



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright© by Chiang Mai University

All rights reserved



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright© by Chiang Mai University
All rights reserved

Factor of Safety calculation sheet Line N30

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35				
-34	179.00	274.00	1.31	404.00
-33	211.00	307.00	1.37	435.00
-32	199.00	296.00	1.34	422.00
-31	209.00	293.00	1.43	445.00
-30	200.00	296.00	1.35	424.00
-29	188.00	295.00	1.27	401.00
-28	161.00	300.00	1.07	342.00
-27	136.00	316.00	0.86	276.00
-26	152.00	344.00	0.88	280.00
-25	202.00	406.00	1.00	318.00
-24	243.00	450.00	1.08	356.00
-23	258.00	514.00	1.00	322.00
-22	271.00	484.00	1.12	378.00
-21	271.00	485.00	1.12	377.00
-20	282.00	498.00	1.13	386.00
-19	287.00	514.00	1.12	380.00
-18	290.00	517.00	1.12	383.00
-17	287.00	515.00	1.11	379.00
-16	297.00	524.00	1.13	390.00
-15	308.00	526.00	1.17	410.00
-14	313.00	530.00	1.18	416.00
-13	291.00	507.00	1.15	395.00
-12	268.00	486.00	1.10	370.00
-11	233.00	447.00	1.04	339.00
-10	197.00	404.00	0.98	310.00
-9	208.00	406.00	1.02	330.00
-8	215.00	409.00	1.05	341.00
-7	271.00	421.00	1.29	441.00
-6	271.00	395.00	1.37	467.00
-5	266.00	364.00	1.46	488.00
-4	241.00	325.00	1.48	477.00
-3	220.00	303.00	1.45	457.00
-2	214.00	286.00	1.50	462.00
-1	201.00	256.00	1.57	466.00
0				

Factor of Safety calculation sheet Line N32

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	249.00	334.00	1.49	484.00
-34	253.00	337.00	1.50	489.00
-33	228.00	301.00	1.51	475.00
-32	190.00	274.00	1.39	426.00
-31	204.00	299.00	1.36	429.00
-30	207.00	302.00	1.37	432.00
-29	214.00	320.00	1.34	428.00
-28	222.00	350.00	1.27	414.00
-27	204.00	355.00	1.15	373.00
-26	203.00	375.00	1.08	351.00
-25	186.00	391.00	0.95	301.00
-24	254.00	459.00	1.11	369.00
-23	281.00	486.00	1.16	396.00
-22	290.00	518.00	1.12	382.00
-21	236.00	469.00	1.01	323.00
-20	218.00	473.00	0.92	283.00
-19	201.00	461.00	0.87	261.00
-18	196.00	456.00	0.86	256.00
-17	190.00	450.00	0.84	250.00
-16	190.00	450.00	0.84	250.00
-15	206.00	452.00	0.91	280.00
-14	202.00	445.00	0.91	279.00
-13	202.00	451.00	0.90	273.00
-12	199.00	448.00	0.89	270.00
-11	202.00	436.00	0.93	288.00
-10	228.00	409.00	1.11	367.00
-9	231.00	387.00	1.19	395.00
-8	228.00	361.00	1.26	415.00
-7	237.00	343.00	1.38	451.00
-6	231.00	317.00	1.46	465.00
-5	217.00	288.00	1.51	466.00
-4	261.00	322.00	1.62	520.00
-3	285.00	366.00	1.56	524.00
-2	335.00	393.00	1.70	597.00
-1	384.00	417.00	1.84	671.00
0	423.00	430.00	1.97	736.00

Factor of Safety calculation sheet Line N34

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	302.00	361.00	1.67	563.00
-34	265.00	338.00	1.57	512.00
-33	228.00	312.00	1.46	464.00
-32	211.00	295.00	1.43	447.00
-31	195.00	283.00	1.38	427.00
-30	183.00	278.00	1.32	408.00
-29	197.00	292.00	1.35	422.00
-28	164.00	288.00	1.14	360.00
-27	130.00	280.00	0.93	300.00
-26	187.00	359.00	1.04	335.00
-25	216.00	415.00	1.04	337.00
-24	258.00	463.00	1.11	373.00
-23	237.00	453.00	1.05	341.00
-22	260.00	476.00	1.09	364.00
-21	211.00	438.00	0.96	304.00
-20	214.00	463.00	0.92	285.00
-19	231.00	484.00	0.95	298.00
-18	216.00	465.00	0.93	287.00
-17	204.00	461.00	0.89	267.00
-16	230.00	467.00	0.99	313.00
-15	226.00	453.00	1.00	319.00
-14	200.00	426.00	0.94	294.00
-13	170.00	401.00	0.85	259.00
-12	184.00	381.00	0.97	307.00
-11	192.00	353.00	1.09	351.00
-10	182.00	343.00	1.06	341.00
-9	214.00	350.00	1.22	398.00
-8	211.00	310.00	1.36	432.00
-7	215.00	290.00	1.48	460.00
-6	208.00	264.00	1.58	472.00
-5	203.00	245.00	1.66	481.00
-4	229.00	269.00	1.70	509.00
-3	253.00	301.00	1.68	525.00
-2	320.00	345.00	1.86	615.00
-1	365.00	375.00	1.95	675.00
0	471.00	466.00	2.02	796.00

Factor of Safety calculation sheet Line N36

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	267.00	329.00	1.62	525.00
-34	240.00	302.00	1.59	498.00
-33	204.00	277.00	1.47	451.00
-32	175.00	259.00	1.35	411.00
-31	178.00	271.00	1.31	405.00
-30	201.00	296.00	1.36	426.00
-29	221.00	316.00	1.40	446.00
-28	202.00	330.00	1.22	394.00
-27	201.00	351.00	1.15	371.00
-26	205.00	377.00	1.09	353.00
-25	225.00	419.00	1.07	351.00
-24	232.00	470.00	0.99	314.00
-23	263.00	494.00	1.06	352.00
-22	234.00	461.00	1.02	327.00
-21	154.00	392.00	0.79	236.00
-20	153.00	414.00	0.74	212.00
-19	181.00	437.00	0.83	245.00
-18	202.00	440.00	0.92	284.00
-17	219.00	452.00	0.97	306.00
-16	226.00	448.00	1.01	324.00
-15	216.00	423.00	1.02	329.00
-14	152.00	350.00	0.87	274.00
-13	111.00	304.00	0.73	238.00
-12	101.00	274.00	0.74	248.00
-11	96.00	246.00	0.78	266.00
-10	100.00	223.00	0.90	297.00
-9	108.00	210.00	1.03	326.00
-8	156.00	218.00	1.43	414.00
-7	178.00	218.00	1.63	458.00
-6	194.00	216.00	1.80	492.00
-5	203.00	216.00	1.88	510.00
-4	209.00	218.00	1.92	520.00
-3	271.00	268.00	2.02	594.00
-2	286.00	282.00	2.03	610.00
-1	343.00	339.00	2.02	667.00
0	375.00	371.00	2.02	699.00

