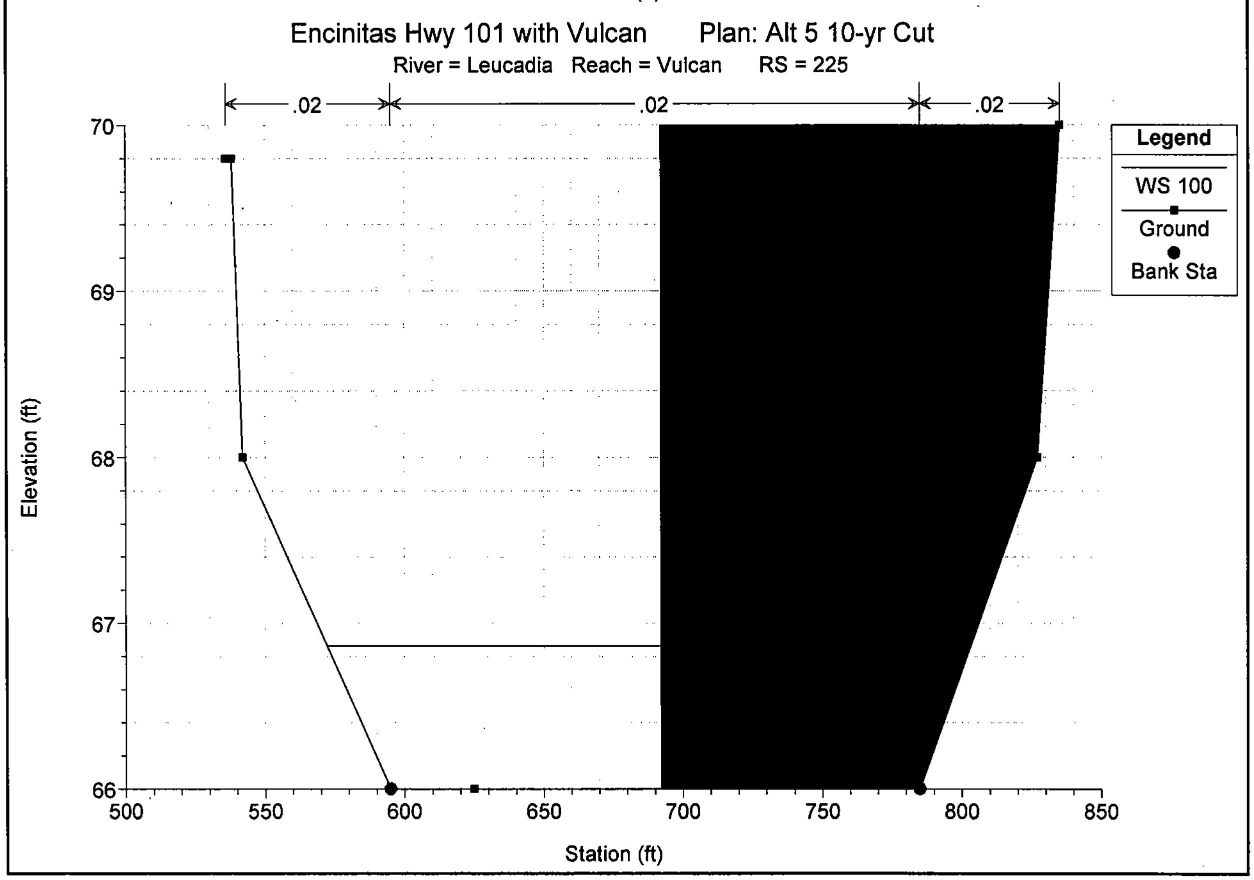

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 245
.03
.035
.03
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 240
.03
.035
.03
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
70
69
68
67
66
65
64
0
50
100
150
200
250

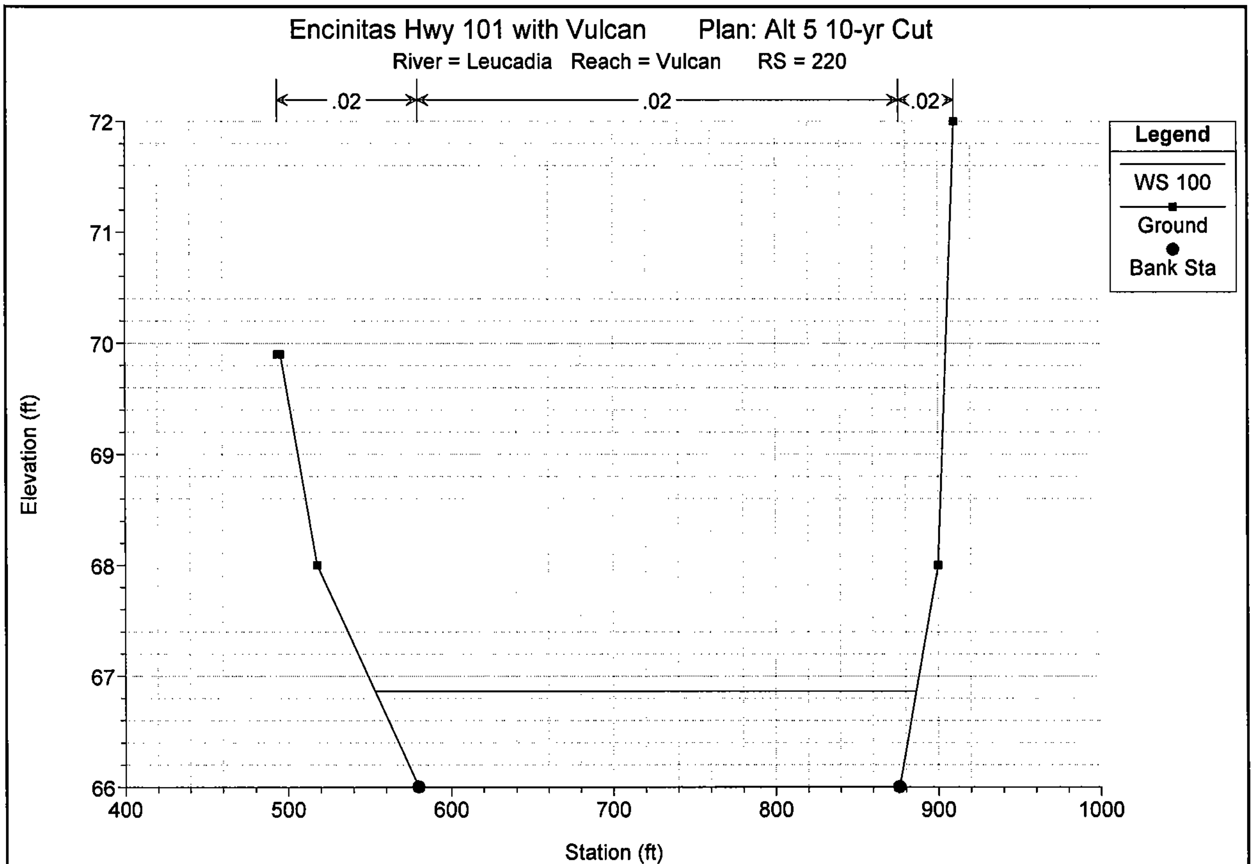

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 235
.03
.035
.03
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
70
69
68
67
66
0
50
100
150
200
250

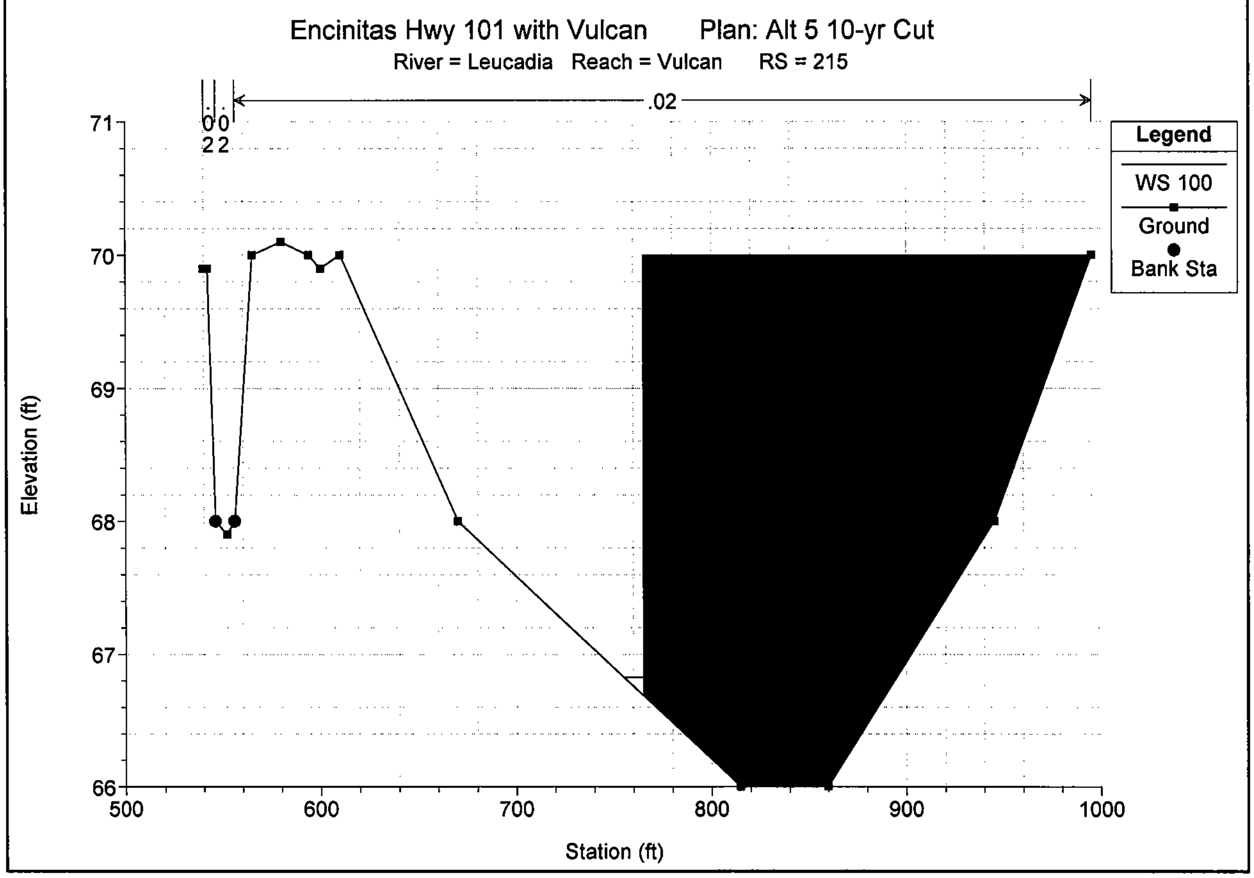


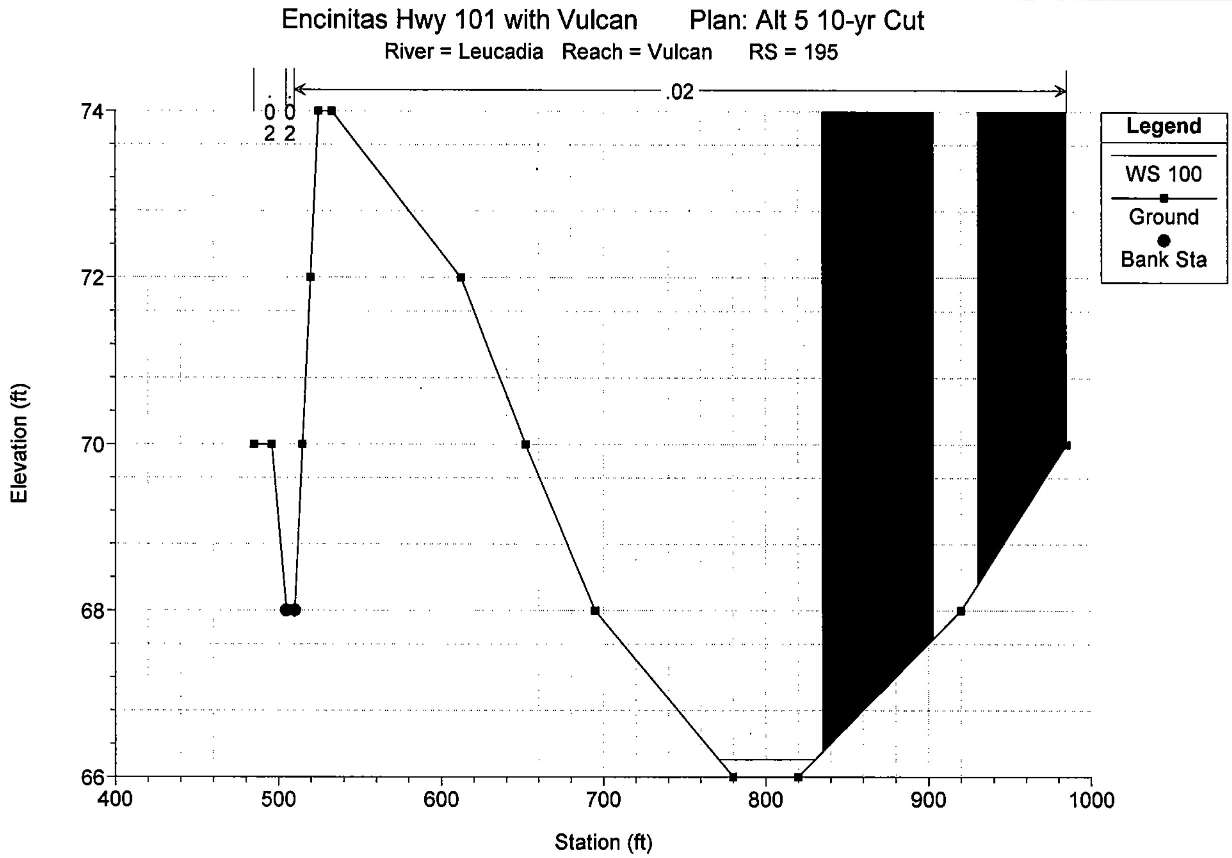
Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 230
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
70
69
68
67
66
400
500
600
700
800
900
Station (ft)

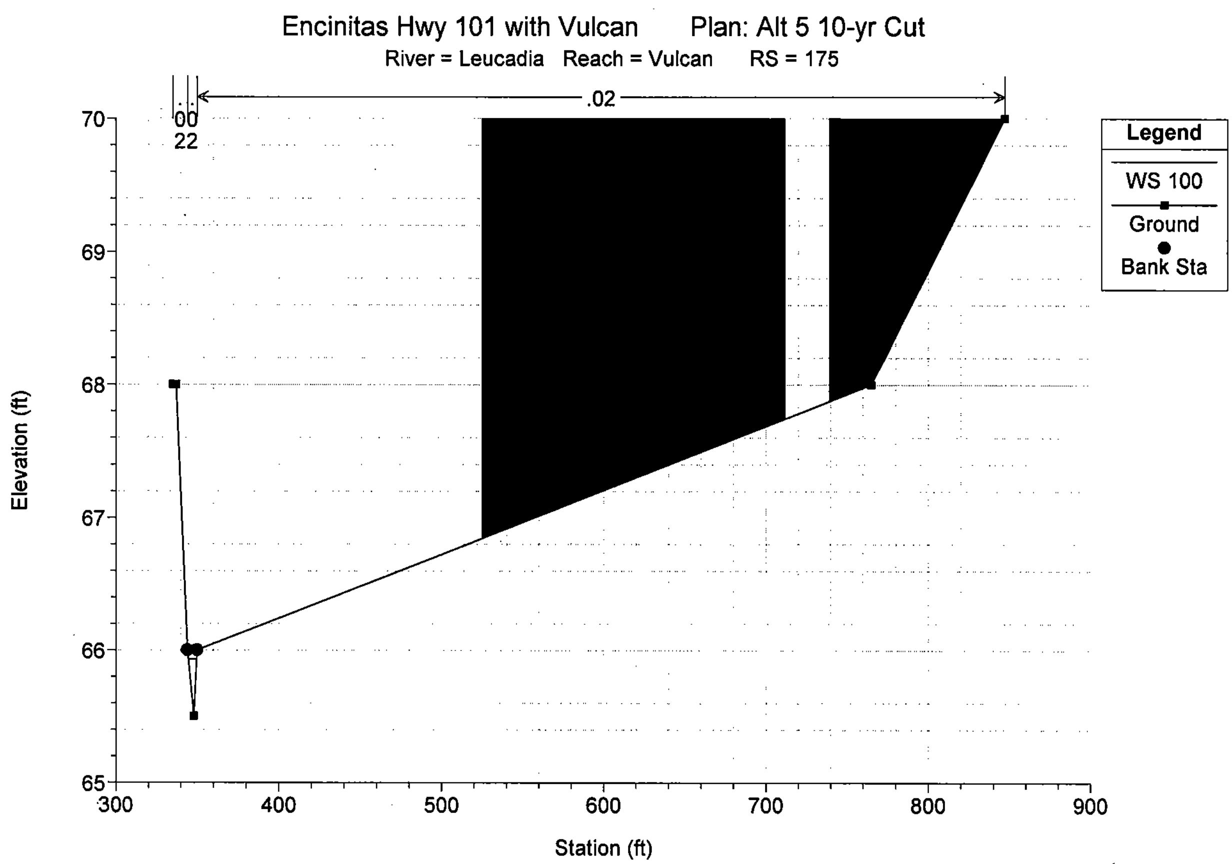


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 225
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
70
69
68
67
66
500
550
600
650
700
750
800
850
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 220
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
72
71
70
69
68
67
66
400
500
600
700
800
900
1000


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 215
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
71
70
69
68
67
66
500
600
700
800
900
1000


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 195
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
74
72
70
68
66
400
500
600
700
800
900
1000


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 175
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
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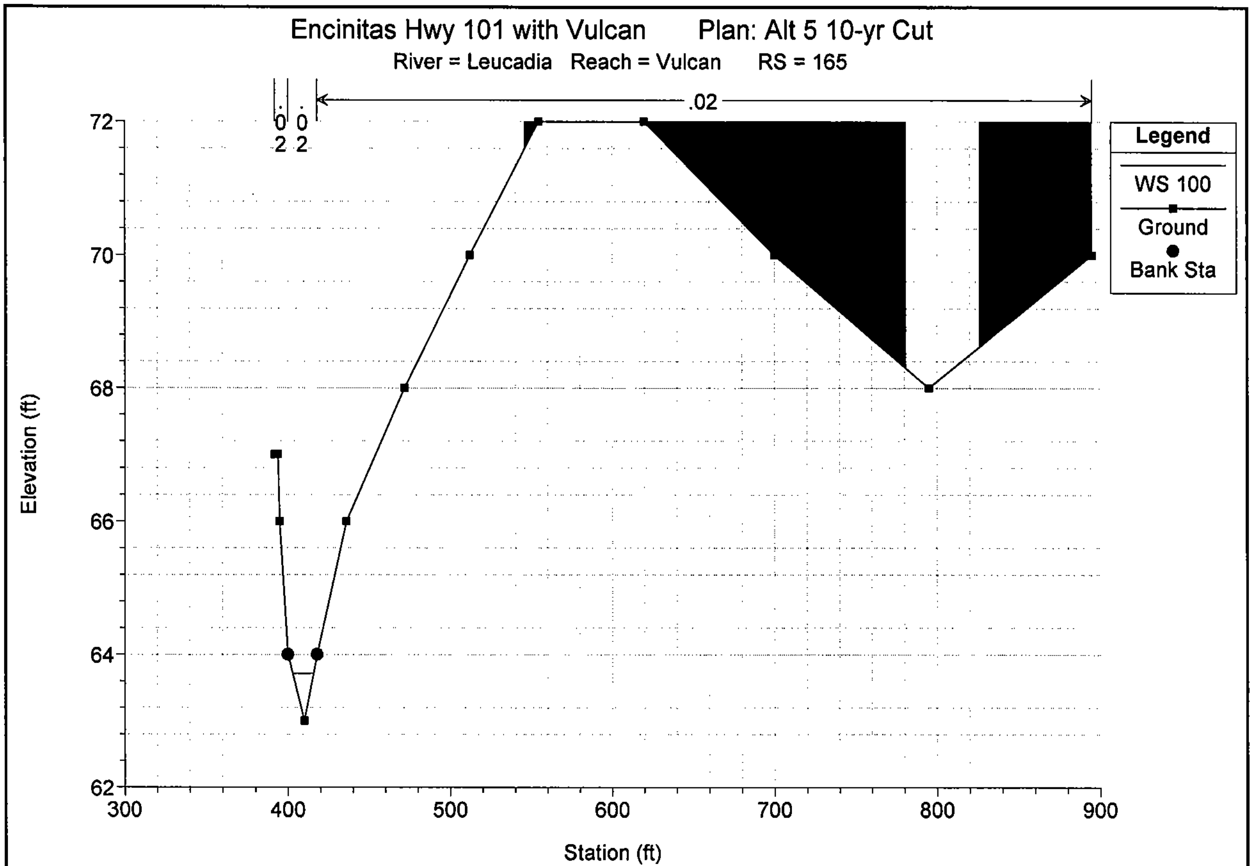
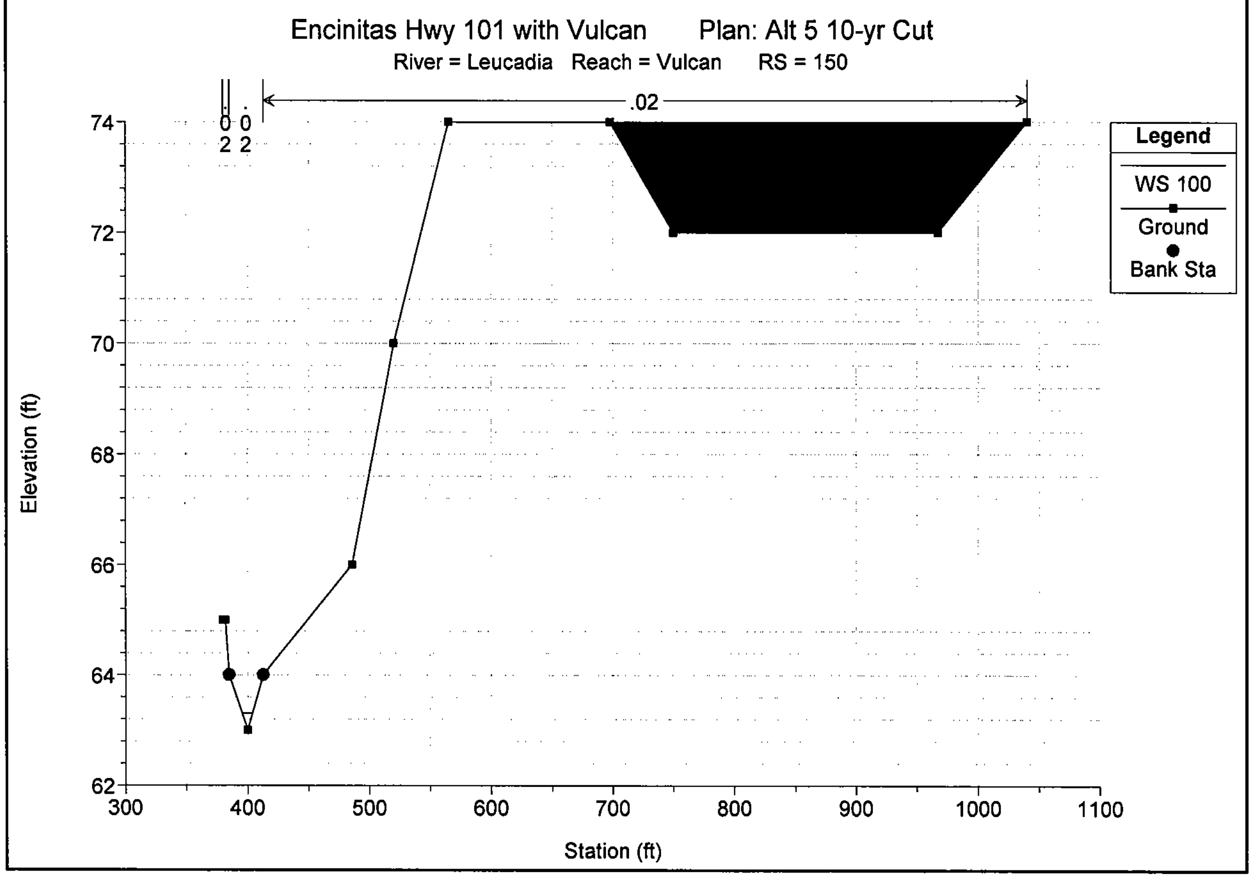
65
300
400
500
600
700
800
900


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 165
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
62
64
66
68
70
72
300
400
500
600
700
800
900


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Vulcan RS = 150
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
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66
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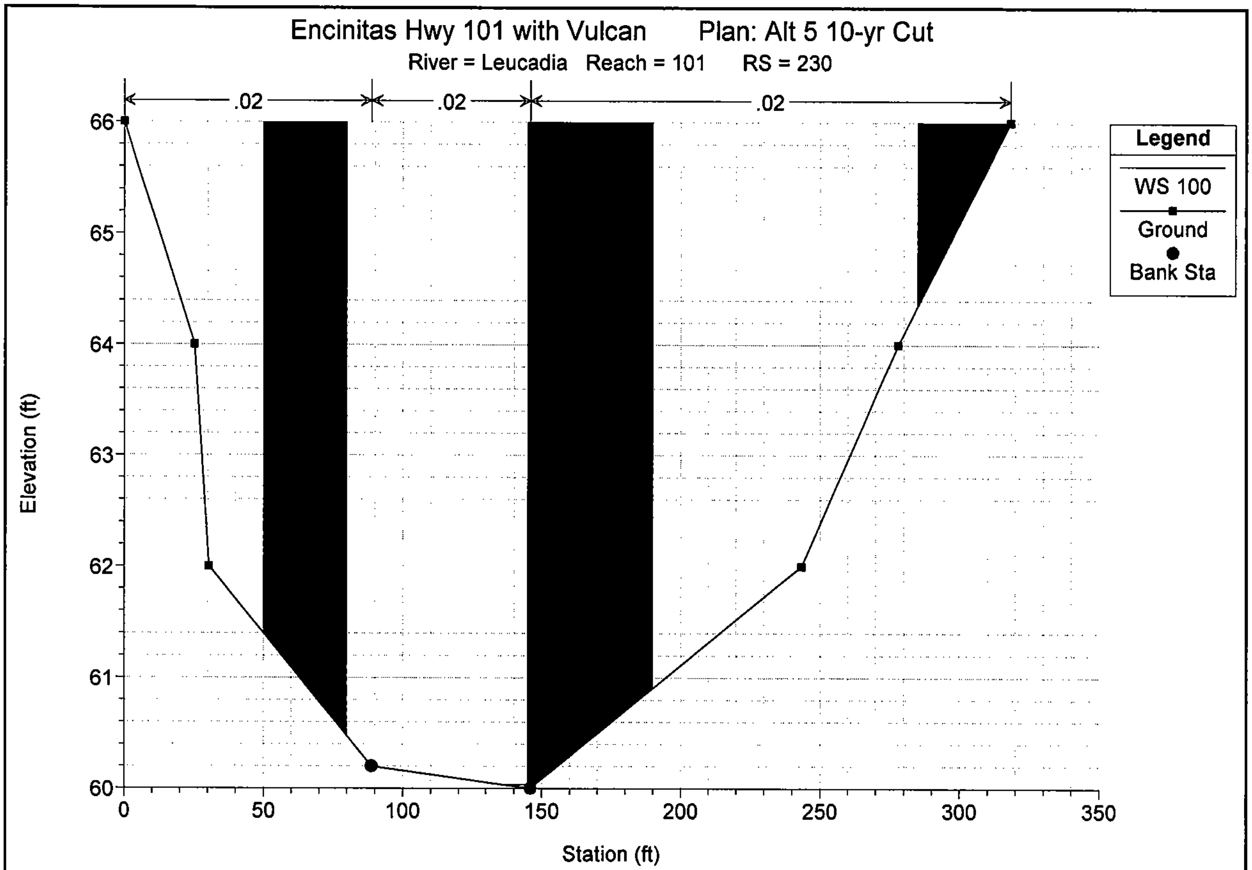
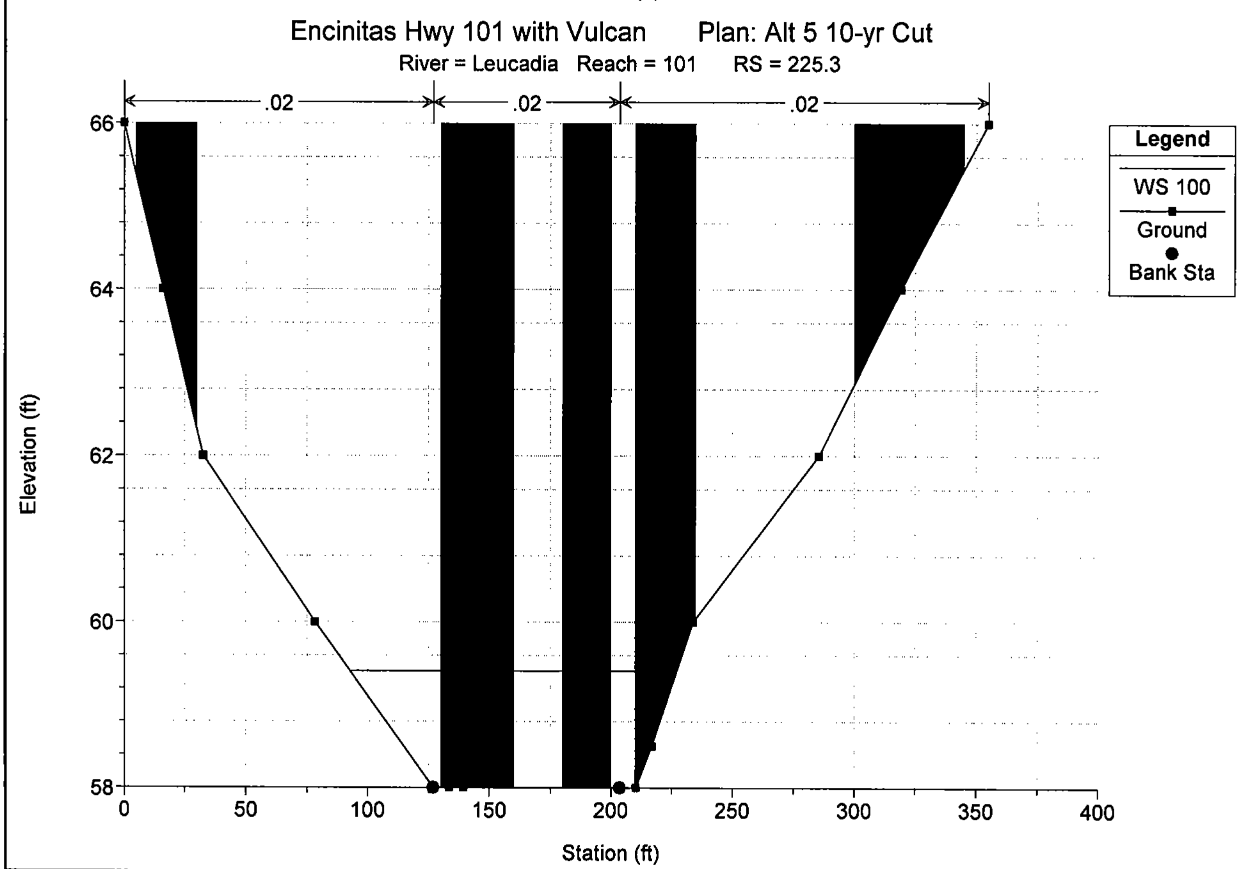
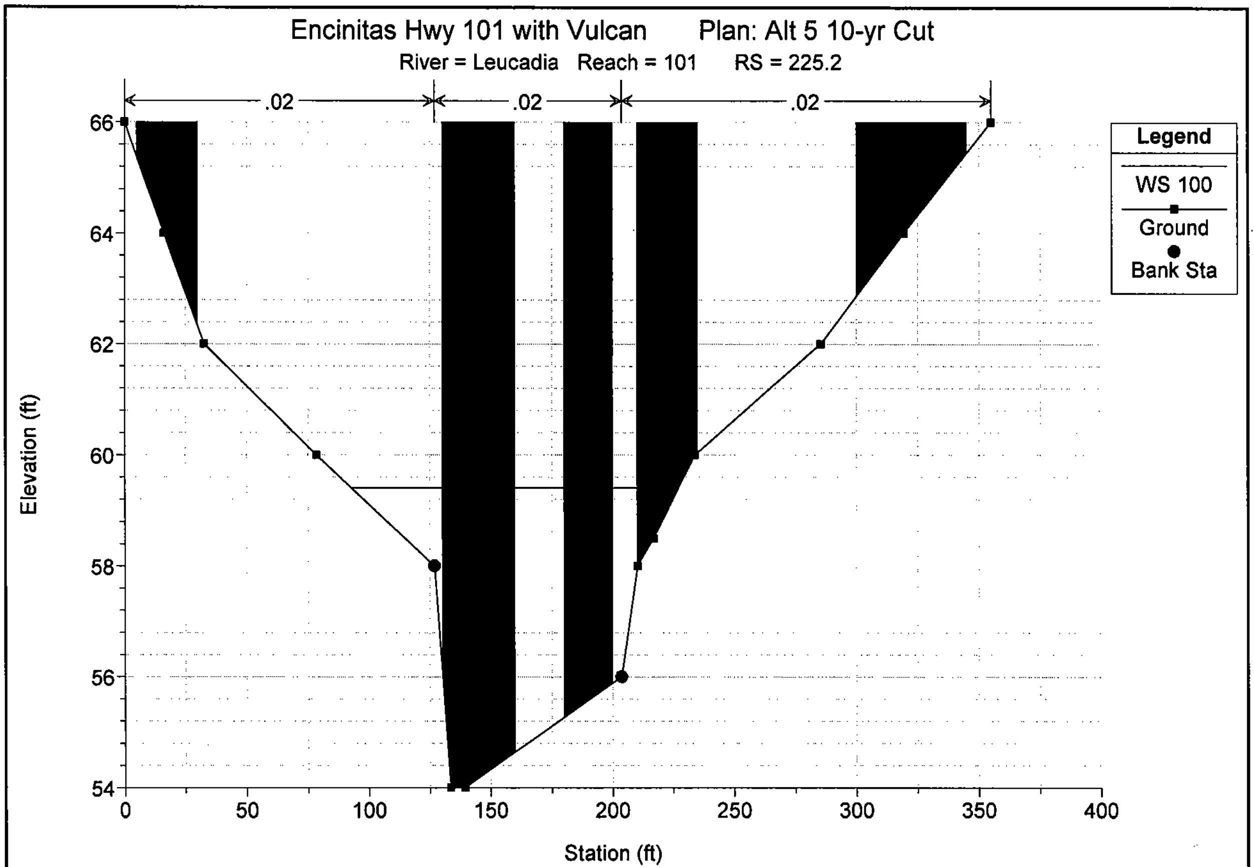
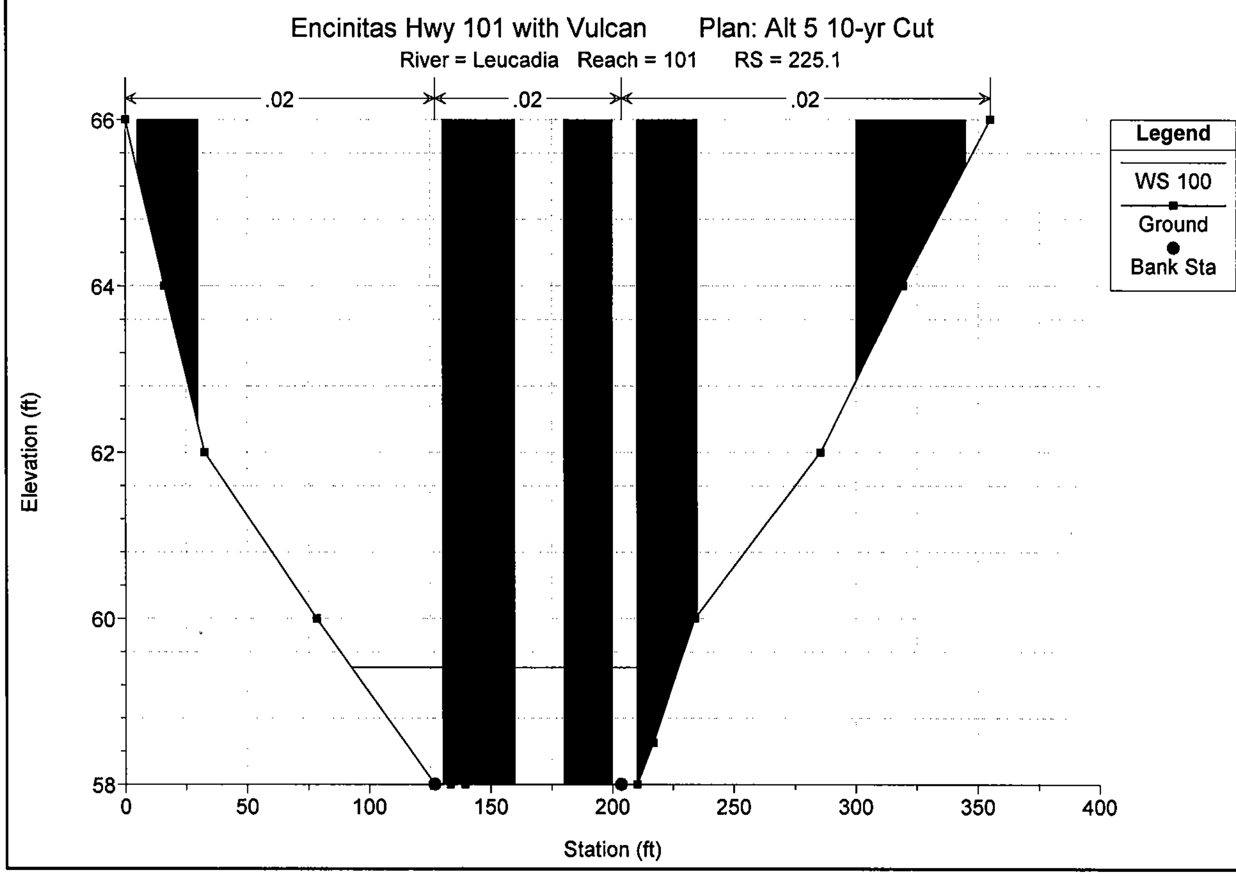
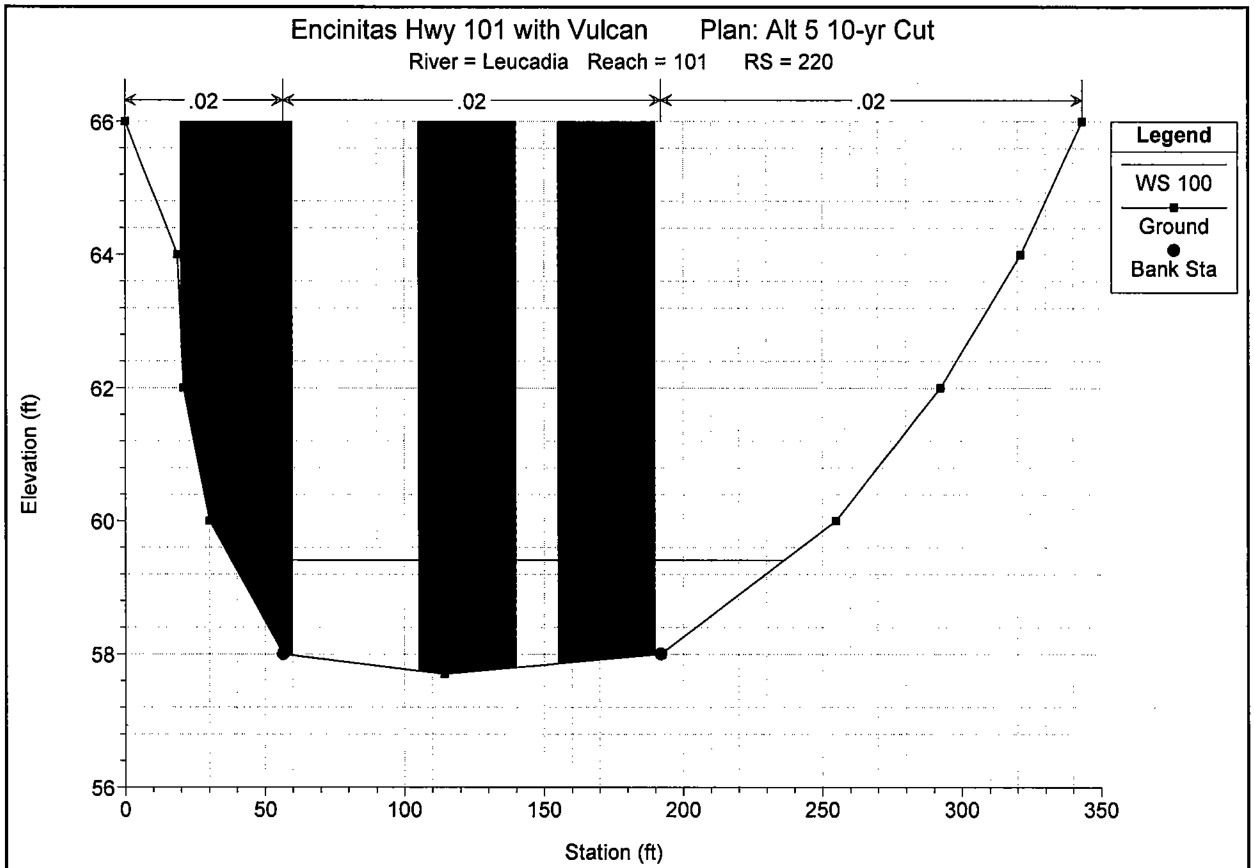
700
800
900
1000
1100

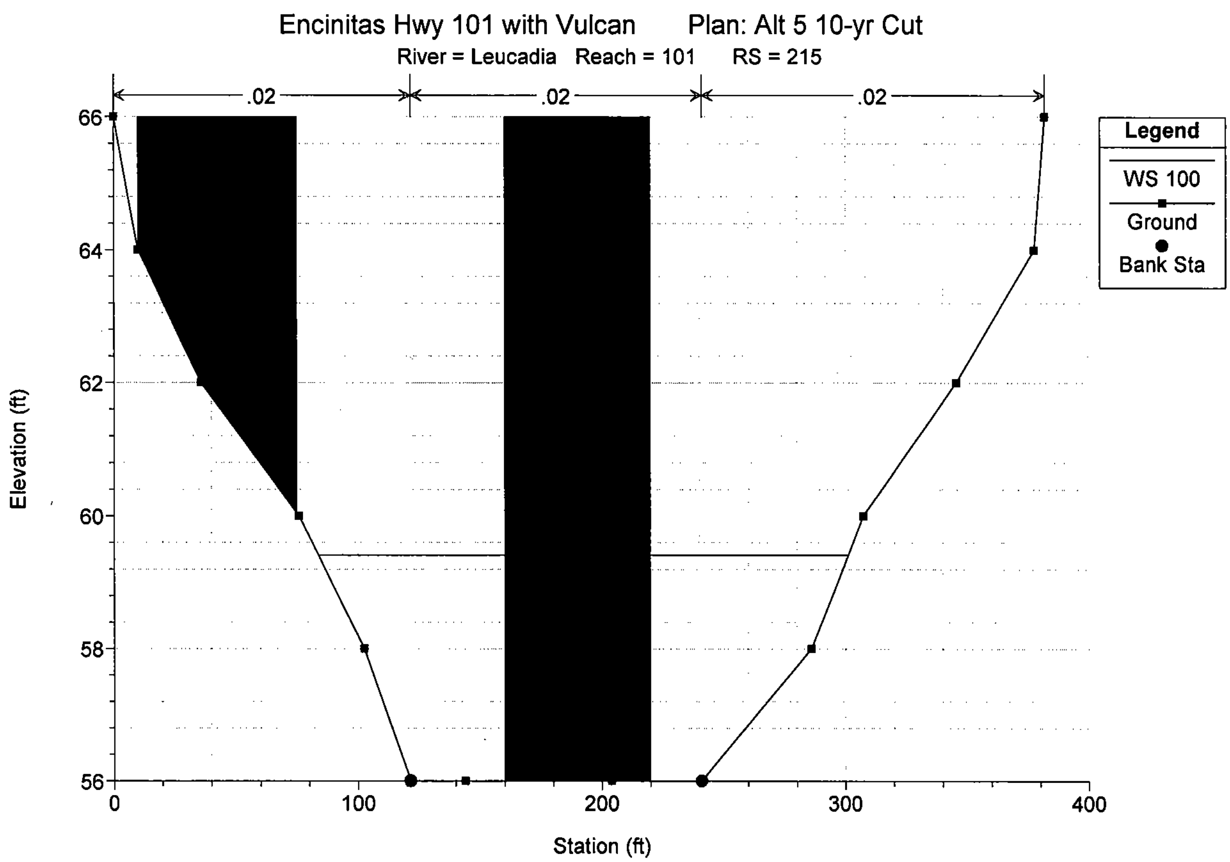

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 230
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
65
64
63
62
61
60
0
50
100
150
200
250
300
350

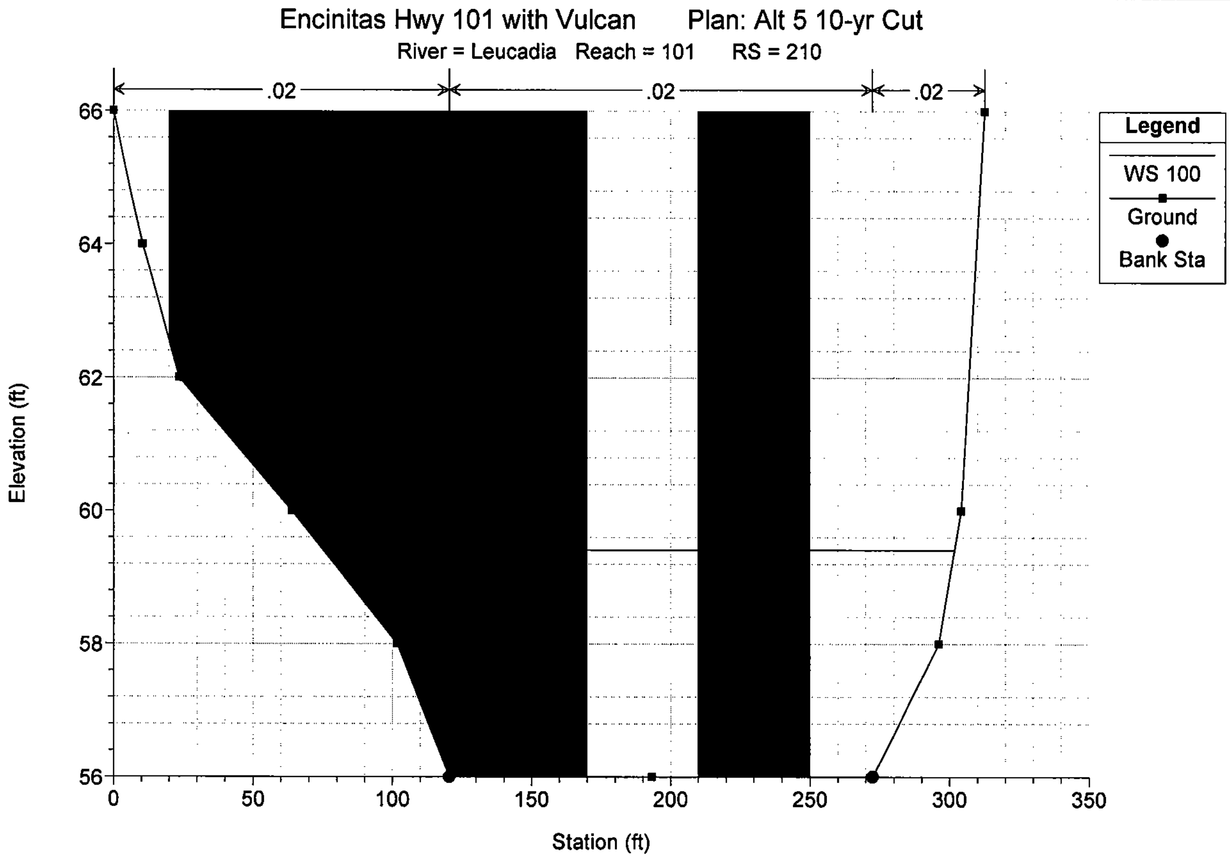

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 225.3
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
0
50
100
150
200
250
300
350
400


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 225.2
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
56
54
0
50
100
150
200
250
300
350
400

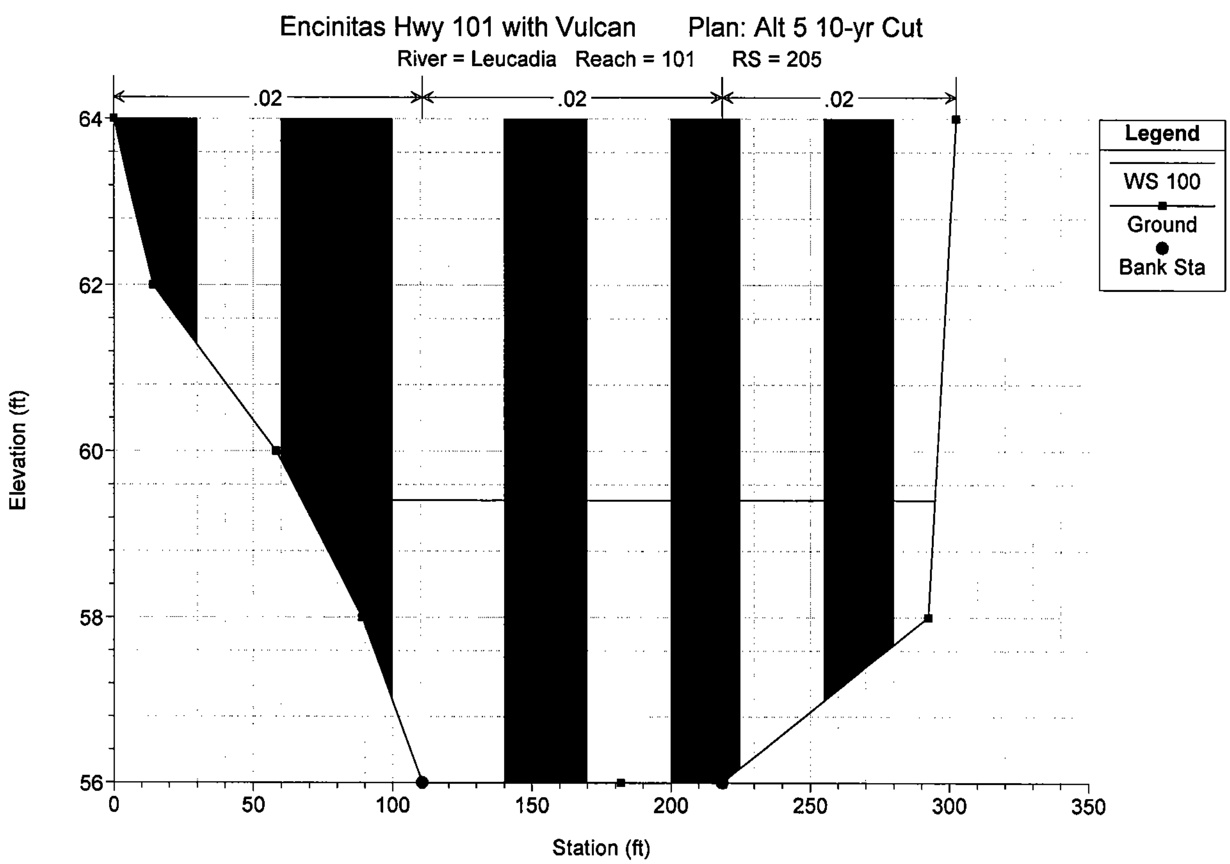

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 225.1
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
0
50
100
150
200
250
300
350
400


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 220
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
56
0
50
100
150
200
250
300
350

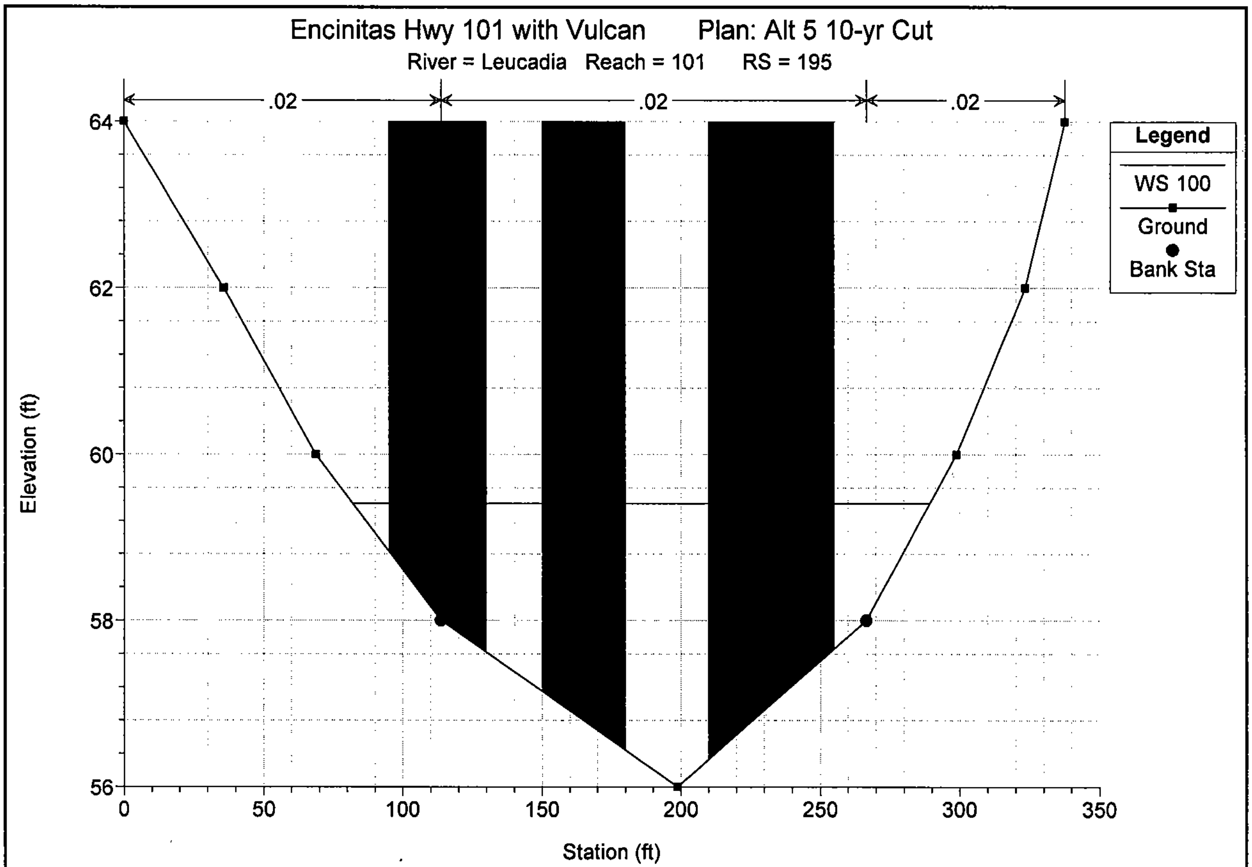

Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 215
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
56
0
100
200
300
400

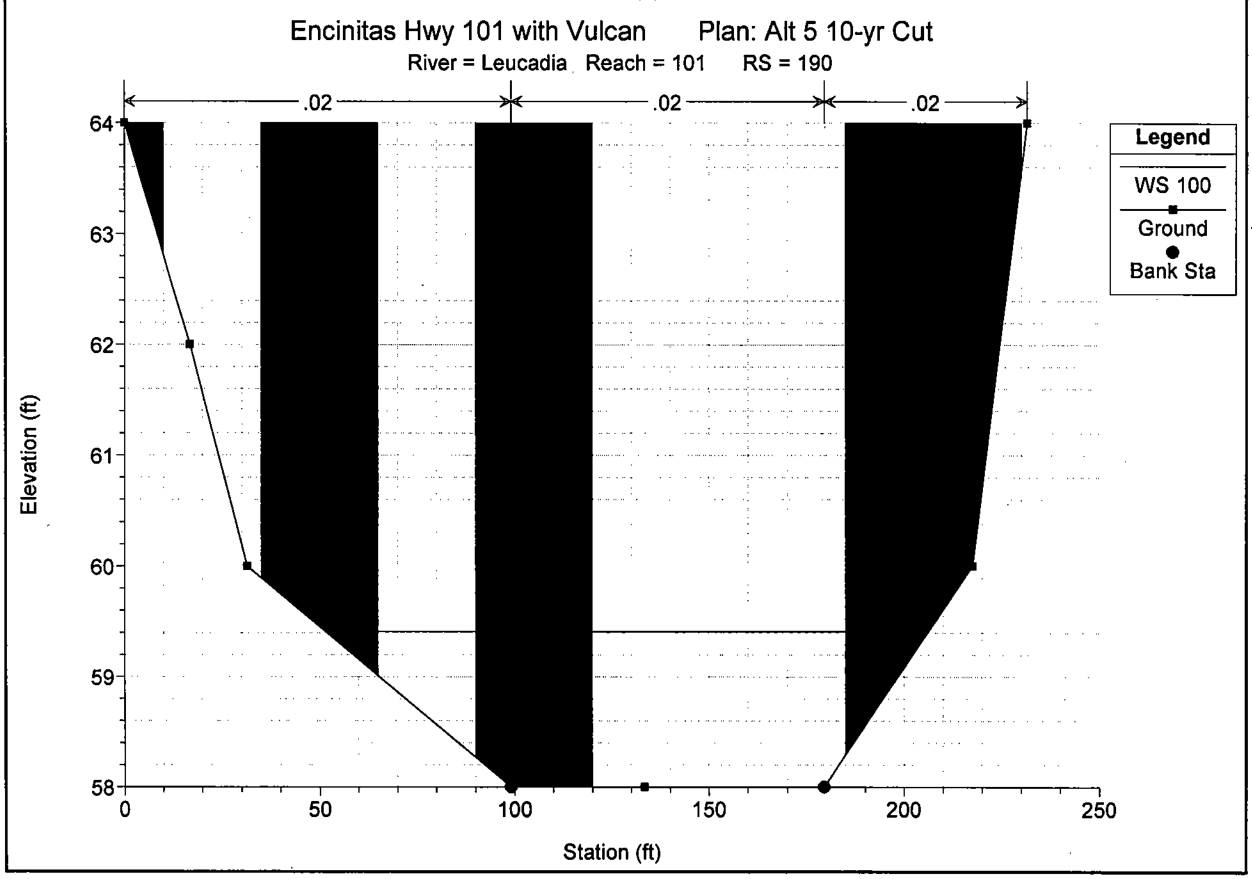


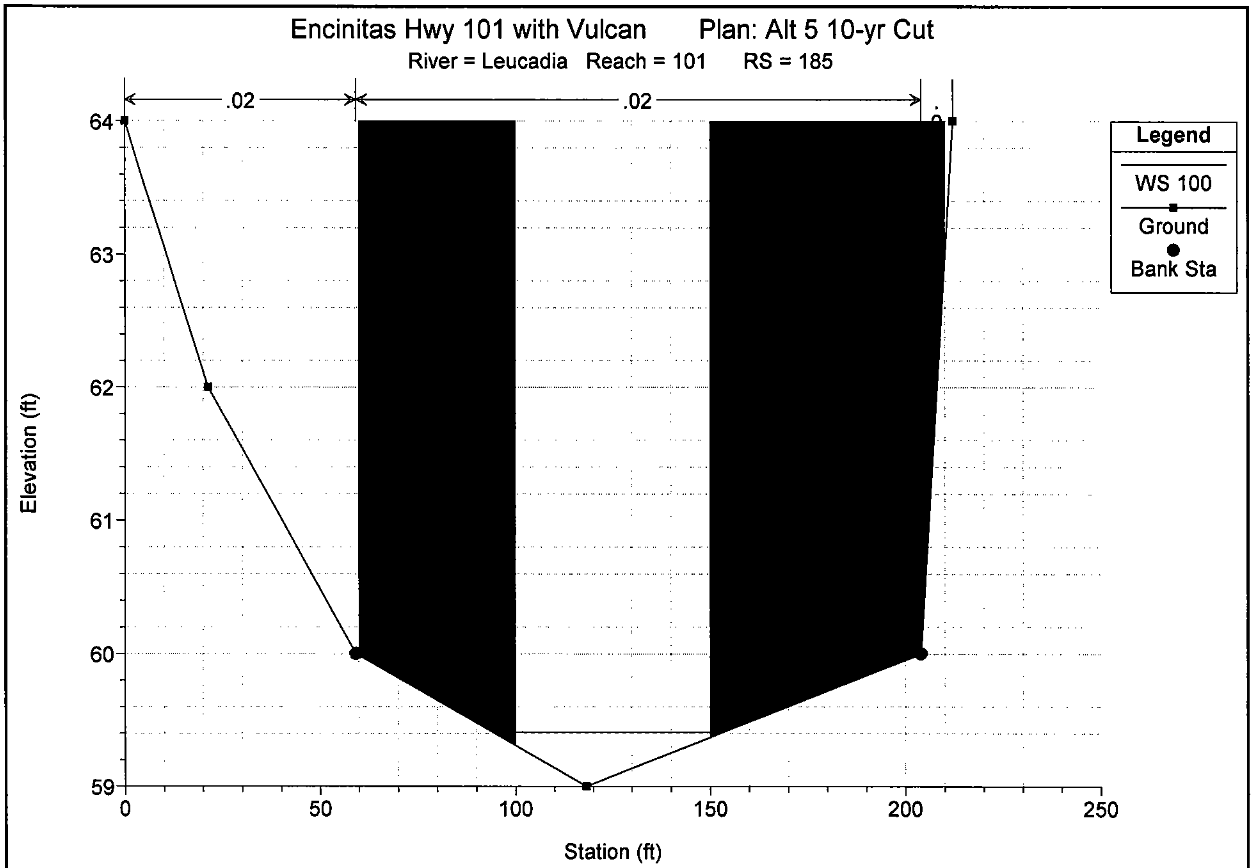
Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 210
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

