



RAINFALL DATA

Station: Addis Ababa Observatory

Element: Rainfall (mm)

Location:

9°00" N Latitude ;38°45" E Longitude

Altitude:- 2408 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1962	0.0	0.0	138.8	32.3	11.9	50.8	226.7	224.6	216.2	12.5	14.2	9.4	937.4
1963	11.0	32.3	17.6	142.3	116.9	110.7	196.2	250.8	116.1	0.0	17.9	18.1	1029.9
1964	0.0	0.0	121.1	68.0	118.7	198.4	270.0	123.6	202.1	81.5	1.4	50.2	1235.0
1965	9.6	6.3	38.4	53.3	9.2	61.6	275.2	277.7	116.0	113.4	4.9	0.0	965.6
1966	26.4	70.1	81.2	83.8	3.8	137.5	311.4	329.7	150.0	57.0	3.2	0.0	1254.1
1967	0.0	5.0	81.3	93.1	113.5	94.9	190.1	293.8	232.8	36.1	60.4	0.0	1201.0
1968	12.0	138.8	35.4	229.5	32.9	140.1	205.7	228.8	181.0	4.8	0.0	0.0	1209.0
1969	43.3	86.9	96.0	109.6	116.7	146.1	232.6	311.5	161.4	1.0	4.0	0.0	1309.1
1970	42.9	60.2	231.5	41.3	17.8	85.8	302.9	424.7	214.1	0.4	0.0	0.0	1421.6
1971	23.8	0.0	15.1	69.6	200.7	131.9	240.5	340.4	126.6	7.6	10.6	14.1	1180.9
1972	20.8	71.6	43.2	180.2	39.5	123.9	230.1	137.3	115.3	0.0	16.0	0.4	978.3
1973	0.3	1.6	2.2	33.6	138.8	107.0	267.7	345.5	269.8	50.3	0.0	52.5	1269.3
1974	0.0	31.9	21.7	8.9	114.2	135.5	264.9	330.8	229.2	3.5	0.0	0.0	1140.6
1975	0.0	2.7	24.4	60.3	53.5	123.5	271.5	183.6	181.3	17.0	0.0	0.0	917.8
1976	19.3	61.4	44.0	94.8	113.9	108.7	181.2	277.7	145.5	3.0	62.3	13.2	1125.0
1977	55.7	40.0	68.0	65.9	146.0	154.6	255.3	278.8	133.6	272.5	1.2	0.0	1471.6
1978	2.1	63.3	30.8	80.3	30.8	116.7	208.1	361.3	111.0	39.1	0.0	3.4	1046.9
1979	75.7	19.1	73.6	84.9	103.2	144.7	316.1	204.5	225.1	0.0	0.0	16.2	1263.1
1980	23.2	36.6	45.3	88.5	54.2	162.2	385.1	297.4	111.9	51.5	0.0	0.0	1255.9
1981	0.0	75.5	176.0	82.9	3.9	50.1	266.5	320.9	182.1	13.3	0.0	5.2	1176.4
1982	48.7	80.9	57.8	103.7	115.9	31.9	259.3	257.9	135.8	64.4	43.2	12.8	1212.3
1983	18.3	21.7	48.7	117.0	257.0	109.3	199.3	244.7	161.6	26.3	0.1	8.8	1212.8
1984	0.0	8.0	8.7	8.4	127.8	220.8	296.1	295.6	142.4	0.0	4.4	16.3	1128.5
1985	14.2	0.0	17.5	96.3	83.7	112.2	270.4	327.7	205.9	58.0	3.3	1.2	1190.4



Station: Addis Ababa Observatory Element: Rainfall (mm)

Location: 9°00" N Latitude; 38°45" E Longitude

Altitude:- 2408 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1987	0.5	53.5	236.5	98.9	217.0	99.7	197.5	170.3	114.9	21.8	0.8	0.3	1211.7
1988	9.7	53.4	5.3	144.6	16.6	106.2	277.9	299.3	229.7	59.9	0.0	0.0	1202.6
1989	0.8	75.9	76.5	153.6	0.5	120.9	357.2	325.3	188.7	14.5	0.0	7.6	1321.5
1990	0.8	155.9	59.2	106.4	20.0	88.8	218.7	268.6	184.0	16.2	6.0	0.0	1124.6
1991	0.0	74.5	106.6	34.7	55.3	191.1	248.9	262.6	126.4	3.4	0.0	50.0	1153.5
1992	20.2	33.7	20.2	41.0	52.0	109.1	248.5	294.7	209.4	69.7	0.0	2.9	1101.4
1993	10.8	67.2	16.1	157.9	97.2	208.3	274.0	426.5	243.3	62.1	0.0	4.5	1567.9
1994	0.0	0.0	82.4	82.6	63.3	123.4	308.9	225.0	141.3	0.5	14.7	0.0	1042.1
1995	0.0	69.0	41.5	174.4	68.2	102.9	190.2	314.9	136.1	0.0	0.0	48.4	1145.6
1996	28.1	5.2	106.8	128.2	122.0	258.5	266.4	338.7	294.2	0.2	0.2	0.0	1548.5
1997	39.2	0.0	24.5	51.3	38.5	104.0	272.6	194.3	113.8	62.4	50.3	1.5	952.4
1998	55.2	20.5	43.0	48.5	154.2	124.4	258.4	260.0	213.6	116.9	0.0	0.0	1294.7
1999	2.9	0.3	28.8	16.3	23.8	119.6	268.6	305.3	88.4	55.4	0.0	0.0	909.4
2000	0.0	0.0	2.4	58.7	110.0	144.5	244.8	306.2	250.6	46.4	21.1	0.0	1184.7
2001	0.0	12.2	213.5	25.0	168.0	213.5	428.0	246.4	130.7	14.6	0.0	0.0	1451.9
2002	14.7	21.0	90.2	56.5	63.1	172.5	255.2	215.9	108.8	0.2	0.0	16.5	1014.6
2003	10.5	53.3	62.6	99.9	20.2	151.8	291.8	233.3	214.1	0.8	1.5	54.9	1194.7
2004	24.8	20.3	49.5	139.9	30.1	141.9	248.5	268.6	164.0	76.9	0.0	0.0	1164.5
Mean	15.5	38.7	66.8	89.4	83.0	130.7	259.5	276.5	170.9	36.5	7.9	9.5	1185.0
Max	75.7	155.9	236.5	229.5	257.0	258.5	428.0	426.5	294.2	272.5	62.3	54.9	1567.9
Min	0.0	0.0	2.2	8.4	0.5	31.9	180.1	123.6	88.4	0.0	0.0	0.0	909.4
R. Coeff	0.2	0.4	0.7	0.9	0.8	1.3	2.6	2.8	1.7	0.4	0.1	0.1	
Stdev	18.9	37.6	58.7	51.9	62.1	46.7	51.7	64.5	51.1	48.8	16.1	16.3	156.9
75%	2.7	13.4	27.2	54.4	41.1	99.2	224.6	233.0	136.4	3.6	0.0	0.0	835.7
85%	0.0	0.0	5.9	35.7	18.7	82.3	205.9	209.6	117.9	0.0	0.0	0.0	676.0



Station: Chancho Element: Rainfall (mm)

Location: 9°19" N Latitude; 38°45" E Longitude

Altitude:- 2500 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1972	36.3	20.5	64.3	33.1	62.0	103.6	264.4	191.5	89.3	40.5	32.3	31.7	469.5
1973	0.0	0.0	4.0	16.8	52.3	180.3	290.6	328.5	107.1	8.7	0.5	8.7	997.5
1974	0.0	19.8	91.3	9.5	78.2	143.9	186.8	216.0	88.6	9.8	0.0	4.2	848.1
1975	15.7	22.0	35.4	87.9	113.7	169.9	351.7	244.8	58.8	0.0	1.0	27.5	1128.4
1976	7.5	39.9	64.1	93.9	29.1	245.4	297.5	275.0	111.1	67.3	9.2	9.9	1249.9
1977	51.1	21.7	106.2	50.9	31.4	215.4	367.4	278.5	126.5	164.8	12.4	10.9	1437.2
1978	27.4	11.6	65.7	45.4	11.5	46.4	356.0	391.0	203.0	9.3	18.4	28.2	1214.4
1979	90.6	19.3	65.7	54.1	119.7	123.6	244.8	275.1	136.3	77.7	25.4	18.3	1250.6
1980	33.1	20.5	64.3	90.5	62.2	168.9	448.2	275.0	130.0	50.5	20.0	17.5	1380.1
1982	27.0	20.5	82.2	38.8	42.6	46.0	109.1	275.6	11.5	38.5	12.5	12.8	717.1
1983	27.0	10.0	64.2	30.9	39.5	50.0	131.0	744.0	97.0	38.0	7.5	10.9	390.9
1990	6.8	54.0	39.6	63.3	22.7	120.0	387.3	392.3	155.3	0.9	X	0.0	1242.2
1991	49.3	44.3	161.5	10.8	14.4	162.0	283.9	338.3	121.9	5.0	2.4	12.2	1206.0
1992	59.4	67.5	80.2	62.3	72.4	116.6	288.6	332.6	142.0	71.1	20.3	13.4	1326.4
1993	18.4	60.3	24.4	177.2	119.6	115.7	352.9	405.0	262.4	21.8	0.0	0.0	1557.7
1994	0.0	0.0	50.7	48.2	30.8	198.6	334.1	245.4	161.2	0.0	10.5	0.0	1079.5
1995	0.0	39.3	52.7	151.3	62.5	78.2	367.4	305.4	77.3	0.0	0.0	31.2	1165.3
1996	59.7	27.7	109.5	55.4	81.2	209.8	298.5	367.8	162.0	0.0	16.4	1.2	1389.2
1997	54.4	0.0	61.5	52.7	54.9	122.3	380.8	219.8	56.1	49.7	47.2	1.8	1101.2
1998	52.8	32.6	21.5	43.3	142.4	140.0	412.0	332.4	183.9	75.4	0.9	0.0	1437.2
1999	9.8	0.0	36.3	23.3	39.4	65.4	378.7	326.8	137.2	66.9	0.0	1.7	1085.5
2000	0.0	0.0	8.8	102.7	34.5	108.5	248.2	319.4	137.8	42.5	52.9	28.5	1083.8
Mean	30.4	27.2	60.7	72.7	65.2	131.7	334.5	319.3	144.2	33.2	15.1	9.0	1243.2
Max	59.7	67.5	161.5	177.2	142.4	209.8	412.0	405.0	262.4	75.4	52.9	31.2	1557.7
Min	0.0	0.0	8.8	10.8	14.4	65.4	248.2	219.8	56.1	0.0	0.0	0.0	1079.5
Stdev	26.8	26.1	46.2	54.3	40.4	47.1	52.6	53.8	56.7	31.5	19.9	12.1	173.0
R. Coeff	0.3	0.3	0.6	0.7	0.6	1.3	3.2	3.1	1.4	0.3	0.1	0.1	
75%	12.3	9.5	29.5	36.1	37.9	100.0	299.0	283.0	105.9	12.0	1.7	0.9	927.8
85%	2.6	0.1	12.8	16.4	23.3	82.9	280.0	263.6	85.4	0.6	0.0	0.0	767.6



Station:-Derba Element:-Rainfall (mm)