Factor of Safety calculation sheet Line N38

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	215.00	296.00	1.45	454.00
-34	214.00	259.00	1.65	489.00
-33	185.00	230.00	1.61	460.00
-32	188.00	239.00	1.57	457.00
-31	195.00	268.00	1.46	442.00
-30	213.00	297.00	1.43	449.00
-29	254.00	333.00	1.53	495.00
-28	251.00	346.00	1.45	476.00
-27	243.00	360.00	1.35	446.00
-26	234.00	384.00	1.22	404.00
-25	259.00	442.00	1.17	396.00
-24	266.00	480.00	1.11	372.00
-23	220.00	447.00	0.98	313.00
-22	222.00	449.00	0.99	315.00
-21	164.00	405.00	0.81	243.00
-20	184.00	455.00	0.81	233.00
-19	175.00	437.00	0.80	233.00
-18	155.00	415.00	0.75	215.00
-17	167.00	399.00	0.84	255.00
-16	164.00	379.00	0.87	269.00
-15	153.00	346.00	0.88	280.00
-14	133.00	305.00	0.87	281.00
-13	108.00	261.00	0.83	275.00
-12	92.00	230.00	0.80	274.00
-11	89.00	208.00	0.86	290.00
-10	106.00	201.00	1.05	331.00
-9	127.00	192.00	1.32	382.00
-8	146.00	177.00	1.65	435.00
-7	154.00	163.00	1.89	465.00
-6	184.00	180.00	2.04	508.00
-5	182.00	177.00	2.06	507.00
-4	164.00	177.00	1.85	471.00
-3	170.00	179.00	1.90	481.00
-2	217.00	210.00	2.07	544.00
-1	232.00	228.00	2.04	556.00
0	253.00	241.00	2.10	585.00

Factor of Safety calculation sheet Line N40

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	247.00	292.00	1.69	522.00
-34	201.00	246.00	1.63	476.00
-33	215.00	260.00	1.65	490.00
-32	250.00	301.00	1.66	519.00
-31	249.00	322.00	1.55	496.00
-30	256.00	313.00	1.64	519.00
-29	250.00	323.00	1.55	497.00
-28	243.00	344.00	1.41	462.00
-27	248.00	368.00	1.35	448.00
-26	267.00	414.00	1.29	440.00
-25	328.00	489.00	1.34	487.00
-24	300.00	483.00	1.24	437.00
-23	271.00	476.00	1.14	386.00
-22	262.00	476.00	1.10	368.00
-21	220.00	477.00	0.92	283.00
-20	229.00	486.00	0.94	292.00
-19	249.00	476.00	1.05	342.00
-18	186.00	394.00	0.94	298.00
-17	164.00	355.00	0.92	293.00
-16	146.00	322.00	0.91	290.00
-15	125.00	284.00	0.88	286.00
-14	105.00	245.00	0.86	285.00
-13	95.00	218.00	0.87	292.00
-12	93.00	199.00	0.93	307.00
-11	104.00	185.00	1.12	343.00
-10	130.00	183.00	1.42	397.00
-9	135.00	176.00	1.53	414.00
-8	166.00	168.00	1.98	484.00
-7	130.00	141.00	1.84	439.00
-6	114.00	128.00	1.78	420.00
-5	116.00	133.00	1.74	419.00
-4	122.00	137.00	1.78	427.00
-3	140.00	129.00	2.17	471.00
-2	113.00	108.00	2.09	438.00
-1	97.00	77.00	2.52	437.00
0	96.00	62.00	3.10	450.00

Factor of Safety calculation sheet Line N42

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	240.00	260.00	1.85	540.00
-34	269.00	308.00	1.75	550.00
-33	267.00	312.00	1.71	542.00
-32	336.00	391.00	1.72	601.00
-31	441.00	491.00	1.80	711.00
-30	432.00	494.00	1.75	690.00
-29	425.00	487.00	1.75	683.00
-28	376.00	460.00	1.63	612.00
-27	347.00	442.00	1.57	572.00
-26	374.00	491.00	1.52	577.00
-25	353.00	492.00	1.43	534.00
-24	323.00	482.00	1.34	484.00
-23	297.00	474.00	1.25	440.00
-22	273.00	470.00	1.16	396.00
-21	268.00	473.00	1.13	383.00
-20	226.00	431.00	1.05	341.00
-19	208.00	400.00	1.04	336.00
-18	194.00	367.00	1.06	341.00
-17	188.00	340.00	1.11	356.00
-16	141.00	279.00	1.01	323.00
-15	138.00	250.00	1.10	346.00
-14	133.00	225.00	1.18	361.00
-13	125.00	208.00	1.20	362.00
-12	115.00	192.00	1.20	358.00
-11	123.00	179.00	1.37	387.00
-10	132.00	167.00	1.58	417.00
-9	139.00	157.00	1.77	441.00
-8	128.00	142.00	1.80	434.00
-7	144.00	157.00	1.83	451.00
-6	138.00	147.00	1.88	449.00
-5	132.00	146.00	1.81	438.00
-4	153.00	141.00	2.17	485.00
-3	135.00	129.00	2.09	461.00
-2	125.00	103.00	2.43	467.00
-1	126.00	85.00	2.96	487.00
0	146.00	97.00	3.01	515.00

Factor of Safety calculation sheet Line N44

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	229.00	220.00	2.08	558.00
-34	180.00	177.00	2.03	503.00
-33	288.00	288.00	2.00	608.00
-32	313.00	343.00	1.83	603.00
-31	363.00	384.00	1.89	662.00
-30	354.00	416.00	1.70	612.00
-29	367.00	429.00	1.71	625.00
-28	356.00	429.00	1.66	603.00
-27	395.00	479.00	1.65	631.00
-26	391.00	475.00	1.65	627.00
-25	368.00	474.00	1.55	582.00
-24	348.00	476.00	1.46	540.00
-23	331.00	481.00	1.38	501.00
-22	313.00	471.00	1.33	475.00
-21	304.00	462.00	1.32	466.00
-20	280.00	438.00	1.28	442.00
-19	255.00	414.00	1.23	416.00
-18	229.00	377.00	1.21	401.00
-17	221.00	344.00	1.28	418.00
-16	214.00	313.00	1.37	435.00
-15	218.00	291.00	1.50	465.00
-14	209.00	259.00	1.61	479.00
-13	191.00	217.00	1.76	485.00
-12	183.00	200.00	1.83	486.00
-11	174.00	190.00	1.83	478.00
-10	180.00	196.00	1.84	484.00
-9	184.00	199.00	1.85	489.00
-8	209.00	219.00	1.91	519.00
-7	224.00	225.00	1.99	543.00
-6	217.00	215.00	2.02	539.00
-5	203.00	195.00	2.08	531.00
-4	180.00	173.00	2.08	507.00
-3	190.00	170.00	2.24	530.00
-2	182.00	144.00	2.53	540.00
-1	156.00	116.00	2.69	516.00
0	135.00	83.00	3.25	507.00