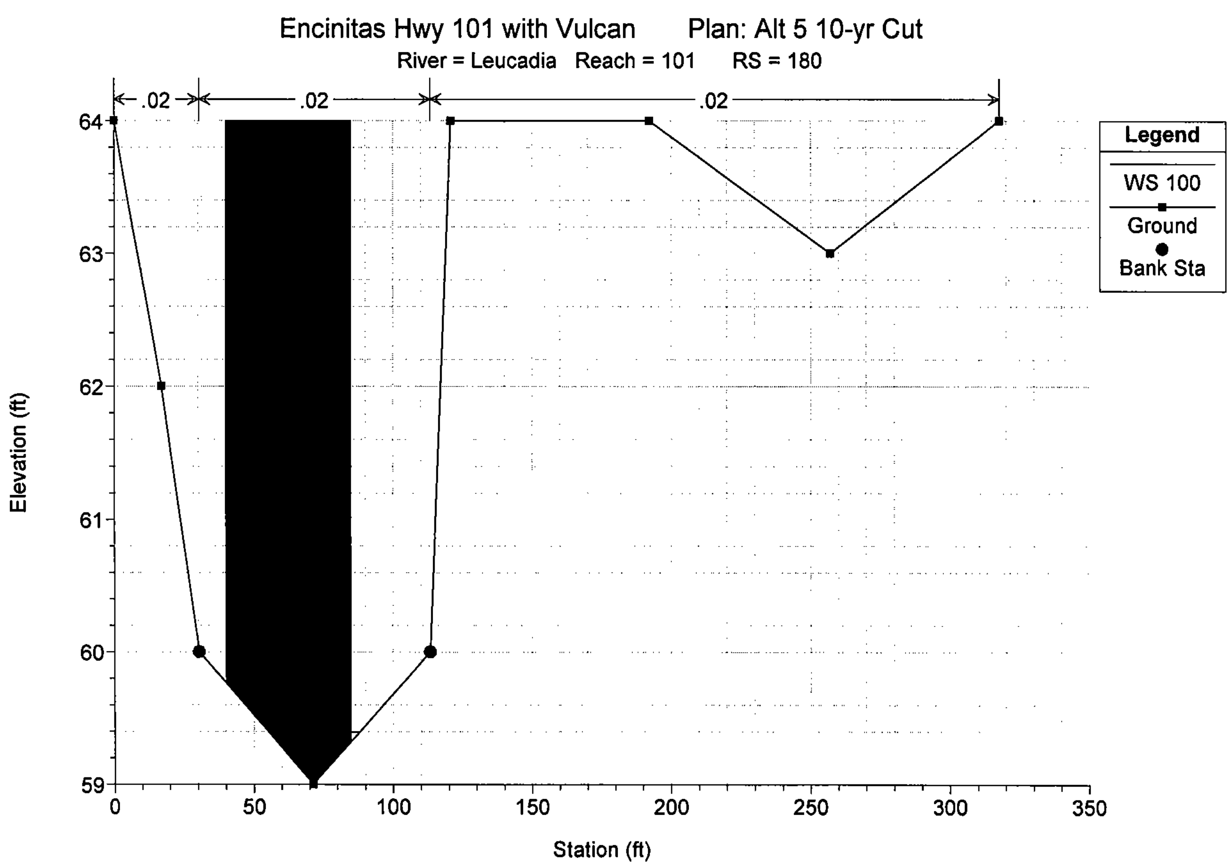


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 205
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 195
.02
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 190
.02
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta


Encinitas Hwy 101 with Vulcan   Plan: Alt 5 10-yr Cut
River = Leucadia   Reach = 101   RS = 185
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
63
62
61
60
59
0
50
100
150
200
250


Encinitas Hwy 101 with Vulcan   Plan: Alt 5 10-yr Cut
River = Leucadia   Reach = 101   RS = 180
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
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63
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61
60
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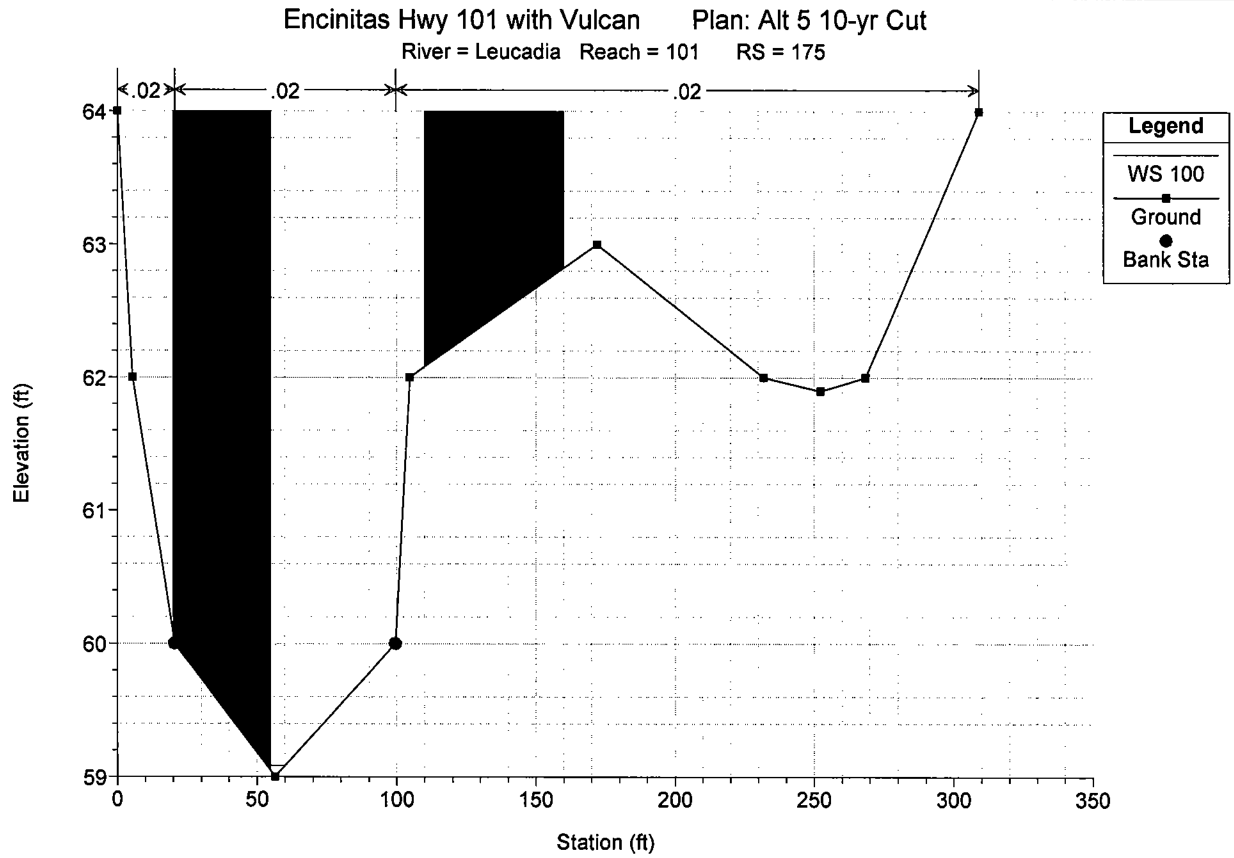
0
50
100
150
200
250
300
350



Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 175
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
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63
62
61
60
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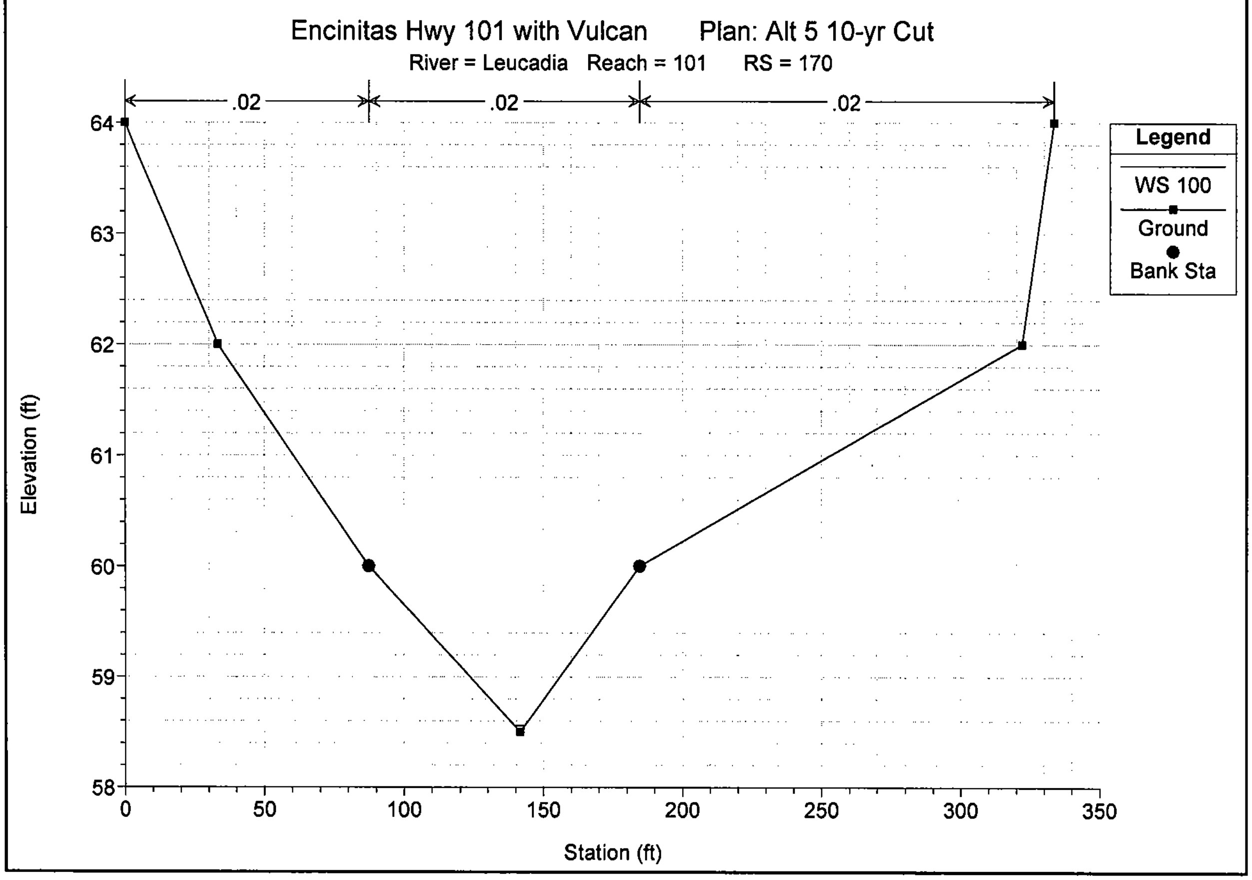
100
150
200
250
300
350



Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 170
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
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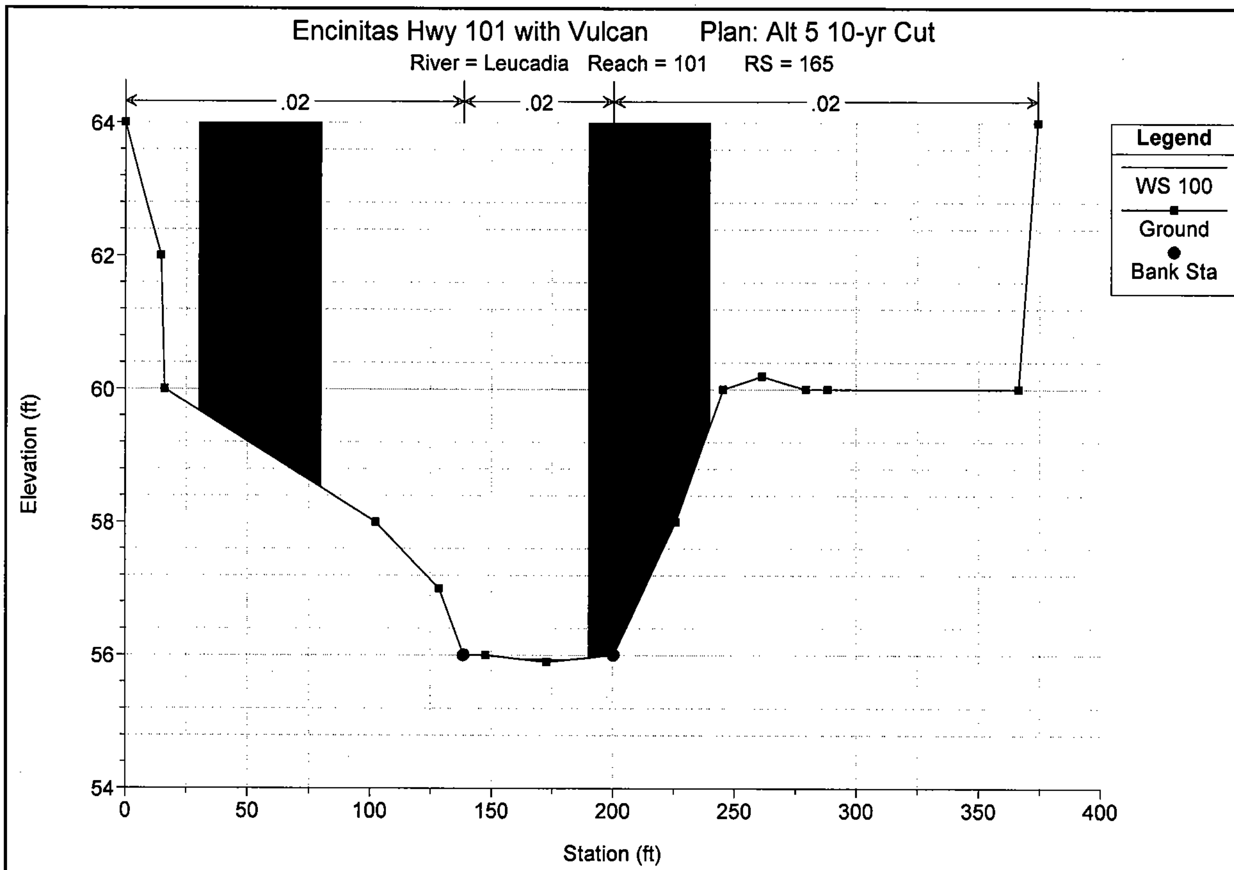
63
62
61
60
59
58
0
50
100
150
200
250
300
350


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 165
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
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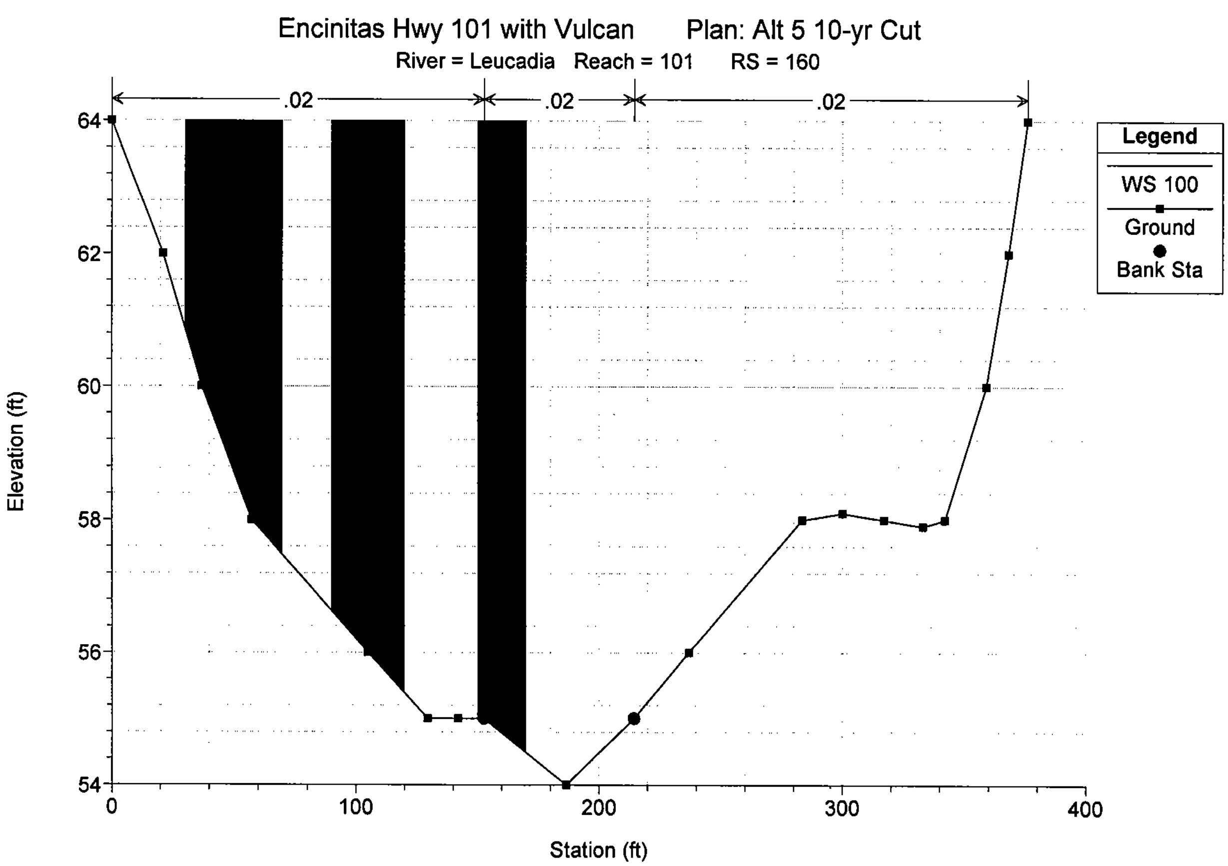
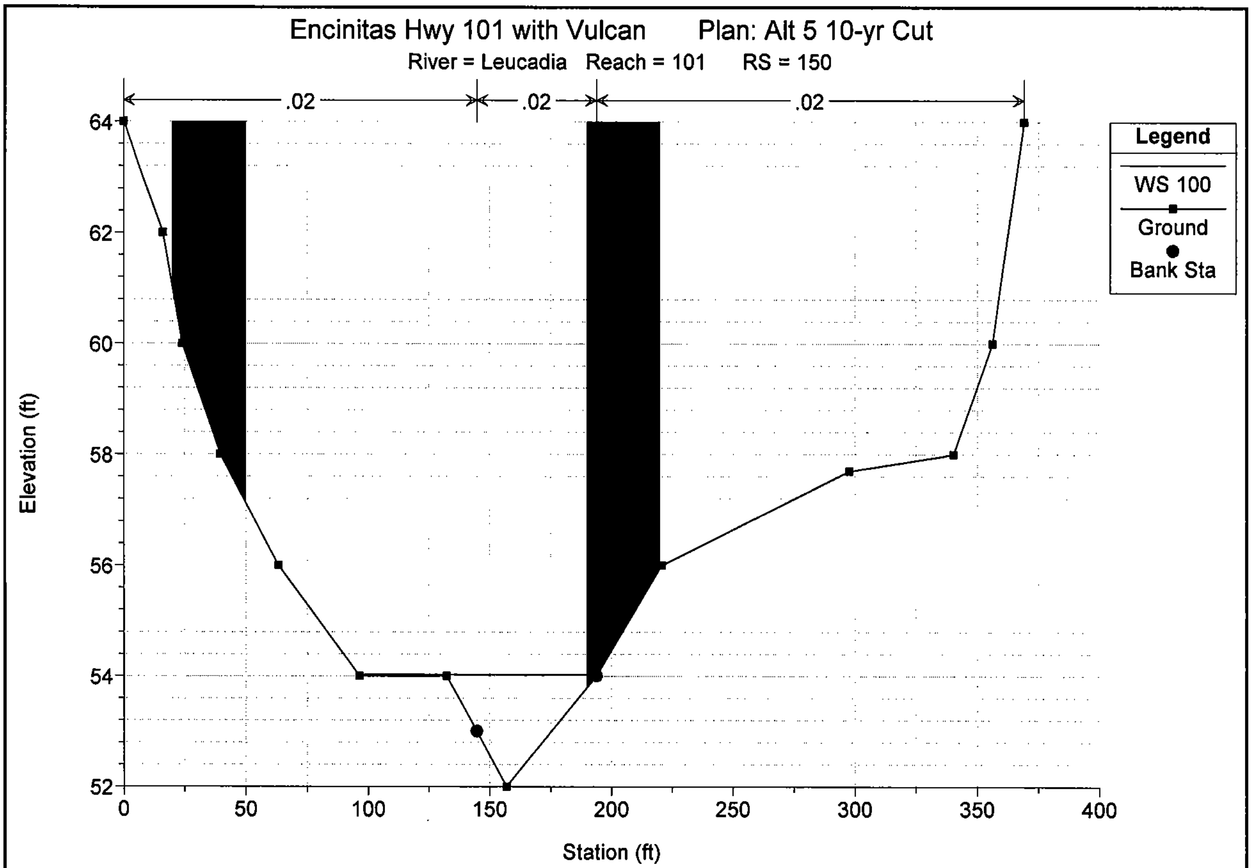
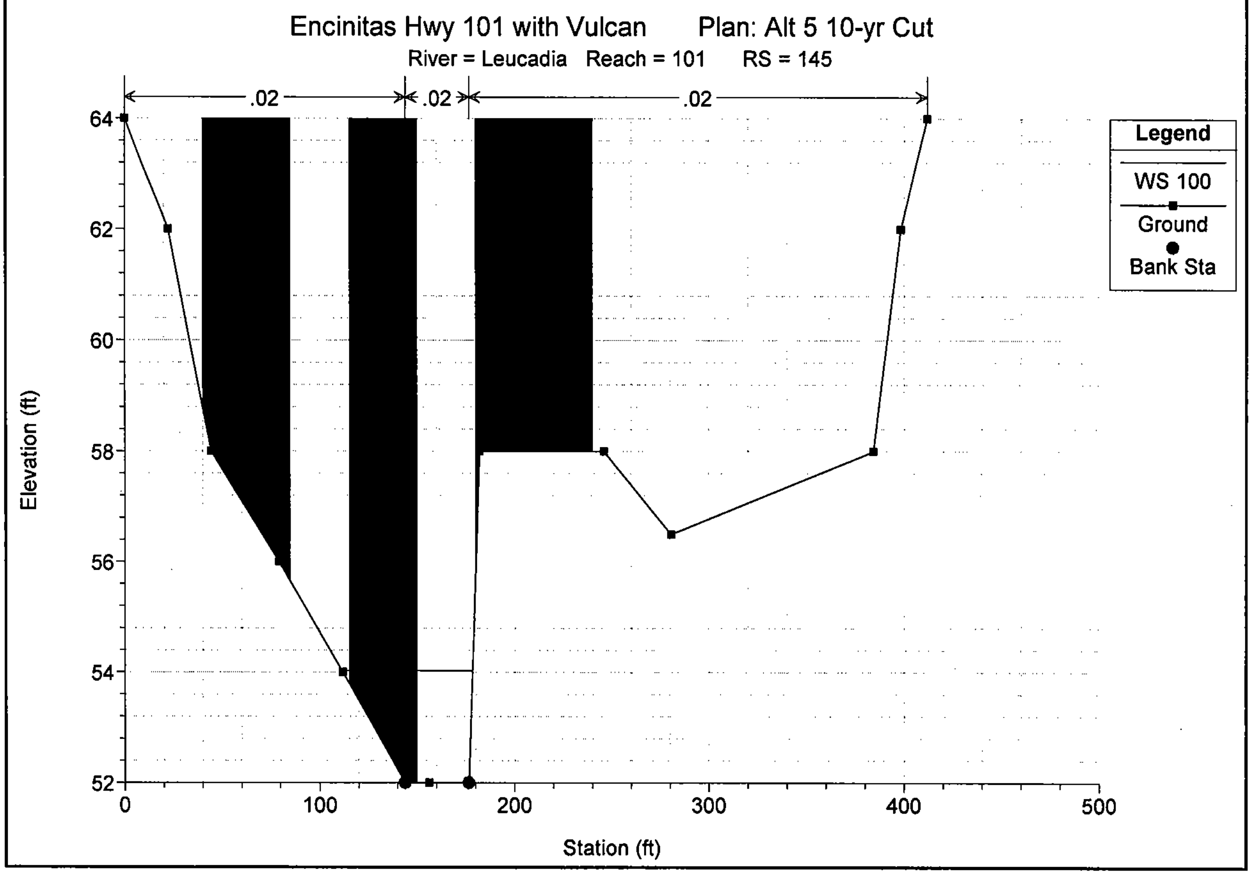
62
60
58
56
54
0
50
100
150
200
250
300
350
400
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 160
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
64
62
60
58
56
54
0
100
200
300
400
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 150
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = 101 RS = 145
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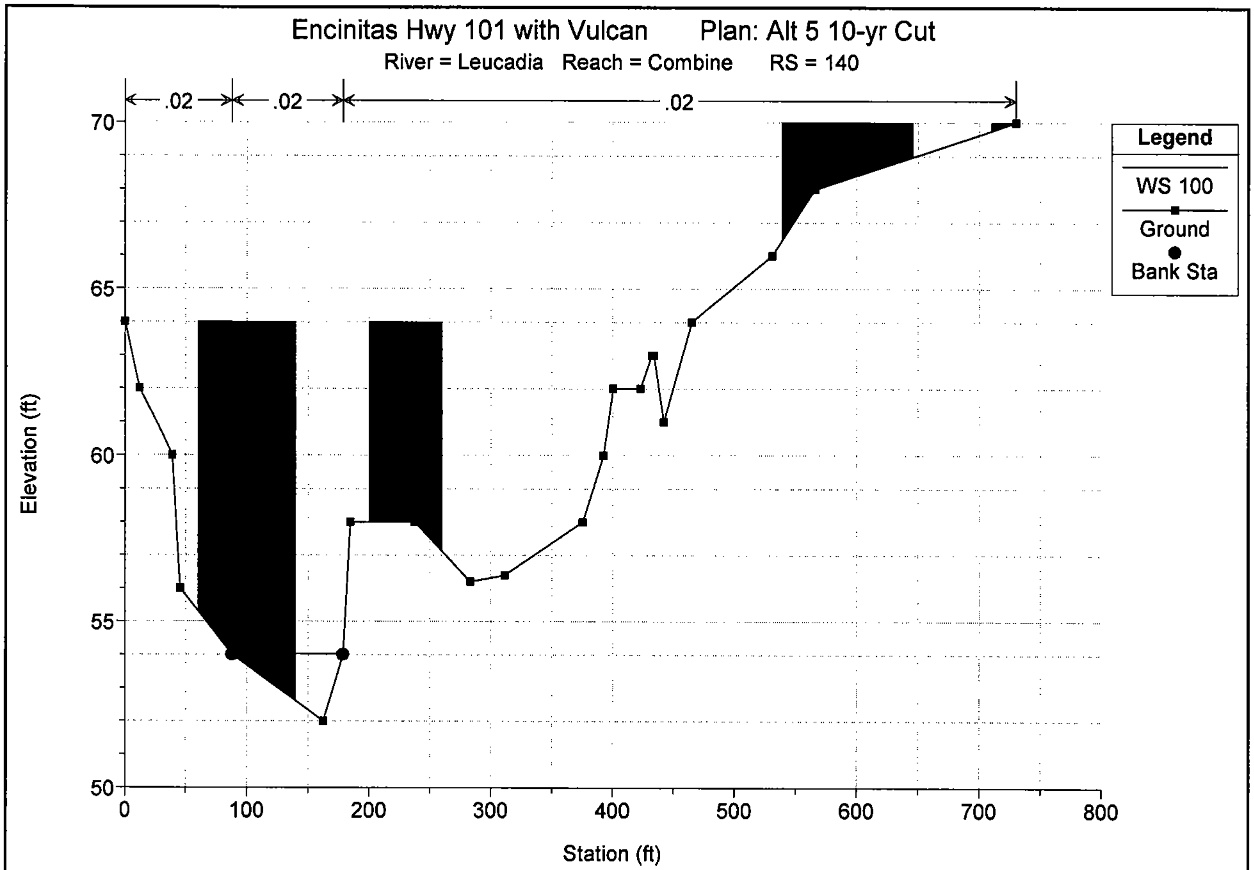
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Combine RS = 140
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
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60
55
50
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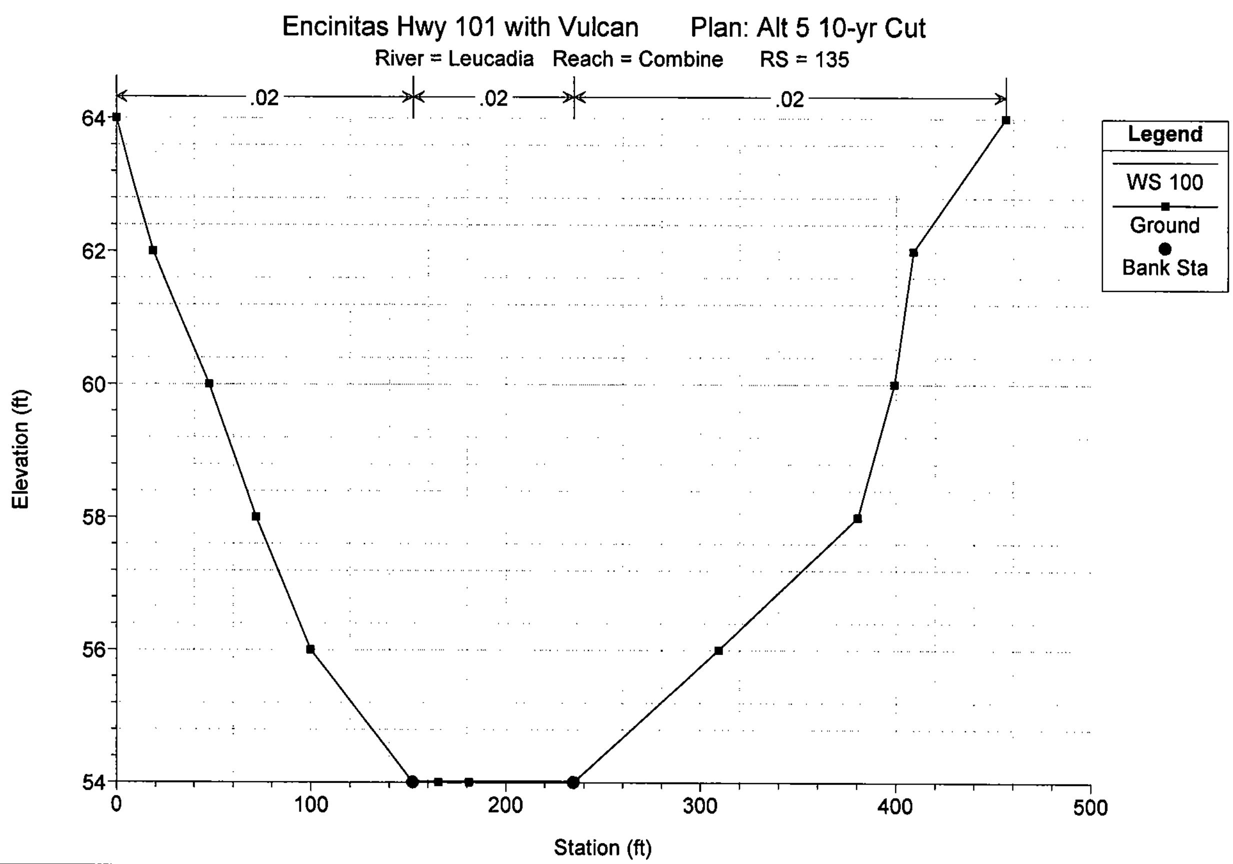
100
200
300
400
500
600
700
800


Encinitas Hwy 101 with Vulcan Plan: Alt 5 10-yr Cut
River = Leucadia Reach = Combine RS = 135
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
0
100
200
300
400
500

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

X     X  XXXXXX   XXXX        XXXX      XX      XXXX
X     X  X       X    X       X   X    X  X    X
X     X  X       X            X   X   X    X   X
XXXXXXX  XXXX    X       XXX  XXXX    XXXXXX    XXXX
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PROJECT DATA
Project Title: Encinitas Hwy 101 with Vulcan
Project File : 101Vul.prj
Run Date and Time: 1/24/2005 9:32:22 AM

Project in English units

Project Description:
ENCINITAS COAST HIGHWAY 101 -100-YR & 10-YR ANALYSIS
JN: 14413 DECEMBER 23,
2003
BASED ON HEC-2 FILENAME: ENC_1.HC2
X-SECTIONS LEFT TO RIGHT LOOKING
DOWNSTREAM

PLAN DATA

Plan Title: Alt 5 10-yr Cut
Plan File : w:\14413\Hec-Ras 101\101Vul.p08

Geometry Title: Alt 2 Option C Cut @ 135
Geometry File : w:\14413\Hec-Ras 101\101Vul.g01

Flow Title   : Alt 5 10-yr cut
Flow File   : w:\14413\Hec-Ras 101\101Vul.f24

Plan Description:
10-YEAR RUN** Includes blocked obstructions in alley
Varying Qs based on HEC-1
FN: 10A5.hc1
Extended XS from 95 down to encompas 100-yr floodplain
Vertical
Datum NAVD 88

Plan Summary Information:

Number of:					
	Cross Sections	= 44	Mulitple Openings	=	0
	Culverts	= 0	Inline Weirs	=	0
	Bridges	= 0			

Computational Information
- Water surface calculation tolerance = 0.003
- Critical depth calculaton tolerance = 0.003
- Maximum number of interations = 20
- Maximum difference tolerance = 0.1
- Flow tolerance factor = 0.001

Computation Options
- Critical depth computed only where necessary
- Conveyance Calculation Method: At breaks in n values only
- Friction Slope Method: Average Conveyance
- Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: Alt 5 10-yr cut
Flow File : w:\14413\Hec-Ras 101\101Vul.f24

Flow Data (cfs)

River	Reach	RS	100
Leucadia	Vulcan	3300.14	1
Leucadia	Vulcan	240	1
Leucadia	Vulcan	195	3
Leucadia	101	230	.1
Leucadia	101	225.3	.1
Leucadia	101	190	.1
Leucadia	Combine	140	1

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Leucadia	Vulcan	100	Critical	
Leucadia	101	100	Critical	
Leucadia	Combine	100		Normal S = .01

GEOMETRY DATA

Geometry Title: Alt 2 Option C Cut @ 135
Geometry File : w:\14413\Hec-Ras 101\101Vul.g01

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
Leucadia	Vulcan		Junction
Leucadia	101		Junction
Leucadia	Combine	Junction	

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3300.14

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	76.16	143	76.56	151	76.16	155	77.16	165	77.56
170	77.56	180	77.16	182.3	74.76	193.6	74.56	196	72.16
204	72.16	206.4	74.56	215.5	74.76	222	74	230	74
240	74.1	245	74	273	74	300	74.46	390	76
420	78								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 169.51 Elevation= 77.58

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3200.15

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

84	75.16	105	74.56	130	75.16	147	75.46	156	76.16
164	76.96	169	76.96	175	76.16	180.6	74.66	192.8	74.46
196	71.16	204	71.16	207.2	74.46	217	74.66	223	74
230	74	235	74.1	242	74	260	74	273	74
300	74.47	388	76	437	78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
84	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 168.69 Elevation= 76.98

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3100.16

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
95	74.06	118	73.66	126	74.16	139	75.06	154	75.16
160	76.16	164	76.76	169	76.76	175	76.16	179.6	74.96
192	74.76	196	70.76	204	70.76	208	74.76	210.7	75.36
230	75.15	403	76	456	78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
95	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 168.28 Elevation= 76.79

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3000.17

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
89	72.66	130	73.16	142	74.06	151	74.16	158	75.16
165	75.96	170	75.96	176	75.16	179.6	74.46	192	74.26
196	70.26	204	70.26	208	74.26	221.38	74.78	423	76
476	78								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
89	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 169.98 Elevation= 76

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2900.18

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
122	71.16	154	73.16	157	74.16	161	75.16	165	75.36
170	75.36	174	75.16	175.4	74.06	192	73.76	196	69.76
204	69.76	208	73.76	217.41	74.2	459	76	515	78

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
122	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 169.51 Elevation= 75.38

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2800.19

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
70	70.06	113	69.46	126	70.16	150	71.16	155	73.16
160	74.16	164	74.66	169	74.66	174	74.16	175.1	73.56
192	73.26	196	69.26	204	69.26	208	73.26	225	74.16
456	76	523	78						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
70	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 168.93 Elevation= 74.71

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2700.20

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
125	68.16	139	68.86	146	69.16	150	70.16	154	71.16
160	73.16	165	73.86	170	73.86	175	73.16	176.2	72.26
192	71.96	196	67.96	204	67.96	208	71.96	212.73	72.57
258	74	423	76	535	78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
125	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 170.68 Elevation= 73.86

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2600.21

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
109	66.46	135	66.46	146	68.16	152	69.16	155	70.16
157	71.16	162	73.16	165	73.26	170	73.26	173	73.16
181	71.16	185.1	70.06	192	69.96	196	65.96	204	65.96
208	69.96	215.42	70.99	237	72	286	74	456	76

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
109	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 170.09 Elevation= 73.26

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2500.22

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
139	65.16	150	68.16	158	71.16	165	72.76	170	72.76
175	71.16	182	69.16	184	68.66	192	68.46	196	64.46
204	64.46	208	68.46	213.55	69.25	233	70	266	72
320	74	498	76						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
139	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 170.09 Elevation= 72.78

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2400.23

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
95	65.56	142	65.16	160	71.16	165	72.46	170	72.46
175	71.16	180	70.16	183	68	192	67.9	194.8	68.16
202	67.96	206	63.96	214	63.96	218	67.96	221.32	68.78
250	70	263	72	360	74				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
95	.03	206	.035	214	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
206	214	100	100	100	.1	.3

Left Levee Station= 169.39 Elevation= 72.47

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2300.24

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2	64.46	129	64.46	141	65.16	160	71.16	165	71.86
170	71.86	175	71.16	185	68.16	190	67	195.2	67.66
202	67.46	206	63.46	214	63.46	218	67.46	221.7	68.36
260	70	316	72	382	74				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
2	.03	206	.035	214	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
206	214	100	100	100	.1	.3

Left Levee Station= 170.56 Elevation= 71.89

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2200.25

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
140	64.16	160	71.16	165	71.46	170	71.46	172	71.16
182	68.16	184.7	66.86	192.3	66.76	196	62.96	204	62.96
207.7	66.76	217	66.86	260	68	287	70	342	72

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
140	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 170.39 Elevation= 71.43

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2100.26

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
144	63.16	164	71.16	165	71.36	170	71.36	175	71.16
182	68.16	186	66	188.3	64.96	193.6	64.86	196	62.46
204	62.46	206.4	64.86	217	65.06	234	66	240	66.1
245	66	248	65.9	252	66	286	68	322	70

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
144	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	15	15	15	.1	.3

Left Levee Station= 169.8 Elevation= 71.43

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 245

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	10	70	16	68	24	66	30	64
40	64	70	66	80	66	87	66	122	68
180	70								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	30	.035	40	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30	40	175	175	175	.1	.3

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 240

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	70	5	70	10	68	20	66	27	64
39	64	89	66	185	68	230	70		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	27	.035	39	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
27	39	275	275	275	.1	.3

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 235

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	68	10	68	15	66	140	66	205	68
246	70								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.03	15	.035	140	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
15	140	120	120	120	.1	.3

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 230

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
430	70	460	70	520	68	525	68	544	69.8
546	69.8	550	68	580	66	715	66	770	68
825	70								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
430	.02	580	.02	715	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
580	715	175	180	185	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
797	825	70

```
CROSS SECTION          RIVER: Leucadia
REACH: Vulcan             RS: 225

INPUT
Description:
Station Elevation Data    num=       8
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     536     69.8      538     69.8      542       68      595       66      625       66
     785       66      827       68      835       70

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
     536      .02      595      .02      785      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           595     785             190     185     185               .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
     692     835      70

CROSS SECTION          RIVER: Leucadia
REACH: Vulcan             RS: 220

INPUT
Description:
Station Elevation Data    num=       7
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     494     69.9      496     69.9      518       68      580       66      876       66
     900       68      910       72

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
     494      .02      580      .02      876      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           580     876             175     175     175               .1       .3

CROSS SECTION          RIVER: Leucadia
REACH: Vulcan             RS: 215

INPUT
Description:
Station Elevation Data    num=      15
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     540     69.9      542     69.9      546       68      552     67.9      556       68
     565       70      580     70.1      594       70      600     69.9      610       70
     670       68      815       66      860       66      945       68      995       70

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
     540      .02      546      .02      556      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           546     556             290     290     290               .1       .3
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
     765     995      70

CROSS SECTION          RIVER: Leucadia
REACH: Vulcan             RS: 195

INPUT
Description:
Station Elevation Data    num=      15
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     485       70      496       70      505       68      510       68      515       70
     520       72      525       74      533       74      612       72      652       70
     695       68      780       66      820       66      920       68      985       70

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
     485      .02      505      .02      510      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
           505     510             340     340     340               .1       .3
```

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
835	903	74	930	985	74

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 175

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
335	68	337	68	344	66	348	65.5	350	66
765	68	847	70						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
335	.02	344	.02	350	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
344	350	225	220	220	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
525	712	70	739	847	70

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 165

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
392	67	394	67	395	66	400	64	410	63
418	64	436	66	472	68	512	70	555	72
620	72	700	70	795	68	895	70		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
392	.02	400	.02	418	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
400	418	360	360	360	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
546	781	72	826	895	72

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 150

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
380	65	382	65	385	64	400	63	413	64
486	66	520	70	565	74	698	74	750	72
967	72	1040	74						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
380	.02	385	.02	413	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
385	413	305	305	305	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
606	1040	74

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 230

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	25.4	64	30.5	62	88.9	60.2	146	60
243.4	62	278	64	318.4	66				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	88.9	.02	146	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
88.9	146	104.1	100.2	136.3	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
50	80	66	145	190	66	285	350	66

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 225.3

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	16	64	32.6	62	78.4	60	126.9	58
133.4	58	139.4	58	203.7	58	210.3	58	216.8	58.5
233.9	60	285.5	62	319.2	64	355	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	126.9	.02	203.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
126.9	203.7	5	5	5	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
5	30	66	130	160	66	180	200	66
210	235	66	300	345	66			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 225.2

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	16	64	32.6	62	78.4	60	126.9	58
133.4	54	139.4	54	203.7	56	210.3	58	216.8	58.5
233.9	60	285.5	62	319.2	64	355	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	126.9	.02	203.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
126.9	203.7	5	5	5	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
5	30	66	130	160	66	180	200	66
210	235	66	300	345	66			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 225.1

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	16	64	32.6	62	78.4	60	126.9	58
133.4	58	139.4	58	203.7	58	210.3	58	216.8	58.5
233.9	60	285.5	62	319.2	64	355	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	126.9	.02	203.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
126.9	203.7	134.2	131.9	133.3	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
5	30	66	130	160	66	180	200	66
210	235	66	300	345	66			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 220

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	18.9	64	21	62	30.1	60	56.5	58
114.4	57.7	192	58	255	60	292.4	62	321.2	64
343.3	66								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	56.5	.02	192	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
56.5	192	222.7	215.1	206.1	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
20	60	66	105	140	66	155	190	66

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 215

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	10	64	35.7	62	75.9	60	102.5	58
121.6	56	143.9	56	204.1	56	241	56	286	58
307.5	60	345.4	62	377.3	64	381.6	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	121.6	.02	241	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
121.6	241	78.2	80.6	89.6	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
10	75	66	160	220	66

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 210

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	10.4	64	23.6	62	63.8	60	101.7	58
120.4	56	193.3	56	272.5	56	296.1	58	304.2	60
312.7	66								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	120.4	.02	272.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
120.4	272.5	47.1	45.4	64.5	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
20	170	66	210	250	66

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 205

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	14	62	58.3	60	89	58	110.7	56
182	56	218.5	56	292.3	58	302.4	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	110.7	.02	218.5	.02

```
Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
         110.7    218.5               141.2   142.6    152.6                .1        .3
Blocked Obstructions       num=        5
   Sta L     Sta R      Elev    Sta L     Sta R      Elev     Sta L     Sta R      Elev
       0        30        64       60       100        64       140       170        64
     200       225        64      255       280        64

CROSS SECTION              RIVER: Leucadia
REACH: 101                    RS: 195

INPUT
Description:
Station Elevation Data     num=         9
     Sta      Elev       Sta     Elev       Sta      Elev       Sta      Elev       Sta      Elev
       0        64      35.6       62      68.6        60     113.8        58     198.9        56
   266.6        58     298.8       60     323.4        62     337.5        64

Manning's n Values         num=         3
     Sta     n Val       Sta    n Val       Sta     n Val
       0       .02     113.8      .02     266.6       .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
         113.8    266.6               143.6   102.4     81.7                .1        .3
Blocked Obstructions       num=        3
   Sta L     Sta R      Elev    Sta L     Sta R      Elev     Sta L     Sta R      Elev
      95       130        64      150       180        64       210       255        64

CROSS SECTION              RIVER: Leucadia
REACH: 101                    RS: 190

INPUT
Description:
Station Elevation Data     num=         8
     Sta      Elev       Sta     Elev       Sta      Elev       Sta      Elev       Sta      Elev
       0        64      16.8       62      31.4        60      99.1        58     133.4        58
   179.5        58     217.5       60     231.5        64

Manning's n Values         num=         3
     Sta     n Val       Sta    n Val       Sta     n Val
       0       .02      99.1      .02     179.5       .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
          99.1    179.5               109.2    93.8      106                .1        .3
Blocked Obstructions       num=        4
   Sta L     Sta R      Elev    Sta L     Sta R      Elev     Sta L     Sta R      Elev
       0        10        64       35        65        64        90       120        64
     185       230        64

CROSS SECTION              RIVER: Leucadia
REACH: 101                    RS: 185

INPUT
Description:
Station Elevation Data     num=         6
     Sta      Elev       Sta     Elev       Sta      Elev       Sta      Elev       Sta      Elev
       0        64      21.3       62      59.2        60     118.2        59     204.1        60
   212.1        64

Manning's n Values         num=         3
     Sta     n Val       Sta    n Val       Sta     n Val
       0       .02      59.2      .02     204.1       .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
          59.2    204.1                56.4    82.7    111.4                .1        .3
Blocked Obstructions       num=        2
   Sta L     Sta R      Elev    Sta L     Sta R      Elev
      60       100        64      150       210        64

CROSS SECTION              RIVER: Leucadia
REACH: 101                    RS: 180

INPUT
Description:
Station Elevation Data     num=         9
     Sta      Elev       Sta     Elev       Sta      Elev       Sta      Elev       Sta      Elev
```

```
       0        64        17        62      30.5        60      71.4        59     113.4        60
   120.7        64     192.2        64     257.1        63     317.6        64

Manning's n Values          num=        3
     Sta     n Val       Sta     n Val       Sta     n Val
       0       .02      30.5       .02     113.4       .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
          30.5    113.4              83.8     85.3    85.6                .1         .3
Blocked Obstructions       num=       2
   Sta L    Sta R     Elev    Sta L    Sta R     Elev
      40       85       64      130      190       64

CROSS SECTION            RIVER: Leucadia
REACH: 101                  RS: 175

INPUT
Description:
Station Elevation Data      num=       11
     Sta      Elev       Sta      Elev       Sta      Elev       Sta      Elev       Sta      Elev
       0        64       5.6        62      20.6        60      56.6        59      99.6        60
   104.6        62       172        63       232        62     252.5      61.9     268.5        62
   309.1        64

Manning's n Values          num=        3
     Sta     n Val       Sta     n Val       Sta     n Val
       0       .02      20.6       .02      99.6       .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
          20.6     99.6             120.2    124.8   122.1                .1         .3
Blocked Obstructions       num=       2
   Sta L    Sta R     Elev    Sta L    Sta R     Elev
      20       55       64      110      160       64

CROSS SECTION            RIVER: Leucadia
REACH: 101                  RS: 170

INPUT
Description:
Station Elevation Data      num=        7
     Sta      Elev       Sta      Elev       Sta      Elev       Sta      Elev       Sta      Elev
       0        64      33.4        62      87.4        60     141.8      58.5     184.7        60
     322        62     333.5        64

Manning's n Values          num=        3
     Sta     n Val       Sta     n Val       Sta     n Val
       0       .02      87.4       .02     184.7       .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
          87.4    184.7             137.5    137.6   138.7                .1         .3

CROSS SECTION            RIVER: Leucadia
REACH: 101                  RS: 165

INPUT
Description:
Station Elevation Data      num=       16
     Sta      Elev       Sta      Elev       Sta      Elev       Sta      Elev       Sta      Elev
       0        64      14.5        62        16        60     102.4        58     128.4        57
   138.5        56     147.5        56     172.9      55.9     200.4        56     225.9        58
   245.3        60     261.4      60.2     279.4        60     288.3        60     366.3        60
   374.3        64

Manning's n Values          num=        3
     Sta     n Val       Sta     n Val       Sta     n Val
       0       .02     138.5       .02     200.4       .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
         138.5    200.4             309.6    309.5   308.6                .1         .3
Blocked Obstructions       num=       2
   Sta L    Sta R     Elev    Sta L    Sta R     Elev
      30       80       64      190      240       64

CROSS SECTION            RIVER: Leucadia
REACH: 101                  RS: 160
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INPUT
Description:
Station Elevation Data    num=      19
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       64       21       62       37       60     57.5       58      105       56
   129.5       55    142.1       55    152.6       55    186.5       54    214.5       55
     237       56    283.6       58    300.1     58.1      317       58      333     57.9
     342       58      359       60      368       62      376       64

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .02    152.6      .02    214.5      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
        152.6   214.5              48.6     52.6    51.9               .1        .3
Blocked Obstructions       num=      3
   Sta L    Sta R     Elev    Sta L    Sta R     Elev    Sta L    Sta R     Elev
      30       70       64       90      120       64      150      170       64

CROSS SECTION           RIVER: Leucadia
REACH: 101                 RS: 150

INPUT
Description:
Station Elevation Data    num=      15
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       64       16       62       24       60     39.5       58     63.4       56
    96.4       54    132.3       54    144.8       53    156.9       52    193.8       54
   220.8       56    297.7     57.7    340.3       58    356.3       60    369.2       64

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .02    144.8      .02    193.8      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
        144.8   193.8             151.2    154.7   157.7               .1        .3
Blocked Obstructions       num=      2
   Sta L    Sta R     Elev    Sta L    Sta R     Elev
      20       50       64      190      220       64

CROSS SECTION           RIVER: Leucadia
REACH: 101                 RS: 145

INPUT
Description:
Station Elevation Data    num=      14
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       64     22.3       62     44.3       58     79.3       56    111.6       54
   143.9       52    156.1       52    176.6       52    182.1       58      246       58
   280.5     56.5    384.4       58    398.4       62    411.9       64

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .02    143.9      .02    176.6      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.    Expan.
        143.9   176.6             175.6    160.5   160.3               .1        .3
Blocked Obstructions       num=      3
   Sta L    Sta R     Elev    Sta L    Sta R     Elev    Sta L    Sta R     Elev
      40       85       64      115      150       64      180      240       64

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 140

INPUT
Description:
Station Elevation Data    num=      22
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       64     12.5       62       39       60     45.5       56       88       54
   162.6       52    178.6       54    184.6       58    237.6       58    283.1     56.2
   311.6     56.4    375.5       58    392.5       60    400.6       62    422.6       62
     432       63      434       63      442       61      465       64      531       66
     566       68      730       70

Manning's n Values        num=       3
     Sta    n Val      Sta    n Val      Sta    n Val
```

0	.02	88	.02	178.6	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
88 178.6 141.5 123.2 117.1 .1 .3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
60	140	64	200	260	64	539	646	70
710	730	70						

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 135

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	18.7	62	47.7	60	71.8	58	99.9	56
152.2	54	165.3	54	181.2	54	234.9	54	309.4	56
380.6	58	399.2	60	408.7	62	456.1	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	152.2	.02	234.9	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
152.2 234.9 6244 6224.6 6385.5 .1 .3

SUMMARY OF MANNING'S N VALUES

River:Leucadia

Reach	River Sta.	n1	n2	n3
Vulcan	3300.14	.03	.035	.03
Vulcan	3200.15	.03	.035	.03
Vulcan	3100.16	.03	.035	.03
Vulcan	3000.17	.03	.035	.03
Vulcan	2900.18	.03	.035	.03
Vulcan	2800.19	.03	.035	.03
Vulcan	2700.20	.03	.035	.03
Vulcan	2600.21	.03	.035	.03
Vulcan	2500.22	.03	.035	.03
Vulcan	2400.23	.03	.035	.03
Vulcan	2300.24	.03	.035	.03
Vulcan	2200.25	.03	.035	.03
Vulcan	2100.26	.03	.035	.03
Vulcan	245	.03	.035	.03
Vulcan	240	.03	.035	.03
Vulcan	235	.03	.035	.03
Vulcan	230	.02	.02	.02
Vulcan	225	.02	.02	.02
Vulcan	220	.02	.02	.02
Vulcan	215	.02	.02	.02
Vulcan	195	.02	.02	.02
Vulcan	175	.02	.02	.02
Vulcan	165	.02	.02	.02
Vulcan	150	.02	.02	.02
101	230	.02	.02	.02
101	225.3	.02	.02	.02
101	225.2	.02	.02	.02
101	225.1	.02	.02	.02
101	220	.02	.02	.02
101	215	.02	.02	.02
101	210	.02	.02	.02
101	205	.02	.02	.02
101	195	.02	.02	.02
101	190	.02	.02	.02
101	185	.02	.02	.02
101	180	.02	.02	.02
101	175	.02	.02	.02
101	170	.02	.02	.02
101	165	.02	.02	.02
101	160	.02	.02	.02
101	150	.02	.02	.02

101	145	.02	.02	.02
Combine	140	.02	.02	.02
Combine	135	.02	.02	.02

SUMMARY OF REACH LENGTHS

River: Leucadia

Reach	River Sta.	Left	Channel	Right
Vulcan	3300.14	100	100	100
Vulcan	3200.15	100	100	100
Vulcan	3100.16	100	100	100
Vulcan	3000.17	100	100	100
Vulcan	2900.18	100	100	100
Vulcan	2800.19	100	100	100
Vulcan	2700.20	100	100	100
Vulcan	2600.21	100	100	100
Vulcan	2500.22	100	100	100
Vulcan	2400.23	100	100	100
Vulcan	2300.24	100	100	100
Vulcan	2200.25	100	100	100
Vulcan	2100.26	15	15	15
Vulcan	245	175	175	175
Vulcan	240	275	275	275
Vulcan	235	120	120	120
Vulcan	230	175	180	185
Vulcan	225	190	185	185
Vulcan	220	175	175	175
Vulcan	215	290	290	290
Vulcan	195	340	340	340
Vulcan	175	225	220	220
Vulcan	165	360	360	360
Vulcan	150	305	305	305
101	230	104.1	100.2	136.3
101	225.3	5	5	5
101	225.2	5	5	5
101	225.1	134.2	131.9	133.3
101	220	222.7	215.1	206.1
101	215	78.2	80.6	89.6
101	210	47.1	45.4	64.5
101	205	141.2	142.6	152.6
101	195	143.6	102.4	81.7
101	190	109.2	93.8	106
101	185	56.4	82.7	111.4
101	180	83.8	85.3	85.6
101	175	120.2	124.8	122.1
101	170	137.5	137.6	138.7
101	165	309.6	309.5	308.6
101	160	48.6	52.6	51.9
101	150	151.2	154.7	157.7
101	145	175.6	160.5	160.3
Combine	140	141.5	123.2	117.1
Combine	135	6244	6224.6	6385.5

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Leucadia

Reach	River Sta.	Contr.	Expan.
Vulcan	3300.14	.1	.3
Vulcan	3200.15	.1	.3
Vulcan	3100.16	.1	.3
Vulcan	3000.17	.1	.3
Vulcan	2900.18	.1	.3
Vulcan	2800.19	.1	.3
Vulcan	2700.20	.1	.3
Vulcan	2600.21	.1	.3
Vulcan	2500.22	.1	.3

Vulcan	2400.23	.1	.3
Vulcan	2300.24	.1	.3
Vulcan	2200.25	.1	.3
Vulcan	2100.26	.1	.3
Vulcan	245	.1	.3
Vulcan	240	.1	.3
Vulcan	235	.1	.3
Vulcan	230	.1	.3
Vulcan	225	.1	.3
Vulcan	220	.1	.3
Vulcan	215	.1	.3
Vulcan	195	.1	.3
Vulcan	175	.1	.3
Vulcan	165	.1	.3
Vulcan	150	.1	.3
101	230	.1	.3
101	225.3	.1	.3
101	225.2	.1	.3
101	225.1	.1	.3
101	220	.1	.3
101	215	.1	.3
101	210	.1	.3
101	205	.1	.3
101	195	.1	.3
101	190	.1	.3
101	185	.1	.3
101	180	.1	.3
101	175	.1	.3
101	170	.1	.3
101	165	.1	.3
101	160	.1	.3
101	150	.1	.3
101	145	.1	.3
Combine	140	.1	.3
Combine	135	.1	.3

