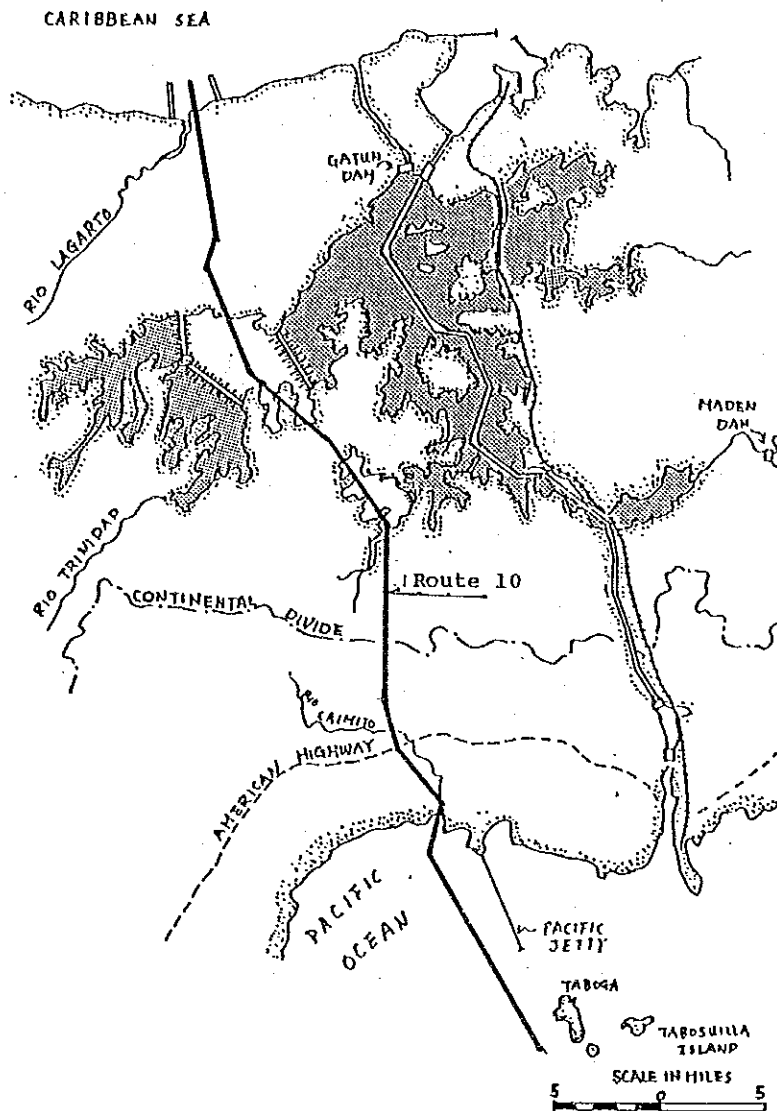


L-18

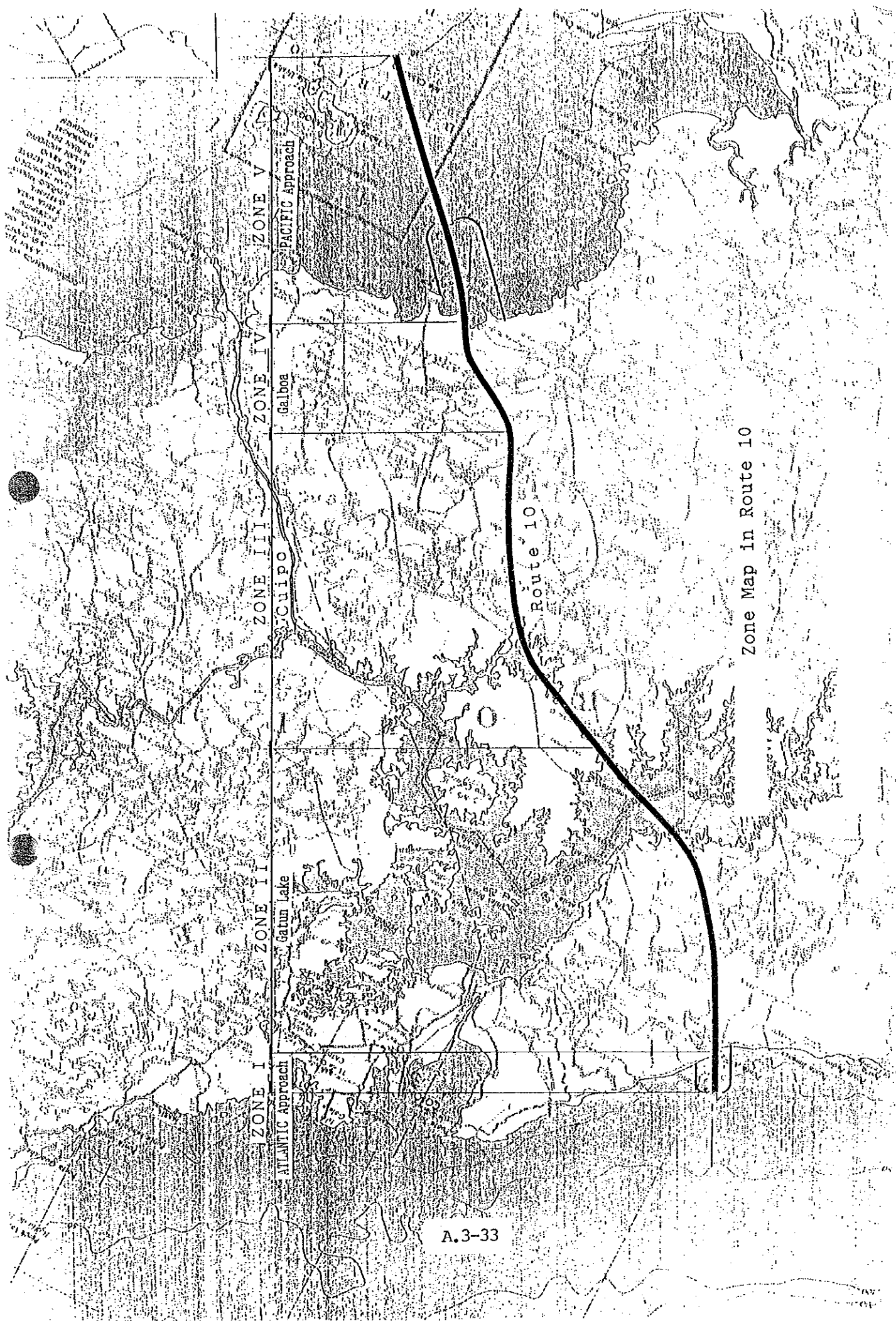
L-18 Calculation Table of Excavation Volume

Station No.	Dis (e)	Hard Rock					Soft Rock					Earth					Mad		
		As	Vo	Wet A1	Wet V1	Dry V2	As	Vo	Wet A1	Wet V1	Dry V2	As	Vo	Wet A1	Wet V1	Dry V2	As	Vo	
-11.50	8,500	0	9,222,500	0	9,222,500	0	10,710,000	0	10,710,000	0	0	4,080,000	0	4,080,000	0	0	4,080,000	0	4,080,000
-3.00	4,000	2,170	11,620,000	2,170	11,820,000	2,520	11,040,000	2,520	11,040,000	0	960	3,920,000	960	3,920,000	0	960	3,920,000	0	3,920,000
1.00	0	3,640	0	3,640	0	3,000	0	3,000	0	0	1,000	0	1,000	0	1,000	0	1,000	0	1,000
Sum 1	12,500		20,842,500		20,842,500	0	21,750,000		21,750,000	0		8,000,000		8,000,000	0		8,000,000		8,000,000
1.00	50	3,640	292,000	3,640	114,750	3,000	150,000	360	22,500	127,500	2,000	100,000	0	0	100,000	0	0	100,000	0
1.05	1,150	8,040	9,246,000	950	1,092,500	8,153,500	3,450,000	520	598,000	2,852,000	2,000	2,300,000	0	0	2,300,000	0	0	2,300,000	0
2.20	10	8,040	80,400	950	9,500	70,900	3,000	30,000	520	5,200	24,800	2,000	25,000	0	0	25,000	0	0	25,000
2.21	190	8,040	1,527,600	950	180,500	1,347,100	3,000	570,000	520	98,800	471,200	3,000	570,000	0	0	570,000	0	0	570,000
2.40	10	8,040	80,400	950	9,500	70,900	3,000	31,650	520	5,200	26,450	3,000	25,000	0	0	25,000	0	0	25,000
2.41	590	8,040	4,743,600	950	560,500	4,183,100	3,330	1,954,700	520	306,600	1,657,900	2,000	1,180,000	0	0	1,180,000	0	0	1,180,000
3.00	2,000	8,040	16,160,000	950	1,800,000	14,260,000	3,330	31,680,000	520	1,040,000	30,840,000	2,000	4,000,000	0	0	4,000,000	0	0	4,000,000
5.00	500	8,120	2,550,000	950	1,462,500	1,792,500	28,350	7,717,500	520	760,000	6,957,500	2,000	712,500	720	320,000	320,000	730	397,500	397,500
5.50	500	4,900	2,630,000	4,900	2,630,000	0	2,630,000	2,630,000	0	0	850	425,000	850	425,000	0	850	430,000	430,000	430,000
6.00	1,000	5,620	4,745,000	5,620	4,745,000	0	4,745,000	4,745,000	0	0	850	845,000	850	845,000	0	850	855,000	855,000	855,000
7.00	1,000	3,870	5,780,000	3,870	5,780,000	0	5,780,000	5,780,000	0	0	850	855,000	850	855,000	0	850	875,000	875,000	875,000
8.00	1,000	7,890	6,110,000	7,890	6,110,000	0	6,110,000	6,110,000	0	0	850	875,000	850	875,000	0	850	885,000	885,000	885,000
9.00	1,000	4,530	6,115,000	4,530	6,115,000	0	6,115,000	6,115,000	0	0	850	875,000	850	875,000	0	850	885,000	885,000	885,000
10.00	1,000	7,700	6,440,000	7,700	6,440,000	0	6,440,000	6,440,000	0	0	850	880,000	850	880,000	0	850	890,000	890,000	890,000
11.00	1,000	5,180	6,025,000	5,180	6,025,000	0	6,025,000	6,025,000	0	0	850	860,000	850	860,000	0	850	870,000	870,000	870,000
12.00	1,000	6,870	6,390,000	6,870	6,390,000	0	6,390,000	6,390,000	0	0	850	860,000	850	860,000	0	850	870,000	870,000	870,000
13.00	500	5,910	3,495,000	5,910	3,495,000	0	3,495,000	3,495,000	0	0	850	445,000	850	445,000	0	850	450,000	450,000	450,000
13.50	500	8,070	3,900,000	8,070	3,900,000	0	3,900,000	3,900,000	0	0	920	447,500	920	447,500	0	920	452,500	452,500	452,500
14.00	1,000	7,530	7,225,000	7,530	7,225,000	0	7,225,000	7,225,000	0	0	870	870,000	870	870,000	0	870	880,000	880,000	880,000
15.00	1,000	6,920	12,350,000	6,920	3,460,000	9,290,000	2,580	2,760,000	2,580	1,290,000	1,470,000	870	1,435,000	870	435,000	1,000,000	880	440,000	440,000
16.00	1,000	18,580	19,535,000	0	4,360,000	15,175,000	2,580	2,460,000	0	210,000	2,250,000	2,000	1,555,000	0	60,000	1,455,000	0	0	0
17.00	1,000	20,490	15,220,000	8,720	9,335,000	5,885,000	1,980	2,280,000	420	1,500,000	780,000	1,110	990,000	120	495,000	495,000	0	450,000	450,000
18.00	1,000	9,950	8,310,000	9,950	8,310,000	0	2,580	2,570,000	2,580	2,570,000	0	870	855,000	870	855,000	0	900	885,000	885,000
19.00	1,000	8,670	12,075,000	8,670	7,885,000	4,390,000	2,580	2,140,000	2,580	1,490,000	650,000	860	895,000	860	430,000	465,000	870	435,000	435,000
20.00	1,000	17,480	13,040,000	8,700	8,650,000	4,390,000	1,720	2,150,000	420	1,500,000	650,000	930	910,000	0	445,000	465,000	0	450,000	450,000
21.00	1,000	8,600	7,865,000	8,600	7,865,000	0	2,580	2,575,000	2,580	2,575,000	0	890	875,000	890	875,000	0	900	885,000	885,000
22.00	1,000	7,130	8,825,000	7,130	8,825,000	0	2,570	2,620,000	2,570	2,620,000	0	860	895,000	860	895,000	0	870	905,000	905,000
23.00	1,000	10,520	10,855,000	10,520	10,855,000	0	2,670	2,700,000	2,670	2,700,000	0	930	930,000	930	930,000	0	940	940,000	940,000
24.00	1,000	11,190	12,825,000	11,190	9,945,000	2,880,000	2,730	2,220,000	2,730	1,530,000	830,000	930	950,000	930	520,000	470,000	940	470,000	470,000
25.00	1,000	14,460	15,870,000	8,700	8,530,000	7,340,000	1,710	1,755,000	450	340,000	1,415,000	970	1,005,000	110	55,000	950,000	0	0	0
26.00	0	17,280	0	8,360	0	0	1,820	0	230	0	1,040	0	0	0	0	0	0	0	0
26.00	1,000	17,480	18,770,000	8,540	4,270,000	14,500,000	1,870	2,455,000	230	115,000	2,350,000	1,140	1,610,000	0	0	1,610,000	0	1,610,000	1,610,000
27.00	1,000	20,060	23,635,000	0	0	23,635,000	3,060	3,195,000	0	0	3,195,000	2,080	2,210,000	0	0	2,210,000	0	2,210,000	2,210,000
28.00	1,000	27,210	26,830,000	0	2,005,000	24,825,000	3,330	3,130,000	0	65,000	3,065,000	2,340	2,070,000	0	0	2,070,000	0	2,070,000	2,070,000
29.00	1,000	26,450	18,350,000	4,010	7,130,000	11,220,000	2,930	2,920,000	130	1,520,000	1,400,000	1,800	1,390,000	0	490,000	900,000	1,000	500,000	500,000
30.00	1,000	10,250	14,285,000	10,250	9,095,000	5,190,000	2,910	2,370,000	2,910	1,500,000	870,000	980	1,050,000	980	490,000	560,000	1,000	455,000	455,000
31.00	1,000	18,320	13,130,000	7,940	7,940,000	5,190,000	1,830	2,235,000	90	1,355,000	870,000	1,120	1,010,000	0	450,000	560,000	0	455,000	455,000
32.00	1,000	7,940	10,855,000	7,940	8,615,000	2,240,000	2,640	1,845,000	2,640	1,335,000	510,000	900	720,000	900	450,000	270,000	910	455,000	455,000
33.00	1,000	13,770	18,475,000	9,290	4,645,000	13,830,000	1,050	2,100,000	30	15,000	2,085,000	540	1,340,000	0	0	1,340,000	0	1,340,000	1,340,000
34.00	1,000	23,180	38,000,000	0	0	38,000,000	3,150	3,405,000	0	0	3,405,000	2,140	2,335,000	0	0	2,335,000	0	2,335,000	2,335,000
35.00	1,000	52,820	40,480,000	0	0	40,480,000	3,660	3,660,000	0	0	3,660,000	2,530	2,550,000	0	0	2,550,000	0	2,550,000	2,550,000
36.00	1,000	28,100	22,940,000	0	2,925,000	20,015,000	3,660	2,865,000	0	180,000	2,685,000	2,570	1,945,000	0	50,000	1,895,000	0	1,895,000	1,895,000
37.00	0	17,780	0	5,850	0	0	2,070	0	350	0	1,320	0	100	0	0	0	0	0	0
Sum 2	36,000		477,140,000		198,629,750	278,510,250		626,266,350		51,569,000	74,697,350		46,690,000		17,290,000	29,400,000		17,235,000	
37.00	1,000	17,780	16,975,000	5,850	4,175,000	12,800,000	2,070	2,320,000	360	235,000	2,085,000	1,320	1,500,000	100	50,000	1,450,000	0	1,450,000	1,450,000
38.00	1,000	16,170	17,245,000	2,500	2,600,000	14,645,000	2,570	2,585,000	110	140,000	2,445,000	1,680	1,685,000	0	20,000	1,665,000	0	1,665,000	1,665,000
39.00	1,000	18,320	24,165,000	2,700	2,600,000	21,565,000	2,600	2,665,000	170	85,000	2,580,000	1,690	1,935,000	40	40,000	1,895,000	0	1,895,000	1,895,000
40.00	1,000	30,010	28,115,0																



Study Case	Route	W. Level	No. of Lifts	No. of Lanes	Ship Size (1000 DWT)	Canal Size (m)
S-1	10	0	-	1	150	147 x 20.9
2	10	0	-	2	150	343 x 20.9
3	10	0	-	1	250	171 x 24.2
4	10	0	-	2	250	399 x 24.2
5	10	0	-	1	300	183 x 25.3
6	10	0	-	2	300	424 x 25.3
13	10	0	-	50%-1	150	147 x 20.9
				50%-2		343 x 20.9
14	10	0	-	50%-1	250	171 x 24.2
				50%-2		399 x 24.2
15	10	0	-	50%-1	300	183 x 25.3
				50%-2		424 x 25.3

Layout of Sea Level Canal
for Group C Study Cases (Route 10)