Factor of Safety calculation sheet Line N46

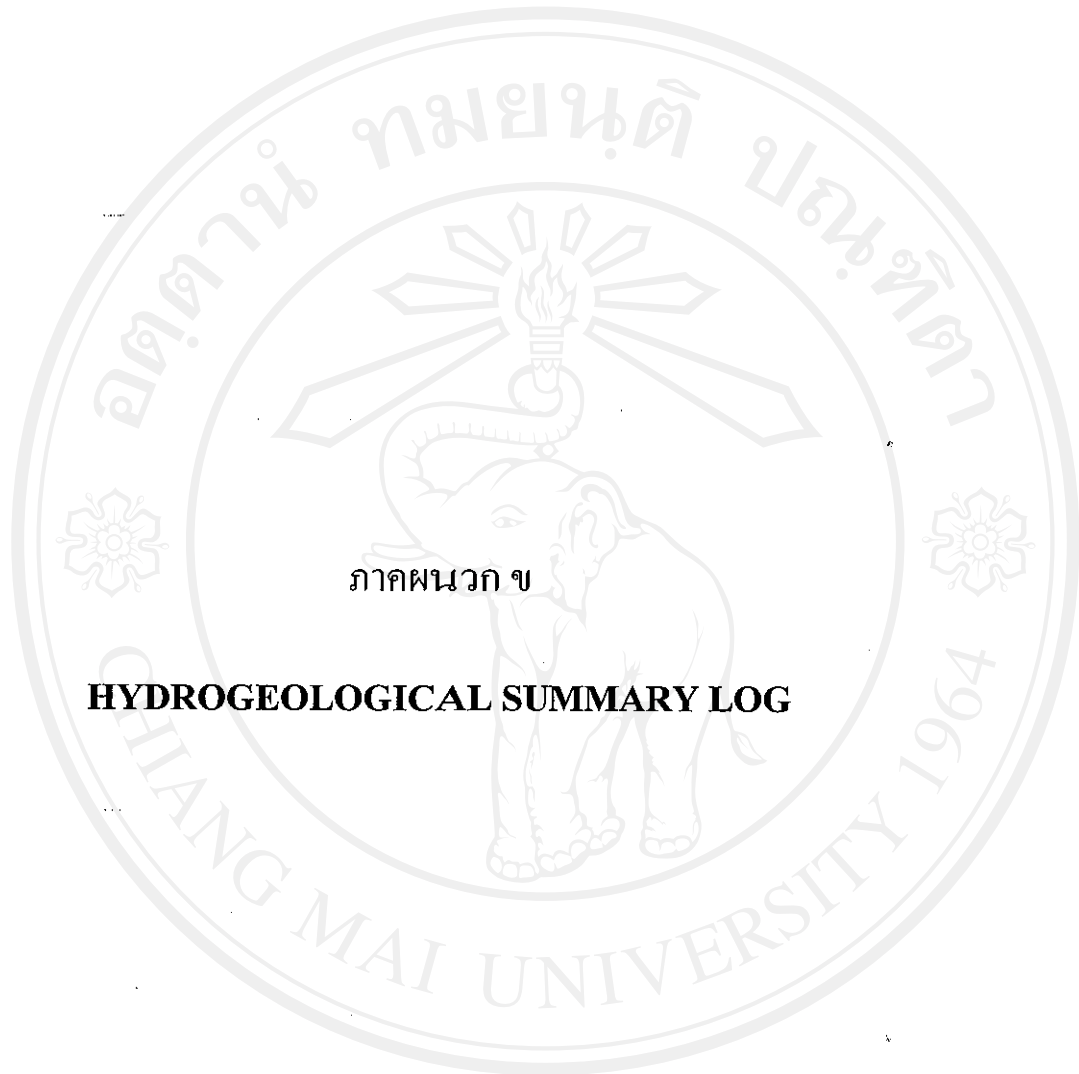
West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	153.00	132.00	2.32	494.00
-34	181.00	160.00	2.26	522.00
-33	190.00	190.00	2.00	510.00
-32	228.00	213.00	2.14	563.00
-31	234.00	240.00	1.95	548.00
-30	204.00	255.00	1.60	473.00
-29	208.00	270.00	1.54	466.00
-28	220.00	282.00	1.56	478.00
-27	251.00	335.00	1.50	487.00
-26	286.00	370.00	1.55	522.00
-25	321.00	405.00	1.59	557.00
-24	364.00	469.00	1.55	579.00
-23	354.00	460.00	1.54	568.00
-22	364.00	470.00	1.55	578.00
-21	364.00	470.00	1.55	578.00
-20	349.00	455.00	1.53	563.00
-19	314.00	420.00	1.50	528.00
-18	214.00	320.00	1.34	428.00
-17	196.00	300.00	1.31	412.00
-16	198.00	280.00	1.41	436.00
-15	191.00	255.00	1.50	447.00
-14	202.00	240.00	1.68	484.00
-13	202.00	220.00	1.84	504.00
-12	188.00	205.00	1.83	491.00
-11	163.00	180.00	1.81	466.00
-10	154.00	170.00	1.81	458.00
-9	143.00	150.00	1.91	456.00
-8	216.00	218.00	1.98	534.00
-7	280.00	280.00	2.00	600.00
-6	265.00	260.00	2.04	590.00
-5	241.00	235.00	2.05	567.00
-4	224.00	204.00	2.20	564.00
-3	199.00	170.00	2.34	548.00
-2	199.00	160.00	2.49	558.00
-1	173.00	120.00	2.88	546.00
0	152.00	90.00	3.38	534.00

Factor of Safety calculation sheet Line N48

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	196.00	174.00	2.25	538.00
-34	219.00	199.00	2.20	559.00
-33	233.00	221.00	2.11	565.00
-32	272.00	257.00	2.12	607.00
-31	300.00	294.00	2.04	626.00
-30	310.00	330.00	1.88	610.00
-29	307.00	358.00	1.72	576.00
-28	327.00	389.00	1.68	585.00
-27	312.00	387.00	1.61	557.00
-26	326.00	401.00	1.63	571.00
-25	358.00	433.00	1.65	603.00
-24	384.00	458.00	1.68	630.00
-23	387.00	462.00	1.68	632.00
-22	381.00	456.00	1.67	626.00
-21	349.00	424.00	1.65	594.00
-20	301.00	385.00	1.56	537.00
-19	267.00	342.00	1.56	512.00
-18	209.00	284.00	1.47	454.00
-17	163.00	222.00	1.47	424.00
-16	146.00	200.00	1.46	412.00
-15	167.00	207.00	1.61	447.00
-14	185.00	209.00	1.77	481.00
-13	187.00	205.00	1.82	489.00
-12	182.00	199.00	1.83	485.00
-11	176.00	183.00	1.92	489.00
-10	187.00	187.00	2.00	507.00
-9	207.00	207.00	2.00	527.00
-8	239.00	239.00	2.00	559.00
-7	254.00	254.00	2.00	574.00
-6	254.00	250.00	2.03	578.00
-5	247.00	241.00	2.05	573.00
-4	253.00	233.00	2.17	593.00
-3	239.00	201.00	2.38	597.00
-2	215.00	165.00	2.61	585.00
-1	189.00	131.00	2.89	567.00
0	167.00	97.00	3.44	557.00

