

DEVILS TOWER NATIONAL MONUMENT
FLOOD PLAIN CROSS SECTIONS OF
BELLE FOURCHE RIVER

Greg L. Kerr
Victor R. Hasfurther
Thomas A. Wesche

WWRC-84-13

Wyoming Water Research Center
University of Wyoming
Laramie, Wyoming

November, 1984

Report prepared for National Park Service
under Contract No. CX-1200-4-A050

Contents of this publication have been reviewed only for editorial and grammatical correctness, not for technical accuracy. The material presented herein resulted from objective research sponsored by the Wyoming Water Research Center, however views presented reflect neither a consensus of opinion nor the views and policies of the Water Research Center or the University of Wyoming. Explicit findings and implicit interpretations of this document are the sole responsibility of the author(s).

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
CROSS SECTION FIELD MEASUREMENTS	1
CROSS SECTION DESCRIPTIONS	3
Cross Section 1	3
Cross Section 2	5
Cross Section 3	5
Cross Section 4	6
Cross Section 5	6
Cross Section 6	7
Cross Section 7	7
Cross Section 8	8
Cross Section Data	8
REGRESSION ANALYSIS	9
LITERATURE CITED	14
APPENDIX A: CROSS SECTION DATA	15
APPENDIX B: REGRESSION ANALYSIS ON CROSS SECTION VARIABLES	25

LIST OF ILLUSTRATIONS

		Page
ILLUSTRATION I.	Devils Tower General Cross Section Locations	2
ILLUSTRATION II.	Belle Fourche River Cross Section Locations	4

LIST OF TABLES

		Page
TABLE I.	Regression equation coefficients for individual cross sections	10
TABLE II:	Correlation coefficients and standard errors for equations	11

INTRODUCTION

This report was prepared for the National Park Service (NPS), Division of Park Planning, Rocky Mountain Regional Office.

The purpose of this study was to obtain baseline information and provide the NPS with current data on the Belle Fourche River and the associated flood plain within the Devils Tower National Monument. This information will assist the NPS with flood plain management and the preparation of a Devils Tower General Management Plan.

CROSS SECTION FIELD MEASUREMENTS

Eight (8) cross sections were surveyed in June, 1984 on the Belle Fourche River inside the park. The study area started at the Belle Fourche River Bridge inside the park and extended to the south park boundary. Each cross section was surveyed as close as possible to those section lines identified by the NPS on the accompanying map (Illustration I). Individual cross section sites included in the study were the south park boundary, residential area, Park Headquarters, picnic area, Belle Fourche River Campground, and Prairie Dog Colony.

Permanent cross section control points (bench marks) were set at each individual cross section by driving a 1/2" x 3' length of rebar into the ground and coloring the top red. Orange flagging was also tied to each stake. Control point locations are provided under each individual cross section description to follow.

Cross sections were measured perpendicular to the flow of the river. Elevations were taken through the main river section with 10' as a maximum spacing and at all abrupt changes in slope. The elevation of

DEVILS TOWER

0 0.1 Kilometer 0.5
0 0.1 Mile 0.5



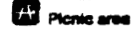
Trail



Ranger station



Campground



Picnic area

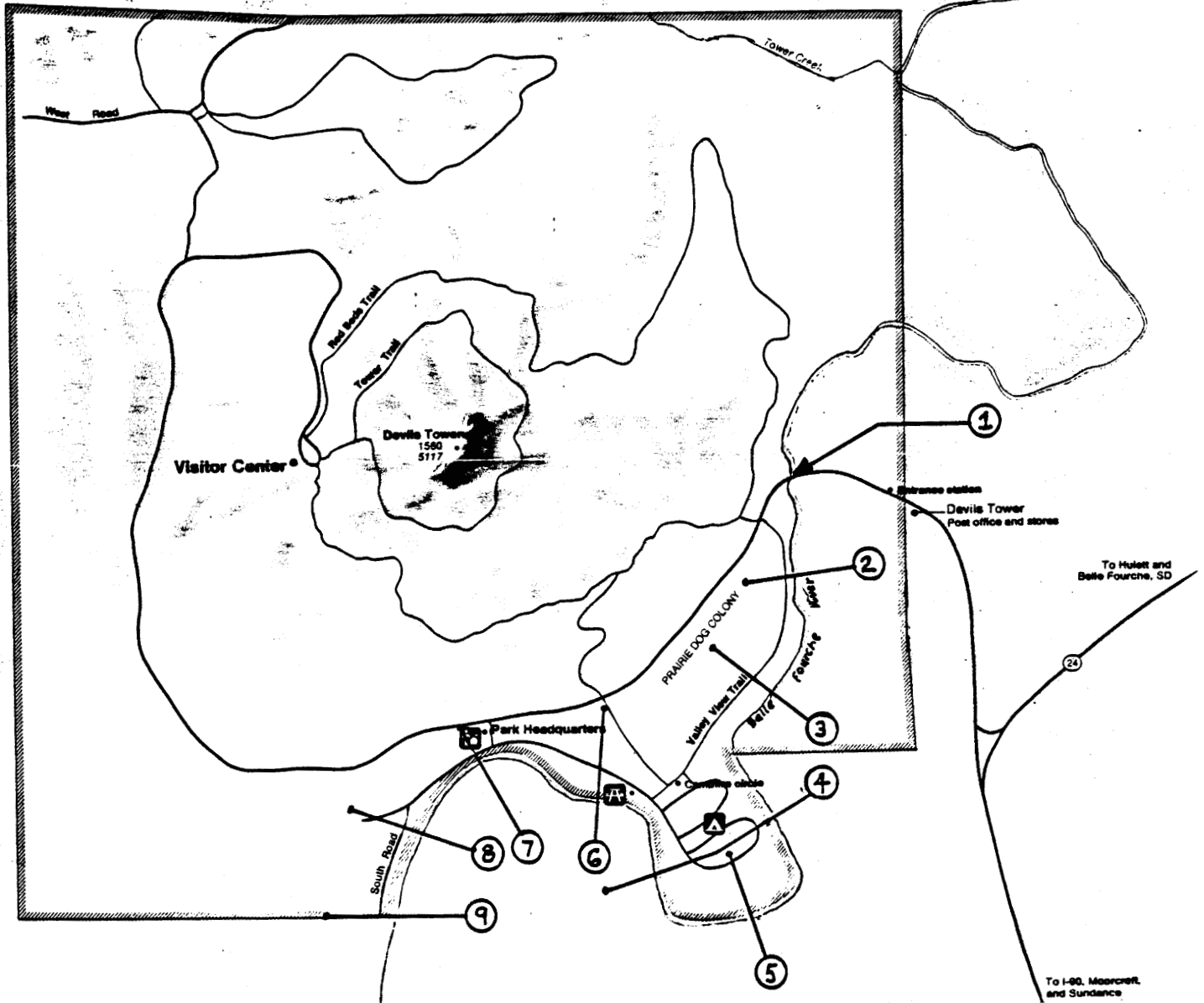


ILLUSTRATION I. Devils Tower General Cross Section Locations.

- 1 = Bridge (Mile 0.0)
- 2 = Begin - Cross Section 1
- 3 = Cross Section #2 -
Prairie Dog Colony
- 4 = Cross Section #3 & 3A

- 5 = Cross Section #4
- 6 = Cross Section #5
- 7 = Cross Section #6
- 8 = Cross Section #7
- 9 = Cross Section #8 End of Reach

the water at each cross section at the time of survey was noted. Outside the main river bank, ground elevations were taken at approximately every 100' along the section line and at any intermediate points where abrupt changes occurred. Where the topography was uniformly sloped, the spacings for section elevations were at a maximum of 200' on center.

Surveying was performed with an automatic self-leveling level and leveling rod using standard methods of the U.S. Geological Survey (Benson and Dalrymple, 1967) and the Soil Conservation Service.

CROSS SECTION DESCRIPTIONS

Cross Section 1

Cross section 1 (Illustration II) starts in the east prairie dog colony and intersects the Belle Fourche River approximately 300 yards upstream of the main park bridge. The control point is located 74 yards northeast of a culvert which is located on the main road 225 yards southwest of the main park bridge. A control point stake with a wooden cover stake was driven into the ground under sagebrush on the edge of the upper terrace. The Belle Fourche River was flowing approximately 40-50 cfs at the time of the cross section survey.