ADDITIONAL
INFORMATION
MAY BE OBTAINED
FROM THE
OFFICE OF THE
ENGINEER,
PANAMA CANAL
ZONE,
PANAMA,
PANAMA
REPUBLIC

ZONE V

ZONE IV

ZONE III

ZONE II

ZONE I

PACIFIC Approach

Galboa

Cuipo

Gatun Lake

ATLANTIC Approach

Route 10

Zone Map in Route 10

S-1 Calculation Table of Excavation Volume

Station No.	Dis (m)	Hard Rock					Soft Rock					Earth					Mad	
		As	Vo	Wet V1	Dry V2		As	Vo	Wet V1	Dry V2		As	Vo	Wet V1	Dry V2	No	Vo	
-2.50	2,500	0	1,062,500	0	1,062,500	0	1,250,000	0	1,250,000	0	0	425,000	0	425,000	0	0	425,000	
0.00	1,000	850	2,747,500	850	425,000	2,322,500	1,000	1,220,000	1,000	500,000	720,000	340	650,000	340	170,000	340	170,000	
1.00	0	4,645	0	0	0	0	1,440	0	0	0	0	960	0	0	0	0	0	
Sum 1	3,500		3,810,000	0	1,487,500	2,322,500		2,470,000		1,750,000	720,000		1,075,000		595,000	480,000	595,000	
1.00	1,000	4,645	5,852,500	0	0	5,852,500	1,440	1,470,000	0	0	1,470,000	960	980,000	0	0	980,000	0	
2.00	1,000	7,060	6,125,000	0	0	6,125,000	1,500	1,530,000	0	0	1,530,000	1,000	1,020,000	0	0	1,020,000	0	
3.00	1,000	5,190	8,155,000	0	0	8,155,000	1,560	1,600,000	0	0	1,600,000	1,040	1,200,000	0	0	1,200,000	0	
4.00	1,000	11,120	17,850,000	0	0	17,850,000	2,040	2,280,000	0	0	2,280,000	1,360	1,520,000	0	0	1,520,000	0	
5.00	1,000	21,560	20,490,000	0	0	20,490,000	2,520	2,340,000	0	0	2,340,000	1,580	1,560,000	0	0	1,560,000	0	
6.00	1,000	16,400	14,795,000	0	0	14,795,000	2,160	2,160,000	0	0	2,160,000	1,440	1,440,000	0	0	1,440,000	0	
7.00	1,000	13,190	8,000,000	0	0	8,000,000	2,160	1,770,000	0	0	1,770,000	1,440	1,180,000	0	0	1,180,000	0	
8.00	1,000	2,810	3,370,000	0	0	3,370,000	1,380	1,470,000	0	0	1,470,000	920	880,000	0	0	880,000	0	
9.00	1,000	3,930	3,685,000	0	0	3,685,000	1,560	1,500,000	0	0	1,500,000	1,040	1,000,000	0	0	1,000,000	0	
10.00	1,000	3,440	4,620,000	0	0	4,620,000	1,440	1,590,000	0	0	1,590,000	960	1,060,000	0	0	1,060,000	0	
11.00	1,000	5,800	4,555,000	0	0	4,555,000	1,740	1,560,000	0	0	1,560,000	1,160	1,040,000	0	0	1,040,000	0	
12.00	1,000	3,510	1,755,000	0	0	1,755,000	1,380	5,035,000	0	0	5,035,000	920	960,000	0	0	960,000	0	
13.00	1,000	4,990	6,720,000	0	0	6,720,000	1,500	1,590,000	0	0	1,590,000	1,000	1,060,000	0	0	1,060,000	0	
14.00	1,000	8,450	8,050,000	0	0	8,050,000	1,680	1,650,000	0	0	1,650,000	1,120	1,100,000	0	0	1,100,000	0	
15.00	1,000	7,650	3,825,000	0	0	3,825,000	1,620	4,300,000	0	0	4,300,000	1,080	1,940,000	0	0	1,940,000	0	
16.00	1,000	0	0	0	0	0	8,690	8,355,000	0	0	8,355,000	2,800	2,850,000	0	0	2,850,000	0	
17.00	1,000	0	0	0	0	0	8,020	6,730,000	0	0	6,730,000	2,900	2,750,000	0	0	2,750,000	0	
18.00	1,000	0	0	0	0	0	5,440	6,210,000	0	0	6,210,000	2,600	2,590,000	0	0	2,590,000	0	
19.00	1,000	0	0	0	0	0	6,980	5,330,000	0	0	5,330,000	2,400	2,300,000	0	0	2,300,000	0	
20.00	1,000	0	0	0	0	0	3,680	3,525,000	0	0	3,525,000	2,200	2,200,000	0	0	2,200,000	0	
21.00	1,000	0	0	0	0	0	3,370	3,015,000	0	0	3,015,000	2,200	2,200,000	0	0	2,200,000	0	
22.00	1,000	0	0	0	0	0	4,210	5,510,000	0	0	5,510,000	2,200	2,325,000	0	0	2,325,000	0	
23.00	1,000	0	0	0	0	0	6,310	6,265,000	0	0	6,265,000	2,450	2,450,000	0	0	2,450,000	0	
24.00	1,000	0	0	0	0	0	6,220	6,560,000	0	0	6,560,000	2,450	2,450,000	0	0	2,450,000	0	
25.00	1,000	0	0	0	0	0	5,900	4,180,000	0	0	4,180,000	2,450	2,300,000	0	0	2,300,000	0	
26.00	1,000	0	0	0	0	0	2,660	4,640,000	0	0	4,640,000	2,150	2,225,000	0	0	2,225,000	0	
27.00	0	0	0	0	0	0	6,620	0	0	0	0	3,300	0	0	0	0	0	
Sum 2	26,000		117,947,500	0	0	117,947,500		92,985,000		0	92,985,000		44,590,000		0	44,590,000	0	
27.00	1,000	0	0	0	0	6,620	7,510,000	0	0	7,510,000	1,300	2,350,000	0	0	2,350,000	0	0	
28.00	1,000	0	0	0	0	8,400	8,570,000	0	0	8,570,000	2,400	2,450,000	0	0	2,450,000	0	0	
29.00	1,000	0	0	0	0	8,740	8,380,000	0	0	8,380,000	2,500	2,500,000	0	0	2,500,000	0	0	
30.00	1,000	0	0	0	0	8,020	7,635,000	0	0	7,635,000	2,500	2,450,000	0	0	2,450,000	0	0	
31.00	1,000	0	0	0	0	7,250	6,585,000	0	0	6,585,000	2,400	2,375,000	0	0	2,375,000	0	0	
32.00	1,000	0	0	0	0	5,940	6,275,000	0	0	6,275,000	2,350	2,375,000	0	0	2,375,000	0	0	
33.00	1,000	0	0	0	0	6,610	5,985,000	0	0	5,985,000	2,400	2,350,000	0	0	2,350,000	0	0	
34.00	1,000	0	0	0	0	5,320	5,290,000	0	0	5,290,000	2,300	2,325,000	0	0	2,325,000	0	0	
35.00	1,000	0	0	0	0	5,260	6,430,000	0	0	6,430,000	2,350	2,375,000	0	0	2,375,000	0	0	
36.00	1,000	0	0	0	0	7,600	5,915,000	0	0	5,915,000	2,400	3,155,000	0	0	3,155,000	0	0	
37.00	1,000	0	0	0	0	4,230	5,550,000	0	0	5,550,000	3,910	4,080,000	0	0	4,080,000	0	0	
38.00	1,000	0	0	0	0	6,870	6,580,000	0	0	6,580,000	4,250	4,930,000	0	0	4,930,000	0	0	
39.00	1,000	0	0	0	0	6,290	9,280,000	0	0	9,280,000	5,610	3,995,000	0	0	3,995,000	0	0	
40.00	1,000	0	0	0	0	12,270	12,170,000	0	0	12,170,000	2,380	2,450,000	0	0	2,450,000	0	0	
41.00	1,000	0	3,185,000	0	3,185,000	12,070	11,080,000	0	0	11,080,000	2,520	2,135,000	0	0	2,135,000	0	0	
42.00	0	0	0	0	0	10,090	0	0	0	0	0	2,310	0	0	0	0	0	
42.00	1,000	6,370	5,910,000	0	0	5,910,000	2,500	2,500,000	0	0	2,500,000	1,750	2,030,000	0	0	2,030,000	0	
43.00	0	5,450	0	0	0	2,500	0	0	0	0	0	1,750	0	0	0	0	0	
43.00	1,000	5,450	2,725,000	0	0	2,725,000	9,170	8,995,000	0	0	8,995,000	2,310	7,955,000	0	0	7,955,000	0	
44.00	1,000	0	0	0	0	8,820	14,560,000	0	0	14,560,000	3,600	4,275,000	0	0	4,275,000	0	0	
45.00	1,000	0	0	0	0	20,300	14,580,000	0	0	14,580,000	4,950	13,175,000	0	0	13,175,000	0	0	
46.00	1,000	0	27,985,000	0	27,985,000	82,040	41,170,000	0	0	41,170,000	21,400	11,265,000	0	0	11,265,000	0	0	
47.00	1,000	55,930	52,715,000	0	0	52,715,000	0	31,020,000	0	0	31,020,000	1,130	1,990,000	0	0	1,990,000	0	
48.00	1,000	49,500	44,430,000	0	0	44,430,000	0	0	0	0	2,850	5,145,000	0	0	5,145,000	0	0	
49.00	1,000	39,360	27,950,000	0	0	27,950,000	0	0	0	0	7,440	4,910,000	0	0	4,910,000	0	0	
50.00	0	16,540	0	0	0	23,190	0	0	0	0	5,390	0	0	0	0	0	0	
50.00	1,000	16,540	15,000,000	0	0	15,000,000	10,200	16,650,000	0	0	16,650,000	2,380	2,380,000	0	0	2,380,000	0	
51.00	1,000	13,460	5,730,000	0	0	5,730,000	20,770	15,485,000	0	0	15,485,000	2,380	4,990,000	0	0	4,990,000	0	
52.00	1,000	0	0	0	0	29,840	25,305,000	0	0	25,305,000	7,600	5,600,000	0	0	5,600,000	0	0	
53.00	0	0	0	0	0	10,780	0	0	0	0	3,600	0	0	0	0	0	0	
Sum 3	26,000		186,610,000	0	0	186,610,000		283,470,000		0	283,470,000		101,010,000		0	101,010,000	0	
53.00	1,000	0	0	0	0	10,780	10,385,000	0	0	10,385,000	3,600	3,550,000	0	0	3,550,000	0	0	
54.00	1,000	0	0	0	0	9,990	7,365,000	0	0	7,365,000	3,500	3,025,000						

Calculation Table of Excavation Volume

Station No.	Dis (m)	Hard Rock				Soft Rock				Earth			Mad				
		As	Vo	Wet VI	Dry V2	As	Vo	Wet VI	Dry V2	As	Vo	Wet VI	Dry V2	As	Vo		
-2.50	2.500	0	2,375,000	0	2,375,000	0	2,700,000	0	2,700,000	0	937,500	0	937,500	0	937,500		
0.00	1,000	1,890	6,175,000	1,900	950,000	2,160	2,400,000	2,160	1,080,000	1,320,000	750	1,255,000	750	375,000	860,000		
1.00	0	10,450	0	0	0	2,640	0	0	0	1,760	0	0	0	0	0		
Sum 1	3,500		8,550,000		3,325,000	5,225,000		5,100,000		3,780,000	1,320,000		2,192,500	1,312,500	880,000		
1.00	1,000	10,450	12,275,000	0	0	12,275,000	2,540	2,670,000	0	0	2,670,000	1,760	1,780,000	0	1,780,000		
2.00	1,000	14,100	13,920,000	0	0	13,920,000	2,700	2,790,000	0	0	2,790,000	1,800	1,850,000	0	1,850,000		
3.00	1,000	13,740	18,075,000	0	0	18,075,000	2,880	2,910,000	0	0	2,910,000	1,920	1,940,000	0	1,940,000		
4.00	1,000	22,410	33,410,000	0	0	33,410,000	2,940	3,360,000	0	0	3,360,000	1,960	2,240,000	0	2,240,000		
5.00	1,000	44,410	37,700,000	0	0	37,700,000	3,780	3,510,000	0	0	3,510,000	2,520	2,340,000	0	2,340,000		
6.00	1,000	30,990	28,545,000	0	0	28,545,000	3,240	3,180,000	0	0	3,180,000	2,160	2,120,000	0	2,120,000		
7.00	1,000	26,100	16,230,000	0	0	16,230,000	3,120	2,850,000	0	0	2,850,000	2,080	1,900,000	0	1,900,000		
8.00	1,000	8,360	8,855,000	0	0	8,855,000	2,580	2,670,000	0	0	2,670,000	1,720	1,780,000	0	1,780,000		
9.00	1,000	11,350	10,750,000	0	0	10,750,000	2,760	2,910,000	0	0	2,910,000	1,840	1,940,000	0	1,940,000		
10.00	1,000	10,150	12,890,000	0	0	12,890,000	3,060	3,090,000	0	0	3,090,000	2,040	2,060,000	0	2,060,000		
11.00	1,000	15,630	11,715,000	0	0	11,715,000	3,120	2,850,000	0	0	2,850,000	1,720	1,820,000	0	1,820,000		
12.00	1,000	7,600	9,665,000	0	0	9,665,000	2,580	2,730,000	0	0	2,730,000	1,720	1,820,000	0	1,820,000		
13.00	1,000	11,530	14,415,000	0	0	14,415,000	2,880	2,880,000	0	0	2,880,000	1,920	1,920,000	0	1,920,000		
14.00	1,000	12,300	16,340,000	0	0	16,340,000	2,880	2,820,000	0	0	2,820,000	1,920	1,880,000	0	1,880,000		
15.00	1,000	15,380	7,690,000	0	0	7,690,000	2,760	9,935,000	0	0	9,935,000	1,840	3,270,000	0	3,270,000		
16.00	1,000	0	0	0	0	17,110	17,670,000	0	0	17,670,000	4,700	4,850,000	0	4,850,000	0	0	
17.00	1,000	0	0	0	0	18,230	15,405,000	0	0	15,405,000	5,000	4,800,000	0	4,800,000	0	0	
18.00	1,000	0	0	0	0	12,580	12,840,000	0	0	12,840,000	4,600	4,400,000	0	4,400,000	0	0	
19.00	1,000	0	0	0	0	13,100	10,660,000	0	0	10,660,000	4,200	4,150,000	0	4,150,000	0	0	
20.00	1,000	0	0	0	0	8,220	8,005,000	0	0	8,005,000	4,100	4,100,000	0	4,100,000	0	0	
21.00	1,000	0	0	0	0	7,790	8,975,000	0	0	8,975,000	4,100	4,125,000	0	4,125,000	0	0	
22.00	1,000	0	0	0	0	10,160	12,340,000	0	0	12,340,000	4,150	4,250,000	0	4,250,000	0	0	
23.00	1,000	0	0	0	0	14,520	15,245,000	0	0	15,245,000	4,350	4,425,000	0	4,425,000	0	0	
24.00	1,000	0	0	0	0	15,970	15,825,000	0	0	15,825,000	4,500	4,450,000	0	4,450,000	0	0	
25.00	1,000	0	0	0	0	15,680	12,110,000	0	0	12,110,000	4,400	4,350,000	0	4,350,000	0	0	
26.00	1,000	0	0	0	0	18,540	10,940,000	0	0	10,940,000	4,300	4,275,000	0	4,275,000	0	0	
27.00	0	0	0	0	0	13,340	0	0	0	4,250	0	0	0	0	0		
Sum 2	26,000		252,475,000		0	252,475,000	191,170,000		0	191,170,000	78,925,000		0	78,925,000	0		
27.00	1,000	0	0	0	0	13,340	14,865,000	0	0	14,865,000	4,250	4,275,000	0	4,275,000	0	0	
28.00	1,000	0	0	0	0	16,390	17,280,000	0	0	17,280,000	4,300	4,400,000	0	4,400,000	0	0	
29.00	1,000	0	0	0	0	18,010	17,745,000	0	0	17,745,000	4,500	4,475,000	0	4,475,000	0	0	
30.00	1,000	0	0	0	0	17,480	16,380,000	0	0	16,380,000	4,450	4,375,000	0	4,375,000	0	0	
31.00	1,000	0	0	0	0	15,280	13,980,000	0	0	13,980,000	4,360	4,300,000	0	4,300,000	0	0	
32.00	1,000	0	0	0	0	12,660	14,070,000	0	0	14,070,000	4,300	3,850,000	0	3,850,000	0	0	
33.00	1,000	0	0	0	0	15,460	13,510,000	0	0	13,510,000	4,300	3,850,000	0	3,850,000	0	0	
34.00	1,000	0	0	0	0	11,580	11,515,000	0	0	11,515,000	4,300	4,300,000	0	4,300,000	0	0	
35.00	1,000	0	0	0	0	11,470	13,990,000	0	0	13,990,000	4,300	4,400,000	0	4,400,000	0	0	
36.00	1,000	0	0	0	0	16,510	12,920,000	0	0	12,920,000	4,500	5,905,000	0	5,905,000	0	0	
37.00	1,000	0	0	0	0	9,330	12,140,000	0	0	12,140,000	7,310	7,395,000	0	7,395,000	0	0	
38.00	1,000	0	0	0	0	14,950	14,040,000	0	0	14,040,000	7,480	8,500,000	0	8,500,000	0	0	
39.00	1,000	0	0	0	0	13,130	17,895,000	0	0	17,895,000	9,520	6,720,000	0	6,720,000	0	0	
40.00	1,000	0	0	0	0	22,660	22,330,000	0	0	22,330,000	3,920	3,815,000	0	3,815,000	0	0	
41.00	1,000	0	7,005,000	0	7,005,000	22,000	20,860,000	0	0	20,860,000	3,710	3,710,000	0	3,710,000	0	0	
42.00	0	0	0	0	0	19,720	0	0	0	3,710	0	0	0	0	0		
42.00	1,000	14,010	13,675,000	0	0	13,675,000	4,400	4,400,000	0	0	4,400,000	3,080	3,080,000	0	3,080,000	0	0
43.00	0	13,340	0	0	0	4,400	0	0	0	0	3,080	0	0	0	0		
43.00	1,000	0	0	0	0	19,090	18,980,000	0	0	18,980,000	3,710	4,655,000	0	4,655,000	0	0	
44.00	1,000	0	0	0	0	18,820	26,585,000	0	0	26,585,000	5,600	5,545,000	0	5,545,000	0	0	
45.00	1,000	0	0	0	0	14,340	26,585,000	0	0	26,585,000	5,490	14,845,000	0	14,845,000	0	0	
46.00	1,000	0	40,290,000	0	40,290,000	35,270	59,805,000	0	0	59,805,000	24,200	18,525,000	0	18,525,000	0	0	
47.00	1,000	80,580	76,555,000	0	76,555,000	0	42,835,000	0	0	42,835,000	12,850	8,120,000	0	8,120,000	0	0	
48.00	1,000	72,530	65,730,000	0	65,730,000	0	0	0	0	0	3,390	6,295,000	0	6,295,000	0	0	
49.00	1,000	60,930	44,890,000	0	44,890,000	0	0	0	0	0	9,200	8,065,000	0	8,065,000	0	0	
50.00	0	28,850	0	0	0	29,700	0	0	0	0	6,930	0	0	0	0		
50.00	1,000	28,360	14,190,000	0	14,190,000	15,900	22,800,000	0	0	22,800,000	3,710	3,745,000	0	3,745,000	0	0	
51.00	1,000	0	0	0	0	11,980	28,940,000	0	0	28,940,000	3,780	6,490,000	0	6,490,000	0	0	
52.00	1,000	0	0	0	0	17,050	44,515,000	0	0	44,515,000	9,200	7,400,000	0	7,400,000	0	0	
53.00	0	0	0	0	0	20,340	0	0	0	5,600	0	0	0	0	0		
Sum 3	26,000		263,335,000		0	263,335,000	508,665,000		0	508,665,000	161,035,000		0	161,035,000	0		
53.00	1,000	0	0	0	0	20,340	19,825,000	0	0	19,825,000	5,600	6,050,000	0	6,050,000	0	0	
54.00	1,000	0	0	0	0	19,310	14,510,000	0	0	14,510,000	5,500	5,600,000	0	5,600,000	0	0	
55.00	1,000	0	0	0	0	9,710	12,785,000	0	0	12,785,000	4,700	4,950,000	0	4,950,000	0	0	
56.00	1,000	0	0	0	0	15,860	15,865,000	0	0	15,865,000	5,200	5,050,000	0	5,050,000	0	0	
57.00	1,000	0	0	0	0	15,870	17,890,000	0	0	17,890,000	4,900	5,475,000	0	5,475,000	0	0	
58.00	0	0	0	0	0	19,510	0	0	0	0	6,050	0	0	0	0	0	
Sum 4	5,000		0		0	0	80,675,000		0	80,675,000	27,125,000		0	27,125,000	0		
58.00	3,000	0	0	0	0	19,510	36,675,000	0	7,410,000	29,265,000	6,050	10,215,000	0	1,140,000	9,075,000	1,140,000	
61.00	9,000	0	0	0	0	4,940	25,110,000	4,940	25,110,000	0	760	6,615,000	760	6,615,000	0	760	
70.00	13,700	0	0	0	0	640	4,384,000	640	4,384,000	0	710	4,863,500	710	4,863,500	0	710	
83.70	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sum 5	25,700		0		0	0	66,169,000		36,904,000	29,265,000	21,693,500		12,618,500	9,075,000	12,618,500	0	
S-2																	
Sum 1	3,500		8,550,000		3,325,000	5,225,000		5,100,000		3,780,							

S-3 Calculation Table of Excavation Volume

S-3

Station No.	Dis (ft)	Hard Rock						Soft Rock						Earth						Mud	
		As	Vo	Wet AI	Wet VI	Dry V2	As	Vo	Wet AI	Wet VI	Dry V2	As	Vo	Wet AI	Wet VI	Dry V2	As	Vo			
-2.85	2,850	0	2,223,000	0	2,223,000	0	0	1,667,250	0	1,667,250	0	0	598,500	0	598,500	0	0	598,500			
0.00	1,000	1,560	3,840,000	1,560	780,000	3,060,000	1,170	1,395,000	1,170	585,000	810,000	420	759,000	420	210,000	540,000	420	210,000			
1.00	0	6,120	0	0	0	0	1,620	0	0	0	0	1,080	0	0	0	0	0				
Sum 1	3,850		6,063,000		3,003,000	3,060,000		3,062,250		2,252,250	810,000		1,348,500		608,500	540,000		808,500			
1.00	1,000	6,120	7,265,000	0	0	7,265,000	1,620	1,680,000	0	0	1,880,000	1,080	1,120,000	0	0	1,120,000	0	0			
2.00	1,000	8,410	7,620,000	0	0	7,620,000	1,740	1,800,000	0	0	1,800,000	1,160	1,200,000	0	0	1,200,000	0	0			
3.00	1,000	8,830	10,310,000	0	0	10,310,000	1,860	2,040,000	0	0	2,040,000	1,240	1,360,000	0	0	1,360,000	0	0			
4.00	1,000	13,790	21,135,000	0	0	21,135,000	2,220	2,460,000	0	0	2,460,000	1,480	1,640,000	0	0	1,640,000	0	0			
5.00	1,000	28,480	23,830,000	0	0	23,830,000	2,700	2,550,000	0	0	2,550,000	1,800	1,700,000	0	0	1,700,000	0	0			
6.00	1,000	19,180	17,620,000	0	0	17,620,000	2,400	2,340,000	0	0	2,340,000	1,600	1,560,000	0	0	1,560,000	0	0			
7.00	1,000	16,060	10,045,000	0	0	10,045,000	2,280	1,920,000	0	0	1,920,000	1,520	1,280,000	0	0	1,280,000	0	0			
8.00	1,000	4,030	4,995,000	0	0	4,995,000	1,560	1,680,000	0	0	1,680,000	1,040	1,120,000	0	0	1,120,000	0	0			
9.00	1,000	5,960	5,275,000	0	0	5,275,000	1,600	1,740,000	0	0	1,740,000	1,200	1,160,000	0	0	1,160,000	0	0			
10.00	1,000	4,590	6,305,000	0	0	6,305,000	1,680	1,890,000	0	0	1,890,000	1,120	1,260,000	0	0	1,260,000	0	0			
11.00	1,000	8,020	6,415,000	0	0	6,415,000	2,100	1,860,000	0	0	1,860,000	1,400	1,240,000	0	0	1,240,000	0	0			
12.00	1,000	4,810	2,405,000	0	0	2,405,000	1,620	9,205,000	0	0	9,205,000	1,080	1,100,000	0	0	1,100,000	0	0			
13.00	1,000	6,550	8,460,000	0	0	8,460,000	1,680	1,770,000	0	0	1,770,000	1,120	1,180,000	0	0	1,180,000	0	0			
14.00	1,000	10,370	9,815,000	0	0	9,815,000	1,860	1,830,000	0	0	1,830,000	1,240	1,220,000	0	0	1,220,000	0	0			
15.00	1,000	9,260	4,630,000	0	0	4,630,000	1,800	5,195,000	0	0	5,195,000	1,200	2,150,000	0	0	2,150,000	0	0			
16.00	1,000	0	0	0	0	0	6,780	13,570,000	0	0	13,570,000	3,100	3,150,000	0	0	3,150,000	0	0			
17.00	1,000	0	0	0	0	0	10,350	8,775,000	0	0	8,775,000	3,200	3,100,000	0	0	3,100,000	0	0			
18.00	1,000	0	0	0	0	0	7,200	7,895,000	0	0	7,895,000	3,000	2,850,000	0	0	2,850,000	0	0			
19.00	1,000	0	0	0	0	0	8,590	6,730,000	0	0	6,730,000	2,700	2,600,000	0	0	2,600,000	0	0			
20.00	1,000	0	0	0	0	0	4,870	4,715,000	0	0	4,715,000	2,500	2,500,000	0	0	2,500,000	0	0			
21.00	1,000	0	0	0	0	0	4,560	4,280,000	0	0	4,280,000	2,500	2,500,000	0	0	2,500,000	0	0			
22.00	1,000	0	0	0	0	0	5,990	7,145,000	0	0	7,145,000	2,500	2,650,000	0	0	2,650,000	0	0			
23.00	1,000	0	0	0	0	0	8,300	8,255,000	0	0	8,255,000	2,800	2,800,000	0	0	2,800,000	0	0			
24.00	1,000	0	0	0	0	0	8,210	8,515,000	0	0	8,515,000	2,800	2,600,000	0	0	2,600,000	0	0			
25.00	1,000	0	0	0	0	0	8,820	6,410,000	0	0	6,410,000	2,800	2,700,000	0	0	2,700,000	0	0			
26.00	1,000	0	0	0	0	0	4,000	6,140,000	0	0	6,140,000	2,600	2,600,000	0	0	2,600,000	0	0			
27.00	0	0	0	0	0	0	8,280	0	0	0	2,600	0	0	0	0	0	0				
Sum 2	26,000		146,125,000		0	146,125,000		122,393,000		0	122,390,000		50,540,000		0	50,540,000		0			
27.00	1,000	0	0	0	0	0	8,280	9,275,000	0	0	9,275,000	2,600	2,650,000	0	0	2,650,000	0	0			
28.00	1,000	0	0	0	0	0	10,270	10,550,000	0	0	10,550,000	2,700	2,750,000	0	0	2,750,000	0	0			
29.00	1,000	0	0	0	0	0	10,830	10,450,000	0	0	10,450,000	2,800	2,800,000	0	0	2,800,000	0	0			
30.00	1,000	0	0	0	0	0	10,070	9,610,000	0	0	9,610,000	2,800	2,750,000	0	0	2,750,000	0	0			
31.00	1,000	0	0	0	0	0	9,150	8,290,000	0	0	8,290,000	2,700	2,650,000	0	0	2,650,000	0	0			
32.00	1,000	0	0	0	0	0	7,430	8,015,000	0	0	8,015,000	2,600	2,650,000	0	0	2,650,000	0	0			
33.00	1,000	0	0	0	0	0	8,600	7,785,000	0	0	7,785,000	2,700	2,650,000	0	0	2,650,000	0	0			
34.00	1,000	0	0	0	0	0	6,970	5,900,000	0	0	5,900,000	2,600	2,600,000	0	0	2,600,000	0	0			
35.00	1,000	0	0	0	0	0	6,830	8,100,000	0	0	8,100,000	2,600	2,650,000	0	0	2,650,000	0	0			
36.00	1,000	0	0	0	0	0	9,370	7,460,000	0	0	7,460,000	2,700	3,560,000	0	0	3,560,000	0	0			
37.00	1,000	0	0	0	0	0	5,550	7,110,000	0	0	7,110,000	4,420	4,590,000	0	0	4,590,000	0	0			
38.00	1,000	0	0	0	0	0	8,670	8,245,000	0	0	8,245,000	4,760	5,530,000	0	0	5,530,000	0	0			
39.00	1,000	0	0	0	0	0	7,820	11,345,000	0	0	11,345,000	6,300	4,535,000	0	0	4,535,000	0	0			
40.00	1,000	0	0	0	0	0	4,870	14,545,000	0	0	14,545,000	2,770	2,785,000	0	0	2,785,000	0	0			
41.00	1,000	0	4,115,000	0	0	4,115,000	4,220	13,200,000	0	0	13,200,000	2,800	2,380,000	0	0	2,380,000	0	0			
42.00	0	0	0	0	0	0	2,180	0	0	0	2,550	0	0	0	0	0	0				
42.00	1,000	8,230	4,115,000	0	0	4,115,000	2,800	8,375,000	0	0	8,375,000	1,860	1,345,000	0	0	1,345,000	0	0			
43.00	0	0	0	0	0	0	9,950	0	0	0	1,930	0	0	0	0	0	0				
43.00	1,000	7,230	3,615,000	0	0	3,615,000	3,900	7,350,000	0	0	7,350,000	2,780	3,340,000	0	0	3,340,000	0	0			
44.00	1,000	0	0	0	0	0	10,820	17,125,000	0	0	17,125,000	3,950	4,405,000	0	0	4,405,000	0	0			
45.00	1,000	0	0	0	0	0	23,430	17,125,000	0	0	17,125,000	4,660	12,960,000	0	0	12,960,000	0	0			
46.00	1,000	0	0	0	0	0	16,610	45,020,000	0	0	45,020,000	21,060	15,860,000	0	0	15,860,000	0	0			
47.00	1,000	0	0	0	0	0	51,180	53,885,000	0	0	53,885,000	10,700	6,850,000	0	0	6,850,000	0	0			
48.00	1,000	0	0	0	0	0	53,660	57,410,000	0	0	57,410,000	3,000	5,420,000	0	0	5,420,000	0	0			
49.00	1,000	0	0	0	0	0	83,280	48,470,000	0	0	48,470,000	7,240	5,215,000	0	0	5,215,000	0	0			
50.00	0	0	0	0	0	0	82,830	0	0	0	6,670	0	0	0	0	0	0				
50.00	1,000	0	0	0	0	0	27,520	35,175,000	0	0	35,175,000	2,690	2,825,000	0	0	2,825,000	0	0			
51.00	1,000	0	0	0	0	0	24,513	28,016,500	0	0	28,016,500	2,650	5,280,000	0	0	5,280,000	0	0			
52.00	1,000	0	0	0	0	0	17,980	28,746,500	0	0	28,746,500	7,900	5,900,000	0	0	5,900,000	0	0			
53.00	0	0	0	0	0	0	22,870	0	0	0	3,900	0	0	0	0	0	0				
Sum 3	26,000		11,845,000		0	11,845,000		493,588,000		0	493,588,000		117,750,000								