Factor of Safety calculation sheet Line N50

West	Thickness of Overburden (m.)	Groundwater Head From Top Aquifer (m.)	Factor of safety	Groundwater Head Require (m.MSL)]
-35	270.00	250.00	2.16	610.00
-34	262.00	242.00	2.17	602.00
-33	292.00	280.00	2.09	624.00
-32	352.00	340.00	2.07	684.00
-31	367.00	355.00	2.07	699.00
-30	371.00	351.00	2.11	711.00
-29	353.00	349.00	2.02	677.00
-28	351.00	358.00	1.96	664.00
-27	384.00	391.00	1.96	697.00
-26	399.00	406.00	1.97	712.00
-25	418.00	425.00	1.97	731.00
-24	430.00	437.00	1.97	743.00
-23	430.00	437.00	1.97	743.00
-22	433.00	439.00	1.97	747.00
-21	393.00	399.00	1.97	707.00
-20	341.00	348.00	1.96	654.00
-19	300.00	307.00	1.95	613.00
-18	252.00	258.00	1.95	566.00
-17	219.00	225.00	1.95	533.00
-16	199.00	206.00	1.93	512.00
-15	194.00	200.00	1.94	508.00
-14	192.00	192.00	2.00	512.00
-13	187.00	199.00	1.88	495.00
-12	158.00	193.00	1.64	443.00
-11	148.00	182.00	1.63	434.00
-10	158.00	183.00	1.73	453.00
-9	186.00	186.00	2.00	506.00
-8	196.00	193.00	2.03	519.00
-7	210.00	206.00	2.04	534.00
-6	220.00	215.00	2.05	545.00
-5	220.00	208.00	2.12	552.00
-4	233.00	202.00	2.31	584.00
-3	228.00	186.00	2.45	590.00
-2	226.00	169.00	2.67	603.00
-1	207.00	141.00	2.94	593.00
0	159.00	79.00	4.03	559.00



HYDROGEOLOGICAL SUMMARY LOG

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่

Copyright© by Chiang Mai University

All rights reserved

HYDROGEOLOGICAL SUMMARY LOG

BORE RA5G

N 46.167, W 33.249 Ground Elevation +325.327 m. (MSL)

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
QUATERNARY 0.00-11.00	SILTY CLAY; reddish brown, 15-20% SILT, low to medium plasticity, stiff.	Aquitard
OVERBURDEN 11.00-114.20	SILTY CLAYSTONE; grey to dark grey, 15% SILT. 59.00-77.00 : some gastropods and sheared zone at 75.30-76.90 m. 77.00-79.10 : LIGNEOUS CLAY; dark brown to black, dip 60-70°. 79.10-80.00 : CLAY; greenish grey, medium plasticity, stiff 80.00-90.30 : abundant gastropods. 90.30-91.75 : SHEARED ZONE OF CLAY.	Aquitard
HUAI KING 114.20-119.00	SILTY SAND; greenish grey, 30-40% SILT, very fine to fine grained, compact and dense, some pebbles of SILTSTONE and gastropods, <u>interpreted major aquifer.</u>	Local Aquifer Zones
119.00-121.30	SILTY CLAYSTONE; grey, mottled brown, 15-20% SILT, some calcretes.	
121.30-122.15	SILTY SAND; greenish grey, 10-20% CLAY, fine to coarse SAND, dense, <u>interpreted minor aquifer.</u>	*
122.15-128.00	SILTY CLAYSTONE; yellowish brown to brown, mottled grey and reddish brown, 20-25% SILT	
128.00-129.30	SILTY SAND; grey, fine to coarse grained, intercalated with SILTY CLAYSTONE at 128.50-128.90 m. <u>interpreted to be minor aquifer.</u>	

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
HUAI KING 129.30-162.75 162.75-163.28 163.28-168.70 168.70-189.00	SILTY CLAYSTONE; as above. 142.30-143.30 : <u>Core loss may be aquifer.</u> 144.00-146.30 : <u>Core loss may be aquifer.</u> CLAYEY SAND; light yellowish brown, mottled grey, 40-50% CLAY, fine to medium grained. SILTY CLAYSTONE; as above. BRECCIA; grey, mostly fragments of MUDSTONE and ARGILLITE, core loss at 168.00-169.10 m., 171.80-173.50 m., 174.00-177.00 m. CRUSHED ZONE at 170.68-171.80, 173.50-174.00 m. <u>interpreted to be major aquifer zone.</u>	Local Aquifer Zones * * *
BASEMENT 189.00-270.00	ARGILLITE; dark grey, slightly metamorphosed, calcite and CLAY filled in fractures. 177.25-187.00 : moderately to slightly weathered, highly fractured zone at 180.00-185.00 m. 187.00-200.00 : slightly weathered. 200.00-270.00 : fresh rock, closed fractured and sheared zone at 195.50-196.00 m., 196.20-196.95 m. 197.30-198.45 m., 212.00-215.00 m. 215.55-216.00 m., 218.70-218.90 m 220.00-223.00 m., 224.00-226.00 m. 228.25-228.60 m., 231.15-232.30 m. 234.00-235.00 m., 240.95-249.35 m. 252.00-252.30 m., 264.30-264.60 m..	Minor Local Aquifers

END OF BOREHOLE

During airlifting Discharge rate <1 L/min

RA 5 G

HYDROGEOLOGICAL SUMMARY LOG

BORE OA17/2G

N 30.559, W 23.867 Ground Elevation +329.129 m, (MSL)

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
QUATERNARY 0.00-18.00	SILTY CLAY; reddish brown, 35-40% SILT, stiff.	Aquitard
OVERBURDEN 18.00-47.00	CLAY; light grey, some carbonaceous matters. CALCAREOUS CLAYSTONE; light grey, highly calcareous.	Aquitard
47.00-83.40	LIGNITE SEAM (J SEAM). LIGNITE, LIGNEOUS CLAY AND CLAYSTONE (40:30:30).	
83.40-165.40	CLAYSTONE, SILTY CLAYSTONE; grey, greenish grey, 30-35% SILT.	
LIGNITE ZONE 165.40-186.10	LIGNITE SEAM (K SEAM).	Aquitard
186.10-212.90	CLAYSTONE AND CLAY; grey, greenish grey.	
212.90-232.80	LIGNITE SEAM (Q SEAM).	
UNDERBURDEN 233.90-375.00	CLAYSTONE; brownish grey.	Aquitard
HUAI KING 375.00-390.00	CLAY; greyish-green (UHK?).	Minor Local Aquifers
390.00-394.00	SILTSTONE; whitish brown.	
394.00-415.15	SILTY CLAY AND CLAYEY SILT; yellowish brown.	
	389.00-391.60 : <u>Interpreted shear zone, numerous fissures Possible aquifer zone?</u>	
415.15-425.50	CONGLOMERATIC CLAY; brownish red, 30- 45% pebble to gravel, <u>core can be broken, shear zones and fractures locally, possible aquifer zones.</u>	Minor Local Aquifers