Location 29° N Latitude ; 38°38' E Longitude

Altitude:-2350m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1974					165.0	108.4	284.4	171.2	128.7	3.1	0.0	0.0	
1975	0.5	31.9	25.0	76.3	38.3	135.7	268.5	198.8	164.2	3.4	0.0	0.0	942.6
1976	6.2	28.0	38.5	44.5	14.3	122.2	209.2	283.1	94.6	12.6	24.7	0.2	878.1
1977	6.8	48.9	70.8	19.9	62.6	115.6	262.0	198.5	143.9	183.8	24.3	2.9	1140.0
1978	0.0	10.9	30.6	22.1	28.3	113.9	330.1	294.8	138.3	26.8	27.1	14.3	1037.2
1979	52.3	14.0	26.7	26.5	132.9	153.7	203.9	215.8	215.2	27.0	0.0	52.5	1120.5
1980	7.0	8.0	50.2	95.0	18.3	80.5	224.3	285.6	32.3	0.0	0.0	0.0	801.2
1981	0.0	0.0	0.0	54.0	0.0	37.2	308.5	250.2	160.0	26.0	0.0	1.5	837.4
1982	12.4	41.7	57.6	90.6	156.9	72.6	209.0	346.8	41.2				
1983					150.2	38.3	217.8	379.5	172.2	36.1	0.0	0.0	
1984	0.0	0.0	0.0	0.0			238.0	211.1	203.8	0.0	0.0	13.7	
1985	0.0	0.0	43.1	116.7	36.5	174.9	466.8	428.3	107.1	0.0	0.0	0.0	1373.4
1986	0.0	19.6	78.2	99.7	78.4	154.0	317.8	228.4	196.2	5.7	0.0	14.0	1192.0
1987	0.0	88.0	290.5	48.0	275.2	71.4	513.3	786.5	425.7	0.0	0.0	0.0	2498.6
1989	45.5	65.6	48.6	98.7	12.0	202.9	434.0	400.1	234.6	11.0	0.0	153.9	1706.9
1990	0.0	122.9	88.7	56.9	62.5	173.5	371.3	565.4	248.3	2.9	0.0		
1991	41.2	98.7	87.8	7.0	55.8	290.6	248.8	509.2	124.0	4.6	14.0	6.1	1487.8
1992	74.1	17.7	83.8	49.0	90.8	105.1	357.2	367.2	266.0	97.8	33.3	52.6	1594.6
1993	0.0	76.4	16.6	240.8	1342.0	246.2	592.5	629.3	289.1	70.4	41.5	3.7	3548.5
1994	0.0	0.0	80.0	5.4	63.7	151.1	349.5	276.8	146.0	0.0	6.0	0.0	1078.5
1995	0.0	32.5	62.9	136.8	79.2	29.5	317.4	196.9	145.0	0.0		41.0	
1996	42.4	0.0	80.5	34.8	37.4	81.2	316.3	196.0	72.1	75.5	27.3	4.6	968.1
1997	0.0	0.0	27.0	100.0	262.0	175.7	387.8	142.3	43.3	60.3	0.0	6.5	1204.9
1998	17.8	25.7	36.2	29.7	99.5	128.2	228.9	243.7	78.8	64.8	16.3	0.0	969.6
2000	0.0	0.0	10.0	36.8	0.0	29.5	167.8	367.0	243.0	36.8	15.2	4.0	910.1
2001	2.2	14.2	105.8		141.2	27.1	348.5	169.0	76.8	2.0	5.8	13.5	
2002	43.0	6.7	52.1	25.3	19.0	92.5	213.1	269.3	140.8	0.0		38.6	
2003	12.0	66.2	165.8	77.5	0.0	109.6	279.8	351.3	121.8	0.0	2.0	11.0	1197.0
2004	20.8	21.6	22.7	74.6	15.0	133.5	262.7					3.0	
Mean	14.2	31.1	62.2	64.1	122.8	119.8	307.9	320.1	159.0	27.8	9.5	16.2	1254.7
Max	74.1	122.9	290.5	240.8	1342.0	290.6	592.5	786.5	425.7	183.8	41.5	153.9	3548.5
Min	0.0	0.0	0.0	0.0	0.0	27.1	167.8	142.3	32.3	0.0	0.0	0.0	801.2
R. Coeff	0.1	0.3	0.6	0.6	1.2	1.1	2.9	3.1	1.5	0.3	0.1	0.2	
Stdev	20.9	34.2	58.4	51.5	250.0	64.4	99.5	151.9	86.7	42.1	12.9	31.8	653.8
75%	0.1	8.0	22.8	29.3	0.0	76.3	240.8	217.6	100.6	0.0	0.8	0.0	696.4
85%	0.0	0.0	1.7	10.7	0.0	53.0	204.8	162.6	69.2	0.0	0.0	0.0	502.1



Station:- Intoto Element:- Rainfall (mm)

Location 9°30" N Latitude; 38°24" E Longitude Altitude:-2900 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1985	14.2	0.0	17.5	96.3	83.7	112.2	270.4	327.7	205.9	58.0	3.3	1.2	1190.4
1986	0.0	35.7	88.0	197.6	125.4	179.5	180.1	264.2	127.8	36.1	0.0	0.0	1234.4
1987	0.5	63.4	248.9	82.4	241.3	92.9	196.5	254.4	115.2	21.3	0.8	0.3	1317.9
1988	9.7	53.4	5.3	144.6	16.6	106.2	277.9	299.3	229.7	59.9	0.0	0.0	1202.6
1989	4.0	75.8	105.4	133.3	5.8	98.2	409.5	323.4	293.9	11.7	0.0	14.5	1475.5
1990	0.0	156.6	42.5	117.9	17.6	100.5	325.1	499.7	180.8	32.1	1.5	0.0	1474.3
1991	12.8	64.9	156.2	37.5	37.0	171.2	258.5	395.2	146.7	1.4	0.0	44.2	1325.6
1992	52.4	31.5	14.6	42.7	84.6	131.6	247.8	387.0	188.6	42.4	0.0	8.1	1231.3
1993	15.3	44.6	5.7	147.5	49.0	123.3	266.1	407.6	183.2	28.7	0.0	0.0	1271.0
1994	0.0	0.0	62.2	56.0	91.0	154.8	336.3	306.9	142.5	0.3	24.4	0.0	1174.4
1995	0.0	96.3	29.7	186.1	84.0	98.0	291.0	222.1	133.7	5.0	0.2	22.7	1168.8
1996	31.1	12.2	121.6	78.3	95.2	242.7	387.2	493.9	158.7	1.2	0.6	0.0	1622.7
1997	21.2	0.0	18.6	77.3	27.4	76.3	256.3	240.8	89.3	88.3	90.0	0.2	985.7
1998	25.3	25.3	45.2	47.0	149.5	149.2	369.0	376.3	134.4	44.5	0.0	0.0	1365.7
Mean	13.3	47.1	68.7	103.2	79.2	131.2	290.8	342.8	166.5	30.8	8.6	6.5	1288.6
Max	52.4	156.6	248.9	197.6	241.3	242.7	409.5	499.7	293.9	88.3	90.0	44.2	1622.7
Min	0.0	0.0	5.3	37.5	5.8	76.3	180.1	222.1	89.3	0.3	0.0	0.0	985.7
R. Coeff	0.1	0.4	0.6	1.0	0.7	1.2	2.7	3.2	1.6	0.3	0.1	0.1	
Stdev	15.3	43.5	69.9	52.4	63.4	44.6	67.5	87.8	52.6	26.4	24.3	12.9	159.8
75%	3.0	17.8	21.5	67.8	36.4	101.1	245.3	283.5	131.0	13.0	0.0	0.0	920.4
85%	0.0	2.0	0.0	48.9	13.4	84.9	220.9	251.7	111.9	3.4	0.0	0.0	737.3



Station:- Muketuri Element: Rainfall (mm)

Location :9°33" N Latitude ;38°52" E Longitude Altitude:- 1979 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1993	8.0	15.2	146.3	131.9	89.2	129.9	290.7	316.1	84.0	134.7	0.4	0.0	1346.4
1995	0.0	25.5	40.1	95.9	36.4	32.8	298.2	297.9	107.2	0.0	0.0	17.2	951.2
1996	67.6		27.3	44.4		163.1	213.2	314.5	88.2	0.0	6.8	1.4	
1997	17.8	0.0	66.6	32.9	25.5	110.3	271.5	254.6	24.1	94.7	14.4		
1998	7.0	39.3	41.6	14.2	99.0	56.0	311.7	200.4	121.9	66.0	3.1	0.0	960.2
1999	9.4	0.0	10.0	13.0	10.5	57.8	286.8	368.4	41.2	44.5	0.0	1.5	843.1
2000	0.0	0.0	14.6	84.1	45.1	50.1	238.1					0.0	
2001		36.1	118.3	18.0	94.5	111.9	339.3	204.9	98.2	9.4	9.0	9.9	
2002	50.2	21.4	64.7	27.8	41.3	84.2	242.9	230.3	78.4	0.0	0.0	40.2	881.4
2003	35.6	24.0	66.3	50.4	11.0	109.7	369.3	312.2	141.5	0.0	0.0	19.0	1139.0
Mean	21.7	17.9	59.6	51.3	50.3	90.6	286.2	277.7	87.2	38.8	3.7	9.9	994.9
Max	67.6	39.3	146.3	131.9	99.0	163.1	369.3	368.4	141.5	134.7	14.4	40.2	1346.4
Min	0.0	0.0	10.0	13.0	10.5	32.8	213.2	200.4	24.1	0.0	0.0	0.0	843.1
R. Coeff	0.3	0.2	0.7	0.6	0.6	1.1	3.5	3.3	1.1	0.5	0.0	0.1	
Stdev	24.0	15.3	43.9	40.1	35.1	41.2	47.5	57.8	36.8	50.0	5.2	13.7	189.5
75%	5.5	7.6	30.0	24.2	26.6	62.8	254.2	238.7	62.3	5.1	0.2	0.7	718.0
85%	0.0	2.1	14.1	9.7	13.8	47.8	237.0	217.8	49.0	0.0	0.0	0.0	591.5



Station:-Sendafa Element:- Rainfall (mm)