Cross section 1 is a total of 831' long. The river bottom is mostly sand intermixed with sections of soft mud. Vegetation on the left side of the river on the upper terrace is mostly short grass extending out into the prairie dog colony. Near the edge of the upper terrace on the left flood plain, a mixture of brush and sage exists before the ground level drops off forming a lower terrace. The lower terrace consists of mostly brush, cottonwood trees and cottonwood dead

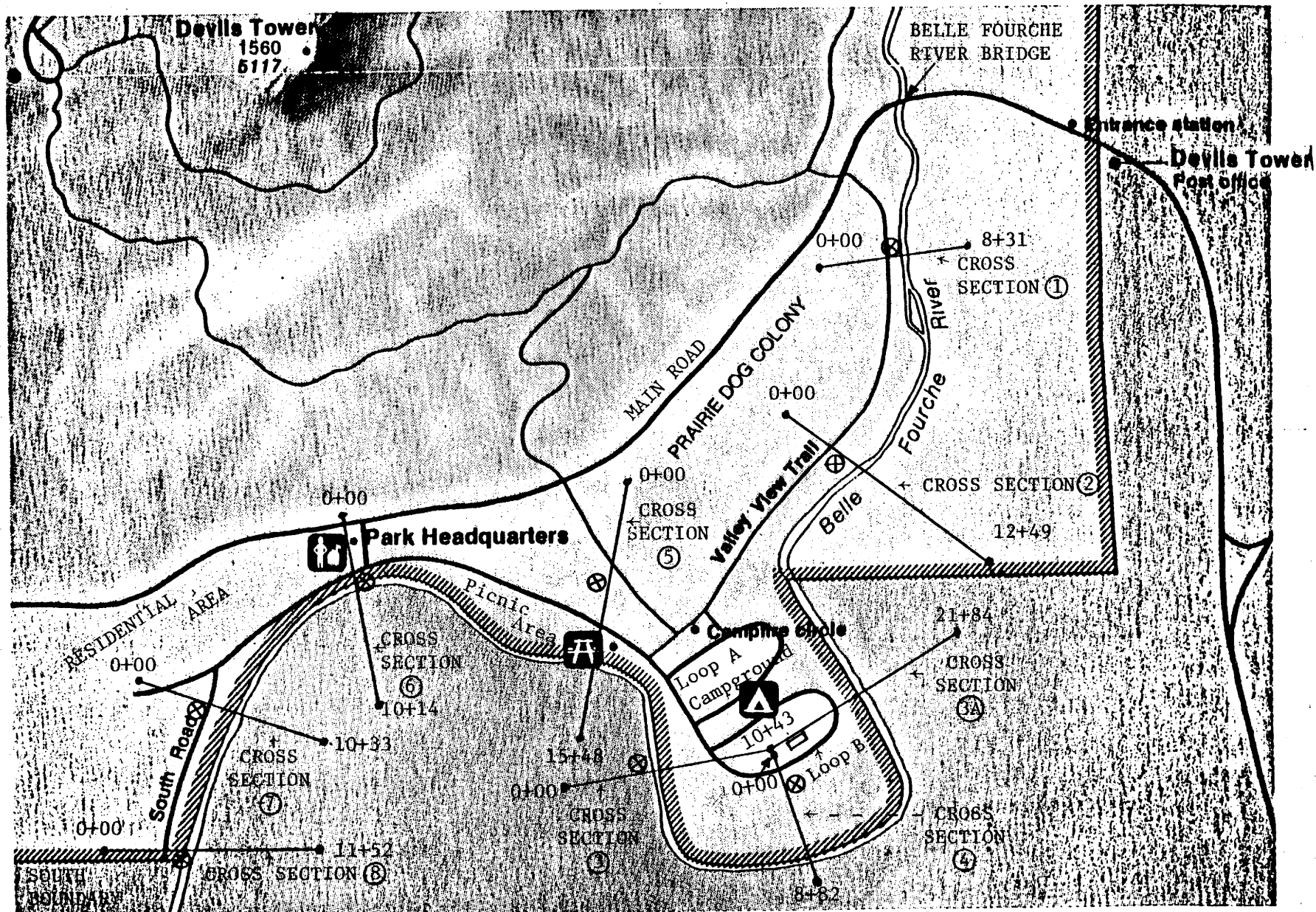


Illustration II. Belle Fourche River Cross Section Locations.

⊗ Control Point

fall. The right side of the river is covered with tall grass on the lower terrace near the river. The upper terrace on the right flood plain consists of tall grass and dead standing cottonwood trees.

Cross Section 2

Cross section 2, (Illustration II) 1,249' long, starts in the prairie dog colony off the main park road and extends southeast intersecting the river approximately 70 yards above the tetrahedrant bank stability structures and 3' below the small concrete and log structure near the river on the lower terrace. The cross section ends at the park boundary fence. The control point for cross section 2 is located on the upper left terrace at the southeast edge of the prairie dog colony, 39' above the the cross section line at station 4 + 74'. The vegetation surrounding the cross section is short grass throughout the prairie dog colony on the left side of the river, with sparse sagebrush at the edge of the upper terrace. The right side of the flood plain is covered with short grass and large amounts of cactus. Above the cross section line there are sparse cottonwood trees. The river bottom along the section consists of cobbles.

Cross Section 3

The control point for section 3 (Illustration II) is located on the outer west side of the river loop, 20' northwest of the cross section line and 111' from the 0 + 00 point next to a large cottonwood tree. Cross section 3 is on a bend of the river, and therefore crosses it twice. The midpoint in the section occurs near the restrooms of loop B within the Belle Fourche River Campground. The total length of the cross section is 2,184'.

The vegetation surrounding 0 + 00 northeast of the river consists of tall grass and intermingled cottonwood trees. Inside the river loop is a mixture of tall grass surrounding the campground road with short grass inside the campground area itself. The inner loop is partially covered with large cottonwood trees. The right side of the river on the northeast side of the river loop consists of tall grass and sagebrush. The river bottom at both places where the cross section intersects consists of soft mud.

Cross Section 4

Cross section 4 (Illustration II) starts within B loop of the Belle Fourche Campground. The 0 + 00 mark begins 20' southwest of the restrooms with the cross section extending a total length of 882'. The control point is located approximately 339' southeast from the 0 + 00 mark and 81' northeast of the cross section line next to a large cottonwood tree.

Vegetation throughout the cross section is grass intermingled with cottonwood trees. The river bottom through the cross section consists of soft mud from the left bank to approximately the center of the channel, then changing to sand.

Cross Section 5

Cross section 5, (Illustration II) 1,548' long, begins with 0 + 00 located just off the main park road in the prairie dog colony. It extends southwest down through the picnic area, intersecting the river, and ends on the right flood plain. The control point for section 5 is located on the southwest edge of the prairie dog colony at the edge of the bank. The ground level then drops off forming a lower terrace into

the picnic area. A stake was placed 430' southwest of 0 + 00 along the section line and 30' west under a spruce tree.

The vegetation consists of tall grass throughout the cross section except on the upper terrace-prairie dog colony which is short grass. A heavy oak tree cover exists from the edge of the prairie dog colony throughout the picnic area. The river bottom is mud near the bank and gravel toward the center of the channel.

Cross Section 6

Cross section 6 (Illustration II) begins on the main park road just to the east of the park headquarters building, crosses the 15' wide, paved service road and intersects the river, ending on the flood plain on the right side. Section 6 is 1,014' in length. The control point is located 61' northeast of the cross section line along the park boundary fence and 3' north of the corner fence post.

Vegetation is tall grass throughout the section with thick stands of oak trees surrounding park headquarters. The right side of the river has sparse cottonwood trees throughout the flood plain. The river bottom is firm and rocky.

Cross Section 7

The 7th cross section (Illustration II) starts northwest of the residential area's 15' wide, paved road and extends toward the river, crossing the south boundary's 10' wide, gravel road. This cross section intersects the Belle Fourche River at a point where an island is formed during low flow. Both the side and main channels are designated in this survey. Cross section 7 extends 1,033', ending on the right flood plain. The control point is located 69' northwest of the northwest edge of the south park boundary's 15' wide, gravel road, along the cross

section line. Two short posts exist at this point. The control stake was driven near the west post.

Existing vegetation includes tall grass and heavy stands of oak trees north of the south park boundary road. The remainder of the cross section has tall grass throughout with sparse cottonwood trees on the right side of the river extending onto the flood plain. The river bottom consists of firm rocky substrate.

Cross Section 8

The final cross section, number 8 (Illustration II), follows the south park boundary fence, crosses the graveled south boundary road and boundary fence following the river, intersects the river and ends on the right side of the Belle Fourche on the flood plain. Cross section 8 begins with 0 + 00 a distance of approximately 354' west of the south boundary road. Total length is 1,152'. The control point is located 150' east of the south boundary road inside the corner of the boundary fence line.

Vegetation along the cross section consists of tall grass throughout with sparse oak tree cover on the left side of the river near 0 + 00. The right side of the river has cottonwood trees and sparse sagebrush intermingled on the flood plain. The river bottom is firm and rocky throughout the cross section.