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
BASEMENT(Tr3)		Major Aquifer Present
425.50-428.45	ARGILLITE AND SANDSTONE (70:30); greyish brown.	Interpreted Shear/Fault Zone at 449-481 m.
428.45-468.00	ARGILLITE AND SILTSTONE (80:20); greyish brown.	*
	424.00-449.00 : <u>Bedrock competent, but locally core very fractured with iron stained joints, definite aquifer. Core loss at 432.50-433.00 m.</u>	
	449.00-461.00 : <u>Below 449 m., core very broken, interpreted shear zone 449-503 m. 449-481 m., core broken, but most fractures filled with black clay, possible aquifer</u>	
468.00-481.00	ARGILLITE; dark grey, very fine grained.	
481.00-490.00	ARGILLITE AND SANDSTONE; (70:30); dark grey, fine grained.	
	481.00-503.00 : <u>core very broken, fracture faces show iron staining, Major core loss : 464.8, 466.5-468 469.1-469.5, 471.6-472, 473-474, 480-481 major aquifer zone.</u>	*
490.00-503.00	ARGILLITE; dark grey, very fine grained.	
503.00-507.20	SANDSTONE AND SILTSTONE (50:50); medium grey.	
507.20-508.80	ARGILLITE; dark grey, very fine grained. 507.20-508.20 : <u>core very broken, core loss 507.6-508.0 m. aquifer?</u>	
508.80-527.20	SANDSTONE AND SILTSTONE (50:50); medium grey. 522.00-526.00 : <u>major core loss, core broken, aquifer?</u>	*

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
527.20-529.80	ARGILLITE AND SANDSTONE (50:50); dark grey, fine grained, core generally more competent below 528.0 m.	*
529.80-531.00	SANDSTONE AND SILTSTONE (50:50); medium grey.	

END OF BOREHOLE
OA 17/2 G

During airlifting
Discharge rate 40 L/min.

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

HYDROGEOLOGICAL SUMMARY LOG

BORE OA41/4B

N 47.764, W 16.508 Ground Elevation +314.403 m, (MSL)

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
QUATERNARY 0.00-2.00 2.00-11.00 11.00-18.00	SILTY CLAY; yellowish brown to brown. CLAYEY SAND; yellowish brown to brown, very fine to fine grained, some SILT. SILTY SAND; light brown to brown, medium to coarse grained, some CLAY.	Aquitard * *
OVERBURDEN 18.00-45.60	SILTY CLAYSTONE; light grey to grey.	Aquitard
LIGNITE ZONE 45.60-49.20 49.20-55.30 55.30-57.20 57.20-58.10 58.10-72.80 72.80-76.20 76.20-164.20 164.20-167.90	LIGNEOUS CLAY/CLAYEY LIGNITE interbedded; dark brown to black. LIGNITE; black. LIGNEOUS CLAY; dark brown. LIGNITE; black. SILTY CLAYSTONE; light grey to grey. LIGNITE; as above. SILTY CLAYSTONE; as above. LIGNEOUS CLAY; dark brown to black.	Aquitard
UNDERBURDEN 167.90-199.80	CLAYSTONE; light grey to light brownish grey.	Aquitard
BASEMENT 199.80-270.00	LIMESTONE; light grey, medium strength. <u>interpreted to be major aquifer zone.</u>	Major Aquifer

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
BASEMENT 199.80-270.00	CAVITY ZONE : 203.10-204.00 m. FRACTURED ZONE : 205.80-207.60 m., 237.30-237.80 m., 240.45-241.10 m., 249.40-251.50 m., 257.00-260.30 m.	Major Aquifer

END OF BOREHOLE
OA 41/4 B

During airlifting Discharge rate 66 L/min

Free flow rate 150 L/min.

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

HYDROGEOLOGICAL SUMMARY LOG**BORE PA9B****N 39.848, W 10.456 Ground Elevation +271.327 m. (MSL)**

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
LIGNITE ZONE 0.00-09.50	Q-SEAM LIGNITE; black, dull, hard.	Aquitard
UNDERBURDEN 09.50-70.00 70.00-75.00 75.00-128.30	SILTY CLAYSTONE; brown, 25-30% SILT SILTY CLAYSTONE; light brown, 25-30% SILT SILTY CLAYSTONE; brown, 25-30% SILT..	Aquitard
BASEMENT 128.30-256.00	LIMESTONE; gray to light grey , some calcite veins; dense, interpreted fracture zone from geophysical logging data at depth 128.30-131.60 m. 134.30-138.00 m. 138.60-140.90 m. 144.30-148.30 m. Water flow out to surface when drilled to depth 129.00 m. These zones were interpreted to be major aquifer zones.	Aquifer

END OF BOREHOLE

Free flow rate as bore developing 8,441 m³/day

PA9B

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved

HYDROGEOLOGICAL SUMMARY LOG**BORE PA10B****N 37.096, W 09.588 Ground Elevation +257.055 m. (MSL)**

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
LIGNITE ZONE 0.00-08.90	Q-SEAM LIGNITE; black, dull, hard.	Aquitard
UNDERBURDEN 08.90-56.00 56.00-98.00 98.00-119.00 119.00-147.00 147.00-176.00	SILTY CLAYSTONE; light brown, 25-30% SILT SILTY CLAYSTONE; brown, 25-30% SILT SILTY CLAYSTONE; dark brown, 25-30% SILT.. SILTY CLAYSTONE; brown, 25-30% SILT SILTY CLAYSTONE; light brown, 25-30% SILT	Aquitard
BASEMENT 176.60-256.00	LIMESTONE; gray to light grey , some calcite veins; dense, interpreted fracture zone from geophysical logging data at depth 181.20-183.00 m. 187.00-189.80 m. 195.00-198.60 m. 202.40-203.20 m. 225.30-226.80 m. 235.30-236.20 m. Water flow out to surface when drilled to depth 129.00 m. These zones were interpreted to be major aquifer zones.	Aquifer

END OF BOREHOLE
PA10B

Free flow rate as bore developing 10,000 m³/day

ลิขสิทธิ์ © by Chiang Mai University
All rights reserved

HYDROGEOLOGICAL SUMMARY LOG**BORE PA11B****N 39.636, W 13.834 Ground Elevation +242.177 m, (MSL)**

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
LIGNITE ZONE 0.00-26.00	K-SEAM LIGNITE; black, dull, hard.	Aquitard
INTERBURDEN 26.00-44.40	SILTY CLAYSTONE; brown, <25-30% SILT.	Aquitard
LIGNITE ZONE 44.40-85.70	Q-SEAM LIGNITE; black, dull, hard	Aquitard
UNDERBURDEN 85.70-156.00 156.00-210.00 210.00-221.00	SILTY CLAYSTONE; light brown, 25-30% SILT. SILTY CLAYSTONE; dark brown to brown, 25-30% SILT. SILTY CLAYSTONE; light brown, 25-30% SILT.	Aquitard
BASEMENT 221.00-402.00	LIMESTONE; light grey to grey, some calcite veins and CLAY filled,dense. Water flow out to surface when drill to depth 225.00m. These zones were interpreted to be major aquifer zones	Aquifer

