DRAINAGE REPORT

FOR

PLUMAS QUAIL PARK

Reno, Washoe County, Nevada

Prepared for:

THE RIBEIRO CORPORATION

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November 7, 1998

Job No. 4376

DRAINAGE REPORT FOR PLUMAS QUAIL PARK

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INTRODUCTION

Plumas Quail Park, a professional office complex, is located on the northwest corner of the intersection of Plumas Street and Plumb Lane in the City of Reno. The site consists of Assessor's Parcel Numbers 014-203-18 and 014-203-19 located in the west ½ of the southwest ¼ of Section 14, Township 19 North, Range 19 East.

The site is currently used as a storage and maintenance yard for a local contractor who also maintains a residence on the southeast corner of the property. The site has a major drainage course that bisects it from the southwest corner of the property to the northeast side.

The project site encompasses approximately 4.04 acres for which a special use permit has been granted to construct a 38,250 square foot professional office complex consisting of four buildings and associated parking, landscaping and drainage facilities. Access to the site will be from Plumb Lane and Plumas Street. Storm runoff from the site and the area tributary to the site will be conveyed through the site via a combination of reinforced concrete box culverts and an open drainage channel. The site lies partially in FEMA Flood Zone A, with no base flood elevation designated, and partially in FEMA Flood Zone X.

Previous related reports pertaining to this site include:

1. *"Belford Road and Sharon Way Deficiency Analysis"*, dated August, 1985, Winzler and Kelly.
2. *"Belford Road Improvement Hydrological Analysis"*, by Glen Daley, City of Reno.
3. *"Preliminary Hydrologic Analysis for Plumas Quail Office Park"*, dated January, 1997, Mountain West Consulting.

HISTORIC DRAINAGE SYSTEM

The Plumas site is part of the downstream corridor for the Rosewood Wash basins described in the Winzler and Kelly (W&K) report. The analysis performed by Glen Daley recalculated some of the basins contained in the W&K analysis and resulted in more conservative values for the amount of runoff in those basins. The W&K report and the Daley analysis calculated flows to the intersection of Belford Road and Sharon Way. This report uses the Daley flow of 737 cfs as part of the analysis since they appear to be the more conservative (i.e. higher) of the two. The additional contributory area between this intersection and the project site was analyzed for the 100 year storm event using the HEC-1 computer simulation in Appendix 1 and the results of that analysis were added to the flows determined in the previous studies. As shown in Table 1 below, the estimated 100 year peak flow tributary to the site is 843 cfs.

Table 1

Elapsed Time, Hrs.	12.3	12.4	12.5	12.6	12.7
CFS per Daley	550	687	737	711	641
Additional Basin CFS	151	132	106	85	62
Total CFS	701	819	843	796	703

The drainage system that enters the site from upstream consists of a 48 inch diameter concrete pipe and a 54 inch diameter concrete pipe. These culverts have a combined estimated capacity of 308 cfs flowing full. It has been reported that, during the 1996 flood, these culverts were unable to convey the storm runoff. Water reportedly backed up at the entrance to these culverts, flowed across Plumb Lane and inundated the area at the east end of Games Drive with between 2-4 feet of water. An additional problem that has been discovered at the east end of Games Drive is that the catch basins are directly connected to the sanitary sewer manhole at that location. This problem needs to be rectified by disconnecting these catch basins from the sanitary sewer and tying them into the storm drain system.

The existing 3 foot by 10 foot box culvert under Plumas Street that serves as the downstream drainage outlet for the site has an estimated capacity of 400 cfs before water flows over the north bank of the open channel and north along Plumas Street to Arroyo, where it turns to the east.

PROPOSED DRAINAGE SYSTEM

I. Conveyance of Offsite Flows

The historic drainage pattern of the watershed will not be changed by the development of this site and some of the existing problems that have been experienced in the immediate area should actually be improved with the proposed improvements. Although the upstream culverts will not be replaced as part of the project, the on-site improvements will alleviate some of the flooding conditions that have persisted, especially at the east end of Games Drive.

The major on-site drainage facilities are designed to pass the 100 year peak runoff of 843 cfs. At the southwest corner of the site, the existing culverts will be replaced with a 5 ft. by 12 ft. reinforced concrete box culvert (RCB). A transition section will be required from the two culverts to the RCB. The RCB will extend into the site approximately 275 feet and turn to the east where it will enter an open channel. The channel will be lined with a combination of grass and riprap surface. A HEC-2 analysis has been performed to determine the water surface elevations for various flow rates up to, and including, the 100 year event. The results of this analysis are shown in Appendix 2. At the east end of the site, a tapered transition section will be constructed to tie into the existing 3 ft. by 10 ft. RCB that runs under Plumas Street. This culvert was analyzed using the FHWA HY-8 Culvert Analysis Program as shown in Appendix 3 and was considered in the HEC-2 analysis.

Although the proposed major on-site system can convey the 100 year event flow, the existing conduits into and out of the site cannot. Consequently, at the 100 year flow rate, there will be weir flow over the headwall at the extension to the existing 3 ft x 10 ft RCB. The tapered inlet will increase the capacity of the RCB from approximately 400 cfs under the existing condition to 516 cfs. The remaining 327 cfs will be weir flow. This water will spill onto Plumas Street and flow north along Plumas to Arroyo, as it currently does when the capacity of the 3 ft x 10 ft RCB is exceeded. Building finished floor elevations are set a minimum of 1.0 feet above the 100 year water surface elevations.

The site grading being proposed will minimize the sump condition that currently exists at the east end of Games Drive. This will allow flood water that crosses Plumb Lane and accumulates at the east end of Games Drive to exit through either the catch basins which will be connected to the drainage channel or, if runoff exceeds the catch basin capacity, allow excess storm runoff to exit through the site along the north drive to Plumas Street. It is estimated that a maximum depth that water will accumulate at the east end of Games Drive will be 1 foot, which is over 1.0 feet below the finished floor elevations of the adjacent houses.

2. On-Site Local Drainage Facilities

On-site drainage facilities are sized to convey the 5 year storm event. Water will be conveyed via gutters and valley gutters to catch basins and storm drains that outfall into the major drainage facilities that convey storm flows through the site. No detention of local drainage is proposed for the site. On-site drainage calculations are contained in Appendix 4.

CONCLUSIONS

The proposed major on-site improvements are designed to convey the 100 year storm event through the site; however, as the analyses show, these improvements will not fully alleviate all of the flooding conditions that presently occur. Several off-site improvements by the City of Reno will be required in order to fully resolve these issues. The two concrete culverts upstream of the site have a capacity of about 308 cfs and need to be replaced with adequately sized conduits to convey the 843 cfs 100 year flow. Additionally, the 3'x10' RCB under Plumas Street needs to be replaced with a conduit adequate to carry the 100 year storm flow.

The channel immediately downstream of the RCB under Plumas appears to be sized adequately to handle the 100 year storm flow; however, additional hydraulic analysis will be needed further downstream to determine if other channel constraints are present. That analysis is beyond the scope of this report.

This development will not completely eliminate the flooding conditions that have historically troubled this area; however, the proposed improvements will significantly lessen those impacts.

APPENDIX 1

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

WASHOE COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 2993 OF 3350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
RENO, CITY OF	320020	2993	E

MAP NUMBER
32031C2993 E

EFFECTIVE DATE:
SEPTEMBER 30, 1994

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

WASHOE COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 2989 OF 3350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
RENO, CITY OF	320020	2989	E

MAP NUMBER
32031C2989 E

EFFECTIVE DATE:
SEPTEMBER 30, 1994

Federal Emergency Management Agency


ZONE X
ZONE A
PROJECT SITE
LIMIT OF STUDY
14
23
TWAIN AVENUE
MARK AVENUE
NIXON
LINWOOD PLACE
GORDON AVENUE
MOUNT ROSE STREET
WEST ARROYO STREET
WEST PUEBLO STREET
WRIGHT AVENUE
LANDER STREET
HUMBOLDT STREET
PLUMAS STREET
FOREST
LITCH COURT
CALIENTE STREET
ARROYO STREET
PUEBLO STREET
ROSE STREET
ARDMORE DRIVE
KOEHLEPP AVENUE
KOEHLEPP AVE
MODOC AVENUE
PATRICK
ARLINGTON
ARLINGTON COURT
DARTMOUTH
DARTMOUTH DRIVE
SOUTH SHANGRI-LA DRIVE
TOIYABE
GAMES
KNOLL DRIVE
KNOX AVENUE
WATT STREET
OAKHURST AVENUE
TULANE STREET
GLENMANOR
PLUMB LANE
PLUMB
HILLCREST DRIVE
SUNSET DRIVE
BONNIE BRIAR
UPSON LANE
THELMA PLACE
HOYT STREET
PHILLIPS STREET
LAMPSON LANE
ALLEY OOP
CHEVY CHASE DRIVE
TAMARACK DRIVE
ROSEWOOD DRIVE
QUAIL CROSSING
MORNINGSIDE DRIVE
WILDROSE
URBAN ROAD
HOMESTEAD PLACE
SHAMPINE WAY
SKYLINE BLVD
FOLEY WAY
SUNRISE DRIVE
WATT STREET
LINDLEY WAY
LAKESIDE
COUNTRY CLUB DRIVE
119°43'45"

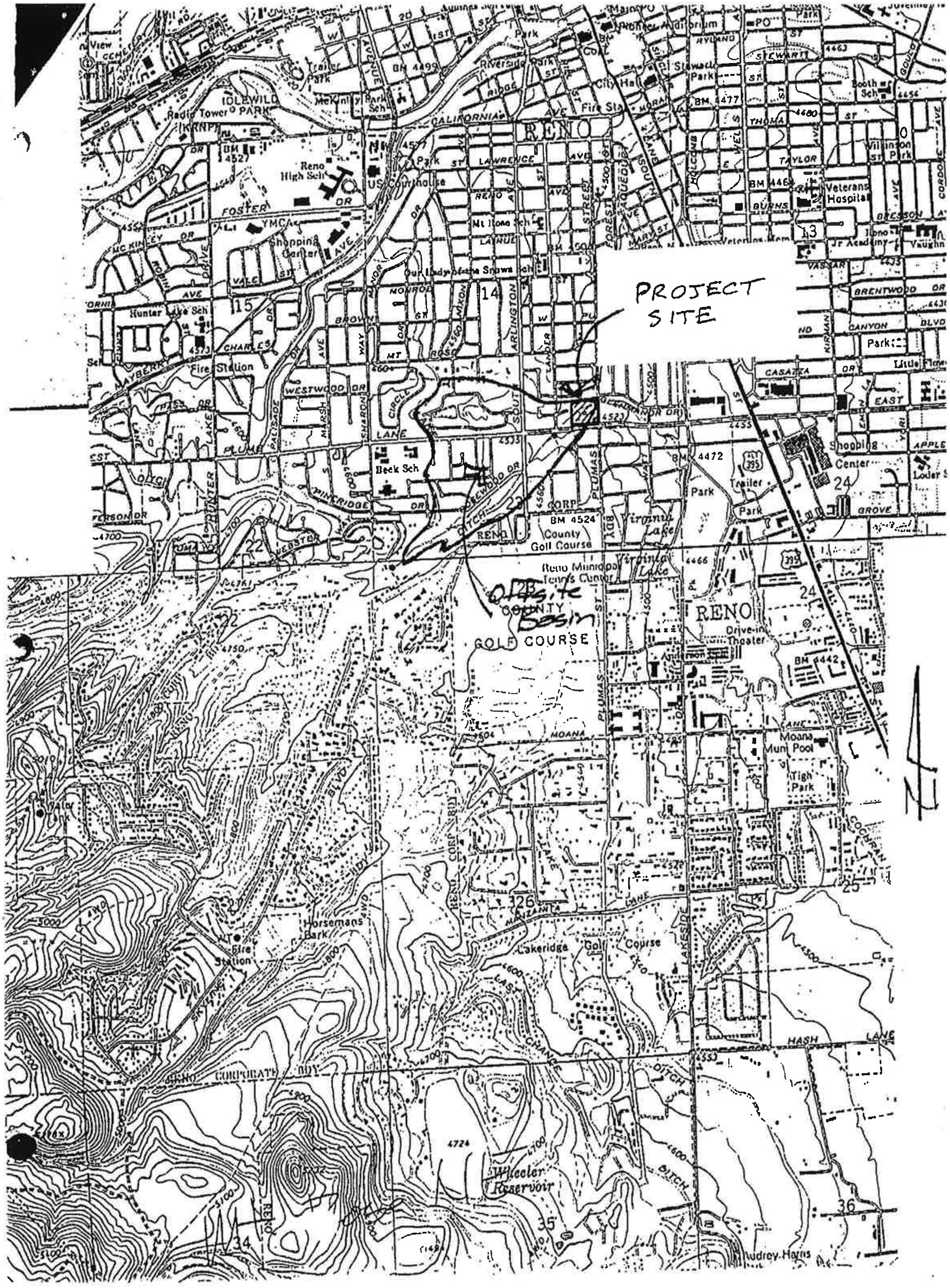

PROJECT SITE
Offsite Basin
RENO
Reno High Sch
US Courthouse
YMCA
Shopping Center
Hunter Lake Sch
Fire Station
Beck Sch
County Golf Course
Reno Municipal Tennis Center
Virginia Lake
COUNTY GOLF COURSE
Drive-in Theater
Moana Muni Pool
Tigh Park
Veterans Hospital
City Hall
Horsemans Park
Lakeridge Golf Course
RENO CORPORATE BDY
Wheeler Reservoir