Cross Section Data

A tabulation of the points for each cross section along with a table showing depth, area, wetted perimeter and top width for each cross section is presented in Appendix A.

REGRESSION ANALYSIS

Simple regression analysis was performed using a statistical package known as MINITAB on the CYBER835 system at the University of Wyoming. The regressions that were run on each cross section were:

$$A = aD^b$$

$$A = cWP^d$$

$$T = eD^f$$

$$WP = gD^h$$

where A is the cross-sectional area (ft²), D is the depth (ft), WP is the wetted perimeter (ft), T is the top width (ft) and a,b,c,d,e,f,g and h are regression coefficients. Table I presents the results of the statistical analysis. Table II gives the correlation coefficients and standard errors of estimate for each equation and cross section. Appendix B presents the complete statistical analysis for each cross section.

TABLE I. Regression equation coefficients
for individual cross sections.

<u>Cross Section</u>	<u>a</u>	<u>b</u>	<u>c</u>	<u>d</u>	<u>e</u>	<u>f</u>	<u>g</u>	<u>h</u>
1	15.14	1.69	0.253	1.53	18.20	0.938	19.05	0.942
2	13.80	1.90	0.035	1.90	25.70	0.929	26.30	0.927
3	6.61	2.23	0.277	1.40	10.72	1.49	11.48	1.47
3A	25.12	1.56	0.003	2.46	38.90	0.594	39.81	0.598
4	29.51	1.38	0.023	2.12	38.02	0.477	38.02	0.490
5	15.49	1.82	0.211	1.51	22.39	1.04	22.91	1.04
6	6.30	2.14	0.095	1.67	12.59	1.23	14.45	1.19
7	12.30	1.96	0.059	1.76	22.39	1.06	23.44	1.05
8	15.49	1.99	0.162	1.50	20.89	1.29	22.39	1.28

Equations: $A = aD^b$
 $A = cWP^d$
 $T = eD^f$
 $WP = gD^h$

TABLE II: Correlation coefficients and standard errors for equations

Cross Section #1

<u>Equation</u>	<u>Correlation Coefficient</u>	<u>* Standard Error</u>
$A = aD^b$	0.99	0.079
$A = cWP^d$	0.94	0.211
$T = eD^f$	0.88	0.177
$WP = gD^h$	0.89	0.165

Cross Section #2

<u>Equation</u>	<u>Correlation Coefficient</u>	<u>* Standard Error</u>
$A = aD^b$	0.99	0.025
$A = cWP^d$	0.96	0.179
$T = eD^f$	0.96	0.095
$WP = gD^h$	0.96	0.094

Cross Section #3

<u>Equation</u>	<u>Correlation Coefficient</u>	<u>* Standard Error</u>
$A = aD^b$	0.99	0.105
$A = cWP^d$	0.97	0.193
$T = eD^f$	0.94	0.193
$WP = gD^h$	0.94	0.184

TABLE II: Correlation coefficients and standard errors for equations (continued)

Cross Section #3A

Equation	<u>Correlation Coefficient</u>	<u>* Standard Error</u>
$A = aD^b$	0.99	0.031
$A = cWP^d$	0.97	0.136
$T = eD^f$	0.96	0.059
$WP = gD^h$	0.97	0.057

Cross Section #4

Equation	<u>Correlation Coefficient</u>	<u>* Standard Error</u>
$A = aD^b$	0.99	0.018
$A = cWP^d$	0.86	0.246
$T = eD^f$	0.84	0.107
$WP = gD^h$	0.85	0.105

Cross Section #5

Equation	<u>Correlation Coefficient</u>	<u>* Standard Error</u>
$A = aD^b$	0.99	0.055
$A = cWP^d$	0.94	0.222
$T = eD^f$	0.91	0.171
$WP = gD^h$	0.91	0.167

TABLE II: Correlation coefficients and standard errors for equations (continued)

Cross Section #6

Equation	<u>Correlation Coefficient</u>	<u>* Standard Error</u>
$A = aD^b$	0.99	0.097
$A = cWP^d$	0.96	0.203
$T = eD^f$	0.95	0.145
$WP = gD^h$	0.95	0.134

Cross Section #7

Equation	<u>Correlation Coefficient</u>	<u>* Standard Error</u>
$A = aD^b$	0.99	0.057
$A = cWP^d$	0.97	0.157
$T = eD^f$	0.96	0.115
$WP = gD^h$	0.96	0.106

Cross Section #8

Equation	<u>Correlation Coefficient</u>	<u>* Standard Error</u>
$A = aD^b$	0.99	0.106
$A = cWP^d$	0.99	0.106
$T = eD^f$	0.96	0.134
$WP = gD^h$	0.96	0.124

*The standard error of estimate is in terms of the logarithm to the base ten since the regression equations are actually logarithmic equations.

LITERATURE CITED

Benson, M.A. and T. Dalrymple. 1967. General field and office procedures for indirect discharge measurements. Chapter A1, Book 3, Techniques of Water-Resources Investigations of the United States Geological Survey. U.S. Government Printing Office. Washington, D.C. 30 p.

APPENDIX A
CROSS SECTION DATA

The data for all cross sections is in feet. A computer program was developed which accepts cross-sectional data values and generates a table of areas, wetted perimeters and top widths for given depth increments.

CROSS SECTION #1

POINT NO.	STATION	ELEVATION
1	0	102.03
2	108	97.72
3	149	83.34
4	233	82.5
5	308	84.13
6	320	84.22
7	333	73.99
8	334	71.82
9	334	72.53
10	338	70.1
11	344	69.79
12	352	70.22
13	361	70.26
14	368	70.62
15	374	71.68
16	375	74.09
17	397	76.79
18	480	77.12
19	490	85.62
20	509	88.27
21	602	84.26
22	731	85.29
23	831	85.24

ELEVATION	DEPTH	AREA	WETTED PER.	TOP WIDTH
69.79	0	0	0	0
70.5625	.7725	12.1332	29.8001	29.6433
71.335	1.545	37.8022	36.5174	36.0801
72.1075	2.3175	67.3939	41.0552	39.6144
72.88	3.09	98.6476	43.9784	40.9864
73.6525	3.8625	130.571	45.6654	41.6629
74.425	4.635	163.527	49.9642	45.2824
75.1975	5.4075	201.319	57.555	52.5585
75.97	6.18	244.73	65.1459	59.8346
76.7425	6.9525	293.763	72.7367	67.1108
77.515	7.725	392.847	157.986	151.944
78.2875	8.4975	510.954	160.428	153.835
79.06	9.27	630.521	162.87	155.725
79.8325	10.0425	751.549	165.312	157.616
80.605	10.815	874.038	167.754	159.506
81.3775	11.5875	997.986	170.196	161.397
82.15	12.36	1123.4	172.638	163.287
82.9225	13.1325	1263.3	236.777	226.868
83.695	13.905	1476.73	317.596	307.065
84.4675	14.6775	1733.29	384.798	373.659
85.24	15.45	2067.43	503.011	491.436

CROSS SECTION #2

POINT NO.	STATION	ELEVATION
1	0	100.92
2	154	101.2
3	313	99.49
4	478	99.85
5	498	86.3
6	525	84.06
7	537	83.14
8	542	80.79
9	543	79.05
10	543	80
11	551	78.46
12	558	78.8
13	567	79.34
14	575	79.37
15	582	79.37
16	587	79.99
17	594	81.08
18	597	80.48
19	600	81.52
20	649	82.71
21	671	89.19
22	780	90.41
23	940	90.61
24	1087	90.96
25	1249	90.87

ELEVATION	DEPTH	AREA	WETTED PER.	TOP WIDTH
78.46	0	0	0	0
79.0805	.6205	4.80949	15.0399	14.9159
79.701	1.241	22.8248	41.6813	40.4902
80.3215	1.8615	50.2534	48.7807	46.8596
80.942	2.482	81.5362	57.4776	55.0799
81.5625	3.1025	117.582	64.0521	61.3936
82.183	3.723	164.013	91.0684	88.2638
82.8035	4.3435	226.952	114.564	111.601
83.424	4.964	297.704	121.267	118.128
84.0445	5.5845	374.168	131.58	128.329
84.665	6.205	456.779	141.297	137.93
85.2855	6.8255	545.338	150.998	147.516
85.906	7.446	639.846	160.699	157.102
86.5265	8.0665	740.03	168.064	164.292
87.147	8.687	842.911	171.366	167.314
87.7675	9.3075	947.667	174.669	170.337
88.388	9.928	1054.3	177.971	173.359
89.0085	10.5485	1162.81	181.274	176.382
89.629	11.169	1281.47	222.247	217.136
90.2495	11.7895	1433.69	278.795	273.49
90.87	12.41	1683.21	563.442	557.945