Calculation Table of Excavation Volume

Station No.	Dis (m)	Hard Rock				Soft Rock				Earth				Mad					
		As	Vo	Ret Al	Wet VI	Dry V2	As	Vo	Ret Al	Wet VI	Dry V2	As	Vo	Ret Al	Wet VI	Dry V2	As	Vo	
-2.85	2,630	0	3,676,500	0	3,676,500	0	0	3,619,500	0	3,619,500	0	0	1,239,750	0	1,239,750	0	0	1,239,750	0
0.00	1,000	2,580	8,260,000	2,580	1,280,000	6,970,000	2,540	2,830,000	2,540	1,270,000	1,560,000	870	1,475,000	870	435,000	1,040,000	870	435,000	870
1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum 1	3,630		11,936,500		4,966,500	6,970,000		6,449,500		4,889,500	1,560,000		2,714,750		1,674,750	1,040,000		1,674,750	
1.00	1,000	3,940	15,650,000	0	0	15,650,000	3,120	3,120,000	0	0	3,120,000	2,080	2,080,000	0	0	2,080,000	0	0	0
2.00	1,000	3,360	17,575,000	0	0	17,575,000	3,120	3,150,000	0	0	3,150,000	2,080	2,100,000	0	0	2,100,000	0	0	0
3.00	1,000	2,790	22,080,000	0	0	22,080,000	3,160	3,180,000	0	0	3,180,000	2,120	2,120,000	0	0	2,120,000	0	0	0
4.00	1,000	2,670	39,525,000	0	0	39,525,000	3,180	3,660,000	0	0	3,660,000	2,120	2,440,000	0	0	2,440,000	0	0	0
5.00	1,000	2,680	44,660,000	0	0	44,660,000	4,140	3,870,000	0	0	3,870,000	2,760	2,580,000	0	0	2,580,000	0	0	0
6.00	1,000	18,640	34,020,000	0	0	34,020,000	3,600	3,510,000	0	0	3,510,000	2,400	2,360,000	0	0	2,360,000	0	0	0
7.00	1,000	11,400	20,205,000	0	0	20,205,000	3,420	3,180,000	0	0	3,180,000	2,320	2,140,000	0	0	2,140,000	0	0	0
8.00	1,000	9,010	12,130,000	0	0	12,130,000	2,940	3,030,000	0	0	3,030,000	1,960	2,020,000	0	0	2,020,000	0	0	0
9.00	1,000	15,250	15,070,000	0	0	15,070,000	3,120	3,390,000	0	0	3,390,000	2,080	2,260,000	0	0	2,260,000	0	0	0
10.00	1,000	14,890	17,960,000	0	0	17,960,000	3,660	3,540,000	0	0	3,540,000	2,440	2,360,000	0	0	2,360,000	0	0	0
11.00	1,000	21,070	15,865,000	0	0	15,865,000	3,420	3,210,000	0	0	3,210,000	2,280	2,140,000	0	0	2,140,000	0	0	0
12.00	1,000	10,660	5,330,000	0	0	5,330,000	3,060	11,920,000	0	0	11,920,000	2,000	2,140,000	0	0	2,140,000	0	0	0
13.00	1,000	15,750	18,625,000	0	0	18,625,000	3,420	3,360,000	0	0	3,360,000	2,280	2,240,000	0	0	2,240,000	0	0	0
14.00	1,000	21,500	20,380,000	0	0	20,380,000	3,360	3,240,000	0	0	3,240,000	2,200	2,160,000	0	0	2,160,000	0	0	0
15.00	1,000	19,260	9,630,000	0	0	9,630,000	3,180	9,770,000	0	0	9,770,000	2,120	3,760,000	0	0	3,760,000	0	0	0
16.00	1,000	0	0	0	0	0	20,840	21,805,000	0	0	21,805,000	5,400	5,550,000	0	0	5,550,000	0	0	0
17.00	1,000	0	0	0	0	0	22,970	19,875,000	0	0	19,875,000	5,760	5,500,000	0	0	5,500,000	0	0	0
18.00	1,000	0	0	0	0	0	16,780	16,570,000	0	0	16,570,000	5,300	5,050,000	0	0	5,050,000	0	0	0
19.00	1,000	0	0	0	0	0	16,380	13,695,000	0	0	13,695,000	4,800	4,750,000	0	0	4,750,000	0	0	0
20.00	1,000	0	0	0	0	0	11,030	10,975,000	0	0	10,975,000	4,700	4,700,000	0	0	4,700,000	0	0	0
21.00	1,000	0	0	0	0	0	10,920	11,565,000	0	0	11,565,000	4,700	4,750,000	0	0	4,750,000	0	0	0
22.00	1,000	0	0	0	0	0	13,640	16,215,000	0	0	16,215,000	4,800	4,900,000	0	0	4,900,000	0	0	0
23.00	1,000	0	0	0	0	0	18,790	19,760,000	0	0	19,760,000	5,000	5,050,000	0	0	5,050,000	0	0	0
24.00	1,000	0	0	0	0	0	20,730	20,885,000	0	0	20,885,000	5,100	4,450,000	0	0	4,450,000	0	0	0
25.00	1,000	0	0	0	0	0	21,040	16,625,000	0	0	16,625,000	3,800	4,400,000	0	0	4,400,000	0	0	0
26.00	1,000	0	0	0	0	0	12,210	14,715,000	0	0	14,715,000	5,000	4,950,000	0	0	4,950,000	0	0	0
27.00	0	0	0	0	0	0	17,220	0	0	0	0	4,900	0	0	0	0	0	0	0
Sum 2	26,000		308,725,000		0	308,725,000		247,915,000		0	247,915,000		88,950,000		0	88,950,000		0	0
27.00	1,000	0	0	0	0	0	17,220	18,620,000	0	0	18,620,000	4,900	4,950,000	0	0	4,950,000	0	0	0
28.00	1,000	0	0	0	0	0	20,020	21,430,000	0	0	21,430,000	5,000	5,050,000	0	0	5,050,000	0	0	0
29.00	1,000	0	0	0	0	0	22,840	22,415,000	0	0	22,415,000	5,100	5,100,000	0	0	5,100,000	0	0	0
30.00	1,000	0	0	0	0	0	21,990	20,560,000	0	0	20,560,000	5,100	5,000,000	0	0	5,000,000	0	0	0
31.00	1,000	0	0	0	0	0	19,190	17,705,000	0	0	17,705,000	4,900	4,900,000	0	0	4,900,000	0	0	0
32.00	1,000	0	0	0	0	0	18,280	17,660,000	0	0	17,660,000	4,900	4,950,000	0	0	4,950,000	0	0	0
33.00	1,000	0	0	0	0	0	19,040	17,040,000	0	0	17,040,000	5,000	4,950,000	0	0	4,950,000	0	0	0
34.00	1,000	0	0	0	0	0	15,040	14,945,000	0	0	14,945,000	4,900	4,900,000	0	0	4,900,000	0	0	0
35.00	1,000	0	0	0	0	0	14,850	17,955,000	0	0	17,955,000	4,900	5,000,000	0	0	5,000,000	0	0	0
36.00	1,000	0	0	0	0	0	21,060	16,765,000	0	0	16,765,000	5,100	6,965,000	0	0	6,965,000	0	0	0
37.00	1,000	0	0	0	0	0	12,470	15,585,000	0	0	15,585,000	8,830	8,750,000	0	0	8,750,000	0	0	0
38.00	1,000	0	0	0	0	0	18,700	18,295,000	0	0	18,295,000	8,670	9,685,000	0	0	9,685,000	0	0	0
39.00	1,000	0	0	0	0	0	17,890	22,900,000	0	0	22,900,000	8,700	2,540,000	0	0	2,540,000	0	0	0
40.00	1,000	0	0	0	0	0	27,910	27,485,000	0	0	27,485,000	4,380	4,280,000	0	0	4,280,000	0	0	0
41.00	1,000	0	0	0	0	0	27,060	25,809,000	0	0	25,809,000	4,200	3,870,000	0	0	3,870,000	0	0	0
42.00	0	0	0	0	0	0	24,540	0	0	0	0	4,200	0	0	0	0	0	0	0
42.00	1,000	0	0	0	0	0	22,930	22,670,000	0	0	22,670,000	3,540	3,925,000	0	0	3,925,000	0	0	0
43.00	0	0	0	0	0	0	22,410	0	0	0	0	3,540	0	0	0	0	0	0	0
43.00	1,000	0	0	0	0	0	13,810	18,850,000	0	0	18,850,000	4,310	5,305,000	0	0	5,305,000	0	0	0
44.00	1,000	0	0	0	0	0	23,890	31,775,000	0	0	31,775,000	6,300	4,710,000	0	0	4,710,000	0	0	0
45.00	1,000	0	0	0	0	0	39,660	31,775,000	0	0	31,775,000	3,120	14,060,000	0	0	14,060,000	0	0	0
46.00	1,000	0	0	0	0	0	94,290	66,975,000	0	0	66,975,000	25,000	19,000,000	0	0	19,000,000	0	0	0
47.00	1,000	0	0	0	0	0	90,450	92,370,000	0	0	92,370,000	13,000	8,300,000	0	0	8,300,000	0	0	0
48.00	1,000	0	0	0	0	0	81,160	85,805,000	0	0	85,805,000	3,600	6,640,000	0	0	6,640,000	0	0	0
49.00	1,000	0	0	0	0	0	69,860	75,510,000	0	0	75,510,000	9,880	6,940,000	0	0	6,940,000	0	0	0
50.00	0	0	0	0	0	0	66,510	0	0	0	0	7,490	0	0	0	0	0	0	0
50.00	1,000	0	0	0	0	0	52,010	59,260,000	0	0	59,260,000	4,200	4,200,000	0	0	4,200,000	0	0	0
51.00	1,000	0	0	0	0	0	50,380	51,295,000	0	0	51,295,000	4,200	6,880,000	0	0</				

Calculation Table of Excavation Volume

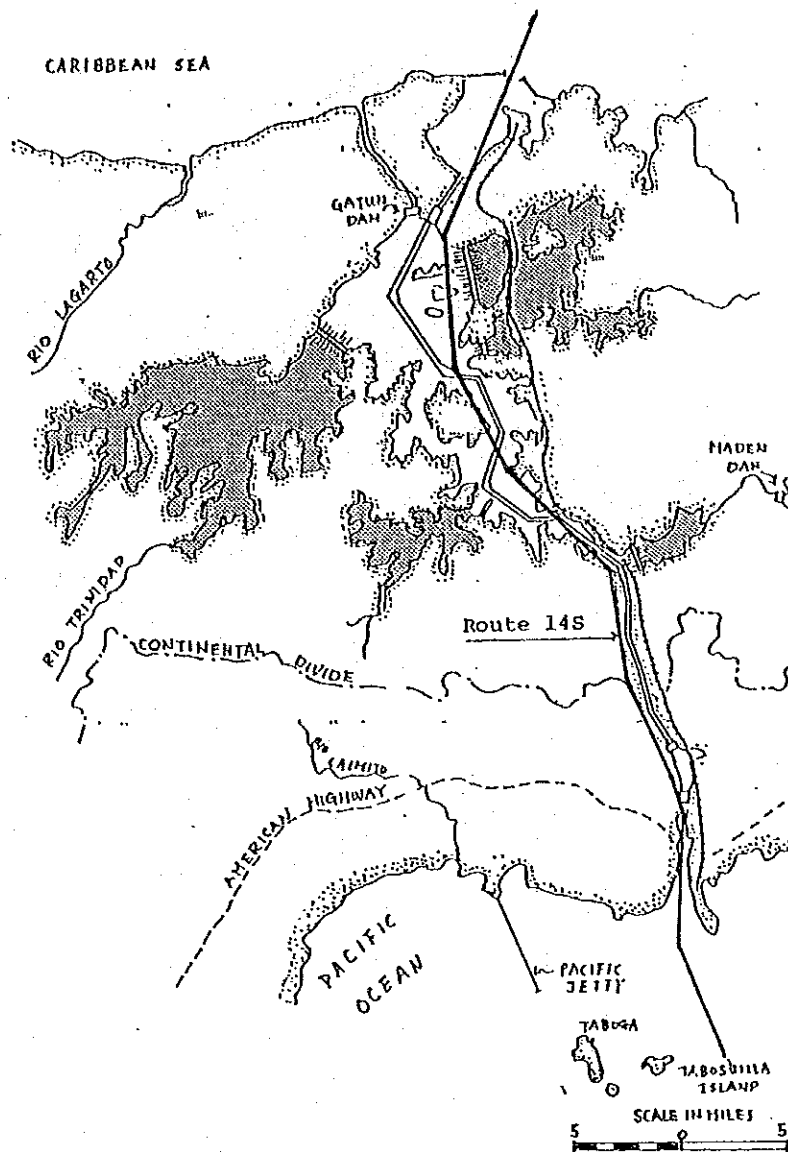
Station No.	Dis (ft)	Hard Rock			Soft Rock			Earth			Mad			
		As	Vo	Wet Al	Wet V1	Dry V2	As	Vo	Wet Al	Wet V1	Dry V2	As	Vo	
-2.90	2,900	0	2,769,500	0	2,769,500	0	1,812,500	0	1,812,500	0	638,000	0	638,000	
0.00	1,000	1,910	5,780,000	1,910	955,000	4,825,000	1,250	1,465,000	1,250	525,000	840,000	440	780,000	
1.00	0	9,650	0	0	0	0	1,680	0	0	0	1,120	0	0	
Sum 1	3,900		8,549,500	0	3,724,500	4,825,000		3,277,500		2,437,500	840,000		1,418,000	
1.00	1,000	6,950	8,100,000	0	0	8,100,000	1,680	1,740,000	0	1,740,000	1,120	1,160,000	0	
2.00	1,000	8,250	8,285,000	0	0	8,285,000	1,600	1,660,000	0	1,660,000	1,200	1,240,000	0	
3.00	1,000	7,320	10,960,000	0	0	10,960,000	1,920	2,100,000	0	2,100,000	1,280	1,400,000	0	
4.00	1,000	14,600	22,150,000	0	0	22,150,000	2,280	2,550,000	0	2,550,000	1,520	1,700,000	0	
5.00	1,000	23,700	25,180,000	0	0	25,180,000	2,620	2,840,000	0	2,840,000	1,680	1,760,000	0	
6.00	1,000	20,650	18,340,000	0	0	18,340,000	2,460	2,430,000	0	2,430,000	1,640	1,620,000	0	
7.00	1,000	17,220	10,775,000	0	0	10,775,000	2,400	2,040,000	0	2,040,000	1,600	1,360,000	0	
8.00	1,000	4,330	5,400,000	0	0	5,400,000	1,680	1,770,000	0	1,770,000	1,120	1,180,000	0	
9.00	1,000	6,470	5,810,000	0	0	5,810,000	1,860	1,830,000	0	1,830,000	1,240	1,220,000	0	
10.00	1,000	5,150	7,035,000	0	0	7,035,000	1,800	1,950,000	0	1,950,000	1,200	1,300,000	0	
11.00	1,000	8,920	7,125,000	0	0	7,125,000	2,100	1,890,000	0	1,890,000	1,400	1,280,000	0	
12.00	1,000	5,330	6,225,000	0	0	6,225,000	1,680	6,520,000	0	6,520,000	1,120	1,160,000	0	
13.00	1,000	7,120	9,195,000	0	0	9,195,000	1,860	1,860,000	0	1,860,000	1,200	1,240,000	0	
14.00	1,000	11,270	10,750,000	0	0	10,750,000	1,920	1,920,000	0	1,920,000	1,280	1,280,000	0	
15.00	1,000	10,230	5,115,000	0	0	5,115,000	1,920	6,640,000	0	6,640,000	1,280	2,240,000	0	
16.00	1,000	0	0	0	0	0	11,300	11,185,000	0	11,185,000	3,200	3,300,000	0	
17.00	1,000	0	0	0	0	0	11,010	9,405,000	0	9,405,000	3,400	3,250,000	0	
18.00	1,000	0	0	0	0	0	7,800	8,600,000	0	8,600,000	3,100	2,900,000	0	
19.00	1,000	0	0	0	0	0	9,480	7,330,000	0	7,330,000	2,700	2,650,000	0	
20.00	1,000	0	0	0	0	0	5,280	5,245,000	0	5,245,000	2,600	2,550,000	0	
21.00	1,000	0	0	0	0	0	5,230	5,940,000	0	5,940,000	2,500	2,550,000	0	
22.00	1,000	0	0	0	0	0	6,650	7,800,000	0	7,800,000	2,600	2,500,000	0	
23.00	1,000	0	0	0	0	0	8,950	8,950,000	0	8,950,000	2,400	2,650,000	0	
24.00	1,000	0	0	0	0	0	8,950	9,210,000	0	9,210,000	2,900	2,900,000	0	
25.00	1,000	0	0	0	0	0	9,470	8,995,000	0	8,995,000	2,900	2,800,000	0	
26.00	1,000	0	0	0	0	0	4,520	6,785,000	0	6,785,000	2,700	2,700,000	0	
27.00	0	0	0	0	0	0	9,650	0	0	0	2,700	0	0	
Sum 2	26,900		161,045,000	0	161,045,000		127,185,000		127,185,000		51,870,000		51,870,000	
27.00	1,000	0	0	0	0	0	9,050	10,030,000	0	10,030,000	2,700	2,750,000	0	
28.00	1,000	0	0	0	0	0	11,010	11,385,000	0	11,385,000	2,800	2,850,000	0	
29.00	1,000	0	0	0	0	0	11,760	11,375,000	0	11,375,000	2,900	2,900,000	0	
30.00	1,000	0	0	0	0	0	10,890	10,405,000	0	10,405,000	2,900	2,850,000	0	
31.00	1,000	0	0	0	0	0	9,920	9,970,000	0	9,970,000	2,800	2,800,000	0	
32.00	1,000	0	0	0	0	0	10,020	9,595,000	0	9,595,000	2,800	2,800,000	0	
33.00	1,000	0	0	0	0	0	8,170	8,335,000	0	8,335,000	2,800	2,700,000	0	
34.00	1,000	0	0	0	0	0	7,500	7,530,000	0	7,530,000	2,600	2,600,000	0	
35.00	1,000	0	0	0	0	0	7,550	8,925,000	0	8,925,000	2,600	2,700,000	0	
36.00	1,000	0	0	0	0	0	10,290	8,185,000	0	8,185,000	2,600	3,740,000	0	
37.00	1,000	0	0	0	0	0	6,090	7,830,000	0	7,830,000	4,680	4,805,000	0	
38.00	1,000	0	0	0	0	0	9,580	8,980,000	0	8,980,000	4,900	5,695,000	0	
39.00	1,000	0	0	0	0	0	8,380	11,890,000	0	11,890,000	5,460	4,665,000	0	
40.00	1,000	0	0	0	0	0	15,400	15,370,000	0	15,370,000	2,870	2,835,000	0	
41.00	1,000	0	0	0	0	0	15,340	14,240,000	0	14,240,000	2,800	2,765,000	0	
42.00	0	0	0	0	0	0	12,140	0	0	0	2,680	0	0	
42.00	1,000	7,230	7,615,000	0	0	7,615,000	3,980	3,400,000	0	3,400,000	2,730	2,660,000	0	
43.00	0	8,000	0	0	0	0	2,900	0	0	0	2,030	0	0	
43.00	1,000	0	0	0	0	0	12,410	12,165,000	0	12,165,000	2,590	3,345,000	0	
44.00	1,000	0	0	0	0	0	11,920	18,350,000	0	18,350,000	4,100	4,480,000	0	
45.00	1,000	0	0	0	0	0	24,780	18,350,000	0	18,350,000	4,860	13,430,000	0	
45.00	1,000	31,810	31,810,000	0	0	31,810,000	68,760	45,770,000	0	45,770,000	22,060	16,850,000	0	
47.00	1,000	83,220	59,580,000	0	0	59,580,000	0	34,380,000	0	34,380,000	11,700	7,350,000	0	
48.00	1,000	55,940	50,880,000	0	0	50,880,000	0	0	0	0	3,000	5,500,000	0	
49.00	1,000	45,820	33,315,000	0	0	33,315,000	0	0	0	0	8,000	5,330,000	0	
50.00	0	20,810	0	0	0	0	24,300	0	0	0	5,670	0	0	
50.00	1,000	17,680	8,840,000	0	0	8,840,000	11,400	17,850,000	0	17,850,000	2,660	8,555,000	0	
51.00	1,000	0	0	0	0	0	34,110	22,755,000	0	22,755,000	14,450	11,225,000	0	
52.00	1,000	0	0	0	0	0	34,650	34,480,000	0	34,480,000	8,080	6,050,000	0	
53.00	0	0	0	0	0	0	13,760	0	0	0	4,100	0	0	
Sum 3	26,000		191,840,000	0	191,840,000		162,495,000		162,495,000		134,230,000		134,230,000	
53.00	1,000	0	0	0	0	0	13,760	13,235,000	0	13,235,000	4,100	4,650,000	0	
54.00	1,000	0	0	0	0	0	12,770	9,735,000	0	9,735,000	5,200	4,100,000	0	
55.00	1,000	0	0	0	0	0	6,760	8,700,000	0	8,700,000	3,000	3,300,000	0	
56.00	1,000	0	0	0	0	0	10,640	10,880,000	0	10,880,000	3,600	3,500,000	0	
57.00	1,000	0	0	0	0	0	11,120	11,635,000	0	11,635,000	3,400	3,850,000	0	
58.00	0	0	0	0	0	0	12,150	0	0	0	4,300	0	0	
Sum 4	5,000		0	0	0	0	54,185,000		54,185,000		19,400,000		19,400,000	
58.00	3,000	0	0	0	0	0	12,150	23,745,000	0	23,745,000	4,300	7,125,000	0	
61.00	9,000	0	0	0	0	0	3,680	21,915,000	3,680	21,915,000	0	3,825,000	450	3,825,000
70.00	16,700	0	0	0	0	0	1,190	9,936,500	1,190	9,936,500	0	3,340,000	400	3,340,000
66.70	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sum 5	28,700		0	0	0	0	55,596,500		57,371,500		14,290,000		7,840,000	
S--5														
Sum 1	3,900		8,549,500	0	3,724,500	4,825,000		3,277,500		2,437,500	840,000		1,418,000	
Sum 2	26,000		161,045,000	0	161,045,000		127,185,000		127,185,000		51,870,000		51,870,000	
Sum 3	26,000		191,840,000	0	191,840,000		162,495,000		162,495,000		134,230,000		134,230,000	
Sum 4	5,000		0	0	0	0	54,185,000		54,185,000		19,400,000		19,400,000	
Sum 5	28,700		0	0	0	0	55,596,500		57,371,500		14,2			