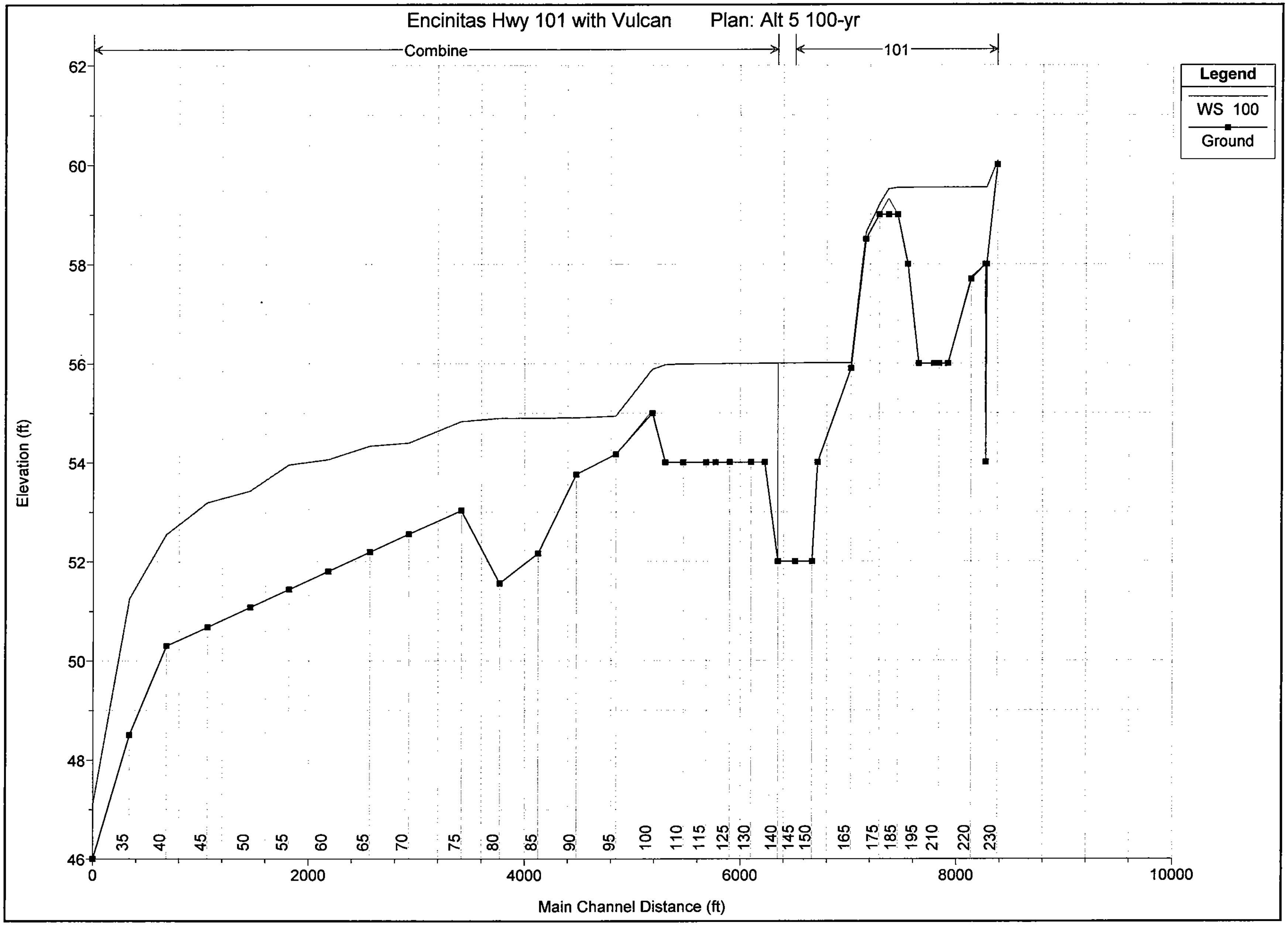
ALTERNATIVE 5
100-YEAR HEC-RAS ANALYSIS

HEC-RAS Plan: 100A5 Profile: 100

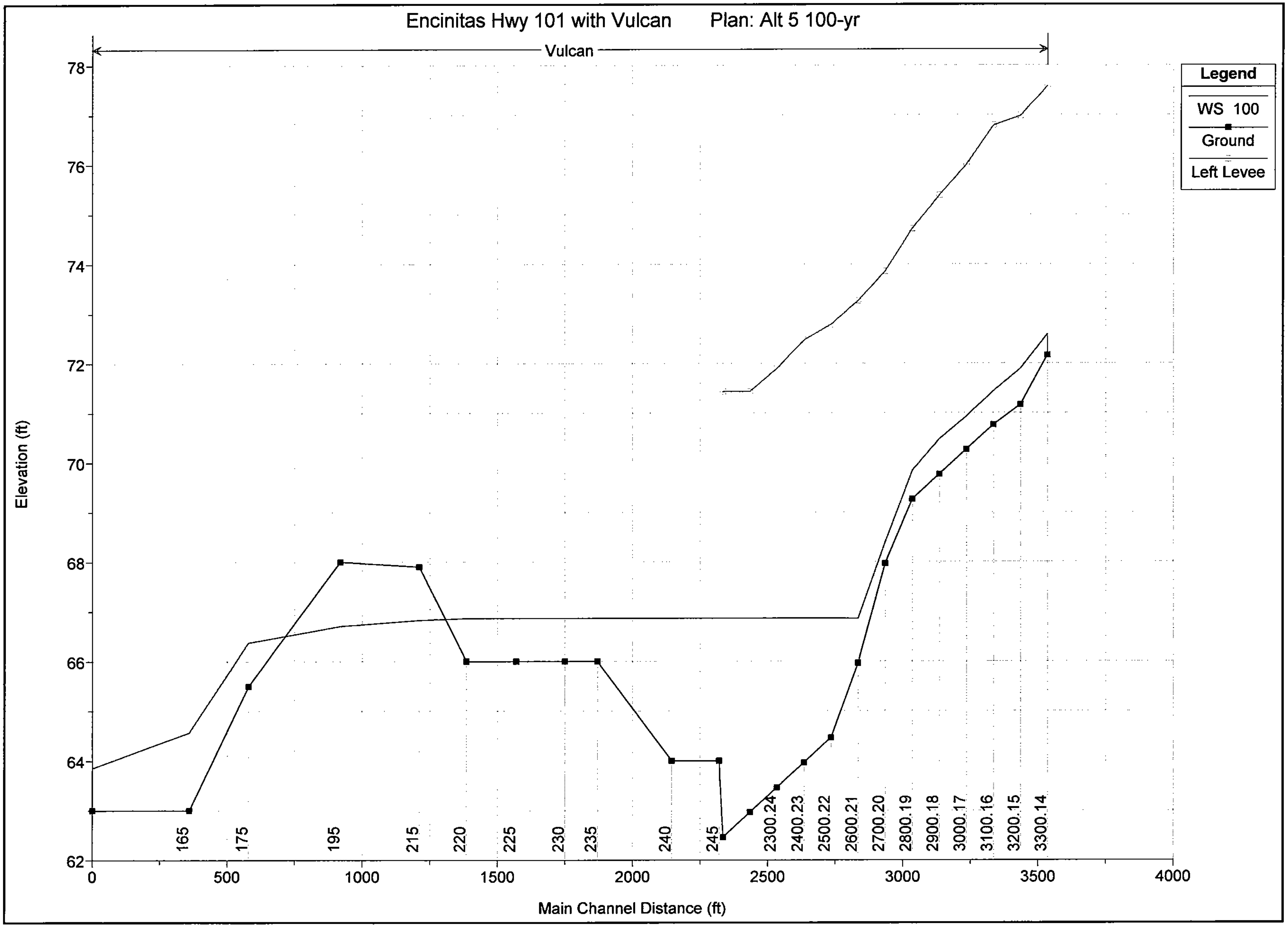
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Vulcan	3300.14	13.00	72.16	72.59	72.59	72.79	0.023812	3.71	3.58	8.85	1.00
Vulcan	3200.15	13.00	71.16	71.88	71.58	71.95	0.003891	2.14	6.30	9.40	0.44
Vulcan	3100.16	13.00	70.76	71.44	71.19	71.51	0.004919	2.29	5.86	9.35	0.49
Vulcan	3000.17	13.00	70.26	70.93	70.69	71.01	0.005168	2.33	5.77	9.33	0.50
Vulcan	2900.18	13.00	69.76	70.47	70.19	70.54	0.004234	2.19	6.14	9.41	0.46
Vulcan	2800.19	13.00	69.26	69.83	69.69	69.94	0.008797	2.74	4.88	9.14	0.64
Vulcan	2700.20	13.00	67.96	68.39	68.39	68.59	0.022845	3.66	3.63	8.86	0.98
Vulcan	2600.21	13.00	65.96	66.85	66.39	66.90	0.001875	1.71	7.95	9.79	0.32
Vulcan	2500.22	13.00	64.46	66.86	64.89	66.87	0.000057	0.58	25.01	12.81	0.07
Vulcan	2400.23	13.00	63.96	66.86	64.39	66.87	0.000029	0.46	31.66	13.81	0.05
Vulcan	2300.24	13.00	63.46	66.86	63.89	66.87	0.000016	0.38	38.81	14.81	0.04
Vulcan	2200.25	13.00	62.96	66.86	63.39	66.87	0.000012	0.36	46.96	32.44	0.03
Vulcan	2100.26	13.00	62.46	66.86	62.89	66.86	0.000002	0.16	129.37	82.28	0.01
Vulcan	245	13.00	64.00	66.86		66.86	0.000003	0.15	118.42	81.57	0.02
Vulcan	240	1.00	64.00	66.86		66.86	0.000000	0.01	160.35	114.77	0.00
Vulcan	235	1.00	66.00	66.86		66.86	0.000000	0.01	121.00	155.23	0.00
Vulcan	230	1.00	66.00	66.86		66.86	0.000000	0.01	132.43	171.70	0.00
Vulcan	225	1.00	66.00	66.86		66.86	0.000000	0.01	93.65	119.89	0.00
Vulcan	220	1.00	66.00	66.86		66.86	0.000000	0.00	271.66	333.13	0.00
Vulcan	215	1.00	67.90	66.83	66.83	66.86	0.014435		0.68	9.90	0.00
Vulcan	195	38.00	68.00	66.71	66.27	66.72	0.000260		47.12	84.98	0.00
Vulcan	175	38.00	65.50	66.37	66.37	66.48	0.004576	3.64	18.56	85.07	0.81
Vulcan	165	38.00	63.00	64.57	64.02	64.62	0.000608	1.90	21.04	24.51	0.33
Vulcan	150	38.00	63.00	63.86	63.86	64.07	0.007780	3.71	10.24	23.94	1.00
101	230	1.00	60.00	60.08	60.08	60.10	0.017075	1.12	0.89	22.55	1.00
101	225.3	1.00	58.00	59.54	58.03	59.54	0.000000	0.01	79.95	70.52	0.00
101	225.2	1.00	54.64	59.54		59.54	0.000000	0.01	158.06	70.52	0.00
101	225.1	1.00	58.00	59.54		59.54	0.000000	0.01	79.94	70.52	0.00
101	220	1.00	57.75	59.54		59.54	0.000000	0.01	141.80	110.60	0.00
101	215	1.00	56.00	59.54		59.54	0.000000	0.00	402.07	160.61	0.00
101	210	1.00	56.00	59.54		59.54	0.000000	0.00	286.25	92.35	0.00
101	205	1.00	56.00	59.54		59.54	0.000000	0.00	354.55	114.90	0.00
101	195	1.00	56.00	59.54		59.54	0.000000	0.01	188.18	102.50	0.00
101	190	1.00	58.00	59.54		59.54	0.000000	0.01	122.09	90.00	0.00
101	185	1.00	59.00	59.54		59.54	0.000002	0.05	18.44	50.00	0.02
101	180	1.00	59.32	59.51	59.49	59.54	0.008400	1.38	0.73	7.81	0.80

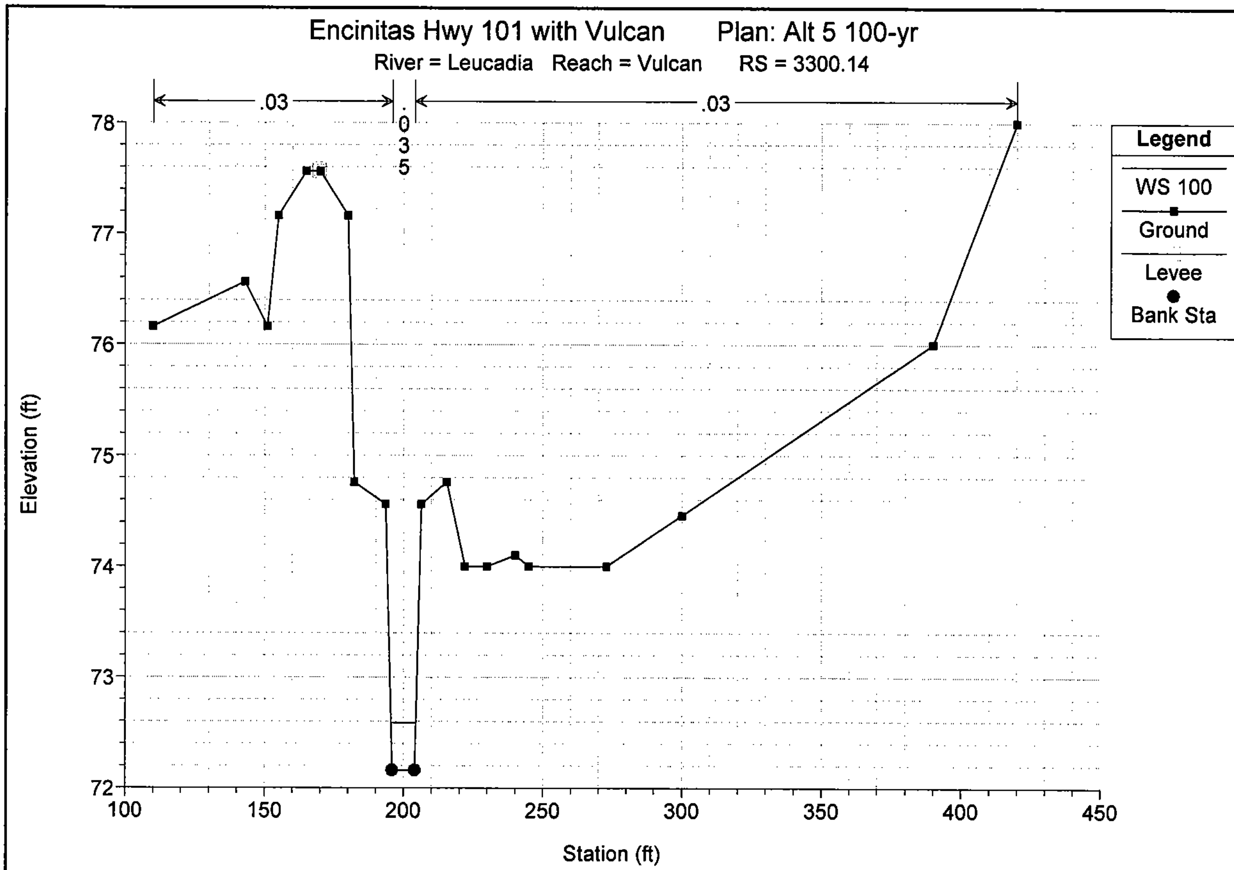
HEC-RAS Plan: 100A5 Profile: 100 (Continued)

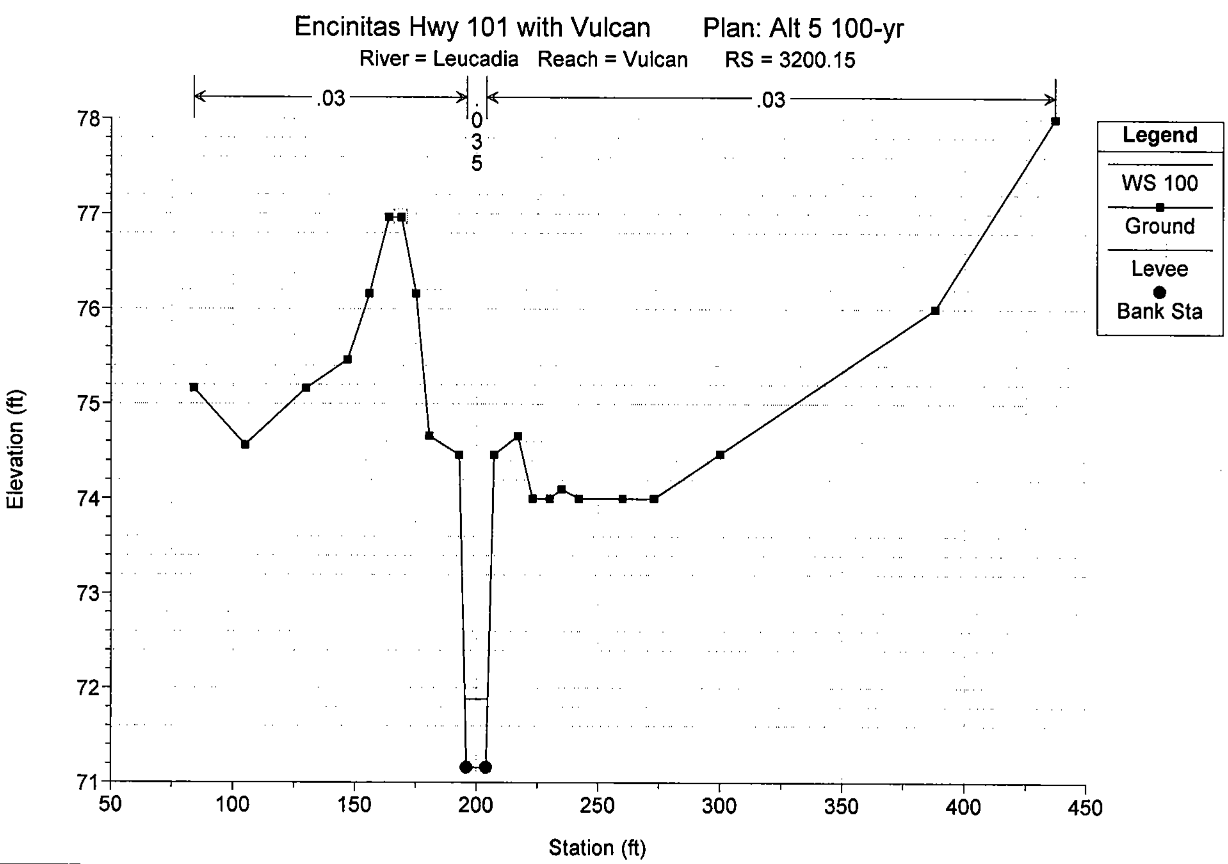
Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
101	175	1.00	59.00	59.21	59.14	59.22	0.002048	0.80	1.25	10.64	0.41
101	170	1.00	58.50	58.64	58.64	58.68	0.014397	1.53	0.65	9.21	1.01
101	165	1.00	55.90	56.01	55.96	56.02	0.000721	0.31	3.20	51.65	0.22
101	160	1.00	54.00	56.01		56.01	0.000000	0.01	111.82	97.34	0.00
101	150	1.00	52.00	56.01		56.01	0.000000	0.00	282.74	128.12	0.00
101	145	1.00	52.00	56.01		56.01	0.000000	0.01	152.78	60.00	0.00
Combine	140	47.00	52.00	56.01	52.75	56.01	0.000005	0.35	139.98	56.13	0.03
Combine	135	47.00	54.00	56.01		56.01	0.000003	0.19	293.67	209.85	0.02
Combine	130	47.00	54.00	56.00		56.01	0.000036	0.70	82.16	79.33	0.09
Combine	125	47.00	54.00	56.00		56.00	0.000004	0.23	245.07	159.21	0.03
Combine	120	57.00	54.00	55.99		56.00	0.000038	0.68	103.14	107.20	0.09
Combine	115	57.00	54.00	55.99		56.00	0.000037	0.66	105.24	116.10	0.08
Combine	110	57.00	54.00	55.99		55.99	0.000009	0.33	212.00	167.22	0.04
Combine	105	90.00	54.00	55.98		55.99	0.000081	0.99	136.00	161.14	0.12
Combine	100	90.00	55.06	55.88	55.75	55.95	0.003147	2.06	43.74	124.73	0.61
Combine	95	90.00	54.16	54.94		55.03	0.002337	2.47	39.95	89.47	0.58
Combine	90	106.00	53.76	54.91		54.91	0.000096	0.79	153.98	171.87	0.13
Combine	85	106.00	52.16	54.90		54.90	0.000013	0.44	262.92	152.87	0.06
Combine	80	106.00	51.56	54.89		54.90	0.000018	0.58	238.19	170.79	0.07
Combine	75	152.00	53.03	54.83		54.87	0.000442	1.66	93.03	129.66	0.34
Combine	70	152.00	52.55	54.40		54.55	0.000979	3.17	48.00	51.04	0.58
Combine	65	152.00	52.19	54.33		54.35	0.000243	1.21	142.49	263.50	0.26
Combine	60	186.00	51.80	54.06		54.18	0.000702	2.84	65.50	81.57	0.56
Combine	55	186.00	51.44	53.95		54.00	0.000293	1.78	104.40	81.71	0.28
Combine	50	276.00	51.08	53.42		53.75	0.001421	4.55	60.65	31.73	0.58
Combine	45	276.00	50.68	53.19		53.31	0.000677	2.80	99.29	71.57	0.41
Combine	40	276.00	50.30	52.55		52.90	0.001653	4.79	57.56	31.49	0.62
Combine	35	276.00	48.50	51.25	51.25	51.91	0.005729	6.50	42.48	33.34	1.01
Combine	30	276.00	46.00	47.11	47.60	48.74	0.017137	10.41	27.36	26.46	1.74

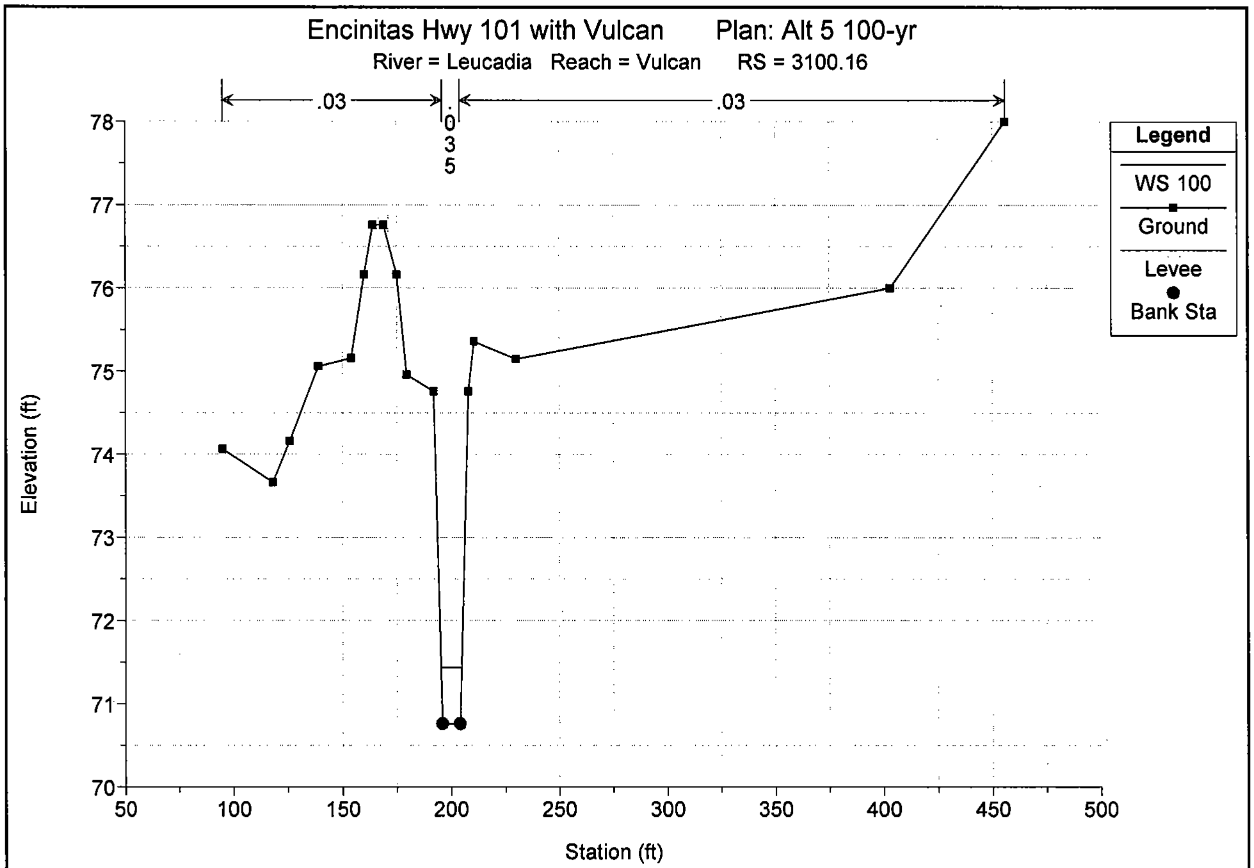


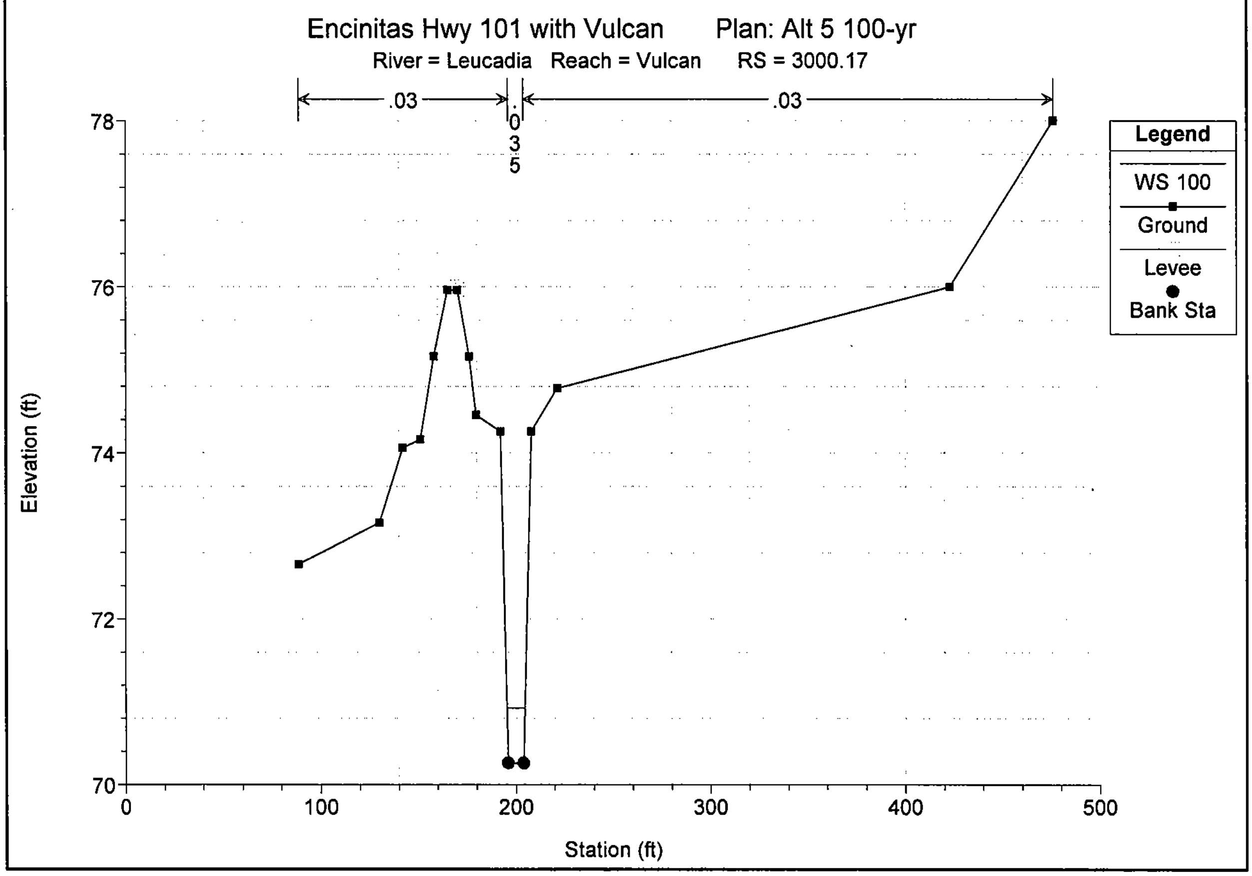
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
Combine
101
Legend
WS 100
Ground
Elevation (ft)
Main Channel Distance (ft)
46
48
50
52
54
56
58
60
62
0
2000
4000
6000
8000
10000
35
40
45
50
55
60
65
70
75
80
85
90
95
100
110
115
125
130
140
145
150
165
175
185
195
210
220
230

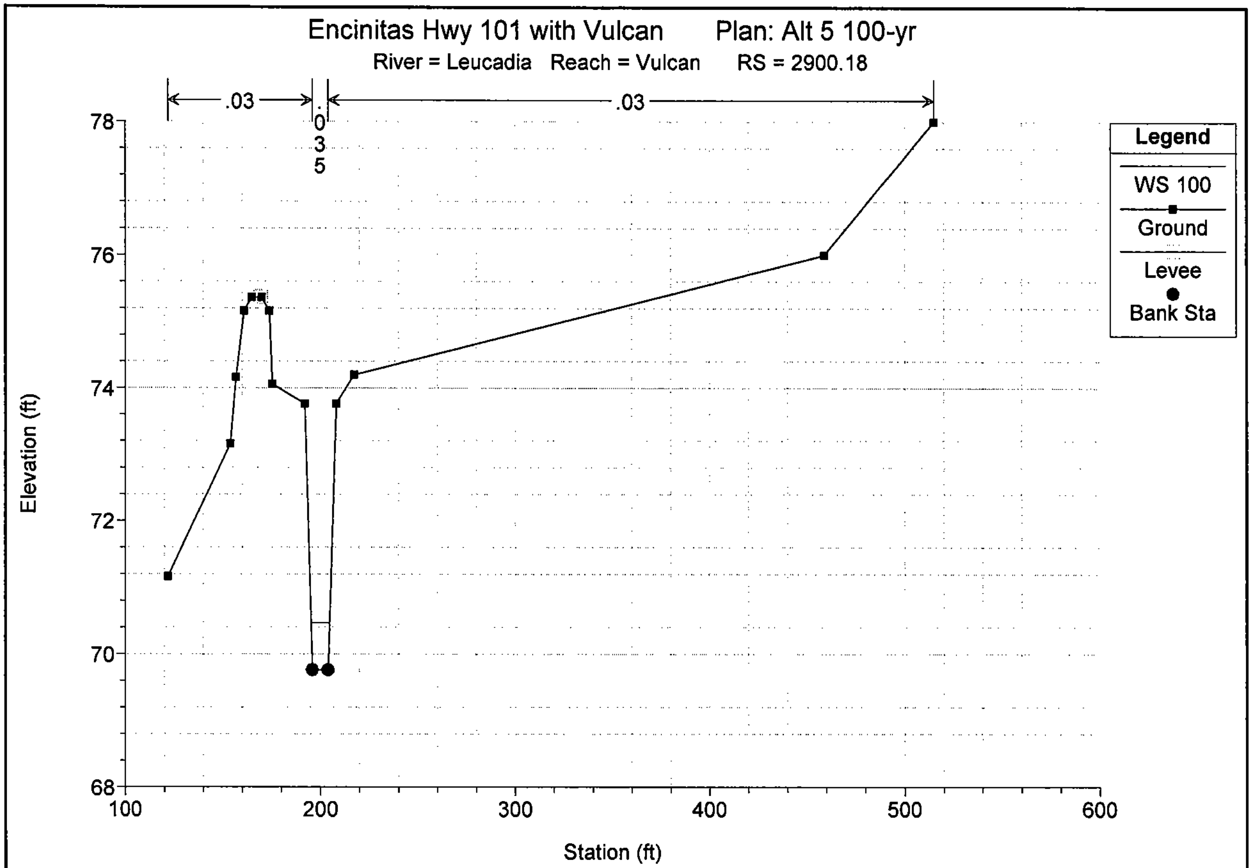

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
Vulcan
Legend
WS 100
Ground
Left Levee
Elevation (ft)
78
76
74
72
70
68
66
64
62
165
175
195
215
220
225
230
235
240
245
2300.24
2400.23
2500.22
2600.21
2700.20
2800.19
2900.18
3000.17
3100.16
3200.15
3300.14
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)

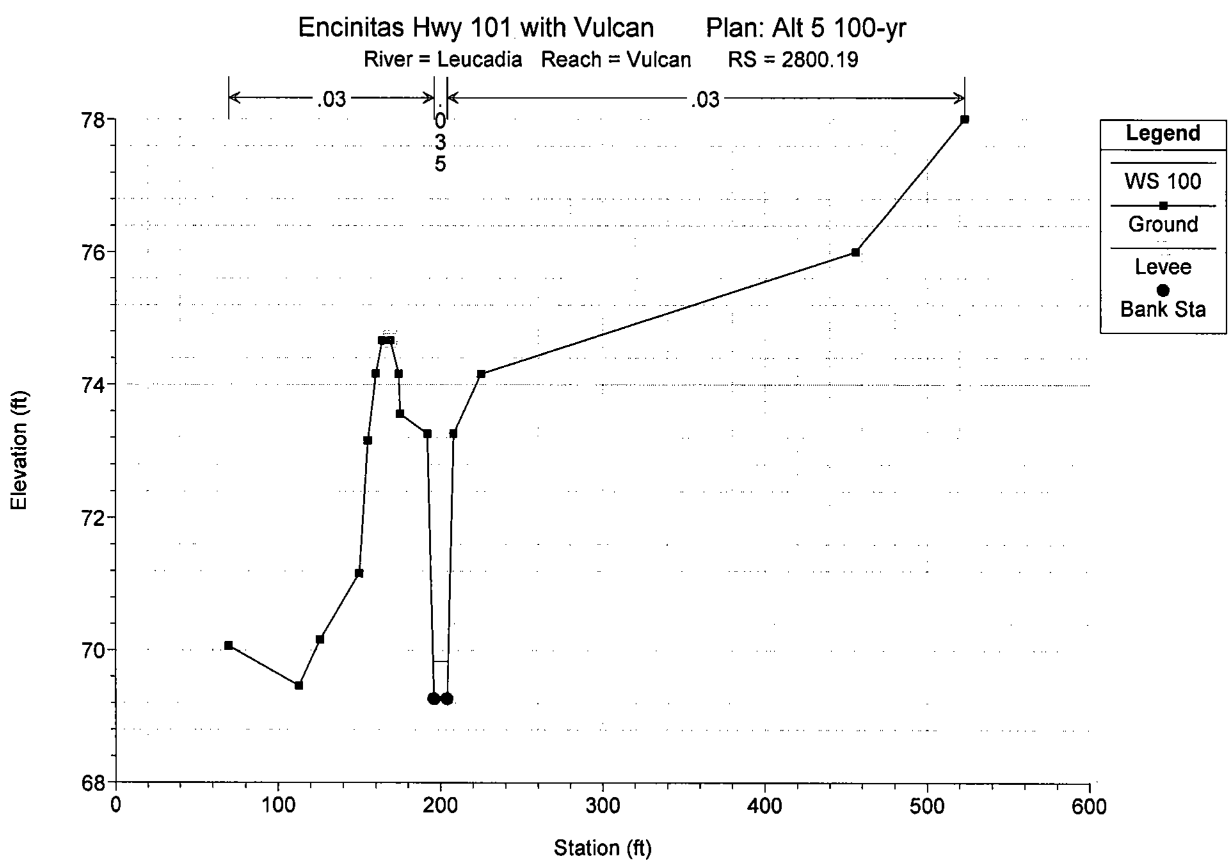

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 3300.14
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

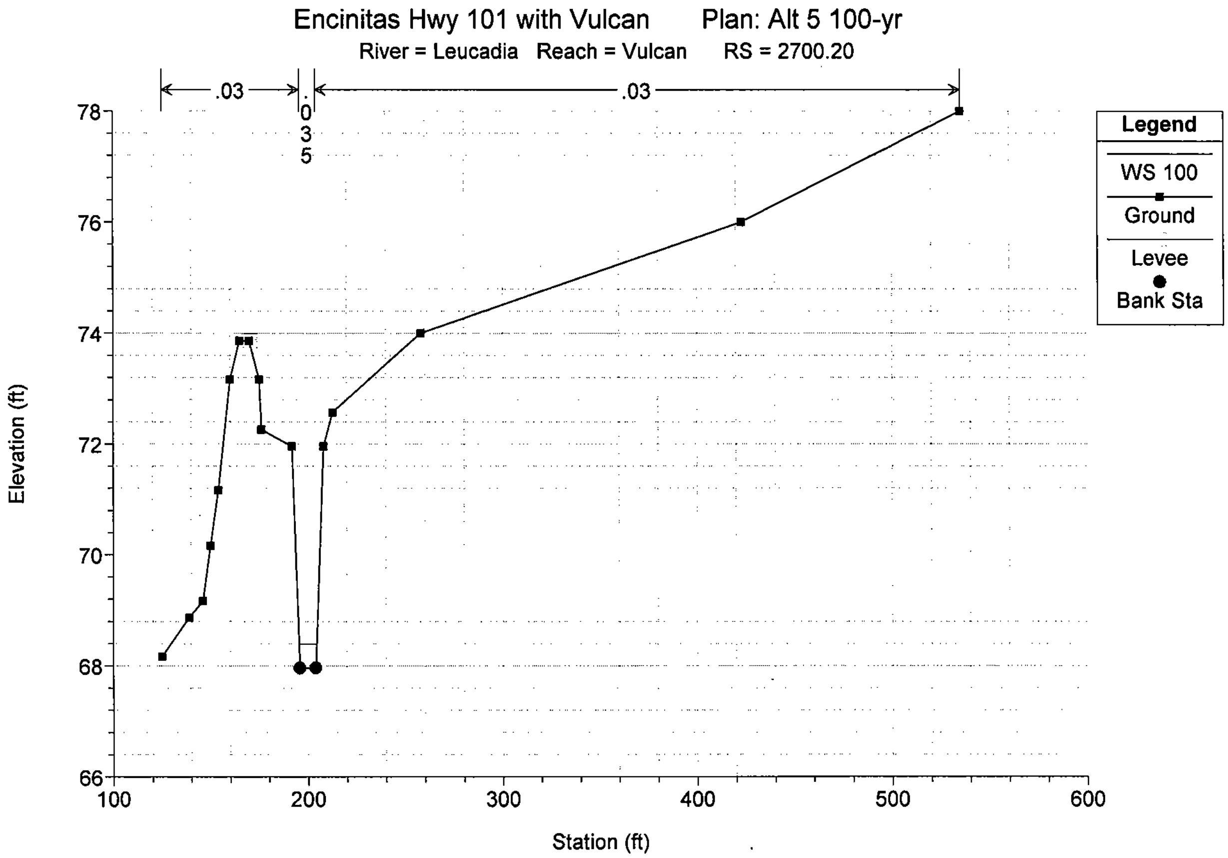

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 3200.15
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)

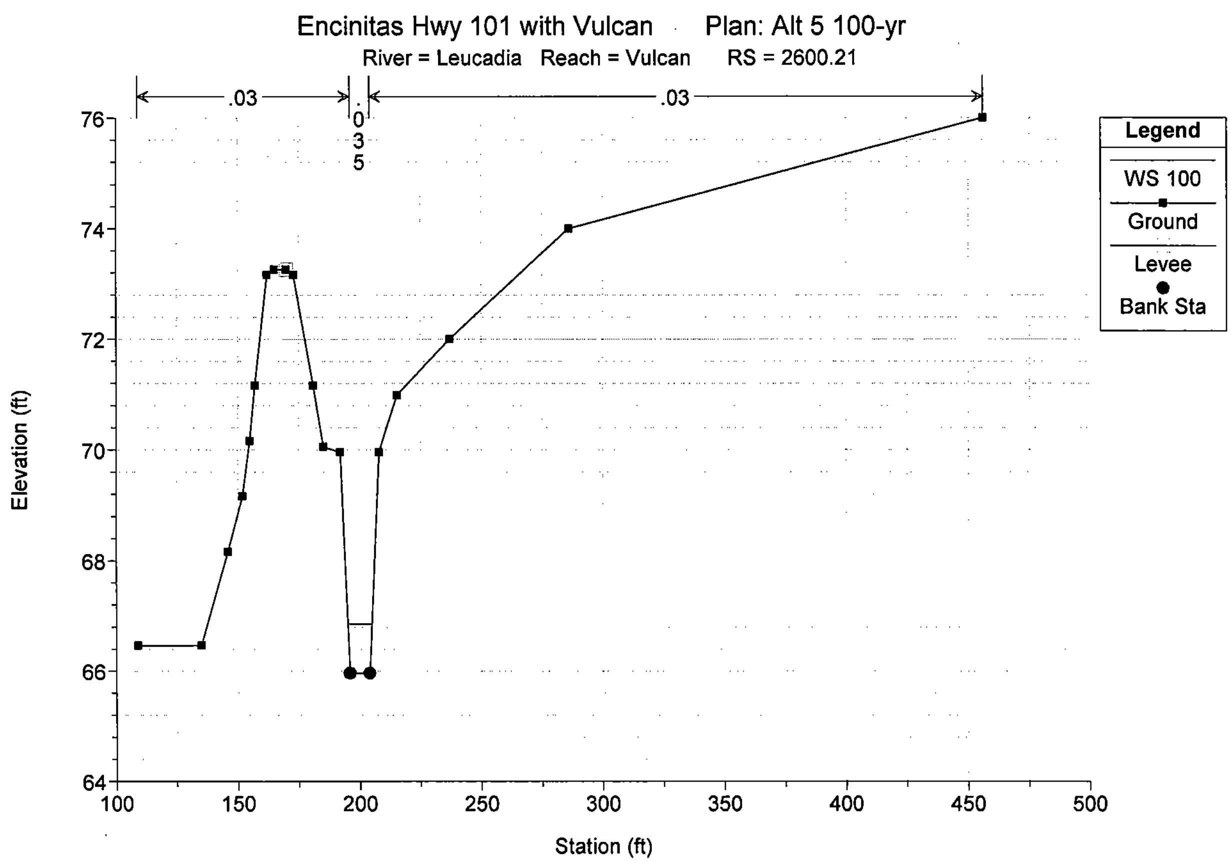

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 3100.16
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
78
77
76
75
74
73
72
71
70
50
100
150
200
250
300
350
400
450
500

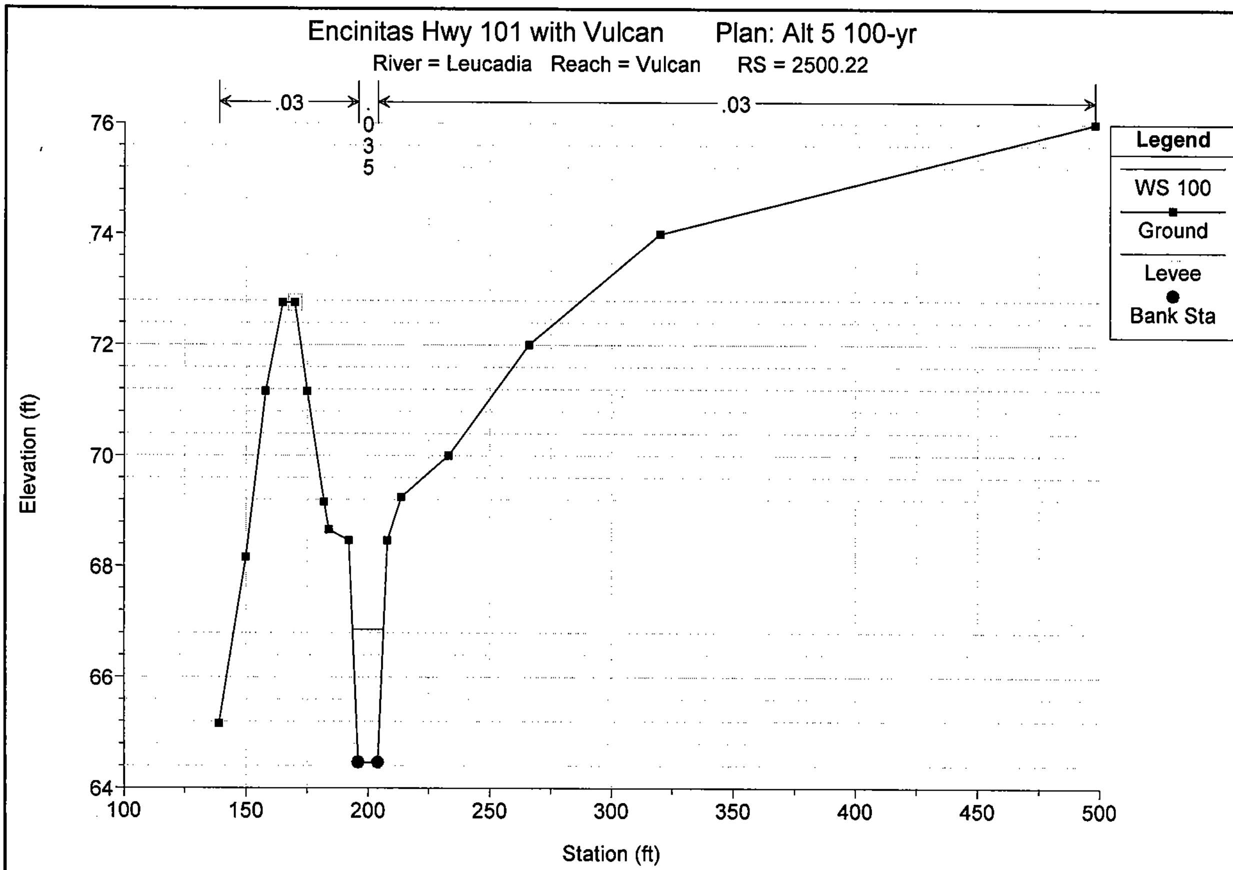

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 3000.17
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
78
76
74
72
70
0
100
200
300
400
500


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 2900.18
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
78
76
74
72
70
68
100
200
300
400
500
600

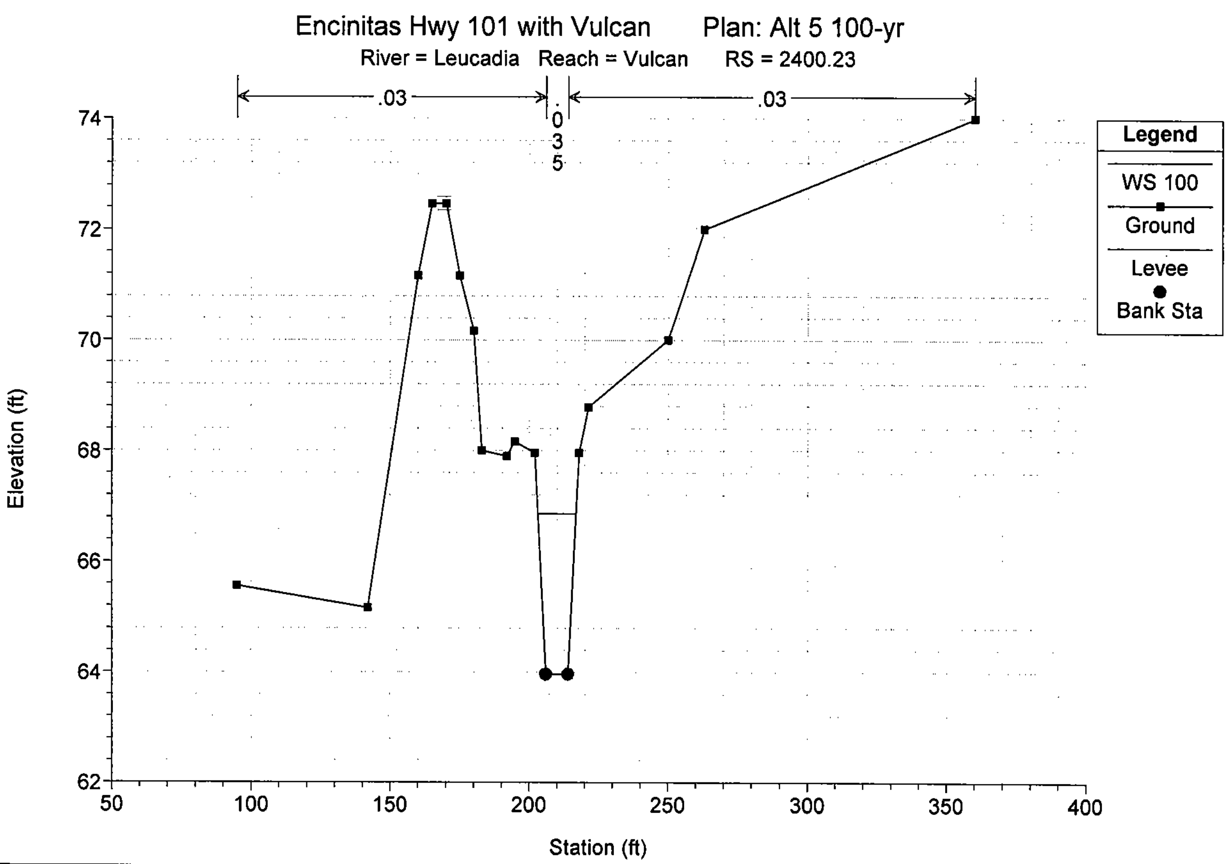

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 2800.19
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
78
76
74
72
70
68
0
100
200
300
400
500
600


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 2700.20
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
78
76
74
72
70
68
66
100
200
300
400
500
600

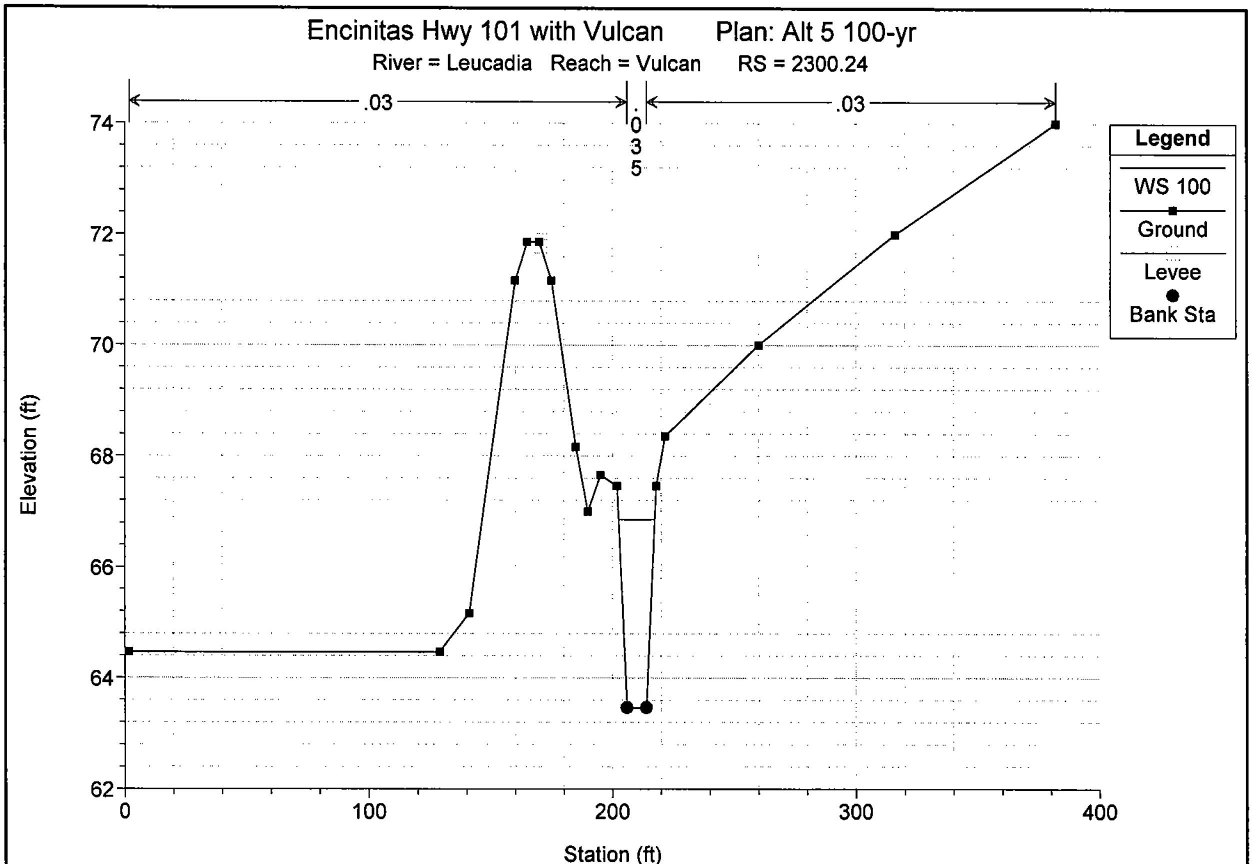

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 2600.21
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
76
74
72
70
68
66
64
100
150
200
250
300
350
400
450
500

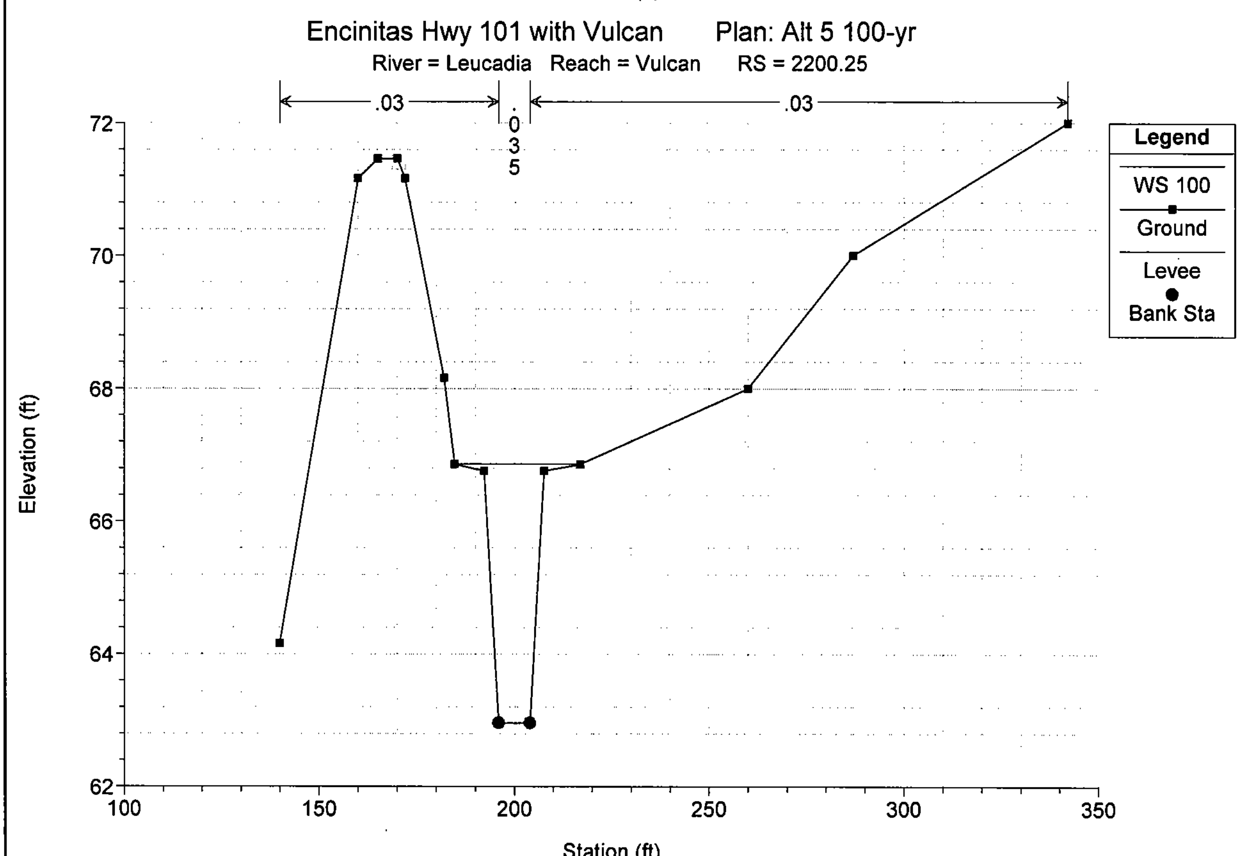


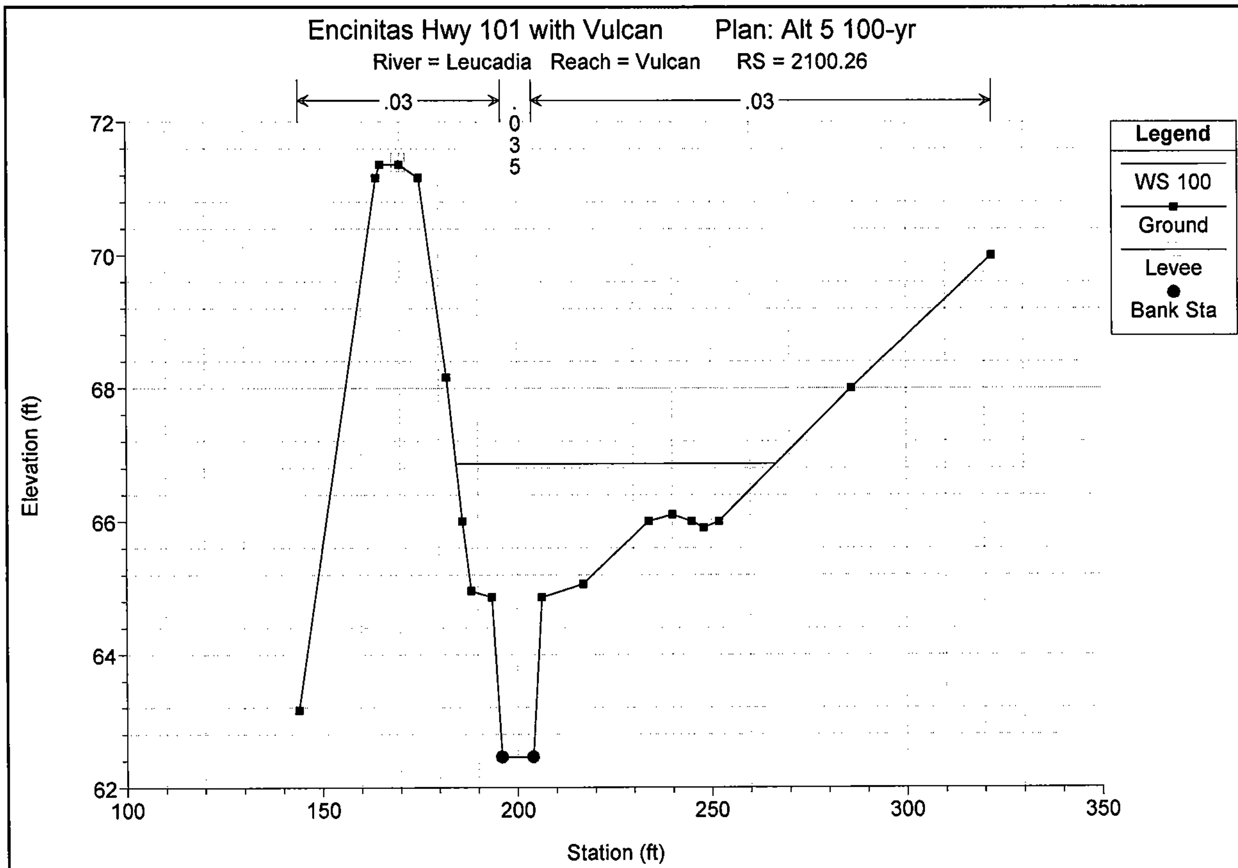
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 2500.22
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
76
74
72
70
68
66
64
100
150
200
250
300
350
400
450
500