CROSS SECTION #3

POINT NO.	STATION	ELEVATION
1	0	102.08
2	159	100.22
3	333	98.45
4	384	97.99
5	475	98.25
6	482	91.82
7	485	89.62
8	485	90.23
9	486	87.8
10	494	88.56
11	503	88.53
12	512	89.04
13	521	89.46
14	524	89.92
15	526	91.37
16	531	92.72
17	588	94.09
18	688	95.1
19	727	93.79
20	752	97.2
21	818	96.24
22	840	98.86
23	855	95.98
24	893	97.79
25	949	100.31
26	1043	99.45

ELEVATION	DEPTH	AREA	WETTED PER.	TOP WIDTH
87.8	0	0	0	0
88.3825	.5825	1.85564	6.78908	6.37129
88.965	1.165	12.0089	25.9646	25.1559
89.5475	1.7475	30.1558	37.5273	36.2898
90.13	2.33	52.5348	42.3451	39.944
90.7125	2.9125	76.2894	44.5307	41.5829
91.295	3.495	100.977	46.5081	43.1806
91.8775	4.0775	126.894	49.5556	45.9422
92.46	4.66	154.468	52.6513	48.7338
93.0425	5.2425	185.64	67.9316	63.7488
93.625	5.825	230.017	93.035	88.6183
94.2075	6.4075	292.51	140.408	135.723
94.79	6.99	394.845	220.607	215.643
95.3725	7.5725	538.952	265.707	260.469
95.955	8.155	692.104	270.878	265.374
96.5375	8.7375	855.599	313.695	307.838
97.12	9.32	1053.88	379.175	372.944
97.7025	9.9025	1280.47	406.387	399.819
98.285	10.485	1539.41	551.77	544.883
98.8675	11.0675	1880.6	631.978	624.987
99.45	11.65	2265.1	702.201	695.194

CROSS SECTION #3A

POINT NO.	STATION	ELEVATION
1	1043	99.45
2	1174	98.89
3	1320	98.14
4	1421	98.26
5	1488	96.86
6	1518	96.14
7	1547	94.13
8	1558	89.5
9	1560	87.27
10	1560	88.44
11	1570	86.87
12	1578	86.71
13	1585	87
14	1593	87.33
15	1601	87.13
16	1608	87.51
17	1618	88.33
18	1634	91.5
19	1681	94.63
20	1692	98.86
21	1841	98.47
22	1990	97.99
23	2184	96.9

ELEVATION	DEPTH	AREA	WETTED PER.	TOP WIDTH
86.71	0	0	0	0
87.2195	.5095	7.1945	27.819	27.776
87.729	1.019	27.7339	47.3208	46.5537
88.2385	1.5285	53.979	58.034	56.4693
88.748	2.038	84.3495	63.4894	61.4353
89.2575	2.5475	116.422	66.7954	64.4639
89.767	3.057	150.091	70.431	67.8873
90.2765	3.5665	185.643	74.3659	71.6694
90.786	4.076	223.122	78.3008	75.4515
91.2955	4.5855	262.528	82.2358	79.2336
91.805	5.095	304.325	89.1913	86.0561
92.3145	5.6045	350.428	98.1723	94.9172
92.824	6.114	401.045	107.153	103.778
93.3335	6.6235	456.178	116.134	112.639
93.843	7.133	515.825	125.115	121.501
94.3525	7.6425	580.285	136.74	133.043
94.862	8.152	651.558	148.931	145.165
95.3715	8.6615	727.73	157.72	153.84
95.881	9.171	808.322	166.508	162.516
96.3905	9.6805	894.189	182.114	178.016
96.9	10.19	990.638	205.016	200.817

CROSS SECTION #4

POINT NO.	STATION	ELEVATION
1	0	99.45
2	88	99.07
3	211	100.12
4	304	100.26
5	316	97.25
6	333	99.3
7	491	100.21
8	647	100.14
9	678	100.4
10	735	100.08
11	756	97.02
12	763	93.66
13	779	90.65
14	782	88.45
15	784	87.46
16	790	86.8
17	804	87.03
18	810	87.11
19	818	87.11
20	826	87.37
21	834	88.83
22	840	91.55
23	856	93.67
24	871	108.87
25	882	110.75

ELEVATION	DEPTH	AREA	WETTED PER.	TOP WIDTH
86.8	0	0	0	0
87.4325	.6325	15.3691	42.1395	42.0925
88.065	1.265	43.6131	47.2777	47.0304
88.6975	1.8975	74.8399	52.0871	51.6115
89.33	2.53	108.444	55.1057	54.3029
89.9625	3.1625	143.504	57.7071	56.5607
90.595	3.795	179.993	60.3086	58.8184
91.2275	4.4275	218.569	65.0571	63.3584
91.86	5.06	260.404	71.6193	69.7715
92.4925	5.6925	307.107	79.8557	77.9072
93.125	6.325	358.957	88.0922	86.0429
93.7575	6.9575	415.911	95.4833	93.2895
94.39	7.59	475.531	97.8336	95.2314
95.0225	8.2225	536.379	100.184	97.1732
95.655	8.855	598.455	102.534	99.1151
96.2875	9.4875	661.759	104.884	101.057
96.92	10.12	726.292	107.235	102.999
97.5525	10.7525	793.293	115.817	111.2
98.185	11.385	867.653	128.975	123.932
98.8175	12.0175	950.066	142.133	136.664
99.45	12.65	1067.57	312.6	306.709

CROSS SECTION #5

POINT NO.	STATION	ELEVATION
1	0	102.41
2	196	100.45
3	345	101.44
4	437	101.39
5	471	93.67
6	677	96.31
7	724	94.87
8	755	95.45
9	895	96.73
10	941	96.61
11	958	89.47
12	1045	86.26
13	1047	84.39
14	1054	83.9
15	1062	83.73
16	1072	83.41
17	1082	82.84
18	1089	82.56
19	1096	82.35
20	1102	83.14
21	1103	86.13
22	1120	92.49
23	1246	93.32
24	1396	93.47
25	1548	95.21

ELEVATION	DEPTH	AREA	WETTED PER.	TOP WIDTH
82.35	0	0	0	0
82.993	.643	7.5924	21.623	21.5678
83.636	1.286	26.1142	37.6659	37.2284
84.279	1.929	56.61	54.7122	53.7952
84.922	2.572	92.3524	57.7588	56.165
85.565	3.215	128.757	59.3783	57.0677
86.208	3.858	165.749	61.1381	58.1529
86.851	4.501	208.461	79.078	75.945
87.494	5.144	263.449	98.352	95.0908
88.137	5.787	330.748	117.626	114.237
88.78	6.43	410.357	136.9	133.382
89.423	7.073	502.278	156.174	152.528
90.066	7.716	602.118	160.823	156.94
90.709	8.359	704.075	164.318	160.189
91.352	9.002	808.121	167.814	163.439
91.995	9.645	914.258	171.31	166.689
92.638	10.288	1024.12	196.851	192.01
93.281	10.931	1179.45	296.125	291.153
93.924	11.574	1461.86	514.337	509.203
94.567	12.217	1824.87	625.253	619.909
95.21	12.86	2264.04	765.447	759.885

CROSS SECTION #6

POINT NO.	STATION	ELEVATION
1	0	99.73
2	28	98.32
3	89	98.33
4	139	97.22
5	158	95.62
6	238	95.56
7	252	94.76
8	266	95.83
9	282	97.29
10	298	96.27
11	323	97.55
12	340	96
13	356	90.64
14	360	92.19
15	365	88.65
16	375	87.41
17	397	84.56
18	398	81.34
19	398	83.44
20	406	81.63
21	415	82.15
22	420	82.18
23	426	81.98
24	433	82.65
25	438	87.34
26	569	89.77
27	583	92.33
28	708	93.59
29	861	96.43
30	1014	95.23

ELEVATION	DEPTH	AREA	WETTED PER.	TOP WIDTH
81.34	0	0	0	0
82.0345	.6945	1.9125	12.4753	11.2089
82.729	1.389	20.1351	34.9896	32.373
83.4235	2.0835	44.0161	40.5736	36.3987
84.118	2.778	69.6771	42.4073	37.4278
84.8125	3.4725	96.2388	45.8507	40.2546
85.507	4.167	126.314	52.2717	46.356
86.2015	4.8615	160.627	58.6927	52.4575
86.896	5.556	199.178	65.1137	58.5589
87.5905	6.2505	243.629	84.737	77.96
88.285	6.945	312.718	127.827	121.001
88.9795	7.6395	411.338	168.81	161.85
89.674	8.334	537.085	207.459	200.271
90.3685	9.0285	680.839	217.164	209.7
91.063	9.723	828.633	224.729	216.834
91.7575	10.4175	982.226	233.901	225.478
92.452	11.112	1142.38	253.319	244.512
93.1465	11.8065	1336.84	324.408	315.484
93.841	12.501	1579.16	384.119	375.077
94.5355	13.1955	1853.37	423.727	414.566
95.23	13.89	2158.37	477.74	468.428