Calculation Table of Excavation Volume

Station No.	Dis (ft)	Hard Rock					Soft Rock					Earth					Mad	
		Ac	Vo	Wet V1	Wet V2	Dry V2	Ac	Vo	Wet V1	Wet V2	Dry V2	Ac	Vo	Wet V1	Wet V2	Dry V2	Ac	Vo
-2.90	2,900	0	6,235,000	0	6,235,000	2,700	3,915,000	0	3,915,000	1,650,000	0	0	1,334,000	0	0	0	920	1,334,000
0.00	1,000	4,300	9,645,000	4,300	2,150,000	7,495,000	2,700	3,000,000	2,700	1,350,000	1,650,000	920	1,560,000	920	460,000	1,100,000	920	460,000
1.00	0	14,990	0	0	0	0	3,300	0	0	0	0	2,200	0	0	0	0	0	0
Sum 1	3,900		15,880,000	0	8,385,000	7,495,000		6,915,000		5,265,000	1,650,000		2,894,000		1,794,000	1,100,000		1,794,000
1.00	1,000	14,990	17,460,000	0	0	17,460,000	3,300	3,270,000	0	0	3,270,000	2,200	2,180,000	0	0	2,180,000	0	0
2.00	1,000	19,990	19,565,000	0	0	19,565,000	3,240	3,270,000	0	0	3,270,000	2,160	2,180,000	0	0	2,180,000	0	0
3.00	1,000	19,200	23,395,000	0	0	23,395,000	3,300	3,300,000	0	0	3,300,000	2,200	2,200,000	0	0	2,200,000	0	0
4.00	1,000	27,590	41,750,000	0	0	41,750,000	3,300	3,780,000	0	0	3,780,000	2,200	2,520,000	0	0	2,520,000	0	0
5.00	1,000	55,910	47,665,000	0	0	47,665,000	4,260	3,990,000	0	0	3,990,000	2,640	2,660,000	0	0	2,660,000	0	0
6.00	1,000	39,420	36,255,000	0	0	36,255,000	3,720	3,590,000	0	0	3,590,000	2,480	2,460,000	0	0	2,460,000	0	0
7.00	1,000	33,090	21,370,000	0	0	21,370,000	3,660	3,390,000	0	0	3,390,000	2,440	2,260,000	0	0	2,260,000	0	0
8.00	1,000	9,650	13,270,000	0	0	13,270,000	3,120	3,210,000	0	0	3,210,000	2,080	2,140,000	0	0	2,140,000	0	0
9.00	1,000	16,890	16,925,000	0	0	16,925,000	3,300	3,660,000	0	0	3,660,000	2,200	2,460,000	0	0	2,460,000	0	0
10.00	1,000	16,960	19,895,000	0	0	19,895,000	4,020	3,840,000	0	0	3,840,000	2,680	2,560,000	0	0	2,560,000	0	0
11.00	1,000	22,830	17,415,000	0	0	17,415,000	3,660	3,390,000	0	0	3,390,000	2,440	2,260,000	0	0	2,260,000	0	0
12.00	1,000	12,000	14,670,000	0	0	14,670,000	3,120	3,390,000	0	0	3,360,000	2,080	2,240,000	0	0	2,240,000	0	0
13.00	1,000	17,340	19,765,000	0	0	19,765,000	3,690	3,540,000	0	0	3,540,000	2,400	2,360,000	0	0	2,360,000	0	0
14.00	1,000	22,190	21,460,000	0	0	21,460,000	3,480	3,390,000	0	0	3,390,000	2,320	2,260,000	0	0	2,260,000	0	0
15.00	1,000	20,730	10,355,000	0	0	10,355,000	3,300	12,825,000	0	0	12,825,000	2,200	3,900,000	0	0	3,900,000	0	0
16.00	1,000	0	0	0	0	0	22,350	23,670,000	0	0	23,670,000	5,600	5,750,000	0	0	5,750,000	0	0
17.00	1,000	0	0	0	0	0	24,990	21,690,000	0	0	21,690,000	5,900	5,750,000	0	0	5,750,000	0	0
18.00	1,000	0	0	0	0	0	18,390	18,027,500	0	0	18,027,500	5,600	5,300,000	0	0	5,300,000	0	0
19.00	1,000	0	0	0	0	0	17,865	14,782,500	0	0	14,782,500	5,000	5,000,000	0	0	5,000,000	0	0
20.00	1,000	0	0	0	0	0	11,990	11,755,000	0	0	11,755,000	5,000	5,000,000	0	0	5,000,000	0	0
21.00	1,000	0	0	0	0	0	11,610	13,075,000	0	0	13,075,000	5,000	5,000,000	0	0	5,000,000	0	0
22.00	1,000	0	0	0	0	0	14,540	17,305,000	0	0	17,305,000	5,000	5,100,000	0	0	5,100,000	0	0
23.00	1,000	0	0	0	0	0	20,070	21,280,000	0	0	21,280,000	5,200	5,250,000	0	0	5,250,000	0	0
24.00	1,000	0	0	0	0	0	22,490	21,720,000	0	0	21,720,000	5,300	5,300,000	0	0	5,300,000	0	0
25.00	1,000	0	0	0	0	0	20,950	17,250,000	0	0	17,250,000	5,300	5,250,000	0	0	5,250,000	0	0
26.00	1,000	0	0	0	0	0	13,550	15,965,000	0	0	15,965,000	5,200	5,200,000	0	0	5,200,000	0	0
27.00	0	0	0	0	0	0	18,380	0	0	0	0	5,200	0	0	0	0	0	
Sum 2	26,000		341,225,000	0	0	341,225,000	0	258,425,000	0	0	258,425,000	0	94,520,000	0	0	94,520,000	0	0
27.00	1,000	0	0	0	0	0	18,380	20,010,000	0	0	20,010,000	5,200	5,200,000	0	0	5,200,000	0	0
28.00	1,000	0	0	0	0	0	21,640	23,015,000	0	0	23,015,000	5,200	5,250,000	0	0	5,250,000	0	0
29.00	1,000	0	0	0	0	0	24,390	24,075,000	0	0	24,075,000	5,300	5,300,000	0	0	5,300,000	0	0
30.00	1,000	0	0	0	0	0	23,760	22,105,000	0	0	22,105,000	5,300	5,250,000	0	0	5,250,000	0	0
31.00	1,000	0	0	0	0	0	20,450	18,875,000	0	0	18,875,000	5,200	5,200,000	0	0	5,200,000	0	0
32.00	1,000	0	0	0	0	0	17,300	19,430,000	0	0	19,430,000	5,200	4,800,000	0	0	4,800,000	0	0
33.00	1,000	0	0	0	0	0	21,560	18,890,000	0	0	18,890,000	4,000	4,500,000	0	0	4,500,000	0	0
34.00	1,000	0	0	0	0	0	16,220	16,200,000	0	0	16,200,000	5,000	5,050,000	0	0	5,050,000	0	0
35.00	1,000	0	0	0	0	0	16,180	19,560,000	0	0	19,560,000	5,100	5,200,000	0	0	5,200,000	0	0
36.00	1,000	0	0	0	0	0	22,940	18,315,000	0	0	18,315,000	5,300	7,070,000	0	0	7,070,000	0	0
37.00	1,000	0	0	0	0	0	13,690	17,070,000	0	0	17,070,000	8,440	8,925,000	0	0	8,925,000	0	0
38.00	1,000	0	0	0	0	0	20,450	20,010,000	0	0	20,010,000	9,010	10,030,000	0	0	10,030,000	0	0
39.00	1,000	0	0	0	0	0	19,570	24,760,000	0	0	24,760,000	11,050	7,600,000	0	0	7,600,000	0	0
40.00	1,000	0	0	0	0	0	29,950	29,370,000	0	0	29,370,000	4,550	4,445,000	0	0	4,445,000	0	0
41.00	1,000	0	0	0	0	0	28,790	27,740,000	0	0	27,740,000	4,340	4,340,000	0	0	4,340,000	0	0
42.00	0	0	0	0	0	0	26,690	0	0	0	0	4,340	0	0	0	0	0	
42.00	1,000	19,750	19,440,000	0	0	19,440,000	5,300	5,300,000	0	0	5,300,000	3,710	3,710,000	0	0	3,710,000	0	0
43.00	0	19,130	0	0	0	0	5,300	0	0	0	0	3,710	0	0	0	0	0	
43.00	1,000	0	0	0	0	0	28,160	25,945,000	0	0	25,945,000	11,480	8,990,000	0	0	8,990,000	0	0
44.00	1,000	0	0	0	0	0	25,730	33,985,000	0	0	33,985,000	6,500	6,400,000	0	0	6,400,000	0	0
45.00	1,000	0	0	0	0	0	42,200	33,965,000	0	0	33,965,000	6,300	15,850,000	0	0	15,850,000	0	0
46.00	1,000	0	47,490,000	0	0	47,490,000	38,360	70,280,000	0	0	70,280,000	25,400	19,350,000	0	0	19,350,000	0	0
47.00	1,000	84,990	88,310,000	0	0	88,310,000	0	49,180,000	0	0	49,180,000	13,300	8,480,000	0	0	8,480,000	0	0
48.00	1,000	81,640	78,270,000	0	0	78,270,000	0	0	0	0	3,660	6,750,000	0	0	6,750,000	0	0	
49.00	1,000	74,900	56,325,000	0	0	56,325,000	0	0	0	0	9,840	8,770,000	0	0	8,770,000	0	0	
50.00	0	37,750	0	0	0	0	33,000	0	0	0	7,100	0	0	0	0	0	0	
50.00	1,000	36,810	18,405,000	0	0	18,405,000	18,600	25,800,000	0	0	25,800,000	4,340	10,385,000	0	0	10,385,000	0	0
51.00	1,000	0	0	0	0	0	26,370	47,485,000	0	0	47,485,000	6,430	12,985,000	0	0	12,985,000	0	0
52.00	1,000	0	0	0	0	0	5,800	41,085,000	0	0	41,085,000	9,500	8,000,000	0	0	8,000,000	0	0
53.00	0	0	0	0	0	0	26,940	0	0									

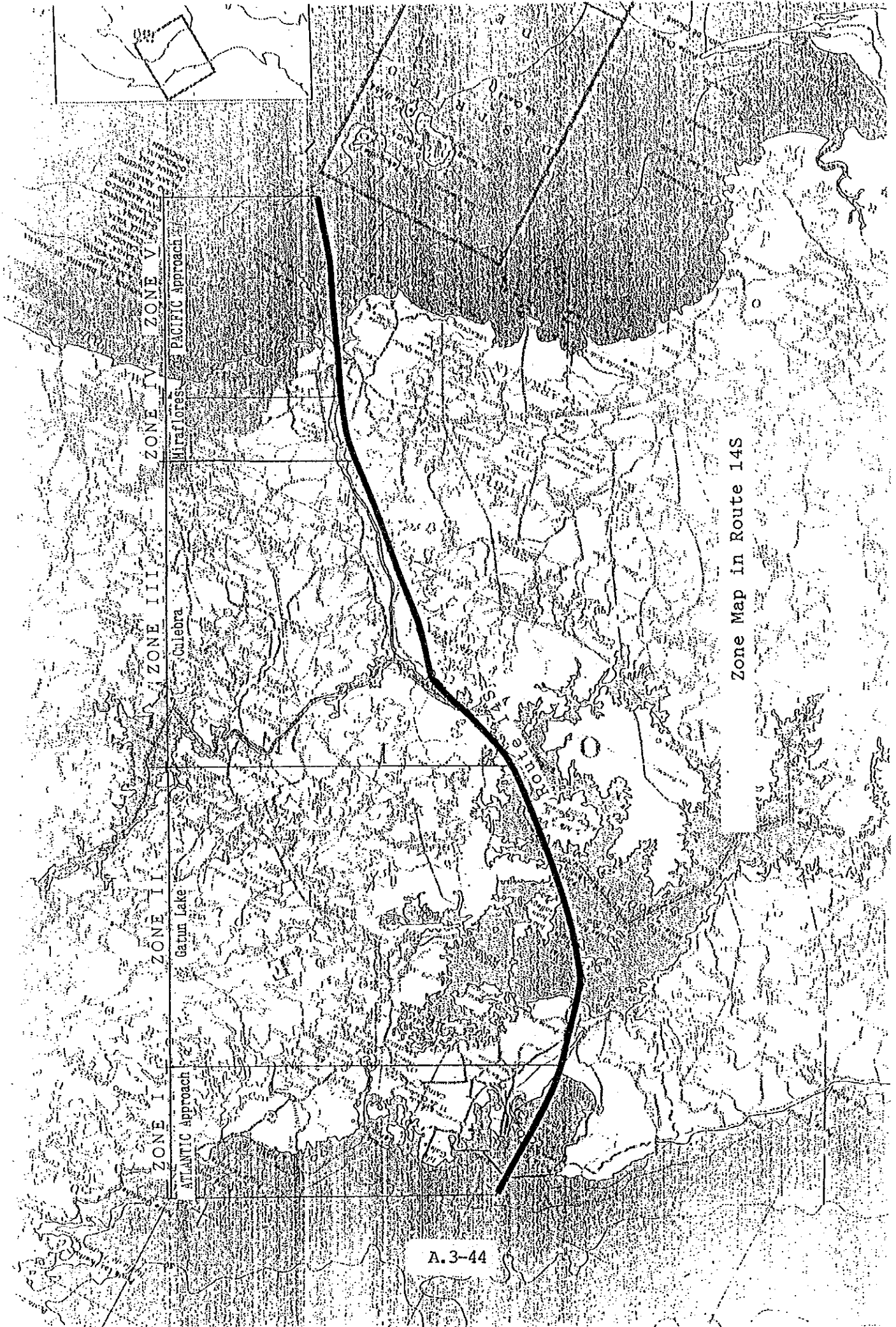
S-15 Calculation Table of Excavation Volume