Location: 9°09" N Latitude ;39°01" E Longitude Altitude:-2560 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1962						23.5	189.0	222.2	160.2	31.0	1.0	26.5	
1963	26.0	53.0	7.0	143.0	29.0	90.3	327.4	433.2	80.7	0.1	3.0	66.9	
1964	8.2	8.3	37.7	79.3	39.5	117.1	279.3	274.2	134.4	37.4	0.0	36.3	
1965	25.3	0.8	18.1	31.3	7.4	27.3	278.7	329.7	72.1	43.9	32.1	0.0	
1966	0.0	141.8	52.9	114.8	9.0	121.4	217.5	392.7	64.1	19.7	0.0	0.0	
1967	0.0	4.0	82.0	150.1	112.3	171.9	293.5	522.4	60.5	20.0	45.2	0.0	
1968	0.0	49.1	0.0	0.0	8.6	33.2	288.6	176.6	186.6	10.1	0.0	0.0	
1969	60.7	69.5	93.4	87.6	6.6	84.7	465.0	293.4	89.6	3.1	6.0	0.0	
1970	81.3	39.8	77.3	49.0	13.9	48.3	322.8	666.5	207.5	7.3	0.0	0.0	
1971	6.0	7.9	173.0	198.3	224.5	490.9	365.5	659.0	246.7	42.7	8.7	24.4	
1972	30.7	0.0	55.0	193.4	134.5	174.4	277.1	208.9	62.0	0.8	12.0	12.0	
1973	0.0	0.0	0.0	13.0	61.5	62.3	217.1	455.6	175.8	0.0	0.0	3.0	
1974	0.0	0.0	87.5	0.0	93.7	123.4	267.5	209.4	116.1	0.0	0.0	0.0	
1975	0.0	0.0	43.2	58.7	22.0	95.0	284.4	296.0	100.2	6.5	0.0	0.0	906.0
1976	0.0	0.0	50.4	115.6	103.9	63.2	234.0	214.8	92.9	10.1	57.6	23.5	966.0
1977	76.9	21.4	22.0	42.4	73.4	159.6	384.4	385.1	242.7	147.1	18.0	0.0	1573.0
1978	0.5	86.7	47.9	43.5	36.7	164.5	265.9	288.4	152.5	63.7	0.0	0.0	1150.3
1979	133.7	8.6	77.6	56.2	81.1	117.8	380.6	256.9	136.4	9.9	0.0	56.4	1315.2
1980	27.9	38.5	32.7	64.2	41.2	88.8	325.5	379.4	49.0	28.0	7.1	0.0	1082.3
1981	0.0	8.9	247.1	94.3	0.0	24.0	413.6	241.0	125.9	9.3	0.0	5.4	1169.5
1982	39.4	84.7	54.8	31.7	71.5	31.3	226.1	262.8	77.0	40.7	14.5	14.1	948.6
1983	1.4	25.4	43.1	91.6						4.7	0.0	0.0	
1984	0.0	0.0	45.2	0.0	78.4	169.1	339.7	184.9	118.3	0.0	0.0	1.2	936.8
1985	9.5	0.0	38.6	158.9	157.9	76.4	394.1	451.5	105.9	10.8	0.0	0.0	1403.6



Station:- Sendafa Element:-Rainfall (mm)

Location: 9°09" N Latitude ;39°01" E Longitude Altitude:-2560 m

1986	0.0	28.1	117.3	193.7	32.3	164.7	270.9	244.5	143.2	0.0	0.0	0.0	1194.7
1987	0.2	33.1	128.9	80.5	110.1	55.7	223.6	143.6	105.3	8.7	0.0	0.0	889.7
1988	0.0	32.9	0.9	132.3	22.1	104.6	451.1	360.3	198.4	5.2	0.0	0.0	1307.8
1989	18.0	10.3	43.3	112.0	21.4	46.3	357.2	339.4	139.9	10.2	0.4	0.6	1099.0
1990	21.5	190.4	35.7	148.4	38.2	88.5	273.4	470.4		3.8	0.0	0.0	
1991	15.9	20.5	118.1	0.5				218.9	134.5		0.0	5.6	
1992	10.7	46.5	1.0	29.1	32.5	69.6	257.5	357.9	151.4	55.5	0.0	0.0	1011.7
1993	4.3	105.2	0.0	118.7			457.2	353.0	158.4	13.7	0.0	0.0	
1994	0.0	0.0	0.0	64.1	11.0	130.7	337.9	184.1		0.0	6.4	0.0	
1995	0.0	11.4	106.2	116.7	42.9	22.5	230.8	338.8		0.0	0.0	0.0	
1996	69.4	5.6	99.3			180.4	339.2	338.6	111.4	0.0	0.0	0.0	
1997	44.5	0.0	29.4	60.0	44.8	149.7	303.8	251.1	84.7	72.0	34.6	0.0	1074.6
1998	28.9	23.3	5.8	27.0	38.2	68.8	359.1	289.7		98.9	0.0	0.0	
1999	0.0	1.2	56.3	11.8	25.4	144.7	441.6	365.2	74.8	79.6	0.0	0.0	1200.6
2000	0.0	0.0	0.0	44.0	87.9	166.0	352.2	373.4	113.9	5.0	10.0	0.0	1152.4
2001	0.0	35.3	154.1	9.2	135.2	149.5	335.5	276.8	27.4	9.8	0.0	0.0	1132.8
2002	21.2	3.4	67.2	20.6	60.9	144.4	246.8	289.2	85.4	0.0	0.0	27.4	966.5
2003	75.5	0.0	29.7	126.9	1.7	120.6	304.4	373.4	122.4	0.0	0.0	19.7	1174.3
2004	21.2	7.1	2.2	118.9	0.0								
Mean	20.4	28.6	56.7	78.8	55.6	111.9	314.5	326.2	121.8	22.2	6.1	7.7	1150.6
Max	133.7	190.4	247.1	198.3	224.5	490.9	465.0	666.5	246.7	147.1	57.6	66.9	1573.0
Min	0.0	0.0	0.0	0.0	0.0	22.5	189.0	143.6	27.4	0.0	0.0	0.0	889.7
R. Coeff	0.2	0.3	0.6	0.8	0.6	1.2	3.3	3.4	1.3	0.2	0.1	0.1	
Stdev	29.9	41.3	53.4	57.6	50.4	79.9	71.6	117.0	51.5	31.8	13.1	15.5	173.6
75%	0.3	0.8	20.7	39.9	21.5	58.0	266.2	247.3	87.1	0.7	0.0	0.0	742.5
85%	0.0	0.0	1.3	19.1	3.3	29.1	240.3	204.9	68.4	0.0	0.0	0.0	566.4



Station: Fitcha Wereda : Grar Garso Awraja : Selallie
 Altitude : 2750 Long.: 38°42' ; Lat. 9°48" Element: Monthly total rainfall (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1954	X	X	73.9	45.0	34.0	138.0	412.4	343.9	183.8	1.0	0.0	2.0	1234.0
1955	52.2		10.5	71.7	23.0	48.3	586.9	476.7	260.7	51.5	X	X	
1956	X	0.0	24.8	111.3	1.0	125.5	495.2	375.5	64.0	134.8	(0.0)	X	1332.1
1957	X	46.0	260.3	93.0	93.5	6.0	71.6	412.0	75.8	9.0	(0.0)	X	1067.2
1958	X	X	6.9	4.5	42.0	114.5	16.4	72.8	92.0	10.5	X	X	359.6
1959	31.5	47.0	11.0	19.0	24.0	41.5	108.5	X	X	37.0	35.0	8.5	363.0
1961	X	X	6.0	126.5	114.5	24.5	12.0	X	X	X	X	X	283.5
1968	1.8	4.6	10.0	X	X	X	55.8	65.0	124.9	X	2.0	0.0	264.1
1969	69.7	X	X	X	11.4		5.5	44.1	X	0.5	4.0	0.0	
1970	48.0	X	X	X	4.0	28.0	71.2	54.7	X	7.0	0.0	4.0	216.9
1971	X	X	X	X	X	X	X	X	X	X	X	X	0.0
1972						168.2	146.0		97.7				
1973			0.0	69.0		54.8	1.9	460.5	157.9	58.0	11.5	0.0	
1974	0.0	14.9	109.9		157.7	197.1	49.0	5.4	144.5	6.6			
1975	0.6	4.1	40.0	87.8	91.0	189.8	89.0	(335.7)	225.9		0.0		
1976	0.0		15.0	19.1	64.9	59.1	41.0	90.6	147.6	0.0	49.1	0.7	
1977	33.4	37.9	34.1	27.1	50.8	8.0	599.9	19.0		221.9	0.0	1.1	
1978	0.0		56.8	29.8	40.2	109.7			163.7	63.8		15.9	
1979	79.9	23.4	66.6	X	134.2	69.2	361.2						
1980	X	X	X	X	10.8	52.4	127.9	167.1	32.7	4.9	0.8	0.0	396.6
1981	1.2	8.8	109.0	86.0	32.5	21.0	452.7	257.0	120.3	0.0	1.7	12.7	1102.9
1982		36.8	84.3	60.4	35.6	15.1	141.7						
1983	X	X	X	X	48.9	81.7	99.0	80.6	75.7	7.5	9.5	0.0	402.9
1984	0.0	0.1	0.3	0.1	2.9	4.4	8.9	4.1	3.4	0.0	0.0	0.0	24.2
1985	0.0	0.0	42.1	93.4	69.2	9.5	336.4		66.0	3.5	20.0	0.0	
1986	12.2	75.6	19.5	109.3	113.2	57.5	234.1	367.8	72.0	24.0	0.0	3.0	1088.2
1987	0.0	25.6	269.0	107.1	151.4	36.0	107.1	270.7	39.9	3.8	2.0	7.6	1020.2
1988	23.5	91.1	8.9	80.6	16.9	41.1	339.5	369.6	163.3	10.3			
1989	19.4	45.2	66.8	117.7	35.4	45.6	260.0	386.0	93.9	33.6	2.0	30.4	1136.0
1990	0.0	106.4	56.5	70.0	11.2	12.9	398.0	281.9	216.8	11.8	0.0	0.6	1166.1



Station: Fitcha Wereda : Grar Garso Awraja : Selallie
Altitude : 2750 Long.: 38°42 ; Lat. 9°48" Element: Monthly total rainfall (mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1991	21.6	53.8	80.5	1.9	32.1	94.7	256.7	365.7	143.4	8.5	0.0	1.4	1060.3
1992	48.1	100.9	63.4	35.9	40.8	70.4	251.0	336.4	99.3	49.0	16.5	18.3	1130.0
1993	21.4	57.1	20.8	133.0	94.6	78.2	377.5	285.9	123.0	14.4	0.0	0.0	1111.3
1994	1.6	2.1	70.2	55.1	18.8	98.4	307.1	324.4	128.0	0.1	10.6	0.0	1016.4
1995	0.0	52.3	45.2	123.2	53.0	52.6	329.2	331.7	130.1	0.0	0.0	35.5	1152.8
1996	29.5	11.5	102.3	79.8	80.1	209.6	393.0	397.9	198.9	7.2	18.1	1.8	1529.7
1997	43.3	0.0	72.0	45.1	29.0	149.8	347.7	276.8	51.1	62.6	20.1	1.8	1099.3
1998	11.2	19.0	49.1	58.3	45.8	87.8	266.9	383.8	181.1	40.5	0.2	0.0	1143.7
1999	42.6	0.0	3.6	12.3	21.8	64.2	422.4	496.0	57.1	79.9	6.6	0.9	1207.4
Mean	18.2	34.8	59.4	65.3	53.5	74.7	243.4	261.5	117.3	28.8	7.3	5.9	970.3
Max	79.9	106.4	269.0	133.0	157.7	209.6	599.9	496.0	225.9	221.9	49.1	35.5	1529.7
Min	0.0	0.0	0.0	0.1	2.9	4.4	1.9	4.1	3.4	0.0	0.0	0.0	24.2
R. Coeff	0.2	0.4	0.7	0.8	0.7	0.9	3.0	3.2	1.5	0.4	0.1	0.1	
Stdev	21.7	34.2	54.6	39.3	43.7	58.2	154.0	150.4	58.7	46.9	11.6	10.1	444.2
75%	3.6	11.8	22.6	38.8	24.1	35.5	139.5	160.0	77.7	0.0	0.0	0.0	513.6
85%	0.0	0.0	2.8	24.6	8.2	14.4	83.8	105.6	56.5	0.0	0.0	0.0	295.9