CROSS SECTION #7

POINT NO.	STATION	ELEVATION
1	0	100.9
2	90	102.09
3	165	101.92
4	189	99.59
5	275	98.73
6	285	99.92
7	293	99.01
8	309	99.58
9	331	93
10	398	91.61
11	403	89.95
12	411	88.24
13	415	87.7
14	419	87.76
15	419	89.09
16	426	90.33
17	461	92.87
18	480	93.15
19	490	90.62
20	495	87.72
21	495	88.04
22	502	86.65
23	509	87.06
24	515	87.17
25	524	87.26
26	526	92.48
27	534	96.33
28	547	95.22
29	613	99.25
30	699	99.4
31	718	97.51
32	737	101.06
33	880	101.88
34	1033	100

ELEVATION	DEPTH	AREA	WETTED PER.	TOP WIDTH
86.65	0	0	0	0
87.3175	.6675	6.49754	25.5022	25.3835
87.985	1.335	26.0297	36.793	35.5688
88.6525	2.0025	51.8366	43.7226	41.0711
89.32	2.67	80.9126	50.7173	46.8989
89.9875	3.3375	114.986	59.7223	55.134
90.655	4.005	154.617	70.4126	65.0409
91.3225	4.6725	202.738	85.1894	79.1434
91.99	5.34	263.536	117.081	110.418
92.6575	6.0075	352.04	162.14	154.985
93.325	6.675	472.773	205.271	197.842
93.9925	7.3425	606.041	209.14	201.461
94.66	8.01	741.724	213.009	205.08
95.3275	8.6775	879.985	219.905	211.718
95.995	9.345	1028.77	242.572	234.086
96.6625	10.0125	1191.73	260.564	251.87
97.33	10.68	1364.24	273.845	265.033
97.9975	11.3475	1547.38	294.706	285.707
98.665	12.015	1745.91	318.365	309.153
99.3325	12.6825	1983.58	465.235	455.749
100.	13.35	2336.69	556.231	546.55

CROSS SECTION #8

POINT NO.	STATION	ELEVATION
1	0	102.51
2	169	100.21
3	354	98.09
4	389	97.65
5	411	100.85
6	427	98.72
7	490	98.75
8	506	91.64
9	582	89.25
10	589	87.98
11	590	87.58
12	591	88.99
13	592	88.05
14	596	88.64
15	597	87.4
16	597	88.57
17	605	86.56
18	613	86.44
19	619	86.35
20	625	86.68
21	630	87.04
22	630	89.37
23	646	90.83
24	681	91.28
25	690	89.25
26	700	93.14
27	748	97.11
28	832	96.41
29	858	94.79
30	900	94.06
31	912	95.74
32	972	98.05
33	1030	96.52
34	1090	95.39
35	1107	90.72
36	1124	94.63
37	1136	96.54
38	1152	99.06

ELEVATION	DEPTH	AREA	WETTED PER.	TOP WIDTH
86.35	0	0	0	0
86.9855	.6355	11.2584	26.0109	25.9366
87.621	1.271	29.0276	30.6243	29.5327
88.2565	1.9065	49.6926	40.3309	37.0664
88.892	2.542	76.6077	50.9542	45.853
89.5275	3.1775	108.38	66.2893	60.494
90.163	3.813	156.872	98.1422	92.1179
90.7985	4.4485	225.486	130.642	124.369
91.434	5.084	327.398	195.385	188.767
92.0695	5.7195	453.187	209.984	202.995
92.705	6.355	584.777	218.536	211.135
93.3405	6.9905	721.731	228.967	221.184
93.976	7.626	866.802	243.477	235.374
94.6115	8.2615	1030.73	293.698	285.233
95.247	8.897	1225.6	331.584	322.761
95.8825	9.5325	1446.48	389.075	379.961
96.518	10.168	1711.93	474.104	464.743
97.1535	10.8035	2048.48	598.625	589.032
97.789	11.439	2438.28	656.916	647.107
98.4245	12.0745	2877.55	736.799	726.747
99.06	12.71	3380.95	867.137	856.894

APPENDIX B

REGRESSION ANALYSIS ON CROSS SECTION VARIABLES

The regression analysis was run using a statistical package called MINITAB. To obtain the relationships in this report, logarithms to the base ten were taken of the data because the linear equations developed are logarithmic. As an example:

$$A = aD^b$$

Taking logs: $\log A = \log a + b \log D$

In the regression equations shown on the following pages for each cross section, $C5 = \log D$; $C6 = \log A$; $C7 = \log WP$; and $C8 = \log T$ where D , A , WP and T were defined in the report. For cross section #1 (page 27), the regression equation is given as:

$$C6 = 1.18 + 1.69 C5$$

Therefore, $\log a = 1.18$ and $b = 1.69$. $10^{1.18} = a = 15.14$. So: $A = 15.14 D^{1.69}$ for cross section #1 with a standard error of estimate (s - page 27) of 0.03089 (note: logarithmic s value) and an R-squared of 93.9 percent.

Since it was easy to run other regressions once the data was input, the same relationships were run for straight linear equations of the form:

$$A = a_1 + b_1 D$$

In the regression equations shown on the following pages for each cross section, C1 = D, C2 = A, C3 = WP and C4 = T. For cross section #1 (linear - page 28), the regression equation is given as:

$$C2 = -380 + 127 C1$$

The standard error of estimate (s - page 28) is 198.6 and R-squared was 89.5 percent.

Hopefully this extra set of data will be of some help in making a comparison of the relationships.

THE REGRESSION EQUATION IS
 $C6 = 1.18 + 1.69 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.17505	0.04527	25.96
C5	1.68903	0.05159	32.74

$S = 0.07937$

R-SQUARED = 98.3 PERCENT
 R-SQUARED = 98.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	6.7526	6.7526
RESIDUAL	18	0.1134	0.0063
TOTAL	19	6.8660	

MTB >REGR C6 ON 1 IN C7

THE REGRESSION EQUATION IS
 $C6 = -0.579 + 1.53 C7$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-0.5790	0.2716	-2.13
C7	1.5290	0.1312	11.66

$S = 0.2112$

R-SQUARED = 88.3 PERCENT
 R-SQUARED = 87.7 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	6.0629	6.0629
RESIDUAL	18	0.8031	0.0446
TOTAL	19	6.8660	

MTB >REGR C8 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C8 = 1.26 + 0.938 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.2589	0.1007	12.51
C5	0.9385	0.1147	8.18

$S = 0.1765$

R-SQUARED = 78.8 PERCENT
 R-SQUARED = 77.6 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	2.0848	2.0848
RESIDUAL	18	0.5608	0.0312
TOTAL	19	2.6456	

MTB >REGR C7 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C7 = 1.28 + 0.942 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.27836	0.09432	13.55
C5	0.9421	0.1075	8.76

$S = 0.1654$

R-SQUARED = 81.0 PERCENT
 R-SQUARED = 80.0 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	2.1010	2.1010
RESIDUAL	18	0.4923	0.0274
TOTAL	19	2.5933	

MTB >REGR C2 ON 1 IN C1

THE REGRESSION EQUATION IS
C2 = - 380 + 127 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-380.28	92.28	-4.12
C1	127.462	9.971	12.78

S = 198.6

R-SQUARED = 90.1 PERCENT
R-SQUARED = 89.5 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	6447290	6447290
RESIDUAL	18	710249	39458
TOTAL	19	7157539	

MTB >REGR C2 ON 1 IN C3

THE REGRESSION EQUATION IS
C2 = - 52.7 + 4.64 C3

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-52.68	57.01	-0.92
C3	4.6438	0.2900	16.01

S = 161.5

R-SQUARED = 93.4 PERCENT
R-SQUARED = 93.1 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	6688018	6688018
RESIDUAL	18	469521	26084
TOTAL	19	7157539	

MTB >REGR C4 ON 1 IN C1

THE REGRESSION EQUATION IS
C4 = - 50.3 + 24.2 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-50.27	27.76	-1.81
C1	24.167	3.000	8.06

S = 59.76

R-SQUARED = 78.3 PERCENT
R-SQUARED = 77.1 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	231765	231765
RESIDUAL	18	64292	3572
TOTAL	19	296056	

MTB >REGR C3 ON 1 IN C1

THE REGRESSION EQUATION IS
C3 = - 49.9 + 24.9 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-49.94	27.69	-1.80
C1	24.907	2.992	8.32