Station No.	Dis (ft)	Hard Rock			Soft Rock			Earth			Mud			
		Net At	Net V1	Dry V2	Net At	Net V1	Dry V2	Net At	Net V1	Dry V2	Net At	Net V1		
-2.90	2,900	0	6,235,000	0	6,235,000	0	3,915,000	0	3,915,000	0	1,334,000	0	1,334,000	
0.00	1,000	4,300	9,645,000	4,300	2,150,000	7,495,000	2,700	3,000,000	2,700	1,350,000	1,850,000	920	1,560,000	
1.00	0	4,990	0	0	0	0	3,300	0	0	0	2,200	0	0	
Sum 1	3,900		15,880,000	0	8,385,000	7,495,000	6,915,000	5,265,000	1,650,000	2,894,000	1,794,000	1,100,000	1,794,000	
1.00	1,000	14,990	17,460,000	0	0	17,460,000	3,300	3,270,000	0	0	3,270,000	2,200	2,160,000	
2.00	1,000	19,930	19,565,000	0	0	19,565,000	3,240	3,270,000	0	0	3,270,000	2,160	2,180,000	
3.00	1,000	19,200	23,395,000	0	0	23,395,000	3,300	3,300,000	0	0	3,300,000	2,200	2,200,000	
4.00	1,000	27,590	41,750,000	0	0	41,750,000	3,390	3,780,000	0	0	3,780,000	2,200	2,520,000	
5.00	1,000	35,910	47,685,000	0	0	47,685,000	4,260	3,890,000	0	0	3,890,000	2,840	2,660,000	
6.00	1,000	39,420	38,255,000	0	0	38,255,000	3,720	3,690,000	0	0	3,690,000	2,480	2,460,000	
7.00	1,000	33,090	21,370,000	0	0	21,370,000	3,660	3,390,000	0	0	3,390,000	2,440	2,260,000	
8.00	1,000	9,850	13,270,000	0	0	13,270,000	3,120	3,210,000	0	0	3,210,000	2,080	2,140,000	
9.00	1,000	16,890	16,925,000	0	0	16,925,000	3,300	3,660,000	0	0	3,660,000	2,200	2,440,000	
10.00	1,000	16,960	19,895,000	0	0	19,895,000	4,020	3,840,000	0	0	3,840,000	2,880	2,560,000	
11.00	1,000	22,830	17,415,000	0	0	17,415,000	3,660	3,390,000	0	0	3,390,000	2,440	2,260,000	
12.00	1,000	22,000	14,670,000	0	0	14,670,000	3,120	3,360,000	0	0	3,360,000	2,080	2,240,000	
13.00	1,000	17,340	19,765,000	0	0	19,765,000	3,600	3,540,000	0	0	3,540,000	2,400	2,360,000	
14.00	1,000	22,190	21,460,000	0	0	21,460,000	3,480	3,390,000	0	0	3,390,000	2,320	2,260,000	
15.00	1,000	20,730	10,365,000	0	0	10,365,000	3,300	12,825,000	0	0	12,825,000	2,200	3,900,000	
16.00	1,000	0	0	0	0	0	22,350	23,670,000	0	0	23,670,000	5,600	5,750,000	
17.00	1,000	0	0	0	0	0	24,990	21,690,000	0	0	21,690,000	5,900	5,750,000	
18.00	1,000	0	0	0	0	0	18,390	18,027,500	0	0	18,027,500	5,600	5,300,000	
19.00	1,000	0	0	0	0	0	17,665	14,782,500	0	0	14,782,500	5,000	5,000,000	
20.00	1,000	0	0	0	0	0	11,900	11,758,000	0	0	11,758,000	5,000	5,000,000	
21.00	1,000	0	0	0	0	0	11,610	13,075,000	0	0	13,075,000	5,000	5,000,000	
22.00	1,000	0	0	0	0	0	14,540	17,305,000	0	0	17,305,000	5,000	5,100,000	
23.00	1,000	0	0	0	0	0	20,070	21,280,000	0	0	21,280,000	5,200	5,250,000	
24.00	1,000	0	0	0	0	0	22,490	21,720,000	0	0	21,720,000	5,300	5,300,000	
25.00	1,000	0	0	0	0	0	20,950	17,250,000	0	0	17,250,000	5,300	5,250,000	
26.00	1,000	0	0	0	0	0	13,589	15,965,000	0	0	15,965,000	5,200	5,200,000	
27.00	0	0	0	0	0	0	18,380	0	0	0	5,200	0	0	
Sum 2	26,000		341,225,000	0	0	341,225,000	258,425,000	258,425,000	0	0	258,425,000	94,520,000	94,520,000	
27.00	1,000	0	0	0	0	0	9,050	10,030,000	0	0	10,030,000	2,700	2,750,000	
28.00	1,000	0	0	0	0	0	11,010	11,385,000	0	0	11,385,000	2,800	2,850,000	
29.00	1,000	0	0	0	0	0	11,760	11,325,000	0	0	11,325,000	2,900	2,900,000	
30.00	1,000	0	0	0	0	0	10,890	10,405,000	0	0	10,405,000	2,800	2,850,000	
31.00	1,000	0	0	0	0	0	9,920	9,970,000	0	0	9,970,000	2,800	2,800,000	
32.00	1,000	0	0	0	0	0	10,020	9,595,000	0	0	9,595,000	2,800	2,800,000	
33.00	1,000	0	0	0	0	0	5,170	8,335,000	0	0	8,335,000	2,800	2,700,000	
34.00	1,000	0	0	0	0	0	7,500	7,530,000	0	0	7,530,000	2,600	2,600,000	
35.00	1,000	0	0	0	0	0	7,560	8,925,000	0	0	8,925,000	2,800	2,700,000	
36.00	1,000	0	0	0	0	0	10,290	8,185,000	0	0	8,185,000	2,800	3,740,000	
37.00	1,000	0	0	0	0	0	6,080	7,830,000	0	0	7,830,000	4,680	4,805,000	
38.00	1,000	0	0	0	0	0	5,560	8,980,000	0	0	8,980,000	4,930	5,895,000	
39.00	1,000	0	0	0	0	0	8,389	11,890,000	0	0	11,890,000	6,460	4,665,000	
40.00	1,000	0	0	0	0	0	15,400	15,370,000	0	0	15,370,000	2,870	2,835,000	
41.00	1,000	0	0	0	0	0	15,340	14,240,000	0	0	14,240,000	2,800	2,765,000	
42.00	0	0	0	0	0	0	13,140	0	0	0	2,650	0	0	
42.00	1,000	7,230	7,615,000	0	0	7,615,000	3,900	3,400,000	0	0	3,400,000	2,730	2,660,000	
43.00	0	8,000	0	0	0	0	2,900	0	0	0	2,030	0	0	
43.00	1,000	0	0	0	0	0	12,410	12,165,000	0	0	12,165,000	2,590	3,345,000	
44.00	1,000	0	0	0	0	0	11,920	18,350,000	0	0	18,350,000	4,100	4,480,000	
45.00	1,000	0	0	0	0	0	24,780	18,350,000	0	0	18,350,000	4,660	13,430,000	
46.00	1,000	0	31,610,000	0	0	31,610,000	58,760	46,770,000	0	0	46,770,000	22,000	16,850,000	
47.00	1,000	53,220	59,580,000	0	0	59,580,000	0	34,380,000	0	0	34,380,000	11,700	7,350,000	
48.00	1,000	55,940	50,880,000	0	0	50,880,000	0	0	0	0	3,000	5,500,000	0	
49.00	1,000	85,820	33,315,000	0	0	33,315,000	0	0	0	0	8,000	5,330,000	0	
50.00	0	20,810	0	0	0	0	24,300	0	0	0	5,670	0	0	
50.00	1,000	17,680	8,840,000	0	0	8,840,000	11,400	17,850,000	0	0	17,850,000	2,660	8,555,000	
51.00	1,000	0	0	0	0	0	14,110	22,755,000	0	0	22,755,000	14,450	11,225,000	
52.00	1,000	0	0	0	0	0	14,850	24,480,000	0	0	24,480,000	8,000	6,050,000	
53.00	0	0	0	0	0	0	13,760	0	0	0	4,100	0	0	
Sum 3	26,000		191,840,000	0	0	191,840,000	362,495,000	362,495,000	0	0	362,495,000	134,230,000	134,230,000	
53.00	1,000	0	0	0	0	0	26,940	26,455,000	0	0	26,455,000	6,500	6,990,000	
54.00	1,000	0	0	0	0	0	25,970	20,540,000	0	0	20,540,000	7,300	6,450,000	
55.00	1,000	0	0	0	0	0	15,110	18,420,000	0	0	18,420,000	5,600	5,850,000	
56.00	1,000	0	0	0	0	0	21,730	21,580,000	0	0	21,580,000	6,100	5,950,000	
57.00	1,000	0	0	0	0	0	21,430	24,255,000	0	0	24,255,000	5,800	6,400,000	
58.00	0	0	0	0	0	0	27,080	0	0	0	7,000	0	0	
Sum 4	5,000		0	0	0	0	111,250,000	111,250,000	0	0	111,250,000	31,550,000	31,550,000	
58.00	3,600	0	0	0	0	0	27,080	52,770,000	0	0	12,150,000	40,620,000	7,000	11,895,000
61.00	9,900	0	0	0	0	0	8,100	48,600,000	8,100	48,600,000	0	920	8,190,000	
70.00	16,400	0	0	0	0	0	2,700	22,140,000	2,700	22,140,000	0	890	7,298,000	
86.40	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sum 5	28,400		0	0	0	0	123,510,000	82,890,000	40,620,000	27,383,000	16,883,000	10,500,000	16,883,000	
S-15														
Sum 1	3,900		15,880,000	8,385,000	7,495,000	6,915,000	5,265,000	1,650,000	2,894,000	1,794,000	1,100,000	1,794,000		
Sum 2	26,000		341,225,000	0	0	341,225,000	258,425,000	258,425,000	0	0	258,425,000	94,520,000	94,520,000	
Sum 3	26,000		191,840,000	0	0	191,840,000	362,495,000	362,495,000	0	0	362,495,000	134,230,000	134,230,000	
Sum 4	5,000		0	0										



Study Case	Route	W. Level	No. of Lifts	No. of Lanes	Ship Size (1000 DWT)	Canal Size (m)
S-7	14S	0	-	1	150	147 x 20.9
8	14S	0	-	2	150	343 x 20.9
9	14S	0	-	1	250	171 x 24.2
10	14S	0	-	2	250	399 x 24.2
11	14S	0	-	1	300	183 x 25.3
12	14S	0	-	2	300	424 x 25.3
16	14S	0	-	50%-1	150	147 x 20.9
				50%-2		343 x 20.9
17	14S	0	-	50%-1	250	171 x 24.2
				50%-2		399 x 24.2
18	14S	0	-	50%-1	300	183 x 25.3
				50%-2		424 x 25.3

Layout of Sea Level Canal
for Group D Study Cases (Route 14S)



Zone Map in Route 14S

Calculation Table of Excavation Volume

Station No.	Dis (e)	Hard Rock				Soft Rock				Earth				Hsd	
		Ao	Vo	Wet V1	Dry V2	Ao	Vo	Wet V1	Dry V2	Ao	Vo	Wet V1	Dry V2	Ao	Vo
-11.10	8.100	0	0	0	0	0	4,900,500	4,900,500	0	0	1,620,000	0	0	0	1,620,000
-3.00	4.600	0	1,040,000	0	1,040,000	1,210	4,820,000	4,820,000	1,210	4,820,000	400	1,620,000	400	1,620,000	400
1.00	0	520	0	520	0	1,200	0	1,200	0	410	0	410	0	410	
Sum 1	12.100		1,040,000	1,040,000	0		9,720,500	9,720,500	0		3,240,000	0	3,240,000	0	
1.00	50	520	79,250	240	17,750	1,200	61,500	190	11,250	50,250	820	42,500	0	0	42,500
1.05	1.150	2,850	3,047,500	470	540,500	2,507,000	1,260	1,448,000	260	299,000	1,150,000	880	1,012,000	0	1,012,000
2.20	10	2,850	26,500	470	4,700	21,800	1,260	12,600	260	2,600	10,000	880	11,300	0	11,300
2.21	190	2,850	303,500	470	89,300	414,200	1,260	239,400	260	48,400	190,000	1,380	262,200	0	262,200
2.40	10	2,850	26,500	470	4,700	21,800	1,260	12,600	260	2,600	10,000	1,380	11,300	0	11,300
2.41	590	2,850	1,563,500	470	277,300	1,286,200	1,260	743,400	260	153,400	590,000	880	519,200	0	519,200
3.00	2,000	2,850	5,300,000	470	500,000	4,800,000	1,260	3,150,000	260	520,000	2,630,000	880	2,200,000	0	2,200,000
5.00	1,000	2,850	3,060,000	38	1,750,000	1,310,000	1,890	1,530,000	260	715,000	815,000	1,320	875,000	0	215,000
6.00	1,000	3,470	3,675,000	3,470	3,675,000	0	1,170	1,225,000	1,170	1,225,000	0	430	430,000	0	430,000
7.00	1,000	2,880	4,225,000	3,880	4,225,000	0	1,280	1,285,000	1,280	1,285,000	0	430	435,000	0	435,000
8.00	1,000	4,570	3,700,000	4,570	3,700,000	0	1,290	1,170,000	1,290	1,170,000	0	440	430,000	0	440,000
9.00	1,000	2,830	3,590,000	2,830	3,590,000	0	1,050	1,170,000	1,050	1,170,000	0	420	425,000	0	425,000
10.00	1,000	4,350	3,810,000	4,350	3,810,000	0	1,290	1,215,000	1,290	1,215,000	0	430	430,000	0	430,000
11.00	1,000	3,270	3,585,000	3,270	3,585,000	0	1,140	1,200,000	1,140	1,200,000	0	430	430,000	0	430,000
12.00	1,000	3,900	3,725,000	3,900	3,725,000	0	1,260	1,245,000	1,260	1,245,000	0	430	435,000	0	435,000
13.00	1,000	3,550	3,845,000	3,550	3,845,000	0	1,230	1,260,000	1,230	1,260,000	0	430	435,000	0	435,000
14.00	1,000	4,140	4,170,000	4,140	4,170,000	0	1,290	1,290,000	1,290	1,290,000	0	440	440,000	0	440,000
15.00	1,000	4,200	6,175,000	4,200	2,100,000	4,075,000	1,290	1,360,000	1,290	845,000	735,000	440	690,000	440	220,000
16.00	1,000	8,150	9,660,000	0	1,135,000	8,525,000	1,470	1,440,000	0	105,000	1,335,000	940	960,000	0	900,000
17.00	1,000	8,170	8,550,000	2,270	4,100,000	4,450,000	1,410	1,385,000	210	785,000	600,000	960	720,000	120	290,000
18.00	1,000	5,930	4,840,000	5,930	4,840,000	0	1,360	1,295,000	1,360	1,295,000	0	460	445,000	0	460,000
19.00	1,000	2,750	5,385,000	3,750	4,635,000	750,000	1,230	1,315,000	1,230	1,070,000	255,000	430	695,000	430	505,000
20.00	1,000	7,020	5,895,000	5,520	5,145,000	750,000	1,420	1,355,000	910	1,100,000	255,000	960	700,000	580	510,000
21.00	1,000	4,170	4,435,000	4,170	4,435,000	0	1,290	1,275,000	1,290	1,275,000	0	440	435,000	0	440,000
22.00	1,000	4,100	4,980,000	4,100	4,980,000	0	1,260	1,280,000	1,260	1,280,000	0	430	440,000	0	430,000
23.00	0	5,860	0	5,860	0	0	1,300	0	1,300	0	0	450	0	0	470
Sum 2	22.000		97,851,750	68,879,250	28,972,500		28,993,500	20,368,250	8,625,250	13,807,500		7,005,000	6,898,500		6,315,000
23.00	1,000	5,860	5,975,000	5,860	5,975,000	0	1,300	1,340,000	1,300	1,340,000	0	450	455,000	0	470,000
24.00	1,000	6,090	6,330,000	6,090	5,780,000	550,000	1,380	1,375,000	1,380	1,355,000	240,000	460	685,000	460	510,000
25.00	1,000	6,570	7,210,000	5,470	4,950,000	2,260,000	1,370	1,370,000	890	790,000	640,000	910	945,000	560	475,000
26.00	0	7,850	0	4,430	0	0	1,370	0	570	0	0	980	0	390	0
26.00	1,000	8,320	10,495,000	4,484	2,242,000	8,253,000	1,560	1,620,000	680	330,000	1,290,000	1,480	1,310,000	820	410,000
27.00	1,000	12,670	13,850,000	0	0	13,850,000	1,680	1,770,000	0	1,770,000	1,140	1,240,000	0	0	1,240,000
28.00	1,000	5,030	14,210,000	0	40,000	14,170,000	1,860	1,935,000	0	1,935,000	1,340	1,365,000	0	0	1,365,000
29.00	1,000	13,390	9,385,000	80	2,710,000	6,675,000	2,010	1,755,000	0	750,000	1,005,000	1,390	945,000	0	250,000
30.00	1,000	5,340	5,755,000	5,340	4,850,000	905,000	1,500	1,560,000	1,500	1,230,000	330,000	500	810,000	500	560,000
31.00	1,000	6,170	5,490,000	4,360	4,585,000	905,000	1,620	1,580,000	960	1,170,000	330,000	1,120	1,040,000	620	790,000
32.00	1,000	4,810	4,780,000	4,810	4,705,000	75,000	1,380	1,410,000	1,380	1,320,000	90,000	960	990,000	960	900,000
33.00	1,000	4,710	8,830,000	4,600	2,300,000	6,530,000	1,440	1,635,000	1,260	630,000	1,065,000	1,020	1,145,000	840	420,000
34.00	1,000	12,950	22,710,000	0	0	22,710,000	1,830	2,190,000	0	2,190,000	1,270	1,515,000	0	0	1,515,000
35.00	1,000	12,470	22,400,000	0	0	22,400,000	2,550	2,325,000	0	2,325,000	1,760	1,595,000	0	0	1,595,000
36.00	1,000	12,330	12,260,000	0	0	12,260,000	2,100	1,935,000	0	1,935,000	1,430	1,320,000	0	0	1,320,000
37.00	1,000	12,190	15,760,000	0	0	15,760,000	1,770	1,935,000	0	1,935,000	3,210	1,325,000	0	0	1,325,000
38.00	0	19,330	0	0	0	0	2,100	0	0	0	0	1,440	0	0	0
38.00	1,000	22,620	31,440,000	0	0	31,440,000	3,300	4,020,000	0	4,020,000	2,260	2,500,000	0	0	2,500,000
39.00	1,000	10,260	29,725,000	0	0	29,725,000	4,740	3,990,000	0	3,990,000	3,260	2,970,000	0	0	2,970,000
40.00	1,000	19,190	21,780,000	0	0	21,780,000	3,240	3,660,000	0	3,660,000	2,740	2,755,000	0	0	2,755,000
41.00	1,000	24,370	30,110,000	0	0	30,110,000	4,080	4,350,000	0	4,350,000	2,770	2,975,000	0	0	2,975,000
42.00	1,000	15,850	61,540,000	0	0	61,540,000	4,620	6,435,000	0	6,435,000	3,180	4,350,000	0	0	4,350,000
43.00	1,000	17,230	75,075,000	0	0	75,075,000	8,250	7,110,000	0	7,110,000	5,520	4,770,000	0	0	4,770,000
44.00	1,000	12,320	47,125,000	0	0	47,125,000	5,970	4,035,000	0	4,035,000	4,020	2,720,000	0	0	2,720,000
45.00	1,000	11,330	37,590,000	0	0	37,590,000	2,100	3,225,000	0	3,225,000	1,420	2,220,000	0	0	2,220,000
46.00	1,000	13,850	23,035,000	0	0	23,035,000	4,350	3,270,000	0	3,270,000	3,020	2,280,000	0	0	2,280,000
47.00	1,000	12,220	9,990,000	0	0	9,990,000	2,190	1,995,000	0	1,995,000	1,540	1,380,000	0	0	1,380,000
48.00	1,000	7,760	10,055,000	0	0	10,055,000	1,800	1,875,000	0	1,875,000	1,240	1,280,000	0	0	1,280,000
49.00	1,000	12,350	13,370,000	0	0	13,370,000	1,950	1,965,000	0	1,965,000	1,320	1,360,000	0	0	1,360,000
50.00	0	14,390	0	0	0	0	1,980	0	0	0	0	1,400	0	0	0
Sum 3	27.000		551,235,000	38,137,000	513,098,000		71,585,000	8,635,000	62,950,000	48,255,000		4,770,000	43,485,000		1,215,000
50.00	1,000	14,390	14,660,000	0	0	14,660,000	1,980	1,850,000	0	1,850,000	1,400	1,315,000	0	0	1,315,000
51.00	1,000	14,930	9,520,000	0	0	9,520,000	1,740	1,600,000	0	595,000	1,005,000	1,230	1,125,000	0	400,000
52.00	1,000	4,110													