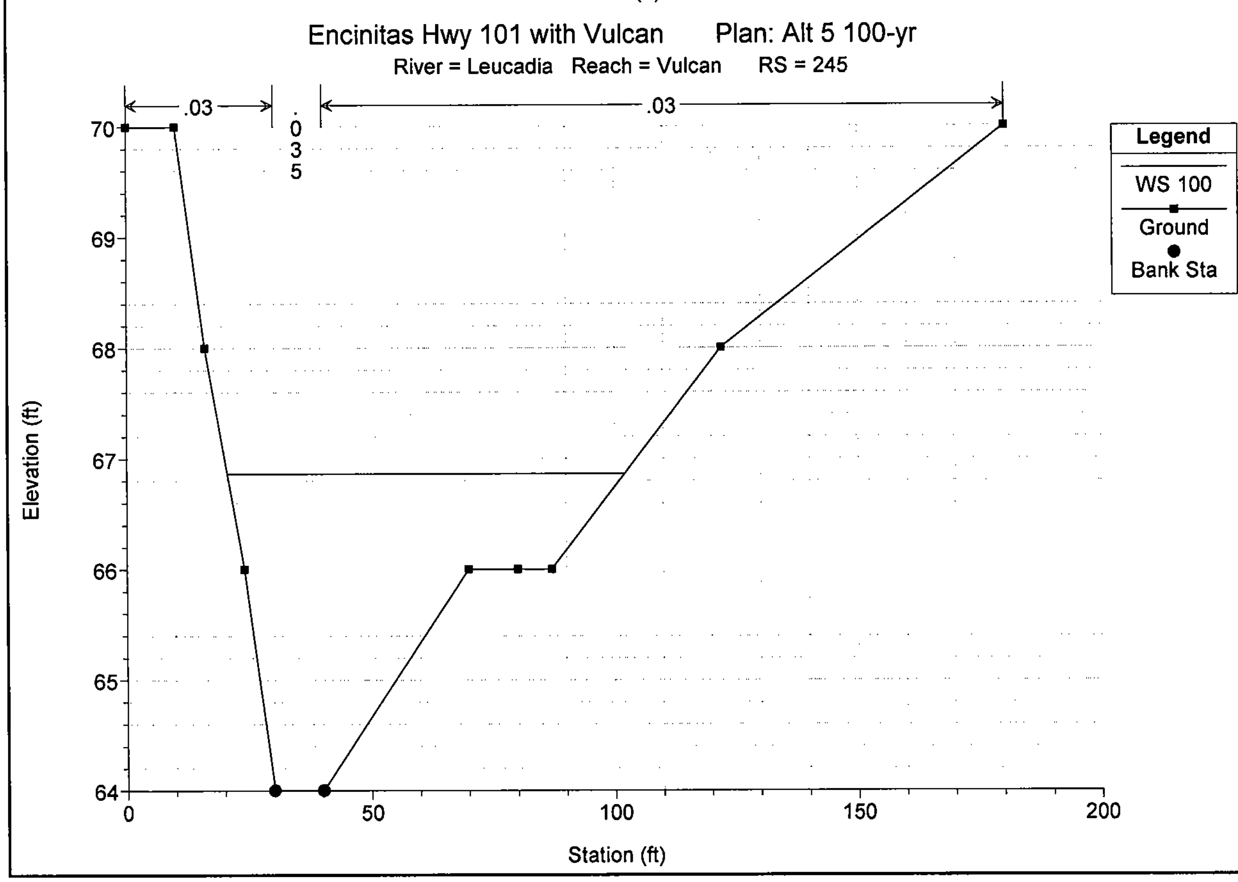


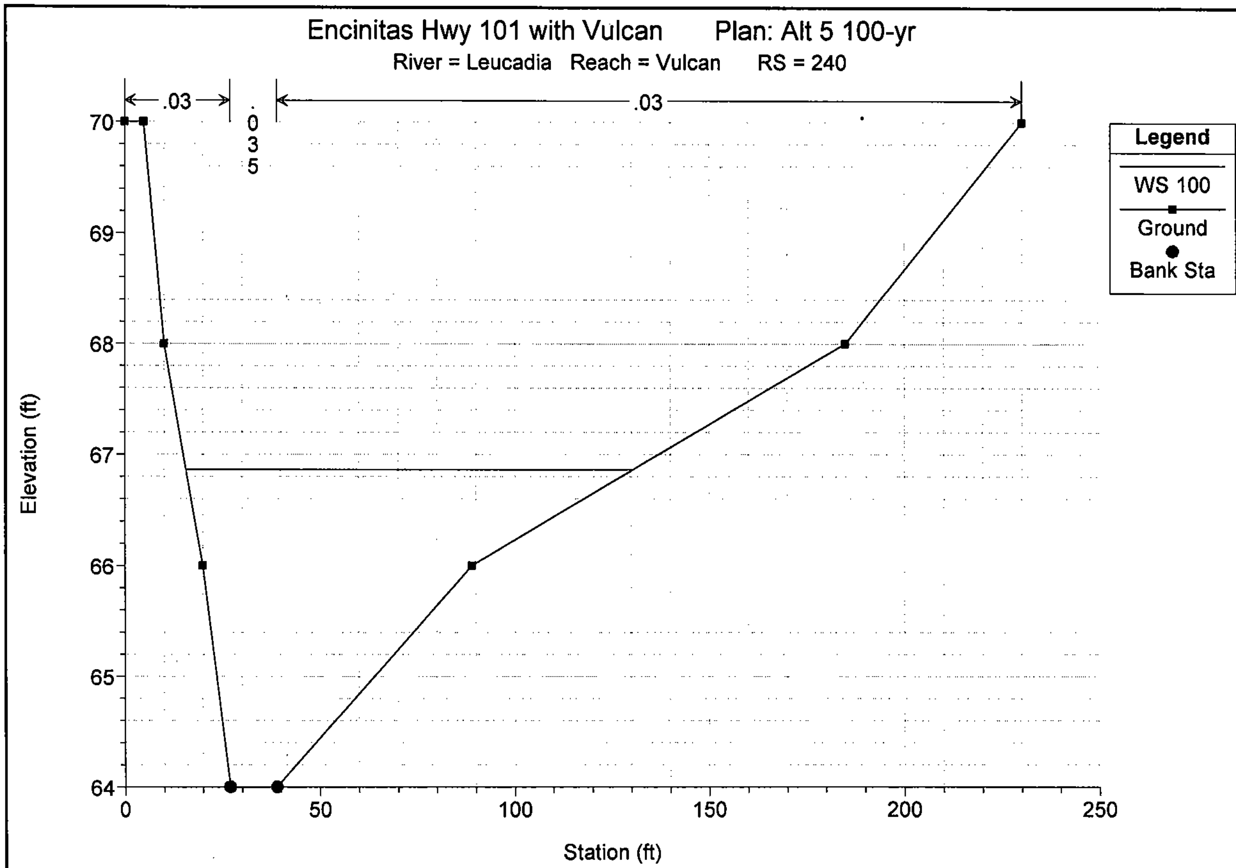
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 2400.23
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
74
72
70
68
66
64
62
50
100
150
200
250
300
350
400

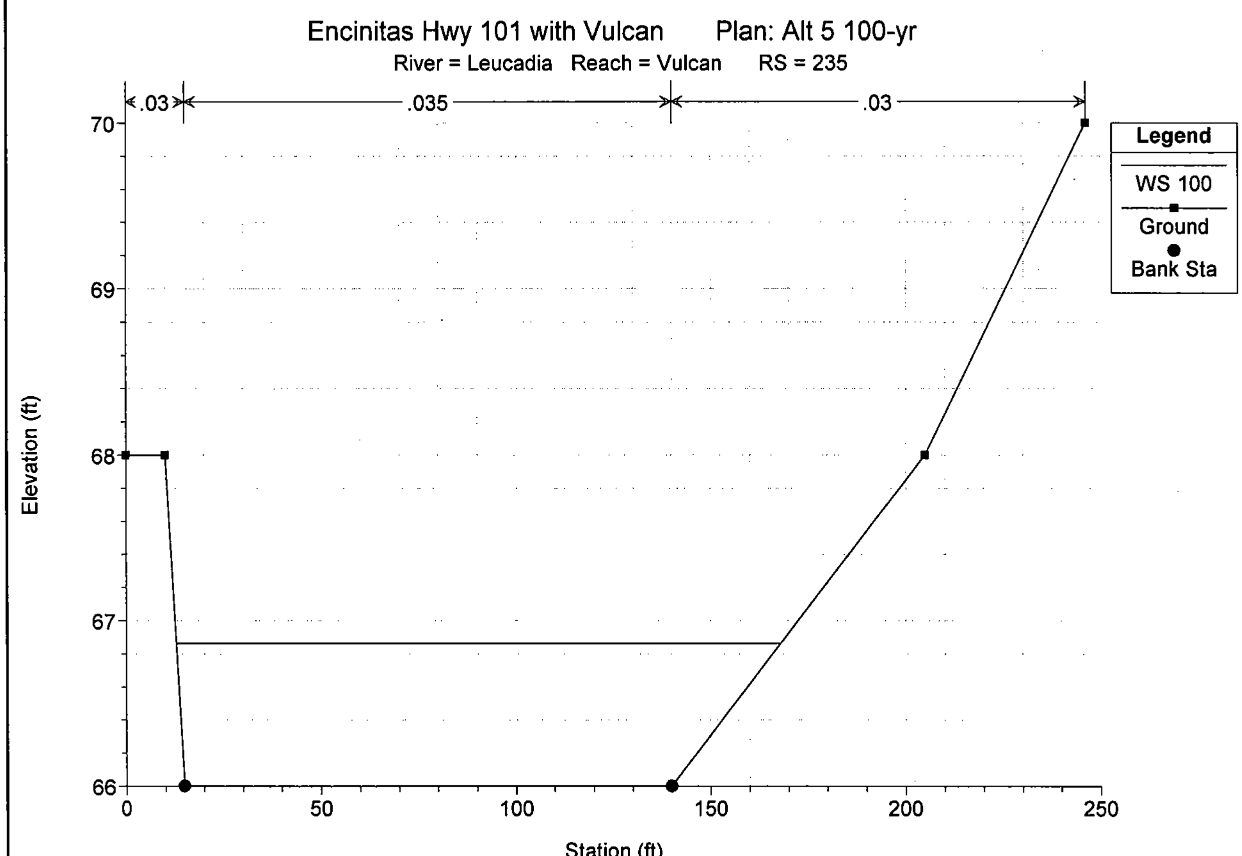

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 2300.24
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
74
72
70
68
66
64
62
0
100
200
300
400

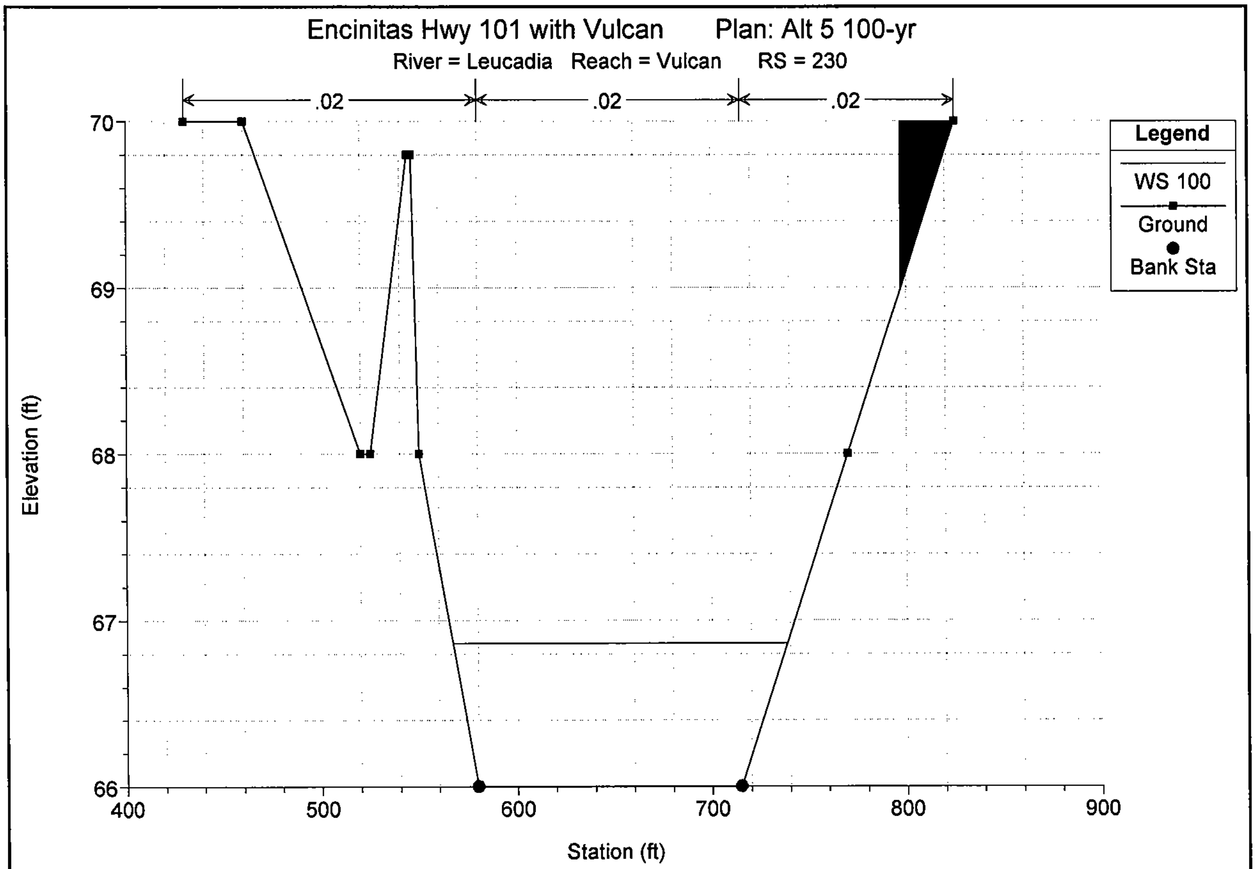

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 2200.25
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)
72
70
68
66
64
62
100
150
200
250
300
350

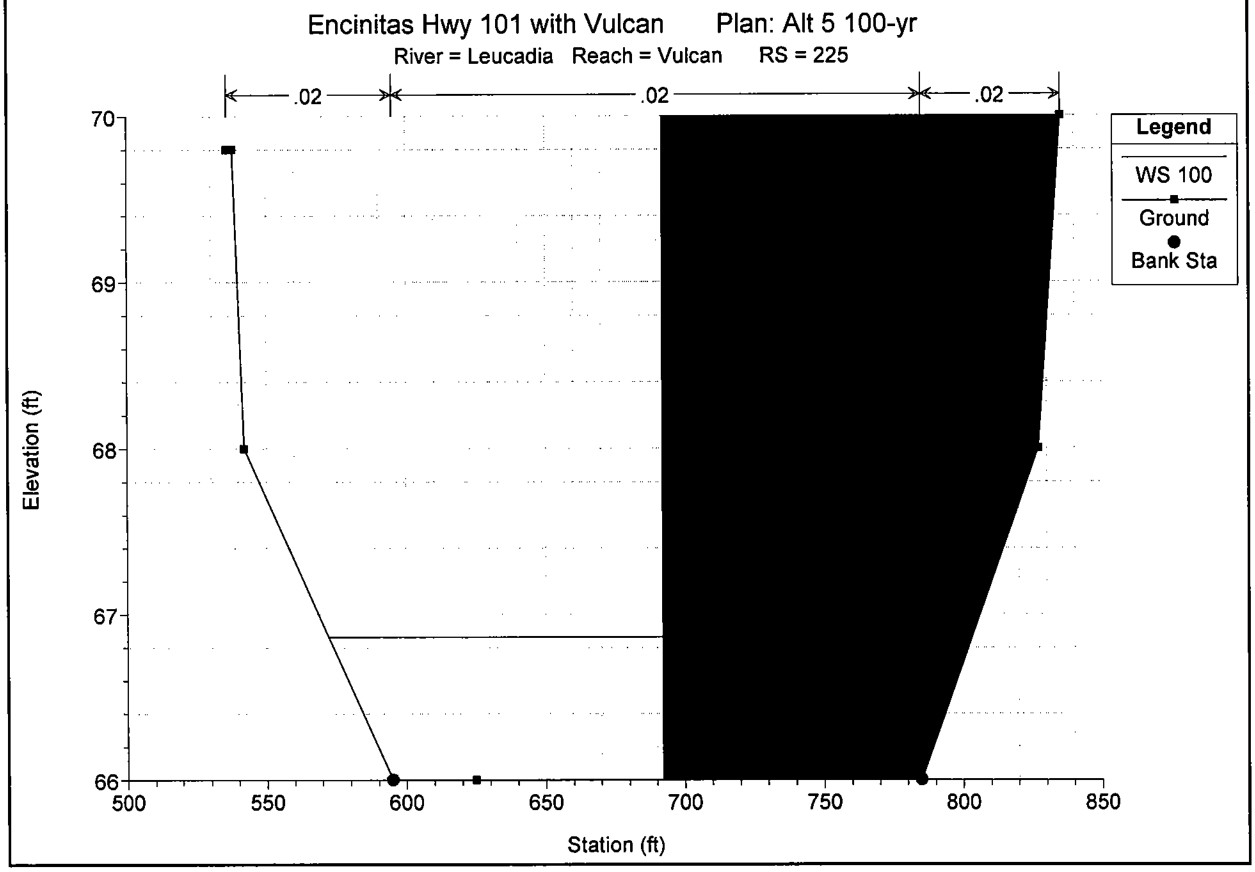

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 2100.26
.03
.035
.03
Legend
WS 100
Ground
Levee
Bank Sta
Elevation (ft)
72
70
68
66
64
62
100
150
200
250
300
350
Station (ft)

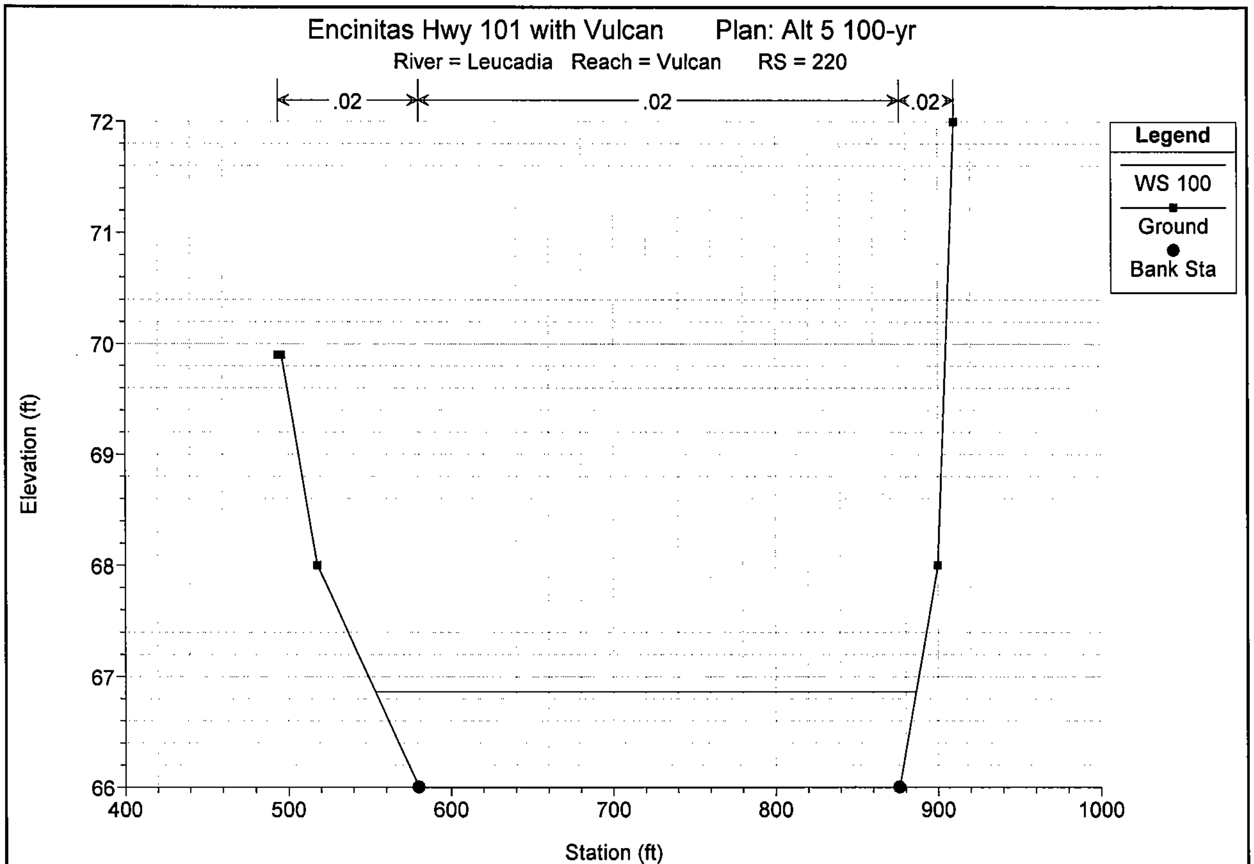

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 245
.03
.035
.03
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
70
69
68
67
66
65
64
0
50
100
150
200
Station (ft)

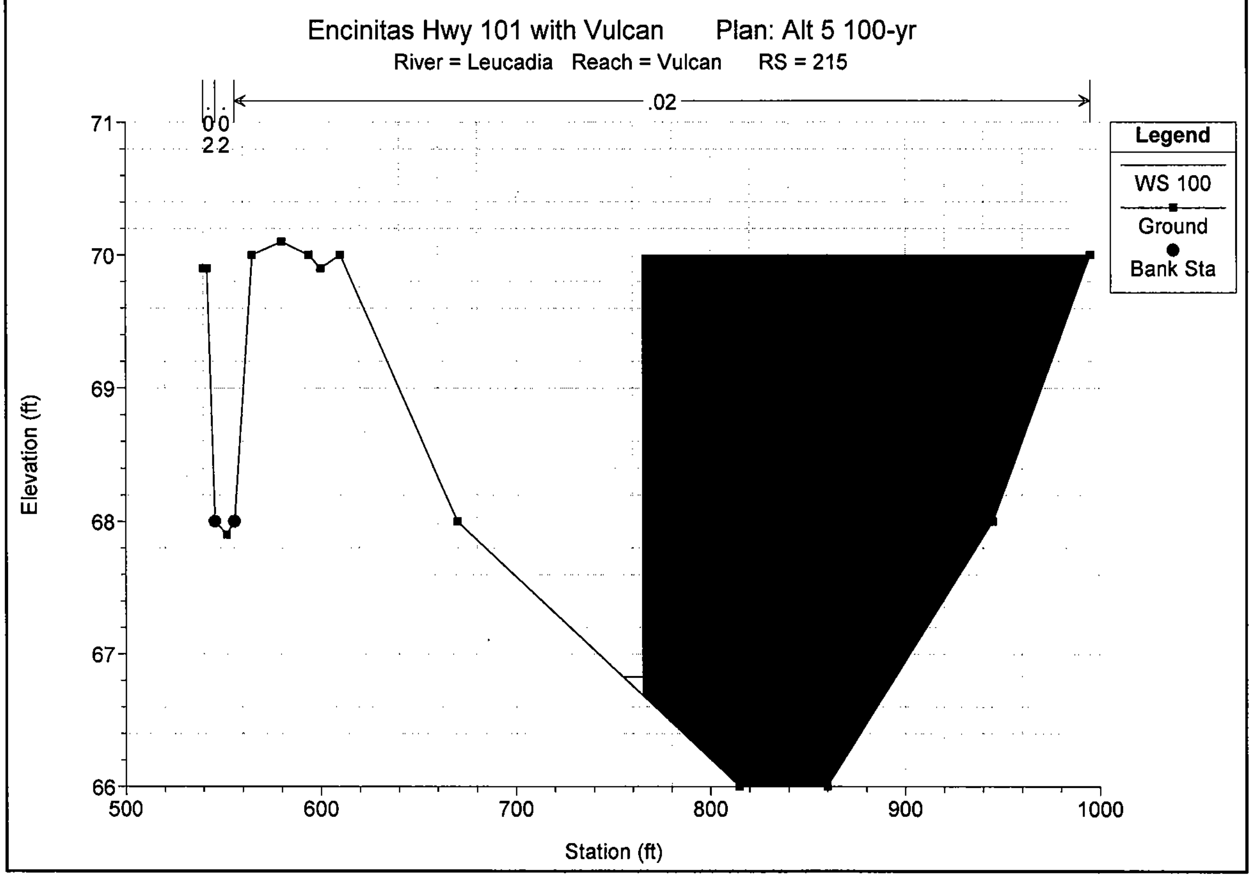

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 240
.03
.035
.03
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

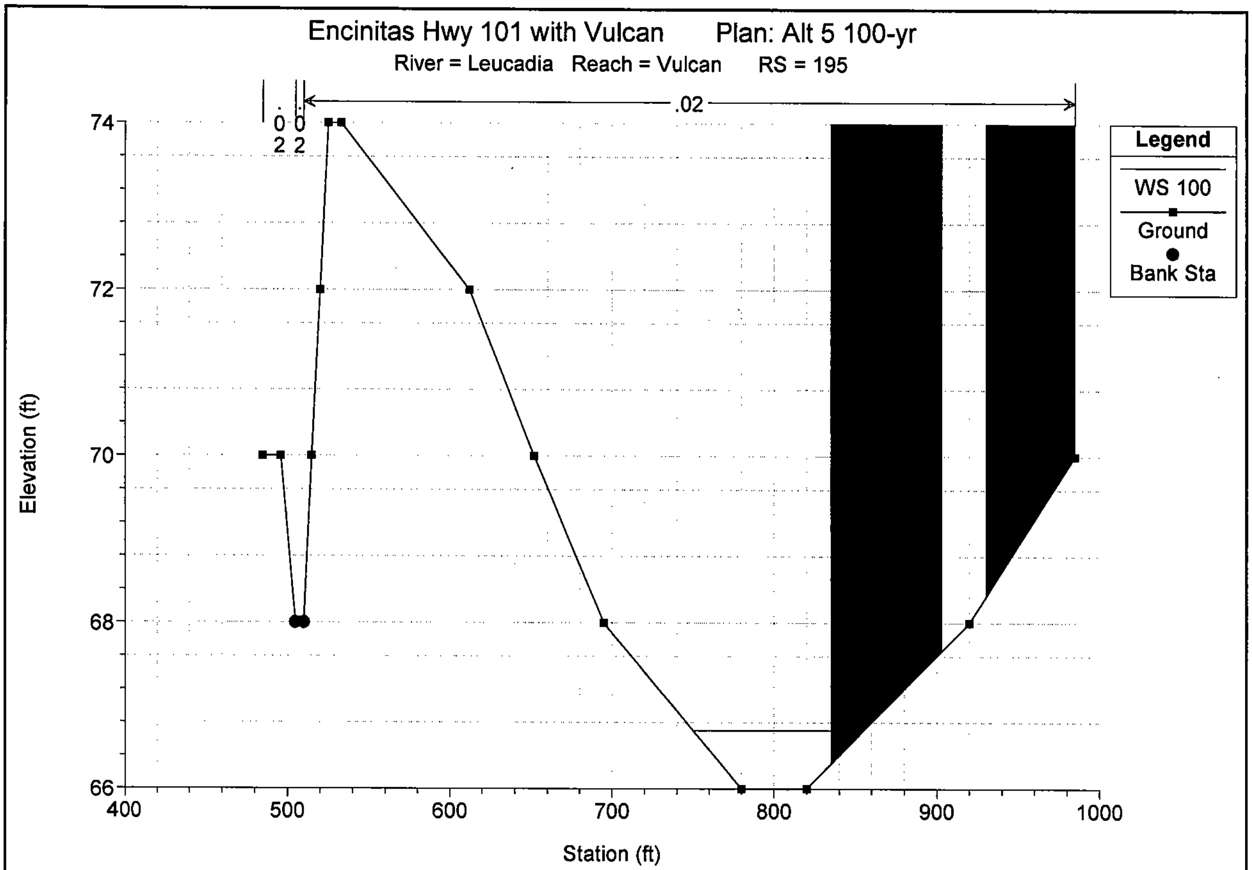

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 235
.03
.035
.03
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 230
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

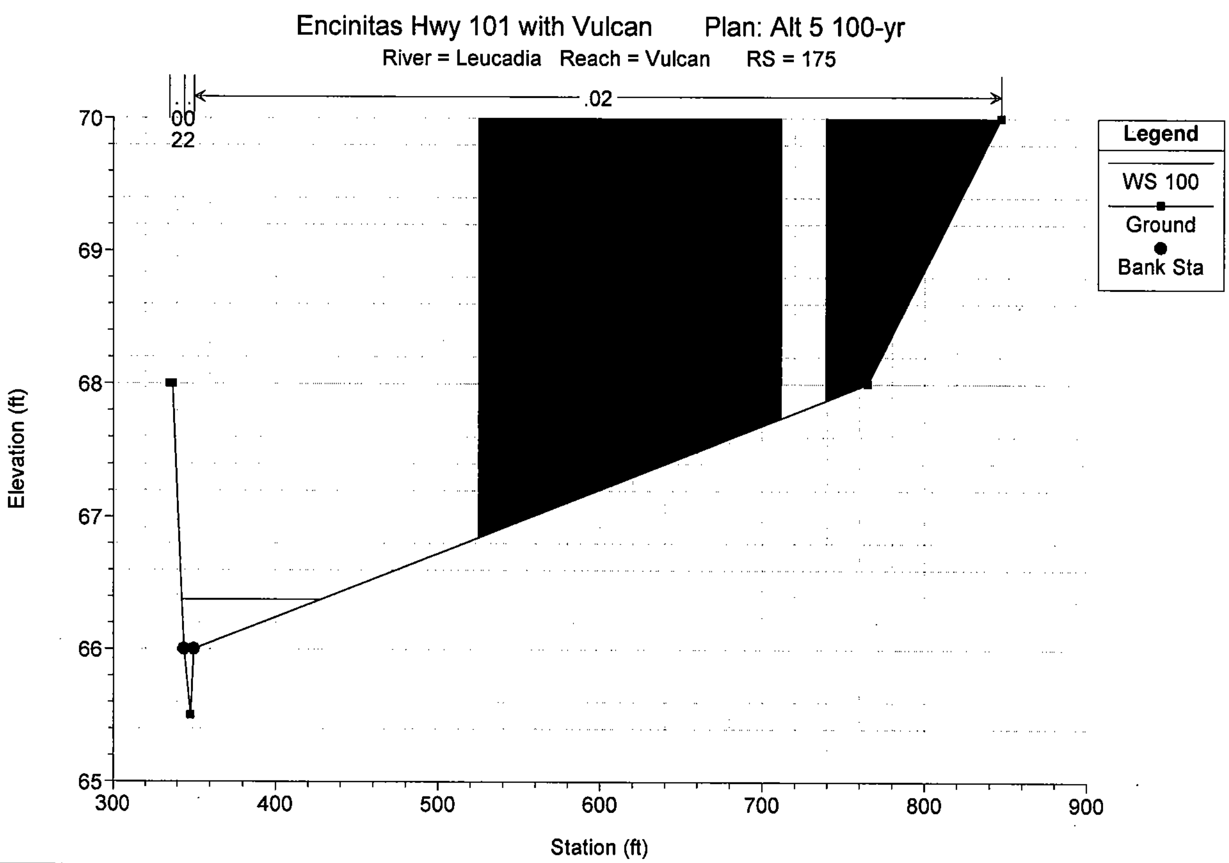

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 225
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 220
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
72
71
70
69
68
67
66
400
500
600
700
800
900
1000

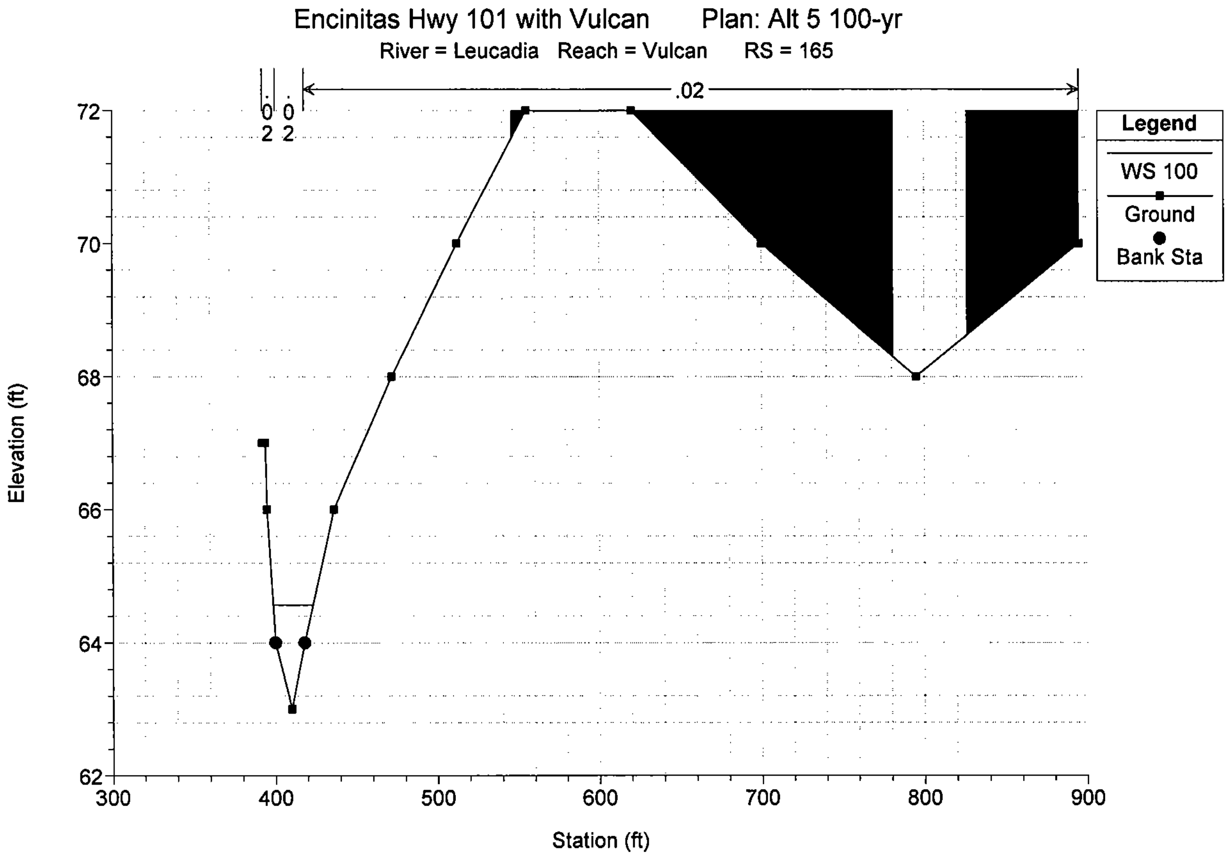

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 215
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
71
70
69
68
67
66
500
600
700
800
900
1000

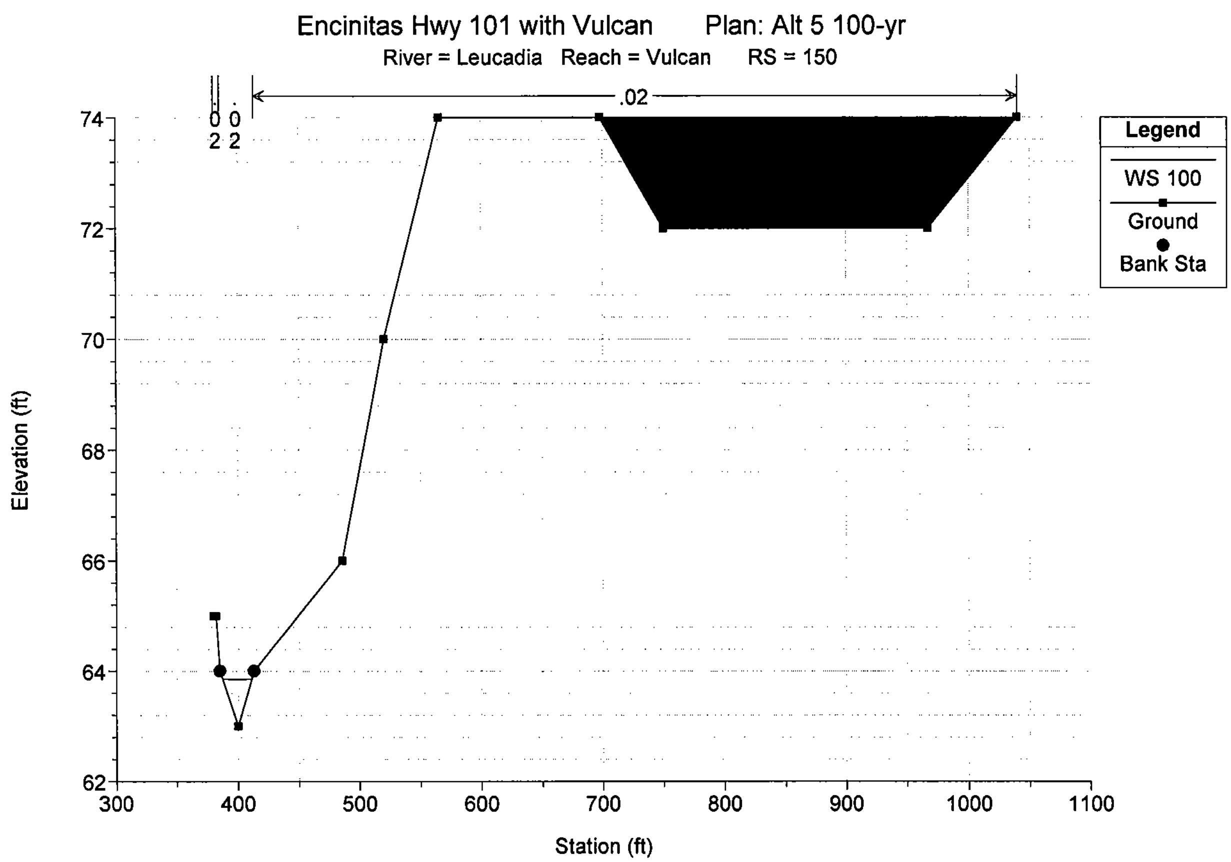


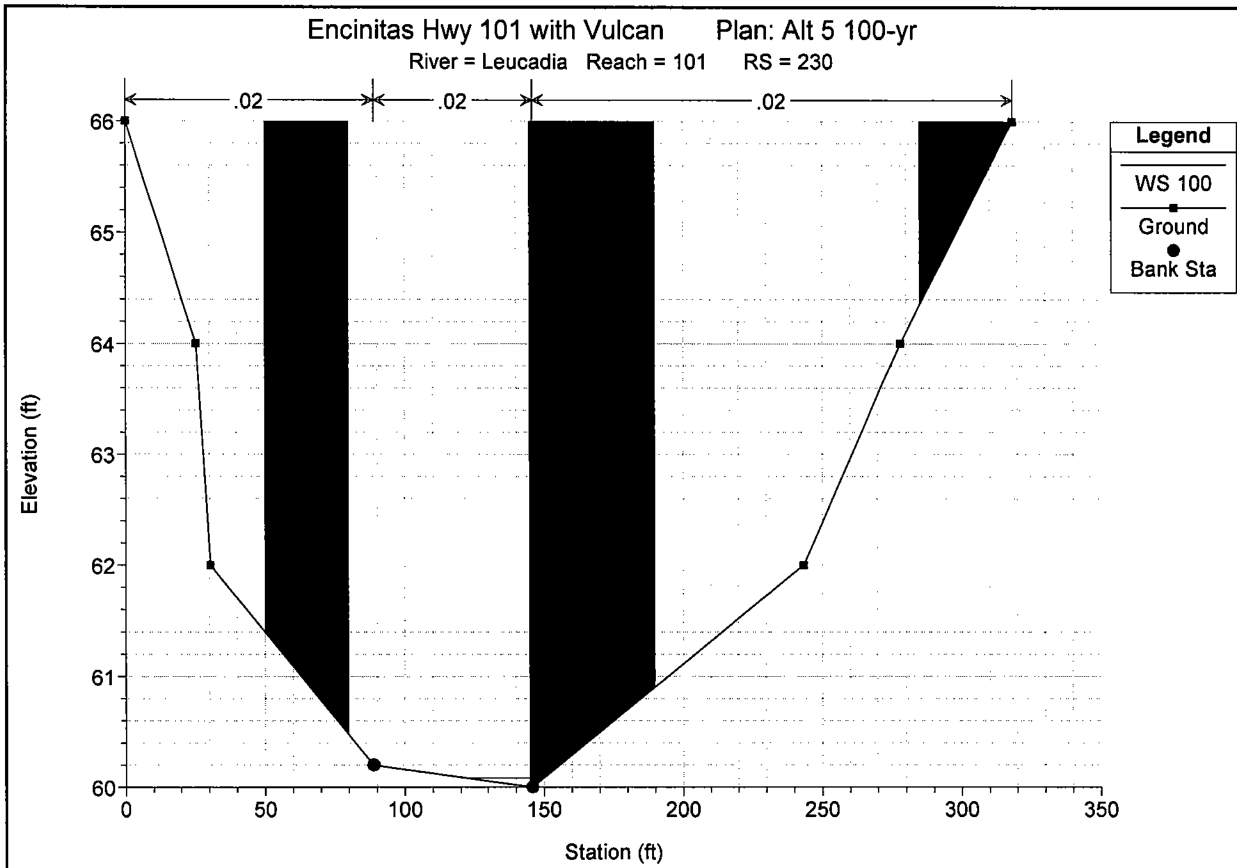
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 195
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

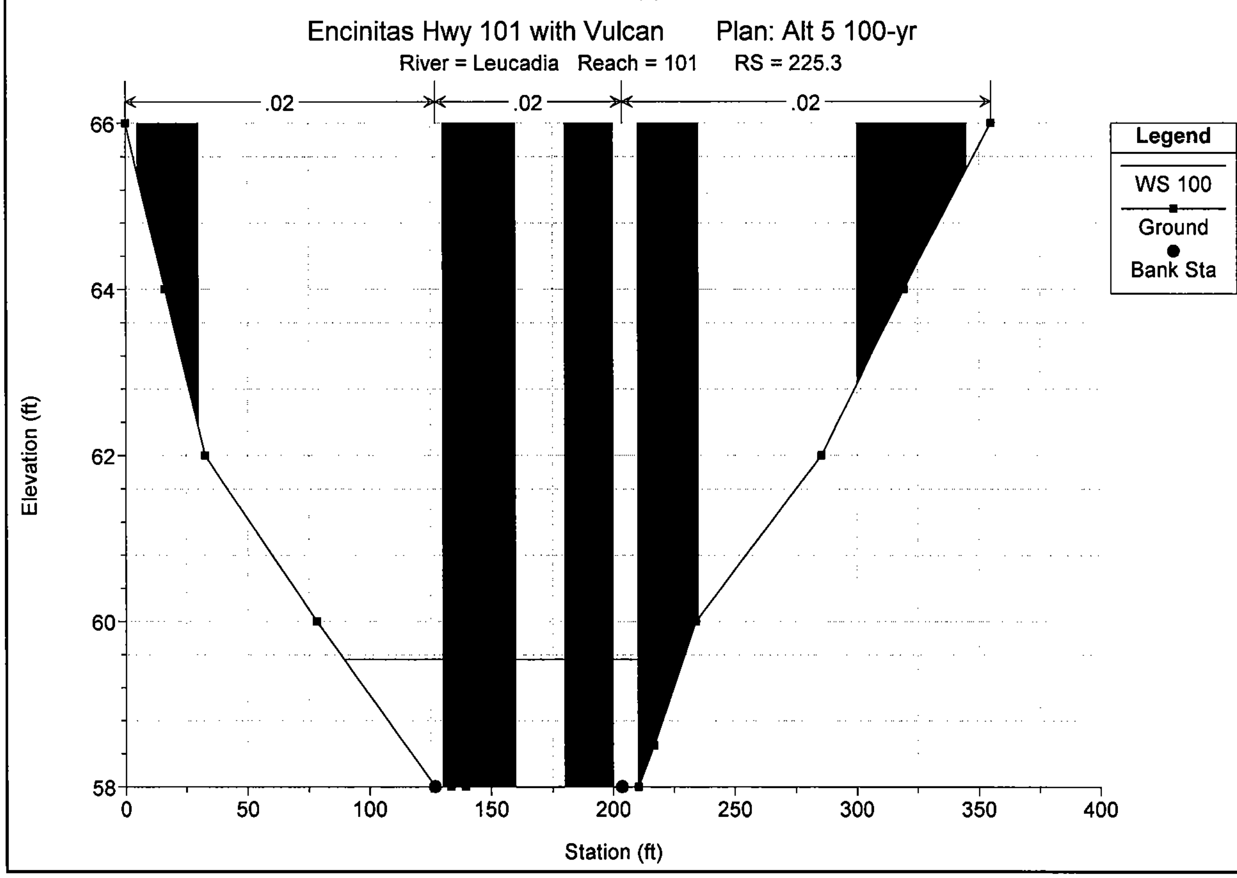


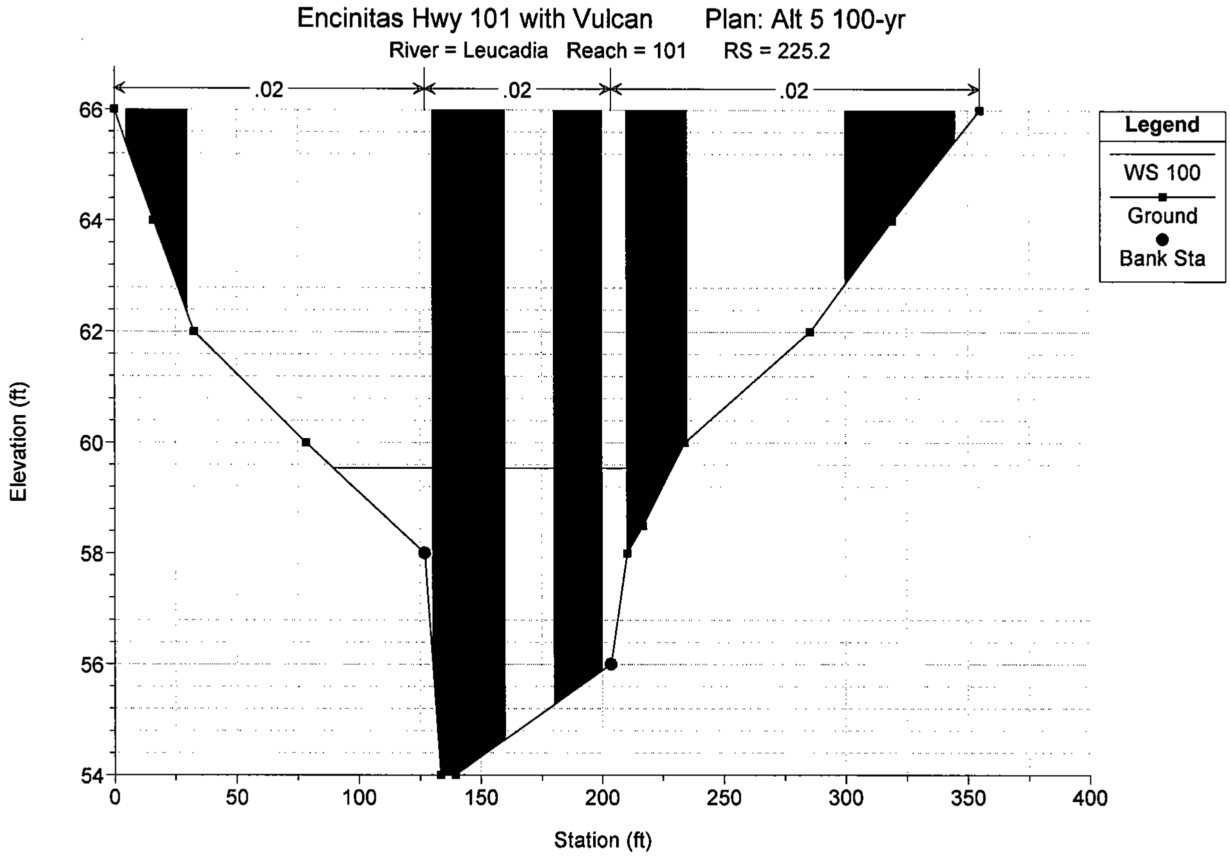
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 175
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

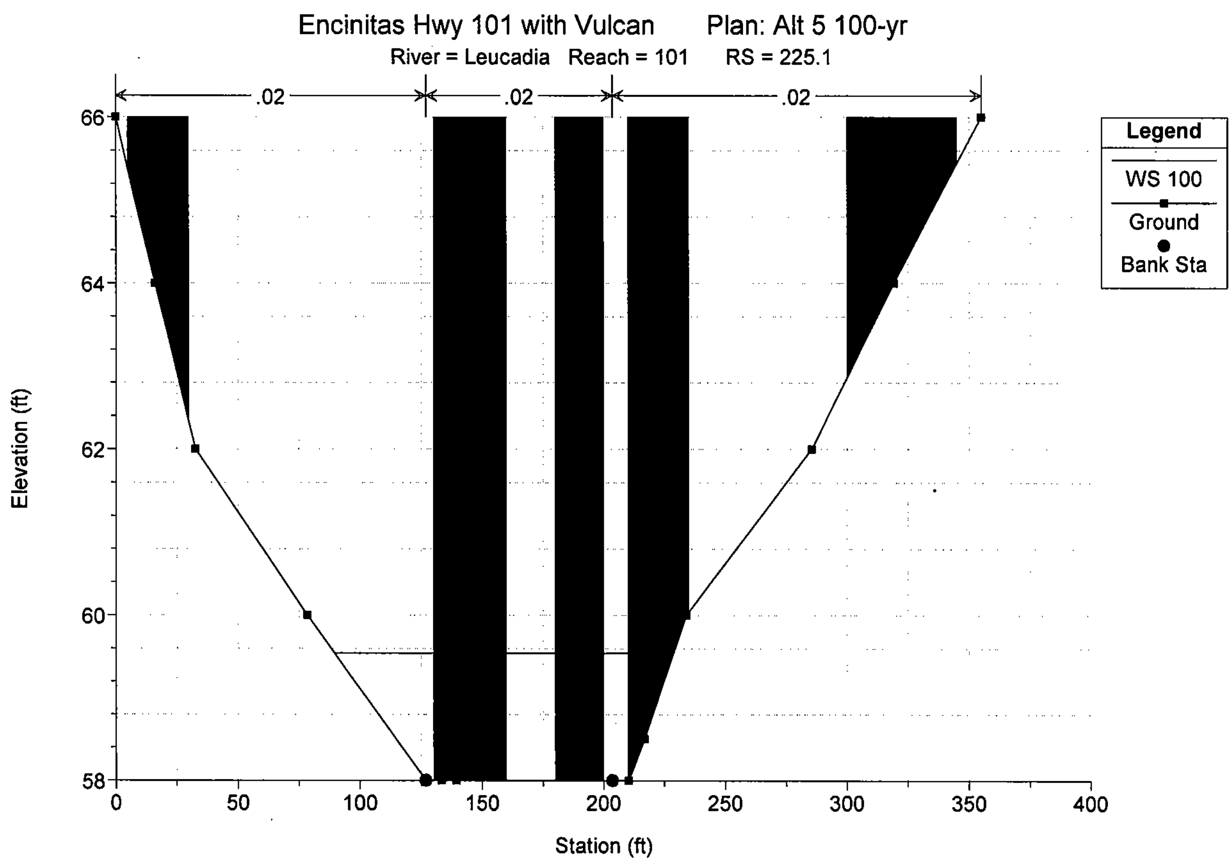

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 165
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

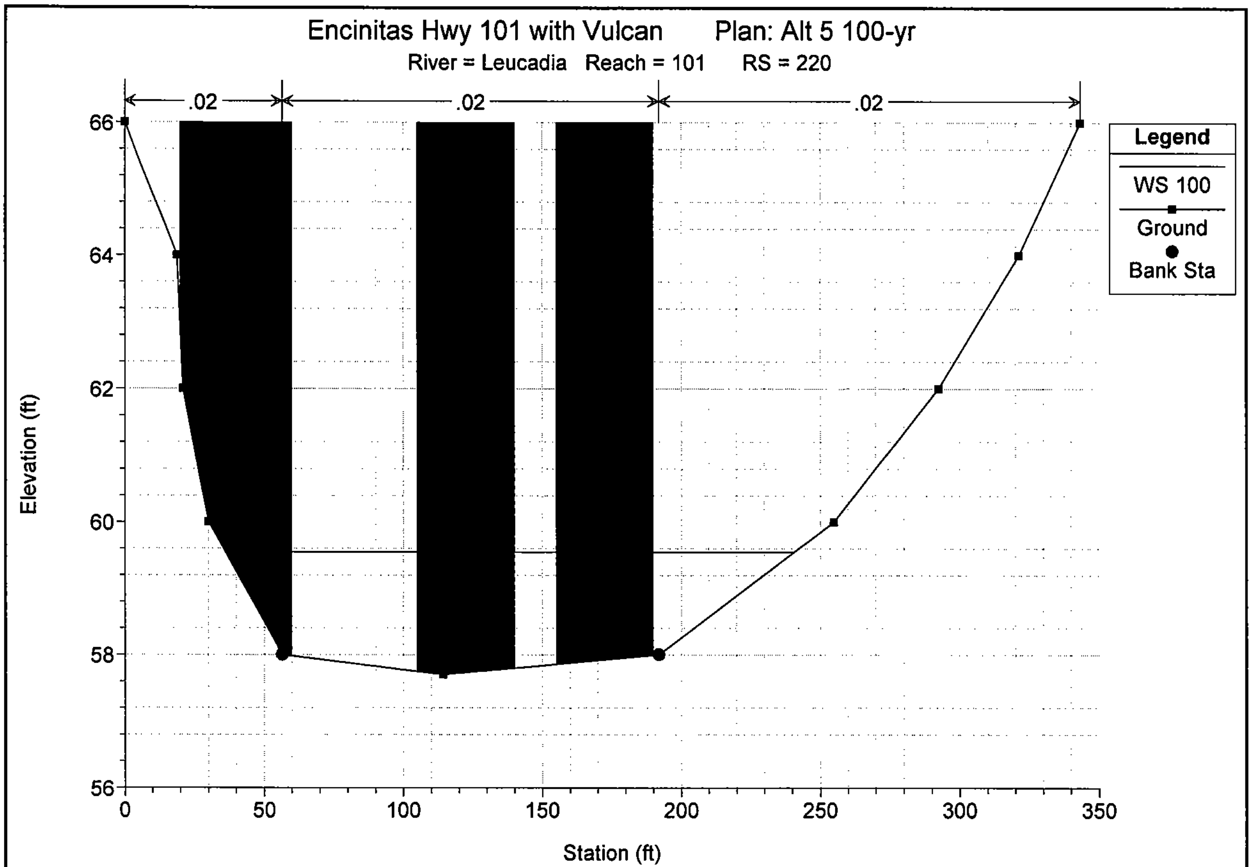

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Vulcan RS = 150
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 230
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
65
64
63
62
61
60
0
50
100
150
200
250
300
350

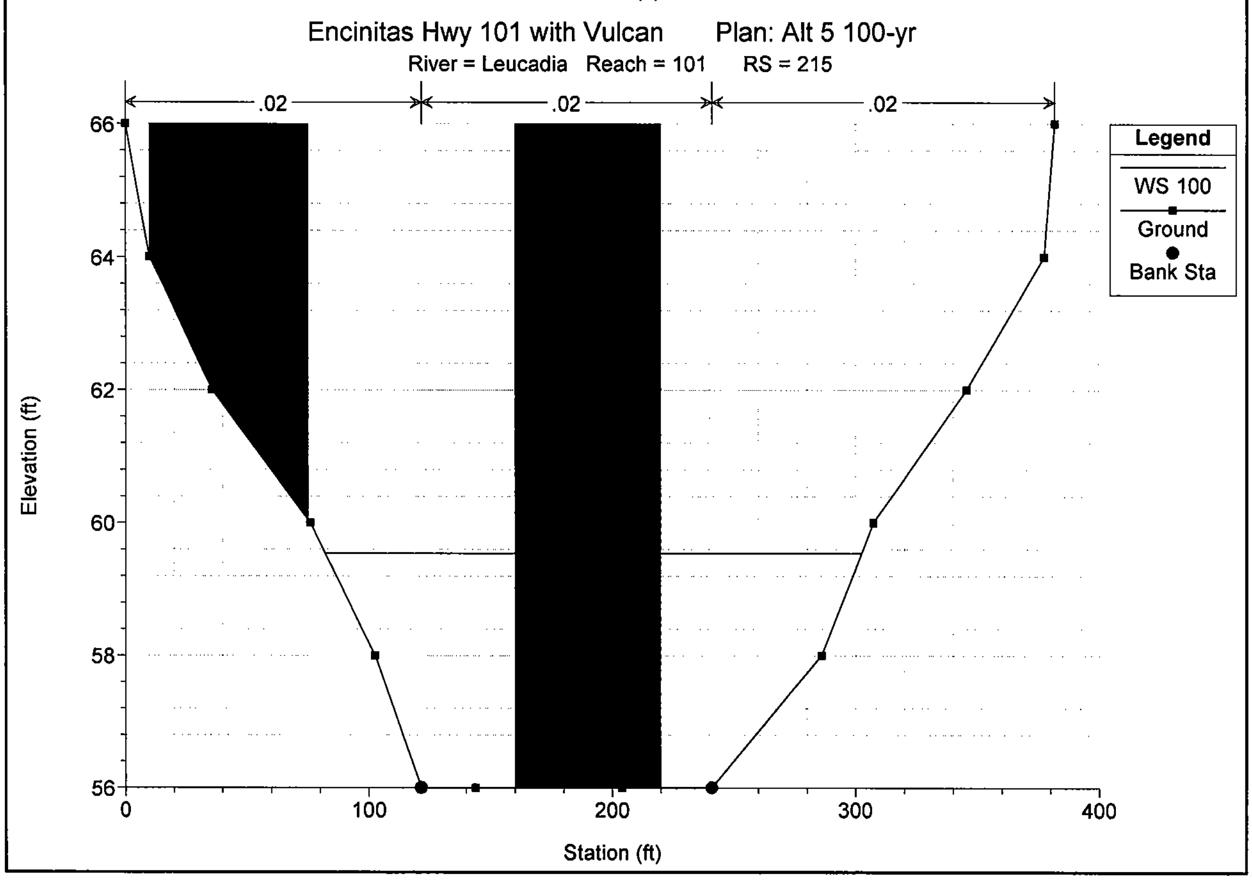

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 225.3
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
0
50
100
150
200
250
300
350
400


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 225.2
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
56
54
0
50
100
150
200
250
300
350
400

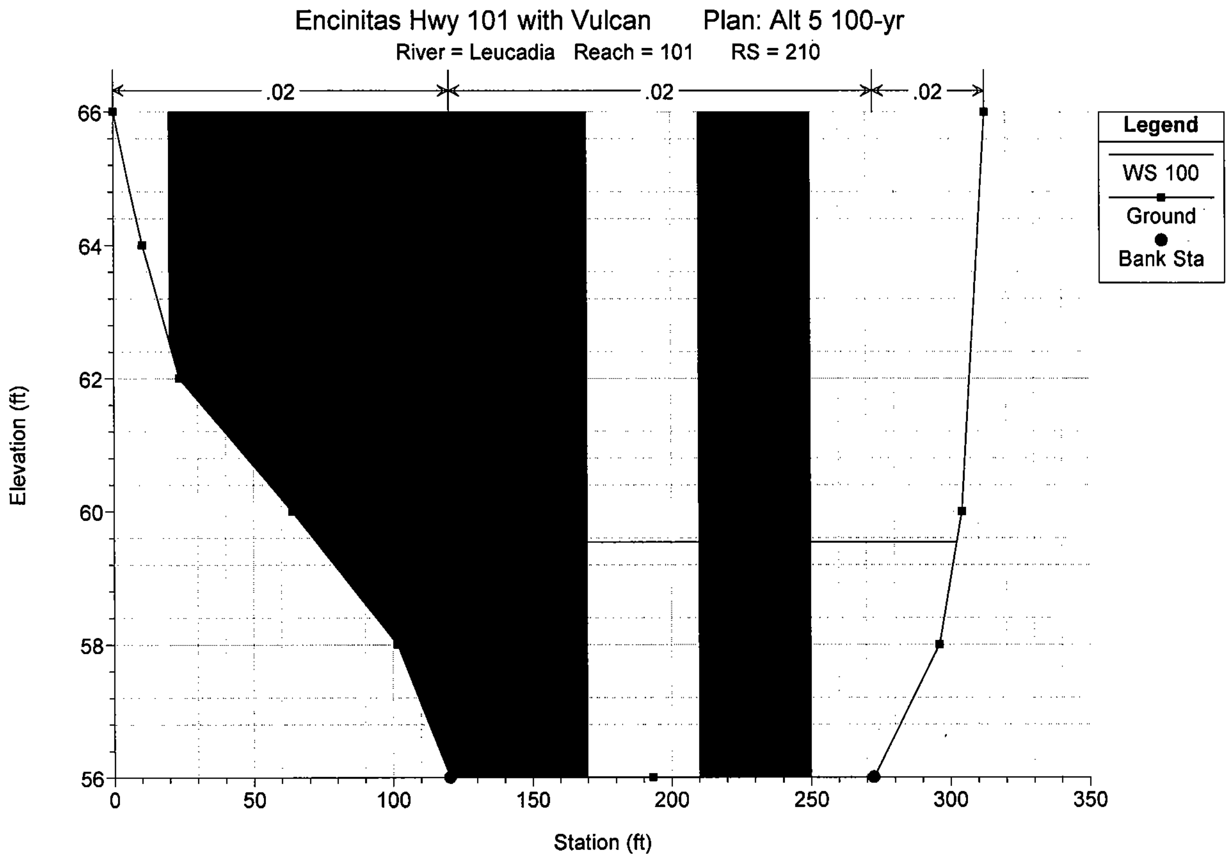

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 225.1
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
66
64
62
60
58
0
50
100
150
200
250
300
350
400