Table 2-2a.—Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

LUMOS & ASSOCIATES, INC.
Civil Engineers • Surveyors • Material Testing

HYDROLOGY COMPUTATIONS

Sheet _____ of _____

LOCATION PLUMAS QUAIL SITE Zone _____

Subd. _____ Average Annual Rainfall _____ By CLM Date 9-1-98

Line _____ Recurrence interval _____ Cross Reference _____

Drainage Area		Areas and Classification Land Use Zoning	Σ Ac	tc min	I in/hr	Q cfs	Size	Point
	A							
	C							
	AC							
	A							
	C							
	AC							
	A							
	C							
	AC							
	A							
	C							
	AC							
	A							
	C							
	AC							
	A							
	C							
	AC							
	A							
	C							
	AC							
	A							
	C							
	AC							

TIME OF CONCENTRATION

Drainage Area	Overland Flow ft.	vel.	min.	Channel Flow ft.	vel.	min.	Roof to Gutter zoned	min.	Gutter Flow ft.	vel.	min.	Pipe Flow ft.	vel.	min.	tc
126 Ac								10	600	3.5	2.9	4000	6	11.1	24

Velocity in feet per second

FLOOD HYDROGRAPH PACKAGE (HEC-1)
MAY 1991
VERSION 4.0.1E

RUN DATE 09/03/1998 TIME 08:22:50

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

PLUMAS QUAIL SITE
UPSTREAM AREA ADDITIONAL TO W&K REPORT
BY: LUMOS AND ASSOCIATES J.N. 4376
100 YEAR 24 HOUR EVENT (EXISTING CONDITION)

6 IO OUTPUT CONTROL VARIABLES
IPRNT 2 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
NMIN 5 MINUTES IN COMPUTATION INTERVAL
IDATE 1 0 STARTING DATE
ITIME 0000 STARTING TIME
NQ 300 NUMBER OF HYDROGRAPH ORDINATES
NDDATE 2 0 ENDING DATE
NDTIME 0055 ENDING TIME
ICENT 19 CENTURY MARK

COMPUTATION INTERVAL 0.08 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

8 KK * SUB1 *

SUBBASIN RUNOFF DATA

9 BA SUBBASIN CHARACTERISTICS
TAREA 0.20 SUBBASIN AREA

PRECIPITATION DATA

10 PH DEPTHS FOR 0-PERCENT HYPOTHETICAL STORM

..... HYDRO-35			..... TP-40					..... TP-49			
5-MIN	15-MIN	60-MIN	2-HR	3-HR	6-HR	12-HR	24-HR	2-DAY	4-DAY	7-DAY	10-DAY
0.30	0.60	1.10	1.30	1.50	1.90	2.40	2.90	0.00	0.00	0.00	0.00

STORM AREA = 0.20

11 LS SCS LOSS RATE
STRTL 0.30 INITIAL ABSTRACTION
CRVNBR 87.00 CURVE NUMBER
RTIMP 0.00 PERCENT IMPERVIOUS AREA

12 UD SCS DIMENSIONLESS UNITGRAPH
TLAG 0.24 LAG

UNIT HYDROGRAPH
16 END-OF-PERIOD ORDINATES

63. 217. 332. 317. 236. 137. 86. 53. 33. 20.
12. 8. 5. 3. 2. 1.

HYDROGRAPH AT STATION SUB1

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1	0000	1	0.00	0.00	0.00	0.	1	1	1230	151	0.04	0.01	0.03	106.	
1	0005	2	0.00	0.00	0.00	0.	1	1	1235	152	0.02	0.00	0.02	85.	
1	0010	3	0.00	0.00	0.00	0.	1	1	1240	153	0.02	0.00	0.02	67.	
1	0015	4	0.00	0.00	0.00	0.	1	1	1245	154	0.02	0.00	0.01	53.	
1	0020	5	0.00	0.00	0.00	0.	1	1	1250	155	0.02	0.00	0.01	41.	
1	0025	6	0.00	0.00	0.00	0.	1	1	1255	156	0.01	0.00	0.01	33.	
1	0030	7	0.00	0.00	0.00	0.	1	1	1300	157	0.01	0.00	0.01	28.	
1	0035	8	0.00	0.00	0.00	0.	1	1	1305	158	0.02	0.00	0.01	24.	
1	0040	9	0.00	0.00	0.00	0.	1	1	1310	159	0.02	0.00	0.01	22.	
1	0045	10	0.00	0.00	0.00	0.	1	1	1315	160	0.02	0.00	0.01	22.	
1	0050	11	0.00	0.00	0.00	0.	1	1	1320	161	0.02	0.00	0.01	21.	
1	0055	12	0.00	0.00	0.00	0.	1	1	1325	162	0.02	0.00	0.01	21.	
1	0100	13	0.00	0.00	0.00	0.	1	1	1330	163	0.02	0.00	0.01	21.	
1	0105	14	0.00	0.00	0.00	0.	1	1	1335	164	0.01	0.00	0.01	20.	
1	0110	15	0.00	0.00	0.00	0.	1	1	1340	165	0.01	0.00	0.01	19.	
1	0115	16	0.00	0.00	0.00	0.	1	1	1345	166	0.01	0.00	0.01	19.	
1	0120	17	0.00	0.00	0.00	0.	1	1	1350	167	0.01	0.00	0.01	18.	
1	0125	18	0.00	0.00	0.00	0.	1	1	1355	168	0.01	0.00	0.01	17.	
1	0130	19	0.00	0.00	0.00	0.	1	1	1400	169	0.01	0.00	0.01	17.	
1	0135	20	0.00	0.00	0.00	0.	1	1	1405	170	0.01	0.00	0.01	16.	
1	0140	21	0.00	0.00	0.00	0.	1	1	1410	171	0.01	0.00	0.01	16.	
1	0145	22	0.00	0.00	0.00	0.	1	1	1415	172	0.01	0.00	0.01	15.	
1	0150	23	0.00	0.00	0.00	0.	1	1	1420	173	0.01	0.00	0.01	15.	

1	0155	24	0.00	0.00	0.00	0.	*	1	1425	174	0.01	0.00	0.01	14.
1	0200	25	0.00	0.00	0.00	0.	*	1	1430	175	0.01	0.00	0.01	14.
1	0205	26	0.00	0.00	0.00	0.	*	1	1435	176	0.01	0.00	0.01	14.
1	0210	27	0.00	0.00	0.00	0.	*	1	1440	177	0.01	0.00	0.01	13.
1	0215	28	0.00	0.00	0.00	0.	*	1	1445	178	0.01	0.00	0.01	13.
1	0220	29	0.00	0.00	0.00	0.	*	1	1450	179	0.01	0.00	0.01	13.
1	0225	30	0.00	0.00	0.00	0.	*	1	1455	180	0.01	0.00	0.01	13.
1	0230	31	0.00	0.00	0.00	0.	*	1	1500	181	0.01	0.00	0.01	12.
1	0235	32	0.00	0.00	0.00	0.	*	1	1505	182	0.01	0.00	0.01	12.
1	0240	33	0.00	0.00	0.00	0.	*	1	1510	183	0.01	0.00	0.01	12.
1	0245	34	0.00	0.00	0.00	0.	*	1	1515	184	0.01	0.00	0.01	12.
1	0250	35	0.00	0.00	0.00	0.	*	1	1520	185	0.01	0.00	0.01	11.
1	0255	36	0.00	0.00	0.00	0.	*	1	1525	186	0.01	0.00	0.01	11.
1	0300	37	0.00	0.00	0.00	0.	*	1	1530	187	0.01	0.00	0.01	11.
1	0305	38	0.00	0.00	0.00	0.	*	1	1535	188	0.01	0.00	0.01	11.
1	0310	39	0.00	0.00	0.00	0.	*	1	1540	189	0.01	0.00	0.01	11.
1	0315	40	0.00	0.00	0.00	0.	*	1	1545	190	0.01	0.00	0.01	10.
1	0320	41	0.00	0.00	0.00	0.	*	1	1550	191	0.01	0.00	0.01	10.
1	0325	42	0.00	0.00	0.00	0.	*	1	1555	192	0.01	0.00	0.01	10.
1	0330	43	0.00	0.00	0.00	0.	*	1	1600	193	0.01	0.00	0.01	10.
1	0335	44	0.00	0.00	0.00	0.	*	1	1605	194	0.01	0.00	0.01	10.
1	0340	45	0.00	0.00	0.00	0.	*	1	1610	195	0.01	0.00	0.01	10.
1	0345	46	0.00	0.00	0.00	0.	*	1	1615	196	0.01	0.00	0.01	10.
1	0350	47	0.00	0.00	0.00	0.	*	1	1620	197	0.01	0.00	0.01	9.
1	0355	48	0.00	0.00	0.00	0.	*	1	1625	198	0.01	0.00	0.01	9.
1	0400	49	0.00	0.00	0.00	0.	*	1	1630	199	0.01	0.00	0.01	9.
1	0405	50	0.00	0.00	0.00	0.	*	1	1635	200	0.01	0.00	0.01	9.
1	0410	51	0.00	0.00	0.00	0.	*	1	1640	201	0.01	0.00	0.01	9.
1	0415	52	0.00	0.00	0.00	0.	*	1	1645	202	0.01	0.00	0.01	9.
1	0420	53	0.00	0.00	0.00	0.	*	1	1650	203	0.01	0.00	0.01	9.
1	0425	54	0.00	0.00	0.00	0.	*	1	1655	204	0.01	0.00	0.01	9.
1	0430	55	0.00	0.00	0.00	0.	*	1	1700	205	0.01	0.00	0.01	9.
1	0435	56	0.00	0.00	0.00	0.	*	1	1705	206	0.01	0.00	0.01	8.
1	0440	57	0.00	0.00	0.00	0.	*	1	1710	207	0.01	0.00	0.01	8.
1	0445	58	0.00	0.00	0.00	0.	*	1	1715	208	0.01	0.00	0.01	8.
1	0450	59	0.00	0.00	0.00	0.	*	1	1720	209	0.01	0.00	0.01	8.
1	0455	60	0.00	0.00	0.00	0.	*	1	1725	210	0.01	0.00	0.01	8.
1	0500	61	0.00	0.00	0.00	0.	*	1	1730	211	0.01	0.00	0.01	8.
1	0505	62	0.00	0.00	0.00	0.	*	1	1735	212	0.01	0.00	0.01	8.
1	0510	63	0.00	0.00	0.00	0.	*	1	1740	213	0.01	0.00	0.00	8.
1	0515	64	0.00	0.00	0.00	0.	*	1	1745	214	0.01	0.00	0.00	8.
1	0520	65	0.00	0.00	0.00	0.	*	1	1750	215	0.01	0.00	0.00	8.
1	0525	66	0.00	0.00	0.00	0.	*	1	1755	216	0.01	0.00	0.00	8.
1	0530	67	0.00	0.00	0.00	0.	*	1	1800	217	0.01	0.00	0.00	8.
1	0535	68	0.00	0.00	0.00	0.	*	1	1805	218	0.00	0.00	0.00	7.
1	0540	69	0.00	0.00	0.00	0.	*	1	1810	219	0.00	0.00	0.00	7.
1	0545	70	0.00	0.00	0.00	0.	*	1	1815	220	0.00	0.00	0.00	7.
1	0550	71	0.00	0.00	0.00	0.	*	1	1820	221	0.00	0.00	0.00	6.
1	0555	72	0.00	0.00	0.00	0.	*	1	1825	222	0.00	0.00	0.00	6.
1	0600	73	0.00	0.00	0.00	0.	*	1	1830	223	0.00	0.00	0.00	6.
1	0605	74	0.01	0.01	0.00	0.	*	1	1835	224	0.00	0.00	0.00	6.
1	0610	75	0.01	0.01	0.00	0.	*	1	1840	225	0.00	0.00	0.00	6.
1	0615	76	0.01	0.01	0.00	0.	*	1	1845	226	0.00	0.00	0.00	6.
1	0620	77	0.01	0.01	0.00	0.	*	1	1850	227	0.00	0.00	0.00	6.
1	0625	78	0.01	0.01	0.00	0.	*	1	1855	228	0.00	0.00	0.00	6.
1	0630	79	0.01	0.01	0.00	0.	*	1	1900	229	0.00	0.00	0.00	5.
1	0635	80	0.01	0.01	0.00	0.	*	1	1905	230	0.00	0.00	0.00	5.
1	0640	81	0.01	0.01	0.00	0.	*	1	1910	231	0.00	0.00	0.00	5.
1	0645	82	0.01	0.01	0.00	0.	*	1	1915	232	0.00	0.00	0.00	5.
1	0650	83	0.01	0.01	0.00	0.	*	1	1920	233	0.00	0.00	0.00	5.
1	0655	84	0.01	0.01	0.00	0.	*	1	1925	234	0.00	0.00	0.00	5.
1	0700	85	0.01	0.01	0.00	0.	*	1	1930	235	0.00	0.00	0.00	5.
1	0705	86	0.01	0.01	0.00	0.	*	1	1935	236	0.00	0.00	0.00	5.
1	0710	87	0.01	0.01	0.00	0.	*	1	1940	237	0.00	0.00	0.00	5.
1	0715	88	0.01	0.01	0.00	0.	*	1	1945	238	0.00	0.00	0.00	5.
1	0720	89	0.01	0.01	0.00	0.	*	1	1950	239	0.00	0.00	0.00	5.
1	0725	90	0.01	0.01	0.00	0.	*	1	1955	240	0.00	0.00	0.00	5.
1	0730	91	0.01	0.01	0.00	0.	*	1	2000	241	0.00	0.00	0.00	5.
1	0735	92	0.01	0.01	0.00	1.	*	1	2005	242	0.00	0.00	0.00	5.
1	0740	93	0.01	0.01	0.00	1.	*	1	2010	243	0.00	0.00	0.00	5.