END OF BOREHOLE

Free flow rate as bore developing 10,000 m³/day

PA11B

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

HYDROGEOLOGICAL SUMMARY LOG**BORE PA12B****N 38.568, W 14.949 Ground Elevation +221.984 m, (MSL)**

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
OVERBURDEN 00.00-19.20	SILTY CLAYSTONE; light greyish brown, <30% SILT	Aquitard
LIGNITE ZONE 19.20-32.70	K-SEAM LIGNITE; black, dull, hard.	Aquitard
INTERBURDEN 32.70-40.50	SILTY CLAYSTONE; brown, <30% SILT.	Aquitard
LIGNITE ZONE 40.50-41.10 41.10-46.20 46.20-52.70 52.70-56.20 56.20-59.20 59.20-60.20 60.20-66.20 66.20-71.20 71.20-71.80 71.80-79.60 79.60-84.00 84.00-86.20	Q-SEAM LIGNITE; black, dull, hard. LIGNEOUS CLAY; dark brown to black, <30% LIGNITE. LIGNITE; black, dull, hard. LIGNEOUS CLAY; dark brown to black, <30% CLAY. CLAYEY LIGNITE; dark brown to black, brittle, <30% LIGNITE LIGNITE; black, dull, hard. CLAYEY LIGNITE; dark brown to black, brittle, <30% CLAY. LIGNEOUS CLAY; dark brown to black, <30% LIGNITE CLAYEY LIGNITE; dark brown to black, brittle, <30% CLAY. LIGNEOUS CLAY; dark brown to black, <30% LIGNITE CLAYEY LIGNITE; dark brown to black, brittle, <30% CLAY.	Aquitard

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
UNDERBURDEN 86.20-234.00	SILTY CLAYSTONE; greyish brown, <30% SILT, interlayer with SANDSTONE at depth 191.30-192.10 m.	Aquitard
WEATHERED ZONE 234.00-245.00	Contact of Underburden and Basement. SILTY CLAYSTONE; light grey to grey, some calcrete	Aquitard
BASEMENT 221.00-402.00	LIMESTONE; light grey . Water flow out to surface when drill to depth 252.00m. These zones were interpreted to be major aquifer zones	Aquifer

END OF BOREHOLE

Free flow rate as bore developing 12,000 m³/day

PA12B

HYDROGEOLOGICAL SUMMARY LOG**BORE PA13B****N 30.758, W 10.730 Ground Elevation +181.817 m. (MSL)**

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
OVERBURDEN 00.00-12.00	SILTY CLAYSTONE; light brownish grey,25-30% SILT	Aquitard
12.00-19.00	SILTY CLAYSTONE; brownish grey,25-30% SILT	
19.00-25.00	SILTY CLAYSTONE; light brownish grey,25-30% SILT	
25.00-35.00	SILTY CLAYSTONE; brownish grey,25-30% SILT	
35.00-47.00	SILTY CLAYSTONE; light brownish grey,25-30% SILT	
LIGNITE ZONE 47.00-72.00	K-SEAM LIGNITE; black, dull, hard.	Aquitard
INTERBURDEN 72.00-102.00	SILTY CLAYSTONE; brown, 25-30% SILT.	Aquitard
LIGNITE ZONE 102.00-125.00	Q-SEAM LIGNITE; black, dull, hard.	Aquitard
UNDERBURDEN 125.00-254.00	SILTY CLAYSTONE; brownish grey, 25-30% SILT..	Aquitard
BASEMENT 254.80-298.00	LIMESTONE; light grey , some calcite veins; interpreted to be major aquifer zone.	Aquifer
298.00-324.00	SANDSTONE; greyish brown, fine grained, subangular-subrounded,well sorted, mostly quartz and feldspar.	
324.00-336.00	ARGILLITE; dark grey.	

END OF BOREHOLE
PA13B

Free flow rate as bore developing 530 m³/day

HYDROGEOLOGICAL SUMMARY LOG

BORE OA63B

N42.757, W 14.442 Ground Elevation +266.888 m, (MSL)

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
LIGNITE ZONE 0.00-03.00 03.00-17.00 17.00-35.00 35.00-38.00 38.00-49.00 49.00-51.00	K-SEAM LIGNEOUS CLAY; brownish black. LIGNITE; black. CLAY; light brown. LIGNITE; black, dull. SILTY CLAY; light brown. LIGNEOUS CLAY; black.	Aquitard
INTERBURDEN 51.00-88.00	SILTY CLAYSTONE; light grey to light brown.	Aquitard
LIGNITE ZONE 88.00-91.00	Q-SEAM CLAYEY LIGNITE; black, dull.	Aquitard
UNDERBURDEN 91.00-222.00	SILTY CLAYSTONE; light grey to light brown, low strength, interlayer with SANDSTONE ; milky, well sorted, well rounded at depth 163.50 – 165.00 m.	Aquitard
BASEMENT 222.00-300.00	LIMESTONE; light grey	Aquifer

END OF BOREHOLE
OA63B

Free flow rate as bore developing 181 m³/day

Copyright © by Chiang Mai University
All rights reserved

HYDROGEOLOGICAL SUMMARY LOG

BORE OA64B

N 33.088, W 14.411 Ground Elevation +194.720 m, (MSL)

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
OVERBURDEN 00.00-19.00 19.00-40.20	CLAYSTONE; light brownish grey. CLAYSTONE; greyish brown.	Aquitard
LIGNITE ZONE 40.20-65.00	K-SEAM LIGNITE; black, dull, hard.	Aquitard
INTERBURDEN 65.00-83.70	CLAYSTONE; greyish brown.	Aquitard
LIGNITE ZONE 83.70-105.60	Q-SEAM LIGNITE; black, dull, brittle.	Aquitard
UNDERBURDEN 105.60-328.60	CLAYSTONE; light brown grey.	Aquitard
BASEMENT 328.60-410.00	LIMESTONE; light grey.	Aquifer

END OF BOREHOLE

Free flow rate as bore developing 1,378 m³/day

OA64B

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

HYDROGEOLOGICAL SUMMARY LOG**BORE OA65B****N 33.473, W 07.591 Ground Elevation +232.174 m, (MSL)**

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
LIGNITE ZONE 00.00-09.00	Q-SEAM LIGNITE; black, dull, brittle.	Aquitard
UNDERBURDEN 09.00-20.00	CLAYSTONE; light brownish grey, some shell fossils.	Aquitard
20.00-215.20	CLAYSTONE; greyish brown.	
215.20-218.00	CLAYSTONE; light grey, coarse grained, subangular, well sorted.	
218.00-221.60	CLAYSTONE; greyish light brown.	
221.60-222.70	CLAYSTONE; light grey, coarse grained, subangular-subrounded, well sorted.	
222.70-233.70	CLAYSTONE; greyish light brown.	
BASEMENT 233.70-320.00	LIMESTONE; light grey.	Aquifer

END OF BOREHOLE
OA65B

Free flow rate as bore developing 662 m³/day

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved

HYDROGEOLOGICAL SUMMARY LOG

BORE OA66B

N 49.993, W 06.280 Ground Elevation +325.889 m, (MSL)