Mean Monthly Runoff Data

Sibilu River near Chancho

Element : Mm³

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1981	0.36	0.30	0.79	0.83	0.49	0.34	33.17	94.71	61.28	5.29	1.53	0.66	199.73
1982	0.70	0.32	0.36	0.49	0.66	0.44	11.40	70.59	34.91	6.48	1.89	0.94	129.17
1983	0.36	0.38	0.45	0.87	2.70	2.69	21.13	107.10	45.78	4.40	1.52	0.87	188.25
1984	0.41	0.29	0.30	0.25	0.31	4.82	87.57	85.40	46.60	2.14	0.82	0.56	229.47
1985	0.36	0.30	0.17	0.24	0.60	0.30	33.95	136.34	51.27	3.20	1.38	0.78	228.89
1986	0.35	0.28	0.39	0.42	0.40	0.80	37.51	58.14	18.06	3.46	1.31	0.60	121.72
1987	0.67	0.47	0.87	1.54	1.67	6.05	48.10	74.14	24.05	3.74	1.13	0.84	163.27
1988	0.45	0.38	0.34	0.25	0.30	0.31	35.88	106.81	65.04	8.64	1.80	1.33	221.53
1989	0.58	0.64	0.53	0.63	0.33	0.42	43.25	109.08	35.70	4.45	1.53	0.91	198.06
1990	0.74	0.55	0.66	0.93	0.55	0.51	16.87	117.07	48.93	9.93	1.70	0.89	199.32
1991	0.90	0.64	0.77	0.45	0.22	0.62	34.51	107.42	55.12	3.18	1.33	0.84	206.00
1992	0.47	0.51	0.40	0.26	0.24	0.38	12.25	95.18	48.59	3.33	1.79	1.10	164.50
1993	0.69	0.35	0.25	0.64	0.59	2.16	43.17	106.34	64.57	11.36	1.69	1.09	232.90
1994	0.47	0.19	0.23	0.31	0.32	1.51	26.61	71.89	32.14				
1995	0.53	0.31	0.31	0.71	0.86	0.73	24.43	66.21	21.67	2.75	1.48	0.77	120.74
1996	0.74	0.50	0.53	0.44	0.37	5.20	63.94		43.99	4.99	1.33	0.87	
1997	0.43	0.21	0.23	0.63	0.25	0.39	19.26	52.94	14.42	2.08	1.50	0.68	93.02
1998	0.73	0.27	0.29	0.27	0.49	2.42	47.39	114.04	43.61	12.32	1.68	0.70	224.19
1999	0.43	0.19	0.27	0.22	0.21	0.83	29.51	98.48	37.43	6.67	1.20	0.62	176.06
2000	0.37	0.18	0.12	0.22	0.33	0.48	19.56	101.46	26.05	4.83	1.23	0.80	155.63
2001	0.42	0.23	0.45	0.45	0.77	3.63	58.04	84.06	29.29	2.27	0.90	0.52	181.03
2002	0.44	0.21	0.33	0.29	0.25	0.43	34.46	75.10	15.52	1.58	0.53	0.40	129.54
Mean	0.53	0.35	0.41	0.52	0.59	1.61	35.54	92.02	39.27	5.10	1.39	0.80	178.15
Std dev	0.16	0.14	0.20	0.32	0.57	1.78	18.12	21.59	15.48	3.09	0.35	0.22	42.18
75%	0.4	0.3	0.3	0.3	0.2	0.4	23.3	77.5	28.8	3.0	1.2	0.7	149.7
85%	0.4	0.2	0.2	0.2	0.0	0.0	16.8	69.6	23.2	1.9	1.0	0.6	134.4
Max	0.90	0.64	0.87	1.54	2.70	6.05	87.57	136.34	65.04	12.32	1.89	1.33	232.90
Min	0.35	0.18	0.12	0.22	0.21	0.30	11.40	52.94	14.42	1.58	0.53	0.40	93.02
CV	0.31	0.41	0.50	0.62	0.97	1.11	0.51	0.23	0.39	0.61	0.25	0.27	0.24



Deneba River near Chancho

Element : Mm³

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1981					0.18	0.00	11.58	20.75	13.67	2.75	0.44	0.18	
1982	0.11	0.08	0.02	0.18	0.22	0.12	1.68	18.24	7.08	1.73	0.50	0.24	30.20
1983	0.13	0.11	0.01	0.00	0.43	0.84	3.73	23.59	11.52	2.84	0.62	0.23	44.05
1984	0.13	0.03	0.00	0.00	0.01	1.42	18.88	20.29	12.38	1.50	0.32	0.11	55.07
1985	0.05	0.04	0.00	0.00	0.21	0.08	7.67	30.77	13.22	2.08	0.47	0.19	54.78
1986	0.12	0.07	0.16	0.12	0.08	0.23	8.49	13.28	6.53	1.16	0.25	0.16	30.65
1987	0.10	0.02	0.14	0.44	0.44	2.14	6.44	21.96	9.76	1.23	0.33	0.20	43.20
1988	0.12	0.15	0.11	0.10	0.08	0.21	9.67	23.71	18.12	3.45	0.40	0.21	
1989	0.17	0.09	0.02	0.16	0.13	0.13	12.00	22.76	16.48	1.69	0.32	0.24	54.19
1990	0.16	0.14	0.12	0.12	0.09	0.11	5.99	27.62	14.12	1.83	0.12	0.15	50.57
1991	0.19	0.11	0.25	0.09	0.35	0.18	7.66	35.29	13.30	1.31	0.27	0.15	59.13
1992	0.16	0.06	0.02	0.02	0.06	0.14	1.21	24.55	15.34	3.01	0.68	0.36	45.61
1993	0.16	0.04	0.01	0.00	0.27	1.16	25.37	39.40	20.75	3.22	0.78	0.28	91.44
1994	0.08	0.00	0.00	0.00	0.00	0.19	8.40	26.99	10.84	19.63	25.94	0.24	92.31
1995	0.14	0.00	0.00	0.10	0.29	0.22	10.67	20.72	6.11	1.03	0.29	0.28	39.85
1996	0.21	0.07	0.00	0.01	0.09	0.41	11.13	30.32	11.90	2.65	0.48	0.23	57.50
1997	0.08	0.02	0.00	0.00	0.00	0.20	11.51	36.09	7.84	1.33	0.37	0.18	57.61
1998	0.17	0.05	0.00	0.00	0.00	0.13	52.31	60.98	25.22	5.21	0.75	0.30	145.12
1999	0.19	0.05	0.00	0.00	0.00	0.07	5.77	81.69	8.25	4.12	0.70	0.35	101.19
2000	0.18	0.02	0.00	0.00	0.05	0.23	2.37	54.89	7.88	3.32	0.75	0.46	70.15
2001	0.18	0.11	0.05	0.06	0.27								
Mean	0.14	0.06	0.05	0.07	0.15	0.41	11.13	32.11	12.52	3.25	1.74	0.24	62.37
Std dev	0.04	0.04	0.07	0.11	0.14	0.55	11.23	17.01	4.97	4.01	5.70	0.08	28.76
75%	0.1	0.0	0.0	0.0	0.1	0.0	3.6	20.6	9.2	0.5	0.0	0.2	43.0
85%	0.1	0.0	0.0	0.0	0.0	0.0	0.0	14.5	7.4	0.0	0.0	0.2	32.6
Max	0.21	0.15	0.25	0.44	0.44	2.14	52.31	81.69	25.22	19.63	25.94	0.46	145.12
Min	0.05	0.00	0.00	0.00	0.00	0.00	1.21	13.28	6.11	1.03	0.12	0.11	30.20
CV	0.30	0.72	1.54	1.53	0.92	1.35	1.01	0.53	0.40	1.23	3.28	0.35	0.46



Muger River near Chancho

Element : Mm³

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1963	0.84	0.72	0.5	1.13	1.7	1.61	66.37			3.37	1	0.88	
1964	0.47	0.3	0.27	0.25	0.22	0.355	7.672	25.913	16.556	6.89	1.08	0.49	60.47
1965	0.42	0.19	0.16	0.28	0.17	1.07	22.5	90.2			0.95	0.478	
1966	0.196	0.324	0.228	0.567	0.19	0.681	25.43	115.18	55.09				
1967	0.39	0.29	0.31	0.32	2.84	2.26	25.795	51.91	33.05	6.683	1.538	0.78	126.18
1968		0.58	1.86	4.63	1.33	4.48	42.08				1.24	0.61	
1969	0.75	0.91	2.21	0.99	0.44	0.61	9.42		35.35	5.62	1.24	0.78	
1970	0.56	0.56	1.78	1.00	0.44	0.61	9.45		35.35	5.62	1.24	0.78	
1971	0.55	0.31	0.42	0.65	0.69	1.82	38.11	79.73	33.37	6.12	1.59	0.85	164.20
1972	0.47	0.52	0.60	0.71	0.67	0.78	55.38	117.05	26.36	2.40	0.68	0.45	206.08
1973	0.36	0.16	0.17	0.18	0.31	1.63	36.77	135.51	86.02	12.08	1.26	0.59	275.03
1974	0.34	0.24	0.36	0.50	0.29	1.50	67.09	90.36	42.22	4.74	0.90	0.37	208.91
1975	0.23	0.16	0.17	0.50	0.23	2.65	94.93	126.20	69.61	7.72	1.09	0.51	303.99
1976	0.40	0.20	0.29	0.36	0.62	1.55	72.54	88.92	38.33	2.41	1.07	0.51	207.20
1977	0.94	0.58	0.28	0.32	0.49	3.10	125.08	141.37	79.56	43.93	35.69	12.79	444.13
1978	5.28	4.04	4.69	3.88	3.94	3.72	42.64	72.48	66.07	16.56	1.55	0.99	225.84
1979	1.01	0.83	0.47	0.57	0.92	1.16	84.65		60.34	6.33	1.18	0.77	
1980	0.49	0.32	0.42	0.36	0.31	0.80	58.41	136.69	52.74	4.09	0.93	0.58	256.14
1981	0.35	0.29	0.69	1.07	0.67	0.37	62.72	132.50	84.47	6.88	0.81	0.59	291.41
1982	0.85	0.53	0.32	0.60	0.92	0.72	16.44	101.27	30.84	6.30	1.62	0.75	161.16
1983	0.64	0.52	0.30	0.50	2.82	2.16	23.59	139.67	65.66	6.73	1.57	0.58	244.73
1984	0.16	3.28	3.53	2.94	4.13	9.40	117.03	111.56	67.99	2.89	1.51	0.92	325.34
1985	0.49	0.34	0.22	0.37	0.89	0.64	53.93	182.52		4.05	1.27	0.69	