1	0745	94	0.01	0.01	0.00	1.	*	1	2015	244	0.00	0.00	0.00	5.
1	0750	95	0.01	0.01	0.00	1.	*	1	2020	245	0.00	0.00	0.00	5.
1	0755	96	0.01	0.01	0.00	1.	*	1	2025	246	0.00	0.00	0.00	5.
1	0800	97	0.01	0.01	0.00	1.	*	1	2030	247	0.00	0.00	0.00	5.
1	0805	98	0.01	0.01	0.00	1.	*	1	2035	248	0.00	0.00	0.00	5.
1	0810	99	0.01	0.01	0.00	1.	*	1	2040	249	0.00	0.00	0.00	5.
1	0815	100	0.01	0.01	0.00	1.	*	1	2045	250	0.00	0.00	0.00	5.
1	0820	101	0.01	0.01	0.00	1.	*	1	2050	251	0.00	0.00	0.00	5.
1	0825	102	0.01	0.01	0.00	2.	*	1	2055	252	0.00	0.00	0.00	5.
1	0830	103	0.01	0.01	0.00	2.	*	1	2100	253	0.00	0.00	0.00	5.
1	0835	104	0.01	0.01	0.00	2.	*	1	2105	254	0.00	0.00	0.00	5.
1	0840	105	0.01	0.01	0.00	2.	*	1	2110	255	0.00	0.00	0.00	5.
1	0845	106	0.01	0.01	0.00	2.	*	1	2115	256	0.00	0.00	0.00	4.
1	0850	107	0.01	0.01	0.00	2.	*	1	2120	257	0.00	0.00	0.00	4.
1	0855	108	0.01	0.01	0.00	2.	*	1	2125	258	0.00	0.00	0.00	4.
1	0900	109	0.01	0.01	0.00	2.	*	1	2130	259	0.00	0.00	0.00	4.
1	0905	110	0.01	0.01	0.00	3.	*	1	2135	260	0.00	0.00	0.00	4.
1	0910	111	0.01	0.01	0.00	3.	*	1	2140	261	0.00	0.00	0.00	4.
1	0915	112	0.01	0.01	0.00	3.	*	1	2145	262	0.00	0.00	0.00	4.
1	0920	113	0.01	0.01	0.00	3.	*	1	2150	263	0.00	0.00	0.00	4.
1	0925	114	0.01	0.01	0.00	3.	*	1	2155	264	0.00	0.00	0.00	4.
1	0930	115	0.01	0.01	0.00	3.	*	1	2200	265	0.00	0.00	0.00	4.
1	0935	116	0.01	0.01	0.00	4.	*	1	2205	266	0.00	0.00	0.00	4.
1	0940	117	0.01	0.01	0.00	4.	*	1	2210	267	0.00	0.00	0.00	4.
1	0945	118	0.01	0.01	0.00	4.	*	1	2215	268	0.00	0.00	0.00	4.
1	0950	119	0.01	0.01	0.00	4.	*	1	2220	269	0.00	0.00	0.00	4.
1	0955	120	0.01	0.01	0.00	4.	*	1	2225	270	0.00	0.00	0.00	4.
1	1000	121	0.01	0.01	0.00	5.	*	1	2230	271	0.00	0.00	0.00	4.
1	1005	122	0.01	0.01	0.00	5.	*	1	2235	272	0.00	0.00	0.00	4.
1	1010	123	0.01	0.01	0.00	5.	*	1	2240	273	0.00	0.00	0.00	4.
1	1015	124	0.01	0.01	0.00	6.	*	1	2245	274	0.00	0.00	0.00	4.
1	1020	125	0.01	0.01	0.00	6.	*	1	2250	275	0.00	0.00	0.00	4.
1	1025	126	0.01	0.01	0.00	6.	*	1	2255	276	0.00	0.00	0.00	4.
1	1030	127	0.01	0.01	0.01	7.	*	1	2300	277	0.00	0.00	0.00	4.
1	1035	128	0.01	0.01	0.01	7.	*	1	2305	278	0.00	0.00	0.00	4.
1	1040	129	0.02	0.01	0.01	7.	*	1	2310	279	0.00	0.00	0.00	4.
1	1045	130	0.02	0.01	0.01	8.	*	1	2315	280	0.00	0.00	0.00	4.
1	1050	131	0.02	0.01	0.01	8.	*	1	2320	281	0.00	0.00	0.00	4.
1	1055	132	0.02	0.01	0.01	9.	*	1	2325	282	0.00	0.00	0.00	4.
1	1100	133	0.02	0.01	0.01	10.	*	1	2330	283	0.00	0.00	0.00	4.
1	1105	134	0.01	0.01	0.01	10.	*	1	2335	284	0.00	0.00	0.00	4.
1	1110	135	0.01	0.01	0.01	10.	*	1	2340	285	0.00	0.00	0.00	4.
1	1115	136	0.02	0.01	0.01	10.	*	1	2345	286	0.00	0.00	0.00	4.
1	1120	137	0.02	0.01	0.01	10.	*	1	2350	287	0.00	0.00	0.00	4.
1	1125	138	0.02	0.01	0.01	11.	*	1	2355	288	0.00	0.00	0.00	4.
1	1130	139	0.02	0.01	0.01	11.	*	2	0000	289	0.00	0.00	0.00	4.
1	1135	140	0.04	0.02	0.02	13.	*	2	0005	290	0.00	0.00	0.00	4.
1	1140	141	0.04	0.02	0.02	15.	*	2	0010	291	0.00	0.00	0.00	3.
1	1145	142	0.05	0.02	0.02	20.	*	2	0015	292	0.00	0.00	0.00	2.
1	1150	143	0.07	0.03	0.04	26.	*	2	0020	293	0.00	0.00	0.00	1.
1	1155	144	0.09	0.04	0.05	34.	*	2	0025	294	0.00	0.00	0.00	1.
1	1200	145	0.18	0.07	0.11	49.	*	2	0030	295	0.00	0.00	0.00	1.
1	1205	146	0.30	0.09	0.21	80.	*	2	0035	296	0.00	0.00	0.00	0.
1	1210	147	0.12	0.03	0.09	121.	*	2	0040	297	0.00	0.00	0.00	0.
1	1215	148	0.08	0.02	0.06	150.	*	2	0045	298	0.00	0.00	0.00	0.
1	1220	149	0.05	0.01	0.04	151.	*	2	0050	299	0.00	0.00	0.00	0.
1	1225	150	0.04	0.01	0.03	132.	*	2	0055	300	0.00	0.00	0.00	0.

TOTAL RAINFALL = 2.90, TOTAL LOSS = 1.25, TOTAL EXCESS = 1.65

PEAK FLOW TIME MAXIMUM AVERAGE FLOW

	6-HR	24-HR	72-HR	24.92-HR	(CFS)	(HR)
(CFS)	151.	12.33	27.	9.	8.	8.
(INCHES)	1.257	1.651	1.651	1.651		
(AC-FT)	13.	17.	17.	17.		