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
EARTH FILL 00.00-12.00 12.00-19.00	SANDY SILT/SANDY CLAY; reddish brown. Sample loss.	Aquitard
INTERBURDEN 19.00-43.00 43.00-47.00	CLAYEY SILT; light brown to light yellowish brown. SILTY SAND; greyish brown, fine SAND.	Aquitard
LIGNITE ZONE 47.00-50.00	Q-SEAM LIGNITE; black, dull.	Aquitard
UNDERBURDEN 50.00-70.00 70.00-127.00 127.00-211.00 211.00-260.40	SILTY CLAYSTONE; brown to grey, some shell fragments. CLAYSTONE; grey to brown mottled yellow. CLAYSTONE; light greyish brown, some shell fragments. SILTY CLAYSTONE; dark brown to brown, 25-30% SILT.	Aquitard
WEATHERED ZONE 260.40-280.00	ARGILLITE; reddish brown, highly weathered.	Aquitard
BASEMENT 280.00-340.00	ARGILLITE; dark grey.	Aquifer

END OF BOREHOLE
OA66B

Free flow rate as bore developing 6 m³/day

All rights reserved

HYDROGEOLOGICAL SUMMARY LOG**BORE OA67B****N 35.286, W 12.366 Ground Elevation +211.099 m, (MSL)**

Depth (m.)	Geology	Hydrogeology (*Possible Aquifer Zones)
OVERBURDEN 00.00-11.20	CLAYSTONE; light brownish grey.	Aquitard
LIGNITE ZONE 11.20-36.28	K-SEAM LIGNITE; black, dull, hard.	Aquitard
INTERBURDEN 36.28-66.60	SILTY CLAYSTONE; brown, <25-30% SILT.	Aquitard
LIGNITE ZONE 66.60-72.50 72.50-82.50 82.50-84.60 84.60-86.30 86.30-88.00 88.00-95.50	Q-SEAM LIGNITE; black, dull, brittle. LIGNITE/CLAYEY LIGNITE; black, dull. CLAYSTONE; light brownish grey. CLAYEY LIGNITE; dark brown to black. CLAYSTONE; light brownish grey. LIGNITE/CLAYEY LIGNITE; dark brown to black, dull.	Aquitard
UNDERBURDEN 95.50-204.60	SILTY CLAYSTONE; greyish brown.	Aquitard
BASEMENT 204.60-280.00	LIMESTONE; light grey.	Aquifer

END OF BOREHOLE

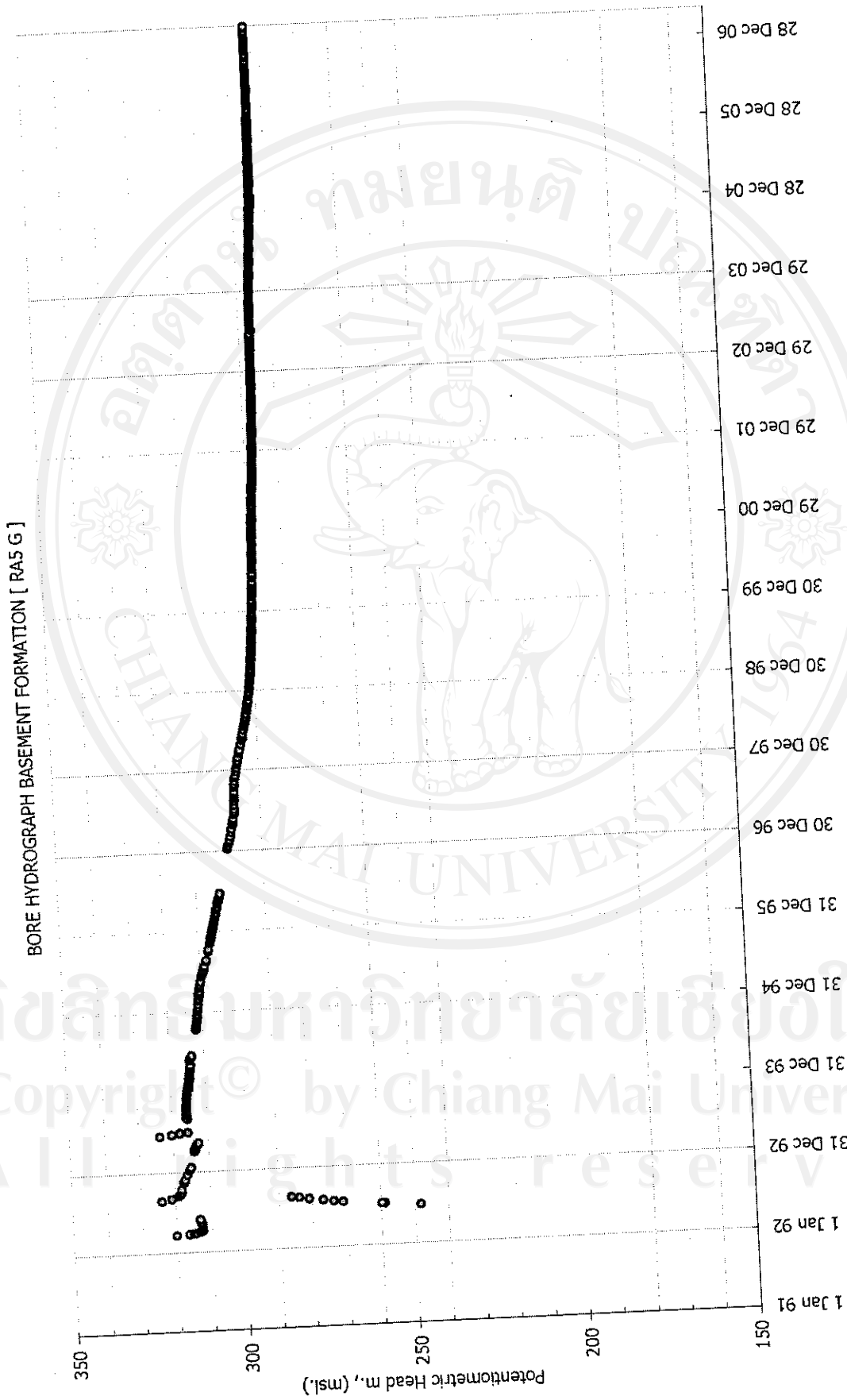
Free flow rate as bore developing 1,600 m³/day