Muger River near Chancho

Element : Mm³

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1986	0.48	0.45	0.64	0.76	0.52	1.42	55.04	96.67	53.07		1.14	0.79	
1987	0.57	0.39	1.21	2.70	2.60	9.27	62.04	105.50	41.01	0.65	1.31	0.86	228.10
1988	0.60	0.69	0.56	0.58	0.40	0.68	58.14	154.79	92.27	12.61	1.66	0.94	323.92
1989	0.73	0.72	0.54	1.04	0.52	0.69	61.58	163.16	55.20	6.32	1.38	1.01	292.89
1990	0.67	0.83	0.69	1.27	0.62	0.78	35.14	172.63	86.57	8.02	1.58	1.04	309.83
1991	0.63	1.07	1.32	0.54	0.38	1.29	41.55	156.11	59.67	4.54	1.16	0.90	269.17
1992	0.70	0.64	0.37	0.43	0.54	0.87	25.38	119.54	60.86	6.57	1.36	0.82	218.07
1993	0.57	0.42	0.30	1.04	1.32	3.27	81.08	169.51	110.46	14.33	2.00	1.01	385.31
1994	0.68	0.27	0.38	0.50	0.44	2.27	52.39	104.80	53.22	6.13	1.41	0.87	223.35
1995	0.45	0.48	0.42	1.01	0.93	0.97	38.93	96.38	30.25	3.45	1.06	0.79	175.12
1996	0.85	0.43	0.48	0.48	0.55	6.93	86.66	174.32	69.03	6.57	1.03	0.53	347.86
1997	0.29	0.16	0.15	0.29	0.17	0.48	32.84	76.72	24.50	2.08	1.02	0.51	139.21
1998	0.53	0.24	0.21	0.19	0.53	1.83	66.19	149.78	66.53	21.32	2.15	0.77	310.26
1999	0.49	0.13	0.19	0.13	0.15	0.76	33.93	153.16	47.57	10.48	1.46	0.61	249.07
2000	0.35	0.13	0.09	0.18	0.36	0.57	26.21	138.01	38.69	7.49	1.45	0.71	214.22
2001	0.43	0.19	0.48	0.35	0.87	8.84		105.81	39.33	2.83	0.82	0.49	
2002	0.44	0.20	0.29	0.28	0.19	0.48	54.78	118.66	34.31	1.16	1.00	0.54	212.32
2003	0.33	0.15	0.21	0.38	0.20	1.51	102.46						
Mean	0.65	0.58	0.70	0.85	0.89	2.11	51.81	119.85	53.93	7.67	2.15	1.02	246.65
Std dev	0.78	0.75	0.92	0.97	0.98	2.38	28.52	36.18	21.83	7.57	5.52	1.94	80.18
75%	0.1	0.1	0.1	0.2	0.2	0.5	32.6	95.4	39.2	2.6	0.0	0.0	192.6
85%	0.0	0.0	0.0	0.0	0.0	0.0	22.3	82.3	31.3	0.0	0.0	0.0	163.5
Max	5.28	4.04	4.69	4.63	4.13	9.40	125.08	182.52	110.46	43.93	35.69	12.79	444.13
Min	0.16	0.13	0.09	0.13	0.15	0.36	7.67	25.91	16.56	0.65	0.68	0.37	60.47
CV	1.20	1.29	1.32	1.15	1.10	1.13	0.55	0.30	0.40	0.99	2.56	1.90	0.33

Water Analysis Reports

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Water Works Design and
Supervision Enterprise Laboratory
Service

Water Quality Section

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Ethiopia

SELECTED PHYSIO CHEMICAL AND BACTERIOLOGICAL WATER ANALYSIS RESULTS					
Client/Project: Mid Day International Consulting Engineers					
SOURCE OF SAMPLE	River	Spring	River	River	Spring
LOCATION					
DATE OF COLLECTION	4/12/1999	4/12/1999	4/12/1999	4/12/1999	4/12/1999
DATE RECEIVED	16/08/07	16/08/07	16/08/07	16/08/07	16/08/07
CLIENTS ID.NO.	Lebu SampleNo 1	Teltote SampleNo 2	Muger SampleNo 3	Muger + Lebu SampleNo 4	Adero SampleNo 5
LAB.ID NO.	217/2000	218/2000	219/2000	220/2000	221/2000
Colour (app)	-	-	-	-	-
Turbidity (NTU)	240.0	18.0	64.0	280.0	19.0
Total Solids 105°C (mg/l)	310.0	36.0	74.0	330.0	44.0
T. Dissolved Solid 105°C(mg/l)	88.0	234.0	170.0	82.0	332.0
Electrical Conductivity (µS/cm)	115.0	353.0	253.0	109.0	512.0
p ^H	7.24	7.29	7.35	7.58	6.69
Ammonia (mg/l NH ₃)	-	-	-	-	-
Sodium (mg/l Na)	11.5	9.7	8.4	7.4	13.7
Potassium (mg/l K)	2.1	1.7	2.2	1.8	2.1
Total Hardness (mg/l Ca CO ₃)	58.8	172.2	123.9	48.3	243.6
Calcium (mg/l CaCO ₃)	39.9	140.7	102.9	33.6	193.2
Magnesium (mg/l MgCO ₃)	15.9	26.6	23.01	12.4	42.5
Calcium (mg/l Ca)	15.96	56.3	41.16	13.4	77.3
Magnesium (mg/l Mg)	4.59	7.65	6.63	3.6	12.2
Total Iron (mg/l Fe)	0.6	0.03	0.3	0.44	0.04
Manganese (mg/l Mn)	-	-	-	-	-
Fluoride (mg/l F)	0.62	0.48	0.7	0.6	0.32
Chloride (mg/l Cl)	5.96	6.95	5.96	3.97	25.8
Nitrite (mg/l NO ₂)	-	-	-	-	-
Nitrate (mg/l NO ₃)	1.77	3.9	0.9	0.8	17.2
Alkalinity (mg/l CaCO ₃)	55.8	151.2	122.4	57.6	192.6
Carbonate (mg/l CO ₃)	Trace	Trace	Trace	Trace	Trace
Bicarbonate (mg/l HCO ₃)	68.07	184.46	149.3	70.77	234.97
Sulphate (mg/l SO ₄)	11.4	32.37	15.13	6.5	12.50
Phosphate (mg/l PO ₄)	0.115	0.244	0.057	0.226	0.854
Dissolved Oxygen (mg/l)	6.0	6.0	5.0	6.0	6.0
REMARK:-					

Checked by: [Signature]
Date: 24/08/2007

Approved by: [Signature]
Date: 24/08/07



Water Analysis Reports

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Water Works Design and
Supervision Enterprise Laboratory
Service

Water Quality Section

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Ethiopia

SELECTED PHYSIO CHEMICAL AND BACTERIOLOGICAL WATER ANALYSIS RESULTS

Client/Project: Mid Day International Consulting Engineers

SOURCE OF SAMPLE	River	Spring			
LOCATION	-	-			
DATE OF COLLECTION	4/12/1999	7/12/1999			
DATE RECEIVED	16/08/07	16/08/07			
CLIENTS ID.NO.	Aleletu Sample No 6	Lega Lomi Sample No 7			
LAB.ID NO.	122/2000	123/2000			
Colour (app)	-	-			
Turbidity (NTU)	340.0	4.0			
Total Solids 105°C (mg/l)	420.0	18.0			
T. Dissolved Solid 105°C(mg/l)	80.0	420.0			
Electrical Conductivity (µS/cm)	115.0	641.0			
pH	7.19	7.3			
Ammonia (mg/l NH ₃)	-	-			
Sodium (mg/l Na)	6.8	26.5			
Potassium (mg/l K)	1.6	1.9			
Total Hardness (mg/l Ca CO ₃)	63.0	294.0			
Calcium (mg/l CaCO ₃)	40.0	189.0			
Magnesium (mg/l MgCO ₃)	19.5	88.5			
Calcium (mg/l Ca)	15.96	75.6			
Magnesium (mg/l Mg)	5.61	25.50			
Total Iron (mg/l Fe)	0.6	0.05			
Manganese (mg/l Mn)	-	-			
Fluoride (mg/l F)	0.48	0.65			
Chloride (mg/l Cl)	3.97	21.85			
Nitrite (mg/l NO ₂)	-	-			
Nitrate (mg/l NO ₃)	0.779	82.4			
Alkalinity (mg/l CaCO ₃)	54.0	208.8			
Carbonate (mg/l CO ₃)	Trace	Trace			
Bicarbonate (mg/l HCO ₃)	65.88	254.74			
Sulphate (mg/l SO ₄)	11.53	23.69			
Phosphate (mg/l PO ₄)	0.158	0.438			
Dissolved Oxygen (mg/l)	5.0	6.0			

REMARK:-

Checked by: Tufan
Date: 24/08/2007

Approved by: [Signature]
Date: 24/08/07



Water Analysis Reports

ETHIOPIAN GEOLOGICAL SURVEYS CENTRAL GEOLOGICAL LABORATORY
Water Laboratory

DATA CODING FOR TRACE CONSTITUENTS

Dep./Proj. Originator MID-DAY INT'L CONSULTING ENGINEERS Approved by Head,Water Lab.

Sample Type WATER Source Area Date Submitted 21/01/00
Chemical Constituents in PERCENT (%) Date completed 27/01/00

Request No. 9065-2007pvt

FIELD No.	plant	quarry
LAB. No.	9065	9066
Copper (Cu)	0.03	<0.03
Lead (Pb)	0.03	0.03
Chromium (Cr)	<0.03	<0.03
Cadmium (Cd)	<0.03	<0.03
Aluminum (Al)	<0.03	<0.03
Zinc (Zn)	0.05	0.03
silica(Si)	13	5

Analysed By Water Analysts

Assef yimer



Checked By

Yimer Al

Total wt of residue 2.

Water Analysis Reports

ETHIOPIAN GEOLOGICAL SURVEYS CENTRAL GEOLOGICAL LABORATORY
Water Laboratory

DATA CODING FOR TRACE CONSTITUENTS

Dep./Proj. Originator MID-DAY INT'L CONSULTING ENGINEERS Approved by Head, Water Lab.

Sample Type WATER Source Area Date Submitted 21/01/00
Chemical Constituents in PERCENT (%) Date completed 27/01/00

Request No. 9065-2007pvt

FIELD No.	plant	quarry
LAB. No.	9065	9066
Copper (Cu)	0.03	<0.03
Lead (Pb)	0.03	0.03
Chromium (Cr)	<0.03	<0.03
Cadmium (Cd)	<0.03	<0.03
Aluminum (Al)	<0.03	<0.03
Zinc (Zn)	0.05	0.03
silica(Si)	13	5

Analysed By Water Analysts

Assef yimer



Checked By

Yimer Al

Total wt of residue 2.

Water Analysis Reports

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Addis Ababa

Ethiopia

SELECTED PHYSIO CHEMICAL AND BACTERIOLOGICAL WATER ANALYSIS RESULTS					ID. NO
Client/Project: Mid Day International Consulting Engineers					
SOURCE OF SAMPLE	Spring	BH	BH	Spring	BH
LOCATION	-	-	-	-	-
DATE OF COLLECTION	26/08/07	25/08/07	26/08/07	26/08/07	26/08/07
DATE RECEIVED	28/08/07	28/08/07	28/08/07	28/08/07	28/08/07
CLIENTS ID.NO.	Duber Spring	Absyina Cement facto	Gorfo BH	Filel Spring	Gimbich
LAB.ID NO.	298/2000	299/2000	300/2000	301/2000	302/2000
Colour (app)	-	-	-	-	-
Turbidity (NTU)	1.0	23.0	8.0	4.0	4.0
Total Suspended Solids (mg/l)	6.0	48.0	22.0	16.0	14.0
T. Dissolved Solid 105°C(mg/l)	154.0	72.0	134.0	192.0	186.0
Electrical Conductivity (µS/cm)	238.0	117.0	235	324.0	315.0
p ^H	8.06	6.69	6.99	7.83	7.93
Ammonia (mg/l NH ₃)	0.25	0.480	0.22	0.160	0.320
Sodium (mg/l Na)	19.0	2.4	13.5	20.0	29.0
Potassium (mg/l K)	1.9	1.0	1.1	2.7	2.0
Total Hardness (mg/l Ca CO ₃)	94.5	63.0	96.6	140.0	109.2
Calcium (mg/l CaCO ₃)	77.7	31.5	69.3	94.50	84.00
Magnesium (mg/l MgCO ₃)	14.16	26.55	23.01	38.94	21.24
Calcium (mg/l Ca)	31.1	12.6	27.7	37.8	33.6
Magnesium (mg/l Mg)	4.08	7.65	6.63	11.2	6.1
Total Iron (mg/l Fe)	0.01	0.27	0.03	0.03	Trace
Manganese (mg/l Mn)	-	-	-	-	-
Fluoride (mg/l F)	0.4	0.48	0.8	0.55	1.05
Chloride (mg/l Cl)	3.97	3.97	8.9	4.96	6.95
Nitrite (mg/l NO ₂)	0.010	0.02	0.01	Trace	Trace
Nitrate (mg/l NO ₃)	-	-	-	-	-
Alkalinity (mg/l CaCO ₃)	120.6	52.2	111.6	165.6	142.2
Carbonate (mg/l CO ₃)	Trace	Trace	Trace	Trace	Trace
Bicarbonate (mg/l HCO ₃)	147	63.68	136.15	202.03	173.48
Sulphate (mg/l SO ₄)	0.74	6.96	2.11	1.9	9.10
Phosphate (mg/l PO ₄)	0.06	0.065	0.108	0.162	0.122
Dissolved Oxygen (mg/l)	6.0	7.0	6.0	6.0	6.0
REMARK:-					