CUMULATIVE AREA = 0.20 SQ MI

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	SUB1	151.	12.33	27.	9.	8.	0.20		

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

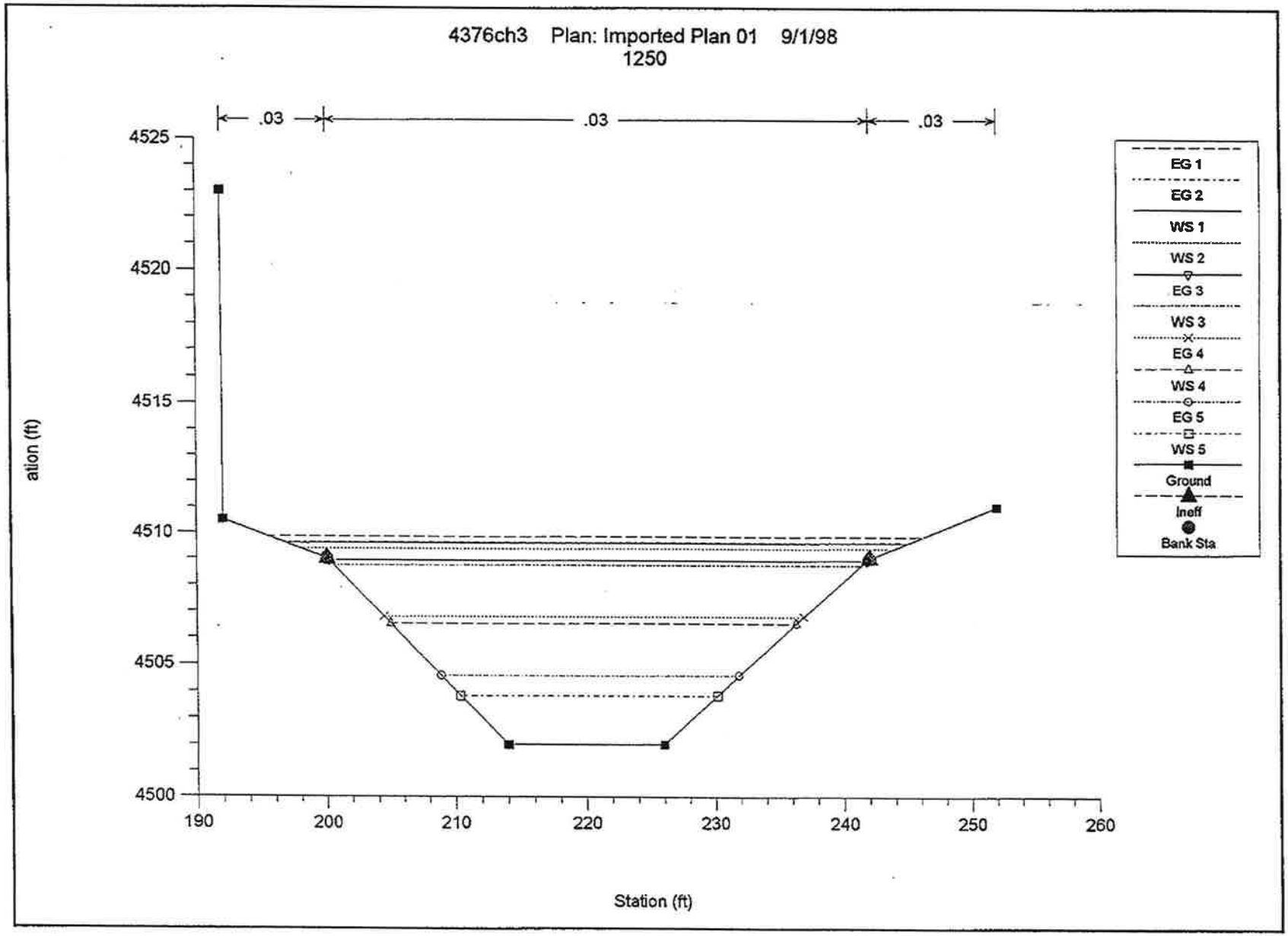
APPENDIX 2

HEC-RAS Plan: Imported Pla Reach: 1 9/1/98

River Sta.	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
1569	870.00	4503.50	4509.90	4507.98	4510.41	0.002291	5.74	151.59	37.41	0.50
1569	800.00	4503.50	4509.69	4507.78	4510.17	0.002221	5.55	144.09	36.54	0.49
1569	600.00	4503.50	4509.02	4507.18	4509.41	0.002024	4.98	120.54	33.66	0.46
1569	400.00	4503.50	4507.64	4506.46	4508.05	0.002933	5.12	78.06	27.73	0.54
1569	200.00	4503.50	4506.69	4505.49	4506.90	0.002055	3.73	53.65	23.66	0.44
1528	870.00	4503.30	4509.82	4508.12	4510.30	0.002358	5.52	157.66	42.62	0.51
1528	800.00	4503.30	4509.62	4507.97	4510.07	0.002329	5.37	148.99	41.59	0.50
1528	600.00	4503.30	4508.94	4507.41	4509.31	0.002283	4.92	121.84	38.19	0.49
1528	400.00	4503.30	4507.28	4506.79	4507.86	0.005808	6.12	65.33	29.89	0.73
1528	200.00	4503.30	4506.36	4505.97	4506.75	0.005887	4.99	40.11	25.32	0.70
1461	870.00	4503.00	4509.82	4507.54	4510.13	0.001404	4.47	194.45	49.09	0.40
1461	800.00	4503.00	4509.61	4507.38	4509.90	0.001378	4.34	184.30	48.04	0.39
1461	600.00	4503.00	4508.92	4506.89	4509.16	0.001322	3.94	152.33	44.59	0.38
1461	400.00	4503.00	4507.10	4506.32	4507.49	0.003753	5.03	79.55	35.50	0.59
1461	200.00	4503.00	4506.07	4505.61	4506.37	0.004859	4.39	45.52	30.33	0.63
1441	870.00	4502.90	4509.80	4507.43	4510.10	0.001326	4.38	198.47	49.49	0.39
1441	800.00	4502.90	4509.59	4507.28	4509.87	0.001299	4.25	188.26	48.45	0.38
1441	600.00	4502.90	4508.90	4506.79	4509.13	0.001236	3.85	156.02	45.00	0.36
1441	400.00	4502.90	4507.04	4506.23	4507.42	0.003587	4.95	80.80	35.68	0.58
1441	200.00	4502.90	4505.97	4505.51	4506.27	0.004826	4.38	45.62	30.35	0.63
1368	870.00	4502.50	4509.75	4507.03	4510.00	0.001016	4.03	216.22	53.21	0.34
1368	800.00	4502.50	4509.54	4506.88	4509.77	0.001014	3.89	205.44	50.50	0.34
1368	600.00	4502.50	4508.85	4506.39	4509.04	0.000939	3.49	172.08	46.75	0.32
1368	400.00	4502.50	4506.85	4505.84	4507.17	0.002741	4.51	88.67	36.77	0.51
1368	200.00	4502.50	4505.68	4505.12	4505.94	0.003873	4.07	49.11	30.92	0.57

HEC-RAS Plan: Imported Pla Reach: 1 9/1/98 (continued)