Calculation Table of Excavation Volume

Station No.	Dls (a)	Hard Rock				Soft Rock				Earth				Mid				
		As	Vo	Ret At	Ret V1	Dry V2	As	Vo	Ret At	Ret V1	Dry V2	As	Vo	Ret At	Ret V1	Dry V2	As	Vo
-11.10	8.180	0	0	0	0	0	9,841,500	9,841,500	0	0	0	3,199,500	3,199,500	0	0	0	0	3,199,500
-3.00	4.000	0	2,060,000	0	2,060,000	0	9,860,000	2,430	9,860,000	2,430	0	790	3,220,000	790	3,220,000	0	790	3,220,000
1.00	0	1,030	0	1,030	0	0	0	2,400	2,400	0	0	820	0	820	0	0	820	0
Sum 1	12.100		2,060,000		2,060,000		19,501,500		19,501,500			6,419,500		6,419,500				6,419,500
1.00	50	1,030	158,250	470	35,500	122,750	2,400	123,000	380	22,500	100,500	1,640	85,000	0	0	85,000	0	0
1.05	1,150	5,300	6,095,000	950	1,032,500	5,002,500	2,520	2,898,000	520	598,000	2,300,000	1,760	2,024,000	0	0	2,024,000	0	0
2.20	10	5,300	53,000	950	9,500	43,500	2,520	25,200	520	5,200	20,000	1,760	22,600	0	0	22,600	0	0
2.21	180	5,300	1,007,000	950	180,500	826,500	2,520	478,800	520	88,800	380,000	2,760	524,400	0	0	524,400	0	0
2.40	10	5,300	53,000	950	9,500	43,500	2,520	25,200	520	5,200	20,000	2,760	22,600	0	0	22,600	0	0
2.41	590	5,300	3,127,000	950	560,500	2,566,500	2,520	1,486,800	520	306,800	1,180,000	1,760	1,038,400	0	0	1,038,400	0	0
3.00	2,000	5,300	10,600,000	950	1,900,000	8,700,000	2,520	5,040,000	520	1,040,000	4,000,000	1,760	3,920,000	0	0	3,920,000	0	0
5.00	1,000	5,300	6,340,000	950	4,165,000	2,175,000	2,520	2,445,000	520	1,445,000	1,000,000	1,760	1,290,000	0	410,000	880,000	0	410,000
6.00	1,000	7,380	8,095,000	7,380	8,095,000	0	2,270	2,415,000	2,270	2,415,000	0	820	825,000	820	825,000	0	820	825,000
7.00	1,000	6,630	9,125,000	8,630	9,125,000	0	2,460	2,430,000	2,460	2,430,000	0	830	830,000	830	830,000	0	830	830,000
8.00	1,000	9,620	7,895,000	9,620	7,895,000	0	2,400	2,320,000	2,400	2,320,000	0	830	795,000	830	795,000	0	830	825,000
9.60	1,000	6,170	7,850,000	8,170	7,850,000	0	2,240	2,335,000	2,240	2,335,000	0	760	795,000	760	795,000	0	820	825,000
10.00	1,000	9,530	8,475,000	9,530	8,475,000	0	2,430	2,385,000	2,430	2,385,000	0	830	830,000	830	830,000	0	830	830,000
11.00	1,000	7,420	8,130,000	7,420	8,130,000	0	2,340	2,385,000	2,340	2,385,000	0	830	830,000	830	830,000	0	830	830,000
12.00	1,000	8,840	8,420,000	8,840	8,420,000	0	2,430	2,415,000	2,430	2,415,000	0	830	830,000	830	830,000	0	830	830,000
13.00	1,000	8,090	7,570,000	8,090	7,570,000	0	2,400	2,430,000	2,400	2,430,000	0	830	830,000	830	830,000	0	830	830,000
14.00	1,000	7,140	8,045,000	7,140	8,045,000	0	2,460	2,460,000	2,460	2,460,000	0	830	830,000	830	830,000	0	830	830,000
15.00	1,000	8,950	14,245,000	8,950	4,475,000	9,770,000	2,480	2,610,000	2,480	1,230,000	1,350,000	830	1,275,000	830	415,000	850,000	830	415,000
16.00	1,000	19,540	19,490,000	0	4,570,000	14,920,000	2,760	2,730,000	0	465,000	2,255,000	1,720	1,730,000	0	230,000	1,500,000	0	0
17.00	1,000	19,440	15,820,000	9,140	10,670,000	5,150,000	2,700	2,590,000	930	1,705,000	885,000	1,740	1,285,000	460	645,000	840,000	0	415,000
18.00	1,000	12,200	10,310,000	12,200	10,310,000	0	2,480	2,470,000	2,480	2,470,000	0	830	830,000	830	830,000	0	830	830,000
19.00	1,000	8,420	12,390,000	8,420	8,475,000	3,915,000	2,460	2,565,000	2,460	1,880,000	585,000	830	1,315,000	830	905,000	410,000	830	415,000
20.00	1,000	16,360	12,045,000	8,530	8,130,000	3,915,000	2,870	2,585,000	1,560	1,880,000	585,000	1,800	1,315,000	380	905,000	410,000	0	415,000
21.00	1,000	7,730	8,475,000	7,730	8,475,000	0	2,460	2,460,000	2,460	2,460,000	0	830	830,000	830	830,000	0	830	830,000
22.00	1,000	9,220	10,730,000	9,220	10,730,000	0	2,460	2,475,000	2,460	2,475,000	0	830	840,000	830	840,000	0	830	845,000
23.00	0	12,240	0	12,240	0	0	2,490	0	2,490	0	850	0	850	0	850	0	850	0
Sum 2	22.000		204,453,250		147,303,000	57,150,250		54,562,000		39,861,500	14,700,500		25,342,000		13,405,000	11,937,000		12,030,000
23.00	1,000	12,240	12,625,000	12,240	12,625,000	0	2,480	2,495,000	2,480	2,495,000	0	850	845,000	850	845,000	0	850	850,000
24.00	1,000	13,010	13,560,000	13,010	10,760,000	2,800,000	2,500	2,525,000	2,500	1,985,000	540,000	840	1,285,000	840	900,000	385,000	860	430,000
25.00	1,000	14,110	15,095,000	8,510	8,080,000	7,015,000	2,550	2,560,000	1,470	1,320,000	1,240,000	1,730	1,745,000	960	870,000	875,000	0	0
26.00	0	16,080	0	7,850	0	0	2,570	0	1,170	0	1,760	0	780	0	780	0	0	0
26.00	1,000	15,580	18,785,000	7,840	3,920,000	14,865,000	2,780	2,795,000	1,260	630,000	2,165,000	1,880	1,900,000	820	410,000	1,490,000	0	0
27.00	1,000	20,950	24,875,000	0	0	24,875,000	3,180	2,990,000	0	0	2,990,000	1,920	2,040,000	0	0	2,040,000	0	0
28.00	1,000	28,760	27,400,000	0	1,700,000	25,700,000	1,800	3,150,000	0	240,000	2,910,000	2,160	2,145,000	0	165,000	1,980,000	0	0
29.00	1,000	26,030	18,985,000	3,400	7,665,000	11,320,000	3,120	2,895,000	480	1,575,000	1,320,000	2,130	1,515,000	330	615,000	900,000	0	450,000
30.00	1,000	11,930	13,830,000	11,930	9,390,000	4,440,000	2,670	2,680,000	2,670	2,115,000	765,000	900	1,500,000	890	950,000	540,000	920	460,000
31.00	1,000	15,730	12,735,000	6,850	8,295,000	4,440,000	3,090	2,835,000	1,580	2,070,000	765,000	2,100	1,910,000	1,020	1,370,000	540,000	0	0
32.00	1,000	9,740	10,925,000	9,740	9,070,000	1,855,000	2,580	2,565,000	2,580	2,220,000	345,000	1,720	1,790,000	1,720	1,470,000	320,000	0	0
33.00	1,000	12,110	18,015,000	8,400	4,200,000	13,815,000	2,550	2,570,000	1,860	930,000	1,600,000	1,860	1,950,000	1,220	610,000	1,340,000	0	0
34.00	1,000	23,820	38,080,000	0	0	38,080,000	2,810	3,240,000	0	0	3,240,000	2,040	2,230,000	0	0	2,230,000	0	0
35.00	1,000	52,240	39,960,000	0	0	39,960,000	3,570	3,540,000	0	0	3,540,000	2,420	2,400,000	0	0	2,400,000	0	0
36.00	1,000	27,680	25,420,000	0	0	25,420,000	3,510	3,230,000	0	0	3,230,000	2,380	2,200,000	0	0	2,200,000	0	0
37.00	1,000	23,180	24,830,000	0	0	24,830,000	2,950	3,065,000	0	0	3,065,000	2,050	2,100,000	0	0	2,100,000	0	0
38.00	0	26,500	0	0	0	0	3,180	0	0	0	0	2,140	0	0	0	0	0	0
38.00	1,000	35,640	47,560,000	0	0	47,560,000	4,310	5,005,000	0	0	5,005,000	2,920	3,420,000	0	0	3,420,000	0	0
39.00	1,000	59,520	46,775,000	0	0	46,775,000	5,700	5,205,000	0	0	5,205,000	3,920	3,745,000	0	0	3,745,000	0	0
40.00	1,000	34,030	36,835,000	0	0	36,835,000	4,710	4,905,000	0	0	4,905,000	3,570	3,555,000	0	0	3,555,000	0	0
41.00	1,000	39,640	49,545,000	0	0	49,545,000	5,100	6,210,000	0	0	6,210,000	3,540	4,220,000	0	0	4,220,000	0	0
42.00	1,000	59,450	88,635,000	0	0	88,635,000	7,320	8,130,000	0	0	8,130,000	4,900	5,490,000	0	0	5,490,000	0	0
43.00	1,000	17,820	94,505,000	0	0	94,505,000	8,940	7,750,000	0	0	7,750,000	6,080	5,290,000	0	0	5,290,000	0	0
44.00	1,000	71,180	66,120,000	0	0	66,120,000	6,560	5,230,000	0	0	5,230,000	4,500	3,550,000	0	0	3,550,000	0	0
45.00	1,000	61,050																

Calculation Table of Excavation Volume

Table with columns for Station No., Dis (ft), Hard Rock (Ao, Vo, Wet V1, Dry V2), Soft Rock (Ao, Vo, Wet V1, Dry V2), Earth (Ao, Vo, Wet V1, Dry V2), and Rad (Ao, Vo). Rows include station numbers from -11.50 to 75.00 and summary rows for S-9.

Total Excavation Vol. 1,059,294.000
Dry 786,398.500
Wet 272,895.500

S-10 Calculation Table of Excavation Volume

Station No.	Dis (ft)	Hard Rock				Soft Rock				Earth				Mad	
		As	Vo	Wet VI	Dry V2	As	Vo	Wet VI	Dry V2	As	Vo	Wet VI	Dry V2		
-11.50	8.500	0	9,222,500	0	9,222,500	0	10,710,000	10,710,000	0	0	4,080,000	4,080,000	0	0	4,080,000
-3.00	4.000	2,170	11,620,000	2,170	11,820,000	2,520	11,040,000	11,040,000	0	960	3,920,000	3,920,000	0	960	3,920,000
1.00	0	3,840	0	3,840	0	3,000	0	3,000	0	1,000	0	1,000	0	1,000	0
Sum 1	12.500		20,842,500		20,842,500		21,750,000	21,750,000			8,000,000	8,000,000			8,000,000
1.00	50	3,640	292,000	3,640	114,750	177,250	3,000	150,000	380	22,500	127,500	2,000	100,000	0	100,000
1.05	1.150	8,040	9,246,000	950	1,082,500	8,153,500	3,000	3,450,000	520	598,000	2,852,000	2,000	2,300,000	0	2,300,000
2.20	10	8,040	80,400	950	9,500	70,900	3,000	30,000	520	5,200	24,800	2,000	25,000	0	25,000
2.21	190	8,040	1,527,600	950	180,500	1,347,100	3,000	570,000	520	98,800	471,200	3,000	570,000	0	570,000
2.40	10	8,040	80,400	950	9,500	70,900	3,000	30,000	520	5,200	24,800	3,000	25,000	0	25,000
2.41	590	8,040	4,743,600	950	560,500	4,183,100	3,000	1,170,000	520	308,800	1,463,200	2,000	1,160,000	0	1,160,000
3.00	2,003	8,040	15,550,000	950	1,900,000	13,650,000	3,000	6,700,000	520	1,040,000	5,660,000	2,000	4,000,000	0	4,000,000
5.00	1,000	7,510	8,890,000	950	5,810,000	3,280,000	3,700	3,155,000	520	1,585,000	1,590,000	2,000	1,470,000	0	1,470,000
6.00	1,000	10,270	10,685,000	10,270	10,685,000	0	2,610	2,715,000	2,610	2,715,000	940	940,000	940	940,000	940
7.00	1,000	11,100	11,935,000	11,100	11,935,000	0	2,820	2,805,000	2,820	2,805,000	940	955,000	940	955,000	940
8.00	1,000	12,770	10,795,000	12,770	10,795,000	0	2,790	2,760,000	2,790	2,760,000	970	925,000	970	925,000	970
9.00	1,000	8,820	10,800,000	8,820	10,800,000	0	2,610	2,885,000	2,610	2,885,000	880	925,000	880	925,000	880
10.00	1,000	12,780	11,505,000	12,780	11,505,000	0	2,760	2,700,000	2,760	2,700,000	970	960,000	970	960,000	970
11.00	1,000	10,230	10,975,000	10,230	10,975,000	0	2,640	2,885,000	2,640	2,885,000	950	950,000	950	950,000	950
12.00	1,000	11,720	11,290,000	11,720	11,290,000	0	2,730	2,735,000	2,730	2,735,000	950	950,000	950	950,000	950
13.00	1,000	10,850	11,820,000	10,850	11,820,000	0	2,740	2,785,000	2,740	2,785,000	950	950,000	950	950,000	950
14.00	1,000	12,780	11,260,000	12,780	11,260,000	0	2,850	2,850,000	2,850	2,850,000	950	950,000	950	950,000	950
15.00	1,000	9,780	16,860,000	9,780	4,890,000	11,970,000	2,850	2,955,000	2,850	1,425,000	950	1,500,000	950	475,000	950
16.00	1,000	23,940	23,955,000	0	5,480,000	18,275,000	3,080	3,030,000	0	515,000	2,515,000	2,050	2,080,000	0	355,000
17.00	1,000	23,570	19,200,000	10,960	12,895,000	6,305,000	3,000	2,870,000	1,030	1,885,000	985,000	2,110	1,525,000	910	825,000
18.00	1,000	14,830	13,130,000	14,830	13,130,000	0	2,740	2,795,000	2,740	2,795,000	940	845,000	940	845,000	940
19.00	1,000	11,430	15,985,000	11,430	10,785,000	5,200,000	2,850	2,945,000	2,850	2,270,000	675,000	950	1,495,000	950	1,025,000
20.00	1,000	20,500	18,825,000	10,100	11,625,000	5,200,000	3,040	2,945,000	1,890	2,210,000	675,000	2,040	1,495,000	1,100	1,025,000
21.00	1,000	11,150	12,280,000	11,150	12,280,000	0	2,850	2,850,000	2,850	2,850,000	950	950,000	950	950,000	950
22.00	1,000	11,410	13,710,000	11,410	13,710,000	0	2,850	2,865,000	2,850	2,865,000	950	955,000	950	955,000	950
Sum 2	22,000		273,220,000		95,337,250	77,882,750		63,780,000	45,186,500	18,593,500		29,120,000		15,530,000	13,590,000
23.00	1,000	16,010	16,465,000	16,010	16,465,000	0	2,880	2,875,000	2,880	2,875,000	960	960,000	960	960,000	960
24.00	1,000	16,920	17,300,000	16,920	13,610,000	3,690,000	2,870	2,905,000	2,870	2,260,000	845,000	960	1,470,000	960	1,020,000
25.00	1,000	17,680	19,065,000	10,300	9,970,000	9,095,000	2,840	2,945,000	1,650	1,500,000	1,445,000	1,980	1,970,000	1,080	970,000
26.00	0	20,450	0	9,640	0	0	2,950	0	1,350	0	1,960	0	860	0	0
26.00	1,000	20,920	23,110,000	9,900	4,950,000	18,160,000	3,120	3,165,000	1,440	720,000	2,445,000	2,120	2,150,000	940	470,000
27.00	1,000	25,360	29,535,000	0	29,535,000	0	3,210	3,405,000	0	0	3,405,000	2,180	2,310,000	0	2,310,000
28.00	1,000	33,770	32,495,000	0	2,515,000	29,980,000	3,600	3,560,000	0	340,000	3,220,000	2,440	2,420,000	0	220,000
29.00	1,000	31,270	23,280,000	5,030	10,185,000	13,095,000	3,520	3,275,000	890	1,855,000	1,420,000	2,400	1,715,000	440	735,000
30.00	1,000	15,340	16,420,000	15,340	12,070,000	4,350,000	3,030	3,270,000	3,030	2,385,000	885,000	1,030	1,710,000	1,030	1,030,000
31.00	1,000	21,500	17,310,000	8,800	10,505,000	6,805,000	3,510	3,225,000	1,740	2,340,000	885,000	2,390	1,685,000	1,140	1,080,000
32.00	1,000	13,120	14,470,000	13,120	11,720,000	2,750,000	2,940	3,045,000	2,940	2,500,000	945,000	980	1,545,000	980	1,160,000
33.00	1,000	15,820	22,420,000	10,320	5,168,000	17,252,000	3,150	3,210,000	2,060	1,030,000	2,180,000	2,110	2,165,000	1,340	670,000
34.00	1,000	29,020	44,215,000	0	44,215,000	0	3,270	3,585,000	0	0	3,585,000	2,220	2,425,000	0	2,425,000
35.00	1,000	59,410	46,965,000	0	46,965,000	0	3,900	3,900,000	0	0	3,900,000	2,630	2,635,000	0	2,635,000
36.00	1,000	34,520	31,520,000	0	31,520,000	0	3,900	3,570,000	0	0	3,570,000	2,640	2,400,000	0	2,400,000
37.00	1,000	28,520	33,635,000	0	33,635,000	0	3,240	3,390,000	0	0	3,390,000	2,180	2,280,000	0	2,280,000
38.00	0	38,750	0	0	0	0	3,540	0	0	0	2,400	0	0	0	0
38.00	1,000	41,430	53,970,000	0	53,970,000	0	4,620	5,355,000	0	5,355,000	3,180	3,650,000	0	3,650,000	
39.00	1,000	66,510	53,135,000	0	53,135,000	0	6,080	5,700,000	0	5,700,000	4,120	4,020,000	0	4,020,000	
40.00	1,000	39,760	42,585,000	0	42,585,000	0	5,310	5,460,000	0	5,460,000	3,920	3,890,000	0	3,890,000	
41.00	1,000	45,430	50,915,000	0	50,915,000	0	5,610	6,630,000	0	6,630,000	3,860	4,500,000	0	4,500,000	
42.00	1,000	59,400	93,105,000	0	93,105,000	0	7,650	8,415,000	0	8,415,000	5,140	5,650,000	0	5,650,000	
43.00	1,000	29,810	118,390,000	0	118,390,000	0	9,180	7,980,000	0	7,980,000	6,220	5,390,000	0	5,390,000	
44.00	1,000	106,970	89,225,000	0	89,225,000	0	6,760	5,590,000	0	5,590,000	4,560	3,750,000	0	3,750,000	
45.00	1,000	71,460	64,560,000	0	64,560,000	0	4,400	5,125,000	0	5,125,000	2,940	3,490,000	0	3,490,000	
46.00	1,000	57,680	43,150,000	0	43,150,000	0	3,650	4,755,000	0	4,755,000	4,040	3,290,000	0	3,290,000	
47.00	1,000	28,620	25,045,000	0	25,045,000	0	3,580	3,585,000	0	3,585,000	2,540	2,470,000	0	2,470,000	
48.00	1,000	21,470	24,800,000	0	24,800,000	0	3,510	3,510,000	0	3,510,000	2,400	2,400,000	0	2,400,000	
49.00	1,000	28,130	29,685,000	0	29,685,000	0	3,510	3,525,000	0	3,525,000	2,400	2,430,000	0	2,430,000	
50.00	0	31,260	0	0	0	0	3,540	0	0	0	2,460	0	0	0	0
Sum 3	27,000		1,078,810,000		97,605,000	981,205,000		114,955,000	17,805,000	97,150,000		74,800,000		8,350,000	66,450,000
50.00	1,000	31,260	29,175,000	0	1,730,000	27,445,000	3,540	3,305,000	0	285,000	3,020,000	2,460	2,300,000	0	210,000
51.00	1,000	27,090	20,840,000	3,460	5,630,000	15,210,000	3,070	3,055,000	570						

Calculation Table of Excavation Volume

Station No.	Dfs (m)	Hard Rock					Soft Rock					Earth					Wsd	
		As	Vo	Wet V1	Dry V2		As	Vo	Wet V1	Dry V2		As	Vo	Wet V1	Dry V2		As	Vo
-11.50	8.800	0	5,160,000	0	5,160,000	0	0	6,020,000	0	6,020,000	0	0	2,279,000	0	2,279,000	0	0	2,279,000
-1.00	4,000	1,260	6,400,000	1,200	6,400,000	0	1,400	6,100,000	1,400	6,100,000	0	530	2,160,000	530	2,160,000	0	530	2,160,000
1.00	0	2,600	0	2,000	0	0	1,650	0	1,650	0	0	550	0	550	0	0	0	
Sum 1	12,600		11,560,000		11,560,000			12,120,000		12,120,000			4,439,000		4,439,000			4,439,000
1.00	50	2,000	160,000	200	18,000	142,000	1,650	82,500	200	12,500	70,000	1,100	55,000	0	0	55,000	0	0
1.05	1,150	4,400	5,060,000	520	598,000	4,482,000	1,650	1,891,500	300	345,000	1,552,500	1,100	1,265,000	0	0	1,265,000	0	0
2.20	10	4,400	44,000	520	5,200	38,800	1,650	16,500	300	3,000	13,500	1,100	13,750	0	0	13,750	0	0
2.21	190	4,400	836,000	520	88,800	737,200	1,650	313,500	300	57,000	256,500	1,650	313,500	0	0	313,500	0	0
2.40	10	4,400	44,000	520	5,200	38,800	1,650	16,500	300	3,000	13,500	1,100	13,750	0	0	13,750	0	0
2.41	590	4,400	2,596,000	520	306,800	2,289,200	1,650	973,500	300	177,000	796,500	1,100	648,000	0	0	648,000	0	0
3.00	2,000	4,400	8,600,000	520	1,040,000	7,560,000	1,650	4,850,000	300	600,000	4,250,000	1,100	2,200,000	0	0	2,200,000	0	0
5.00	1,000	4,200	4,845,000	520	2,805,000	1,840,000	3,200	2,365,000	300	915,000	1,450,000	1,100	805,000	0	0	255,000	550,000	255,000
6.00	1,000	5,050	5,410,000	5,050	5,410,000	0	0	1,530	1,530,000	1,530	1,530,000	0	510	515,000	510	515,000	0	510
7.00	1,000	5,720	5,825,000	5,720	5,825,000	0	0	1,530	1,860,000	1,530	1,410,000	450,000	520	515,000	520	515,000	0	520
8.00	1,000	5,920	5,205,000	5,920	5,205,000	0	0	2,190	1,755,000	1,290	1,305,000	450,000	510	480,000	510	480,000	0	520
9.00	1,000	4,490	5,425,000	4,490	5,425,000	0	0	1,320	1,430,000	1,320	1,430,000	0	450	475,000	450	475,000	0	510
10.00	1,000	6,350	5,615,000	6,350	5,615,000	0	0	1,540	1,445,000	1,540	1,445,000	0	500	505,000	500	505,000	0	520
11.00	1,000	4,870	5,330,000	4,870	5,330,000	0	0	1,350	1,400,000	1,350	1,400,000	0	510	510,000	510	510,000	0	510
12.00	1,000	5,790	5,580,000	5,790	5,580,000	0	0	1,450	1,445,000	1,450	1,445,000	0	510	510,000	510	510,000	0	520
13.00	1,000	5,370	5,740,000	5,370	5,740,000	0	0	1,440	1,500,000	1,440	1,500,000	0	510	515,000	510	515,000	0	520
14.00	1,000	6,110	5,950,000	6,110	5,950,000	0	0	1,560	1,545,000	1,560	1,545,000	0	520	520,000	520	520,000	0	520
15.00	1,000	5,750	8,510,000	5,750	2,895,000	5,615,000	1,530	1,650,000	1,530	765,000	885,000	520	870,000	520	260,000	610,000	520	260,000
16.00	1,000	11,230	12,420,000	0	1,655,000	10,765,000	1,770	1,720,000	0	165,000	1,555,000	1,220	1,175,000	0	105,000	1,070,000	0	0
17.00	1,000	13,610	10,955,000	3,310	5,805,000	5,150,000	1,670	1,835,000	330	965,000	670,000	1,130	835,000	210	375,000	460,000	0	275,000
18.00	1,000	8,300	6,905,000	8,300	6,905,000	0	0	1,680	1,570,000	1,680	1,570,000	0	540	520,000	540	520,000	0	550
19.00	1,000	5,510	7,540,000	5,510	6,255,000	1,285,000	1,540	1,425,000	1,540	1,295,000	330,000	500	835,000	500	565,000	250,000	500	525,000
20.00	1,000	9,570	8,920,000	7,000	7,035,000	1,285,000	1,710	1,635,000	1,650	1,305,000	330,000	1,170	845,000	670	595,000	250,000	0	265,000
21.00	1,000	7,070	6,560,000	7,070	6,560,000	0	0	1,560	1,550,000	1,560	1,550,000	0	520	520,000	520	520,000	0	520
22.00	1,000	6,050	7,130,000	6,050	7,130,000	0	0	1,540	1,555,000	1,540	1,555,000	0	540	530,000	520	530,000	0	520
23.00	0	8,210	0	8,210	0	0	0	1,570	0	1,570	0	0	540	0	540	0	0	550
Sum 2	22,000		140,405,000		99,197,000	41,208,000		37,365,000		24,292,500	13,072,500		15,990,000		8,290,000	7,700,000		7,545,000
23.00	1,000	8,210	8,395,000	8,210	8,395,000	0	0	1,570	1,600,000	1,570	1,600,000	0	540	545,000	540	545,000	0	550
24.00	1,000	8,580	8,810,000	8,580	7,920,000	890,000	1,630	1,835,000	1,630	1,325,000	310,000	550	825,000	550	805,000	220,000	560	289,000
25.00	1,000	9,040	9,715,000	7,260	6,545,000	3,170,000	1,640	1,640,000	1,020	865,000	775,000	1,100	1,125,000	660	570,000	555,000	0	0
26.00	0	60,390	0	5,830	0	0	0	1,640	0	710	0	0	1,150	0	480	0	0	0
26.00	1,000	11,150	13,080,000	6,100	3,050,000	10,030,000	1,870	1,905,000	810	405,000	1,500,000	1,260	1,300,000	520	260,000	1,040,000	0	0
27.00	1,000	15,010	16,695,000	0	0	16,695,000	1,940	2,050,000	0	0	2,050,000	1,320	1,430,000	0	0	1,430,000	0	0
28.00	1,000	18,380	17,725,000	0	590,000	17,135,000	2,160	2,220,000	0	55,000	2,165,000	1,540	1,550,000	0	40,000	1,510,000	0	0
29.00	1,000	17,070	12,350,000	1,180	4,405,000	7,945,000	2,260	2,025,000	110	940,000	1,085,000	1,560	1,080,000	80	340,000	740,000	0	305,000
30.00	1,000	7,630	8,710,000	7,630	6,875,000	1,835,000	1,770	1,860,000	1,770	1,440,000	420,000	600	935,000	600	550,000	345,000	610	305,000
31.00	1,000	9,790	8,295,000	6,120	6,460,000	1,835,000	1,950	1,815,000	1,110	1,395,000	420,000	1,330	975,000	700	630,000	345,000	0	285,000
32.00	1,000	6,800	7,010,000	6,800	6,750,000	260,000	1,680	1,730,000	1,680	1,545,000	185,000	560	885,000	560	745,000	140,000	570	285,000
33.00	1,000	7,220	11,955,000	6,700	3,350,000	8,605,000	1,780	1,910,000	1,410	705,000	1,205,000	1,210	1,320,000	930	465,000	855,000	0	0
34.00	1,000	6,690	27,475,000	0	0	27,475,000	2,040	2,410,000	0	0	2,410,000	1,430	1,660,000	0	0	1,660,000	0	0
35.00	1,000	18,260	27,395,000	0	0	27,395,000	2,780	2,605,000	0	0	2,605,000	1,890	1,770,000	0	0	1,770,000	0	0
36.00	1,000	16,530	16,095,000	0	0	16,095,000	2,430	2,250,000	0	0	2,250,000	1,650	1,525,000	0	0	1,525,000	0	0
37.00	1,000	15,460	19,500,000	0	0	19,500,000	2,070	2,215,000	0	0	2,215,000	1,400	1,495,000	0	0	1,495,000	0	0
38.00	0	23,520	0	0	0	0	0	2,360	0	0	0	0	1,590	0	0	0	0	0
38.00	1,000	26,610	35,990,000	0	0	35,990,000	3,450	4,170,000	0	0	4,170,000	2,420	2,900,000	0	0	2,900,000	0	0
39.00	1,000	15,370	34,295,000	0	0	34,295,000	4,890	4,215,000	0	0	4,215,000	3,380	3,160,000	0	0	3,160,000	0	0
40.00	1,000	23,220	26,195,000	0	0	26,195,000	3,540	3,960,000	0	0	3,960,000	2,940	2,950,000	0	0	2,950,000	0	0
41.00	1,000	19,170	35,240,000	0	0	35,240,000	4,380	4,650,000	0	0	4,650,000	2,960	3,170,000	0	0	3,170,000	0	0
42.00	1,000	11,310	68,255,000	0	0	68,255,000	4,920	6,690,000	0	0	6,690,000	3,380	4,540,000	0	0	4,540,000	0	0
43.00	1,000	15,200	86,235,000	0	0	86,235,000	8,460	7,290,000	0	0	7,290,000	5,700	4,900,000	0	0	4,900,000	0	0
44.00	1,000	17,270	57,495,000	0	0	57,495,000	6,120	4,580,000	0	0	4,580,000	4,100	3,090,000	0	0	3,090,000	0	0
45.00	1,000	17,720	38,420,000	0	0	38,420,000	3,040	3,835,000	0	0	3,835,000	2,080	2,595,000	0	0	2,59		