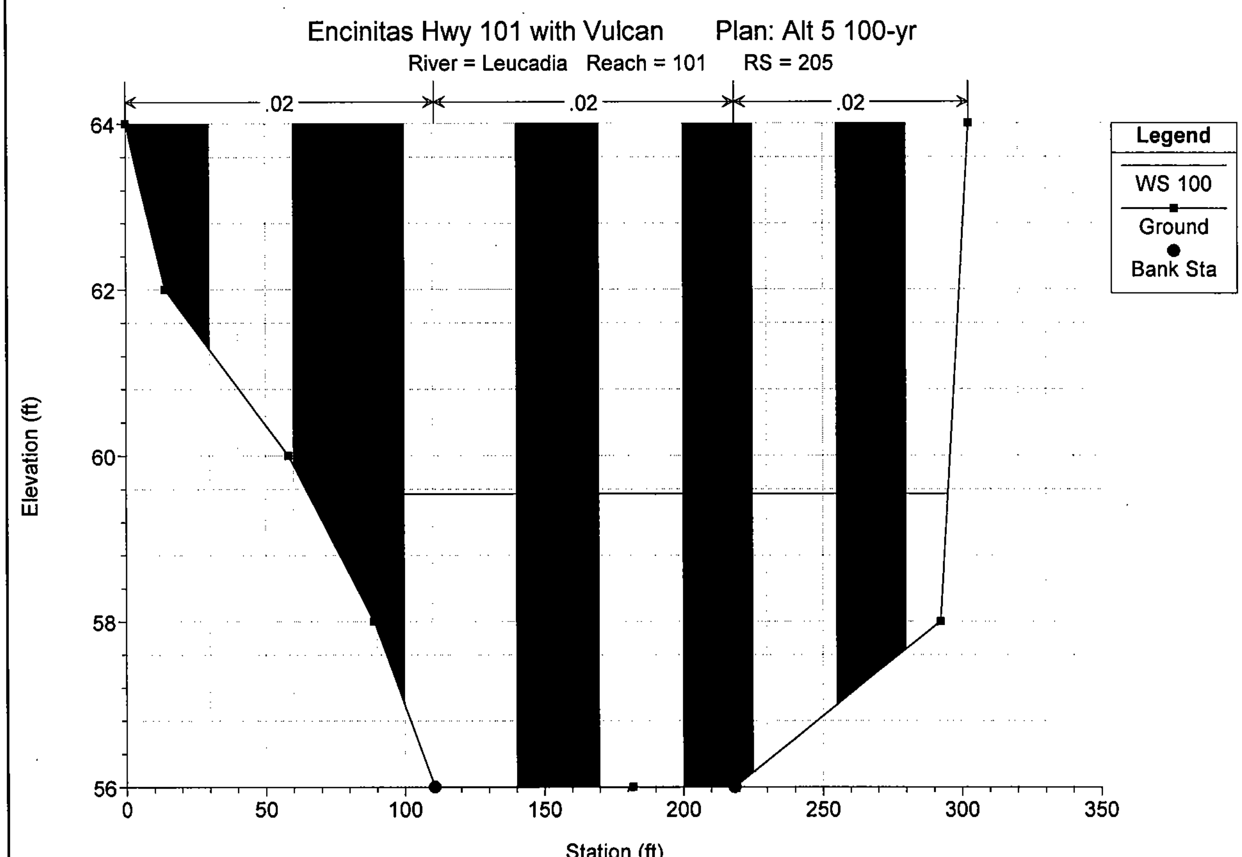


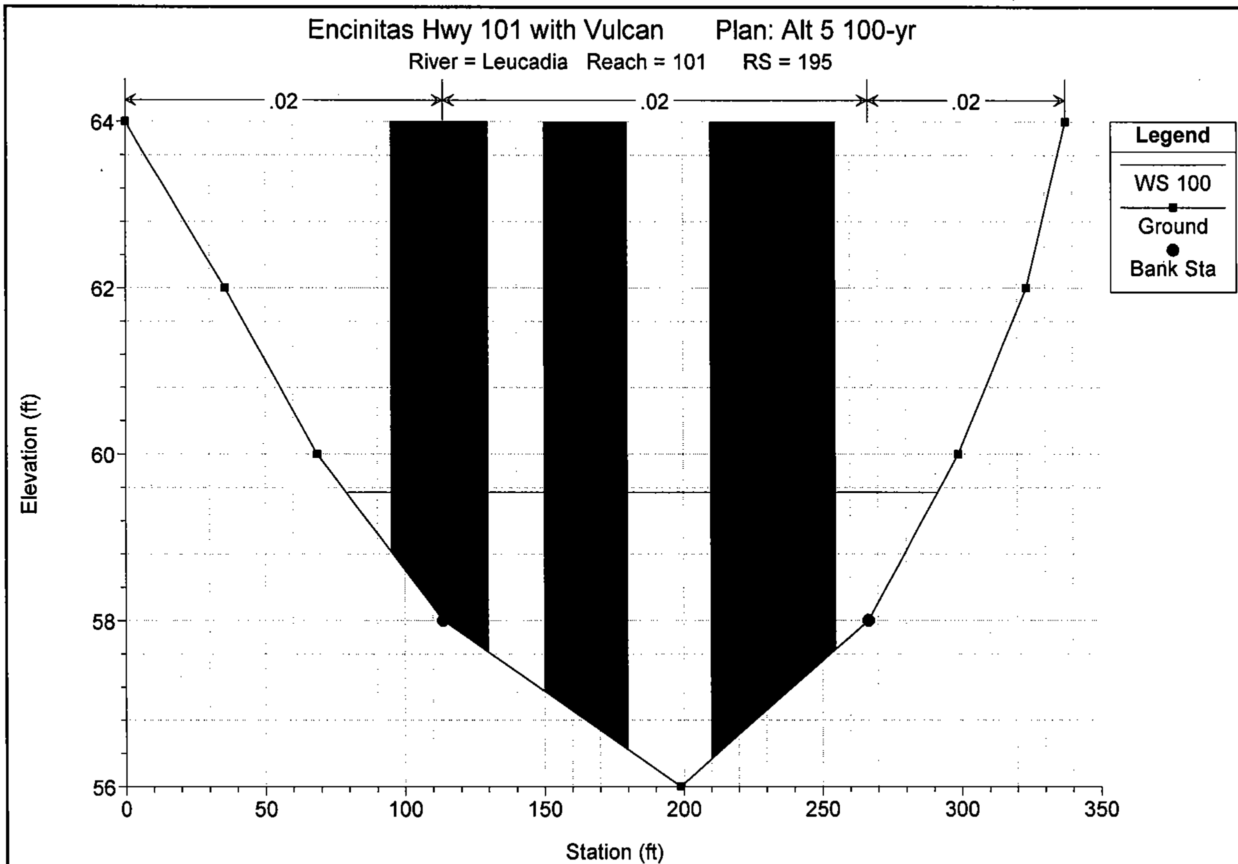
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 220
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)



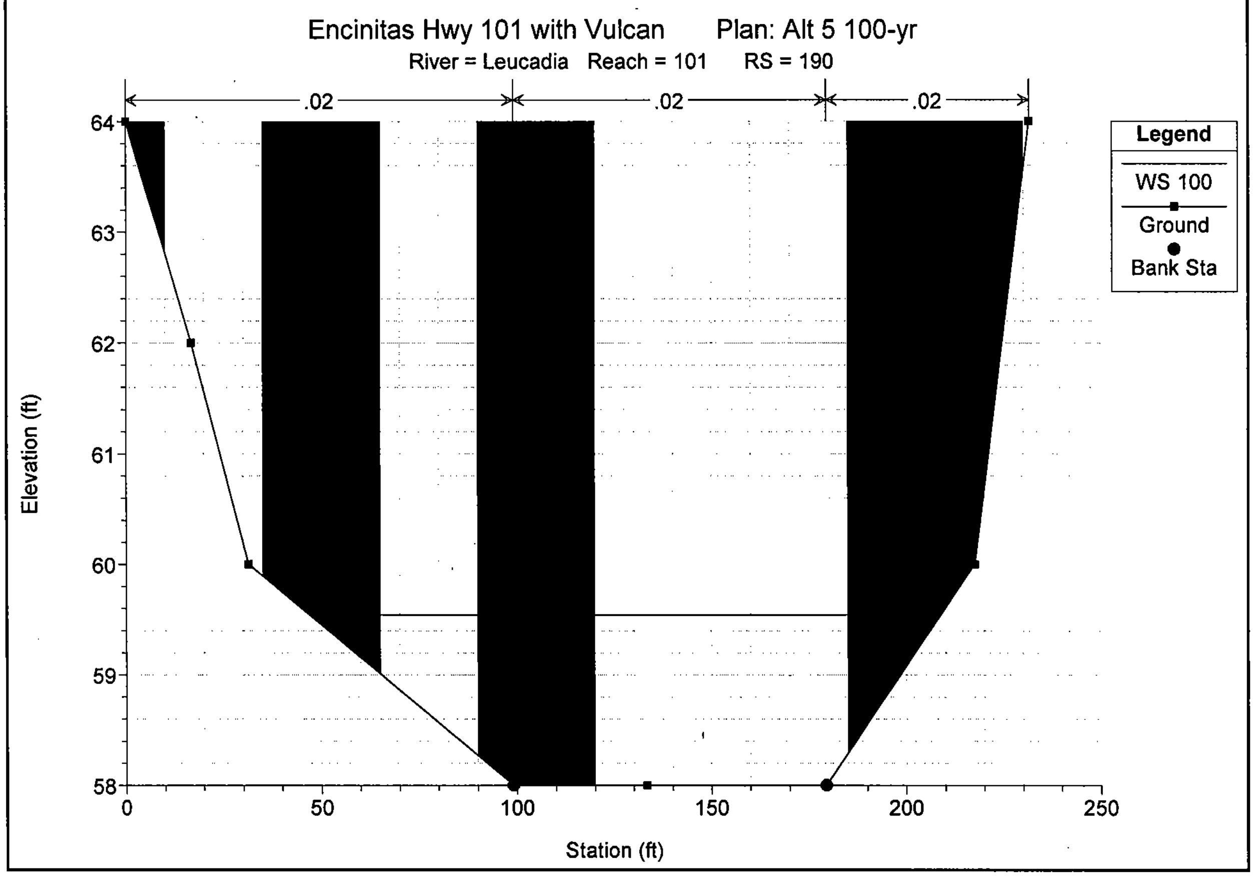
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 215
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 210
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
66
64
62
60
58
56
0
50
100
150
200
250
300
350
Station (ft)

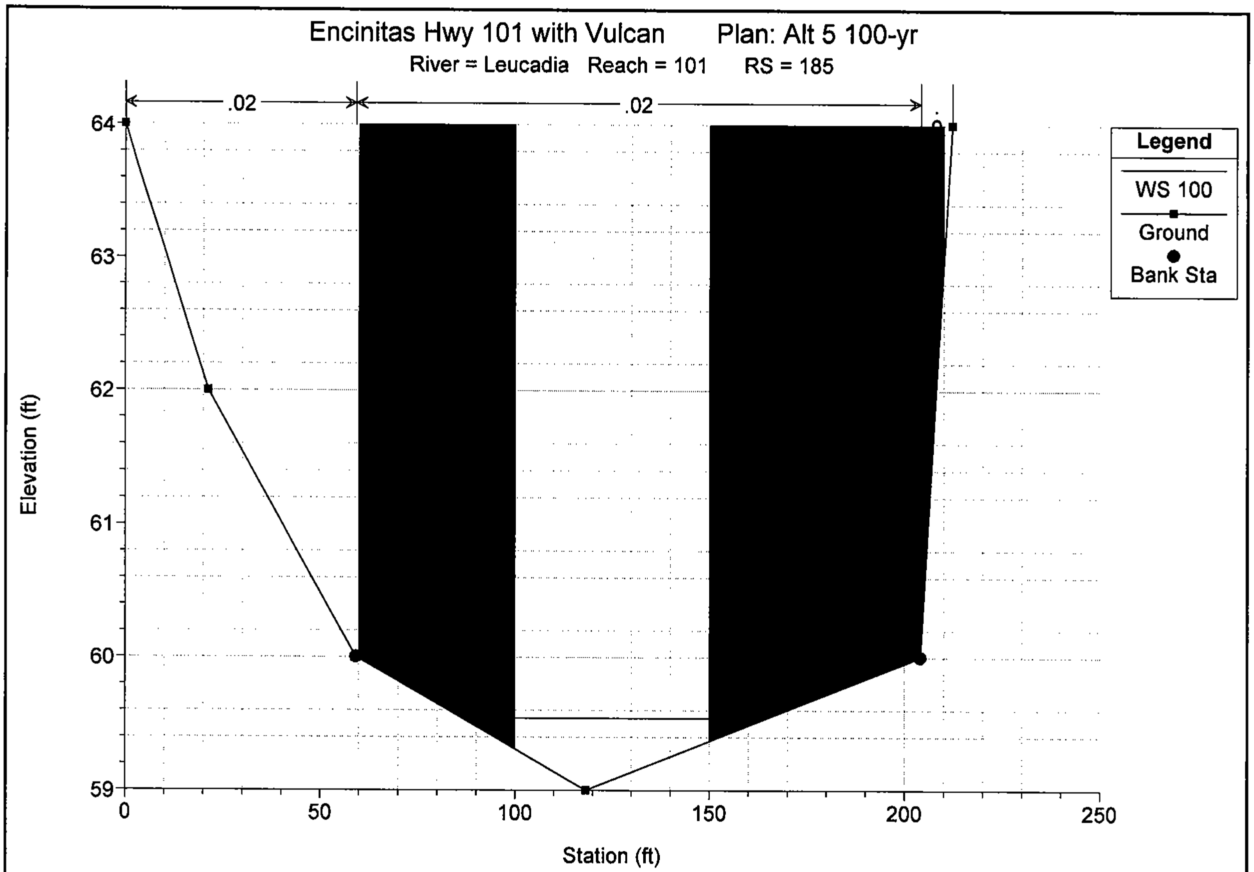

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 205
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
64
62
60
58
56
0
50
100
150
200
250
300
350
Station (ft)



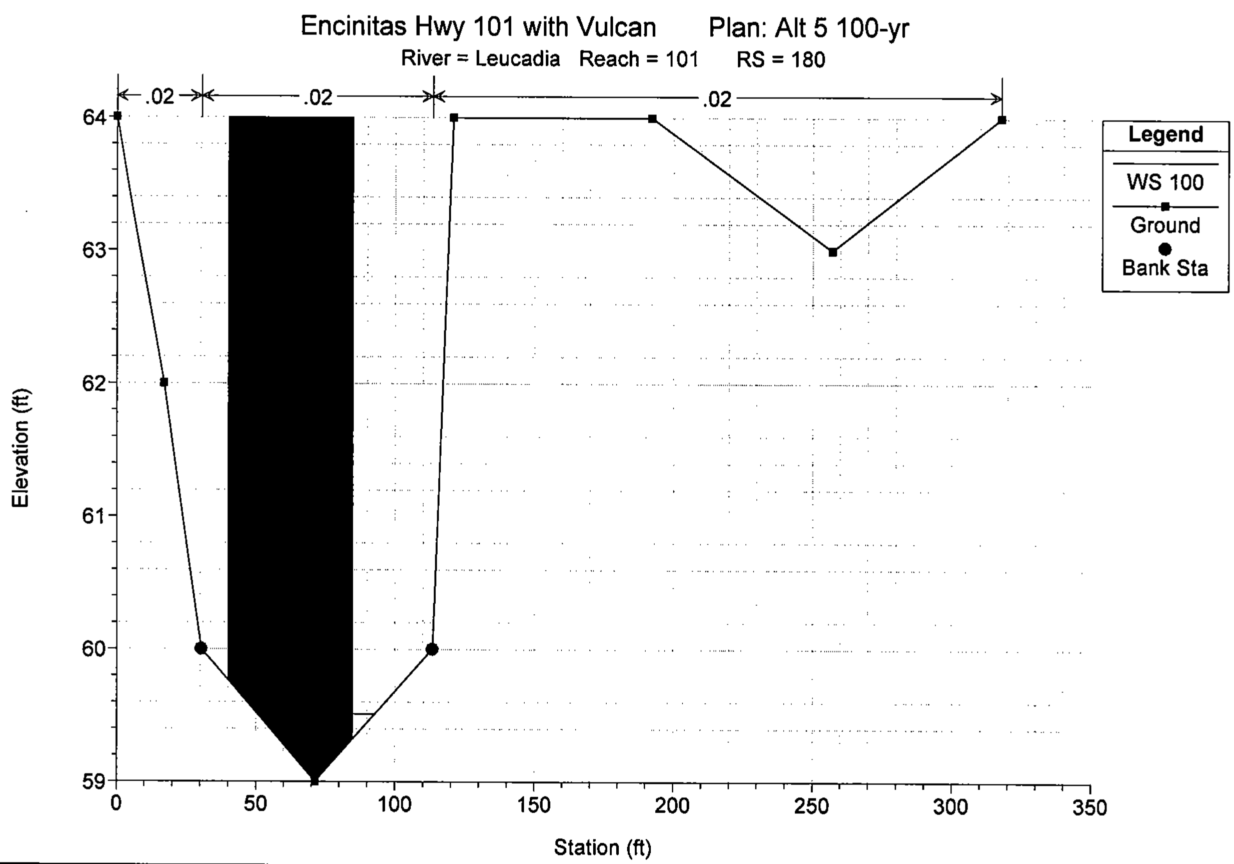
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 195
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)



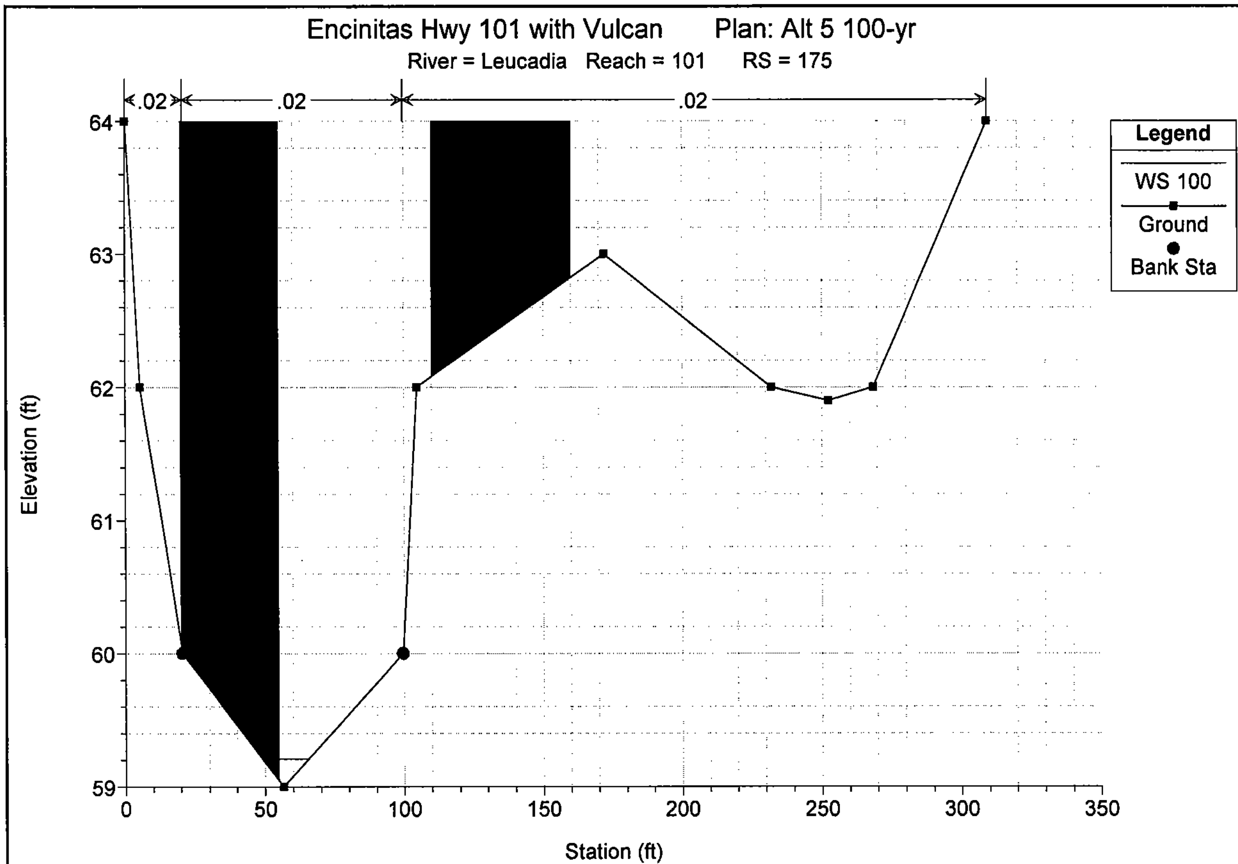
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 190
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

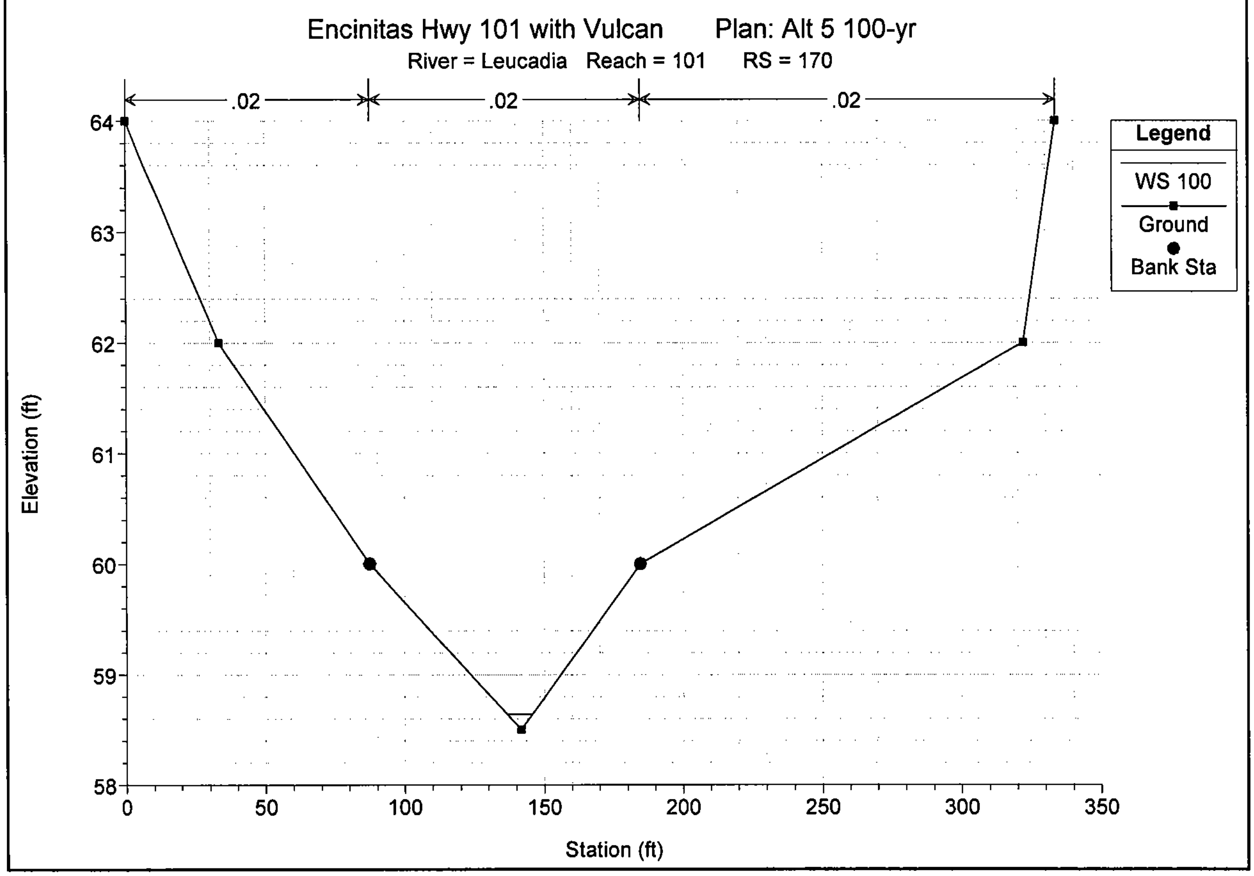


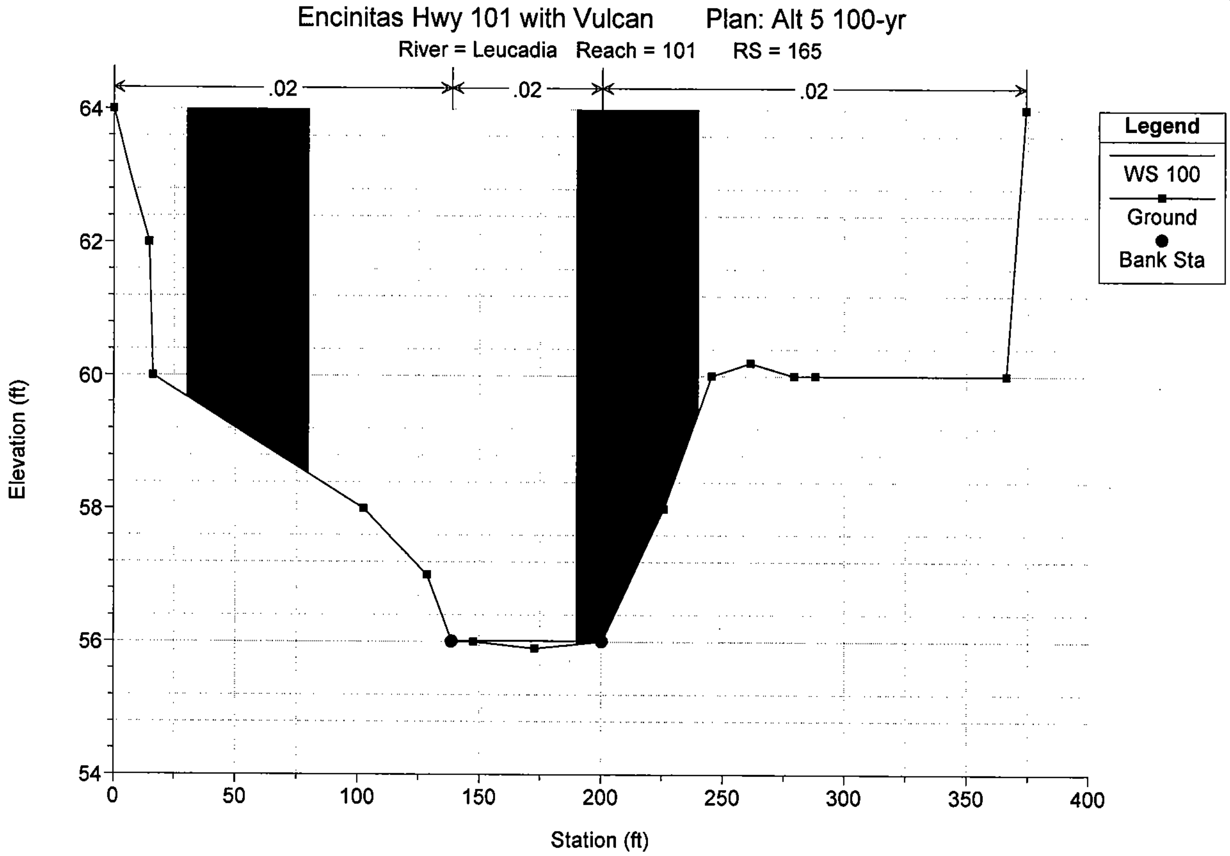
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 185
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta

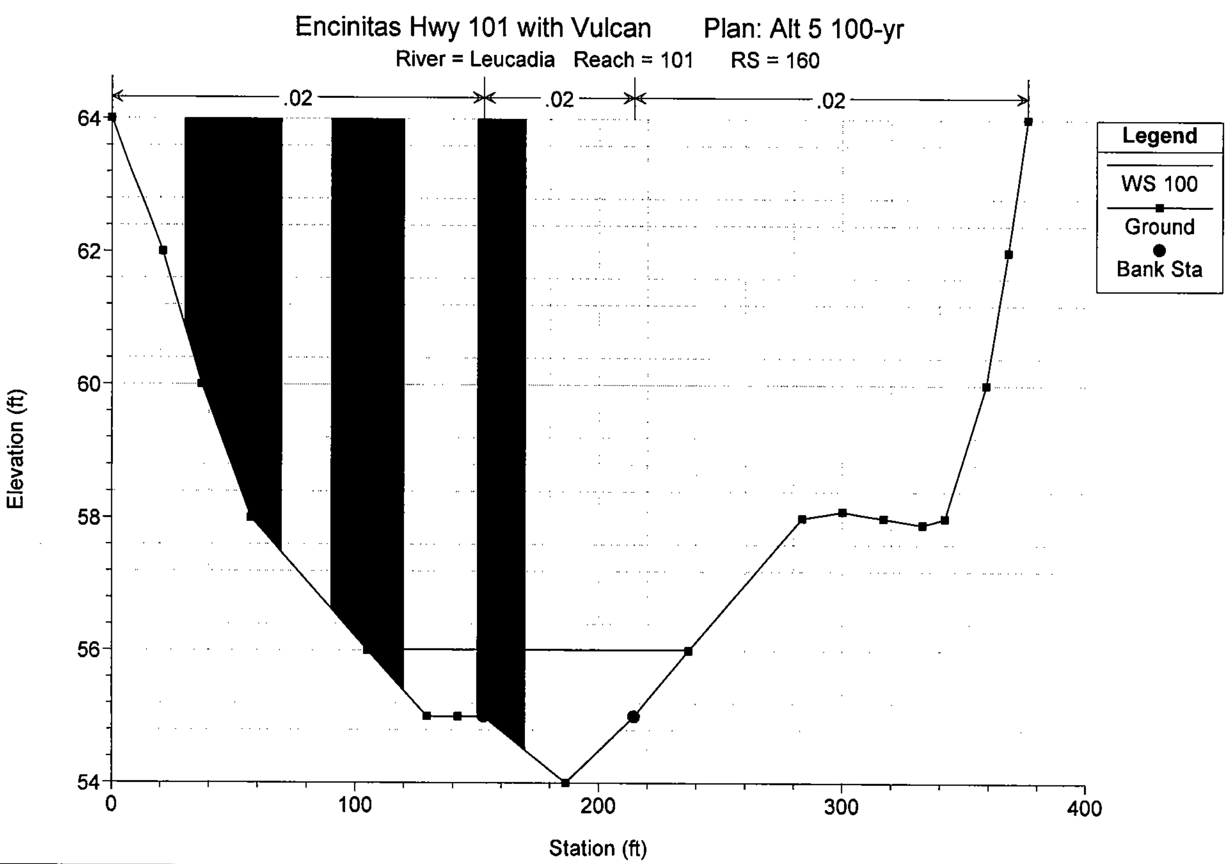


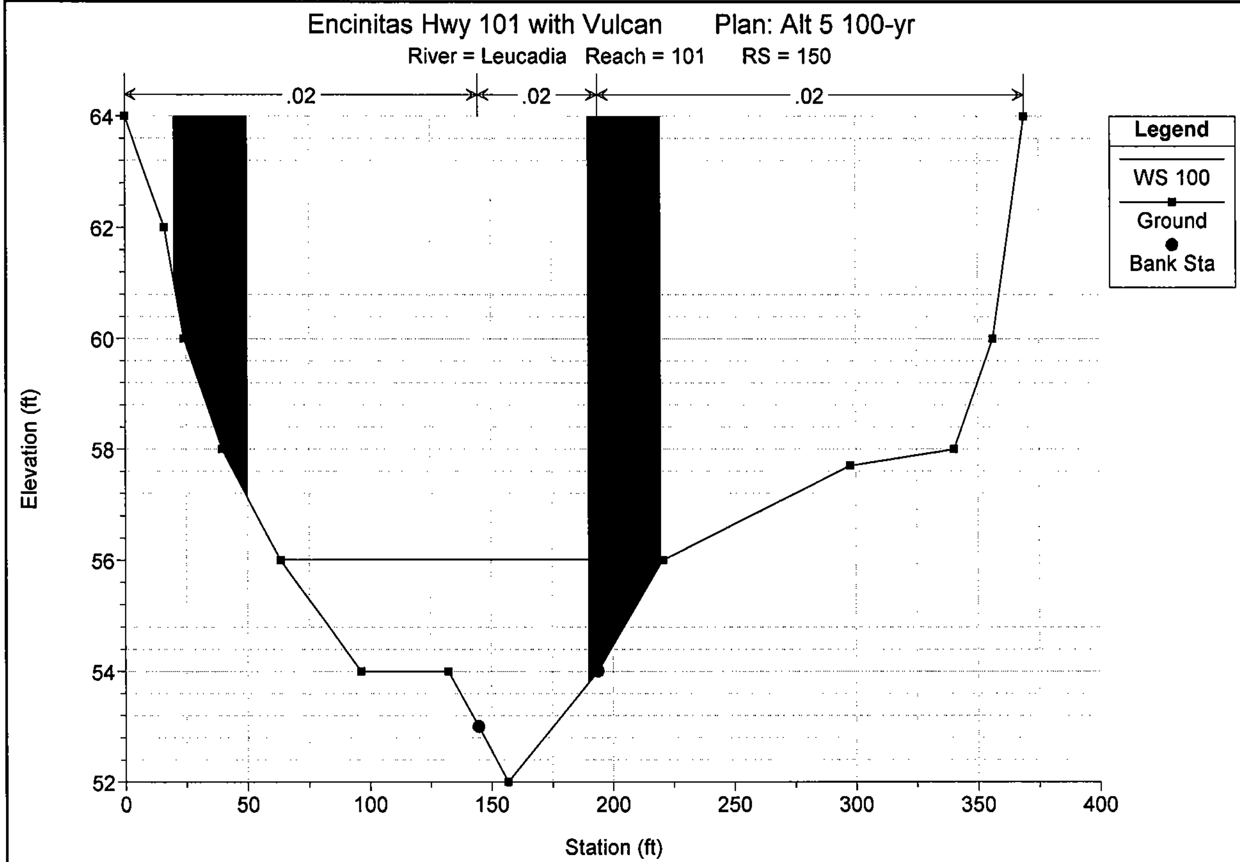
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 180
.02
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta

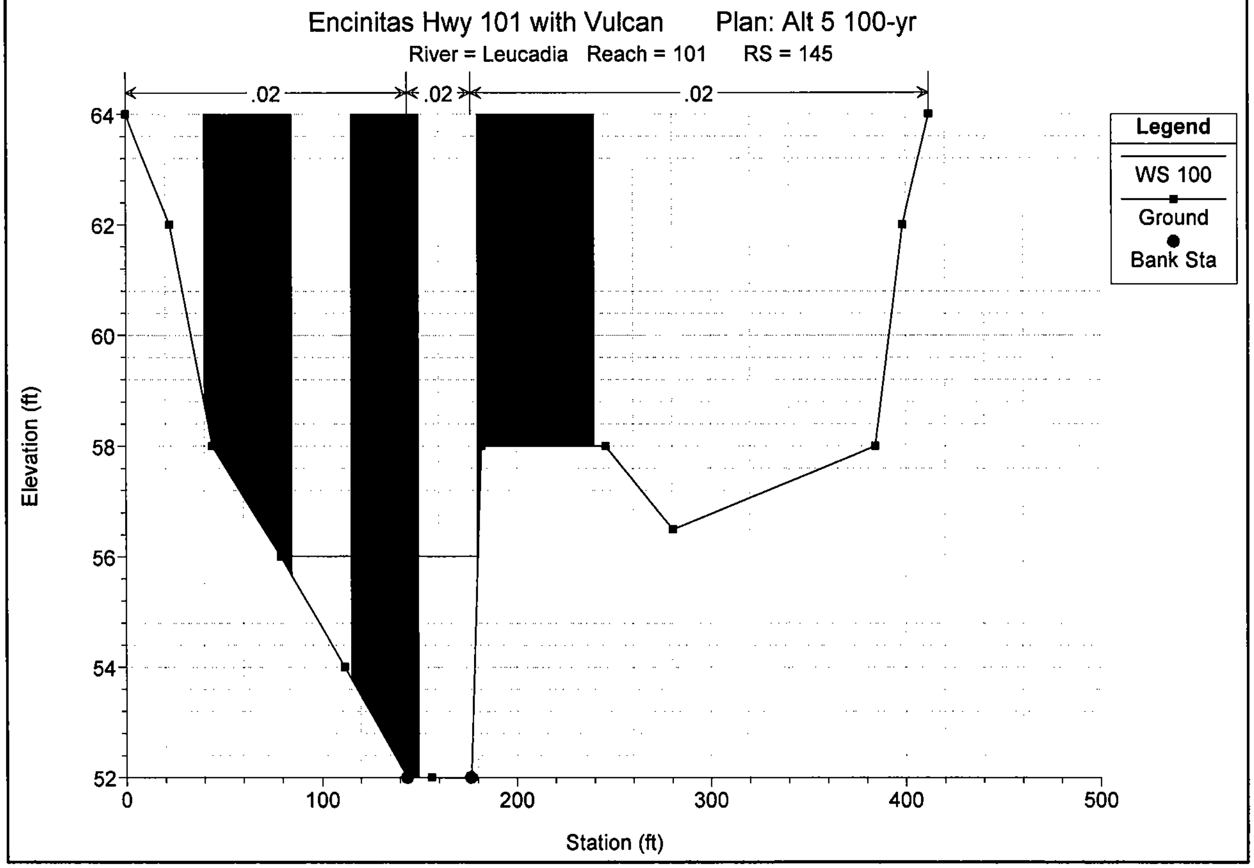

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 175
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
63
62
61
60
59
0
50
100
150
200
250
300
350

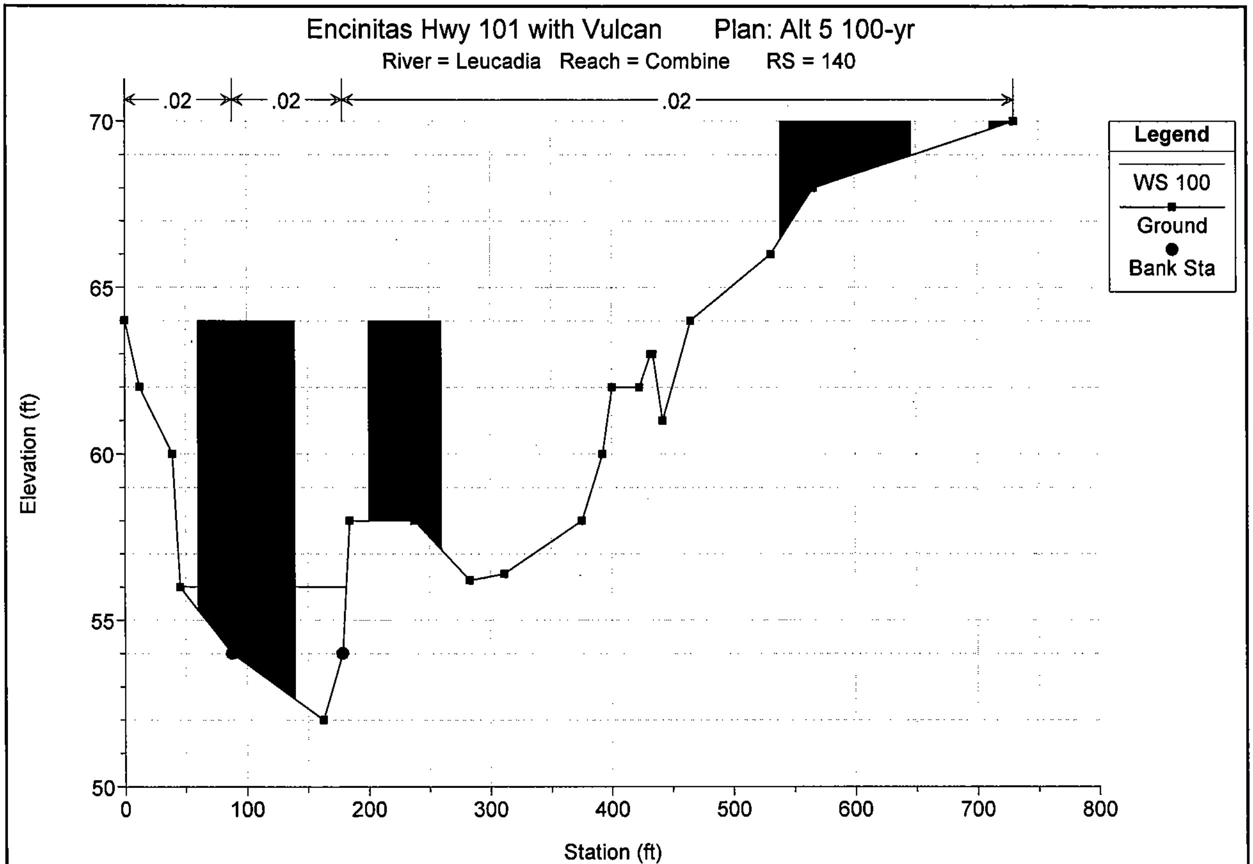

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 170
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
63
62
61
60
59
58
0
50
100
150
200
250
300
350


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 165
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
64
62
60
58
56
54
0
50
100
150
200
250
300
350
400
Station (ft)

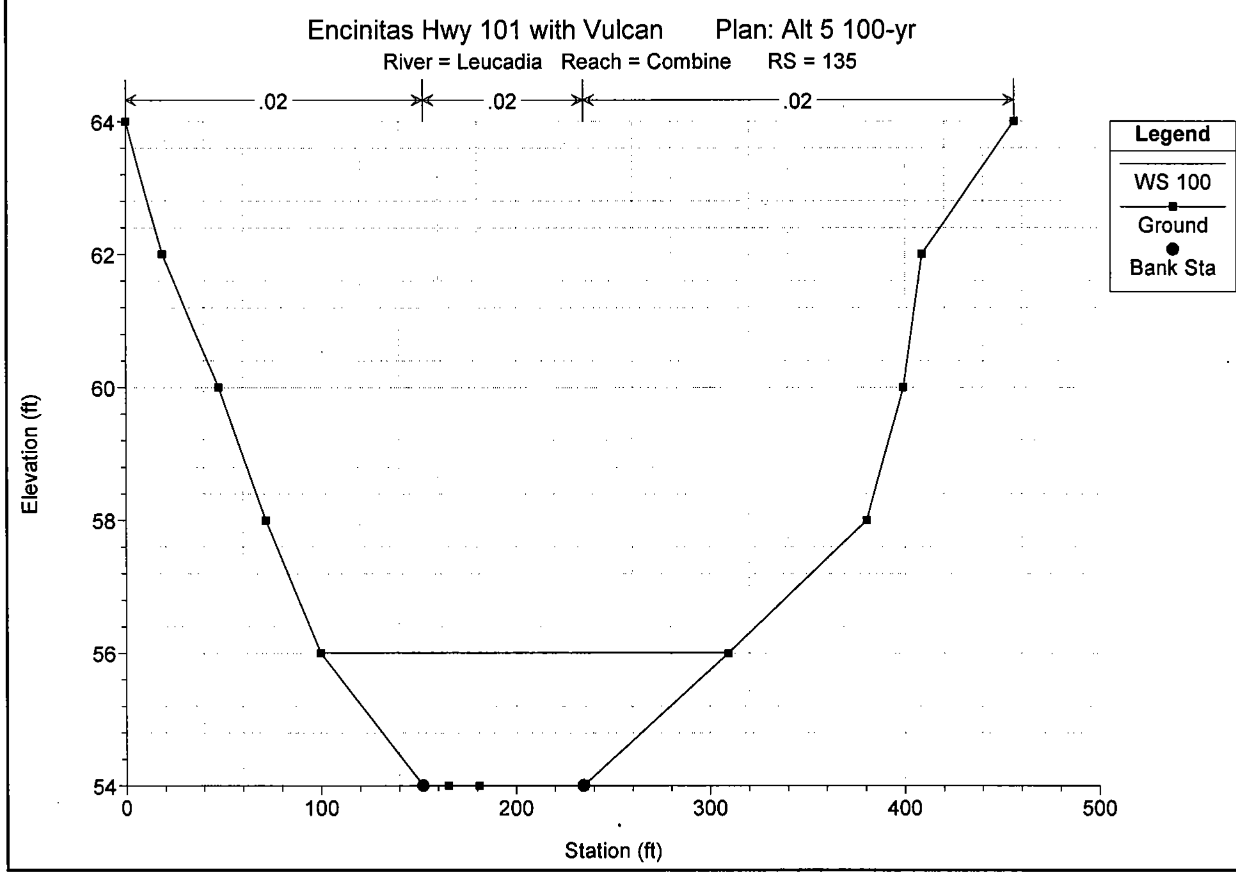

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 160
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
64
62
60
58
56
54
0
100
200
300
400
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 150
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
52
0
50
100
150
200
250
300
350
400

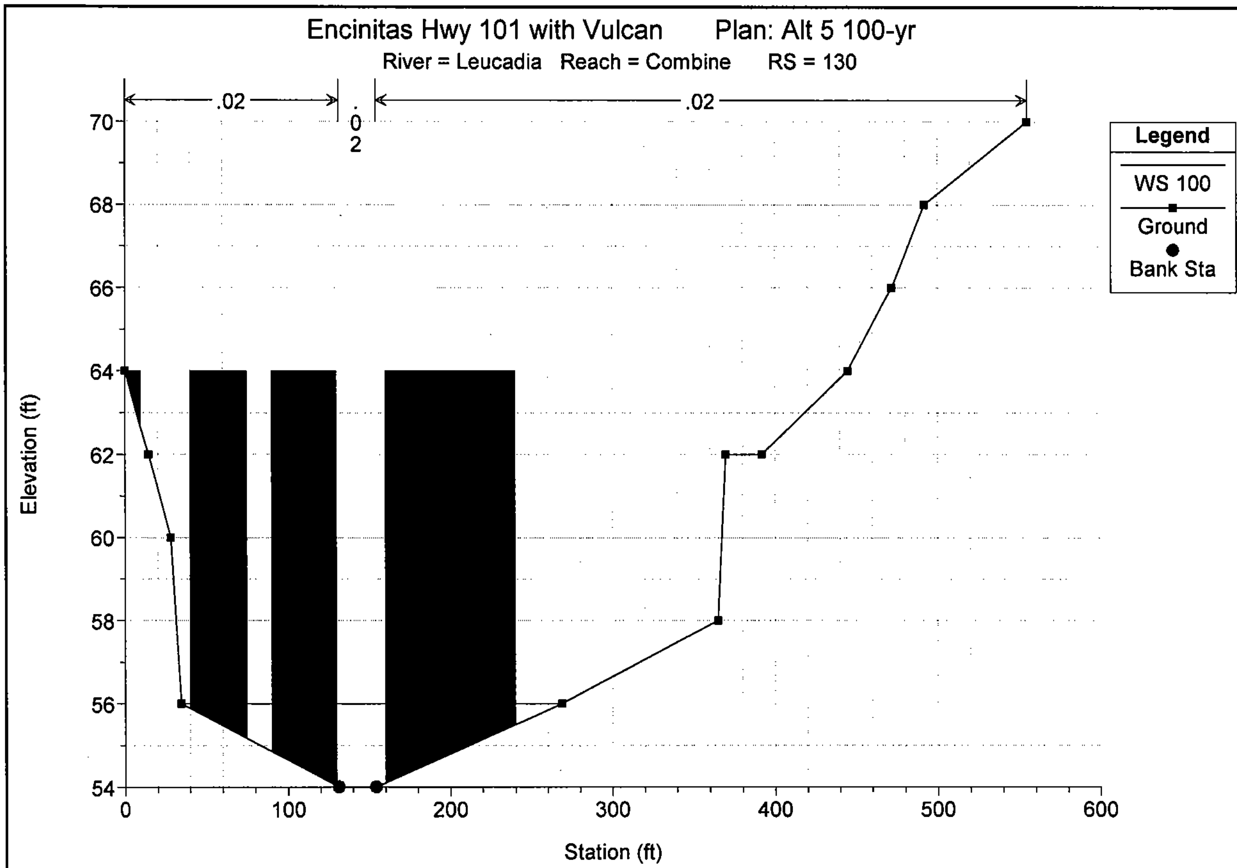

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = 101 RS = 145
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
52
0
100
200
300
400
500

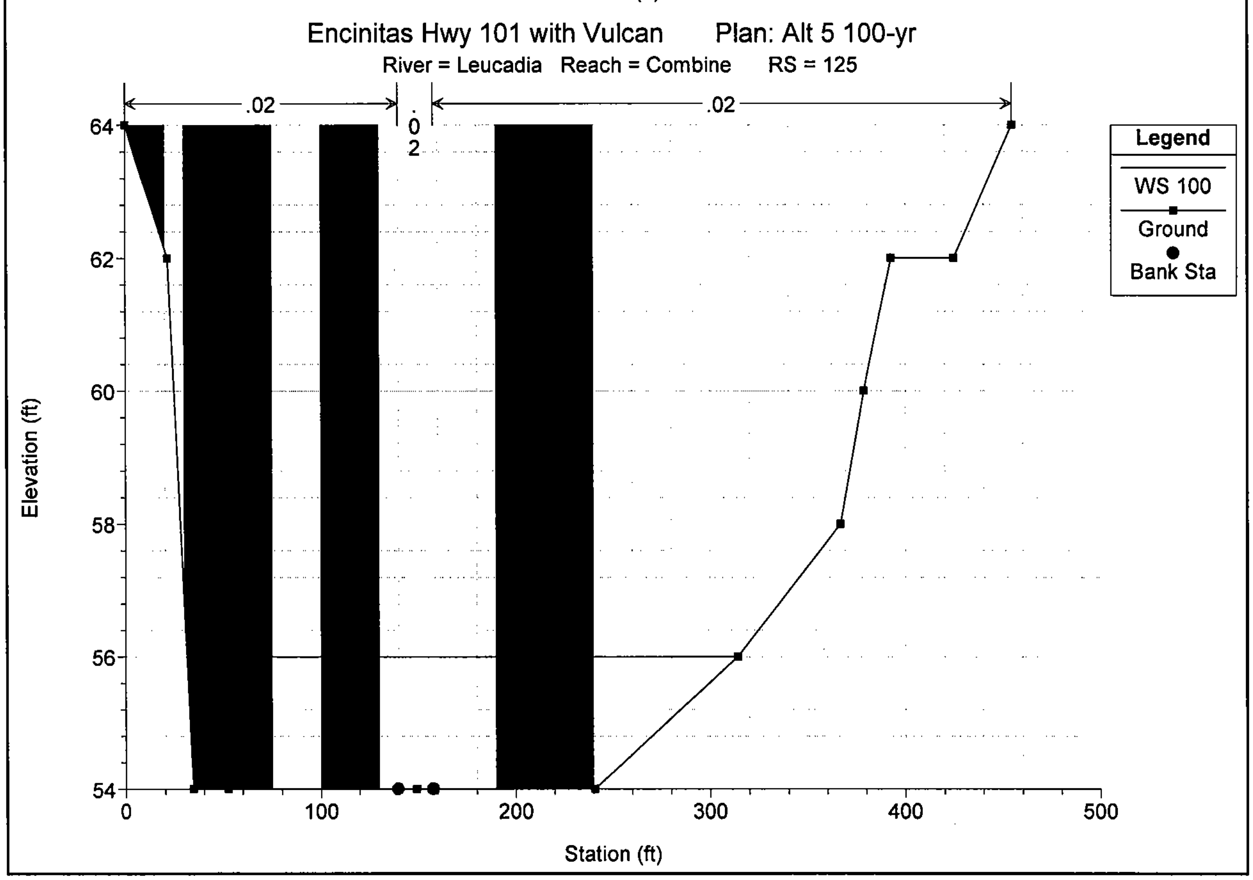


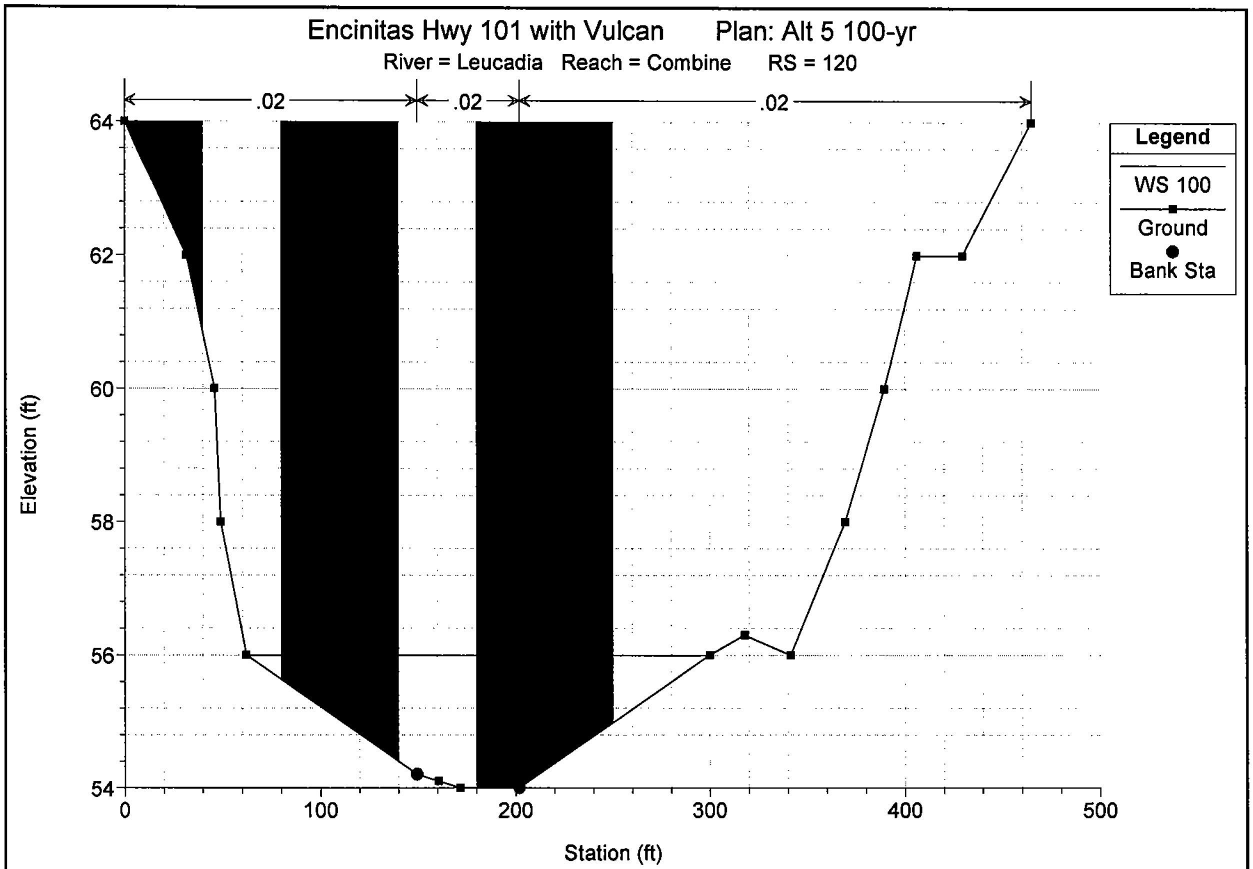
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 140
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

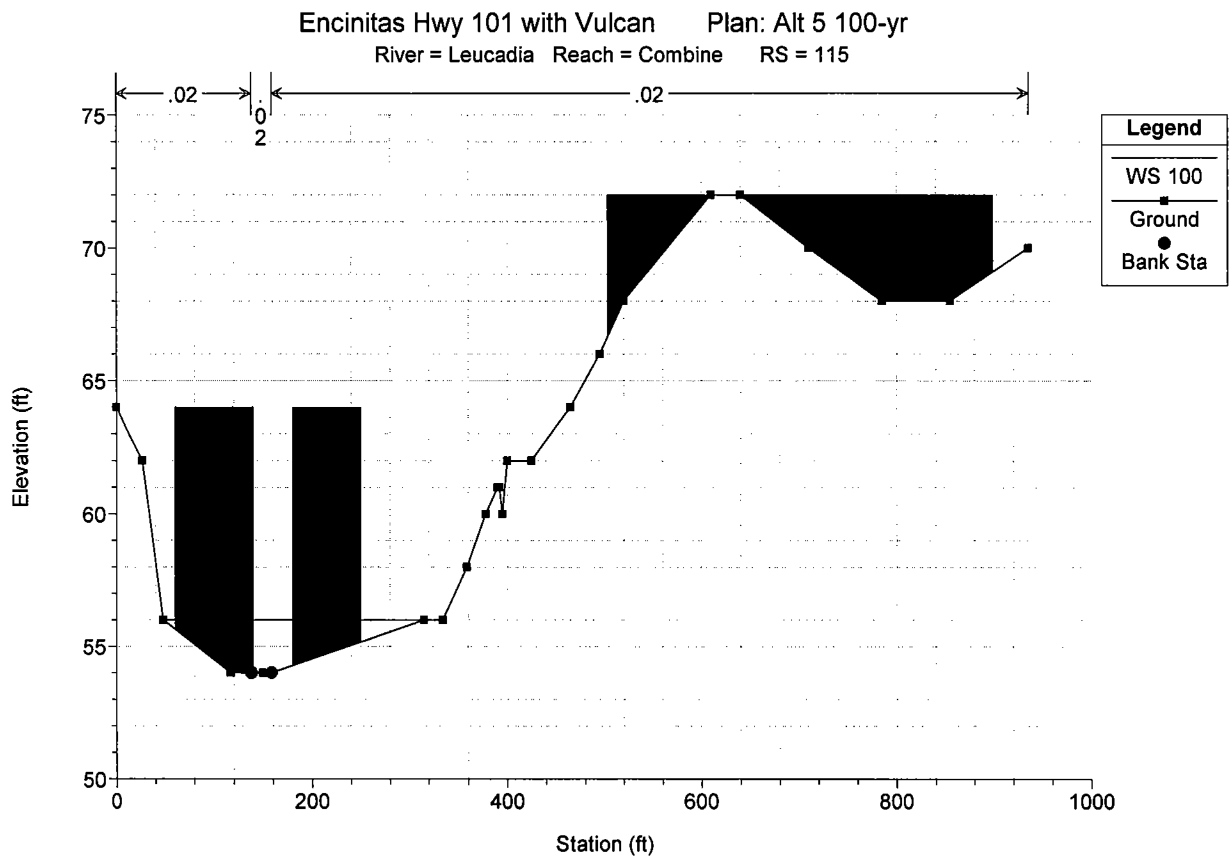


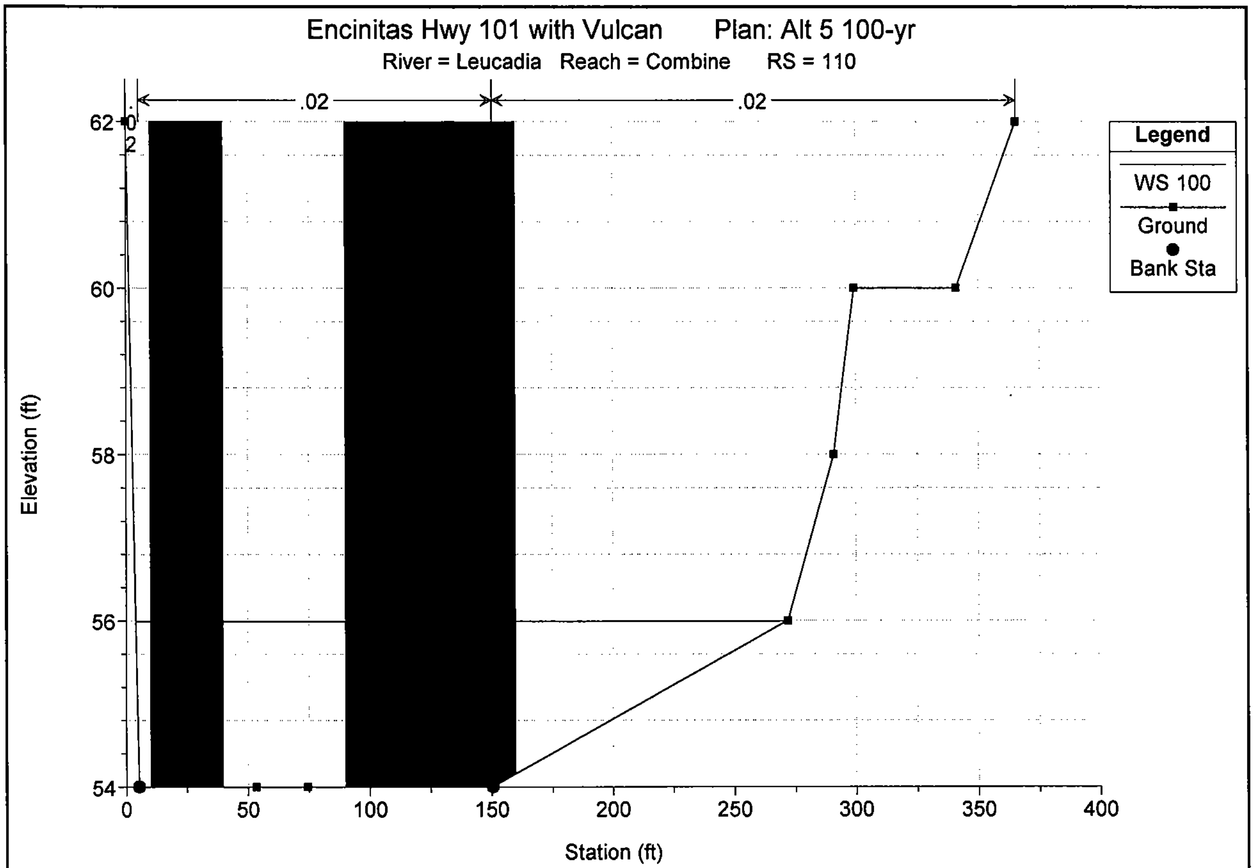
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 135
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 130
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
70
68
66
64
62
60
58
56
54
0
100
200
300
400
500
600