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)	
1323	870.00	4502.30	4509.63	4507.10	4509.94	0.001253	4.46	195.55	48.50	0.38
1323	800.00	4502.30	4509.43	4506.93	4509.72	0.001244	4.30	185.93	46.37	0.37
1323	600.00	4502.30	4508.76	4506.40	4508.99	0.001147	3.84	156.37	42.37	0.35
1323	400.00	4502.30	4506.57	4505.77	4507.01	0.003956	5.32	75.14	31.72	0.61
1323	200.00	4502.30	4505.20	4504.98	4505.67	0.008091	5.51	36.32	25.09	0.81
1298	870.00	4502.20	4509.66		4509.89	0.000861	3.83	229.02	60.16	0.32
1298	800.00	4502.20	4509.46		4509.67	0.000852	3.70	217.06	55.63	0.31
1298	600.00	4502.20	4508.78		4508.95	0.000793	3.28	182.85	47.89	0.30
1298	400.00	4502.20	4506.58		4506.89	0.002664	4.47	89.55	36.88	0.51
1298	200.00	4502.20	4504.84	4504.84	4505.41	0.012734	6.05	33.08	28.21	0.98
1263	870.00	4502.10	4509.61		4509.86	0.000888	4.03	217.49	51.72	0.32
1263	800.00	4502.10	4509.40		4509.64	0.000868	3.87	207.30	49.04	0.32
1263	600.00	4502.10	4508.74		4508.92	0.000774	3.39	177.07	43.19	0.29
1263	400.00	4502.10	4506.52		4506.80	0.001937	4.28	93.40	32.08	0.44
1263	200.00	4502.10	4504.02	4504.02	4504.76	0.012200	6.90	28.98	19.62	1.10
1250	870.00	4502.00	4509.59	4506.22	4509.85	0.000846	4.06	215.57	48.10	0.32
1250	800.00	4502.00	4509.39	4506.03	4509.63	0.000819	3.89	206.17	46.03	0.31
1250	600.00	4502.00	4508.73	4505.44	4508.91	0.000717	3.37	177.82	40.84	0.28
1250	400.00	4502.00	4506.51	4504.74	4506.77	0.001629	4.09	97.70	31.33	0.41
1250	200.00	4502.00	4503.82	4503.82	4504.56	0.012376	6.91	28.94	19.80	1.01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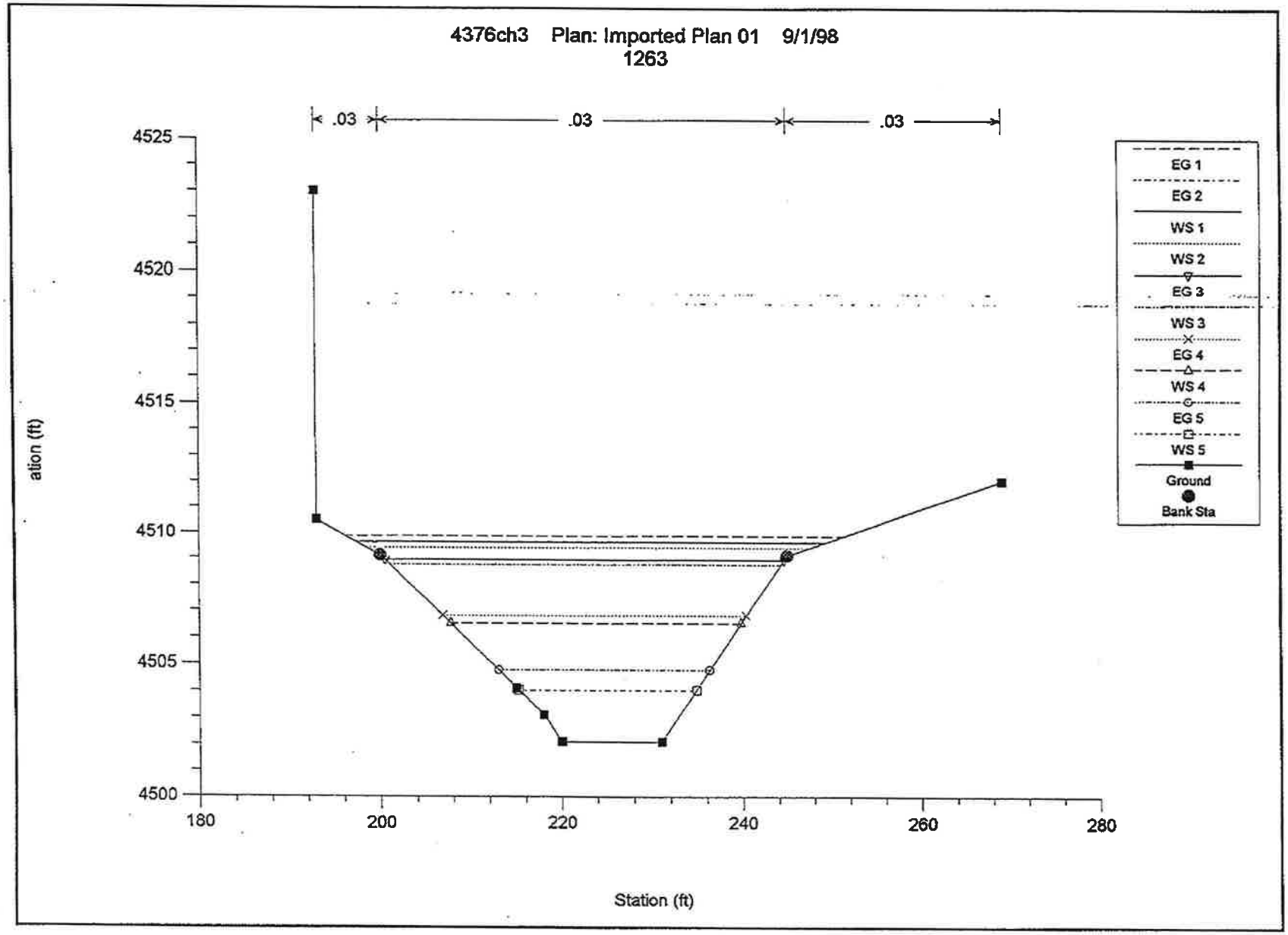