Calculation Table of Excavation Volume

Station No.	dia (ø)	Hard Rock				Soft Rock				Earth				Mud		
		As	Vo	Wet V1	Dry V2	As	Vo	Wet V1	Dry V2	As	Vo	Wet V1	Dry V2	As	Vo	
-11.60	8.600	0	10,320,000	0	10,320,000	0	12,040,000	0	12,040,000	0	4,558,000	0	4,558,000	0	4,558,000	
-3.00	4,000	2,400	12,600,000	2,400	12,600,000	2,800	12,200,000	2,800	12,200,000	0	1,060	4,320,000	1,060	4,320,000	0	1,060
1.00	0	4,000	0	4,000	0	3,300	0	3,300	0	1,100	0	1,100	0	0	1,100	
Sum 1	12.600		23,120,000	4,800	23,120,000	5,600	24,240,000	5,600	24,240,000	1,200	4,878,000	1,200	4,878,000	0	8,878,000	
1.00	50	4,000	321,000	520	39,000	3,300	165,000	410	24,500	140,500	2,200	110,000	0	0	110,000	
1.05	1,150	8,840	10,166,000	1,040	1,196,000	8,970,000	3,300	3,795,000	570	655,500	3,139,500	2,200	2,530,000	0	2,530,000	
2.20	10	8,840	88,400	1,040	10,400	78,000	3,300	33,000	570	5,700	27,300	2,200	27,500	0	27,500	
2.21	190	8,840	1,679,600	1,040	197,600	1,482,000	3,300	627,000	570	108,300	518,700	3,300	627,000	0	627,000	
2.40	10	8,840	88,400	1,040	10,400	78,000	3,300	33,000	570	5,700	27,300	3,300	27,500	0	27,500	
2.41	590	8,840	5,215,600	1,040	613,600	4,602,000	3,300	1,947,000	570	336,300	1,610,700	2,200	1,298,000	0	1,298,000	
3.00	2,000	8,840	17,140,000	1,040	2,080,000	15,060,000	3,300	7,800,000	570	1,140,600	6,660,000	2,200	4,400,000	0	4,400,000	
5.00	1,000	8,300	9,850,000	1,040	6,220,000	8,830,000	4,500	3,735,000	570	1,770,000	3,565,000	2,200	1,595,000	0	1,595,000	
6.00	1,000	11,400	12,120,000	1,490	12,120,000	0	2,970	2,975,000	2,970	2,975,000	0	990	995,000	0	995,000	
7.00	1,000	12,840	13,380,000	2,840	13,380,000	0	2,980	2,945,000	2,980	2,945,000	0	1,000	1,005,000	1,000	1,005,000	
8.00	1,000	13,920	11,950,000	3,920	11,950,000	0	2,910	2,850,000	2,910	2,850,000	0	1,010	970,000	1,010	970,000	
9.00	1,000	9,980	11,940,000	3,980	11,940,000	0	2,790	2,850,000	2,790	2,850,000	0	930	970,000	0	1,000	
10.00	1,000	11,900	12,445,000	3,900	12,445,000	0	2,910	2,850,000	2,910	2,850,000	0	1,010	1,005,000	1,010	1,005,000	
11.00	1,000	10,990	11,840,000	3,990	11,840,000	0	2,790	2,810,000	2,790	2,810,000	0	1,000	990,000	1,000	990,000	
12.00	1,000	12,690	12,100,000	3,690	12,100,000	0	2,830	2,870,000	2,830	2,870,000	0	980	990,000	0	980	
13.00	1,000	11,510	12,550,000	3,510	12,550,000	0	2,910	2,955,000	2,910	2,955,000	0	1,000	1,000,000	1,000	1,000,000	
14.00	1,000	13,590	8,425,000	3,590	8,425,000	0	3,000	3,000,000	3,000	3,000,000	0	1,000	1,000,000	1,000	1,000,000	
15.00	1,000	3,260	14,430,000	3,260	1,630,000	12,800,000	3,000	3,105,000	3,000	1,500,000	1,605,000	1,000	500,000	1,000	1,075,000	
16.00	1,000	25,600	25,560,000	0	6,160,000	19,400,000	3,210	3,195,000	0	570,000	2,625,000	2,150	2,050,000	0	240,000	
17.00	1,000	25,520	20,825,000	2,520	14,025,000	6,600,000	3,180	3,035,000	1,140	2,015,000	1,020,000	1,950	1,485,000	480	730,000	
18.00	1,000	15,730	13,820,000	2,730	13,820,000	0	2,890	2,945,000	2,890	2,945,000	0	980	990,000	0	990,000	
19.00	1,000	11,910	17,170,000	3,910	11,465,000	5,705,000	3,000	3,105,000	3,000	2,385,000	720,000	1,000	1,580,000	1,000	1,970,000	
20.00	1,000	22,430	18,665,000	3,020	12,960,000	5,705,000	3,210	3,110,000	1,770	2,390,000	720,000	2,160	1,580,000	1,140	1,070,000	
21.00	1,000	14,900	14,085,000	4,900	14,085,000	0	3,010	3,005,000	3,010	3,005,000	0	1,000	1,000,000	1,000	1,000,000	
22.00	1,000	13,270	15,205,000	3,270	15,205,000	0	3,000	3,015,000	3,000	3,015,000	0	1,000	1,010,000	1,000	1,010,000	
23.00	0	17,140	0	17,140	0	3,630	0	3,630	0	1,020	0	1,020	0	0		
Sum 2	22.000		290,859,000	206,467,000	84,392,000	68,755,000		47,976,000	20,779,000		30,790,000		16,030,000	14,760,000	14,680,000	
23.00	1,000	17,140	17,515,000	17,140	17,515,000	0	3,030	3,030,000	3,030	3,030,000	0	1,020	1,015,000	1,020	1,015,000	
24.00	1,000	17,890	18,535,000	17,890	14,495,000	4,040,000	3,030	3,075,000	3,030	2,385,000	690,000	1,010	1,555,000	1,010	1,075,000	
25.00	1,000	19,180	20,405,000	19,180	10,750,000	9,655,000	3,120	3,105,000	1,740	1,580,000	1,515,000	2,100	2,105,000	1,140	1,050,000	
26.00	0	21,630	0	10,400	0	3,090	0	1,440	0	2,110	0	960	0	0		
26.00	1,000	22,700	25,085,000	10,720	5,360,000	19,725,000	3,290	3,340,000	1,540	770,000	2,570,000	2,250	2,285,000	1,020	510,000	
27.00	1,000	27,470	31,950,000	0	31,950,000	0	3,390	3,570,000	0	3,570,000	0	2,320	2,430,000	0	2,430,000	
28.00	1,000	35,300	35,995,000	0	2,770,000	33,225,000	3,750	3,720,000	0	385,000	3,340,000	2,540	2,525,000	0	250,000	
29.00	1,000	33,760	25,380,000	5,540	11,270,000	14,110,000	3,700	3,450,000	770	1,945,000	1,465,000	2,510	1,805,000	500	800,000	
30.00	1,000	27,000	20,545,000	17,000	13,340,000	7,205,000	3,820	3,405,000	3,200	2,515,000	930,000	1,100	1,805,000	1,100	1,150,000	
31.00	1,000	24,090	19,010,000	8,880	11,805,000	7,205,000	3,890	3,405,000	1,830	2,475,000	930,000	2,510	1,775,000	1,200	1,120,000	
32.00	1,000	13,930	15,670,000	3,930	12,615,000	3,055,000	3,120	3,215,000	3,120	2,830,000	585,000	1,040	1,645,000	1,040	1,225,000	
33.00	1,000	17,410	24,745,000	11,300	5,650,000	18,595,000	3,310	3,380,000	2,140	1,970,000	2,310,000	2,250	2,290,000	1,410	705,000	
34.00	1,000	21,080	46,830,000	0	46,830,000	0	3,490	3,735,000	0	3,735,000	2,330	2,530,000	0	2,530,000		
35.00	1,000	62,180	49,990,000	0	49,990,000	0	4,020	4,050,000	0	4,050,000	2,730	2,735,000	0	2,735,000		
36.00	1,000	37,800	34,255,000	0	34,255,000	0	4,080	3,750,000	0	3,750,000	2,740	2,530,000	0	2,530,000		
37.00	1,000	30,710	36,175,000	0	36,175,000	0	3,420	3,585,000	0	3,585,000	2,320	2,410,000	0	2,410,000		
38.00	0	41,640	0	0	0	0	3,750	0	0	0	2,560	0	0	0		
39.00	1,000	44,230	58,100,000	0	58,100,000	0	4,680	5,220,000	0	5,220,000	3,280	3,590,000	0	3,590,000		
39.00	1,000	27,970	57,885,000	0	57,885,000	0	5,580	5,580,000	0	5,580,000	3,800	3,900,000	0	3,900,000		
40.00	1,000	42,860	47,150,000	0	47,150,000	0	5,780	5,680,000	0	5,680,000	3,900	3,900,000	0	3,900,000		
41.00	1,000	50,590	61,140,000	0	61,140,000	0	5,780	6,760,000	0	6,760,000	3,900	4,560,000	0	4,560,000		
42.00	1,000	71,780	103,115,000	0	103,115,000	0	7,740	8,490,000	0	8,490,000	5,220	5,750,000	0	5,750,000		
43.00	1,000	34,450	123,085,000	0	123,085,000	0	9,240	8,040,000	0	8,040,000	6,280	5,440,000	0	5,440,000		
44.00	1,000	11,720	93,655,000	0	93,655,000	0	8,840	5,660,000	0	5,660,000	4,600	3,830,000	0	3,830,000		
45.00	1,000	75,590	68,080,000	0	68,080,000	0	4,480	5,225,000	0	5,225,000	3,060	3,595,000	0	3,595,000		
46.00	1,000	60,570	46,905,000	0	46,905,000	0	5,970	4,865,000	0	4,865,000	4,130	3,365,000	0	3,365,000		
47.00	1,000	23,240	27,885,000	0	27,885,000	0	3,760	3,755,000	0	3,755,000	2,600	2,610,000	0	2,610,000		
48.00	1,000	22,530	26,205,000	0	26,205,000	850,000	3,750	3,735,000	0	135,000	3,600,000	2,620	2,585,000	0	2,585,000	
49.00	1,000	29,880	31,525,000	1,700	850,000	30,675,000	3,720	3,720,000	270	135,000	3,585,000	2,550	2,550,000	170	85,000	
50.00	0	33,170	0	0	0	0	3,720	0	0	0	2,550	0	0	0		
Sum 3	27.000		1,165,215,000	107,270,000	1,057,945,000	118,590,000		19,105,000	99,485,000		77,115,000		9,070,000	68,045,000	3,700,000	
50.00	1,000															

Station No.	Dis (ft)	Hard Rock				Soft Rock				Earth				Hnd					
		As	Vo	Net Al	Net V1	Dry V2	As	Vo	Net Al	Net V1	Dry V2	As	Vo	Net Al	Net V1	Dry V2	As	Vo	
-11.10	8.109	0	0	0	0	0	9,841,500	0	9,841,500	0	0	0	0	0	0	0	0	3,199,500	0
-3.00	4.600	0	2,060,000	0	2,060,000	0	2,430,960,000	2,430	9,660,000	0	790	3,220,000	790	3,220,000	0	0	790	3,220,000	0
1.00	0	1,030	0	1,030	0	0	2,400	0	2,400	0	820	0	820	0	0	0	820	0	0
Sum 1	12.100		2,060,000		2,060,000		19,501,500		19,501,500			6,419,500		6,419,500		0		6,419,500	
1.00	50	1,030	158,250	470	35,500	122,750	2,490	123,000	380	22,500	100,500	1,640	85,000	0	0	85,000	0	0	0
1.05	1,150	5,300	6,095,000	950	1,082,500	5,002,500	2,520	2,898,000	520	588,000	2,300,000	1,760	2,024,000	0	0	2,024,000	0	0	0
2.20	10	5,300	53,000	950	9,500	43,500	2,520	25,200	520	5,200	20,000	1,760	22,600	0	0	22,600	0	0	0
2.21	190	5,300	1,007,000	950	180,500	826,500	2,520	478,800	520	98,800	380,000	2,760	524,400	0	0	524,400	0	0	0
2.40	10	5,300	53,000	950	9,500	43,500	2,520	25,200	520	5,200	20,000	1,760	22,600	0	0	22,600	0	0	0
2.41	590	5,300	3,127,000	950	560,500	2,566,500	2,520	1,466,800	520	306,800	1,180,000	1,760	1,038,400	0	0	1,038,400	0	0	0
3.00	2,000	5,300	10,600,000	950	1,800,000	8,798,000	2,520	5,040,000	520	1,040,000	4,000,000	1,760	3,520,000	0	0	3,520,000	0	0	0
5.00	1,000	5,300	6,340,000	950	1,185,000	2,175,000	2,520	2,445,000	520	1,445,000	1,000,000	1,760	1,290,000	0	0	1,290,000	0	0	410,000
6.00	1,000	7,300	8,005,000	7,380	8,005,000	0	2,370	2,415,000	2,370	2,415,000	0	820	825,000	820	825,000	0	820	825,000	0
7.00	1,000	8,630	9,125,000	8,630	9,125,000	0	2,460	2,430,000	2,460	2,430,000	0	830	830,000	830	830,000	0	830	830,000	0
8.00	1,000	9,620	7,895,000	9,620	7,895,000	0	2,400	2,320,000	2,400	2,320,000	0	830	795,000	830	795,000	0	830	825,000	0
9.00	1,000	6,170	7,850,000	5,170	7,850,000	0	2,240	2,335,000	2,240	2,335,000	0	760	795,000	760	795,000	0	820	825,000	0
10.00	1,000	9,530	8,475,000	9,530	8,475,000	0	2,430	2,385,000	2,430	2,385,000	0	830	830,000	830	830,000	0	830	830,000	0
11.00	1,000	7,420	8,130,000	7,420	8,130,000	0	2,340	2,385,000	2,340	2,385,000	0	830	830,000	830	830,000	0	830	830,000	0
12.00	1,000	8,840	8,420,000	8,840	8,420,000	0	2,430	2,415,000	2,430	2,415,000	0	830	830,000	830	830,000	0	830	830,000	0
13.00	1,000	8,900	7,570,000	8,900	7,570,000	0	2,400	2,430,000	2,400	2,430,000	0	830	830,000	830	830,000	0	830	830,000	0
14.00	1,000	7,140	8,045,000	7,140	8,045,000	0	2,460	2,460,000	2,460	2,460,000	0	830	830,000	830	830,000	0	830	830,000	0
15.00	1,000	8,950	14,245,000	8,950	4,475,000	9,770,000	2,460	2,610,000	2,460	1,230,000	1,380,000	830	1,275,000	830	415,000	860,000	830	415,000	0
16.00	1,000	19,440	19,440,000	0	4,570,000	14,870,000	2,780	2,730,000	0	465,000	2,265,000	1,720	1,730,000	0	230,000	1,500,000	0	0	0
17.00	1,000	19,440	15,820,000	9,140	10,670,000	5,150,000	2,700	2,590,000	930	1,705,000	885,000	1,740	1,285,000	460	645,000	640,000	0	0	415,000
18.00	1,000	12,200	10,310,000	9,200	10,310,000	0	2,400	2,470,000	2,480	2,470,000	0	830	830,000	830	830,000	0	830	830,000	0
19.00	1,000	8,420	12,390,000	8,420	8,475,000	3,915,000	2,460	2,565,000	2,460	1,980,000	585,000	830	1,315,000	830	905,000	410,000	830	415,000	0
20.00	1,000	16,360	12,845,000	8,520	8,130,000	3,915,000	2,670	2,585,000	1,500	1,980,000	585,000	1,800	1,315,000	980	995,000	410,000	830	415,000	0
21.00	1,000	7,730	8,475,000	7,730	8,475,000	0	2,460	2,460,000	2,460	2,460,000	0	830	830,000	830	830,000	0	830	830,000	0
22.00	1,000	9,220	10,730,000	9,220	10,730,000	0	2,460	2,475,000	2,460	2,475,000	0	830	840,000	830	840,000	0	830	845,000	0
23.00	0	12,240	0	12,240	0	0	2,490	0	2,490	0	0	850	0	850	0	0	850	0	0
Sum 2	22.000		204,453,250		147,303,000	57,150,250	54,562,000		39,861,500	14,700,500	25,342,000		13,405,000		11,937,000		12,030,000		
23.00	1,000	5,860	5,975,000	5,860	5,975,000	0	1,300	1,340,000	1,300	1,340,000	0	450	455,000	450	455,000	0	470	470,000	0
24.00	1,000	6,090	6,330,000	6,090	5,780,000	550,000	1,380	1,375,000	1,380	1,135,000	240,000	460	685,000	460	510,000	175,000	470	235,000	0
25.00	1,000	6,570	7,210,000	5,470	4,950,000	2,260,000	1,370	1,370,000	890	730,000	840,000	910	945,000	560	475,000	470,000	0	0	0
26.00	0	7,850	0	4,430	0	0	1,370	0	570	0	0	980	0	390	0	0	0	0	0
26.00	1,000	8,320	10,485,000	4,464	2,242,000	8,251,000	1,560	1,620,000	660	330,000	1,290,000	1,480	1,310,000	820	410,000	900,000	0	0	0
27.00	1,000	12,670	13,850,000	0	0	13,850,000	1,660	1,770,000	0	0	1,770,000	1,140	1,240,000	0	0	1,240,000	0	0	0
28.00	1,000	15,030	14,210,000	0	40,000	14,170,000	1,850	1,935,000	0	0	1,935,000	1,240	1,365,000	0	0	1,365,000	0	0	0
29.00	1,000	13,390	9,385,000	80	2,710,000	8,675,000	2,010	1,755,000	0	750,000	1,005,000	1,390	945,000	0	250,000	695,000	0	255,000	0
30.00	1,000	5,340	5,785,000	5,340	4,850,000	905,000	1,500	1,560,000	1,500	1,230,000	330,000	500	810,000	500	560,000	250,000	510	255,000	0
31.00	1,000	6,170	5,490,000	4,360	4,585,000	905,000	1,620	1,500,000	950	1,170,000	330,000	1,120	1,040,000	620	790,000	250,000	0	0	0
32.00	1,000	4,810	4,760,000	4,810	4,705,000	55,000	1,380	1,410,000	1,380	1,320,000	90,000	960	990,000	960	900,000	90,000	0	0	0
33.00	1,000	4,710	8,830,000	4,600	2,300,000	6,530,000	1,440	1,635,000	1,260	630,000	1,005,000	1,020	1,145,000	840	420,000	725,000	0	0	0
34.00	1,000	12,950	22,710,000	0	0	22,710,000	1,830	2,190,000	0	0	2,190,000	1,270	1,515,000	0	0	1,515,000	0	0	0
35.00	1,000	32,470	22,400,000	0	0	22,400,000	2,550	2,325,000	0	0	2,325,000	1,760	1,595,000	0	0	1,595,000	0	0	0
36.00	1,000	12,330	12,260,000	0	0	12,260,000	2,100	1,935,000	0	0	1,935,000	1,430	1,320,000	0	0	1,320,000	0	0	0
37.00	1,000	12,190	15,760,000	0	0	15,760,000	1,720	1,935,000	0	0	1,935,000	1,210	1,325,000	0	0	1,325,000	0	0	0
38.00	0	19,330	0	0	0	0	2,100	0	0	0	0	1,440	0	0	0	0	0	0	0
38.00	1,000	22,620	31,440,000	0	0	31,440,000	3,360	4,020,000	0	0	4,020,000	2,260	2,500,000	0	0	2,500,000	0	0	0
39.00	1,000	40,260	29,725,000	0	0	29,725,000	4,740	3,990,000	0	0	3,990,000	3,200	2,970,000	0	0	2,970,000	0	0	0
40.00	1,000	19,190	21,780,000	0	0	21,780,000	3,240	3,660,000	0	0	3,660,000	2,740	2,755,000	0	0	2,755,000	0	0	0
41.00	1,000	24,370	30,110,000	0	0	30,110,000	4,080	4,350,000	0	0	4,350,000	2,770	2,575,000	0	0	2,575,000	0	0	0
42.00	1,000	35,850	61,540,000	0	0	61,540,000	4,620	6,435,000	0	0	6,435,000	3,180	4,350,000	0	0	4,350,000	0	0	0
43.00	1,000	87,230	75,075,000	0	0	75,075,000	8,290	7,110,000	0	0	7,110,000	5,520	4,770,000	0	0	4,770,000	0	0	0