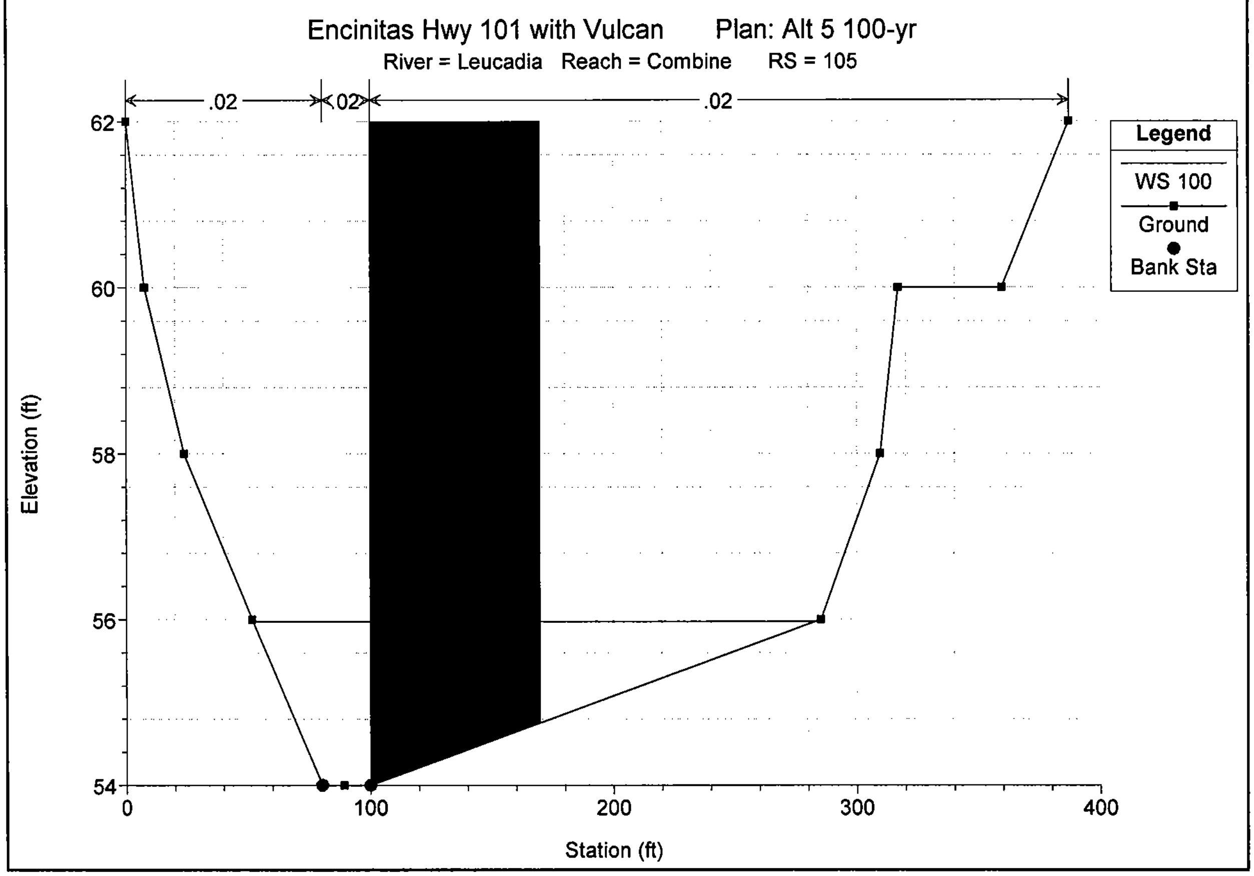

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 125
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
0
100
200
300
400
500


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 120
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
64
62
60
58
56
54
0
100
200
300
400
500

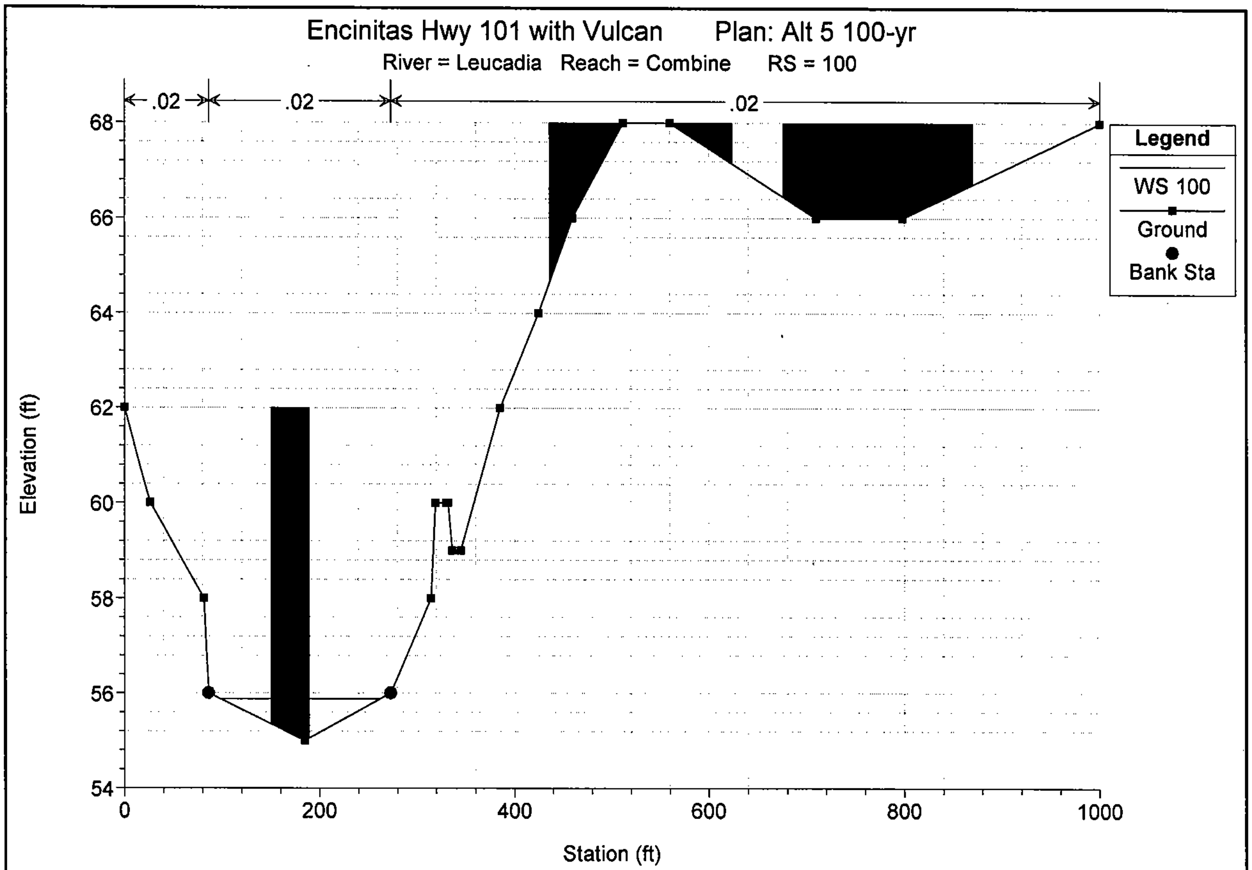

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 115
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
75
70
65
60
55
50
0
200
400
600
800
1000

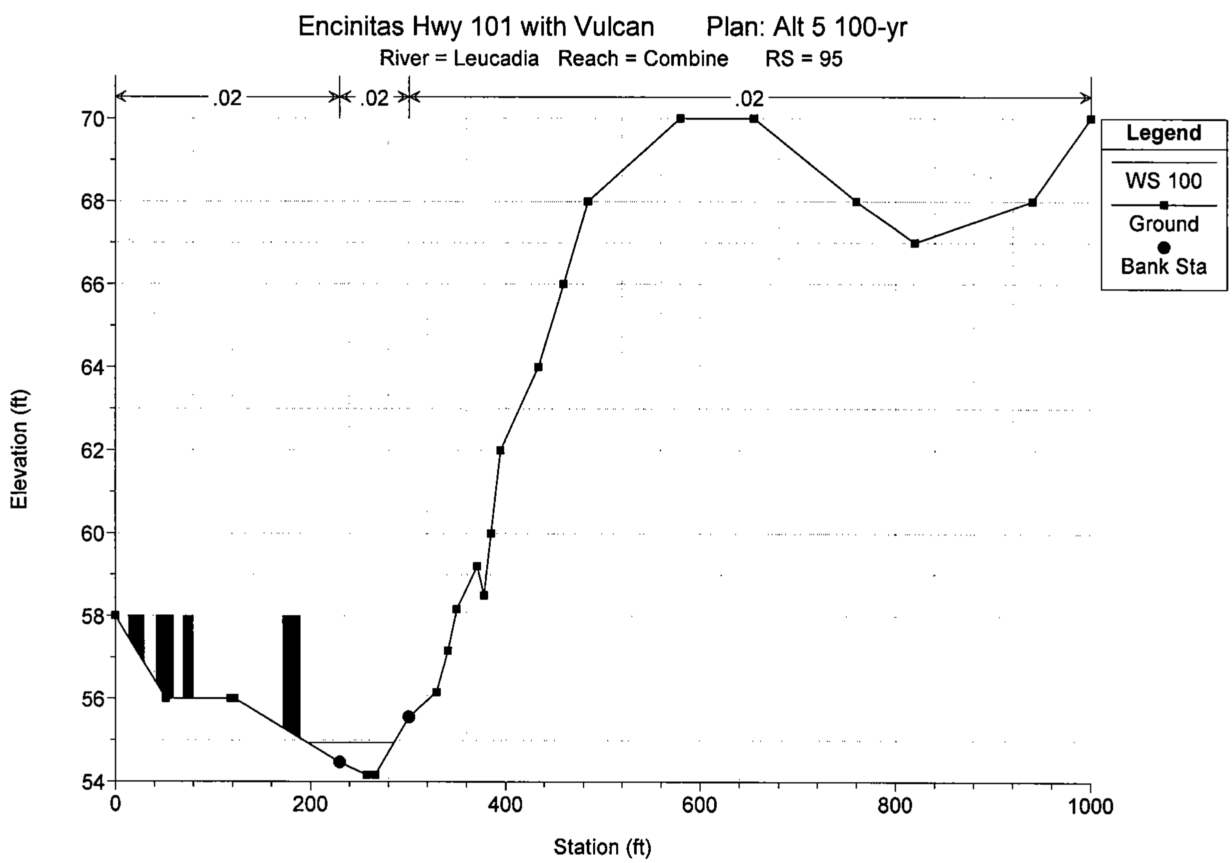


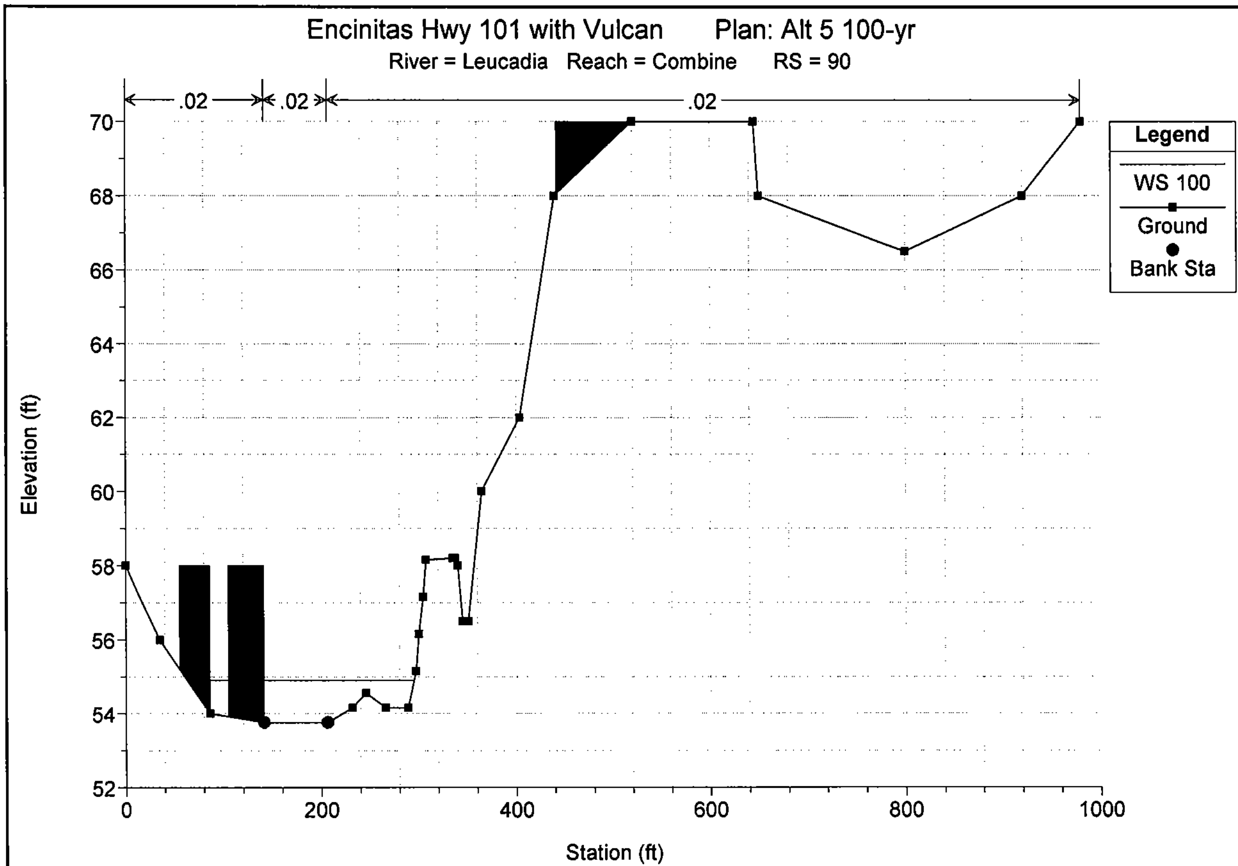
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 110
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
54
56
58
60
62
0
50
100
150
200
250
300
350
400



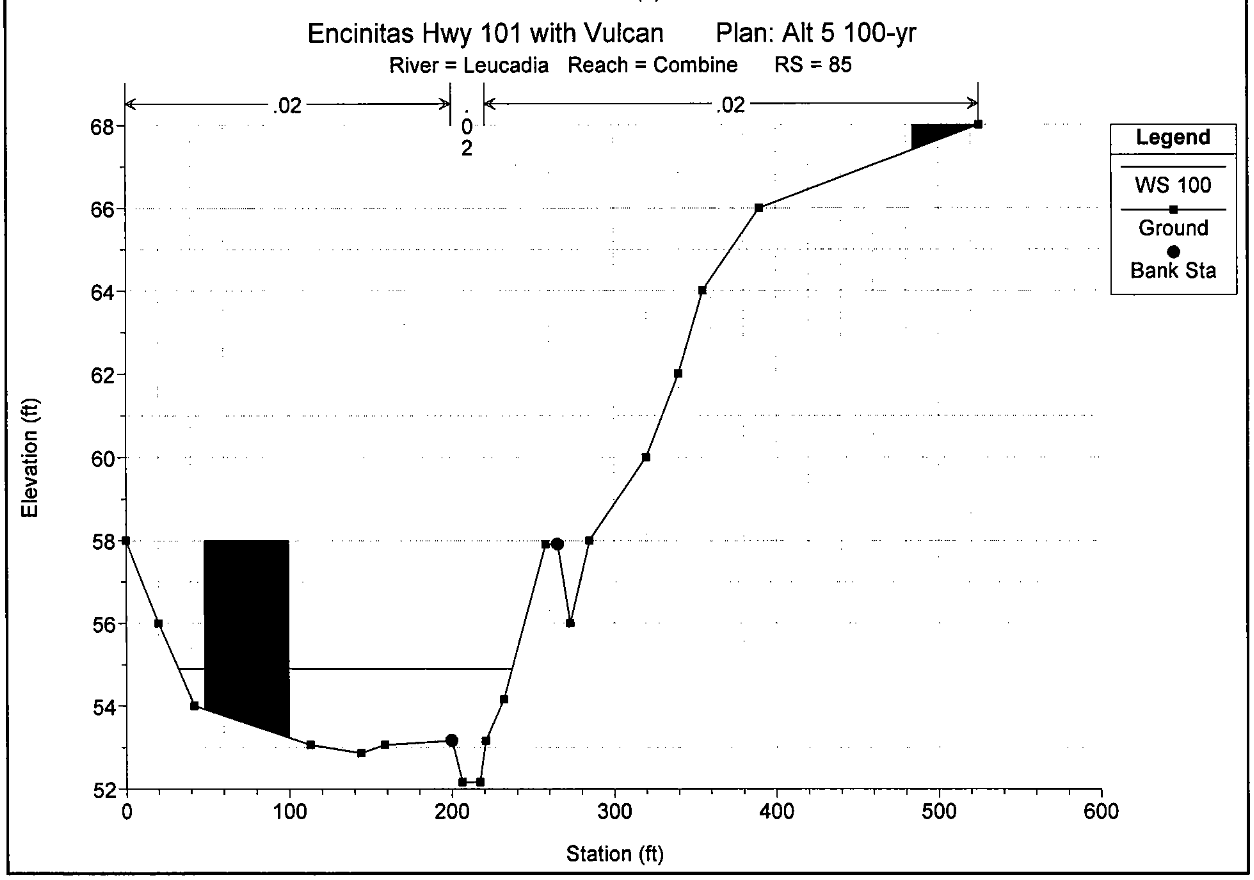
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 105
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
54
56
58
60
62
0
100
200
300
400


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 100
.02
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta

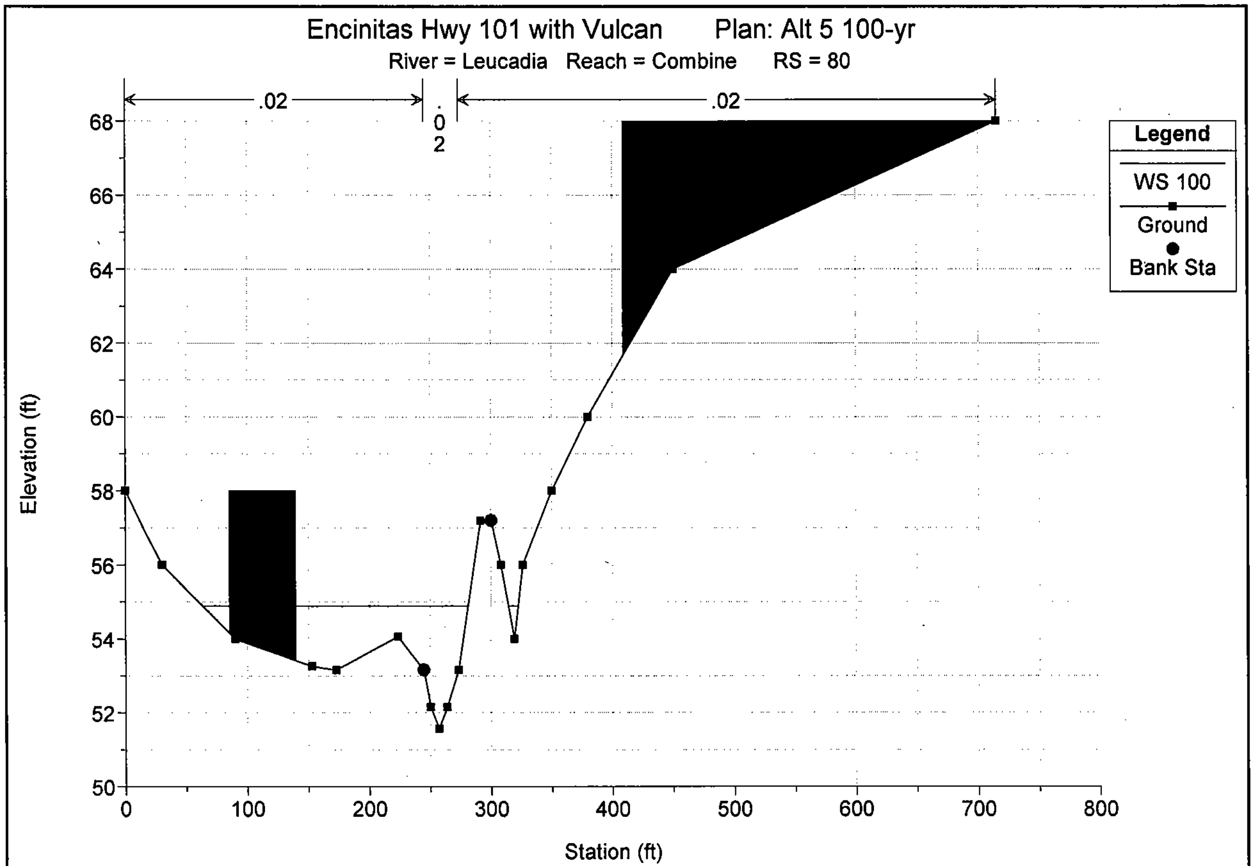

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 95
.02
.02
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta

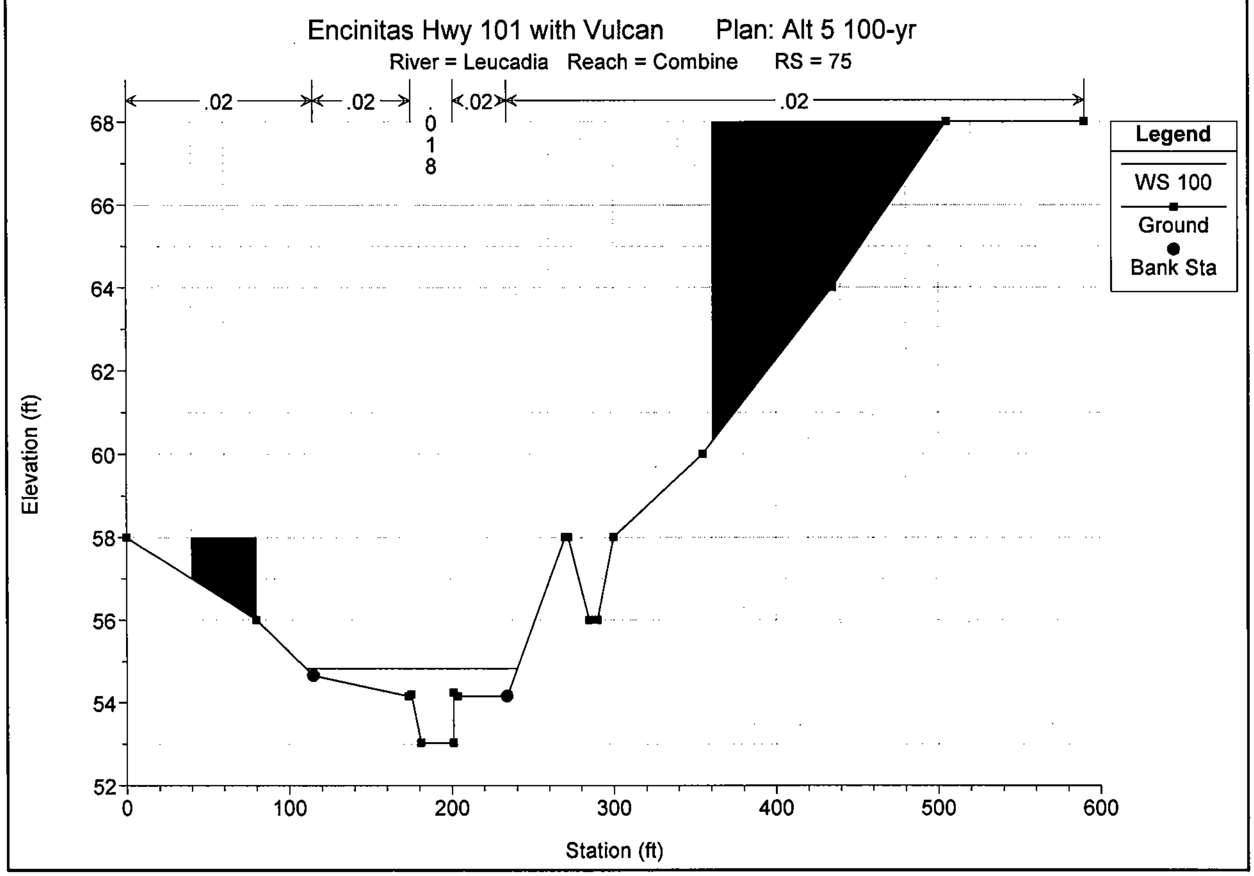


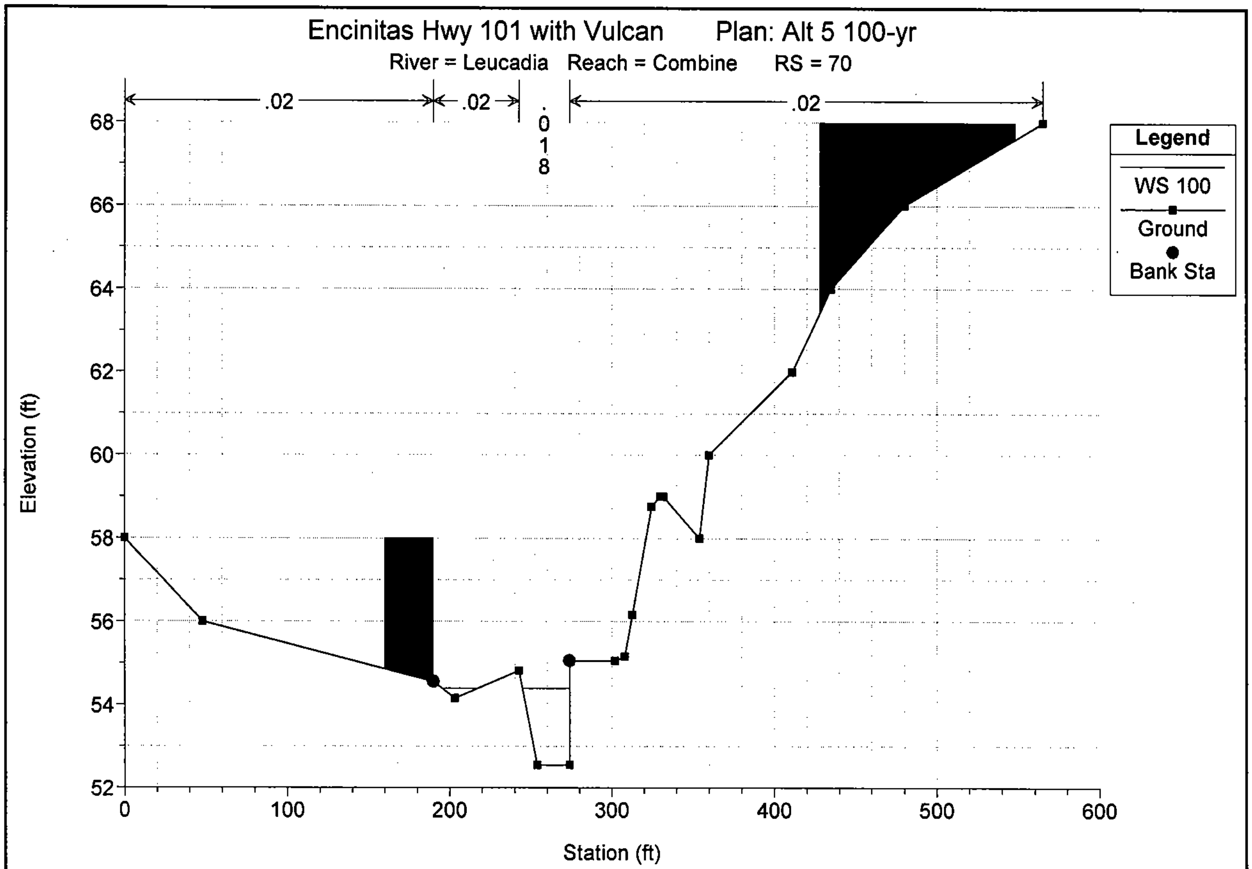
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 90
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)



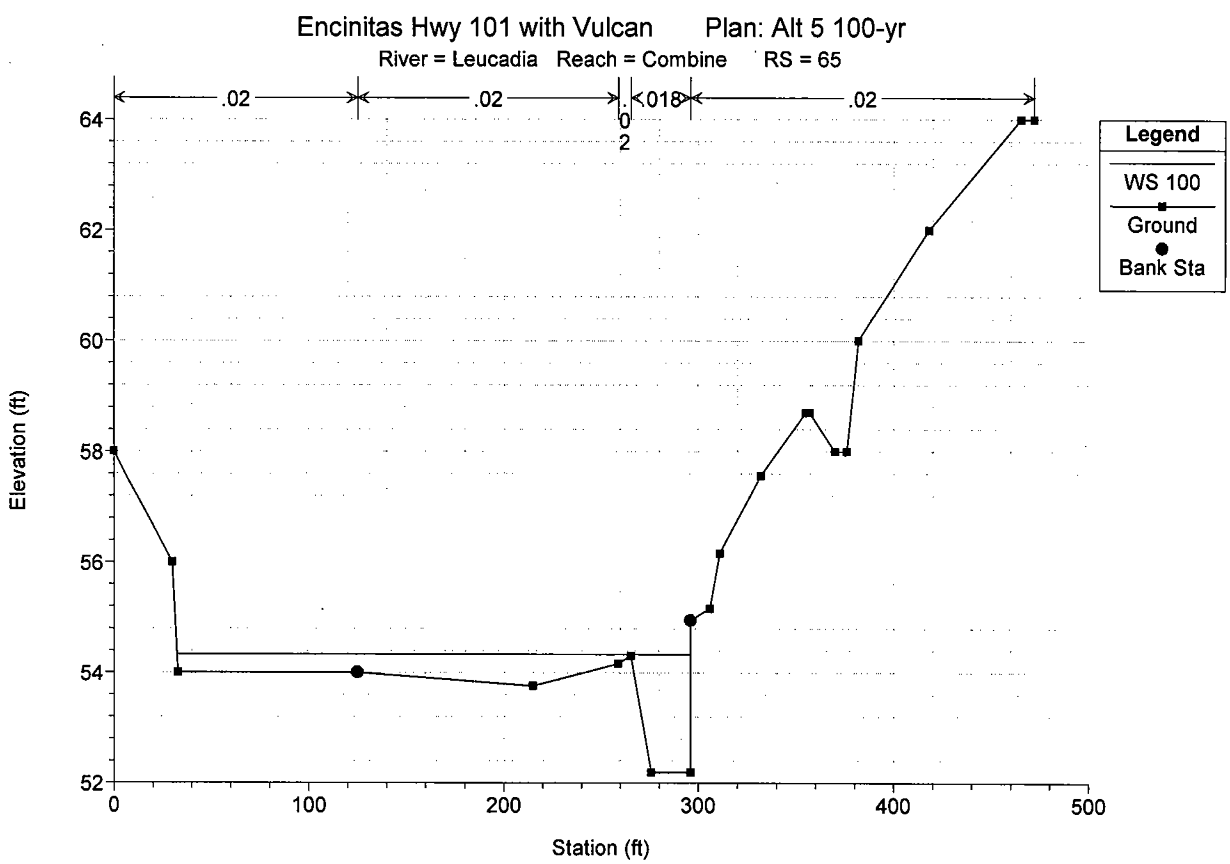
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 85
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 80
.02
0
2
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

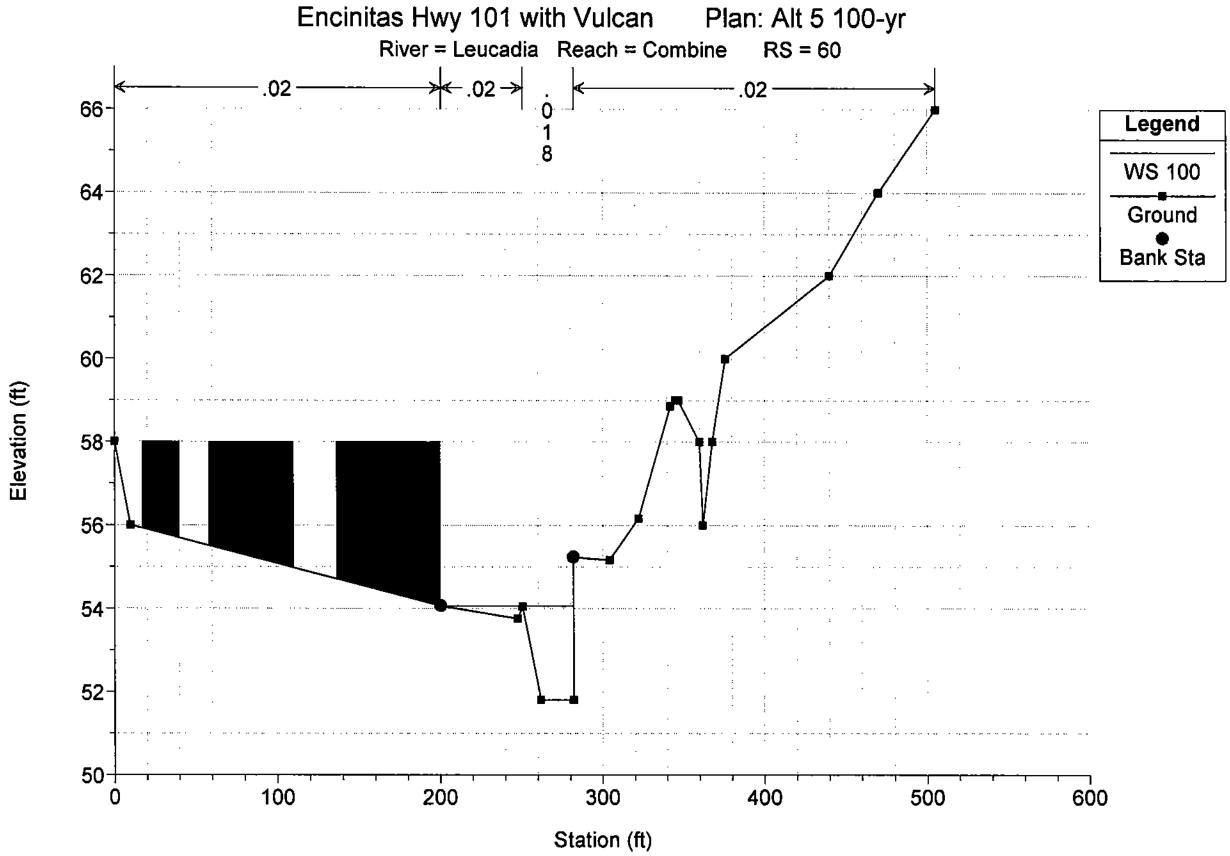

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 75
.02
.02
0
1
8
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)

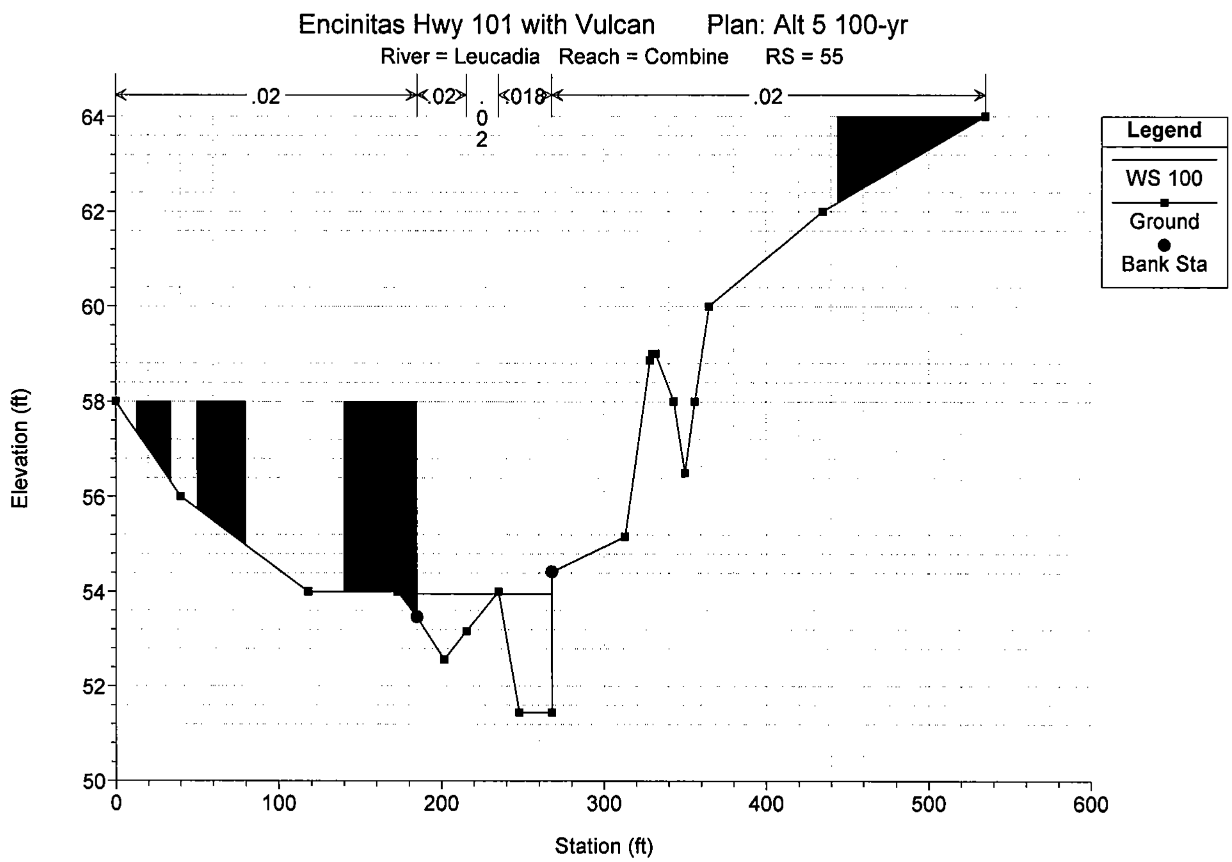


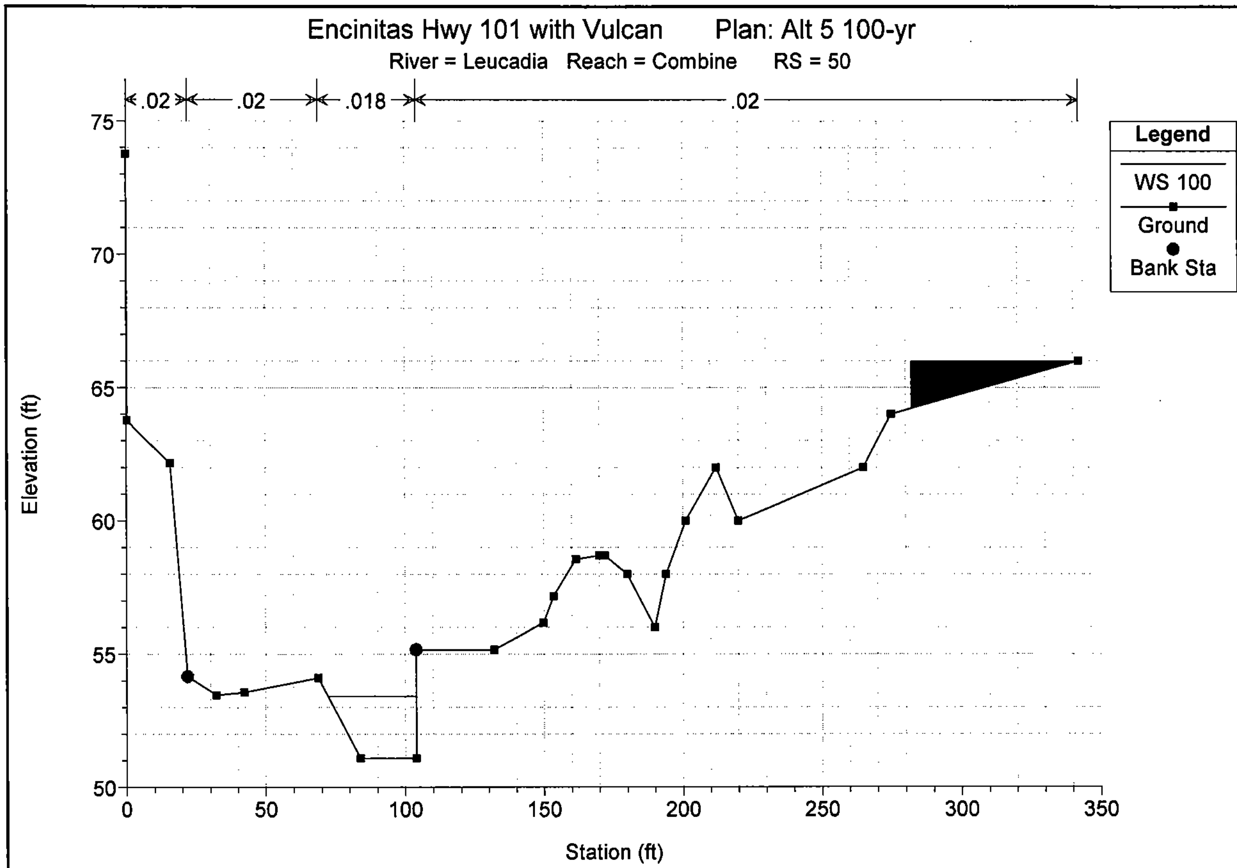
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 70
.02
.02
.018
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)



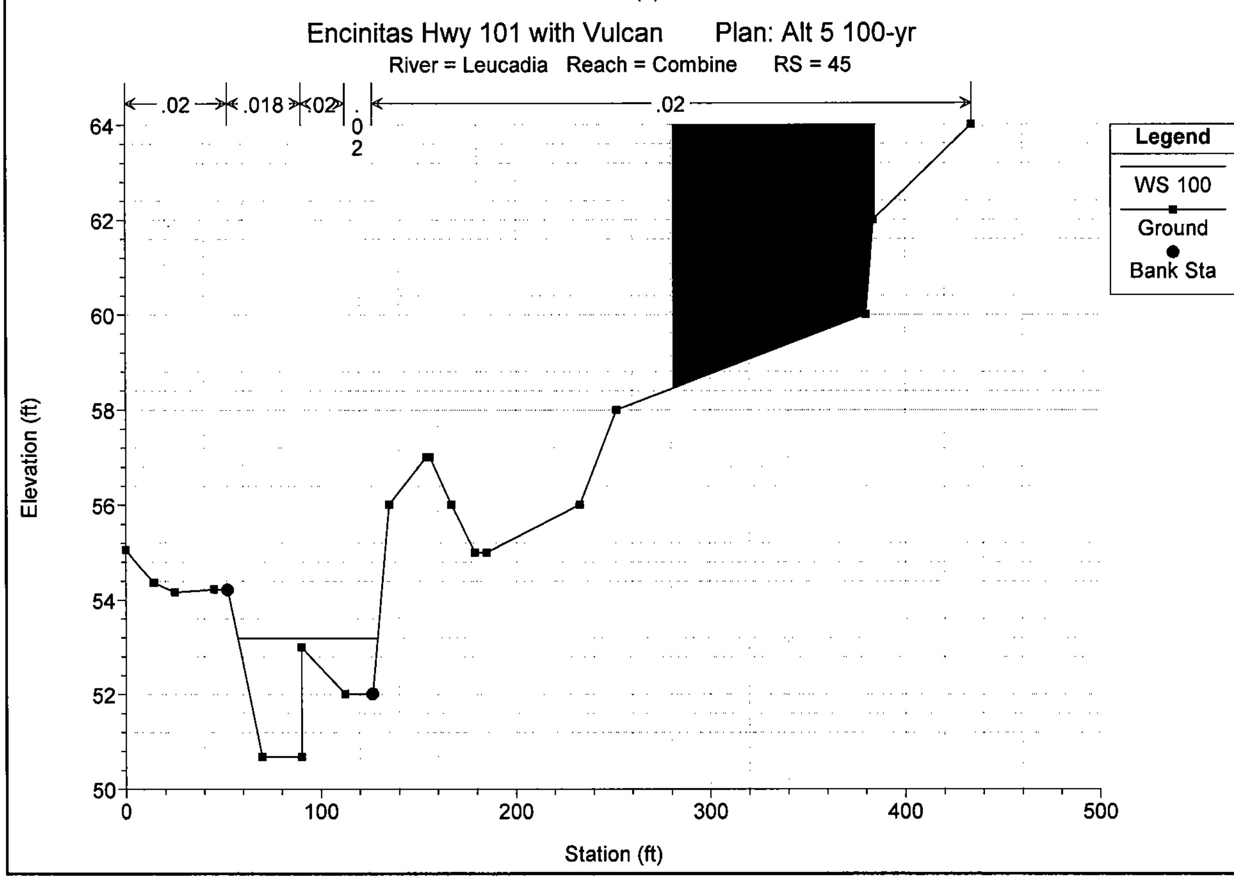
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 65
.02
.02
.02
.018
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 60
.02
.02
.018
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta

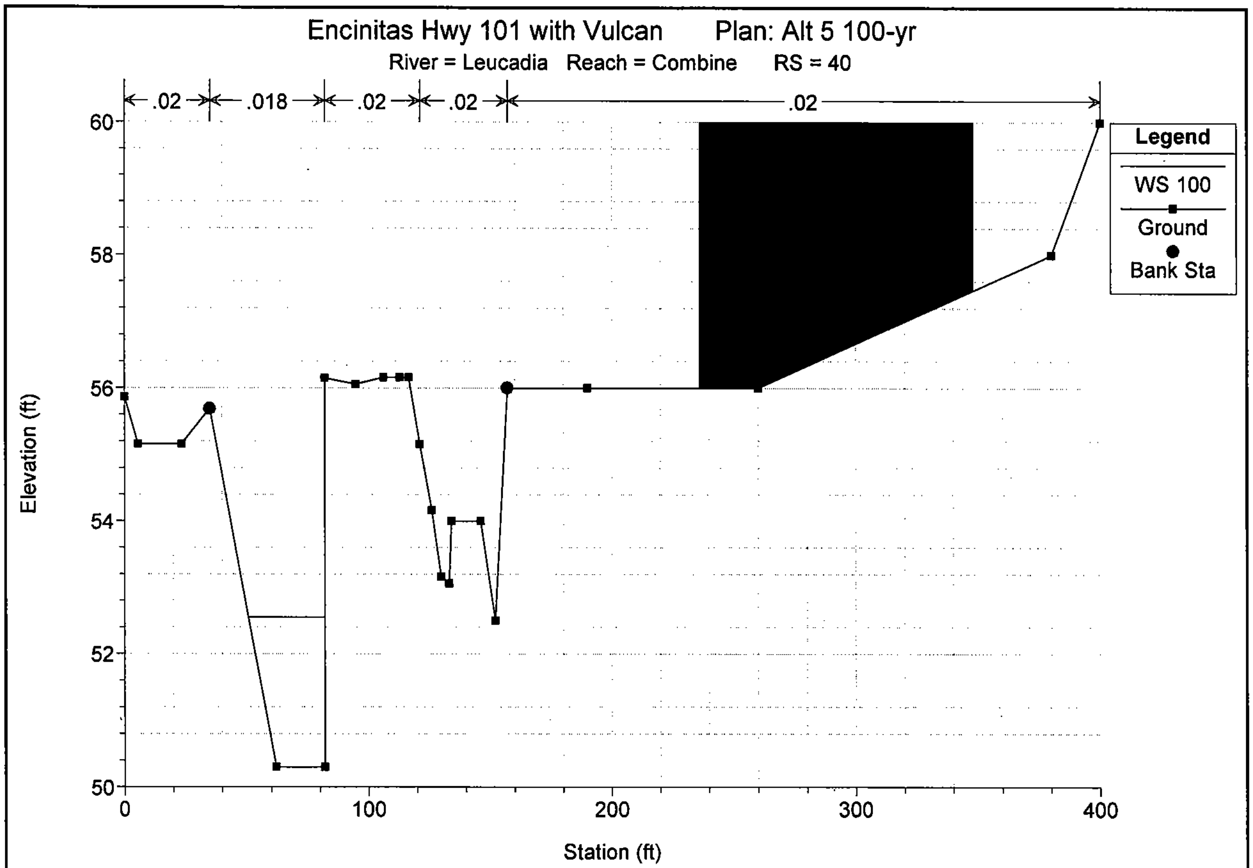

Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 55
.02
.02
.02
.018
.02
Elevation (ft)
Station (ft)
Legend
WS 100
Ground
Bank Sta

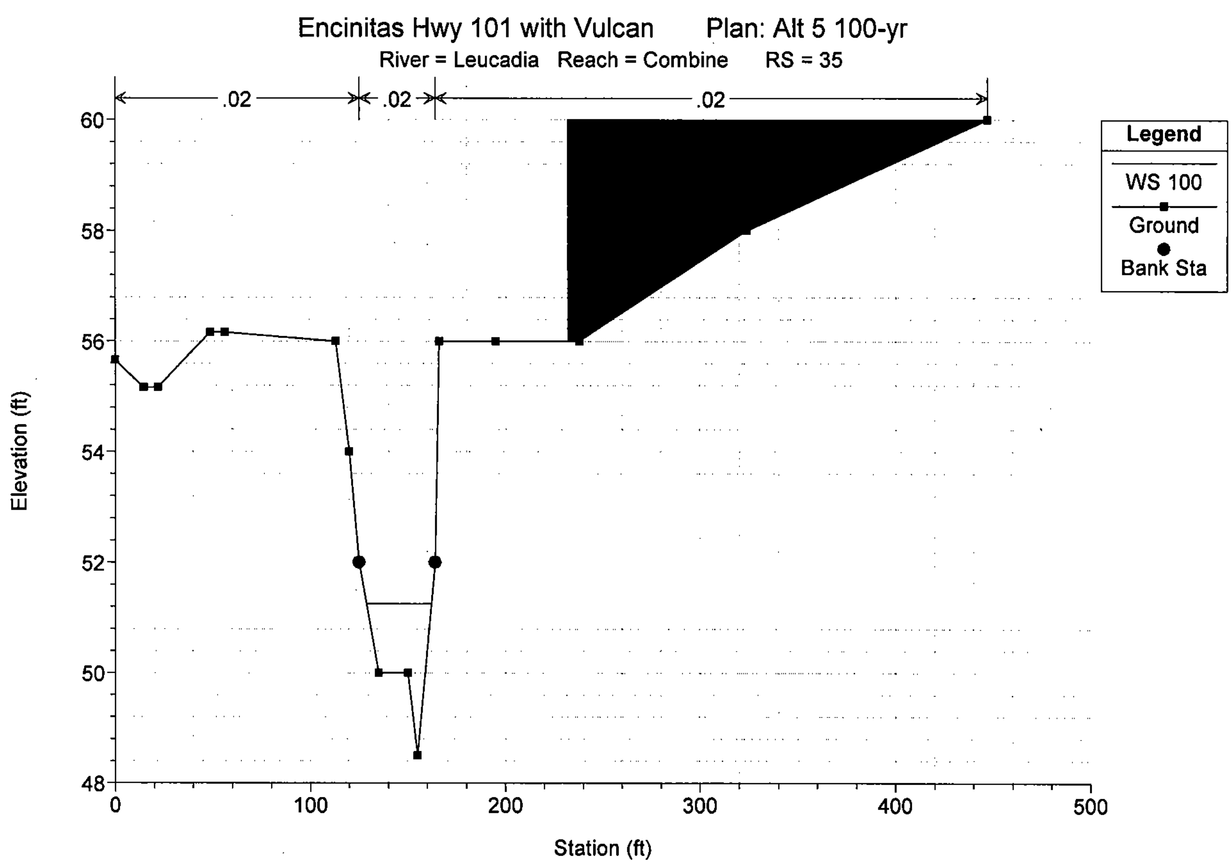


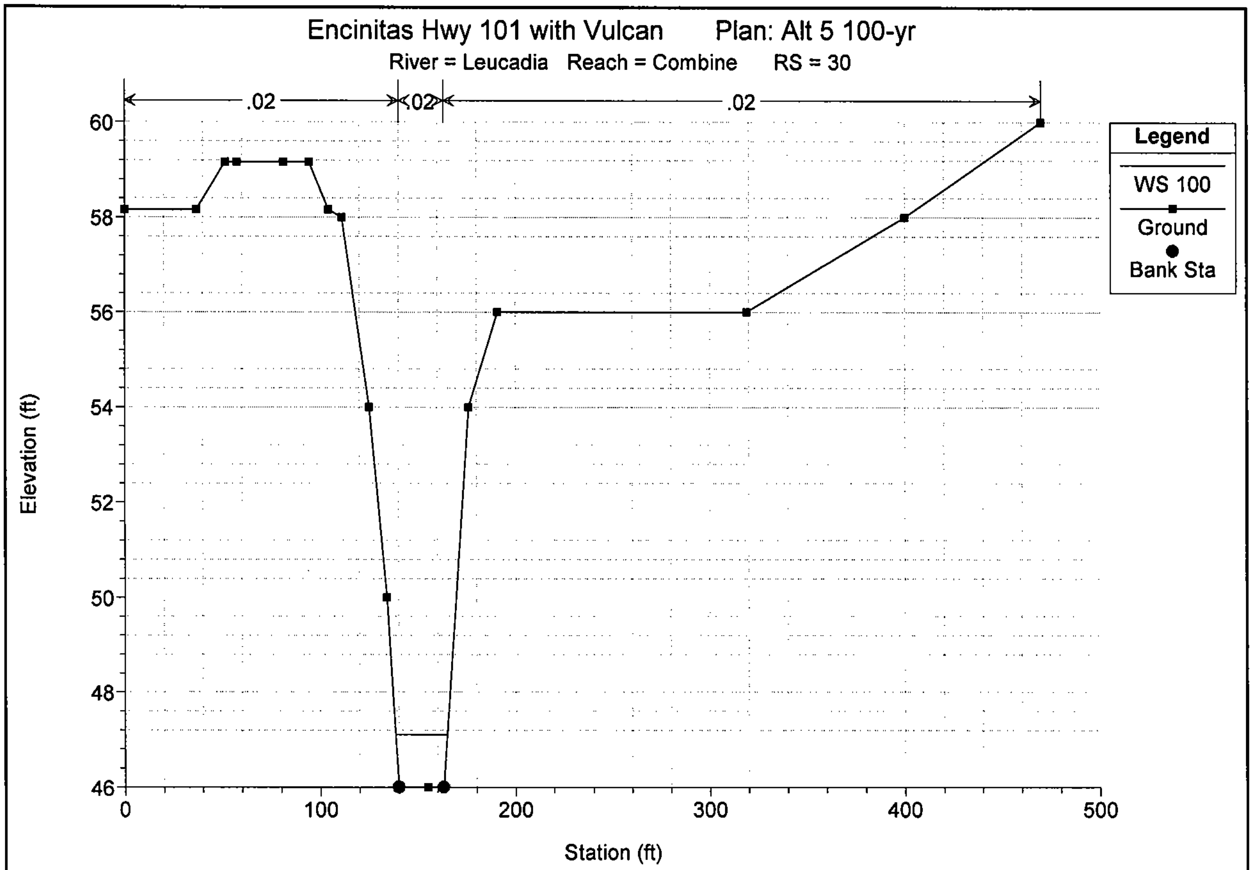
Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 50
.02
.02
.018
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
75
70
65
60
55
50
0
50
100
150
200
250
300
350
Station (ft)



Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 45
.02
.018
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
64
62
60
58
56
54
52
50
0
100
200
300
400
500
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 40
.02
.018
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
60
58
56
54
52
50
0
100
200
300
400
Station (ft)


Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 35
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
60
58
56
54
52
50
48
0
100
200
300
400
500
Station (ft)



Encinitas Hwy 101 with Vulcan Plan: Alt 5 100-yr
River = Leucadia Reach = Combine RS = 30
.02
.02
.02
Legend
WS 100
Ground
Bank Sta
Elevation (ft)
Station (ft)
60
58
56
54
52
50
48
46
0
100
200
300
400
500

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

      X     X  XXXXXX    XXXX        XXXX      XX      XXXX
      X     X  X        X    X       X   X    X  X    X
      X     X  X        X            X   X   X    X   X
      XXXXXXX  XXXX     X       XXX  XXXX    XXXXXX    XXXX
      X     X  X        X            X  X    X    X        X
      X     X  X        X    X       X   X   X    X        X
      X     X  XXXXXX    XXXX        X    X  X    X   XXXXX
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PROJECT DATA
Project Title: Encinitas Hwy 101 with Vulcan
Project File : 101Vul.prj
Run Date and Time: 8/30/2004 5:48:13 AM

Project in English units

Project Description:
ENCINITAS COAST HIGHWAY 101 -100-YR & 10-YR ANALYSIS
JN: 14413 DECEMBER 23,
2003
BASED ON HEC-2 FILENAME: ENC_1.HC2
X-SECTIONS LEFT TO RIGHT LOOKING
DOWNSTREAM

PLAN DATA

Plan Title: Alt 5 100-yr
Plan File : w:\14413\Hec-Ras 101\101Vul.p17

Geometry Title: Alt 2 Option C
Geometry File : w:\14413\Hec-Ras 101\101Vul.g20

Flow Title   : Alt 5 100-yr
Flow File   : w:\14413\Hec-Ras 101\101Vul.f22

Plan Description:
100-YEAR RUN** Includes blocked obstructions in alley
Varying Qs based on
HEC-1 FN: 100det8.hc1
Extended XS from 95 down to encompas 100-yr
floodplain
Vertical Datum NAVD 88

Plan Summary Information:

Number of:	Cross Sections	= 65	Mulitple Openings	=	0
	Culverts	= 0	Inline Weirs	=	0
	Bridges	= 0			

Computational Information
Water surface calculation tolerance = 0.003
Critical depth calculaton tolerance = 0.003
Maximum number of interations = 20
Maximum difference tolerance = 0.1
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: Alt 5 100-yr
Flow File : w:\14413\Hec-Ras 101\101Vul.f22

Flow Data (cfs)

River	Reach	RS	100
Leucadia	Vulcan	3300.14	13
Leucadia	Vulcan	240	1
Leucadia	Vulcan	195	38
Leucadia	101	230	1
Leucadia	101	225.3	1
Leucadia	101	190	1
Leucadia	Combine	140	47
Leucadia	Combine	120	57
Leucadia	Combine	105	90
Leucadia	Combine	90	106
Leucadia	Combine	75	152
Leucadia	Combine	60	186
Leucadia	Combine	50	276

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Leucadia	Vulcan	100	Critical	
Leucadia	101	100	Critical	
Leucadia	Combine	100		Normal S = .01

GEOMETRY DATA

Geometry Title: Alt 2 Option C
Geometry File : w:\14413\Hec-Ras 101\101Vul.g20

Reach Connection Table

River	Reach	Upstream Boundary	Downstream Boundary
Leucadia	Vulcan		Junction
Leucadia	101		Junction
Leucadia	Combine	Junction	

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3300.14

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
110	76.16	143	76.56	151	76.16	155	77.16	165	77.56
170	77.56	180	77.16	182.3	74.76	193.6	74.56	196	72.16
204	72.16	206.4	74.56	215.5	74.76	222	74	230	74
240	74.1	245	74	273	74	300	74.46	390	76
420	78								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
110	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 169.51 Elevation= 77.58

CROSS SECTION RIVER: Leucadia

REACH: Vulcan RS: 3200.15

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
84	75.16	105	74.56	130	75.16	147	75.46	156	76.16
164	76.96	169	76.96	175	76.16	180.6	74.66	192.8	74.46
196	71.16	204	71.16	207.2	74.46	217	74.66	223	74
230	74	235	74.1	242	74	260	74	273	74
300	74.47	388	76	437	78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
84	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 168.69 Elevation= 76.98