Checked by: [Signature]
Date: 31/08/2007

Approved by: [Signature]
Date: 31/08/07



Water Analysis Reports

ETHIOPIAN GEOLOGICAL SURVEYS CENTRAL GEOLOGICAL LABORATORY

Water Laboratory

DATA CODING FOR MAJOR AND TRACE CONSTITUENTS

Originator Mid-Day Consulting Engineers
Source Area
Sample Type soil
Chemical Constituents in Percent (%)

Approved by Head water Lab
Request No. 8550/2007PVT
Date Submitted 15/12/1999E.c
Date completed 22/12/1999E.c

FIELD No	1p1 0-30	1p1 30-60	1p1 60-100	1p2 0-25	1p2 25-45	1p2 45-100	1p3 0-25
LAB No	8550	8551	8552	8553	8554	8555	8556
Electrical Conductivity in $\mu\text{S}/\text{Cm}$ at 25°C	461	201	186	482	483	256	302
pH	6.24	7.21	7.28	4.92	4.93	5.45	8.32
Sodium(Na)	0.01	0.014	0.016	0.006	0.004	0.006	0.004
Potassium(K)	0.01	0.006	0.004	0.0259	0.024	0.0219	0.032
Calcium(Ca)	0.056	0.0299	0.0539	0.0339	0.032	0.0458	0.1519
Magnesium(Mg)	0.01	0.004	0.006	0.004	0.004	0.004	0.014
Chromium(Cr)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc(Zn)	<0.002	<0.002	<0.002	0.002	0.002	0.002	0.002
Lead(Pb)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel(Ni)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Copper(Cu)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Nitrogen(N)	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016
Phosphorus(p)	0.0039	0.002	0.0052	0.0079	<0.0019	0.0054	0.0047

Analysed by Water analysts

Checked by

Head Water Laboratory

Tilahun M. *Yimer-Ab*



Water Analysis Reports


ETHIOPIAN GEOLOGICAL SURVEYS CENTRAL GEOLOGICAL LABORATORY
Water Laboratory
DATA CODING FOR MAJOR AND TRACE CONSTITUENTS

Originator Mid-day consulting Engineers **Approved by** Head water Lab
Source Area **Request No** 8550/2007PVT
Sample Type soil **Date Submitted** 15/12/1999E.c
Chemical Constituents in percent (%) **Date completed** 22/12/1999E.c

FIELD No	1p3 25-60	1p3 60-100	1p4 0-40	1p4 40-100	1p5 0-40	1p5 40-100	RFG 30-100	RFG 0-30
LAB No	8557	8558	8559	8560	8561	8562	8563	8679
Electrical Conductivity in $\mu\text{S}/\text{Cm}$ at 25°C	390	277	563	425	476	249	194	55
pH	8.07	8.43	6.92	6.82	6.82	7.48	7.13	7.35
Sodium(Na)	0.004	0.004	0.004	0.004	0.002	0.002	0.006	0.002
Potassium(K)	0.034	0.0339	0.0839	0.0519	0.0719	0.0739	0.014	0.008
Calcium(Ca)	0.1399	0.1716	0.036	0.0419	0.0579	0.5074	0.0279	0.008
Magnesium(Mg)	0.018	0.0319	0.008	0.01	0.008	0.008	0.002	<0.002
Chromium(Cr)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zinc(Zn)	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Lead(Pb)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel(Ni)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Copper(Cu)	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Nitrogen(N)	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0016
Phosphorus(p)	0.007	0.0053	<0.0019	0.0024	0.016	0.0143	0.0061	0.0551

Analysed by Water analysts Checked by Head Water Laboratory

Tilahun *Yimer-Ali*



Water Analysis Reports

ETHIOPIAN GEOLOGICAL SURVEYS CENTRAL GEOLOGICAL LABORATORY
Water Laboratory

DATA CODING FOR MAJOR AND TRACE CONSTITUENTS

Originator Mid-Day Consulting Engineers
Source Area
Sample Type Water
Chemical Constituents in ppm (mg/Lt)

Approved by Head water Lab
Request No. 8566/2007PVT
Date Submitted 15/12/1999E.c
Date completed 21/12/1999E.c

FIELD No	sample-1	sample-2	sample-3	sample-4	sample-5	sample-6	sample-7
LAB No	8566	8567	8568	8569	8570	8571	8572
Sodium(Na)	4	9	6	3	12	3	19
Chromium(Cr)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Aluminium(Al)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium(Cd)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Zinc(Zn)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Lead(Pb)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Manganese(Mn)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper(Cu)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron(HBO ₂)	1.39	<0.15	1.47	<0.15	0.59	0.73	0.44

Analysed by Water analysts

Checked by

Head Water Laboratory

Tilahun

Tilahun

Yimer Al'

Yimer Al'





Soil Auger Data

Site No	Depth cm	Northing	Easting	Colour (moist)	Slope %	Land Use	Drainage Class	Texture
Ag1	0-20	1047377	0461814	10YR3/2	>50	Grazing	Excessively	C
Ag2	0-20	1047298	0461107	10YR3/2	>50	Grazing	Excessively	CL
Ag3	0-20	1047053	0461272	10YR4/2	>45	Grazing	Excessively	SCL
Ag4	0-20 20-80 SWR	1047799	0464089	10YR4/2 10YR3/2	8	Cultivation	Mod. well Mod. well	CL SCL
Ag5	0-20 20-40 SWR	1047915	0464456	2.5Y3/2 2.5Y4/1	12	Cultivation	Mod. well Mod. well	ZCL ZCL
Ag6	0-20 20-80	1048677	0464435	10YR3/2 2.5Y4/2	12	Cultivation	Mod. well Mod. well	ZCL ZC
Ag7	0-30 30-100	1039763	0461272	10YR3/4 2.5Y3/3	6	Cultivation	Mod. well Mod. well	C ZC
Ag8	0-40 40-125	1040993	0462156	10YR3/2 2.5Y3/3	8	Cultivation	Mod. well Mod. well	ZC ZCL
Ag9	0-40	1040301	0461592	10YR2/2	7	Cultivation	Mod. well	ZCL
Ag10	0-40 40-100	1040378	0461339	10YR3/4 2.5YR3/6	12	Cultivation	Mod. well Mod. well	ZC CL
Ag11	0-25 25-50	1047670	0455234	5YR4/4 7.5YR3/3	6	Cultivation	Mod. well Mod. well	ZC SCL
Ag12	0-40 40-125	1046964	0455818	2.5Y2.5/1 10YR3/2	6	Cultivation	Well Well	L L
Ag13	0-30	1046671	0454704	7.5YR4/6	10	Grazing	Mod. well	C
Ag14	0-35 35-50	1046853	0454227	10YR3/4 10YR3/6	8	Grazing	Mod. well Well	C L



Soil Auger Data

Site No	Depth cm	Northing	Easting	Colour (moist)	Slope %	Land Use	Drainage Class	Texture
Ag15	0-20 Bed rock	1047085	0452788	10YR3/3	12	Grazing	Well	C
Ag16	0-25 25-50	1048677	0464435	2.5Y4/2 2.5Y5/4	10	Cultivation	Mod. well Mod. well	C C
Ag17	0-40 40-120	1049201	0457150	2.5Y2.5/1 2.5Y3/1	6	Cultivation	Mod. well Mod. well	ZCL ZL
Ag18	0-40 40-100	1047378	0456886	5YR4/3 7.5YR3/4	7	Cultivation	Mod. well Well	ZC SCL
Ag19	0-30 30-100	1048497	0456318	10YR3/2 10YR4/3	7	Cultivation	Mod. well Mod. well	ZCL ZC
Ag20	0-20 20-80	1049723	0454354	10YR3/2 10YR4/2	10	Cultivation	Mod. well Mod. well	ZCL ZC
Ag21	0-30 30-60	1050712	0456102	2.5Y4/3 5Y5/3	10	Cultivation	Mod. well Mod. well	C C
Ag22	0-30 30-100	1044865	0460530	7.5YR3/4 7.5YR5/6	10	Grazing	Mod. well Mod. well	ZC C
Ag23	0-40	1045863	0460225	7.5YR4/6	12	Cultivation	Mod. well	ZCL
Ag24	0-30	1048196	0460193	10YR3/1	>30	Cultivation	Mod. well	ZCL
Ag25	0-30	1048488	0459339	7.5YR4/4	8	Cultivation	Mod. well	ZCL
Ag26	0-30 30-60	1050780	0459485	7.5YR4/6 7.5Y4/4	7	Cultivation	Mod. well Mod. well	ZCL C
Ag27	0-30 30-100	1040609	0464085	10YR3/4 7.5YR3/2	10	Cultivation	Mod. well Mod. well	C C
Ag28	0-30 30-50	1040913	0463617	7.5YR3/3 7.5YR3/3	10	Cultivation	Mod. well Mod. well	C C
Ag29	0-30 30-60	1036811	0465064	2.5Y3/2 2.5Y3/3	8	Cultivation	Mod. well Mod. well	ZC ZCL



Soil Auger Data

Site No	Depth cm	Northing	Easting	Colour (moist)	Slope %	Land Use	Drainage Class	Texture
Ag30	0-40 40-120	1035709	0464656	2.5Y2.5/1 2.5Y3/1	6	Cultivation	Well Well	CL CL
Ag31	0-40 40-120	1039684	0463748	2.5Y3/2 2.5Y3/3	7	Cultivation	Mod. well Mod. well	ZC ZC
Ag32	0-20 20-50	1040528	0463332	10YR3/3 10YR3/6	6	Cultivation	Mod. well Mod. well	ZCL ZC
Ag33	0-30 30-100	1047428	0462704	10YR2/1 10YR2/2	7	Cultivation	Mod. well Mod. well	C C
Ag34	0-30 30-100	1048411	0462723	10YR3/1 10Y3/2	5	Cultivation	Mod. well Mod. well	C C
Ag35	0-30 30-100	1047928	0462356	10YR3/2 10YR3/1	6	Cultivation	Mod. well Mod. well	C C
Ag36	0-30 30-60	1057612	0459591	7.5YR3/1 7.5YR3/2	6	Cultivation	Mod. well Mod. well	ZC ZCL
Ag37	0-40	1057495	0461846	7.5YR4/4	10	Cultivation	Mod. well	ZCL
Ag38	0-40 40-100	1058342	0460205	5Y2.5/1 2.5Y2.5/1	3	Cultivation	Mod. well Mod. well	ZC ZCL
Ag39	0-40 40-100	1046943	0461884	2.5Y3/2 7.5YR4/4	6	Cultivation	Mod. well Mod. well	ZC ZCL
Ag40	0-40 40-100	1045250	0463105	2.5Y3/2 2.5Y3/1	6	Cultivation	Mod. well Mod. well	ZC ZCL
Ag41	0-20	1046163	0462551	10YR3/2	6	Cultivation	Mod. well	ZCL
Ag42	0-20	1044337	0463658	10YR3/3	7	Cultivation	Mod. well	ZC
Ag43	0-40 40-100	1043280	0463723	2.5Y3/2 2.5Y3/1	5	Cultivation	Mod. well Mod. well	ZC ZCL
Ag44	0-20 20-80	1056720	0470650	10YR2/1 10YR3/2	8	Cultivation	Mod. well Mod. well	C C



SOIL PROFILE PIT DATA

Survey Area	Derba	Pit no.	1
Author	Aberra	Date: 10/8/07	
Location, UTM	N: 1047801 E: 0464094	Slope %	12
Topography	Sloping land	Position	Middle slope
Parent material	Basalt	Surface stones	Few
Drainage	Moderate	Human influence	Cultivation & grazing
Eff. Soil Depth, cm	>100	Surface cracks	Common boulders
Land cover	Cultivated	Land Use	Rainfed
Crop type	Barley & wheat	Soil unit	Pellic Vertisol

0-30 cm 10YR2/1(black) moist; loam; well drained; common fine and medium prominent black and red mottles; strong, medium to coarse, sub-angular blocky structured; sticky and plastic wet; many coarse and fine roots; common fine to medium pores; slow permeability; clear and smooth boundary.