S-17 Calculation Table of Excavation Volume

Station No.	Dis (ft)	Hard Rock				Soft Rock				Earth				Total	
		Ao	Vo	Wet V1	Dry V2	Ao	Vo	Wet V1	Dry V2	Ao	Vo	Wet V1	Dry V2		
-11.50	8.500	0	9,222,500	0	9,222,500	0	10,710,000	0	10,710,000	0	4,080,000	0	4,080,000	0	4,080,000
-3.00	4.000	2,170	11,620,000	2,170	11,620,000	2,520	11,040,000	2,520	11,040,000	0	3,920,000	3,920	3,920,000	0	3,920,000
1.00	0	3,840	0	3,840	0	3,000	0	3,000	0	1,000	0	1,000	0	1,000	0
Sum 1	12.500		20,842,500		20,842,500		21,750,000		21,750,000		8,000,000		8,000,000		8,000,000
1.00	50	3,640	292,000	3,640	114,750	3,000	150,000	360	22,500	127,500	2,000	100,000	0	100,000	0
1.05	1.150	8,040	9,216,000	950	1,092,500	3,000	3,450,000	520	598,000	2,852,000	2,000	2,300,000	0	2,300,000	0
2.20	10	8,040	89,400	950	9,500	3,000	30,000	520	5,200	24,800	2,000	25,000	0	25,000	0
2.21	190	8,040	1,527,600	950	180,500	3,000	570,000	520	98,800	471,200	3,000	570,000	0	570,000	0
2.40	10	8,040	89,400	950	9,500	3,000	30,000	520	5,200	24,800	3,000	25,000	0	25,000	0
2.41	590	8,040	4,743,600	950	560,500	3,000	1,770,000	520	306,800	1,463,200	2,000	1,180,000	0	1,180,000	0
3.00	2,000	8,040	15,550,000	950	1,900,000	3,000	8,700,000	520	3,006,800	5,660,000	2,000	4,000,000	0	4,000,000	0
5.00	1,000	7,510	8,890,000	950	5,810,000	3,700	3,155,000	520	1,565,000	1,590,000	2,000	1,470,000	0	1,470,000	0
6.00	1,000	10,270	10,685,000	10,270	10,685,000	2,610	2,715,000	2,610	2,715,000	0	940	940,000	0	940,000	0
7.00	1,000	11,100	11,935,000	11,100	11,935,000	2,820	2,805,000	2,820	2,805,000	0	940	945,000	0	945,000	0
8.00	1,000	12,770	10,795,000	12,770	10,795,000	2,790	2,700,000	2,790	2,700,000	0	970	925,000	0	925,000	0
9.00	1,000	8,820	10,800,000	8,820	10,800,000	2,610	2,685,000	2,610	2,685,000	0	880	925,000	0	925,000	0
10.00	1,000	12,780	11,505,000	12,780	11,505,000	2,760	2,700,000	2,760	2,700,000	0	970	960,000	0	960,000	0
11.00	1,000	10,230	10,975,000	10,230	10,975,000	2,640	2,685,000	2,640	2,685,000	0	950	950,000	0	950,000	0
12.00	1,000	11,720	11,290,000	11,720	11,290,000	2,730	2,735,000	2,730	2,735,000	0	950	950,000	0	950,000	0
13.00	1,000	10,860	11,020,000	10,860	11,020,000	2,740	2,795,000	2,740	2,795,000	0	950	950,000	0	950,000	0
14.00	1,000	12,780	11,280,000	12,780	11,280,000	2,850	2,850,000	2,850	2,850,000	0	950	950,000	0	950,000	0
15.00	1,000	9,780	16,850,000	9,780	4,890,000	2,850	2,955,000	2,850	1,425,000	1,520,000	950	1,500,000	950	475,000	1,025,000
16.00	1,000	23,910	23,755,000	0	5,480,000	3,000	3,030,000	0	515,000	2,515,000	2,050	2,050,000	0	355,000	1,725,000
17.00	1,000	23,570	19,200,000	10,950	12,895,000	3,000	2,870,000	1,020	1,685,000	985,000	2,110	1,525,000	710	825,000	700,000
18.00	1,000	14,830	13,130,000	14,830	13,130,000	2,740	2,795,000	2,740	2,795,000	0	940	945,000	0	945,000	0
19.00	1,000	11,430	15,950,000	11,430	10,785,000	2,850	2,845,000	2,850	2,270,000	675,000	950	1,495,000	950	1,025,000	470,000
20.00	1,000	20,500	16,825,000	10,100	11,825,000	3,040	2,945,000	1,890	2,270,000	675,000	2,040	1,495,000	1,100	1,025,000	470,000
21.00	1,000	13,150	12,280,000	13,150	12,280,000	2,850	2,850,000	2,850	2,850,000	0	950	950,000	0	950,000	0
22.00	1,000	11,410	13,710,000	11,410	13,710,000	2,850	2,865,000	2,850	2,865,000	0	950	955,000	0	955,000	0
23.00	0	16,010	0	16,010	0	2,280	0	2,280	0	960	0	960	0	960	0
Sum 2	22.000		273,220,000		195,337,250		63,780,000		45,186,500	18,593,500		29,120,000		15,530,000	13,590,000
23.00	1,000	7,600	7,725,000	7,600	7,725,000	1,460	1,510,000	1,460	1,510,000	0	500	510,000	500	510,000	0
24.00	1,000	7,850	8,005,000	7,850	7,725,000	1,560	1,545,000	1,560	1,260,000	285,000	520	760,000	520	570,000	210,000
25.00	1,000	8,160	8,820,000	6,600	5,990,000	1,530	1,545,000	960	810,000	735,000	1,040	1,030,000	620	520,000	530,000
26.00	0	9,600	0	5,380	0	1,550	0	660	0	0	0	1,060	0	420	0
26.00	1,000	10,420	12,245,000	5,600	2,800,000	1,770	1,800,000	760	380,000	1,420,000	1,200	1,230,000	480	240,000	990,000
27.00	1,000	14,070	15,570,000	0	15,570,000	1,830	1,965,000	0	1,965,000	1,260	1,360,000	0	0	1,360,000	0
28.00	1,000	17,070	16,460,000	0	385,000	2,100	2,130,000	0	30,000	2,100,000	1,480	1,480,000	0	20,000	1,460,000
29.00	1,000	15,850	11,325,000	770	3,785,000	2,160	1,905,000	60	855,000	1,050,000	1,500	1,930,000	40	300,000	730,000
30.00	1,000	6,800	7,540,000	6,800	6,100,000	1,650	1,740,000	1,650	1,350,000	390,000	560	690,000	560	610,000	280,000
31.00	1,000	8,280	7,180,000	5,400	5,740,000	1,830	1,695,000	1,050	1,305,000	390,000	1,220	870,000	660	590,000	280,000
32.00	1,000	6,880	6,220,000	6,080	6,045,000	1,550	1,610,000	1,550	1,460,000	150,000	520	820,000	520	700,000	120,000
33.00	1,000	6,360	10,780,000	6,010	3,005,000	1,660	1,615,000	1,360	680,000	1,135,000	1,120	1,250,000	880	440,000	810,000
34.00	1,000	15,220	25,735,000	0	25,735,000	1,970	2,325,000	0	2,325,000	1,380	1,600,000	0	0	1,600,000	0
35.00	1,000	36,250	25,675,000	0	25,675,000	2,680	2,490,000	0	0	2,490,000	1,820	1,690,000	0	1,690,000	0
36.00	1,000	15,100	14,685,000	0	14,685,000	2,300	2,140,000	0	2,140,000	1,560	1,450,000	0	0	1,450,000	0
37.00	1,000	14,270	18,110,000	0	18,110,000	1,980	2,130,000	0	2,130,000	1,340	1,440,000	0	0	1,440,000	0
38.00	0	21,950	0	0	0	2,280	0	0	0	0	1,540	0	0	0	0
38.00	1,000	24,620	34,155,000	0	34,155,000	3,350	4,080,000	0	4,080,000	2,180	2,740,000	0	0	2,740,000	0
39.00	1,000	43,690	32,765,000	0	32,765,000	4,660	4,125,000	0	4,125,000	3,300	3,090,000	0	0	3,090,000	0
40.00	1,000	21,640	24,730,000	0	24,730,000	3,450	3,845,000	0	3,845,000	2,880	2,860,000	0	0	2,860,000	0
41.00	1,000	27,620	33,435,000	0	33,435,000	4,740	4,520,000	0	4,520,000	2,840	3,090,000	0	0	3,090,000	0
42.00	1,000	39,250	66,340,000	0	66,340,000	4,800	6,620,000	0	6,620,000	3,340	4,480,000	0	0	4,480,000	0
43.00	1,000	33,430	79,745,000	0	79,745,000	8,440	7,250,000	0	7,250,000	5,640	4,870,000	0	0	4,870,000	0
44.00	1,000	66,060	50,810,000	0	50,810,000	6,060	4,490,000	0	4,490,000	4,100	3,060,000	0	0	3,060,000	0
45.00	1,000	35,560	36,590,000	0	36,590,000	2,820	3,740,000	0	3,740,000	2,020	2,580,000	0	0	2,580,000	0
46.00	1,000	37,620	26,155,000	0	26,155,000	4,560	3,515,000	0	3,515,000	3,100	2,385,000	0	0	2,385,000	0
47.00	1,000	14,690	12,475,000	0	12,475,000	2,470	2,255,000	0	2,255,000	1,670	1,525,000	0	0	1,525,000	0
48.00	1,000	10,260	12,620,000	0	12,620,000	2,040	2,100,000	0	2,100,000	1,380	1,420,000	0	0	1,420,000	0
49.00	1,000	14,980	16,040,000	0	16,040,000	2,160	2,180,000	0	2,180,000	1,460	1,510,000	0	0	1,510,000	0
50.00	0	17,100	0	0	0	2,200	0	0	0	1,560	0	0	0	0	0
Sum 3	27.000		622,005,000		48,800,000		77,065,000		9,640,000	67,425,000		51,050,000		4,500,000	46,550,000
50.00	1,000	31,260	29,175,000	0	1,730,000	3,540	3,305,000	0	285,000	3,020,000	2,460	2,300,000	0	210,000	2,090,000
51.00	1,000	27,090	20,840,000	3,460	5,330,000	3,070	3,055,000	570	935,0						

Calculation Table of Excavation Volume

Table with columns: Station No., Dis (m), Hard Rock (Ao, Vo, Wet V1, Dry V2), Soft Rock (Ao, Vo, Wet V1, Dry V2), Earth (Ao, Vo, Wet V1, Dry V2), and Mud (Ao, Vo). Rows 1-50, 51-100, 101-150, 151-200, 201-250, 251-300, 301-350, 351-400, 401-450, 451-500, 501-550, 551-600, 601-650, 651-700, 701-750, 751-800, 801-850, 851-900, 901-950, 951-1000.

Excavation Vol. 1,502,589.000
Dry 842,396.000
Wet 560,193.000

APPENDIX 4 : ESTIMATION OF OPERATION AND MAINTENANCE COST

APPENDIX 4 : Estimation of Operation and Maintenance Cost

Operation and maintenance cost of the Study Cases are roughly estimated as follows.

1. O&M cost for the canal consists of two costs, O&M cost of the existing canal system (if it is available) and O&M cost for the new canal system.
2. Usage of the existing canal with the new canal system are considered as follows.

New canal system	Existing canal
Group A (high rise lock system) Group B (low rise lock system)	available available with modifications
Group C (Route 10 sea level) Group D (Route 14S sea level)	available not available

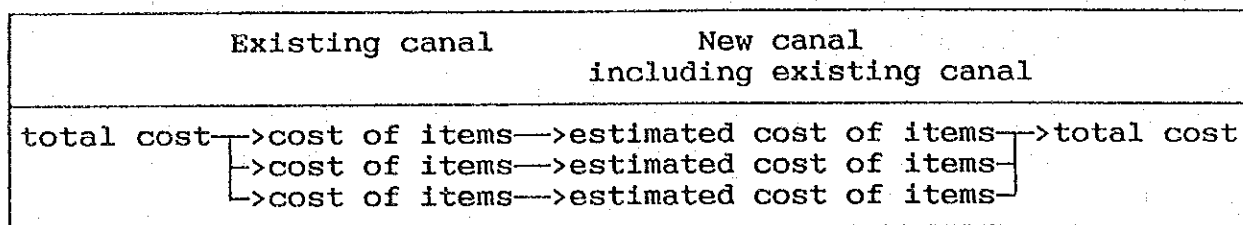
3. O&M cost estimate will be based on the Annual Report 1990 of PCC and the items composing of O&M cost are classified in the annual report as shown below.

(Cost Items)

- 1) Maintenance of channels and harbors
- 2) Navigation service and control
- 3) Locks operation
- 4) General repair, engineering and maintenance services
- 5) Supply and logistics
- 6) Utilities
- 7) Housing operations
- 8) General and administrative
- 9) Interest on interest-bearing investment
- 10) Others

Total cost for the existing canal operation and maintenance reaches to 390 million US\$ in 1990.

4. Cost estimation will be carried out under the following method.



5. Factors affecting to the costs of each items

In order to estimate the O&M cost for new canal from the cost of the existing canal, operation and maintenance costs of each item are classified into groups by the following factors.

- 1) Length of the canal
- 2) Size of the ship
- 3) Number of the lift of the locks

6. Relation between items and factors should be estimated after detailed survey. But for the Phase 1 Study, factors affecting to items are shown on the table below and the ratio of the cost of each item between new canal system (including existing one) and the cost of the existing one will be estimated as follows.

Item of Cost	Factor		
	1)Length of canal	2)Size of ship	3)Number of lift
1) Maintenance of channels and harbors 2) Navigation service and control	○	○	
3) Locks operation		○	
4) General repair, engineering and maintenance services 5) Supply and logistics 6) Utilities 7) Housing operations 8) General and administrative 9) Interest on interest-bearing investment 10) Others	○		

6.1 Items 1) Maintenance of channels and harbors, and Item 2) Navigation service and control, depend on the factors

- 1) Length of the canal, and
- 2) Size of the ship

6.1.1 For the factor 1) Length of the canal, the cost for maintenance of channels and navigation service will be estimated to change according to the length of the canal proportionally.

(1) Group A: The most part of canals are commonly used for both new and existing canals. Cost will be a little bit larger than the existing one. The ratio to the existing canal will be 1.2 for both new and existing canal.

(2) Group B: The situation is same with group A. The ratio will be 1.2 for both new and existing canal.

(3) Group C: Both new and existing canal will be operated quite separately. There is no common part of the canal for both new and existing canals, that is, there are two canals. The ratio will be 2.0 to the existing canal for both new and existing canals.

- (4) Group D: The existing canal is not available any more for this group. Cost will be the cost for the new canal only. Ratio will be 1.0.
- (5) For the factor 1) Length of the canal, final result are shown below.

Group	A	B	C	D
Ratio	1.2	1.2	2.0	1.0

6.1.2 For the factor 2) Size of the ship, the cost for maintenance of channels and navigation service will increase by the size of the ship passing through the canal. But the cost will not increase proportionally with the size of the ship. The increasing ratio of the cost by the ship size shall be checked by the survey in the near future. In this study the cost will be estimated to show small increasing ratio by the size of the ship. Following ratio will be adopted as additional ratio by the size of ship.

Size of ship (1000DWT)	65	100	150	250	300
Additional ratio	0	0	0.1	0.2	0.2

6.1.3 Cost increasing ratio for maintenance and navigation service will be summarized from 6.1.1 and 6.1.2 as shown below.

		Size of the ship (1,000DWT)				
		65	100	150	250	300
Group	basic rat.	0	0	0.1	0.2	0.2
SQ	1.0	1.0				
A	1.2		1.2	1.3	1.4	
B	1.2		1.2	1.3	1.4	
C	2.0			2.1	2.2	2.2
D	1.0			1.1	1.2	1.2

6.2 Item 3) Locks operation, depends on the factors 2) Size of the ship, and 3) Number of the lift in the locks, but nothing for the sea level canal.

6.2.1 For the factor 2) Size of the ship for the lock canal, the cost for lock operation will be affected by the size of the ship. But increasing ratio will be less than the increasing ratio of the size of the ship. The ratio shall be checked by the survey later on. In this study cost increasing ratio will be estimated as follows.

Size of ship (1000DWT)	65	100	150	250	300
Cost increasing ratio	1.0	1.1	1.2	1.3	1.3

6.2.2 For the factor 3) Number of lift for the lock canal

There are three lifts for the existing lock canal. Cost for the lock operation will be affected directly by the number of lift. Considering that no lift means no cost for lock operation, cost ratio for lock operation will be estimated as follows.

Number of lift	3	2	1	0
Cost ratio	1.0	0.7	0.4	0

6.2.3 For the sea level canal

There is no lock operation but is tidal gate operation in the sea level canal system. Cost for tidal gate operation will be estimated 0.1 of the existing lock operation.

6.2.4 Cost increasing ratio for lock operation will be summarized from 6.2.1, 6.2.2 and 6.2.3 as shown below.

			Size of the ship (1,000DWT)				
For lock canal			65	100	150	250	300
	Basic rat		1.0	1.1	1.2	1.3	
Number of lift	3	1.0	(1.0)				
	2	0.7		1.8	1.8	2.0	
	1	0.4		1.4	1.5	1.6	
For sea level canal	Group C	1.1			1.1	1.1	1.1
	Group D	0.1			0.1	0.1	0.1

$$\text{Increasing ratio} = \text{Ship} \times \text{Lift} + 1$$

6.3 Item 4) General repair, engineering and maintenance services, to Item 10) Others, depend on the factor 1) Length of the canal. But increasing ratio of the cost for these items by the increasing of the length of the canal is not so much larger than the other items.

- (1) Group A: As explained in 6.1.1 and above, the ratio to the existing canal will be smaller than others. It will be estimated 1.1 of the existing canal including it
- (2) Group B: The situation is same with the group A. The ratio will be estimated 1.1 of the existing canal including it
- (3) Group C: Both new and existing canal will be operated quite separately. The ratio will be 1.3 to the existing canal for both new and existing canals.
- (4) Group D: The existing canal is not available any more for this group. Cost will be the cost for the new canal only. Ratio will be 1.0.

(5) The ratio of the items 4) to 10) are summarized as shown below.

Group	A	B	C	D
Cost Ratio	1.2	1.2	2.0	1.0

7. O&M cost for each study case estimated under above mentioned conditions are shown as follows.

1) Lock canal

Case Number	Group	Size of ship	Number of Lift	Item			
				1) & 2)	3)	4) - 10)	
(Ratio to SQ)				Ratio of Items			
L -1	A	100	2	1.2	1.8	1.1	
2	A	100	2	1.2	1.8	1.1	
3	B	100	1	1.2	1.4	1.1	
4	A	150	2	1.3	1.8	1.1	
5	A	150	2	1.3	1.8	1.1	
6	B	150	1	1.3	1.5	1.1	
7	A	250	2	1.4	2.0	1.1	
8	A	250	2	1.4	2.0	1.1	
9	B	250	1	1.4	1.6	1.1	
10	A	100	2	1.2	1.8	1.1	
11	B	100	1	1.2	1.4	1.1	
12	B	100	1	1.2	1.4	1.1	
13	A	150	2	1.3	1.8	1.1	
14	B	150	1	1.3	1.5	1.1	
15	B	150	1	1.3	1.5	1.1	
16	A	250	2	1.4	2.0	1.1	
17	B	250	1	1.4	1.6	1.1	
18	B	250	1	1.4	1.6	1.1	
(O&M Cost: million US\$ 1990)				Cost of Items			Total
SQ	A	65	3	123	54	213	390
L -1,2	A	100	2	148	97	234	479
3	B	100	1	148	76	234	458
4,5	A	150	2	160	97	234	491
6	B	150	1	160	81	234	475
7,8	A	250	2	172	108	234	514
9	B	250	1	172	86	234	492
10	A	100	2	148	97	234	479
11,12	B	100	1	148	76	234	458
13	A	150	2	160	97	234	491
14,15	B	150	1	160	81	234	475
16	A	250	2	172	108	234	514
17,18	B	250	1	172	86	234	492