S = 59.60

R-SQUARED = 79.4 PERCENT
R-SQUARED = 78.2 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	246186	246186
RESIDUAL	18	63945	3553
TOTAL	19	310131	

THE REGRESSION EQUATION IS
 $C6 = 1.14 + 1.90 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.14419	0.01260	90.78
C5	1.89666	0.01594	119.01

S = 0.02452

R-SQUARED = 99.9 PERCENT
 R-SQUARED = 99.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	8.5148	8.5148
RESIDUAL	18	0.0108	0.0006
TOTAL	19	8.5256	

MTB >REGR C6 ON 1 IN C7

THE REGRESSION EQUATION IS
 $C6 = -1.46 + 1.90 C7$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-1.4637	0.2539	-5.76
C7	1.9049	0.1207	15.79

S = 0.1786

R-SQUARED = 93.3 PERCENT
 R-SQUARED = 92.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	7.9513	7.9513
RESIDUAL	18	0.5743	0.0319
TOTAL	19	8.5256	

MTB >REGR C8 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C8 = 1.41 + 0.929 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.40534	0.04903	28.67
C5	0.92895	0.06199	14.98

S = 0.09538

R-SQUARED = 92.6 PERCENT
 R-SQUARED = 92.2 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	2.0426	2.0426
RESIDUAL	18	0.1637	0.0091
TOTAL	19	2.2063	

MTB >REGR C7 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C7 = 1.42 + 0.927 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.41829	0.04833	29.35
C5	0.92658	0.06112	15.16

S = 0.09403

R-SQUARED = 92.7 PERCENT
 R-SQUARED = 92.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	2.0322	2.0322
RESIDUAL	18	0.1591	0.0088
TOTAL	19	2.1913	

MTB >REGR C2 ON 1 IN C1

THE REGRESSION EQUATION IS
C2 = - 287 + 137 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-287.01	52.29	-5.49
C1	137.125	7.035	19.49

S = 112.6

R-SQUARED = 95.5 PERCENT
R-SQUARED = 95.2 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	4814392	4814392
RESIDUAL	18	228061	12670
TOTAL	19	5042453	

MTB >REGR C2 ON 1 IN C3

THE REGRESSION EQUATION IS
C2 = 14.7 + 3.85 C3

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	14.66	98.29	0.15
C3	3.8470	0.5141	7.48

S = 261.1

R-SQUARED = 75.7 PERCENT
R-SQUARED = 74.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	3815758	3815758
RESIDUAL	18	1226695	68150
TOTAL	19	5042453	

MTB >REGR C4 ON 1 IN C1

THE REGRESSION EQUATION IS
C4 = - 16.2 + 25.6 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-16.16	32.06	-0.50
C1	25.563	4.313	5.93

S = 69.01

R-SQUARED = 66.1 PERCENT
R-SQUARED = 64.2 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	167319	167319
RESIDUAL	18	85726	4763
TOTAL	19	253045	

MTB >REGR C3 ON 1 IN C1

THE REGRESSION EQUATION IS
C3 = - 15.1 + 25.9 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-15.10	32.06	-0.47
C1	25.926	4.313	6.01

S = 69.01

R-SQUARED = 66.8 PERCENT
R-SQUARED = 64.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	172103	172103
RESIDUAL	18	85725	4762
TOTAL	19	257827	

THE REGRESSION EQUATION IS
C6 = 0.820 + 2.23 C5

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	0.81998	0.05251	15.62
C5	2.22546	0.06854	32.47

S = 0.1054

R-SQUARED = 98.3 PERCENT
R-SQUARED = 98.2 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	11.723	11.723
RESIDUAL	18	0.200	0.011
TOTAL	19	11.923	

MTB >REGR C6 ON 1 IN C7

THE REGRESSION EQUATION IS
C6 = - 0.557 + 1.40 C7

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-0.5573	0.1724	-3.23
C7	1.40127	0.08065	17.37

S = 0.1931

R-SQUARED = 94.4 PERCENT
R-SQUARED = 94.1 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	11.252	11.252
RESIDUAL	18	0.671	0.037
TOTAL	19	11.923	

MTB >REGR C8 ON 1 IN C5

THE REGRESSION EQUATION IS
C8 = 1.03 + 1.49 C5

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.03443	0.09591	10.79
C5	1.4882	0.1252	11.89

S = 0.1926

R-SQUARED = 88.7 PERCENT
R-SQUARED = 88.1 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	5.2419	5.2419
RESIDUAL	18	0.6676	0.0371
TOTAL	19	5.9095	

MTB >REGR C7 ON 1 IN C5

THE REGRESSION EQUATION IS
C7 = 1.06 + 1.47 C5

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.06328	0.09173	11.59
C5	1.4707	0.1197	12.28

S = 0.1842

R-SQUARED = 89.3 PERCENT
R-SQUARED = 88.8 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	5.1197	5.1197
RESIDUAL	18	0.6107	0.0339
TOTAL	19	5.7305	

MTB >REGR C2 ON 1 IN C1

THE REGRESSION EQUATION IS
C2 = - 497 + 177 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-497.2	140.7	-3.53
C1	177.46	20.17	8.80

S = 302.9

R-SQUARED = 81.1 PERCENT
R-SQUARED = 80.1 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	7105933	7105933
RESIDUAL	18	1651658	91759
TOTAL	19	8757591	

MTB >REGR C2 ON 1 IN C3

THE REGRESSION EQUATION IS
C2 = - 85.0 + 3.10 C3

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-85.01	30.24	-2.81
C3	3.09555	0.09960	31.08

S = 94.34

R-SQUARED = 98.2 PERCENT
R-SQUARED = 98.1 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	8597397	8597397
RESIDUAL	18	160194	8900
TOTAL	19	8757591	

MTB >REGR C4 ON 1 IN C1

THE REGRESSION EQUATION IS
C4 = - 140 + 57.7 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-139.90	39.65	-3.53
C1	57.719	5.682	10.16

S = 85.36

R-SQUARED = 85.1 PERCENT
R-SQUARED = 84.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	751713	751713
RESIDUAL	18	131146	7286
TOTAL	19	882860	

MTB >REGR C3 ON 1 IN C1

THE REGRESSION EQUATION IS
C3 = - 139 + 58.3 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-139.10	39.52	-3.52
C1	58.300	5.664	10.29

S = 85.08

R-SQUARED = 85.5 PERCENT
R-SQUARED = 84.7 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	766926	766926
RESIDUAL	18	130280	7238
TOTAL	19	897206	

THE REGRESSION EQUATION IS
 $C6 = 1.40 + 1.56 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.39704	0.01435	97.36
C5	1.56385	0.02008	77.89

S = 0.03089

R-SQUARED = 99.7 PERCENT
 R-SQUARED = 99.7 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	5.7888	5.7888
RESIDUAL	18	0.0172	0.0010
TOTAL	19	5.8060	

MTB >REGR C6 ON 1 IN C7

THE REGRESSION EQUATION IS
 $C6 = -2.48 + 2.46 C7$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-2.4826	0.2841	-8.74
C7	2.4620	0.1431	17.20

S = 0.1360

R-SQUARED = 94.3 PERCENT
 R-SQUARED = 93.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	5.4730	5.4730
RESIDUAL	18	0.3330	0.0185
TOTAL	19	5.8060	

MTB >REGR C8 ON 1 IN C65

THE REGRESSION EQUATION IS
 $C8 = 1.59 + 0.594 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.58949	0.02756	57.67
C5	0.59356	0.03856	15.39

S = 0.05933

R-SQUARED = 92.9 PERCENT
 R-SQUARED = 92.5 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	0.83392	0.83392
RESIDUAL	18	0.06336	0.00352
TOTAL	19	0.89729	

MTB >REGR C7 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C7 = 1.60 + 0.598 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.59931	0.02628	60.85
C5	0.59758	0.03678	16.25

S = 0.05658

R-SQUARED = 93.6 PERCENT
 R-SQUARED = 93.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	0.84526	0.84526
RESIDUAL	18	0.05762	0.00320
TOTAL	19	0.90289	

MTB >REGR C2 ON 1 IN C1

THE REGRESSION EQUATION IS
C2 = - 138 + 98.6 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-137.72	27.52	-5.00
C1	98.564	4.509	21.86

S = 59.25

R-SQUARED = 96.4 PERCENT
R-SQUARED = 96.2 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	1677067	1677067
RESIDUAL	18	63187	3510
TOTAL	19	1740254	

MTB >REGR C2 ON 1 IN C3

THE REGRESSION EQUATION IS
C2 = - 265 + 6.23 C3

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-265.35	17.65	-15.04
C3	6.2327	0.1533	40.67