30-60 cm 10YR3/2 (very dark brown) moist; loam; well drained; few stones; dominant fine and medium faint black and red mottles; moderate, medium to coarse, sub-angular blocky structured; friable moist, sticky and plastic wet; common stones; very few and very fine pores; slow permeability; clear and smooth boundary.

60-100 cm 10YR3/1 (very dark gray) moist; loam; drained; dominant fine and medium faint black and red mottles; moderate, medium to coarse, sub-angular blocky structured; friable moist, sticky and plastic wet; many stones; slow permeability.

Remarks: Few shallow gullies



Survey Area	Derba	Pit no.	2
Author	Aberra & Milliyon	Date: 11/8/07	
Location, UTM	N: 1040750	Slope %	6
	E: 0461881		
Topography	Gently sloping	Position	Middle slope
Parent material	Basalt	Surface stones	Few
Drainage	Moderate	Human influence	Cultivation & grazing
Eff. Soil Depth, cm	>100	Surface cracks	No
Land cover	Cultivated	Land Use	Rainfed
Crop type	Barley & wheat	Soil unit	Vertic Cambisols

0-25 cm 10YR2/2(very dark brown) moist; clay; moderately well drained; common fine and medium prominent black and red mottles; strong, medium to coarse, sub-angular blocky structured; sticky and plastic wet; common coarse and fine roots; common fine to medium pores; slow permeability; clear and smooth boundary.

25-45 cm 10YR3/2 (very dark brown) moist; clay; moderately well drained; few fine roots; few stones; dominant fine and medium faint black and red mottles; moderate, medium to coarse, sub-angular blocky structured; friable moist, sticky and plastic wet; very few and very fine pores; slow permeability; clear and smooth boundary.

45-100 cm 10YR3/3 (dark brown) moist; clay; imperfectly drained; dominant fine and medium faint black and red mottles; moderate, medium to coarse, sub-angular blocky structured; friable moist, sticky and plastic wet; many stones; slow permeability.

Remarks: Few shallow gullies



Survey Area	Muger	Pit no.	3
Author	Aberra	Date: 10/8/07	
Location, UTM	N: 1047881	Slope %	8
	E: 0453697		
Topography	Gently sloping	Position	Middle slope
Parent material	Limestone	Surface stones	Few
Drainage	Moderate	Human influence	Cultivation & grazing
Eff. Soil Depth, cm	>100	Surface cracks	No
Land cover	Cultivated	Land Use	Rainfed
Crop type	Maize	Soil unit	

- 0-30 cm** **10YR3/6(dark yellowish brown) moist; sandy clay; moderately well drained; weak sub-angular blocky structured; sticky and plastic wet; many coarse and fine roots; common fine to medium pores; slow permeability; moderately calcareous; clear and smooth boundary.**
- 30-60 cm** **2.5Y4/3 (olive brown) moist; sandy clay; moderately well drained; moderate, medium to coarse, sub-angular blocky structured; friable moist, sticky and plastic wet; very few and very fine pores; slow permeability; clear and smooth boundary.**
- 60-100 cm** **5Y5/3 (olive) moist; sandy clay; moderately well drained; dominant fine and medium faint black and red mottles; moderate, medium to coarse, sub-angular blocky structured; friable moist, sticky and plastic wet; many stones; slow permeability.**

Remarks: Top soil affected by splash erosion



Survey Area	Derba	Pit no.	4
Author	Aberra & Milliyon	Date: 17/8/07	
Location, UTM	N: 1048399	Slope %	8
	E: 0459908		
Topography	Rolling	Position	Middle slope
Parent material	Undifferentiated	Surface stones	Few
Drainage	Moderate	Human influence	Cultivation & grazing
Eff. Soil Depth, cm	>100	Surface cracks	No
Land cover	Cultivated	Land Use	Rainfed
Crop type	Maize & teff	Soil unit	Regosols

0-40 cm **5YR3/1 (very dark gray) moist; silt clay; moderately well drained; weak medium to coarse, granular structured; friable, sticky and plastic wet; common medium and fine roots; common fine to medium pores; slow permeability; non calcareous; clear and smooth boundary.**

40-100 cm **7.5YR3/2 (dark brown) moist; silt clay loam; well drained; few stones; moderate, medium to coarse, sub-angular blocky structured; friable moist, sticky and plastic wet; very few and very fine pores; slow permeability;**

Remarks: Annually flooding



Annex 4.4

Survey Area	Yaya Gulele	Pit no.	5
Author	Aberra	Date: 19/8/07	
Location, UTM	N: 1057999	Elevation, masl	2424
	E: 0461753	Slope %	6
Topography	Undulating	Position	Middle slope
Parent material	Basalt	Surface stones	Few
Drainage	Moderate	Human influence	Cultivation & grazing
Eff. Soil Depth, cm	>100	Surface cracks	No
Land cover	Cultivated	Land Use	Rainfed
Crop type	Barley & wheat	Soil unit	Vertisol

0-40 cm 5Y3/1(very dark gray) moist; clay; moderately well drained; common fine and medium prominent black and red mottles; strong, medium to coarse, granular structured; sticky and plastic wet; many coarse and fine roots; common fine to medium pores; slow permeability; non calcareous; clear and smooth boundary.

40-100 cm 10YR3/2 (very dark brown) moist; clay; moderately well drained; few stones; dominant fine and medium faint black and red mottles; moderate, medium to coarse, platy structured; friable moist, sticky and plastic wet; very few and very fine pores; slow permeability.

Remarks: Few shallow gullies



Annex 4.4

Survey Area	Derba	Pit no.	6
Author	Abebe	Date: 17/8/07	
Location, UTM	N: 1040922	Elevation, masl	2400
	E: 0462995	Slope %	8
Topography	Gently sloping	Position	Middle slope
Parent material	Basalt	Surface stones	No
Drainage	Moderate	Human influence	Cultivation & grazing
Eff. Soil Depth, cm	>100	Surface cracks	No
Land cover	Cultivated	Land Use	Rainfed
Crop type	Barley & wheat	Soil unit	Pellic Vertisols

0-30 cm **10YR3/2(very dark greyish brown) moist; clay; moderately well drained; common fine and medium prominent black and red mottles; strong, medium to coarse, sub-angular blocky structured; sticky and plastic wet; many coarse and fine roots; common fine to medium pores; slow permeability; non calcareous; clear and smooth boundary.**

30-100 cm **10YR3/1 (very dark gray) moist; clay; moderately well drained; dominant fine and medium faint black and red mottles; moderate, medium to coarse, sub-angular blocky structured; friable moist, very sticky and very plastic when wet; very few and very fine pores; slow permeability.**

Remarks: Many deep gullies and rill erosion

Ethiopian Geological Surveys
 Central Geological Laboratory - Physical Laboratory
 Grain Size Distribution

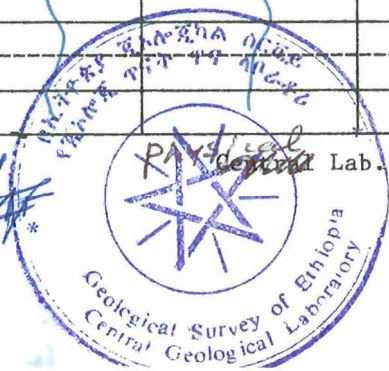
Nº 0979

Printed in Commercial Printing Enterprise

Sample Nº		DATA OF PIPETTE ANALYSIS							
Lab Nº	Coll. Nº		<0.00063	0.00063-0.002	0.002-0.0063	0.0063-0.016	0.016-0.04	0.04-0.063	>0.063
			mm 1. weight in g 2. mass %	mm 1. weight in g 2. mass %	mm 1. weight in g 2. mass %	mm 1. weight in g 2. mass %	mm 1. weight in g 2. mass %	mm 1. weight in g 2. mass %	mm 1. weight in g 2. mass %
8659/2007	RFq 0-30	1	104.13	15.49	15.12	24.45	17.73	9.70	13.38
		2	52.07	7.74	7.56	12.22	8.86	4.85	6.69
8655/2007	1P1 0-30	1	57.31	14.50	17.43	32.10	35.73	15.53	27.39
		2	28.65	7.25	8.72	16.05	17.87	7.77	13.69
8655/2007	1P2 30-60	1	24.83	6.64	23.89	51.10	33.69	18.03	41.82
		2	12.42	3.32	11.94	25.55	16.85	9.02	20.90
8645/2007	1P5 40-100	1	30.03	8.77	24.57	46.60	77.80	7.22	5.01
		2	15.01	4.39	12.28	23.30	38.90	3.61	2.51
8658/2007	RFq 30-100	1	98.26	18.06	15.20	22.05	21.29	15.20	9.94
		2	49.13	9.03	7.60	11.02	10.64	7.60	4.98
8656/2007	1P3 0-25	1	51.59	19.17	11.98	7.08	0.68	23.63	85.87
		2	25.79	9.59	5.99	3.54	0.34	11.81	42.93
8647/2007	1P3 25-60	1	64.46	26.62	4.87	11.20	15.80	7.77	68.28
		2	32.73	13.30	2.44	5.60	7.90	3.89	34.14
8657/2007	1P4 0-40	1	38.53	10.28	19.52	23.25	23.76	13.10	71.55
		2	19.27	5.13	9.76	11.62	11.88	6.55	35.78
		1							
		2							
		1							
		2							

Locality
 Client - Mid-Day International Consulting Eng.