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3100.16

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
95	74.06	118	73.66	126	74.16	139	75.06	154	75.16
160	76.16	164	76.76	169	76.76	175	76.16	179.6	74.96
192	74.76	196	70.76	204	70.76	208	74.76	210.7	75.36
230	75.15	403	76	456	78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
95	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 168.28 Elevation= 76.79

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 3000.17

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
89	72.66	130	73.16	142	74.06	151	74.16	158	75.16
165	75.96	170	75.96	176	75.16	179.6	74.46	192	74.26
196	70.26	204	70.26	208	74.26	221.38	74.78	423	76
476	78								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
89	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 169.98 Elevation= 76

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2900.18

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
122	71.16	154	73.16	157	74.16	161	75.16	165	75.36
170	75.36	174	75.16	175.4	74.06	192	73.76	196	69.76
204	69.76	208	73.76	217.41	74.2	459	76	515	78

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
122	.03	196	.035	204	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

	196	204		100	100	100		.1	.3

Left Levee Station= 169.51 Elevation= 75.38

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2800.19

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
70	70.06	113	69.46	126	70.16	150	71.16	155	73.16
160	74.16	164	74.66	169	74.66	174	74.16	175.1	73.56
192	73.26	196	69.26	204	69.26	208	73.26	225	74.16
456	76	523	78						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
70	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 168.93 Elevation= 74.71

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2700.20

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
125	68.16	139	68.86	146	69.16	150	70.16	154	71.16
160	73.16	165	73.86	170	73.86	175	73.16	176.2	72.26
192	71.96	196	67.96	204	67.96	208	71.96	212.73	72.57
258	74	423	76	535	78				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
125	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 170.68 Elevation= 73.86

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2600.21

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
109	66.46	135	66.46	146	68.16	152	69.16	155	70.16
157	71.16	162	73.16	165	73.26	170	73.26	173	73.16
181	71.16	185.1	70.06	192	69.96	196	65.96	204	65.96
208	69.96	215.42	70.99	237	72	286	74	456	76

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
109	.03	196	.035	204	.03

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
196	204	100	100	100	.1	.3

Left Levee Station= 170.09 Elevation= 73.26

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2500.22

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
139	65.16	150	68.16	158	71.16	165	72.76	170	72.76
175	71.16	182	69.16	184	68.66	192	68.46	196	64.46
204	64.46	208	68.46	213.55	69.25	233	70	266	72
320	74	498	76						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
139	.03	196	.035	204	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
196 204 100 100 100 .1 .3
Left Levee Station= 170.09 Elevation= 72.78

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2400.23

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
95	65.56	142	65.16	160	71.16	165	72.46	170	72.46
175	71.16	180	70.16	183	68	192	67.9	194.8	68.16
202	67.96	206	63.96	214	63.96	218	67.96	221.32	68.78
250	70	263	72	360	74				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
95	.03	206	.035	214	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
206 214 100 100 100 .1 .3
Left Levee Station= 169.39 Elevation= 72.47

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2300.24

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
2	64.46	129	64.46	141	65.16	160	71.16	165	71.86
170	71.86	175	71.16	185	68.16	190	67	195.2	67.66
202	67.46	206	63.46	214	63.46	218	67.46	221.7	68.36
260	70	316	72	382	74				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
2	.03	206	.035	214	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
206 214 100 100 100 .1 .3
Left Levee Station= 170.56 Elevation= 71.89

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2200.25

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
140	64.16	160	71.16	165	71.46	170	71.46	172	71.16
182	68.16	184.7	66.86	192.3	66.76	196	62.96	204	62.96
207.7	66.76	217	66.86	260	68	287	70	342	72

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
140	.03	196	.035	204	.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
196 204 100 100 100 .1 .3
Left Levee Station= 170.39 Elevation= 71.43

CROSS SECTION RIVER: Leucadia
REACH: Vulcan RS: 2100.26

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
144	63.16	164	71.16	165	71.36	170	71.36	175	71.16
182	68.16	186	66	188.3	64.96	193.6	64.86	196	62.46
204	62.46	206.4	64.86	217	65.06	234	66	240	66.1

```
     245       66      248     65.9      252       66      286       68      322       70

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     144      .03      196     .035      204      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right     Coeff Contr.    Expan.
           196      204                15       15       15                .1        .3
Left Levee       Station=    169.8      Elevation=    71.43

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 245

INPUT
Description:
Station Elevation Data     num=       11
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       70       10       70       16       68       24       66       30       64
      40       64       70       66       80       66       87       66      122       68
     180       70

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       30     .035       40      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right     Coeff Contr.    Expan.
            30       40               175      175      175                .1        .3

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 240

INPUT
Description:
Station Elevation Data     num=        9
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       70        5       70       10       68       20       66       27       64
      39       64       89       66      185       68      230       70

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       27     .035       39      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right     Coeff Contr.    Expan.
            27       39               275      275      275                .1        .3

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 235

INPUT
Description:
Station Elevation Data     num=        6
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
       0       68       10       68       15       66      140       66      205       68
     246       70

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
       0      .03       15     .035      140      .03

Bank Sta: Left    Right     Lengths: Left Channel    Right     Coeff Contr.    Expan.
            15      140               120      120      120                .1        .3

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 230

INPUT
Description:
Station Elevation Data     num=       11
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     430       70      460       70      520       68      525       68      544     69.8
     546     69.8      550       68      580       66      715       66      770       68
     825       70

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     430      .02      580      .02      715      .02
```

```
Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          580     715               175     180     185                .1       .3
Blocked Obstructions      num=        1
   Sta L    Sta R    Elev
     797     825      70

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 225

INPUT
Description:
Station Elevation Data    num=        8
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     536     69.8     538     69.8     542       68     595       66     625       66
     785       66     827       68     835       70

Manning's n Values        num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
     536      .02     595      .02     785      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          595     785               190     185     185                .1       .3
Blocked Obstructions      num=        1
   Sta L    Sta R    Elev
     692     835      70

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 220

INPUT
Description:
Station Elevation Data    num=        7
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     494     69.9     496     69.9     518       68     580       66     876       66
     900       68     910       72

Manning's n Values        num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
     494      .02     580      .02     876      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          580     876               175     175     175                .1       .3

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 215

INPUT
Description:
Station Elevation Data    num=       15
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     540     69.9     542     69.9     546       68     552     67.9     556       68
     565       70     580     70.1     594       70     600     69.9     610       70
     670       68     815       66     860       66     945       68     995       70

Manning's n Values        num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
     540      .02     546      .02     556      .02

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
          546     556               290     290     290                .1       .3
Blocked Obstructions      num=        1
   Sta L    Sta R    Elev
     765     995      70

CROSS SECTION            RIVER: Leucadia
REACH: Vulcan               RS: 195

INPUT
Description:
Station Elevation Data    num=       15
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
     485       70     496       70     505       68     510       68     515       70
     520       72     525       74     533       74     612       72     652       70
     695       68     780       66     820       66     920       68     985       70
```

```
Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     485     .02       505     .02       510     .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
           505     510               340      340      340                .1         .3
Blocked Obstructions       num=        2
   Sta L    Sta R     Elev    Sta L    Sta R     Elev
     835      903       74      930      985       74

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 175

INPUT
Description:
Station Elevation Data     num=        7
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     335       68      337       68      344       66      348     65.5      350       66
     765       68      847       70

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     335     .02       344     .02       350     .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
           344     350               225      220      220                .1         .3
Blocked Obstructions       num=        2
   Sta L    Sta R     Elev    Sta L    Sta R     Elev
     525      712       70      739      847       70

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 165

INPUT
Description:
Station Elevation Data     num=       14
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     392       67      394       67      395       66      400       64      410       63
     418       64      436       66      472       68      512       70      555       72
     620       72      700       70      795       68      895       70

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     392     .02       400     .02       418     .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
           400     418               360      360      360                .1         .3
Blocked Obstructions       num=        2
   Sta L    Sta R     Elev    Sta L    Sta R     Elev
     546      781       72      826      895       72

CROSS SECTION           RIVER: Leucadia
REACH: Vulcan              RS: 150

INPUT
Description:
Station Elevation Data     num=       12
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
     380       65      382       65      385       64      400       63      413       64
     486       66      520       70      565       74      698       74      750       72
     967       72     1040       74

Manning's n Values          num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
     380     .02       385     .02       413     .02

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.     Expan.
           385     413               305      305      305                .1         .3
Blocked Obstructions       num=        1
   Sta L    Sta R     Elev
     606     1040       74

CROSS SECTION           RIVER: Leucadia
REACH: 101                 RS: 230

INPUT
```

Description:

Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	25.4	64	30.5	62	88.9	60.2	146	60
243.4	62	278	64	318.4	66				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	88.9	.02	146	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
88.9	146	104.1	100.2	136.3	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
50	80	66	145	190	66	285	350	66

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 225.3

INPUT
Description:

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	16	64	32.6	62	78.4	60	126.9	58
133.4	58	139.4	58	203.7	58	210.3	58	216.8	58.5
233.9	60	285.5	62	319.2	64	355	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	126.9	.02	203.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
126.9	203.7	5	5	5	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
5	30	66	130	160	66	180	200	66
210	235	66	300	345	66			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 225.2

INPUT
Description:

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	16	64	32.6	62	78.4	60	126.9	58
133.4	54	139.4	54	203.7	56	210.3	58	216.8	58.5
233.9	60	285.5	62	319.2	64	355	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	126.9	.02	203.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
126.9	203.7	5	5	5	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
5	30	66	130	160	66	180	200	66
210	235	66	300	345	66			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 225.1

INPUT
Description:

Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	16	64	32.6	62	78.4	60	126.9	58
133.4	58	139.4	58	203.7	58	210.3	58	216.8	58.5
233.9	60	285.5	62	319.2	64	355	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	126.9	.02	203.7	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

126.9	203.7	134.2	131.9	133.3	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
5	30	66	130	160	66	180	200	66
210	235	66	300	345	66			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 220

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	18.9	64	21	62	30.1	60	56.5	58
114.4	57.7	192	58	255	60	292.4	62	321.2	64
343.3	66								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	56.5	.02	192	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
56.5	192	222.7	215.1	206.1	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
20	60	66	105	140	66	155	190	66

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 215

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	10	64	35.7	62	75.9	60	102.5	58
121.6	56	143.9	56	204.1	56	241	56	286	58
307.5	60	345.4	62	377.3	64	381.6	66		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	121.6	.02	241	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
121.6	241	78.2	80.6	89.6	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
10	75	66	160	220	66

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 210

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	66	10.4	64	23.6	62	63.8	60	101.7	58
120.4	56	193.3	56	272.5	56	296.1	58	304.2	60
312.7	66								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	120.4	.02	272.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
120.4	272.5	47.1	45.4	64.5	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
20	170	66	210	250	66

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 205

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev

0	64	14	62	58.3	60	89	58	110.7	56
182	56	218.5	56	292.3	58	302.4	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	110.7	.02	218.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
110.7	218.5	141.2	142.6	152.6	.1	.3

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	30	64	60	100	64	140	170	64
200	225	64	255	280	64			

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 195

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	35.6	62	68.6	60	113.8	58	198.9	56
266.6	58	298.8	60	323.4	62	337.5	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	113.8	.02	266.6	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
113.8	266.6	143.6	102.4	81.7	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
95	130	64	150	180	64	210	255	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 190

INPUT
Description:
Station Elevation Data num= 8

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	16.8	62	31.4	60	99.1	58	133.4	58
179.5	58	217.5	60	231.5	64				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	99.1	.02	179.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
99.1	179.5	109.2	93.8	106	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	10	64	35	65	64	90	120	64
185	230	64						

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 185

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	21.3	62	59.2	60	118.2	59	204.1	60
212.1	64								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	59.2	.02	204.1	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
59.2	204.1	56.4	82.7	111.4	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
60	100	64	150	210	64

CROSS SECTION RIVER: Leucadia

REACH: 101 RS: 180

INPUT
Description:
Station Elevation Data num= 9

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	17	62	30.5	60	71.4	59	113.4	60
120.7	64	192.2	64	257.1	63	317.6	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	30.5	.02	113.4	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
30.5	113.4	83.8	85.3	85.6	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
40	85	64	130	190	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 175

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	5.6	62	20.6	60	56.6	59	99.6	60
104.6	62	172	63	232	62	252.5	61.9	268.5	62
309.1	64								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	20.6	.02	99.6	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
20.6	99.6	120.2	124.8	122.1	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
20	55	64	110	160	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 170

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	33.4	62	87.4	60	141.8	58.5	184.7	60
322	62	333.5	64						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	87.4	.02	184.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
87.4	184.7	137.5	137.6	138.7	.1	.3

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 165

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	14.5	62	16	60	102.4	58	128.4	57
138.5	56	147.5	56	172.9	55.9	200.4	56	225.9	58
245.3	60	261.4	60.2	279.4	60	288.3	60	366.3	60
374.3	64								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	138.5	.02	200.4	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
138.5	200.4	309.6	309.5	308.6	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
30	80	64	190	240	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 160

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	21	62	37	60	57.5	58	105	56
129.5	55	142.1	55	152.6	55	186.5	54	214.5	55
237	56	283.6	58	300.1	58.1	317	58	333	57.9
342	58	359	60	368	62	376	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	152.6	.02	214.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
152.6	214.5	48.6	52.6	51.9	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
30	70	64	90	120	64	150	170	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 150

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	16	62	24	60	39.5	58	63.4	56
96.4	54	132.3	54	144.8	53	156.9	52	193.8	54
220.8	56	297.7	57.7	340.3	58	356.3	60	369.2	64

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	144.8	.02	193.8	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
144.8	193.8	151.2	154.7	157.7	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
20	50	64	190	220	64

CROSS SECTION RIVER: Leucadia
REACH: 101 RS: 145

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	22.3	62	44.3	58	79.3	56	111.6	54
143.9	52	156.1	52	176.6	52	182.1	58	246	58
280.5	56.5	384.4	58	398.4	62	411.9	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	143.9	.02	176.6	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
143.9	176.6	175.6	160.5	160.3	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
40	85	64	115	150	64	180	240	64

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 140

INPUT
Description:
Station Elevation Data num= 22

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	12.5	62	39	60	45.5	56	88	54
162.6	52	178.6	54	184.6	58	237.6	58	283.1	56.2

311.6	56.4	375.5	58	392.5	60	400.6	62	422.6	62
432	63	434	63	442	61	465	64	531	66
566	68	730	70						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	88	.02	178.6	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
88	178.6	141.5	123.2	117.1	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
60	140	64	200	260	64	539	646	70
710	730	70						

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 135

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	18.7	62	47.7	60	71.8	58	99.9	56
152.2	54	165.3	54	181.2	54	234.9	54	309.4	56
380.6	58	399.2	60	408.7	62	456.1	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	152.2	.02	234.9	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
152.2	234.9	122.2	126.9	132.7	.1	.3

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 130

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	14.5	62	28	60	34.5	56	131.4	54
154.3	54	268.8	56	365.1	58	370	62	392	62
445	64	472	66	492	68	555	70		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	131.4	.02	154.3	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
131.4	154.3	197.5	197.3	196.3	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	10	64	40	75	64	90	130	64
160	240	64						

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 125

INPUT
Description:
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	21.6	62	34.6	54	52.6	54	139.7	54
149.2	54	157.7	54	240.8	54	314.2	56	366.8	58
378.8	60	392.8	62	424.8	62	454.4	64		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	139.7	.02	157.7	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
139.7	157.7	131.2	129.8	132.3	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	20	64	30	75	64	100	130	64
190	240	64						

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 120

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	31.6	62	46	60	49.1	58	62.2	56
149.5	54.2	160.5	54.1	171.6	54	202.1	54	299.9	56
317.9	56.3	341.4	56	369.5	58	389.6	60	406.1	62
429.6	62	464.8	64						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	149.5	.02	202.1	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
149.5	202.1	86.1	88.2	95.5	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
0	40	64	80	140	64	180	250	64

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 115

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	64	26.5	62	48	56	117	54	138	54
149.5	54	158.5	54	314.9	56	333.9	56	358.8	58
377.9	60	390	61	392	61	395	60	400	62
425	62	465	64	495	66	520	68	610	72
640	72	710	70	785	68	855	68	935	70

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	138	.02	158.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
138	158.5	218.8	211.7	222.6	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
60	140	64	180	250	64	503	899	72

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 110

INPUT
Description:
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	62	5.5	54	53.5	54	74.5	54	150.5	54
271.9	56	290.9	58	299.4	60	340.9	60	365.4	62

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	5.5	.02	150.5	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
5.5	150.5	180.1	165.1	173.7	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
10	40	62	90	160	62

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 105

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	62	7.6	60	23.8	58	51.8	56	80.4	54
89.2	54	100.1	54	285.3	56	309.6	58	316.9	60
359.4	60	387	62						

```
Manning's n Values         num=       3
     Sta    n Val      Sta    n Val     Sta    n Val
       0      .02     80.4      .02   100.1      .02

Bank Sta: Left   Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
           80.4   100.1               106.7   119.5   229.1               .1        .3
Blocked Obstructions       num=       1
   Sta L    Sta R     Elev
     100      170       62

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 100

INPUT
Description:
Station Elevation Data     num=      20
     Sta     Elev      Sta     Elev     Sta     Elev      Sta     Elev      Sta     Elev
       0       62     26.6       60    81.5       58     86.5       56      185       55
   273.2       56    314.6       58   319.3       60      330       60      332       60
     336       59      345       59     385       62      425       64      460       66
     512       68      560       68     710       66      798       66     1000       68

Manning's n Values         num=       3
     Sta    n Val      Sta    n Val     Sta    n Val
       0      .02     86.5      .02   273.2      .02

Bank Sta: Left   Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
           86.5   273.2                 360     340     360               .1        .3
Blocked Obstructions       num=       3
   Sta L    Sta R     Elev    Sta L    Sta R     Elev    Sta L    Sta R     Elev
     150      190       62      436      624       68      676      870       68

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 95

INPUT
Description:
Station Elevation Data     num=      24
     Sta     Elev      Sta     Elev     Sta     Elev      Sta     Elev      Sta     Elev
       0       58       52       56     118       56      122       56      230    54.46
   257.9    54.16    266.8    54.16   301.1    55.56    329.4    56.16    341.1    57.16
   350.3    58.16      371     59.2     378     58.5      385       60      395       62
     434       64      460       66     485       68      580       70      655       70
     760       68      820       67     940       68     1000       70

Manning's n Values         num=       3
     Sta    n Val      Sta    n Val     Sta    n Val
       0      .02      230      .02   301.1      .02

Bank Sta: Left   Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
            230   301.1               365.1   364.9     363               .1        .3
Blocked Obstructions       num=       4
   Sta L    Sta R     Elev    Sta L    Sta R     Elev    Sta L    Sta R     Elev
      14       30       58       42       60       58       70       80       58
     172      190       58

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 90

INPUT
Description:
Station Elevation Data     num=      27
     Sta     Elev      Sta     Elev     Sta     Elev      Sta     Elev      Sta     Elev
       0       58       35       56      86       54      142    53.76    206.7    53.76
   231.7    54.16    245.3    54.56   265.7    54.16    288.9    54.16    296.9    55.16
   299.9    56.16    304.4    57.16   307.3    58.16      335     58.2      337     58.2
     340       58      345     56.5     351     56.5      365       60      404       62
     440       68      520       70     645       70      650       68      800     66.5
     920       68      980       70

Manning's n Values         num=       3
     Sta    n Val      Sta    n Val     Sta    n Val
       0      .02      142      .02   206.7      .02

Bank Sta: Left   Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
```

```
        142   206.7             356.3   355.5   353.7            .1        .3
Blocked Obstructions      num=       3
   Sta L    Sta R    Elev   Sta L   Sta R    Elev   Sta L   Sta R    Elev
      55       86      58     105     142      58     442     625      70

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 85

INPUT
Description:
Station Elevation Data     num=       20
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0       58      20       56      42       54     113    53.06   144.1    52.86
   158.7    53.06   199.9    53.16   206.4    52.16   217.1    52.16   220.7    53.16
   231.8    54.16  257.91     57.9   265.4     57.9     273       56     285       58
     320       60     340       62     355       64     390       66     525       68

Manning's n Values         num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
       0      .02   199.9      .02   220.7      .02

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
      199.9   265.4             353.7   357.5   356.9            .1        .3
Blocked Obstructions      num=       2
   Sta L    Sta R    Elev   Sta L   Sta R    Elev
      48      100      58     484     525      68

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 80

INPUT
Description:
Station Elevation Data     num=       20
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0       58      30       56      90       54     153    53.26   172.5    53.16
   223.6    54.06   244.7    53.16   250.2    52.16   256.8    51.56   263.6    52.16
   273.1    53.16  291.38     57.2   300.2     57.2     308       56     319       54
     326       56     350       58     380       60     450       64     715       68

Manning's n Values         num=        3
     Sta    n Val     Sta    n Val     Sta    n Val
       0      .02   244.7      .02   273.1      .02

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
      244.7   300.2             357.5   355.1   356.2            .1        .3
Blocked Obstructions      num=       2
   Sta L    Sta R    Elev   Sta L   Sta R    Elev
      85      140      58     409     715      68

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 75

INPUT
Description:
Station Elevation Data     num=       19
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
       0       58      80       56     115    54.66   173.4    54.16  175.14     54.2
     181    53.03     201    53.03     201    54.24   203.6    54.16     234    54.16
     270       58     272       58     285       56     290       56     300       58
     355       60     435       64     505       68     590       68

Manning's n Values         num=        5
     Sta    n Val     Sta    n Val     Sta    n Val     Sta    n Val     Sta    n Val
       0      .02     115      .02  175.14     .018     201      .02     234      .02

Bank Sta: Left   Right     Lengths: Left Channel   Right      Coeff Contr.   Expan.
        115     234               488     485     489            .1        .3
Blocked Obstructions      num=       2
   Sta L    Sta R    Elev   Sta L   Sta R    Elev
      40       80      58     361     590      68

CROSS SECTION           RIVER: Leucadia
REACH: Combine             RS: 70

INPUT
Description:
```

Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	48	56	190	54.56	203	54.16	242.65	54.82
254	52.55	274	52.55	274	55.06	301.9	55.06	308.1	55.16
312.8	56.16	324.7	58.76	330	59	332	59	354	58
360	60	411	62	435	64	480	66	565	68

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	190	.02	242.65	.018	274	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
190	274	360	359.8	358.2	.1	.3

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
160	190	58	428	548	68

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 65

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	30	56	33	54	125	54	215	53.76
258.9	54.16	265.45	54.3	276	52.19	296	52.19	296	54.95
306	55.16	311.1	56.16	331.9	57.56	355	58.7	357	58.7
370	58	376	58	382	60	418	62	465	64
472	64								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	125	.02	258.9	.02	265.45	.018	296	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
125	296	384.7	386.9	384.1	.1	.3

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 60

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	10	56	200.3	54.06	247.7	53.76	250.73	54.05
262	51.8	282	51.8	282	55.23	304.3	55.16	322.1	56.16
342.1	58.86	345	59	347	59	360	58	362	56
368	58	376	60	440	62	470	64	505	66

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	200.3	.02	250.73	.018	282	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
200.3	282	364.2	363.7	367	.1	.3

Blocked Obstructions num= 3

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
17	40	58	58	110	58	136	200	58

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 55

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58	40	56	118	54	173	54	185	53.46
201.7	52.56	215.5	53.16	235.2	54	248	51.44	268	51.44
268	54.42	313	55.16	328.4	58.86	330	59	332	59
343	58	350	56.5	356	58	365	60	435	62
535	64								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	185	.02	215.5	.02	235.2	.018	268	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Contr.	Expan.
185	268	354.4	358.2	348.8	.1	.3

Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
13	34	58	50	80	58	140	185	58
444	535	64						

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 50

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	73.76	.3	63.76	15.6	62.16	21.9	54.16	32.2	53.46
42.3	53.56	68.84	54.11	84	51.08	104	51.08	104	55.16
132	55.16	149.9	56.16	153.5	57.16	161.6	58.56	170	58.7
172	58.7	180	58	190	56	194	58	201	60
212	62	220	60	265	62	275	64	342	66

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	21.9	.02	68.84	.018	104	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Contr.	Expan.
21.9	104	393.5	397.9	398.7	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
282	342	66

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 45

INPUT
Description:
Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	55.06	14.4	54.36	25.2	54.16	45.21	54.22	52.34	54.21
70	50.68	90	50.68	90	53	112.5	52.01	126.52	52.01
135	56	154	57	156	57	167	56	179	55
185	55	233	56	252	58	380	60	384	62
434	64								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	52.34	.018	90	.02	112.5	.02	126.52	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Contr.	Expan.
52.34	126.52	375	380	385	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
281	385	64

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 40

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	55.86	5.8	55.16	23.5	55.16	35.04	55.69	62	50.3
82	50.3	82	56.15	94.6	56.06	106.1	56.16	112.85	56.16
116.5	56.16	121	55.16	126	54.16	129.8	53.16	133	53.06
134	54	146	54	152	52.5	157	56	190	56
260	56	380	58	400	60				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.02	35.04	.018	82	.02	121	.02	157	.02

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

Left	Right	Left	Channel	Right	Contr.	Expan.
35.04	157	343.5	344.8	345.4	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
236	348	60

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 35

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	55.66	14.7	55.16	22.1	55.16	48.8	56.16	56.3	56.16
113	56	120	54	125	52	135	50	150	50
155	48.5	164	52	166	56	195	56	238	56
324	58	447	60						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	125	.02	164	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
125	164	345.5	336.8	337.3	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
232	447	60

CROSS SECTION RIVER: Leucadia
REACH: Combine RS: 30

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	58.16	36.8	58.16	51.59999	59.16	57.59999	59.16	81.3	59.16
94.39999	59.16	104.2	58.16	111	58	125	54	134	50
140	46	155	46	163	46	176	54	191	56
319	56	400	58	470	60				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.02	140	.02	163	.02

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
140	163	0	0	0	.1	.3

SUMMARY OF MANNING'S N VALUES

River:Leucadia

Reach	River Sta.	n1	n2	n3	n4	n5
Vulcan	3300.14	.03	.035	.03		
Vulcan	3200.15	.03	.035	.03		
Vulcan	3100.16	.03	.035	.03		
Vulcan	3000.17	.03	.035	.03		
Vulcan	2900.18	.03	.035	.03		
Vulcan	2800.19	.03	.035	.03		
Vulcan	2700.20	.03	.035	.03		
Vulcan	2600.21	.03	.035	.03		
Vulcan	2500.22	.03	.035	.03		
Vulcan	2400.23	.03	.035	.03		
Vulcan	2300.24	.03	.035	.03		
Vulcan	2200.25	.03	.035	.03		
Vulcan	2100.26	.03	.035	.03		
Vulcan	245	.03	.035	.03		
Vulcan	240	.03	.035	.03		
Vulcan	235	.03	.035	.03		
Vulcan	230	.02	.02	.02		
Vulcan	225	.02	.02	.02		
Vulcan	220	.02	.02	.02		
Vulcan	215	.02	.02	.02		
Vulcan	195	.02	.02	.02		
Vulcan	175	.02	.02	.02		
Vulcan	165	.02	.02	.02		
Vulcan	150	.02	.02	.02		
101	230	.02	.02	.02		
101	225.3	.02	.02	.02		
101	225.2	.02	.02	.02		

101	225.1	.02	.02	.02		
101	220	.02	.02	.02		
101	215	.02	.02	.02		
101	210	.02	.02	.02		
101	205	.02	.02	.02		
101	195	.02	.02	.02		
101	190	.02	.02	.02		
101	185	.02	.02	.02		
101	180	.02	.02	.02		
101	175	.02	.02	.02		
101	170	.02	.02	.02		
101	165	.02	.02	.02		
101	160	.02	.02	.02		
101	150	.02	.02	.02		
101	145	.02	.02	.02		
Combine	140	.02	.02	.02		
Combine	135	.02	.02	.02		
Combine	130	.02	.02	.02		
Combine	125	.02	.02	.02		
Combine	120	.02	.02	.02		
Combine	115	.02	.02	.02		
Combine	110	.02	.02	.02		
Combine	105	.02	.02	.02		
Combine	100	.02	.02	.02		
Combine	95	.02	.02	.02		
Combine	90	.02	.02	.02		
Combine	85	.02	.02	.02		
Combine	80	.02	.02	.02		
Combine	75	.02	.02	.018	.02	.02
Combine	70	.02	.02	.018	.02	
Combine	65	.02	.02	.02	.018	.02
Combine	60	.02	.02	.018	.02	
Combine	55	.02	.02	.02	.018	.02
Combine	50	.02	.02	.018	.02	
Combine	45	.02	.018	.02	.02	.02
Combine	40	.02	.018	.02	.02	.02
Combine	35	.02	.02	.02		
Combine	30	.02	.02	.02		

SUMMARY OF REACH LENGTHS

River: Leucadia

Reach	River Sta.	Left	Channel	Right
Vulcan	3300.14	100	100	100
Vulcan	3200.15	100	100	100
Vulcan	3100.16	100	100	100
Vulcan	3000.17	100	100	100
Vulcan	2900.18	100	100	100
Vulcan	2800.19	100	100	100
Vulcan	2700.20	100	100	100
Vulcan	2600.21	100	100	100
Vulcan	2500.22	100	100	100
Vulcan	2400.23	100	100	100
Vulcan	2300.24	100	100	100
Vulcan	2200.25	100	100	100
Vulcan	2100.26	15	15	15
Vulcan	245	175	175	175
Vulcan	240	275	275	275
Vulcan	235	120	120	120
Vulcan	230	175	180	185
Vulcan	225	190	185	185
Vulcan	220	175	175	175
Vulcan	215	290	290	290
Vulcan	195	340	340	340
Vulcan	175	225	220	220
Vulcan	165	360	360	360
Vulcan	150	305	305	305
101	230	104.1	100.2	136.3
101	225.3	5	5	5
101	225.2	5	5	5
101	225.1	134.2	131.9	133.3

101	220	222.7	215.1	206.1
101	215	78.2	80.6	89.6
101	210	47.1	45.4	64.5
101	205	141.2	142.6	152.6
101	195	143.6	102.4	81.7
101	190	109.2	93.8	106
101	185	56.4	82.7	111.4
101	180	83.8	85.3	85.6
101	175	120.2	124.8	122.1
101	170	137.5	137.6	138.7
101	165	309.6	309.5	308.6
101	160	48.6	52.6	51.9
101	150	151.2	154.7	157.7
101	145	175.6	160.5	160.3
Combine	140	141.5	123.2	117.1
Combine	135	122.2	126.9	132.7
Combine	130	197.5	197.3	196.3
Combine	125	131.2	129.8	132.3
Combine	120	86.1	88.2	95.5
Combine	115	218.8	211.7	222.6
Combine	110	180.1	165.1	173.7
Combine	105	106.7	119.5	229.1
Combine	100	360	340	360
Combine	95	365.1	364.9	363
Combine	90	356.3	355.5	353.7
Combine	85	353.7	357.5	356.9
Combine	80	357.5	355.1	356.2
Combine	75	488	485	489
Combine	70	360	359.8	358.2
Combine	65	384.7	386.9	384.1
Combine	60	364.2	363.7	367
Combine	55	354.4	358.2	348.8
Combine	50	393.5	397.9	398.7
Combine	45	375	380	385
Combine	40	343.5	344.8	345.4
Combine	35	345.5	336.8	337.3
Combine	30	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Leucadia

Reach	River Sta.	Contr.	Expan.
Vulcan	3300.14	.1	.3
Vulcan	3200.15	.1	.3
Vulcan	3100.16	.1	.3
Vulcan	3000.17	.1	.3
Vulcan	2900.18	.1	.3
Vulcan	2800.19	.1	.3
Vulcan	2700.20	.1	.3
Vulcan	2600.21	.1	.3
Vulcan	2500.22	.1	.3
Vulcan	2400.23	.1	.3
Vulcan	2300.24	.1	.3
Vulcan	2200.25	.1	.3
Vulcan	2100.26	.1	.3
Vulcan	245	.1	.3
Vulcan	240	.1	.3
Vulcan	235	.1	.3
Vulcan	230	.1	.3
Vulcan	225	.1	.3
Vulcan	220	.1	.3
Vulcan	215	.1	.3
Vulcan	195	.1	.3
Vulcan	175	.1	.3
Vulcan	165	.1	.3
Vulcan	150	.1	.3
101	230	.1	.3
101	225.3	.1	.3
101	225.2	.1	.3
101	225.1	.1	.3
101	220	.1	.3

101	215	.1	.3
101	210	.1	.3
101	205	.1	.3
101	195	.1	.3
101	190	.1	.3
101	185	.1	.3
101	180	.1	.3
101	175	.1	.3
101	170	.1	.3
101	165	.1	.3
101	160	.1	.3
101	150	.1	.3
101	145	.1	.3
Combine	140	.1	.3
Combine	135	.1	.3
Combine	130	.1	.3
Combine	125	.1	.3
Combine	120	.1	.3
Combine	115	.1	.3
Combine	110	.1	.3
Combine	105	.1	.3
Combine	100	.1	.3
Combine	95	.1	.3
Combine	90	.1	.3
Combine	85	.1	.3
Combine	80	.1	.3
Combine	75	.1	.3
Combine	70	.1	.3
Combine	65	.1	.3
Combine	60	.1	.3
Combine	55	.1	.3
Combine	50	.1	.3
Combine	45	.1	.3
Combine	40	.1	.3
Combine	35	.1	.3
Combine	30	.1	.3

ATTACHMENT 5

RICK ENGINEERING COMPANY
COST ESTIMATES FOR
ALTERNATIVE 3 – PHASED CONSTRUCTION
AND ALTERNATIVE 4

Alternative 3 - Main Line

Cost Estimate for 100-Year Capacity Storm Drain System

OPINION OF PROBABLE CONSTRUCTION COSTS				
FOR: CITY OF ENCINITAS / HIGHWAY 101			JOB NO.:	14413
CUT AND COVER FOR PROPOSED STORM DRAIN - MAIN LINE			DATE:	06/03/04
ESTIMATED BY: CA CHECKED BY: CSH			REVISED:	
ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICES	TOTAL COSTS
MOBILIZATION	1	LS	$1,200,000.00	$1,200,000
CONSTRUCTION STAKING	1	LS	$25,000.00	$25,000
EROSION CONTROL	1	LS	$50,000.00	$50,000
TRAFFIC CONTROL	1	LS	$600,000.00	$600,000
TRENCHING / EXCAVATION (20' DEEP)	20,000	CY	$8.00	$160,000
TRENCHING / EXCAVATION (30' DEEP)	40,000	CY	$10.00	$400,000
TRENCHING / EXCAVATION (40' DEEP)	50,000	CY	$16.00	$800,000
SHORING, STEEL SHEET PILES (20' DRIVE)	129,600	SF	$18.00	$2,332,800
SHORING, STEEL SHEET PILES (30' DRIVE)	181,200	SF	$19.00	$3,442,800
SHORING, STEEL SHEET PILES (40' DRIVE)	225,600	SF	$20.00	$4,512,000
SLURRY BACKFILLING	70,000	CY	$50.00	$3,500,000
DOZER BACKFILLING, AIR TAMPED (TOP 10	40,000	CY	$8.00	$320,000
EXPORT EXCAVATED MATERIAL	70,000	CY	$10.00	$700,000
36" RCP	470	LF	$84.00	$39,480
60" RCP	890	LF	$188.00	$167,320
66" RCP	510	LF	$220.00	$112,200
72" RCP	410	LF	$250.00	$102,500
78" RCP	960	LF	$315.00	$302,400
90" RCP	610	LF	$430.00	$262,300
96" RCP	1,750	LF	$475.00	$831,250
102" RCP	2,080	LF	$525.00	$1,092,000
108" RCP	1,400	LF	$575.00	$805,000
GASKETS AND FITTINGS	1	LS	$200,000.00	$200,000
CLEANOUT STRUCTURE 36" RCP	1	EA	$10,000.00	$10,000
CLEANOUT STRUCTURE 60" RCP	1	EA	$12,000.00	$12,000
CLEANOUT STRUCTURE 66" RCP	1	EA	$14,000.00	$14,000
CLEANOUT STRUCTURE 72" RCP	1	EA	$14,000.00	$14,000
CLEANOUT STRUCTURE 78" RCP	1	EA	$18,000.00	$18,000
CLEANOUT STRUCTURE 90" RCP	1	EA	$18,000.00	$18,000
CLEANOUT STRUCTURE 96" RCP	3	EA	$18,000.00	$54,000
CLEANOUT STRUCTURE 102" RCP	3	EA	$24,000.00	$72,000
CLEANOUT STRUCTURE 108" RCP	3	EA	$24,000.00	$72,000
INTERIM STRUCTURES	2	EA	$100,000.00	$200,000
			SUBTOTAL	$22,441,050
			DESIGN / INDIRECT 40%	$8,976,420
			10% CONTINGENCY	$2,244,105
			TOTAL	**$33,661,575**

ASSUMPTIONS:

1) SITE IS CLEARED AND GRUBBED, READY TO EXCAVATE STORM DRAIN TRENCH, NO SELECTIVE CLEARING REQUIRED.

2) WATER TABLE DEPTH IS UNKNOWN, DEWATERING IS EXCLUDED FROM THIS ESTIMATED OPINION.

3) COST FOR SHORING/SHEET PILES ASSUMES PILES ARE DRIVEN, EXTRACTED AND SALVAGED.

4) NUMBER OF CLEANOUT AND INLET STRUCTURES IS APPROXIMATE, NO BASIS FOR DESIGN.

5) NO COST INCLUDED FOR MODIFICATION OF EXISTING UTILITIES.

6) TRENCHING / EXCAVATION DEPTHS ARE ASSUMED.

Alternative 3 - Laterals

OPINION OF PROBABLE CONSTRUCTION COSTS				
FOR: CITY OF ENCINITAS / HIGHWAY 101			JOB NO.:	14413
CUT AND COVER FOR PROPOSED STORM DRAIN - LATERALS			DATE:	06/03/04
ESTIMATED BY: CA CHECKED BY: CSH			REVISED:	
ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICES	TOTAL COSTS
MOBILIZATION	1	LS	$250,000.00	$250,000
CONSTRUCTION STAKING	1	LS	$25,000.00	$25,000
EROSION CONTROL	1	LS	$50,000.00	$50,000
TRAFFIC CONTROL	1	LS	$300,000.00	$300,000
TRENCHING / EXCAVATION (10' DEEP)	9,000	CY	$4.00	$36,000
TRENCHING / EXCAVATION (15' DEEP)	4,000	CY	$6.00	$24,000
TRENCHING / EXCAVATION (20' DEEP)	4,000	CY	$8.00	$32,000
SHORING, STEEL SHEET PILES (10' DRIVE)	72,000	SF	$18.00	$1,296,000
SHORING, STEEL SHEET PILES (15' DRIVE)	36,000	SF	$19.00	$684,000
SHORING, STEEL SHEET PILES (20' DRIVE)	32,000	SF	$20.00	$640,000
SLURRY BACKFILLING	3,000	CY	$50.00	$150,000
DOZER BACKFILLING, AIR TAMPED (TOP 10	14,000	CY	$8.00	$112,000
EXPORT EXCAVATED MATERIAL	3,000	CY	$10.00	$30,000
24"RCP	400	LF	$44.00	$17,600
30"RCP	400	LF	$64.00	$25,600
36"RCP	1,800	LF	$84.00	$151,200
42"RCP	200	LF	$107.00	$21,400
48"RCP	400	LF	$127.00	$50,800
60"RCP	2,000	LF	$188.00	$376,000
GASKETS AND FITTINGS	1	LS	$150,000.00	$150,000
CLEANOUT STRUCTURE 24" RCP	1	EA	$5,000.00	$5,000
CLEANOUT STRUCTURE 30" RCP	1	EA	$5,500.00	$5,500
CLEANOUT STRUCTURE 36" RCP	3	EA	$6,000.00	$18,000
CLEANOUT STRUCTURE 42" RCP	1	EA	$6,500.00	$6,500
CLEANOUT STRUCTURE 48" RCP	1	EA	$7,000.00	$7,000
CLEANOUT STRUCTURE 60" RCP	3	EA	$8,000.00	$24,000
RAILROAD CROSSINGS	9	EA	$100,000.00	$900,000
			SUBTOTAL	$5,387,600
			DESIGN / INDIRECT 35%	$1,885,660
			10% CONTINGENCY	$538,760
			TOTAL	**$7,812,020**

ASSUMPTIONS:

1) SITE IS CLEARED AND GRUBBED, READY TO EXCAVATE STORM DRAIN TRENCH, NO SELECTIVE CLEARING REQUIRED.

2) WATER TABLE DEPTH IS UNKNOWN, DEWATERING IS EXCLUDED FROM THIS ESTIMATED OPINION.

3) COST FOR SHORING/SHEET PILES ASSUMES PILES ARE DRIVEN, EXTRACTED AND SALVAGED.

4) NUMBER OF CLEANOUT AND INLET STRUCTURES IS APPROXIMATE, NO BASIS FOR DESIGN.

5) NO COST INCLUDED FOR MODIFICATION OF EXISTING UTILITIES.

6) TRENCHING / EXCAVATION DEPTHS ARE ASSUMED.

Alternative 4 - Main Line

Table 11. Cost Estimate for 10-Year Capacity Storm Drain System

OPINION OF PROBABLE CONSTRUCTION COSTS				
FOR: CITY OF ENCINITAS / HIGHWAY 101			JOB NO.:	14413
CUT AND COVER FOR PROPOSED STORM DRAIN - MAIN LINE			DATE:	06/03/04
ESTIMATED BY: CA CHECKED BY: CSH			REVISED:	
ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICES	TOTAL COSTS
MOBILIZATION	1	LS	$400,000.00	$400,000
CONSTRUCTION STAKING	1	LS	$25,000.00	$25,000
EROSION CONTROL	1	LS	$50,000.00	$50,000
TRAFFIC CONTROL	1	LS	$600,000.00	$600,000
TRENCHING / EXCAVATION (20' DEEP)	18,149	CY	$8.00	$145,188
TRENCHING / EXCAVATION (30' DEEP)	32,827	CY	$10.00	$328,272
TRENCHING / EXCAVATION (40' DEEP)	35,000	CY	$16.00	$560,000
SHORING, STEEL SHEET PILES (20' DRIVE)	148,120	SF	$18.00	$2,666,160
SHORING, STEEL SHEET PILES (30' DRIVE)	223,080	SF	$19.00	$4,238,520
SHORING, STEEL SHEET PILES (40' DRIVE)	207,120	SF	$20.00	$4,142,400
SLURRY BACKFILLING	56,849	CY	$50.00	$2,842,454
DOZER BACKFILLING, AIR TAMPED (TOP 10	28,647	CY	$8.00	$229,173
EXPORT EXCAVATED MATERIAL	56,849	CY	$10.00	$568,491
30" RCP	947	LF	$64.00	$60,608
48" RCP	2,756	LF	$127.00	$350,012
54" RCP	978	LF	$158.00	$154,524
60" RCP	2,740	LF	$188.00	$515,120
72" RCP	2,589	LF	$250.00	$647,250
GASKETS AND FITTINGS	1	LS	$200,000.00	$200,000
CLEANOUT STRUCTURE 30" RCP	2	EA	$10,000.00	$20,000
CLEANOUT STRUCTURE 48" RCP	5	EA	$12,000.00	$60,000
CLEANOUT STRUCTURE 54" RCP	2	EA	$14,000.00	$28,000
CLEANOUT STRUCTURE 60" RCP	4	EA	$14,000.00	$56,000
CLEANOUT STRUCTURE 66" RCP	1	EA	$18,000.00	$18,000
CLEANOUT STRUCTURE 72" RCP	5	EA	$18,000.00	$90,000
			SUBTOTAL	$18,995,172
			DESIGN / INDIRECT 35%	$6,648,310
			10% CONTINGENCY	$1,899,517
			TOTAL	**$27,543,000**

ASSUMPTIONS:

1) SITE IS CLEARED AND GRUBBED, READY TO EXCAVATE STORM DRAIN TRENCH, NO SELECTIVE CLEARING REQUIRED.
2) STORM DRAIN SYS. DESIGNED FOR 10YR STORM.
3) WATER TABLE DEPTH IS UNKNOWN, DEWATERING IS EXCLUDED FROM THIS ESTIMATED OPINION.
4) COST FOR SHORING/SHEET PILES ASSUMES PILES ARE DRIVEN, EXTRACTED AND SALVAGED.
5) NUMBER OF CLEANOUT AND INLET STRUCTURES IS APPROXIMATE, NO BASIS FOR DESIGN.
6) NO COST INCLUDED FOR MODIFICATION OF EXISTING UTILITIES.
7) TRENCHING / EXCAVATION DEPTHS ARE ASSUMED.

Alternative 4 - Laterals

OPINION OF PROBABLE CONSTRUCTION COSTS				
FOR: CITY OF ENCINITAS / HIGHWAY 101			JOB NO.:	14413
CUT AND COVER FOR PROPOSED STORM DRAIN - LATERALS			DATE:	06/03/04
ESTIMATED BY: CA CHECKED BY: CSH			REVISED:	
ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICES	TOTAL COSTS
MOBILIZATION	1	LS	$250,000.00	$250,000
CONSTRUCTION STAKING	1	LS	$25,000.00	$25,000
EROSION CONTROL	1	LS	$50,000.00	$50,000
TRAFFIC CONTROL	1	LS	$300,000.00	$300,000
TRENCHING / EXCAVATION (10' DEEP)	9,000	CY	$4.00	$36,000
TRENCHING / EXCAVATION (15' DEEP)	4,000	CY	$6.00	$24,000
TRENCHING / EXCAVATION (20' DEEP)	4,000	CY	$8.00	$32,000
SHORING, STEEL SHEET PILES (10' DRIVE)	72,000	SF	$18.00	$1,296,000
SHORING, STEEL SHEET PILES (15' DRIVE)	36,000	SF	$19.00	$684,000
SHORING, STEEL SHEET PILES (20' DRIVE)	32,000	SF	$20.00	$640,000
SLURRY BACKFILLING	3,000	CY	$50.00	$150,000
DOZER BACKFILLING, AIR TAMPED (TOP 10	14,000	CY	$8.00	$112,000
EXPORT EXCAVATED MATERIAL	3,000	CY	$10.00	$30,000
24"RCP	400	LF	$44.00	$17,600
30"RCP	400	LF	$64.00	$25,600
36"RCP	1,800	LF	$84.00	$151,200
42"RCP	200	LF	$107.00	$21,400
48"RCP	400	LF	$127.00	$50,800
60"RCP	2,000	LF	$188.00	$376,000
GASKETS AND FITTINGS	1	LS	$150,000.00	$150,000
CLEANOUT STRUCTURE 24" RCP	1	EA	$5,000.00	$5,000
CLEANOUT STRUCTURE 30" RCP	1	EA	$5,500.00	$5,500
CLEANOUT STRUCTURE 36" RCP	3	EA	$6,000.00	$18,000
CLEANOUT STRUCTURE 42" RCP	1	EA	$6,500.00	$6,500
CLEANOUT STRUCTURE 48" RCP	1	EA	$7,000.00	$7,000
CLEANOUT STRUCTURE 60" RCP	3	EA	$8,000.00	$24,000
RAILROAD CROSSINGS	9	EA	$100,000.00	$900,000
			SUBTOTAL	$5,387,600
			DESIGN / INDIRECT 35%	$1,885,660
			10% CONTINGENCY	$538,760
			TOTAL	**$7,812,020**

ASSUMPTIONS:

1) SITE IS CLEARED AND GRUBBED, READY TO EXCAVATE STORM DRAIN TRENCH, NO SELECTIVE CLEARING REQUIRED.

2) WATER TABLE DEPTH IS UNKNOWN, DEWATERING IS EXCLUDED FROM THIS ESTIMATED OPINION.

3) COST FOR SHORING/SHEET PILES ASSUMES PILES ARE DRIVEN, EXTRACTED AND SALVAGED.

4) NUMBER OF CLEANOUT AND INLET STRUCTURES IS APPROXIMATE, NO BASIS FOR DESIGN.

5) NO COST INCLUDED FOR MODIFICATION OF EXISTING UTILITIES.

6) TRENCHING / EXCAVATION DEPTHS ARE ASSUMED.

ATTACHMENT 6

HALEY & ALDRICH COST ESTIMATES:

JUNE 8, 2004

AUGUST 13, 2004

HALEY & ALDRICH COST ESTIMATE – JUNE 8, 2004
"GEOTECHNICAL FEASIBILITY STUDY"

Haley & Aldrich, Inc.
9040 Friars Rd.
Suite 220
San Diego, CA 92108-5860

Tel: 619.280.9210
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HaleyAldrich.com

HALEY & ALDRICH

8 June 2004
File No. 30769-000

Mr. Dennis Bowling
Rick Engineering Company
5620 Friars Road
San Diego, California 92110-2596

Subject: Geotechnical Feasibility Study
Trenchless Construction Methods
Encinitas Storm Drain Project
Encinitas, California

Dear Dennis:

Haley & Aldrich, Inc. (Haley & Aldrich) is pleased to provide this letter report presenting the results of our geotechnical feasibility study to evaluate trenchless techniques for storm drain pipeline installation. Our study was performed in accordance with our 10 February 2004 proposal and the Consultant and Subconsultant Agreement dated 5 April 2004. For our study we have received plan and profile drawings from Rick Engineering Company (Rick) for "Leucadia Drainage & Sewer Force Main, CMD95A & CEE97A," dated 23 July 2001. We have also received the following two geotechnical reports for the soil conditions in the general area:

- "Comments on GeoPacifica Report of August 24, 2001, Highway 101 Sewer Force Main Replacement, 14" PVC Sewer Force Main System, Encinitas, California," dated 30 July 2003, prepared by Kleinfelder, Inc.
- "Geotechnical Investigation, Beacon's Beach Access, Encinitas, California," date 17 April 2003, prepared by URS Corporation.

PROJECT DESCRIPTION

From our discussions with you, we understand that flooding occurs in the area of Highway 101 after storm events. The City of Encinitas (City) would like to alleviate this flooding by upgrading the existing storm drain system in the area. The approximate location of the reported flooding and the proposed new storm drains (project site) are presented on the Vicinity Map, Figure 1. We further understand that three different storm drain reaches are being considered to upgrade the current storm drain system. These reaches include the Leucadia Boulevard to Beacon's Beach storm drain, the Highway 101 storm drain, and the various railroad crossings. Each of these storm drain reaches has unique properties requiring different trenchless alternative methods.

The Leucadia Boulevard to Beacon's Beach reach would start at Leucadia Roadside Park adjacent to Highway 101 and drain along Leucadia Boulevard to empty onto Beacon's Beach. We understand that a 48-inch diameter pipe is planned for this reach. This storm drain would be approximately 840 feet long. We understand that a diversionary structure would be installed at the storm drain inlet to divert normal flows into the existing storm drain and that the new storm drain would only be flowing during major storms. This line would alleviate some of the flooding in the area and may be used in conjunction with the Highway 101 storm drain. The proposed alignment for the Leucadia Boulevard reach is shown on Figure 2.

Based on preliminary information received from Rick, we understand that the Highway 101 reach will extend from just south of the intersection of Marcheta and Highway 101 and drain north to empty into Batiquitos Lagoon with the pipeline alignment traversing under the Highway 101 right-or-way. This proposed storm drain will drain the storm waters of most of the catchment area along Highway 101. The alignment is approximately 9,000 feet long with the approximate location shown on Figure 3. Tentatively, the storm drain diameter has been estimated at about 36 inches at the south end, stepping up incrementally in size to about 9 feet at the north end of the proposed alignment. This storm drain will be in addition to the existing 24-inch storm drain, which will remain in service. Storm drain manhole locations for the Highway 101 reach have been assumed to be needed at storm drain laterals. These laterals are anticipated approximately every 1000 feet.

The final reach involves transporting storm flows from the east side of the existing railroad tracks to the west side to tie into the Highway 101 storm drain. We understand that storm flows currently pass from the east to west by surface flow through the railroad track ballast. We further understand that the proposed storm drain crossings are anticipated to consist of a 48-inch diameter pipe. The number of railroad crossings required is not known at this time. We estimate that the trenchless portions of these crossings will be approximately 50 feet in length about every 1,000 feet along the railroad tracks. The approximate location of the storm drain laterals are shown on Figure 4.

SCOPE OF WORK

For this study we performed a site reconnaissance on 20 April 2004, reviewed the drawings provided by Rick, and reviewed the geotechnical reports for the project area. We have also reviewed published geologic data for the project site. This feasibility study was performed to evaluate several trenchless techniques for installation of new pipelines for the three reaches listed above, including constructability and anticipated order of magnitude design and construction costs for various methods. The results of our feasibility study are presented hereinafter.

SITE AND SUBSURFACE CONDITIONS

Site Conditions

The various reaches are located along existing city streets or under the railroad tracks adjacent to Highway 101. The Leucadia Boulevard alignment starts at Leucadia Park at the intersection of Highway 101 and Leucadia Boulevard at an elevation of approximately +55 feet, Mean Sea Level (MSL). This alignment follows Leucadia Boulevard, which rises to an elevation of approximately +95 feet, MSL to the parking lot for Beacon's Beach. The parking lot is positioned at the crest of coastal bluffs leading down to the beach below at an elevation of approximately +10 feet, MSL. Leucadia Boulevard is bordered on both sides by residential housing. The proposed storm drain would have an inlet structure at Leucadia Park and drain by gravity to Beacon's Beach.

The Highway 101 reach starts just south of the intersection of Marcheta and Highway 101 and extends along the Highway 101 right-of-way, north to La Costa Avenue. This alignment then moves east of Highway 101 to Batiquitos Lagoon below. Highway 101 is a four-lane asphalt paved highway with two lanes of traffic in each direction. There is parking along the west side of the highway and a tree lined median between the north and south bound lanes. Commercial buildings border the west side of Highway 101 and railroad tracks and the accompanying right-of-way border the highway on the east. Highway 101 gently slopes from an elevation of approximately +75 feet, MSL at El Portal to approximately +55 feet, MSL at Andrew Avenue. The highway rises to +60 feet, MSL at La Costa Avenue before descending towards Batiquitos Lagoon. We understand that the proposed storm drain would be located approximately 15 to 30 feet below the ground surface along the highway and empty into Batiquitos Lagoon.

We understand that the railroad crossings would be installed to transport water under the existing railroad tracks from the east to the west. The railroad tracks are relatively level and dirt access roads border the railroad on either side.

Geologic Conditions

Based on our review of the available information and our site reconnaissance; we anticipate that the different reaches described above are underlain by several marine deposits including Pleistocene sand terrace deposits, the Ardath Formation and the underlying Torrey Sandstone. Fill soils derived from these parent formational soils may be encountered along the proposed pipeline reaches near the ground surface. Landslide Debris will most likely be encountered along the coastal bluffs at the end of the Leucadia Boulevard reach at Beacon's Beach.

As noted above the fill material is anticipated to be derived from the native formational material in the area. Fill materials are anticipated to be shallow (less than 10 feet thick) deposits along the graded roadways and railroad right-of-way.

Terrace deposits are exposed at the surface or underlying the fill material. The terrace deposits consist of medium dense to dense, light brown to reddish brown silty sand and sandy silt, with occasional layers of cohesionless sand. The terrace deposits are relatively flat lying sedimentary beds encountered to depths in excess of 30 feet as described in the Kleinfelder, 2003 report. The terrace deposits extend down to an elevation of approximately +20 to +25 feet, MSL at the contact with the underlying Ardath Shale.

The Ardath Shale in the area generally consists of light gray to gray green hard claystone with some slickensided bedding planes. The Ardath Shale may be encountered at lower elevations of the proposed trenchless pipeline reaches. The Torrey Sandstone underlies the site at depth, but is not anticipated within the limits of the pipeline excavations.

Several ancient landslides, thought to have occurred during the late Pleistocene have been mapped along the coastal bluffs in the Encinitas area. At the western end of the Leucadia Boulevard pipeline reach, at Beacon's Beach, a large amphitheatre-shaped landslide has been mapped. The proposed pipeline alignment would pass through this landslide. We understand that the City currently plans to stabilize this landslide within the next eight months to a year. However, if landslide stabilization is not performed prior to the installation of the storm drain pipeline, landslide debris and a failure surface will be encountered. The landslide debris consists of rotated section of the terrace deposits and Ardath Shale. The landslide failure surface consists of remolded clay with low shear strength.

Groundwater conditions within the pipeline alignment are uncertain based on the available geologic reports. Seepage was observed in the borings performed in 2001 for the existing storm drain at depths below Highway 101 of about 12 feet but is likely due to perched water.

TRENCHLESS ALTERNATIVES

The subsurface conditions at the site and the final storm drain alignments selected will have an influence on the trenchless technology applicable for this project. More than one method may be technically feasible for each reach, depending upon the final alignment selected. Based on our experience it is our opinion that several trenchless methods may be technically feasible for each reach. For the Leucadia Boulevard to Beacon's Beach Reach these methods include Horizontal Directional Drilling (HDD), Jack and Bore, microtunneling, and conventional tunneling methods. For the Highway 101 Reach these methods may include one single method or a combination of methods, including mechanical methods, such as a wheel Tunnel Boring Machine (TBM) or a digger shield; and conventional tunneling methods, such as a modified horseshoe tunnel. A combination of two of these methods may be used as the required pipeline diameter changes along the alignment. Jack & Bore is probably the most feasible method for the railroad crossings. A discussion of each of these methods for the respective reach follows.

Leucadia Boulevard to Beacon's Beach

A. Horizontal Directional Drilling

Horizontal directional drilling is a process of drilling a guided borehole, referred to as the pilot hole through the ground along a predetermined path from a bore pit to a receiving pit. For larger pipes, once the pilot hole is completed it is reamed by one or more passes of a reamer to a diameter typically 1.5 times the pipe diameter. Throughout the pilot hole drilling and reaming process, soil and rock cuttings are removed and borehole stability is maintained by a drilling fluid, typically bentonite slurry. On completion of reaming, the pipe is typically pulled into the borehole. Prior to pulling, the pipe is typically preassembled to its final length so that it can be pulled into the hole in one shot. The pipe can be preassembled in segments and welded/fused in the field during pull back but at an elevated risk and increased pull time.

B. Jack and Bore

Jack and Bore is a trenchless method in which pipe casing is directly advanced through the ground with thrust provided by hydraulic jacks from a jacking pit and excavation being performed from within a steerable jacking shield at the leading edge of the pipe being jacked. Soil and rock may be excavated using augers within the casing, which transport the muck through the pipe back to the jacking pit for removal, or alternatively, excavation can be conducted manually by hand-held tools or mechanically with wheel-type or hydraulic excavators at the face. Open face shields are those without a system for pressure regulation at the face in order to prevent uncontrolled ground and groundwater inflow into the face, and wherein the excavation face is readily accessible by the workers. Open face shields are typically used in soil types with good stand-up time, or in soils that have been dewatered or otherwise prestabilized by ground improvement methods such as grouting. For open face shields used on jack and bore projects, removal of excavated soil is typically done using small carts winched between the jacking shaft and the face. The process requires personnel entry into the pipe being jacked to operate excavation equipment.

Typically, the pipe being jacked using jack and bore techniques is the product (final) pipe to be installed. However, with auger boring, where the soil is transported from the face using augers inside the pipe, and with small diameter pipes, an oversize pipe or sleeve would be jacked in-place and the storm drain pipe would be placed in the sleeve and grouted in place. Typically, jacking and boring is done with pipes 42 to 48 in. in diameter and larger.

C. Microtunneling

Microtunneling is a method of trenchless construction using a remotely controlled, laser-guided tunnel-boring machine that uses pipe jacking and permits continuous support of the excavation face. The remotely operated microtunneling tunnel-boring machine (MTBM) cuts a circular excavation slightly larger than the required pipeline diameter. The MTBM is typically classified as a so called closed face tunneling shield in that there is a face support/stabilization system which uses either earth or slurry pressure to ensure that the soil ahead of the MTBM remains stable and there is no uncontrolled flow of groundwater into the MTBM. The excavated material is mixed into slurry at the face of the MTBM and transported back to a "mud plant" by transmission lines, typically at the jacking shaft site where the solids are removed. The "clean" slurry is then recycled and the solids are disposed of.

D. Conventional Tunneling

A conventional modified horseshoe tunnel is a method by which the tunnel is excavated a few feet at a time horizontally along the alignment and is supported by the ground's own strength until support structures can be added. The tunnel progresses incrementally with a series of tunnel excavation followed by tunnel support erection. The tunnel support generally consists of beam and column bracing or wire mesh and shotcrete. After the initial support is complete and the tunnel excavation finished, the carrier pipe is installed and the annular space between the carrier pipe and the tunnel support is grouted.