S = 32.26

R-SQUARED = 98.9 PERCENT
R-SQUARED = 98.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	1721517	1721517
RESIDUAL	18	18737	1041
TOTAL	19	1740254	

MTB >REGR C4 ON 1 IN C1

THE REGRESSION EQUATION IS
C4 = 20.0 + 15.4 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	20.009	4.683	4.27
C1	15.3563	0.7673	20.01

S = 10.08

R-SQUARED = 95.7 PERCENT
R-SQUARED = 95.5 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	40708	40708
RESIDUAL	18	1830	102
TOTAL	19	42538	

MTB >REGR C3 ON 1 IN C1

THE REGRESSION EQUATION IS
C3 = 21.1 + 15.7 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	21.089	4.602	4.58
C1	15.6998	0.7539	20.82

S = 9.906

R-SQUARED = 96.0 PERCENT
R-SQUARED = 95.8 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	42550	42550
RESIDUAL	18	1766	98
TOTAL	19	44316	

MTB >REGR C6 ON 1 IN C5

THE REGRESSION EQUATION IS
C6 = 1.47 + 1.38 C5

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.46805	0.00942	155.80
C5	1.38213	0.01180	117.09

S = 0.01816

R-SQUARED = 99.9 PERCENT
R-SQUARED = 99.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	4.5216	4.5216
RESIDUAL	18	0.0059	0.0003
TOTAL	19	4.5276	

MTB >REGR C6 ON 1 IN C7

THE REGRESSION EQUATION IS
C6 = - 1.64 + 2.12 C7

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-1.6354	0.5455	-3.00
C7	2.1201	0.2807	7.55

S = 0.2456

R-SQUARED = 76.0 PERCENT
R-SQUARED = 74.7 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	3.4415	3.4415
RESIDUAL	18	1.0861	0.0603
TOTAL	19	4.5276	

MTB >REGR C8 ON 1 IN C5

THE REGRESSION EQUATION IS
C8 = 1.58 + 0.477 C5

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.57884	0.05531	28.55
C5	0.47701	0.06928	6.89

S = 0.1066

R-SQUARED = 72.5 PERCENT
R-SQUARED = 71.0 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	0.53859	0.53859
RESIDUAL	18	0.20451	0.01136
TOTAL	19	0.74310	

MTB >REGR C7 ON 1 IN C5

THE REGRESSION EQUATION IS
C7 = 1.58 + 0.490 C5

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.58078	0.05446	29.03
C5	0.48961	0.06822	7.18

S = 0.1050

R-SQUARED = 74.1 PERCENT
R-SQUARED = 72.7 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	0.56742	0.56742
RESIDUAL	18	0.19827	0.01101
TOTAL	19	0.76569	

MTB >REGR C2 ON 1 IN C1

THE REGRESSION EQUATION IS
C2 = - 125 + 85.0 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-124.64	23.62	-5.28
C1	85.048	3.117	27.28

S = 50.84

R-SQUARED = 97.6 PERCENT
R-SQUARED = 97.5 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	1924298	1924298
RESIDUAL	18	46530	2585
TOTAL	19	1970827	

MTB >REGR C2 ON 1 IN C3

THE REGRESSION EQUATION IS
C2 = - 0.0 + 4.57 C3

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-0.01	82.42	-0.00
C3	4.5689	0.7373	6.20

S = 186.9

R-SQUARED = 68.1 PERCENT
R-SQUARED = 66.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	1341867	1341867
RESIDUAL	18	628960	34942
TOTAL	19	1970827	

MTB >REGR C4 ON 1 IN C1

THE REGRESSION EQUATION IS
C4 = 17.1 + 11.5 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	17.06	17.56	0.97
C1	11.547	2.317	4.98

S = 37.80

R-SQUARED = 58.0 PERCENT
R-SQUARED = 55.6 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	35470	35470
RESIDUAL	18	25715	1429
TOTAL	19	61186	

MTB >REGR C3 ON 1 IN C1

THE REGRESSION EQUATION IS
C3 = 16.6 + 12.0 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	16.56	17.62	0.94
C1	12.014	2.325	5.17

S = 37.92

R-SQUARED = 59.7 PERCENT
R-SQUARED = 57.5 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	38398	38398
RESIDUAL	18	25884	1438
TOTAL	19	64281	

MTB >REGR C6 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C6 = 1.19 + 1.82 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.19130	0.02892	41.19
C5	1.81790	0.03594	50.58

S = 0.05530

R-SQUARED = 99.3 PERCENT
 R-SQUARED = 99.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	7.8223	7.8223
RESIDUAL	18	0.0550	0.0031
TOTAL	19	7.8774	

MTB >REGR C6 ON 1 IN C7

THE REGRESSION EQUATION IS
 $C6 = -0.675 + 1.51 C7$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-0.6748	0.2722	-2.48
C7	1.5077	0.1265	11.92

S = 0.2219

R-SQUARED = 88.7 PERCENT
 R-SQUARED = 88.1 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	6.9911	6.9911
RESIDUAL	18	0.8862	0.0492
TOTAL	19	7.8774	

MTB >REGR C8 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C8 = 1.35 + 1.04 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.34643	0.08965	15.02
C5	1.0423	0.1114	9.36

S = 0.1714

R-SQUARED = 82.9 PERCENT
 R-SQUARED = 82.0 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	2.5713	2.5713
RESIDUAL	18	0.5287	0.0294
TOTAL	19	3.1000	

MTB >REGR C7 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C7 = 1.36 + 1.04 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.35614	0.08723	15.55
C5	1.0430	0.1084	9.62

S = 0.1668

R-SQUARED = 83.7 PERCENT
 R-SQUARED = 82.8 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	2.5751	2.5751
RESIDUAL	18	0.5006	0.0278
TOTAL	19	3.0756	

MTB >REGR C2 ON 1 IN C1

THE REGRESSION EQUATION IS
C2 = - 398 + 155 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-397.7	112.5	-3.53
C1	155.00	14.61	10.61

S = 242.2

R-SQUARED = 86.2 PERCENT
R-SQUARED = 85.5 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	6605547	6605547
RESIDUAL	18	1056066	58670
TOTAL	19	7661613	

MTB >REGR C2 ON 1 IN C3

THE REGRESSION EQUATION IS
C2 = 57.6 + 3.00 C3

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	57.65	55.77	1.03
C3	2.9986	0.1993	15.05

S = 177.0

R-SQUARED = 92.6 PERCENT
R-SQUARED = 92.2 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	7097383	7097383
RESIDUAL	18	564230	31346
TOTAL	19	7661613	

MTB >REGR C4 ON 1 IN C1

THE REGRESSION EQUATION IS
C4 = - 101 + 43.7 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-101.27	55.33	-1.83
C1	43.693	7.183	6.08

S = 119.1

R-SQUARED = 67.3 PERCENT
R-SQUARED = 65.5 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	524893	524893
RESIDUAL	18	255370	14187
TOTAL	19	780263	

MTB >REGR C3 ON 1 IN C1

THE REGRESSION EQUATION IS
C3 = - 101 + 44.1 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-100.64	55.24	-1.82
C1	44.105	7.171	6.15

S = 118.9

R-SQUARED = 67.8 PERCENT
R-SQUARED = 66.0 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	534840	534840
RESIDUAL	18	254502	14139
TOTAL	19	789342	

MTB >REGR C6 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C6 = 0.799 + 2.14 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	0.79877	0.05275	15.14
C5	2.14466	0.06317	33.95

S = 0.09718

R-SQUARED = 98.5 PERCENT
R-SQUARED = 98.4 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	10.887	10.887
RESIDUAL	18	0.170	0.009
TOTAL	19	11.057	

MTB >REGR C6 ON 1 IN C7

THE REGRESSION EQUATION IS
 $C6 = -1.02 + 1.67 C7$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-1.0247	0.2231	-4.59
C7	1.6742	0.1059	15.82

S = 0.2031

R-SQUARED = 93.3 PERCENT
R-SQUARED = 92.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	10.315	10.315
RESIDUAL	18	0.742	0.041
TOTAL	19	11.057	

MTB >REGR C8 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C8 = 1.10 + 1.23 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.10009	0.07853	14.01
C5	1.22845	0.09404	13.06

S = 0.1447

R-SQUARED = 90.5 PERCENT
R-SQUARED = 89.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	3.5720	3.5720
RESIDUAL	18	0.3768	0.0209
TOTAL	19	3.9488	

MTB >REGR C7 ON 1 IN C5

THE REGRESSION EQUATION IS
 $C7 = 1.16 + 1.19 C5$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.15781	0.07280	15.90
C5	1.19080	0.08717	13.66