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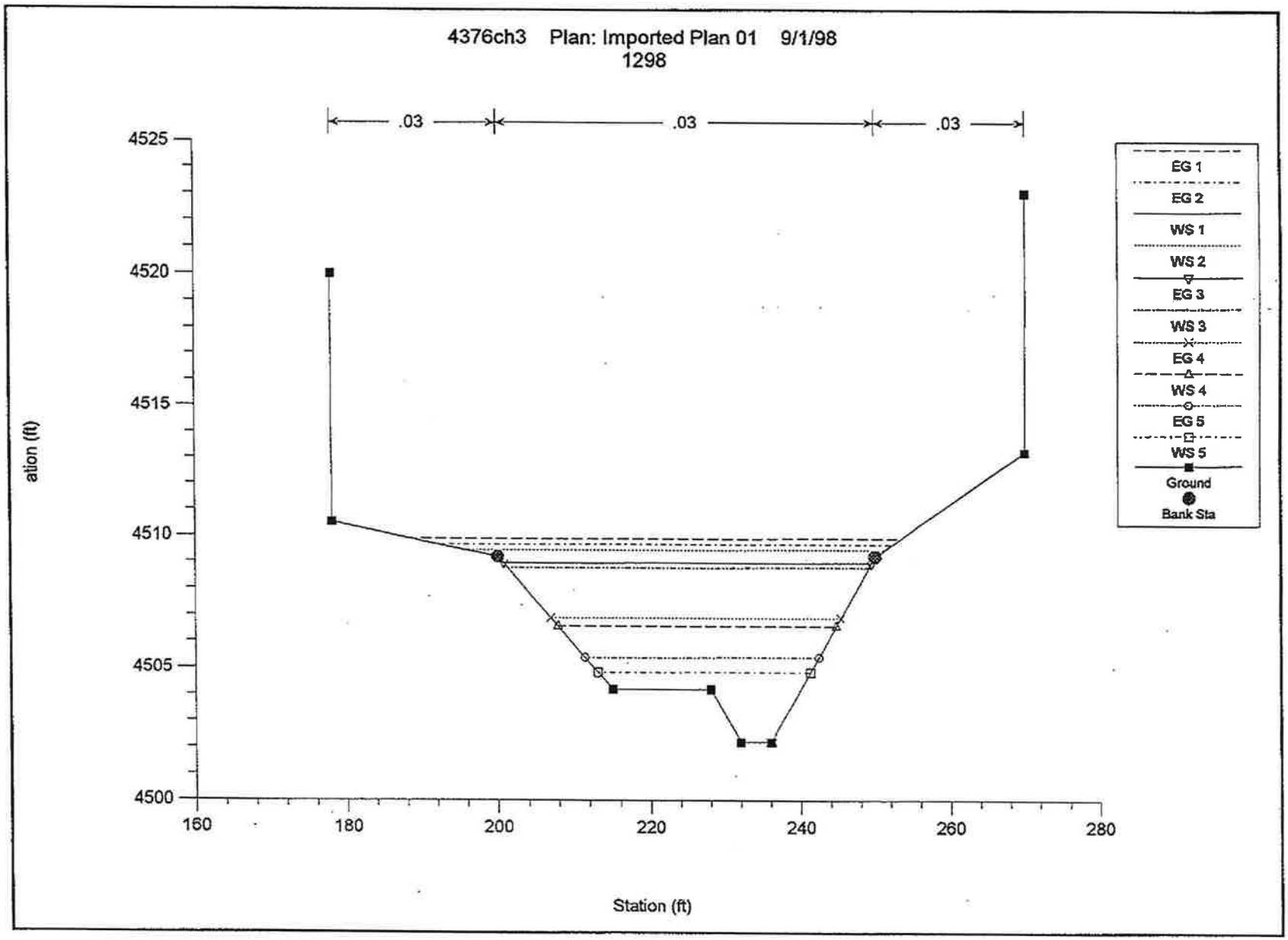
4376ch3 Plan: Imported Plan 01 9/1/98
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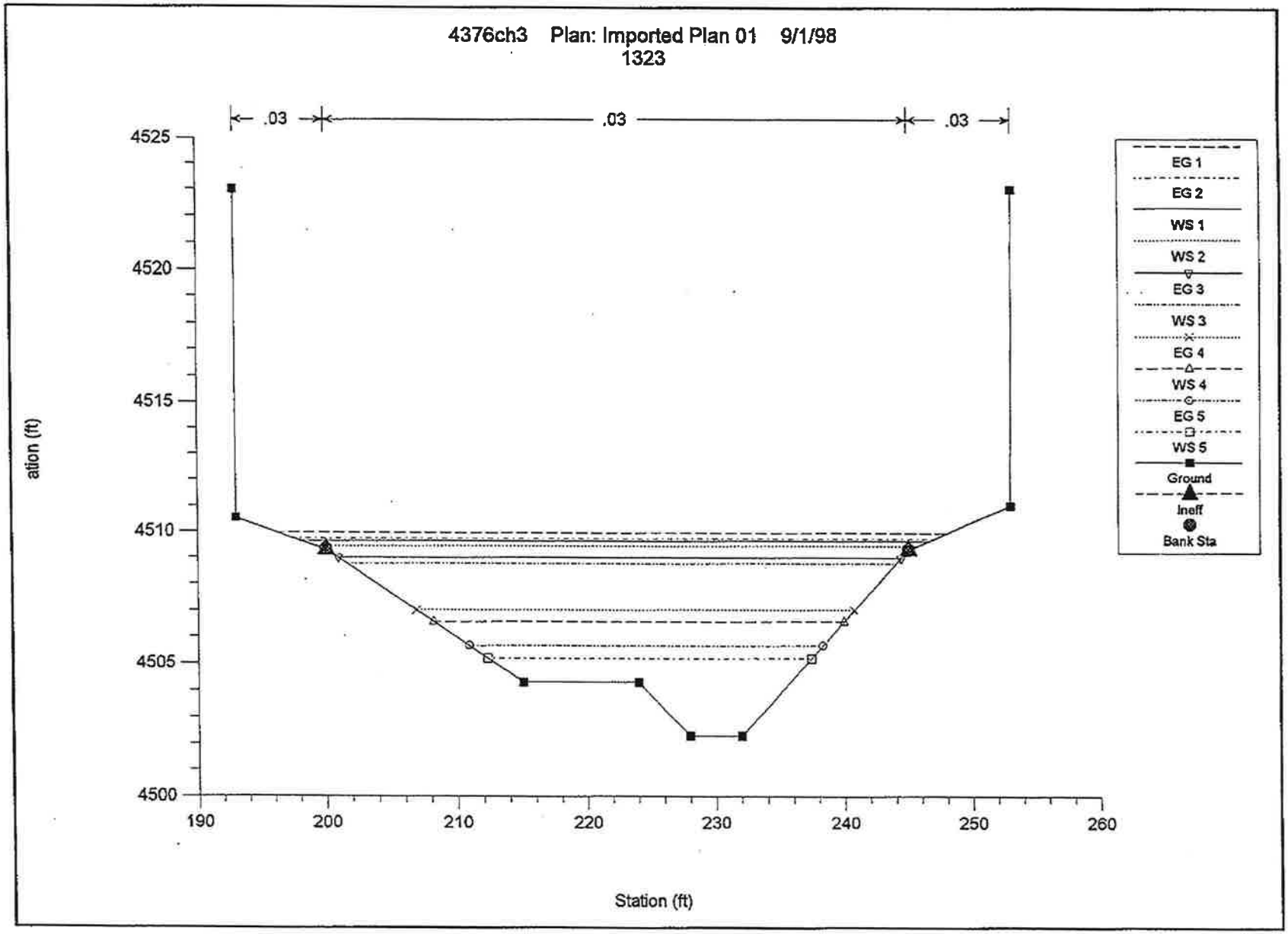
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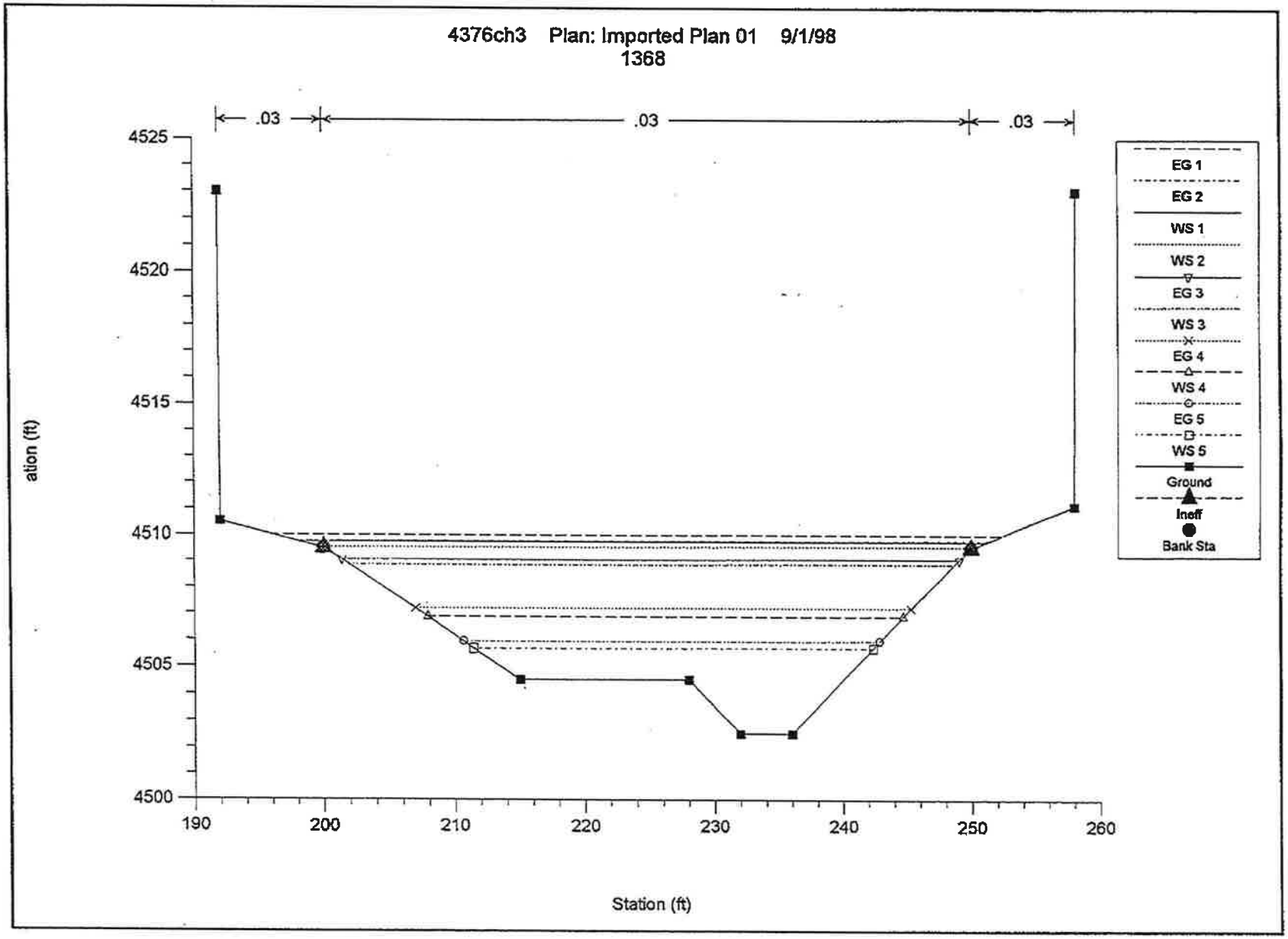
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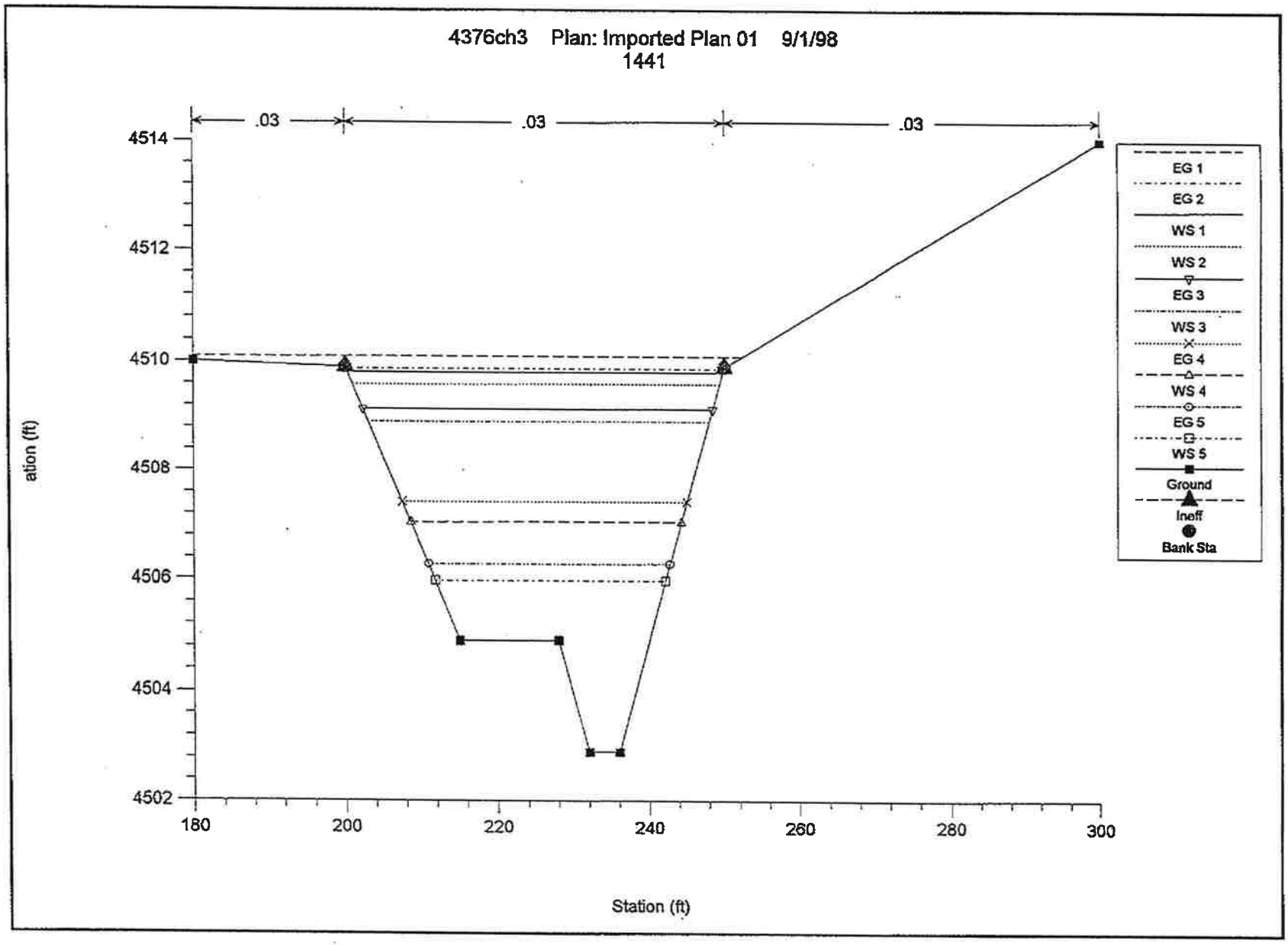
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ation (ft)
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240
260
280
300
Station (ft)
EG 1
EG 2
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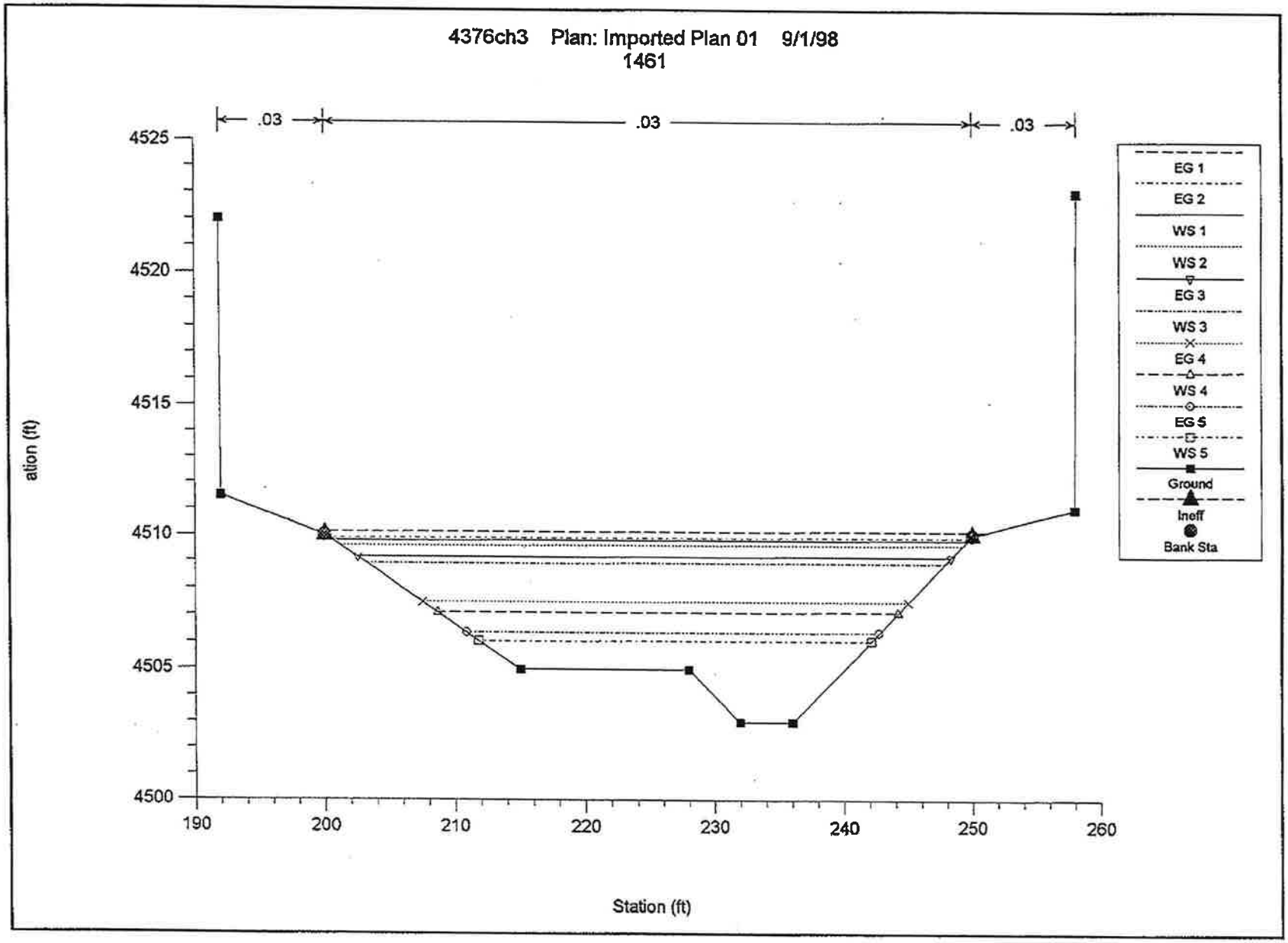
WS 2
EG 3
WS 3
EG 4
WS 4
EG 5
WS 5
Ground
Ineff
Bank Sta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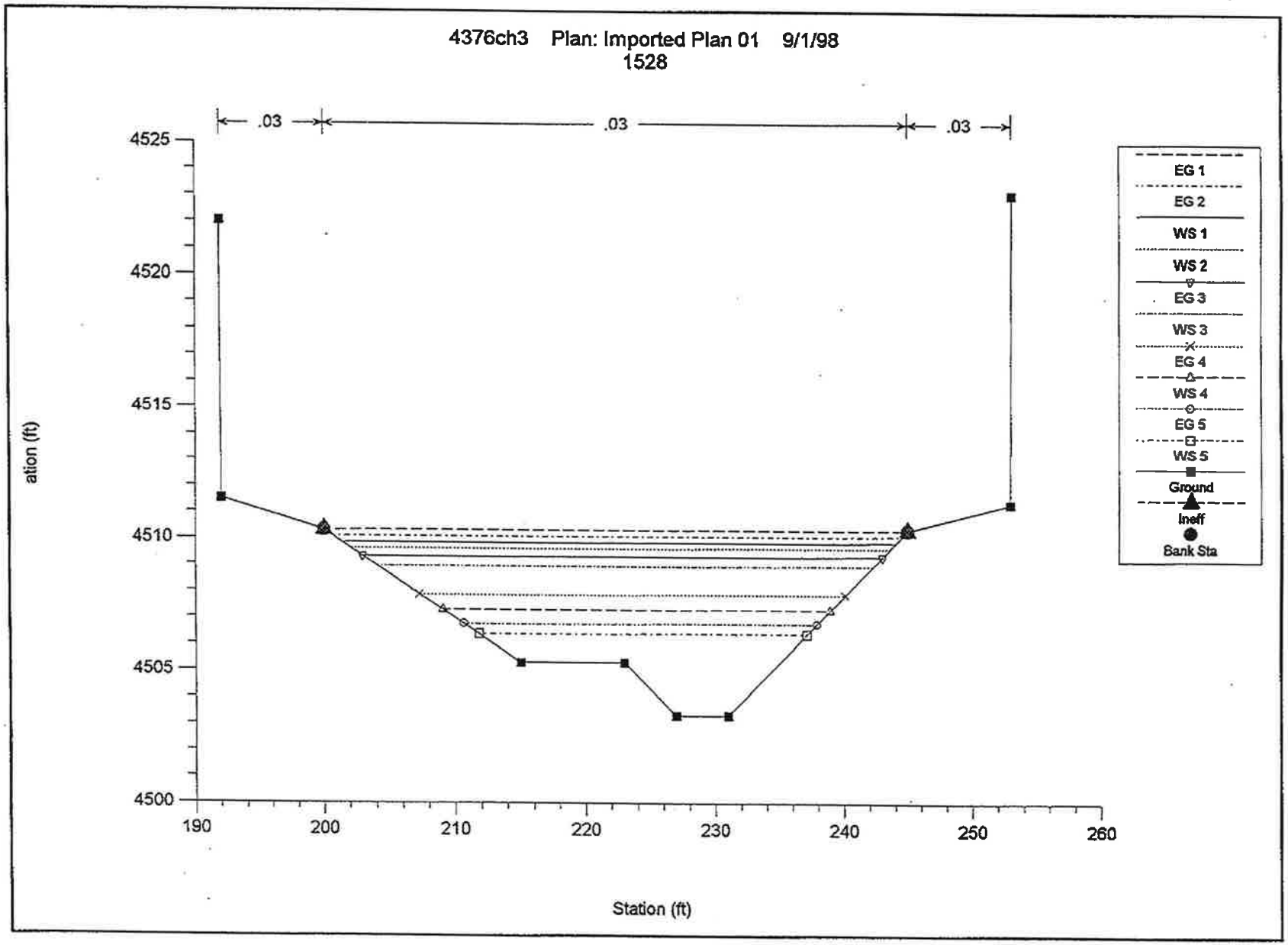
220
230
240
250
260
Station (ft)
EG 1
EG 2
WS 1
WS 2
EG 3
WS 3
EG 4
WS 4
EG 5
WS 5
Ground
Ineff
Bank Sta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200
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230
240
250
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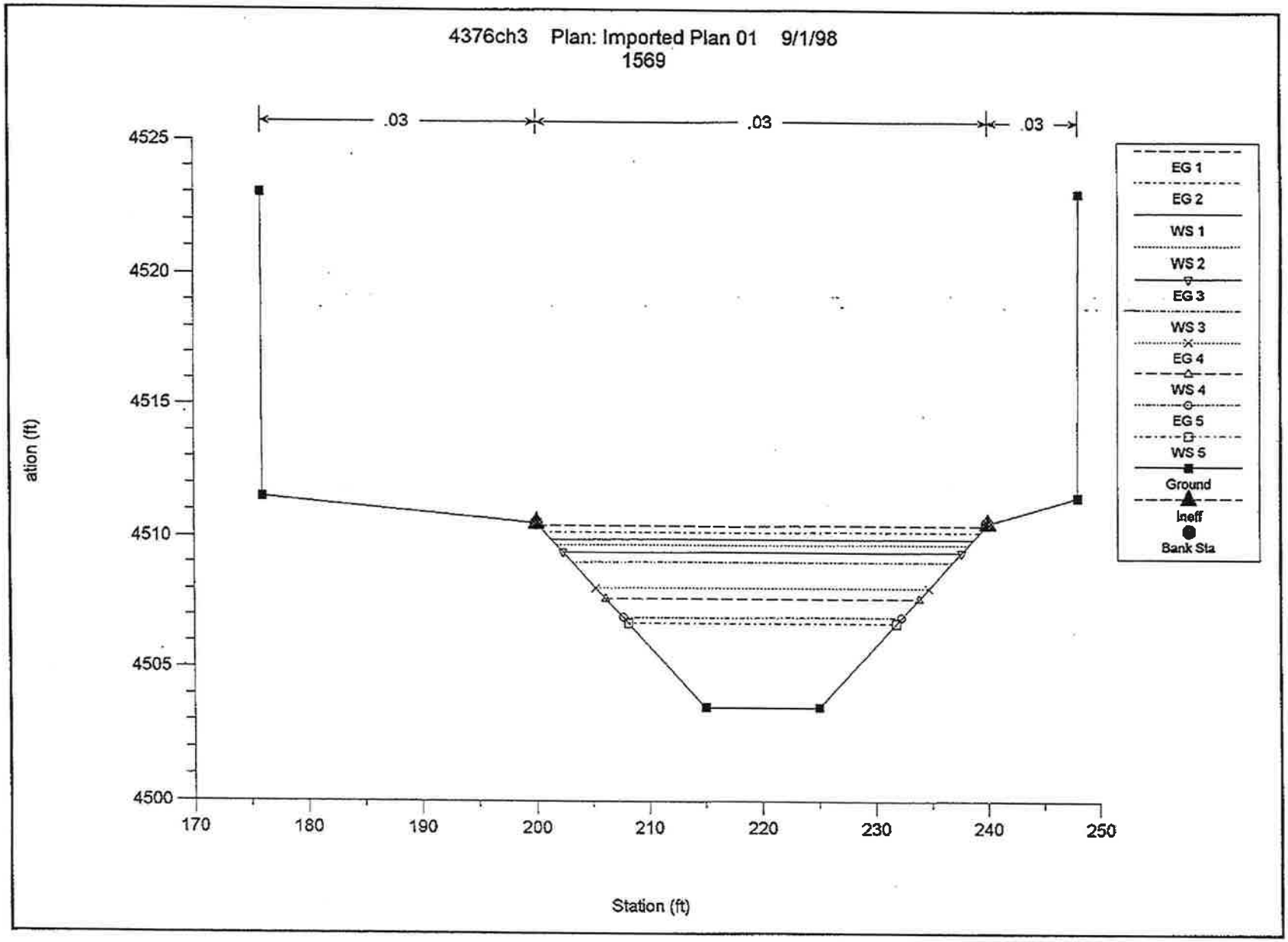
Station (ft)
EG 1
EG 2
WS 1
WS 2
EG 3
WS 3
EG 4
WS 4
EG 5
WS 5
Ground
Ineff
Bank Sta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4515
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170
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210
220
230
240
250
Station (ft)
EG 1
EG 2
WS 1
WS 2
EG 3
WS 3
EG 4
WS 4
EG 5
WS 5
Ground
Ineff
Bank Sta