Analysed by - Mistrak and Belay
 Checked by - Mistrak Tefera



Girma Asema

Ethiopian Geological Surveys
 Central Geological Laboratory - Physical Laboratory
 Grain Size Distribution

No 0977

Printed in Commercial Printing Enterprises

Sample N°		DATA OF PIPETTE ANALYSIS							
Lab N°	Coll. N°		<0.00063	0.00063-0.002	0.002-0.0063	0.0063-0.016	0.016-0.04	0.04-0.063	>0.063
			mm	mm	mm	mm	mm	mm	mm
			1. weight in g 2. mass %	1. weight in g 2. mass %	1. weight in g 2. mass %	1. weight in g 2. mass %	1. weight in g 2. mass %	1. weight in g 2. mass %	1. weight in g 2. mass %
8649/2007	1P ₃ 60-100	1	64.62	18.09	16.34	14.35	6.86	4.49	75.25
		2	32.31	9.05	8.17	7.17	3.43	2.25	37.62
8648/2007	1P ₂ 0-25	1	105.59	31.75	16.47	20.73	4.07	15.11	6.25
		2	52.80	15.89	8.23	10.37	2.03	7.56	3.12
8652/2007	1P ₂ 45-100	1	114.73	25.04	13.83	17.94	8.22	7.10	13.14
		2	57.37	12.52	6.91	8.97	4.11	3.55	6.57
8653/2007	1P ₂ 25-45	1	120.31	8.28	17.71	7.31	37.54	1.35	7.50
		2	60.16	4.14	8.85	3.66	18.77	0.67	3.75
8650/2007	1P ₄ 40-100	1	32.39	15.44	15.09	19.97	20.09	13.12	83.89
		2	16.20	7.72	7.54	9.99	10.04	6.56	41.95
8646/2007	1P ₁ 60-100	1	60.67	6.32	34.69	34.18	25.46	9.57	29.11
		2	30.33	3.16	17.35	17.09	12.73	4.79	14.55
8654/2007	1P ₅ 0-40	1	83.07	7.27	21.81	29.82	30.36	9.45	18.22
		2	41.54	3.63	10.90	14.91	15.18	4.73	9.11
}	}	1							
		2							
}	}	1							
		2							
}	}	1							
		2							



Locality
 Client - Mid-Day International Consulting Eng
 Analysed by Mistrak and Belay
 Checked by Mistrak Tefeha
 Head, physical Lab.

Girma Asem

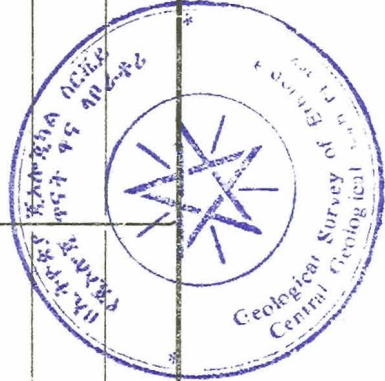
Ethiopian Geological Surveys
 Cen. Geological Laboratory - Physical Laboratory
 Grain size distribution - Data of pipette Analysis

N^o 2408

COMMERCIAL P. E. 57583/88

Project Locality Designation

Total Weight of sample in g:		Related sample weight (mo) in g:							Weight of peptisator (m ⁴) in g/10ml:	Weight percent of grain size distribution $\frac{m \times 100 \times 100}{m_0} = \%$
Lab. No	Coll. No	settle time at t s	settle way s cm	settle velocity equivalent diameter ds cm	Weight of Evaporation dish m ₁	Weight of Evaporation sample and peptisator m ₂ g	Weight of sample with peptisator m ₃ g	Weight of sample m = m ₃ - m ₄ g		
8649 2007	1P3 60-100		15	0.004	28.3968	28.5056	0.1088	0.0964		96.4
				0.002						
			10	0.0016	35.3172	35.4205	0.1033	0.0909		90.9
			10	0.00063	34.485	34.5768	0.0918	0.0794		79.4
			5	0.00025	30.5605	30.6392	0.0787	0.0663		66.3
				0.0002						
				0.0001						
			10	0.000063	31.7386	31.8028	0.0642	0.0518		51.8
				0.00002						



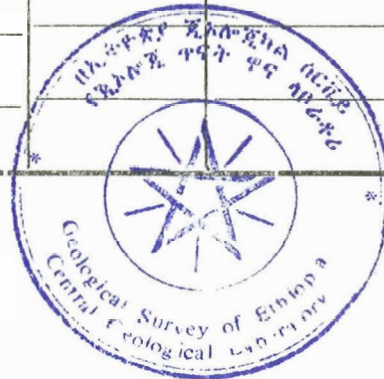
Analysed by Mistak and Beley
 Checked by Mistak Tesfaye
 Physical Control Lab.
Girma Asemu

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Grain size distribution - Data of pipette Analysis

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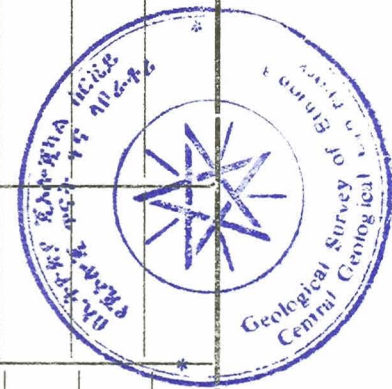
Project		Locality				Designation			
Total Weight of sample in g:		Related sample weight (m ₀) in g:				Weight of peptisator (m ₄) in g/10m ³ :			
Lab. No	Coll. No	settle time at Oc t s	settle way s cm	settle velocity equivalent diameter d _s cm	Weight of Evaporation dish m ₁	Weight of Evapor- ation dish with sample and peptisator m ₂ g	Weight of sample with peptisator m ₃ m ₃ = m ₂ - m ₁ g	Weight of sample m m = m ₃ - m ₄ g	Weight percent of grain size distribution $\frac{m \times 100 \times 100}{m_0} = \%$
8648 2007	IP2 0-25		15	0.004	35.6791	35.7837	0.1046	0.0922	92.2
				0.002					
			10	0.0016	34.7888	34.8913	0.1025	0.0901	90.1
			10	0.00063	30.5616	30.6534	0.0918	0.0794	79.4
			5	0.00025	30.8549	30.9382	0.0833	0.0709	70.9
				0.0002					
				0.0001					
			10	0.000063	31.3558	31.4227	0.0669	0.0545	54.5
				0.00002					



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Project			Designation						
Lab. No	Coll. No	settle time at t s	settle way s cm	settle velocity equivalent diameter ds cm	Weight of Evaporation dish m ₁	Weight of Evapor- ation dish with sample and peptisator m ₂ g	Weight of sample with peptisator m ₃ m ₃ = m ₂ - m ₁ g	Weight of sample m m = m ₃ - m ₄ g	Weight percent of grain size distribution $\frac{m \times 100}{m_3} = \%$ mo
8651 2007	1P2 45-100		15	0.004	29.9981	30.1184	0.1203	0.0962	96.2
				0.002					
			10	0.0016	34.7284	34.8443	0.1159	0.0918	91.8
			10	0.00063	35.1822	35.2885	0.1063	0.0822	82.2
			5	0.00025	39.6966	39.7955	0.0989	0.0748	74.8
				0.0002					
			10	0.00063	28.0981	28.1836	0.0855	0.0614	61.40
				0.00002					



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Central Lab.
774
Girma Asemu

Ethiopian Geological Surveys

Central Geological Laboratory - Physical Laboratory,
Grain size distribution - Data of pipette Analysis

No. 2411

COMMERCIAL P. E. 57583/88

Project		Locality				Designation			
Total Weight of sample in g:		Related sample weight (m ₀) in g:				Weight of peptisator (m ₄) in g/10m ₀ :			
Lab. No	Coll. No	settle time at O c t s	settle way s cm	settle velocity equivalent diameter d _s cm	Weight of Evaporation dish m ₁	Weight of Evaporation dish with sample and peptisator m ₂ g	Weight of sample with peptisator m ₃ m ₃ = m ₂ - m ₁ g	Weight of sample m m = m ₃ - m ₄ g	Weight percent of grain size distribution $\frac{m \times 100 \times 100}{m_0} = \%$ mo
8643 2007	IP2 25-45		15	0.004	35.895	36.0184	0.1234	0.0993	99.3
				0.002					
			10	0.0016	30.6805	30.7844	0.1039	0.0798	79.8
			10	0.00063	30.1735	30.2736	0.1001	0.076	76
			5	0.00025	28.5968	28.6877	0.0909	0.0668	66.8
				0.0002					
				0.0001					
			10	0.000063	27.1138	27.2004	0.0866	0.0625	62.5
			1	0.00002					



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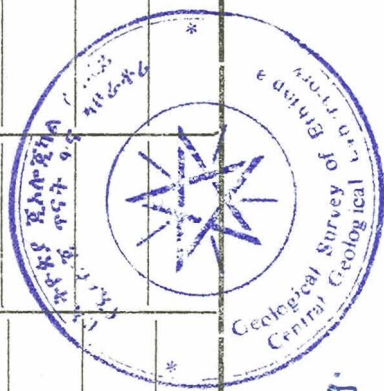
Checked by Misrak Tesera

Head, Physical

Central Lab.

Girma Asemu

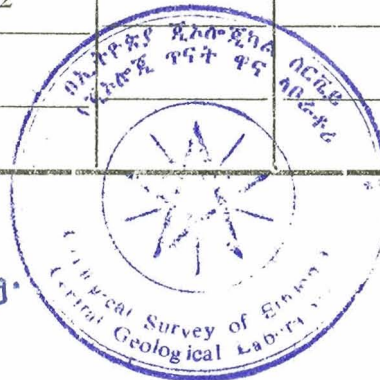
Project		Designation									
Total Weight of sample in g:		Weight of peptisator (m4) in g/10m/:									
Lab. No	Coll. No	settle time at Oc t s	settle way s cm	settle velocity equivalent diameter ds cm	Weight of Evapor- ation dish with sample and peptisator m ₂ g	Weight of sample with peptisator m ₃ m ₃ = m ₂ - m ₁ g	Weight of sample m m = m ₃ - m ₄ g	Weight percent of grain size distribution $\frac{m \times 100}{m_4} = \%$ mo			
			15	0.004	30.9715	0.1128	0.0887	88.7			
				0.002							
			10	0.0016	27.0045	0.0955	0.0714	71.4			
			10	0.00063	35.2561	0.0783	0.0542	54.2			
			5	0.00025	26.9492	0.0653	0.0412	41.2			
				0.0002							
				0.0001							
			10	0.000063	31.6963	0.052	0.0279	27.9			
				0.00002							



Analysed by Misrak and Beley
 Checked by Misrak Tefeta
 Head, physical Central Lab. Girha Asemu

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Project		Locality				Designation			
Total Weight of sample in g:		Related sample weight (m ₀) in g:				Weight of peptisator (m ₄) in g/10m/:			
Lab. No	Coll. No	settle time at Oct s	settle way s cm	settle velocity equivalent diameter ds cm	Weight of Evaporation dish m ₁	Weight of Evaporation dish with sample and peptisator m ₂ g	Weight of sample with peptisator m ₃ m ₃ = m ₂ - m ₁ g	Weight of sample m m = m ₃ - m ₄ g	Weight percent of grain size distribution $\frac{m \times 100 \times 100}{m_0} = \%$
8646 2007	LP1 60-100		15	0.004	35.5544	35.6729	0.1185	0.0944	94.4
				0.002					
			10	0.0016	31.9887	32.0923	0.1036	0.0795	79.5
			10	0.00063	30.5549	30.6385	0.0836	0.0595	59.5
			5	0.00025	34.4189	34.4822	0.0633	0.0392	39.2
				0.0002					
				0.0001					
			10	0.000063	36.7069	36.7665	0.0596	0.0355	35.5
				0.00002					



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Central Lab.GA
Girma Asemu