S = 0.1341

R-SQUARED = 91.2 PERCENT
R-SQUARED = 90.7 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	3.3564	3.3564
RESIDUAL	18	0.3238	0.0180
TOTAL	19	3.6801	

MTB >REGR C2 ON 1 INCC1

THE REGRESSION EQUATION IS
C2 = - 457 + 150 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-457.4	113.8	-4.02
C1	150.39	13.68	10.99

S = 245.0

R-SQUARED = 87.0 PERCENT
R-SQUARED = 86.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	7254346	7254346
RESIDUAL	18	1080345	60019
TOTAL	19	8334691	

MTB >REGR C2 ON 1 IN C3

THE REGRESSION EQUATION IS
C2 = - 161 + 4.60 C3

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-161.10	39.19	-4.11
C3	4.5992	0.1762	26.10

S = 109.2

R-SQUARED = 97.4 PERCENT
R-SQUARED = 97.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	8120166	8120166
RESIDUAL	18	214525	11918
TOTAL	19	8334691	

MTB >REGR C4 ON 1 IN C1

THE REGRESSION EQUATION IS
C4 = - 69.9 + 32.5 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-69.95	20.37	-3.43
C1	32.535	2.448	13.29

S = 43.85

R-SQUARED = 90.7 PERCENT
R-SQUARED = 90.2 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	339529	339529
RESIDUAL	18	34612	1923
TOTAL	19	374141	

MTB >REGR C3 ON 1 INCC1

THE REGRESSION EQUATION IS
C3 = - 66.9 + 33.0 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-66.90	20.13	-3.32
C1	33.037	2.419	13.66

S = 43.33

R-SQUARED = 91.2 PERCENT
R-SQUARED = 90.7 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	350090	350090
RESIDUAL	18	33792	1877
TOTAL	19	383882	

MTB > MTB > REGR C6 ON 1 IN C5

THE REGRESSION EQUATION IS

$$C6 = 1.09 + 1.96 C5$$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.09169	0.03018	36.18
C5	1.95859	0.03683	53.19

$$S = 0.05666$$

R-SQUARED = 99.4 PERCENT

R-SQUARED = 99.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	9.0800	9.0800
RESIDUAL	18	0.0578	0.0032
TOTAL	19	9.1377	

MTB > REGR C6 ON 1 IN C7

THE REGRESSION EQUATION IS

$$C6 = -1.23 + 1.76 C7$$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-1.2320	0.2043	-6.03
C7	1.75516	0.09346	18.78

$$S = 0.1570$$

R-SQUARED = 95.1 PERCENT

R-SQUARED = 94.9 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	8.6940	8.6940
RESIDUAL	18	0.4437	0.0246
TOTAL	19	9.1377	

MTB > REGR C8 ON 1 IN C5

THE REGRESSION EQUATION IS

$$C8 = 1.35 + 1.06 C5$$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.34838	0.06116	22.05
C5	1.05770	0.07464	14.17

$$S = 0.1148$$

R-SQUARED = 91.8 PERCENT

R-SQUARED = 91.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	2.6480	2.6480
RESIDUAL	18	0.2373	0.0132
TOTAL	19	2.8854	

MTB > REGR C7 ON 1 IN C5

THE REGRESSION EQUATION IS

$$C7 = 1.37 + 1.05 C5$$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.37139	0.05646	24.29
C5	1.05208	0.06890	15.27

$$S = 0.1060$$

R-SQUARED = 92.8 PERCENT

R-SQUARED = 92.4 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	2.6200	2.6200
RESIDUAL	18	0.2022	0.0112
TOTAL	19	2.8222	

MTB >REGR C2 ON 1 IN C1

THE REGRESSION EQUATION IS
C2 = - 468 + 175 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
C1	-468.21	99.83	-4.69
	174.90	12.48	14.01

S = 214.9

R-SQUARED = 91.6 PERCENT
R-SQUARED = 91.1 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	9063424	9063424
RESIDUAL	18	831327	46185
TOTAL	19	9894751	

MTB >REGR C2 ON 1 IN C3

THE REGRESSION EQUATION IS
C2 = - 193 + 4.86 C3

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
C3	-192.87	70.15	-2.75
	4.8616	0.2916	16.67

S = 182.8

R-SQUARED = 93.9 PERCENT
R-SQUARED = 93.6 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	9293096	9293096
RESIDUAL	18	601655	33425
TOTAL	19	9894751	

MTB >REGR C4 ON 1 IN C1

THE REGRESSION EQUATION IS
C4 = - 47.2 + 33.7 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
C1	-47.21	23.07	-2.05
	33.687	2.885	11.68

S = 49.66

R-SQUARED = 88.3 PERCENT
R-SQUARED = 87.7 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	336236	336236
RESIDUAL	18	44398	2467
TOTAL	19	380634	

MTB >REGR C3 ON 1 IN C1

THE REGRESSION EQUATION IS
C3 = - 45.3 + 34.4 C1

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
C1	-45.27	22.84	-1.98
	34.353	2.857	12.03

S = 49.17

R-SQUARED = 88.9 PERCENT
R-SQUARED = 88.3 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	349668	349668
RESIDUAL	18	43523	2418
TOTAL	19	393191	

MTB >REGR C6 ON 1 IN C5

THE REGRESSION EQUATION IS
C6 = 1.19 + 1.99 C5

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.18907	0.05525	21.52
C5	1.99423	0.06904	28.88

S = 0.1062

R-SQUARED = 97.9 PERCENT
R-SQUARED = 97.8 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	9.4134	9.4134
RESIDUAL	18	0.2031	0.0113
TOTAL	19	9.6165	

MTB >REGR C6 ON 1 IN C7

THE REGRESSION EQUATION IS
C6 = - 0.791 + 1.50 C7

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-0.7906	0.1207	-6.55
C7	1.50355	0.05202	28.91

S = 0.1061

R-SQUARED = 97.9 PERCENT
R-SQUARED = 97.8 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	9.4137	9.4137
RESIDUAL	18	0.2028	0.0113
TOTAL	19	9.6165	

MTB >REGR C8 ON 1 IN C5

THE REGRESSION EQUATION IS
C8 = 1.32 + 1.29 C5

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.32281	0.06960	19.01
C5	1.29496	0.08698	14.89

S = 0.1338

R-SQUARED = 92.5 PERCENT
R-SQUARED = 92.1 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	3.9692	3.9692
RESIDUAL	18	0.3223	0.0179
TOTAL	19	4.2915	

MTB >REGR C7 ON 1 IN C5

THE REGRESSION EQUATION IS
C7 = 1.35 + 1.28 C5

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	1.34894	0.06440	20.95
C5	1.28166	0.08048	15.93

S = 0.1238

R-SQUARED = 93.4 PERCENT
R-SQUARED = 93.0 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	3.8882	3.8882
RESIDUAL	18	0.2760	0.0153
TOTAL	19	4.1641	

MTB >REGR C2 ON 1 IN C1

THE REGRESSION EQUATION IS
 $C2 = -709 + 254 C1$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-709.2	174.2	-4.07
C1	254.44	22.89	11.12

S = 375.1

R-SQUARED = 87.3 PERCENT
R-SQUARED = 86.6 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	17386380	17386380
RESIDUAL	18	2531949	140664
TOTAL	19	19918329	

MTB >REGR C2 ON 1 IN C3

THE REGRESSION EQUATION IS
 $C2 = -202 + 4.05 C3$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-202.37	39.67	-5.10
C3	4.0458	0.1035	39.08

S = 113.5

R-SQUARED = 98.8 PERCENT
R-SQUARED = 98.8 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	19686266	19686266
RESIDUAL	18	232063	12892
TOTAL	19	19918329	

MTB >REGR C4 ON 1 IN C1

THE REGRESSION EQUATION IS
 $C4 = -130 + 62.6 C1$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-130.02	39.49	-3.29
C1	62.550	5.187	12.06

S = 85.00

R-SQUARED = 89.0 PERCENT
R-SQUARED = 88.4 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	1050776	1050776
RESIDUAL	18	130049	7225
TOTAL	19	1180825	

MTB >REGR C3 ON 1 IN C1

THE REGRESSION EQUATION IS
 $C3 = -128 + 63.3 C1$

COLUMN	COEFFICIENT	ST. DEV. OF COEF.	T-RATIO = COEF/S.D.
	-127.75	39.17	-3.26
C1	63.260	5.145	12.30

S = 84.31

R-SQUARED = 89.4 PERCENT
R-SQUARED = 88.8 PERCENT, ADJUSTED FOR D.F.

ANALYSIS OF VARIANCE

DUE TO	DF	SS	MS=SS/DF
REGRESSION	1	1074759	1074759
RESIDUAL	18	127952	7108
TOTAL	19	1202711	