Highway 101

Several methods are presented below for this reach. However, because of the varying required pipeline diameter, more than one method may be employed for the reach with two different tunnel sizes as will be described in the Recommendations section of this report.

Non-pressurized face machines are applicable for this reach above groundwater levels in formations such as soil, cemented sandstone, conglomerate, and shale. Non-pressurized face machines can also be used below the groundwater level in soil and rock where groundwater seepage can be controlled and adequate ground stability can be maintained. Two types of non-pressurized face machines (TBM and shield tunneling) are considered feasible for this reach of the project. Pressurized face machines can also be used but are not considered necessary for this project.

A. Tunnel Boring Machine

A tunnel boring machine consists of a rotating cutterhead and a tunnel shield. The cutterhead excavates the ground at the tunnel heading and is attached to a full circular shield to support the ground during excavation and installation of the initial or final support system. The excavated ground is taken into the machine though openings located within the cutterhead and is conveyed through the machine. The tunnel spoils are subsequently removed from the tunnel using additional conveyor systems and/or a locomotive with muck cars. A TBM would generally be applicable to the longer tunnel segments in ground with good to limited stand-up time.

The initial support system for this method would most likely consist of steel ribs and lagging or lattice support and shotcrete. These liner systems would be installed in the tail of the shield and expanded to support the tunnel. After completion of the tunnel and the initial liner system the carrier pipe would be installed and the annular space would be grouted.

B. Shield Tunneling

A digger shield consists of a full circular shield. The shield also supports the ground in the rear of the machine during installation of the initial or final tunnel support system. Shield tunneling requires the use of a tunneling shield, which provides immediate support of the ground prior to installation of the initial support system. The shield is required to have steering jacks to maintain line and grade. The shield may have breasting capabilities to support the face when unstable ground conditions are encountered. Full breasting is usually required during shutdown periods such as weekends, off shifts, and mechanical breakdowns. Dewatering is required when tunneling below natural groundwater. An open faced digger shield is well suited to all the anticipated ground conditions. The open face configuration allows access for removal of cobbles and boulders, if encountered. To allow for man-entry, tunnel shields are usually a minimum of 42-in. diameter.

The initial tunnel support system (typically steel ribs and lagging or liner plate) is erected from within the tail of the tunneling shield and jacking of the tunnel shield from the installed tunnel support is used to advance the shield. The excavation proceeds using hand mining or mechanical excavation methods, such as electric digger arms, breakers, or roadheaders, from within the shield. Muck is transported from the face of the tunnel to the access pit using train type muck cars or conveyor systems. The carrier pipe is placed within the excavated tunnel and the annular space between the carrier pipe and the initial tunnel support system is filled with cement grout.

C. Conventional Tunneling

Two types of conventional tunneling were considered for this reach. A conventional modified horseshoe tunnel as described for the Leucadia Boulevard to Beacon's Beach Reach above and the Sequential Excavation Method, also known as the New Austrian Tunneling Method (NATM). The sequential excavation method is a method of creating underground space, which utilizes the self-supporting capacity of the rock or soil. The tunnel is generally excavated sequentially, beginning with a starter tunnel, and progressively widened with side drifts and/or bottom headings until the required underground space is achieved. Rock bolts, lattice girders, wire mesh and shotcrete are typically used for ground support and reinforcement. When the initial support of the NATM tunnel is finished, drainage, waterproofing, and a final structural liner are added to complete the tunnel. Further evaluation of the ground condition is warranted before selecting this trenchless method, as the Kleinfelder report for the area indicates pockets of cohesionless sand, which will not support itself.

D. Jack & Bore

The Jack & Bore method described above for the Leucadia Boulevard to Beacon's Beach Reach will be the same for this reach as well. This method would be practical for pipeline diameters less than about 7 feet to account for the space limitations for jacking and receiving pits along Highway 101.

Railroad Crossings

The actual number of crossings and the location of the crossings are not known at this time. We assumed one crossing every 1,000 feet (about 11 crossings) and each crossing about 50 feet long. The Jack & Bore method as described above is the most practical method for the railroad crossings. Because of the short distance and the space available for jacking and receiving pits, this method would be both feasible and cost effective. However, for railroad crossings, steel casing around the final carrier pipe will be required in the railroad right-of-way.

Shaft Construction

Each of the trenchless methods described above, except HDD will require a work shaft from the surface to install the tunnel. However, we understand that a drop shaft will be required for the Leucadia Boulevard to Beacon's Beach Reach for the inlet manhole. Work shafts, as defined herein, are the shafts required by the contractor during construction to provide access to the tunnel or trenchless method for personnel and equipment, as well as for removal of excavated material (muck). The work shaft will also be used to jack pipe as necessary and for pipe installation within the tunnel excavation. From a constructability standpoint, it would be desirable, although not necessary, to locate the work shaft at the down stream end of the pipeline segment being constructed. This reduces problems associated with removal of groundwater infiltration and improves efficiency of muck removal. We understand that environmental limitations with staging on the beach will most likely require a work shaft at the upstream end of the alignment for the Leucadia Boulevard to Beacon's Beach Reach. Approximate land area requirements at the work shaft sites would include the access shaft itself and room for cranes and additional equipment and pipe materials. The area required for the work shafts are anticipated to be on the order of 1 acre for larger tunnels constructed using TBMs or shields. Work shaft area requirements for smaller jack and bore operations can be much smaller, perhaps on the order of ½ acre.

Along with a work shaft, it should be assumed for planning purposed that additional shafts, referred to herein as access shaft will be required at the opposite end of each tunnel or trenchless segment from the work shaft. The purpose of these shafts would be to remove tunnel excavation equipment (shields or TBM's) after completion of excavation and provide access to the tunnel during final lining construction. The various methods will require a different number of intermediate shafts and spacing between shafts as well as the size of the shaft required to account for limited drive lengths. The Jack & Bore methods described can have drive lengths of approximately 400 to 800 feet for the diameters and soil types anticipated. This would require an access shaft at these intervals. Similarly, microtunneling can typically have drive lengths of approximately 1,000 feet. These methods would allow for an entrance shaft at Leucadia Park and a receiving area or pit at Beacon's Beach for the Leucadia Boulevard to Beacon's Beach alignment.

The TBM, shield tunneling, and conventional tunneling methods all have theoretically infinite drive lengths. An access shaft would only need to be installed at the ends of the alignment. However, intermediate shafts may be installed for manhole construction or storm drain laterals as needed. The land area requirement for the access shafts would be on the order of ¼ to ½ acre.

Access shafts could be installed in Leucadia Park and within the median of Highway 101. The entrance shaft for a pipeline of about 9 feet in diameter along Highway 101 could most likely be installed in the vacant parcel between Highway 101 and the railroad tracks, immediately north of La Costa Boulevard to minimize traffic impacts. Intermediate access shafts for jacking pits or manhole construction would generally need to be about 12 to 15 feet wide for pipeline diameters of less than 7 feet and about 20 to 25 feet long for pipeline diameters between 7 and 9 feet. These intermediate shafts may require that parking along Highway 101 be temporarily removed and that the traffic lanes be rerouted around the access shafts to ease traffic impacts. These access shafts could be located to minimize impacts to businesses. Additional work laydown areas for pipe material and equipment storage could be located off the pipeline alignments. Pipe storage laydown areas are currently being utilized along Highway 101 for the installation of storm drain and sewer pipe in Encinitas as shown in the Appendix to this report.

Spoil Handing and Disposal

Spoil will be generated from tunnel boring, shafts and underground excavation activities. The volume will be proportional to the mined volume of the tunnels, shafts and underground excavations, combined with bulking and/or shrinking associated with the soil and rock materials. The bulking factor is the ratio of the excavated volume of material to the in-situ volume of material. Similarly, the shrinkage factor is the ratio of the volume after placement and compaction to the in-situ volume.

The characteristics of the spoil will depend upon the type of material being excavated and the excavation/tunneling methods employed. Every effort should be made during design and construction planning to determine commercial reuse for the spoil. These may include reuse as concrete aggregate, structural fill, daily cover or lining material at landfills, or other uses.

Tunnels which are constructed using slurry methods will create spoil which contains a mixture of slurry and excavated soil or rock. Slurry for tunneling is typically composed of bentonite, a naturally occurring clay mineral, and water. The soil and rock are typically removed from the slurry and the slurry reused via an automated process consisting of a series of sieves, hydro-cyclones and filter presses. Although rigorous separation techniques can remove virtually all slurry from the soil and rock, the potential presence of residual slurry or other materials in the spoil should be considered when selecting a suitable commercial reuse or disposal of the material.

CONCEPTUAL COST ESTIMATES

Conceptual cost estimates have been prepared for trenchless construction methods and are presented in the table below. These costs include equipment mobilization, excavation and spoils disposal, casing or initial tunnel support, shaft construction, and grouting as applicable.

Proposed Trenchless Method	Estimated Cost[2]	Estimated Construction Duration[3]
Highway 101		
TBM only	$22 to 25 million	14 months
TBM and shield tunnel	$23 to 26 million	20 months
TBM and Jack & Bore	$20 to 24 million	20 months
Conventional (horseshoe or NATM)	$28 to 33 million	30 months
Digger Shield	$24 to 28 million	30 months
Leucadia Boulevard		
HDD	$1.5 to 1.8 million	2 months
Microtunnelling	$0.90 to 1.05 million	2 months
Jack & Bore	$0.90 to 1.05 million	3 months
Conventional	$1 to 1.25 million	6 months
Railroad Crossings[1]		
Jack & Bore	$75,000 to 100,000	1 month each

EACH OR EVERY 1000'?

Notes:
1. Costs for railroad crossings indicated are per crossing. The number of crossings and exact lengths are unknown at this time.
2. Estimated costs include shaft construction, tunnel excavation, soil disposal, and pipe installation.
3. Estimated construction schedule includes tunnel and shaft excavation and pipeline installation. Duration is based on 5 day work week.

The estimated costs presented do not include the cost for permitting or other utility realignment. We have assumed a 20 percent contingency in our cost estimate as indicated by the cost estimate range provided. For preliminary planning purposes, we recommend that a design cost of approximately 35 percent be added to the above costs for comparison purposes with the conventional open trench cost estimate prepared by Rick Engineering for this project. We have included an estimated cost of 4.2 million for the cost of the final product pipe, gaskets and fittings, and the 11 cleanout structures assumed in the Rick Engineering open trench cost estimate. The cost estimate presented above is subject to change based on the number of access shaft required for final pipeline access and the final pipeline alignment, and the number of connections to laterals. Additional cost estimates will be required in subsequent stages of project planning and design.

Contaminated soils are not anticipated to be encountered along the proposed pipeline alignments. Costs associated with testing, handling, or disposal of potentially hazardous material encountered in the subsurface is not included in this project. Likewise the cost for dewatering is not included in this study.

We understand that the landslide on the coastal bluffs at Beacon's Beach will be stabilized within the next year. If this landslide stabilization does not occur before the start of this storm drain project, stabilization of the earth slope in the vicinity of the proposed storm drain will be required, which was not included in this cost estimate.

For cost estimating purposes, we evaluated several different scenarios for the Highway 101 Reach using different trenchless methods and two different tunnel diameters. We assumed that the tunnel may be completed with one 12-foot diameter using TBM technology or with the tunnel diameter stepping down to 7-foot diameter to complete the tunnel with various other methods. The smaller 7-foot diameter was chosen based on the hydraulic requirements for the storm drain. Additional evaluations of the practical tunnel sizes and refinement of the cost estimates can be performed during a follow-on geotechnical investigation. The estimates provided above are for preliminary planning purposed only.

CONCLUSIONS AND RECOMMENDATIONS

For the proposed project alignments and the geologic and topographic conditions present at the site, it is our opinion that the methods discussed above for each reach are all technically feasible options to install a new pipeline by trenchless technology. The various methods along each pipeline reach are presented on Figures 2 through 4. However, each method has its own limitations. Based on our review of the project constraints, the geologic conditions at the site, our site reconnaissance, our discussion with local contractors, and our experience, the three reaches will each be discussed below. Photographs of the various pipeline alignments, potential access pit locations, and staging areas are presented in an Appendix to this report.

The methods selected are based on the preliminary information obtained for this study. Additional geotechnical investigations and the cost of construction materials may alter the feasibility factors for the recommended methods presented below.

Leucadia Boulevard to Beacon's Beach

It is our opinion that conventional tunneling would be the most feasible trenchless method for the Leucadia Boulevard to Beacon's Beach Reach to keep the alignment within the Leucadia Boulevard right-of-way. Microtunneling or jack & Bore methods may also be reasonable, if a straight alignment from Leucadia Park to Beacon's Beach is permissible (outside of the Leucadia Boulevard right-of-way). Our evaluation takes into account the two horizontal curves in the alignment necessary to stay within the city street right-of-way, the grade change or slope of the storm drain, and the necessity to pass through the existing landslide. We have assumed that the entrance shaft will be located within Leucadia Park and that the storm drain will empty onto the sand at Beacon's Beach. HDD methods are pushing the size limitations for this reach (an approximately 5-foot diameter tunnel for a 4-foot diameter carrier pipe). Likewise, the approximately 850 foot length may be approaching the upper bound for a feasible drive length for jack & bore techniques.

As the Beacon's Beach end of the pipeline alignment would require passage through the existing landslide, additional hazards are present. Movement of the landslide after pipeline installation could damage the pipe and cause leakage of storm water into the ground, which may propagate the movement of the landslide. We recommend that the landslide repair that is planned occur before the installation of the pipeline. A knockout panel can be placed in the retaining wall planned for the landslide repair to accommodate the trenchless alignment.

Highway 101

For the Highway 101 alignment, we have evaluated excavating one tunnel for the entire approximately 9,000 foot of length with an diameter of 12 feet, and we have evaluated transitioning the tunnel excavation after about 5,800 feet from a 12-ft diameter tunnel to a 7-ft diameter tunnel for the last approximately 3,200 feet at the south end of the alignment, using two different tunnel methods. The diameters and number of transitions selected are preliminary and included for planning purposed only. Additional analyses would be required to evaluate the number of transitions and diameters to be used in design. In our opinion, the most feasible and cost effective methods for the installation of the proposed storm drain would be a combination of a TBM machine for the larger diameter portion of the tunnel followed by a transition to a tunnel excavated using digger shield methods, or one diameter using the TBM method only. Conventional tunneling would be costly and time prohibitive. In addition, conventional methods may not be practical if cohesionless areas of the terrace deposit sandstone are encountered as discussed in the Kleinfelder report. The jack & bore method would be cost effective, but would cause much more disruption to the traffic and business as additional access shafts would be required at approximately 500 foot intervals.

For these methods existing laydown areas that have recently been used for the installation of the 24-inch storm drain and associated sewer lines in the area can probably be used for staging areas for this project. We have assumed that the main tunnel entrance will be located on the vacant parcel of land between Highway 101 and the railroad tracks immediately north of La Costa Avenue. Additional access shafts may be located in the center median of Highway 101 as described above to minimize traffic, parking, and business impacts.

Ground surface settlements resulting from tunneling and their impacts on adjacent utilities and structures will have to be evaluated for this trenchless alignment as additional information becomes available. Surface manifestations of ground settlement would most likely be the greatest directly above the tunnel excavation and diminish to a negligible amount at a distance equal to approximately two times the depth of the tunnel either side of the centerline. If settlement related impacts are determined to be unacceptable then mitigation measures such as compaction grouting will be necessary to reduce tunneling related settlement to acceptable levels.

Railroad Crossings

Because of the short length for each railroad crossing and the requirement for steel casing beneath the railroad tracks, we recommend that jack & bore methods be used for the railroad crossings. However, we understand from Rick Engineering that there are tentative plans to lower the railroad tracks along this stretch of Highway 101 in Encinitas. If this plan comes to fruition, conventional open trench pipe installation may be feasible during the grade realignment of the railroad tracks. If the storm drains are installed prior to lowering of the grade, the steel casing will allow for a minimal amount of soil cover between the pipeline invert and the bottom of the railroad ballast.

Further Studies

This feasibility study was performed based on the geotechnical reports provided to us, published information on the local and regional geology, and our experience in the area. Although the geotechnical information provided was adequate for this conceptual level study, it is not sufficient for future planning and design. Before pipeline design and specifications for trenchless excavation are developed, we recommend that an additional geotechnical investigation be performed for this project including field explorations, laboratory testing, measurement of groundwater, if present, and engineering analyses. In addition, we recommend that the records for the City of Encinitas be examined for additional geotechnical investigations in the area that could assist with the geotechnical investigation for this project. Haley & Aldrich would be pleased to provide this additional geotechnical investigation and recommendations for trenchless pipeline design for the project, if this next step is taken towards the completion of this exciting project.

LIMITATIONS

This report was prepared for the purposes of a feasibility planning study only. The preliminary geotechnical considerations discussed herein are not intended for detailed design purposes. This work was performed by Haley & Aldrich, Inc., in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

The preliminary geotechnical considerations presented herein are based, in part, on information from previous subsurface investigations by others. The accuracy of this information and nature and extent of variations along the pipeline alignments may not become evident until additional subsurface explorations are conducted. If changes do appear, it will be necessary to re-evaluate the information presented in this report.

The scope of work for this report did not include an assessment of the presence of or impact that hazardous materials might have on the feasibility or cost of the proposed construction.

Sincerely,

HALEY & ALDRICH, INC.

Steven M. Fitzwilliam, G.E. 2501
Senior Engineer

Daniel J. Dobbels
Vice President

Enclosures:

- Figure 1 - Vicinity Map
- Figure 2 – Site Plan Leucadia Boulevard
- Figure 3 – Site Plan Highway 101
- Figure 4 – Site Plan Railroad Crossings
- Appendix A – Project Photographs

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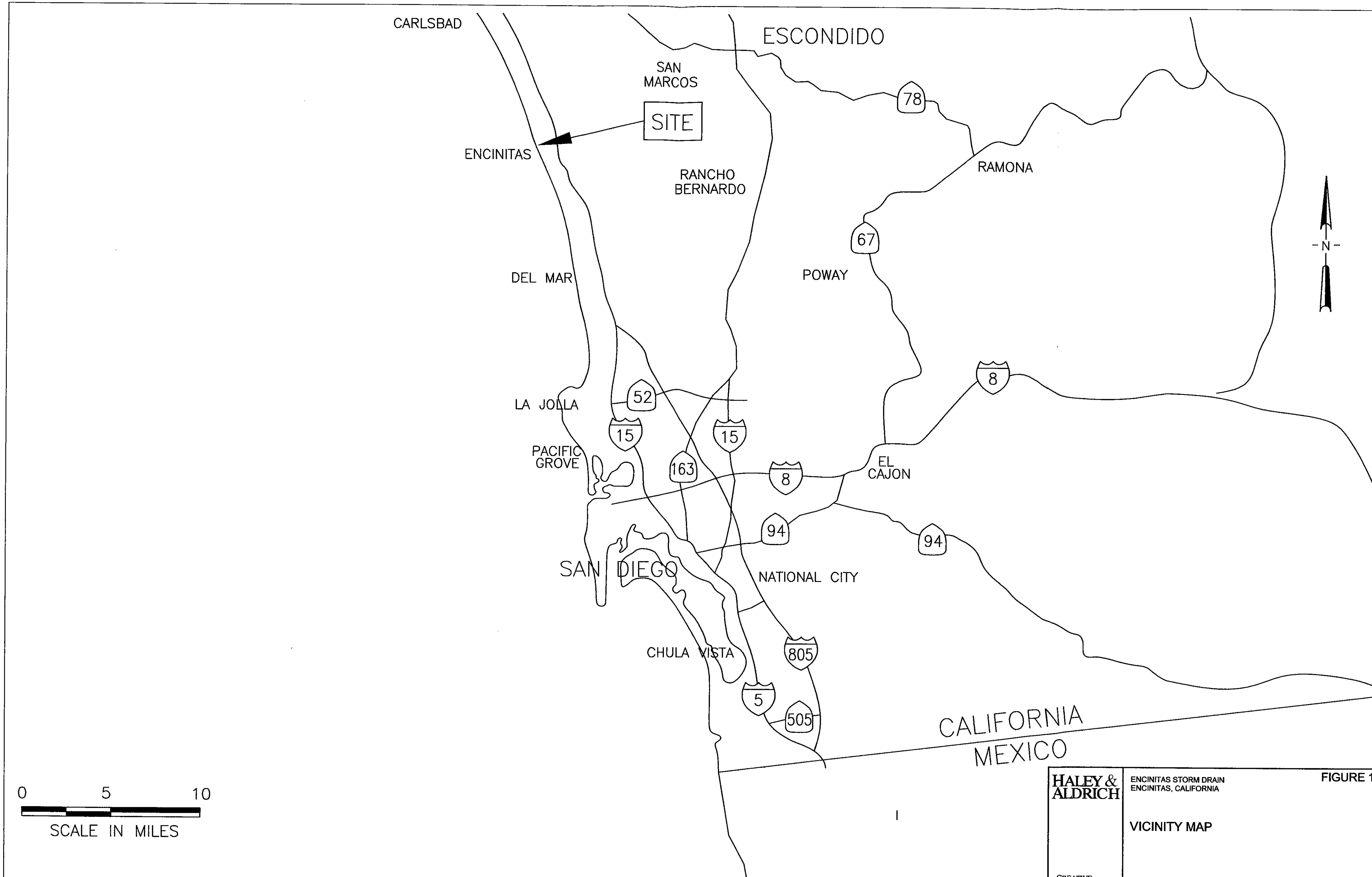
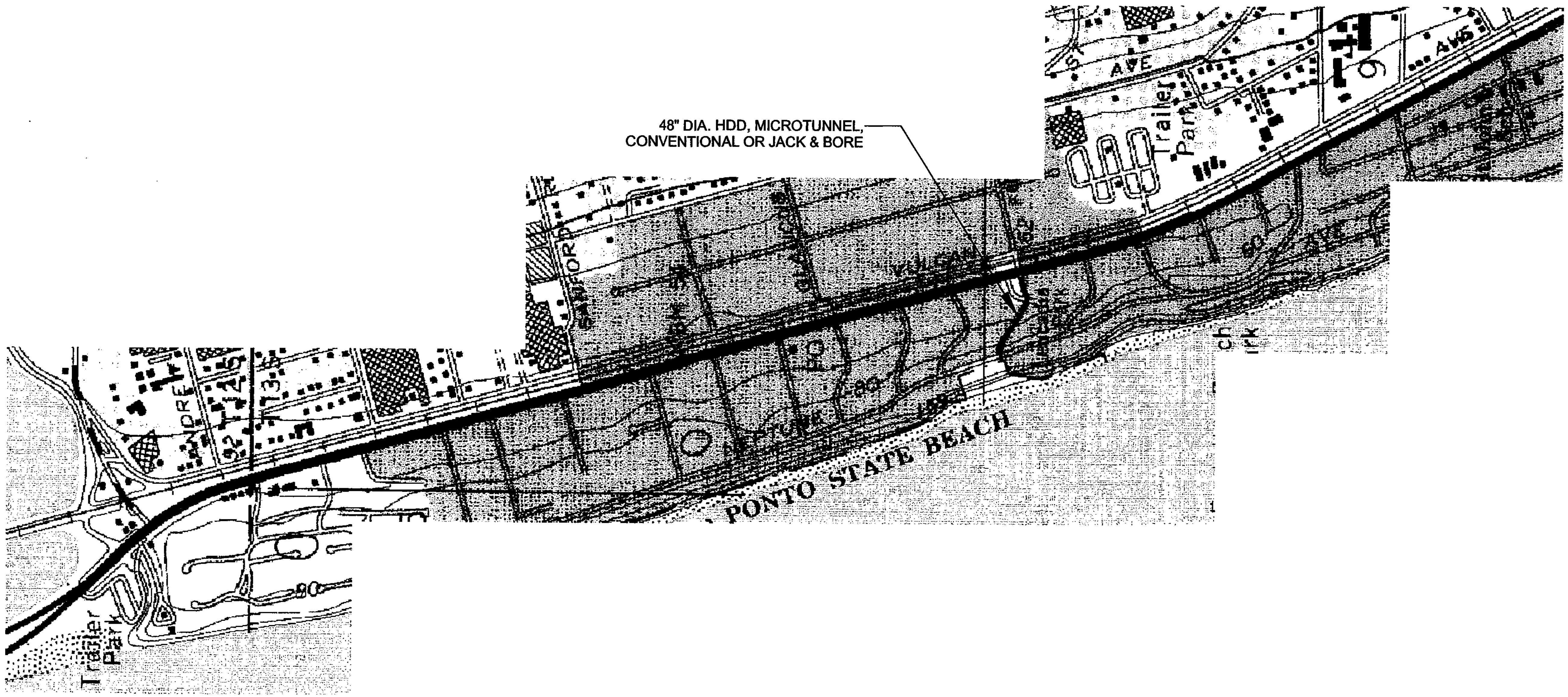


REFERENCE: Jennings, C.W. and Saucedo, G.S., 1994, "Fault Activity Map of California and Adjacent Areas", Map Sheet 29, California Department of Mines and Geology Sacramento, California

HALEY & ALDRICH CREATIVE SOLUTIONS FOR CLIENT SUCCESS	ENCINITAS STORM DRAIN ENCINITAS, CALIFORNIA VICINITY MAP SCALE: AS SHOWN	FIGURE 1 JUNE 2004



LEGEND

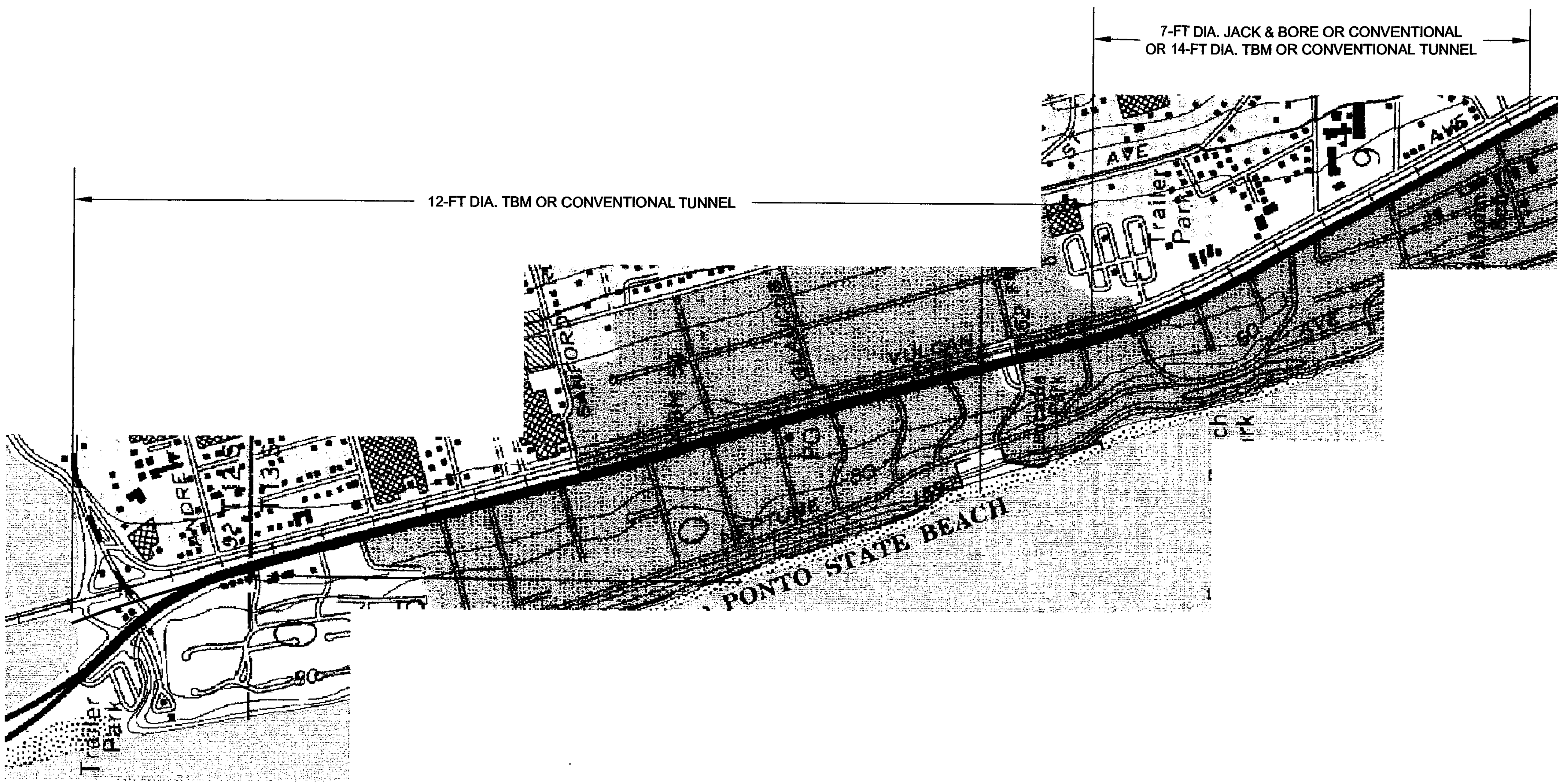
PIPELINE ALIGNMENT

N

0 1/6 1/3
APPROXIMATE SCALE IN MILES

SOURCE: USGS ENCINITAS 7.5' QUADRANGLE, 1979

HALEY & ALDRICH	ENCINITAS STORM DRAIN ENCINITAS, CALIFORNIA FIGURE 2
	SITE PLAN LEUCADIA BOULEVARD STORM DRAIN
CREATIVE SOLUTIONS FOR CLIENT SUCCESS	SCALE: AS SHOWN JUNE 2004



LEGEND

PIPELINE ALIGNMENT

N

0 1/6 1/3
APPROXIMATE SCALE IN MILES

SOURCE: USGS ENCINITAS 7.5' QUADRANGLE, 1979

HALEY & ALDRICH
CREATIVE SOLUTIONS FOR CLIENT SUCCESS

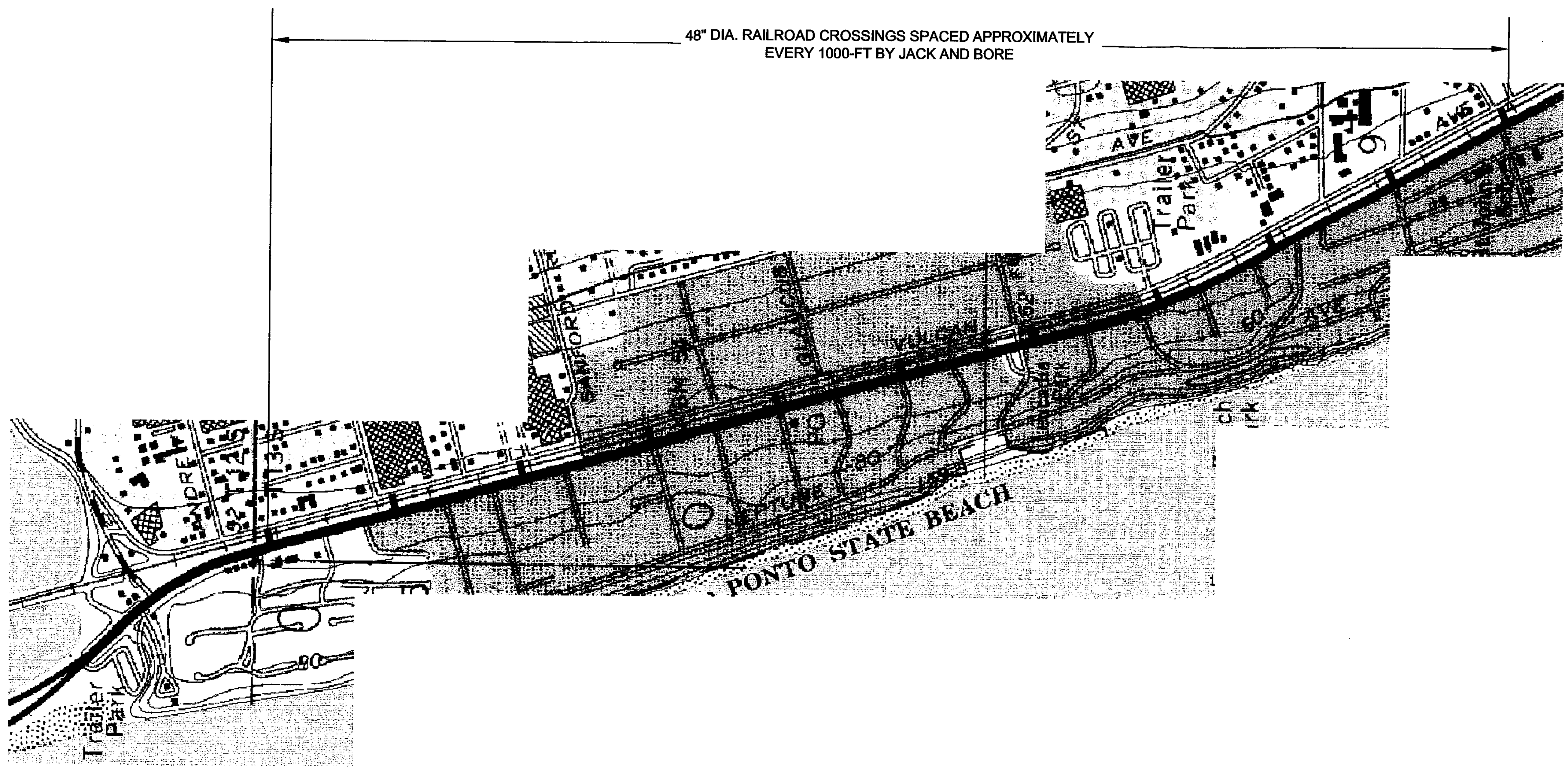
ENCINITAS STORM DRAIN
ENCINITAS, CALIFORNIA

FIGURE 3

SITE PLAN
HIGHWAY 101 STORM DRAIN

SCALE: AS SHOWN

JUINE 2004



LEGEND

RAILROAD CROSSINGS BY JACK AND BORE

N

0 1/6 1/3

APPROXIMATE SCALE IN MILES

SOURCE: USGS ENCINITAS 7.5' QUADRANGLE, 1979

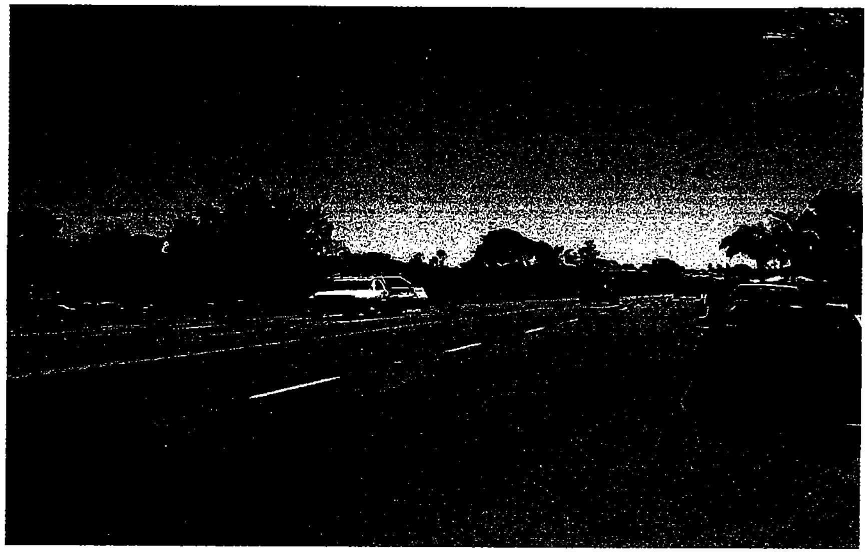
HALEY & ALDRICH	ENCINITAS STORM DRAIN ENCINITAS, CALIFORNIA	FIGURE 4
	SITE PLAN RAILROAD CROSSINGS	
CREATIVE SOLUTIONS FOR CLIENT SUCCESS	SCALE: AS SHOWN	JUNE 2004

Potential working shaft location at Leucadia Park

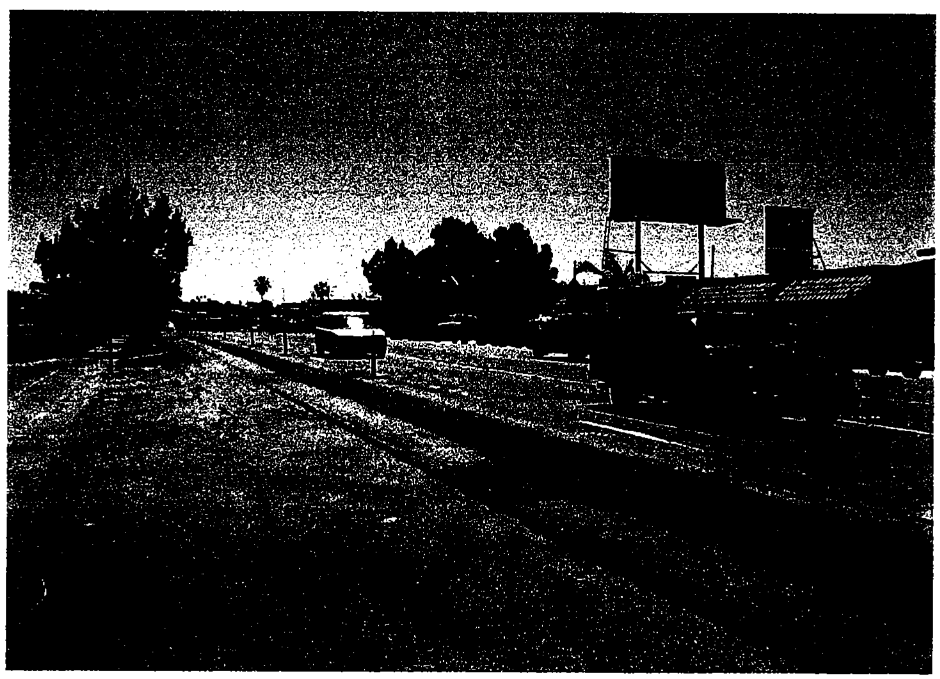
View looking west of Leucadia Boulevard from Leucadia Park

Parking area above Beacon's Beach along Leucadia Boulevard

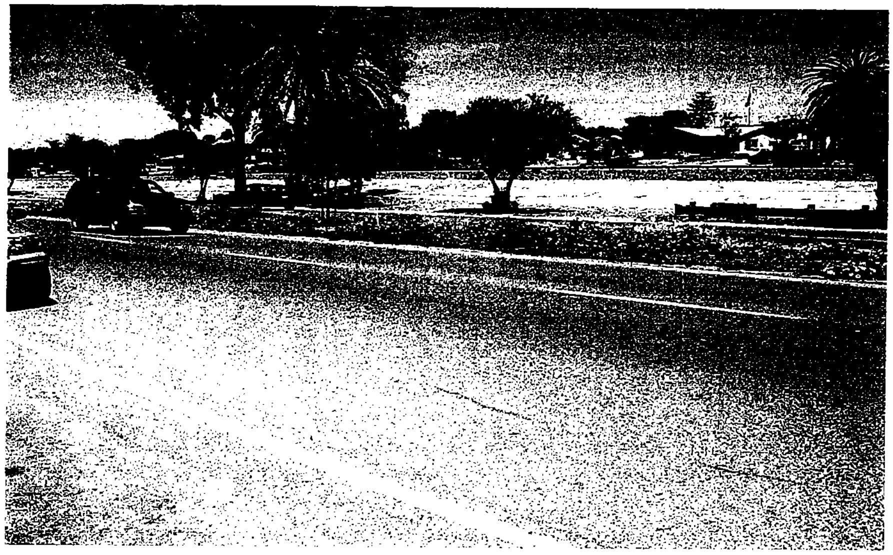
View of Beacon's Beach Landslide at end of Leucadia Boulevard



Highway 101 looking south from Marcheta

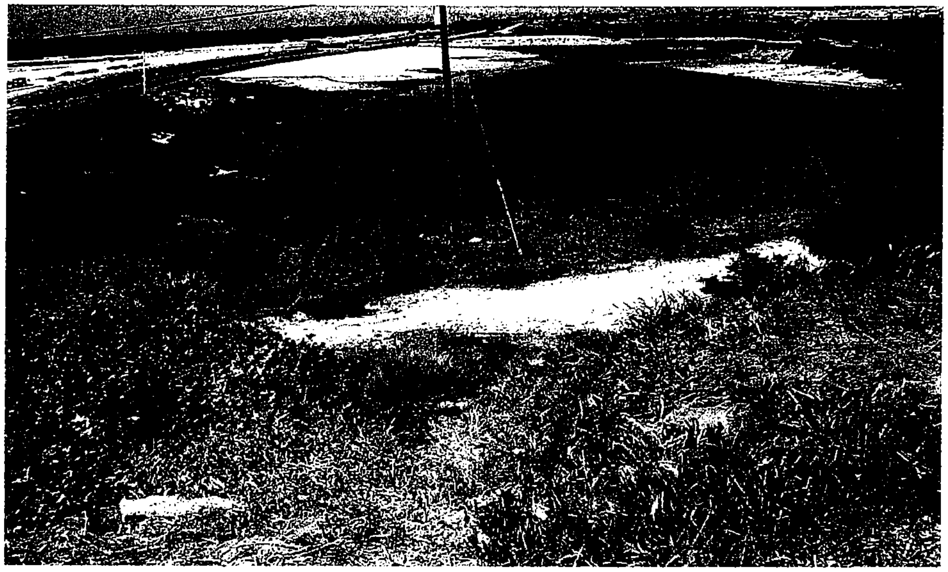


Highway 101 showing two lanes of traffic each direction, median, and parking on west side of street

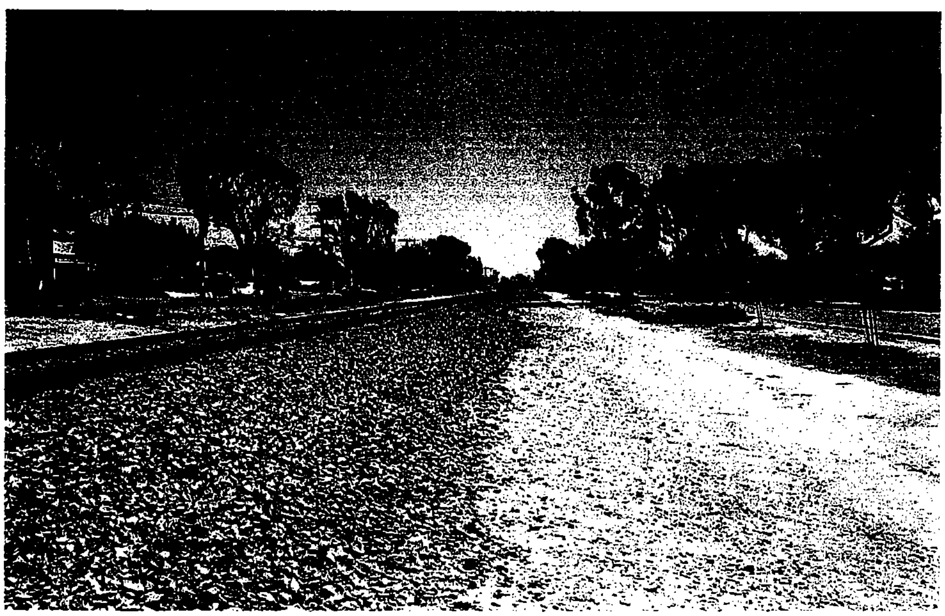


Highway 101 showing two lanes of traffic each direction, center median, and railroad ballast to the east north or Leucadia Boulevard

Vacant lot adjacent to La Costa Avenue between Highway 101 and railroad tracks



View from vacant lot adjacent to La Costa Avenue looking down to Batiquitos Lagoon



View of railroad tracks adjacent to Highway 101

View of laydown area for along Highway 101 for current storm drain and sewer installation project

HALEY & ALDRICH COST ESTIMATE – AUGUST 13, 2004
"SUPPLEMENTAL GEOTECHNICAL FEASIBILITY STUDY"

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13 August 2004
File No. 30769-001

Mr. Dennis Bowling
Rick Engineering Company
5620 Friars Road
San Diego, California 92110-2596

Subject: Supplemental Geotechnical Feasibility Study
Trenchless Construction Methods
Encinitas Storm Drain Project
Encinitas, California

Dear Dennis:

Haley & Aldrich, Inc. (Haley & Aldrich) is pleased to provide this letter report presenting the results of our supplemental geotechnical feasibility study relative trenchless pipeline construction techniques for the subject project. We have previously prepared a report for the project entitled "Geotechnical Feasibility Study, Trenchless Construction Methods, Encinitas Storm Drain Project, Encinitas, California," dated 8 June 2004. This letter report is an addendum to that report and presents additional recommendations and cost estimates for alternative pipeline sizes and construction scenarios. Our supplemental geotechnical engineering services were performed in accordance with our proposal dated 20 July 2004 and our Consultant and Subconsultant Agreement dated 5 April 2004.

PROJECT DESCRIPTION

As indicated in our 8 June 2004 report, we understand that flooding occurs in the area of Highway 101 after storm events. The City of Encinitas (City) would like to alleviate this flooding by upgrading the existing storm drain system in the area. We further understand that three different storm drain reaches are being considered to upgrade the current storm drain system. These reaches include the Leucadia Boulevard to Beacon's Beach storm drain, the Highway 101 storm drain, and the various railroad crossings.

We understand that the Highway 101 reach will extend from just south of the intersection of Marcheta and Highway 101 and drain north to empty into Batiquitos Lagoon with the pipeline alignment traversing under the Highway 101 right-of-way. This proposed storm drain will drain the storm waters of most of the catchment area along Highway 101. The alignment is approximately 9,000 feet long. This storm drain will be in addition to the existing 24-inch storm drain, which will remain in service. Storm drain manhole locations for the Highway 101 reach have been assumed to be needed at storm drain laterals. These laterals are anticipated approximately every 1000 feet.

SCOPE OF WORK

For the proposed storm drain along Highway 101, we have been requested by the City of Encinitas and Rick Engineering to evaluate the estimated costs to construct (by trenchless methods) a storm drain pipeline sized to pass 10-year storm flows as opposed to the 100-year storm flow pipeline sizes considered in our 8 June 2004 report. We understand that the pipeline diameter required for the 10-year storm flows are about half the diameter of those required for the 100-year storm flows. Feasible trenchless construction methods for these smaller pipeline diameters have been evaluated as part of this additional study.

We have also been requested to evaluate the feasibility and estimated construction costs for constructing the full size (100-year storm flow) pipeline along Encinitas Boulevard in three separate construction periods. We understand that the City of Encinitas is interested in the cost to break up the total construction into three parts to spread the costs out over several years. The results of our supplemental feasibility study and cost estimates are presented hereinafter.

SITE AND SUBSURFACE CONDITIONS

Site Conditions

The Highway 101 reach starts just south of the intersection of Marcheta and Highway 101 and extends along the Highway 101 right-of-way, north to La Costa Avenue. This alignment then moves east of Highway 101 to Batiquitos Lagoon below. Highway 101 is a four-lane asphalt paved highway with two lanes of traffic in each direction. There is parking along the west side of the highway and a tree lined median between the north and south bound lanes. Commercial buildings border the west side of Highway 101 and railroad tracks and the accompanying right-of-way border the highway on the east. Highway 101 gently slopes from an elevation of approximately +75 feet, Mean Sea Level (MSL) at El Portal to approximately +55 feet, MSL at Andrew Avenue. The highway rises to +60 feet, MSL at La Costa Avenue before descending towards Batiquitos Lagoon. We understand that the proposed storm drain would be located approximately 15 to 30 feet below the ground surface along the highway and empty into Batiquitos Lagoon.

Geologic Conditions

As described in our 8 June 2004 report; we anticipate that the Highway 101 alignment underlain by several marine deposits including Pleistocene sand terrace deposits, the Ardath Formation and the underlying Torrey Sandstone. Fill soils derived from these parent formational soils may be encountered along the proposed pipeline alignment near the ground surface.

Groundwater conditions within the pipeline alignment are uncertain based on the available geologic reports. Seepage was observed in the borings performed in 2001 for the existing storm drain at depths below Highway 101 of about 12 feet but is likely due to perched water.

10-YEAR STORM EVENT

Our 8 June 2004 report provides a feasibility study for trenchless methods and estimated construction costs for a pipeline with diameters suitable for passing the 100-year storm event. The pipeline diameters for a 10-year storm event are smaller and would present different constraints on trenchless construction. Based on the information provided by Rick Engineering, the design diameter to pass the 100-year storm event has been estimated at about 36 inches at the south end, stepping up incrementally in size to about 9 feet at the north end of the proposed alignment. Alternatively, the design diameter to pass the 10-year storm event has been estimated at about 30 inches at the south end, stepping up incrementally in size to about 6 feet at the north end.

For background, evaluations for the 100-year storm event design, included two different tunnel diameters for different pipeline reaches (e.g. part of the alignment was assumed to be a 12-foot diameter tunnel to accommodate the larger diameter pipe and part of the alignment was assumed to be an approximately 7-foot diameter tunnel). This scenario of using two different tunnel diameters and potential trenchless methods is impractical for the smaller required diameter of the 10-year storm pipeline design and was not considered. The trenchless methods considered feasible for the 10-year storm event are non-pressurized face tunnel boring machines, shield tunneling, conventional tunneling, and jack & bore. These methods are described below as in our 8 June 2004 report for convenience.

Trenchless Alternatives

A. Tunnel Boring Machine

For this study we define a tunnel boring machine as consisting of a rotating cutterhead and a tunnel shield. The cutterhead excavates the ground at the tunnel heading and is attached to a full circular shield to support the ground during excavation and installation of the initial or final support system. The excavated ground is taken into the machine though openings located within the cutterhead and is conveyed through the machine. The tunnel spoils are subsequently removed from the tunnel using additional conveyor systems and/or a locomotive with muck cars. A TBM would generally be applicable to the longer tunnel segments in ground with good to limited stand-up time.

The initial support system for this method would most likely consist of steel ribs and lagging or lattice support and shotcrete. These liner systems would be installed in the tail of the shield and expanded to support the tunnel. After completion of the tunnel and the initial liner system the carrier pipe would be installed and the annular space would be grouted.

B. Shield Tunneling

A digger shield consists of a full circular shield. The shield also supports the ground in the rear of the machine during installation of the initial or final tunnel support system. Shield tunneling requires the use of a tunneling shield, which provides immediate support of the ground prior to installation of the initial support system. The shield is required to have steering jacks to maintain line and grade. The shield may have breasting capabilities to support the face when unstable ground conditions are encountered. Full breasting is usually required during shutdown periods such as weekends, off shifts, and mechanical breakdowns. Dewatering is required when tunneling below natural groundwater. An open faced digger shield is well suited to all the anticipated ground conditions. The open face configuration allows access for removal of cobbles and boulders, if encountered. To allow for man-entry, tunnel shields are usually a minimum of 42-in. diameter.

The initial tunnel support system (typically steel ribs and lagging or liner plate) is erected from within the tail of the tunneling shield and jacking of the tunnel shield from the installed tunnel support is used to advance the shield. The excavation proceeds using hand mining or mechanical excavation methods, such as electric digger arms, breakers, or roadheaders, from within the shield. Muck is transported from the face of the tunnel to the access pit using train type muck cars or conveyor systems. The carrier pipe is placed within the excavated tunnel and the annular space between the carrier pipe and the initial tunnel support system is filled with cement grout.

C. Conventional Tunneling

Two types of conventional tunneling were considered. A conventional modified horseshoe tunnel is a method by which the tunnel is excavated a few feet at a time horizontally along the alignment and is supported by the ground's own strength until support structures can be added. The tunnel progresses incrementally with a series of tunnel excavation followed by tunnel support erection. The tunnel support generally consists of beam and column bracing or wire mesh and shotcrete. After the initial support is complete and the tunnel excavation finished, the carrier pipe is installed and the annular space between the carrier pipe and the tunnel support is grouted.

Alternatively, for larger diameter tunnel excavations, the Sequential Excavation Method, also known as the New Austrian Tunneling Method (NATM) may be used. The sequential excavation method is a method of creating underground space, which utilizes the self-supporting capacity of the rock or soil. The tunnel is generally excavated sequentially, beginning with a starter tunnel, and progressively widened with side drifts and/or bottom headings until the required underground space is achieved. Rock bolts, lattice girders, wire mesh and shotcrete are typically used for ground support and reinforcement. When the initial support of the NATM tunnel is finished, drainage, waterproofing, and a final structural liner are added to complete the tunnel.

Although technically feasible, an NATM tunnel would likely not be practicable for the smaller size of the 10-year storm pipeline diameters.

D. Jack & Bore

Jack and Bore is a trenchless method in which pipe casing is directly advanced through the ground with thrust provided by hydraulic jacks from a jacking pit and excavation being performed from within a steerable jacking shield at the leading edge of the pipe being jacked. Soil and rock may be excavated using augers within the casing, which transport the muck through the pipe back to the jacking pit for removal, or alternatively, excavation can be conducted manually by hand-held tools or mechanically with wheel-type or hydraulic excavators at the face. Open face shields are those without a system for pressure regulation at the face in order to prevent uncontrolled ground and groundwater inflow into the face, and wherein the excavation face is readily accessible by the workers. Open face shields are typically used in soil types with good stand-up time, or in soils that have been dewatered or otherwise prestabilized by ground improvement methods such as grouting. For open face shields used on jack and bore projects, removal of excavated soil is typically done using small carts winched between the jacking shaft and the face. The process requires personnel entry into the pipe being jacked to operate excavation equipment.

Typically, the pipe being jacked using jack and bore techniques is the product (final) pipe to be installed. However, with auger boring, where the soil is transported from the face using augers inside the pipe, and with small diameter pipes, an oversize pipe or sleeve would be jacked in-place and the storm drain pipe would be placed in the sleeve and grouted in place. Typically, jacking and boring is done with pipes 42 to 48 in. in diameter and larger.

Shaft Construction

Work shafts, as defined herein, are the vertical excavations that are required by the contractor during construction to provide access to the tunnel or trenchless method for personnel, ventilation, and equipment, as well as for removal of excavated material (spoil). The work shaft requirements presented in our 8 June 2004 report for the project are applicable for both of the new scenarios evaluated. However, additional considerations are discussed below for the phased construction option.

Conceptual Cost Estimates

Conceptual cost estimates have been prepared for trenchless construction methods and are presented in the table below. These costs include equipment mobilization, excavation and spoils disposal, casing or initial tunnel support, shaft construction, and grouting as applicable.

Proposed Trenchless Method 10-year Storm Event	Estimated Cost[1]	Estimated Construction Duration[2]
TBM only	$13 to 16 million	14 months
TBM and shield tunnel	N/A	N/A
TBM and Jack & Bore	N/A	N/A
Conventional (horseshoe or NATM)	$15 to 18 million	30 months
Digger Shield	$15 to 18 million	30 months
Jack & Bore	$13 to 16 million	25 months

Notes:

1. Estimated costs include shaft construction, tunnel excavation, soil disposal, and pipe installation.
2. Estimated construction schedule includes tunnel and shaft excavation and pipeline installation. Duration is based on 5 day work week.

The estimated costs presented do not include the cost for permitting or other utility realignment. We have assumed a 20 percent contingency in our cost estimate as indicated by the cost estimate range provided. For preliminary planning purposes, we recommend that a design cost of approximately 35 percent be added to the above costs for comparison purposes with the conventional open trench cost estimate prepared by Rick Engineering for this project.

We have included an estimated cost of $1.7 million for the cost of the final product pipe, gaskets and fittings, and the 11 cleanout structures assumed in the Rick Engineering open trench cost estimate.

The cost estimate presented above is subject to change based on the number of access shaft required for final pipeline access and the final pipeline alignment, and the number of connections to laterals. Additional cost estimates will be required in subsequent stages of project planning and design.

Contaminated soils are not anticipated to be encountered along the proposed pipeline alignments. Costs associated with testing, handling, or disposal of potentially hazardous material encountered in the subsurface is not included in this project. Likewise the cost for dewatering is not included in this study.

PHASED CONSTRUCTION OF PIPELINE FOR 100 YEAR STORM EVENT

The feasibility and estimated costs for phased construction of the pipeline diameters for the 100-year storm event were evaluated for this project. The methods described above and in our 8 June 2004 report for Highway 101 were evaluated for construction performed in three separate phases. As the ultimate phased construction schedule is unknown, no consideration for time related cost escalation the economic factors with time was taken into consideration.

Conceptual Cost Estimates

For conveyance, the table below includes the estimated costs to perform the construction of the pipeline to pass a 100-year storm event as presented in our 8 June 2004 report, as well as the estimated costs to perform the construction in three separate stages. The additional costs associated with the phased construction include additional mobilization/demobilization of the equipment and personnel, overhead costs for additional mobilizations (such as additional costs for new electrical and water taps), additional access shafts required for separate mobilizations, and efficiencies of excavation with three shorter alignments rather than one long alignment. The base costs as presented in our 8 June 2004 report include equipment mobilization, excavation and spoils disposal, casing or initial tunnel support, shaft construction, and grouting as applicable.

Proposed Trenchless Method	Estimated Cost[1] – From 8 June 2004 Report	Estimated Cost[1] – Phased Construction
TBM only	$22 to 25 million	$25 to 29 million
TBM and shield tunnel	$23 to 26 million	$26 to 30 million
TBM and Jack & Bore	$20 to 24 million	$23 to 27 million
Conventional (horseshoe or NATM)	$28 to 33 million	$32 to 37 million
Digger Shield	$24 to 28 million	$27 to 32 million

Notes:

1. Estimated costs include shaft construction, tunnel excavation, soil disposal, and pipe installation.

Similar to above, the estimated costs presented do not include the cost for permitting or other utility realignment. We have assumed a 20 percent contingency in our cost estimate as indicated by the cost estimate range provided. For preliminary planning purposes, we recommend that a design cost of approximately 35 percent be added to the above costs for comparison purposes with the conventional open trench cost estimate prepared by Rick Engineering for this project. We have included an estimated cost of $4.2 million for the cost of the final product pipe, gaskets and fittings, and the 11 cleanout structures assumed in the Rick Engineering open trench cost estimate. Contaminated soils are not anticipated to be encountered along the proposed pipeline alignments.

CONCLUSIONS AND RECOMMENDATIONS

For the proposed project alignments and the geologic and topographic conditions present at the site, it is our opinion that the methods discussed above are all technically feasible options to install a new pipeline by trenchless technology. However, each method has its own limitations. Additional geotechnical investigations and the cost of construction materials may alter the feasibility factors for the recommended methods presented below.

10-Year Storm Event

The methods evaluated and presented above for the 10-year storm event pipeline diameters are all considered feasible. Using two different methods and two different diameters along the alignment, as evaluated for the 100-year storm event were not considered practical. The cost estimates suggest that both the jack & bore and the TBM methods would be the most cost efficient. However, the jack & bore method would cause much more disruption to the traffic and business as additional access shafts would be required at approximately 500 foot intervals.

The diameters and number of transitions selected are preliminary and included for planning purposes only. Additional analyses would be required to evaluate the number of transitions and diameters to be used in design.

Phased Construction of Pipeline for 100 Year Storm Event

As indicated in the table above presenting our estimated costs for the phased construction, as compared with construction performed during one mobilization to the site, the phased construction is significantly more expensive. However, inflation, depreciation of equipment and financing costs were outside of the scope of work for this project and were not considered. These factors may make the phased construction more cost effective or feasible over time.

SUMMARY OF COST ESTIMATE

We have summarized the estimated costs for the various scenarios in the table below for convenience. We have also included in the estimated costs below the 35 percent design costs as assumed above. A 20 percent contingency is still evident in the range of estimated costs presented. Included are the table are the 100-year storm costs from our 8 June 2004 report, the 100-year storm pipeline costs for construction in three phases, and the 10-year storm pipeline costs.

Proposed Trenchless Method	Estimated Cost 100-year Storm	Estimated Cost 100-year Storm – Phased Construction	Estimated Cost 10-year Storm
TBM only	$30 to 34 million	$34 to 39 million	$18 to 22 million
TBM and shield tunnel	$31 to 35 million	$35 to 40 million	N/A
TBM and Jack & Bore	$27 to 32 million	$31 to 36 million	N/A
Conventional (horseshoe or NATM)	$38 to 45 million	$43 to 50 million	$20 to 24 million
Digger Shield	$32 to 38 million	$36 to 43 million	$20 to 24 million
Jack & Bore	N/A	N/A	$18 to 22 million

LIMITATIONS

This report is subject to the same limitations presented in our 8 June 2004 report for the project.

Sincerely,

HALEY & ALDRICH, INC.

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