APPENDIX 3

PLUMAS QUAIL TN 4376

EXISTING 10'x3' RCB WITH SLOPE-TAPERED INLET

CURRENT DATE: 08-27-1998 FILE DATE: 08-27-1998
CURRENT TIME: 08:38:50 FILE NAME: 4376E

****
********** FHWA CULVERT ANALYSIS **********
********** HY-8, VERSION 4.1 **********
****

CULV #	SITE DATA: INLET ELEV. (FT)	SITE DATA: OUTLET ELEV. (FT)	SITE DATA: CULVERT LENGTH (FT)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (FT)	RISE (FT)	MANNING n	INLET TYPE
1	4500.50	4499.60	126.00	1 RCB	10.00	3.40	.014	IMPR SLT REC
2								
3								
4								
5								
6								

****
SUMMARY OF CULVERT FLOWS (CFS) FILE: 4376E DATE: 08-27-1998

ELEV (FT)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
4500.50	0	0	0	0	0	0	0	0	1
4502.56	100	100	0	0	0	0	0	0	1
4503.76	200	200	0	0	0	0	0	0	1
4504.92	300	300	0	0	0	0	0	0	1
4506.51	400	400	0	0	0	0	0	0	1
4508.27	500	477	0	0	0	0	0	22	5
4508.73	600	498	0	0	0	0	0	102	4
4509.07	700	511	0	0	0	0	0	187	3
4509.39	800	514	0	0	0	0	0	283	3
4509.59	870	516	0	0	0	0	0	352	3
4509.94	1000	519	0	0	0	0	0	480	3
4508.00	465	465	0	0	0	0	0	OVERTOPPING	

****
SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: 4376E DATE: 08-27-1998

HEAD ELEV(FT)	HEAD ERROR(FT)	TOTAL FLOW(CFS)	FLOW ERROR(CFS)	% FLOW ERROR
4500.50	0.00	0	0	0.00
4502.56	0.00	100	0	0.00
4503.76	0.00	200	0	0.00
4504.92	0.00	300	0	0.00
4506.51	0.00	400	0	0.00
4508.27	-0.00	500	1	0.19
4508.73	-0.00	600	0	0.08
4509.07	-0.01	700	2	0.29
4509.39	-0.01	800	2	0.28
4509.59	-0.00	870	2	0.19
4509.94	-0.00	1000	1	0.10

PERFORMANCE CURVE FOR CULVERT # 1 - 1 (10 BY 3.4) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRITICAL DEPTH (ft)	OUTLET VEL. (fps)	OUTLET DEPTH (ft)	TAILWATER VEL. (fps)	TAILWATER DEPTH (ft)
0	4500.50	0.00	0.00	0-NF	0.00	0.00	0.00	0.00	0.00	0.00
100	4502.56	2.06	2.06	1-S2n	1.15	1.46	8.67	1.15	6.81	1.19
200	4503.76	3.26	3.26	1-S2n	1.83	2.32	10.66	1.88	8.46	1.75
300	4504.92	4.42	4.42	5-S2n	2.41	3.04	12.01	2.50	9.54	2.19
400	4506.51	6.01	6.01	5-S2n	2.95	3.40	12.85	3.11	10.37	2.55
477	4508.27	7.55	7.77	6-FFn	3.40	3.40	14.04	3.40	11.05	2.87
498	4508.72	8.00	8.22	6-FFn	3.40	3.40	14.63	3.40	11.63	3.16
511	4509.06	8.31	8.56	4-FFt	3.40	3.40	15.03	3.40	12.13	3.42
514	4509.39	8.39	8.89	4-FFt	3.40	3.40	15.13	3.40	12.59	3.67
516	4509.59	8.43	9.09	4-FFt	3.40	3.40	15.18	3.40	12.88	3.83
519	4509.94	8.50	9.44	4-FFt	3.40	3.40	15.26	3.40	13.37	4.11

El. inlet face invert 4500.50 ft El. outlet invert 4499.60 ft
El. inlet throat invert 4500.00 ft El. inlet crest 4500.50 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION (FT)	100.00
INLET ELEVATION (FT)	4500.50
OUTLET STATION (FT)	226.00
OUTLET ELEVATION (FT)	4499.60
NUMBER OF BARRELS	1
SLOPE (V-FT/H-FT)	0.0071
CULVERT LENGTH ALONG SLOPE (FT)	126.00

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	10.00 FT
BARREL RISE	3.40 FT
BARREL MATERIAL	CONCRETE
BARREL MANNING'S N	0.014
INLET TYPE	IMPR SLT RECT
INLET EDGE AND WALL	BEVELED EDGES (45-90 DEG WINGWALL)
INLET DEPRESSION	FALL INCLUDED IN SLOPE TAPER

IMPROVED INLET FOR CULVERT # 1 - 1 (10 BY 3.4) RCB

DIS-CHARGE Flow (cfs)	HEAD-WATER Elev. (ft)	INLET CONTROL Depth (ft)	OUTLET CONTROL Depth (ft)	FLOW TYPE <F4>	CREST CONTROL Elev. (ft)	FACE CONTROL Elev. (ft)	THROAT CONTROL Elev. (ft)	TAILWATER Elev. (ft)
0	4500.50	0.00	0.00	0-NF	4500.50	4500.50	4500.00	4499.60
100	4502.56	2.06	2.06	1-S2n	4502.56	4502.56	4502.17	4500.79
200	4503.76	3.26	3.26	1-S2n	4503.76	4503.76	4503.47	4501.35
300	4504.92	4.42	4.42	5-S2n	4504.77	4504.92	4504.60	4501.79
400	4506.51	6.01	6.01	5-S2n	4505.68	4506.51	4505.77	4502.15
477	4508.27	7.55	7.77	6-FFn	4506.33	4508.05	4506.81	4502.47
498	4508.72	8.00	8.22	6-FFn	4506.49	4508.50	4507.10	4502.76
511	4509.06	8.31	8.56	4-FFt	4506.60	4508.81	4507.31	4503.02
514	4509.39	8.39	8.89	4-FFt	4506.62	4508.89	4507.36	4503.27
516	4509.59	8.43	9.09	4-FFt	4506.64	4508.93	4507.39	4503.43
519	4509.94	8.50	9.44	4-FFt	4506.66	4509.00	4507.43	4503.71

***** SLOPE-TAPERED IMPROVED INLET **********

FACE WIDTH		12.00 FT
SIDE TAPER (4:1 TO 6:1)	(X:1)	6.00
FALL SLOPE (2:1 TO 3:1)	(X:1)	3.00
FALL		0.50 FT
MITERED FACE	(Y/N)	N
FACE-CREST LENGTH IF MITERED		12.00 FT

****
********** TAILWATER **********
****

******* REGULAR CHANNEL CROSS SECTION **********

BOTTOM WIDTH (FT)	10.00
SIDE SLOPE H/V (X:1)	2.0
CHANNEL SLOPE V/H (FT/FT)	0.020
MANNING'S N (.01-0.1)	0.030
CHANNEL INVERT ELEVATION (FT)	4499.60
CULVERT NO.1 OUTLET INVERT ELEVATION	4499.60 FT

******* UNIFORM FLOW RATING CURVE FOR DOWNSTREAM CHANNEL

FLOW (CFS)	W.S.E. (FT)	FROUDE NUMBER	DEPTH (FT)	VEL. (FPS)	SHEAR (PSF)
0.00	4499.60	0.000	0.00	0.00	0.00
100.00	4500.79	1.102	1.19	6.81	1.48
200.00	4501.35	1.126	1.75	8.46	2.19
300.00	4501.79	1.137	2.19	9.54	2.73
400.00	4502.15	1.144	2.55	10.37	3.19
500.00	4502.47	1.149	2.87	11.05	3.59
600.00	4502.76	1.152	3.16	11.63	3.95
700.00	4503.02	1.156	3.42	12.13	4.27
800.00	4503.27	1.158	3.67	12.59	4.58
870.00	4503.43	1.160	3.83	12.88	4.78
1000.00	4503.71	1.163	4.11	13.37	5.13

****
********** ROADWAY OVERTOPPING DATA **********
****

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH (FT)	60.00
CREST LENGTH (FT)	60.00
OVERTOPPING CREST ELEVATION (FT)	4508.00

****

LUMOS AND ASSOCIATES

Lumos and Associates, Inc.

CIVIL ENGINEERING
PLANNING
SURVEYING
MATERIALS TESTING

800 E. College Parkway
Carson City, NV 89706
(702) 883-7077

5401 Longley Lane, Suite 13,
Reno, NV 89511
(702) 827 - 6111

137 Keddie Street
Fallon, NV 89406
(702) 423 - 2188

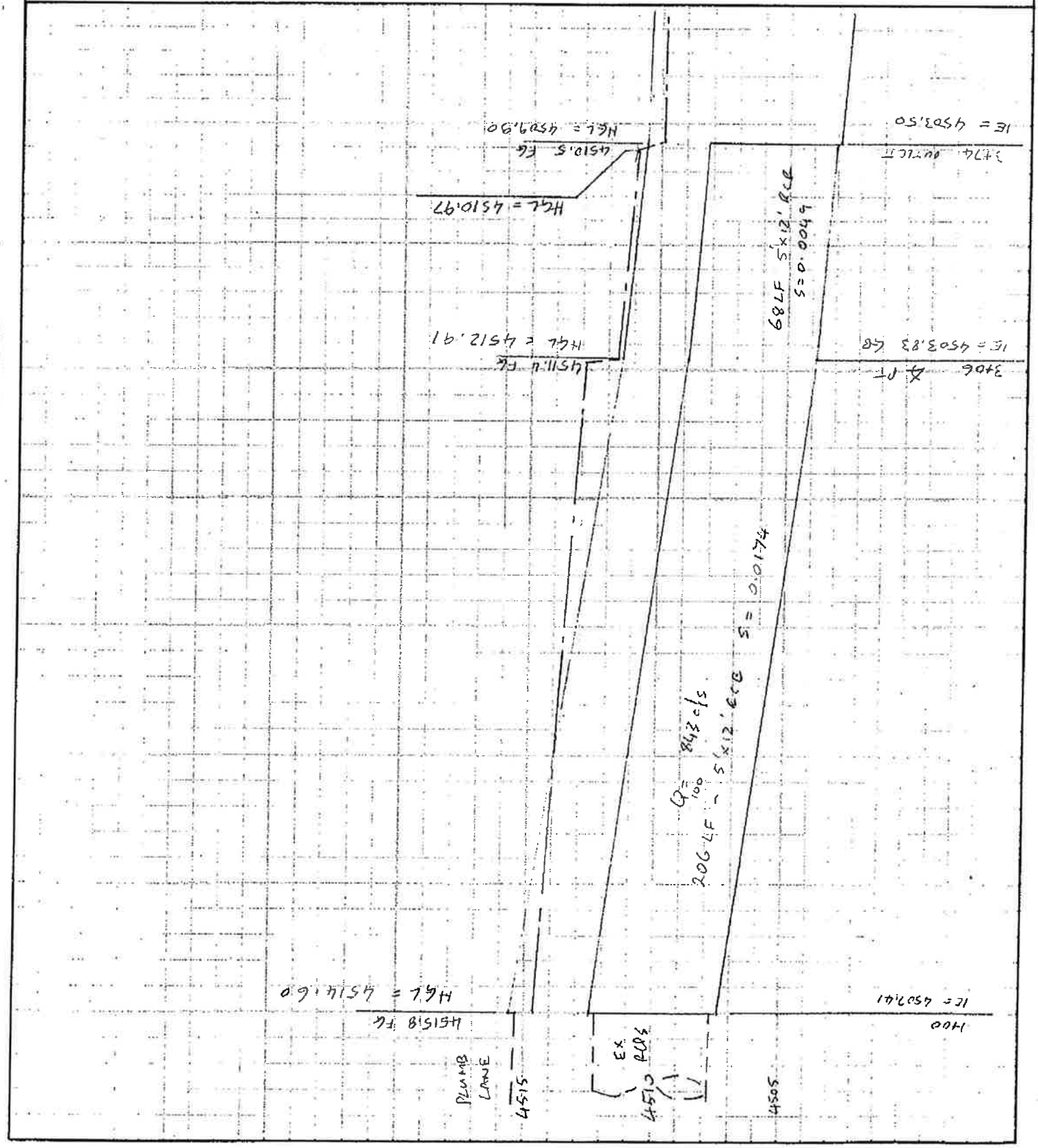
Client: RIBEIRO Sheet 1 Of 2

Description PLUMAS QUAIL

5'x12' RCB HGL Job No. 4376

By: CLM Date 11/5/98

Checked By: Date



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Client: _____ Sheet 2 Of 2

Description PLUMAS QUAIL

Job No. 4376

By: CLM Date 11/3/98

Checked By: _____ Date _____

5 FT x 12 FT RCB HGL CALCS.

STA 3+74

$Q = 843$, $A = 60$ SF, $V = 14.05$ fps (RCB) $V = 5.74$ fps (Channel)

$$\text{Exit loss} = \frac{V_1^2 - V_2^2}{2g} = \frac{(14.05 - 5.74)^2}{2g} = 1.07'$$

Channel HGL_{100} at outlet = 4509.90

RCB HGL_{100} upstream of outlet = 4509.9 + 1.07 = 4510.97

STA 3+06

60° BEND LOSS $= 0.45 \frac{V^2}{2g} = 0.45 \times \frac{14.05^2}{64.4} = 1.38'$

68 LF x 0.0082 = 0.56'

$\therefore HGL_{100} = 4510.97 + 0.56 + 1.38 = \underline{4512.91}$

STA 1+00

$$Q = \frac{A \times 1.486 \times R^{2/3} \times S^{1/2}}{n} \qquad R = \frac{A}{P} = \frac{60}{34} = 1.765$$

$$\Rightarrow S_f = \left(\frac{Qn}{A \times 1.486 \times R^{2/3}}\right)^2$$

$$= \left(\frac{843 \times 0.014}{60 \times 1.486 \times (1.765)^{0.67}}\right)^2 = 0.0082$$

206 LF x 0.0082 = 1.69'

$HGL_{100} = 4512.91 + 1.69 = \underline{4514.60}$

APPENDIX 4

LUMOS & ASSOCIATES, INC.
Civil Engineers • Surveyors • Material Testing

HYDROLOGY COMPUTATIONS

Sheet 1 of 3

LOCATION RENO - PLUMAS & PLUMB Zone TN 4376

Subd. Riberio - PLUMAS QUAIL Average Annual Rainfall By CLM Date 11/4/98

Line SDCB Flows Recurrence interval 57R Cross Reference Drainage Map

Drainage Area		Areas and Classification Land Use Zoning	Σ Ac	tc min	I in/hr	Q cfs	Size	Point
SDCB # 1	A	1.32	1.19	10	1.4	1.7		
	C	0.9						
	AC	1.19						
SDCB # 2	A	0.55	0.50	10	1.4	0.7	—	over 10'x3' RCB
	C	0.9						
	AC	0.50						
SDCB # 3	A	0.55	0.50	10	1.4	0.7	10" PVC	S = 0.005
	C	0.9						
	AC	0.50						
SDCB # 4	A	0.57	0.51	10	1.4	0.7	12" PVC	S = 0.039
	C	0.9						
	AC	0.51						
SDCB # 5	A	0.46	0.41	10	1.4	0.6		
	C	0.9						
	AC	0.41						
	A							
	C							
	AC							
EX. SDCB # 6 (offsite)	A	0.70	0.32	10	1.4	0.5		
	C	0.45						
	AC	0.32						
EX. SDCB # 7 (offsite)	A	0.98	0.44	10	1.4	0.6		
	C	0.45						
	AC	0.44						

TIME OF CONCENTRATION

Drainage Area	Overland Flow ft.	vel.	min.	Channel Flow ft.	vel.	min.	Roof to Gutter zoned	min.	Gutter Flow ft.	vel.	min.	Pipe Flow ft.	vel.	min.	tc

Velocity in feet per second

LUMOS & ASSOCIATES, INC.
Civil Engineers • Surveyors • Material Testing

HYDROLOGY COMPUTATIONS

Sheet 2 of 3

LOCATION RENO - PLUMAS & PLUMB Zone JN 4376

Subd. _____ Average Annual Rainfall _____ By CLM Date 11/4/98

Line _____ Recurrence interval 100YR Cross Reference _____

Drainage Area		Areas and Classification Land Use Zoning	Σ Ac	tc min	I in/hr	Q cfs	Size	Point
SDCB # 1	A		1.19	10	3.8	4.5		
	C							
	AC							
SDCB # 2	A		0.50	10	3.8	1.9		
	C							
	AC							
SDCB # 3	A		0.50	10	3.8	1.9		
	C							
	AC							
SDCB # 4	A		0.51	10	3.8	1.9		
	C							
	AC							
SDCB # 5	A		0.41	10	3.8	1.6		
	C							
	AC							
	A							
	C							
	AC							
EX. SDCB # 6 (offsite)	A		0.32	10	3.8	1.2		
	C							
	AC							
EX, SDCB # 7. (offsite)	A		0.44	10	3.8	1.6		
	C							
	AC							

TIME OF CONCENTRATION

Drainage Area	Overland Flow			Channel Flow			Roof to Gutter		Gutter Flow			Pipe Flow			tc
	ft.	vel.	min.	ft.	vel.	min.	zoned	min.	ft.	vel.	min.	ft.	vel.	min.	

Velocity in feet per second

LUMOS & ASSOCIATES, INC.
Civil Engineers • Surveyors • Material Testing

HYDROLOGY COMPUTATIONS

Sheet 3 of 3

LOCATION RENO - PLUMAS & PLUMB — Zone JN 4376

Subd. — Average Annual Rainfall — By CLM — Date 11/4/98

Line — Recurrence interval 5YR & 100YR — Cross Reference

	Drainage Area		Areas and Classification Land Use Zoning	Σ Ac	tc min	I in/hr	Q cfs	Size	Point
5YR	SDCB #3	A		0.50	10	1.4	0.7	10" PVC	S=0.005
		C							
		AC	0.50						
	SDCB #4	A		1.01	10.9	1.4	1.4	12" PVC	S=0.039
		C							
		AC	0.51						
		A							
		C							
		AC							
100YR	SDCB #3	A		0.5	10	3.8	1.9		
		C							
		AC							
	SDCB #4	A		1.01	10.9	3.6	3.6		
		C							
		AC							
		A							
		C							
		AC							
		A							
		C							
		AC							
		A							
		C							
		AC							

TIME OF CONCENTRATION

Drainage Area	Overland Flow ft.	vel.	min.	Channel Flow ft.	vel.	min.	Roof to Gutter zoned	min.	Gutter Flow ft.	vel.	min.	Pipe Flow ft.	vel.	min.	tc
#3								10							10
#4								10				160	3	0.9	10.9

Velocity in feet per second