OA67B

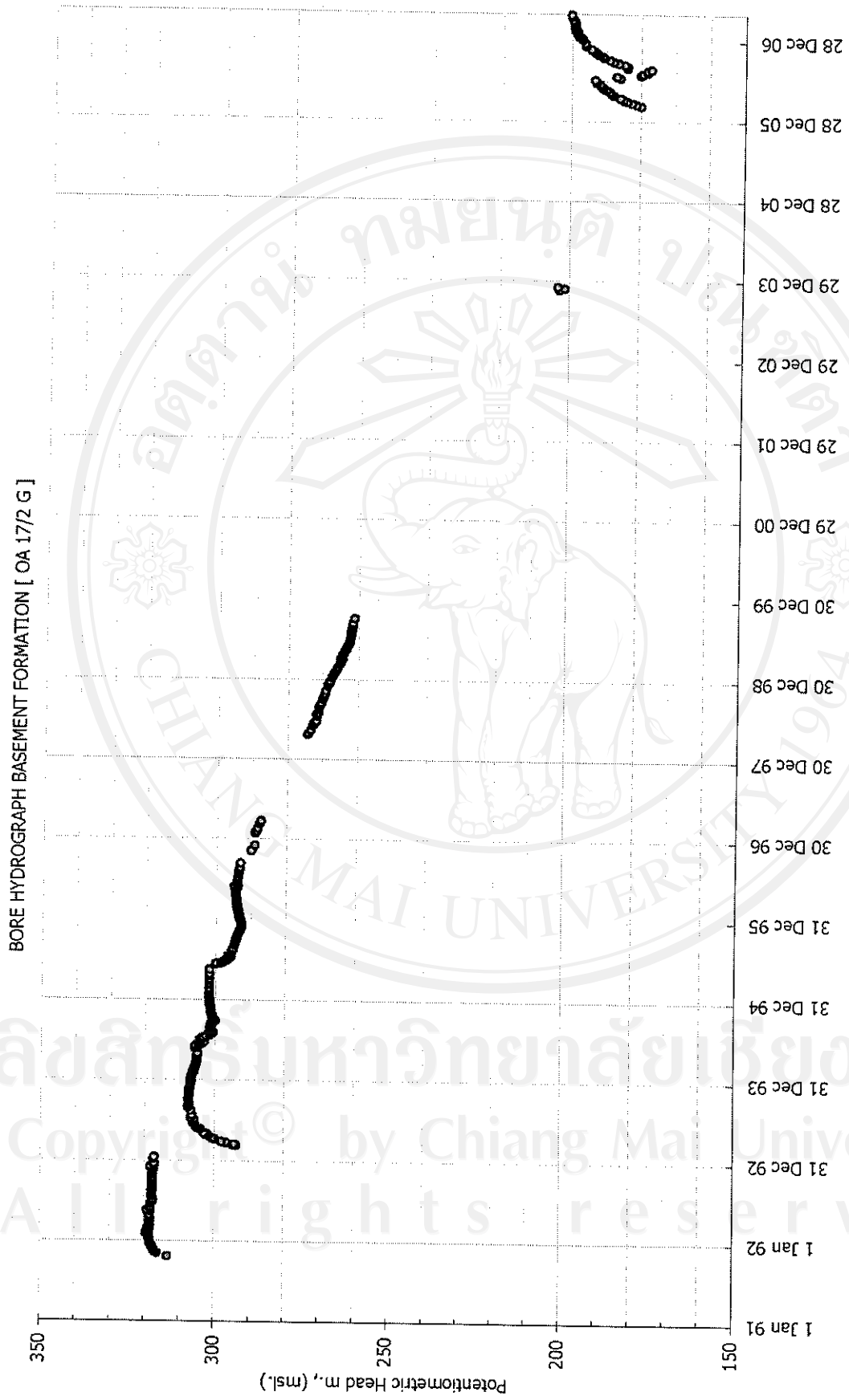
ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



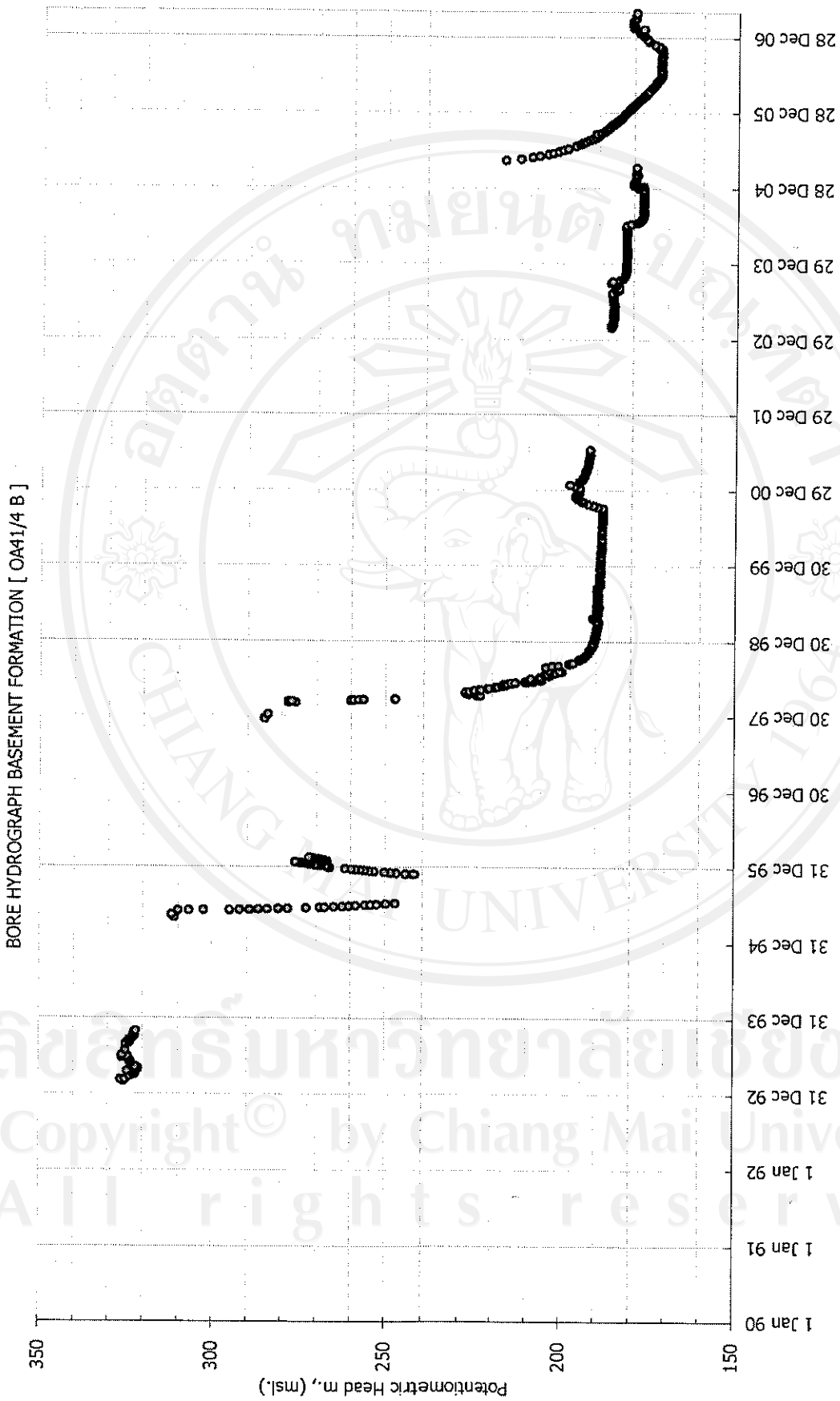
ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved



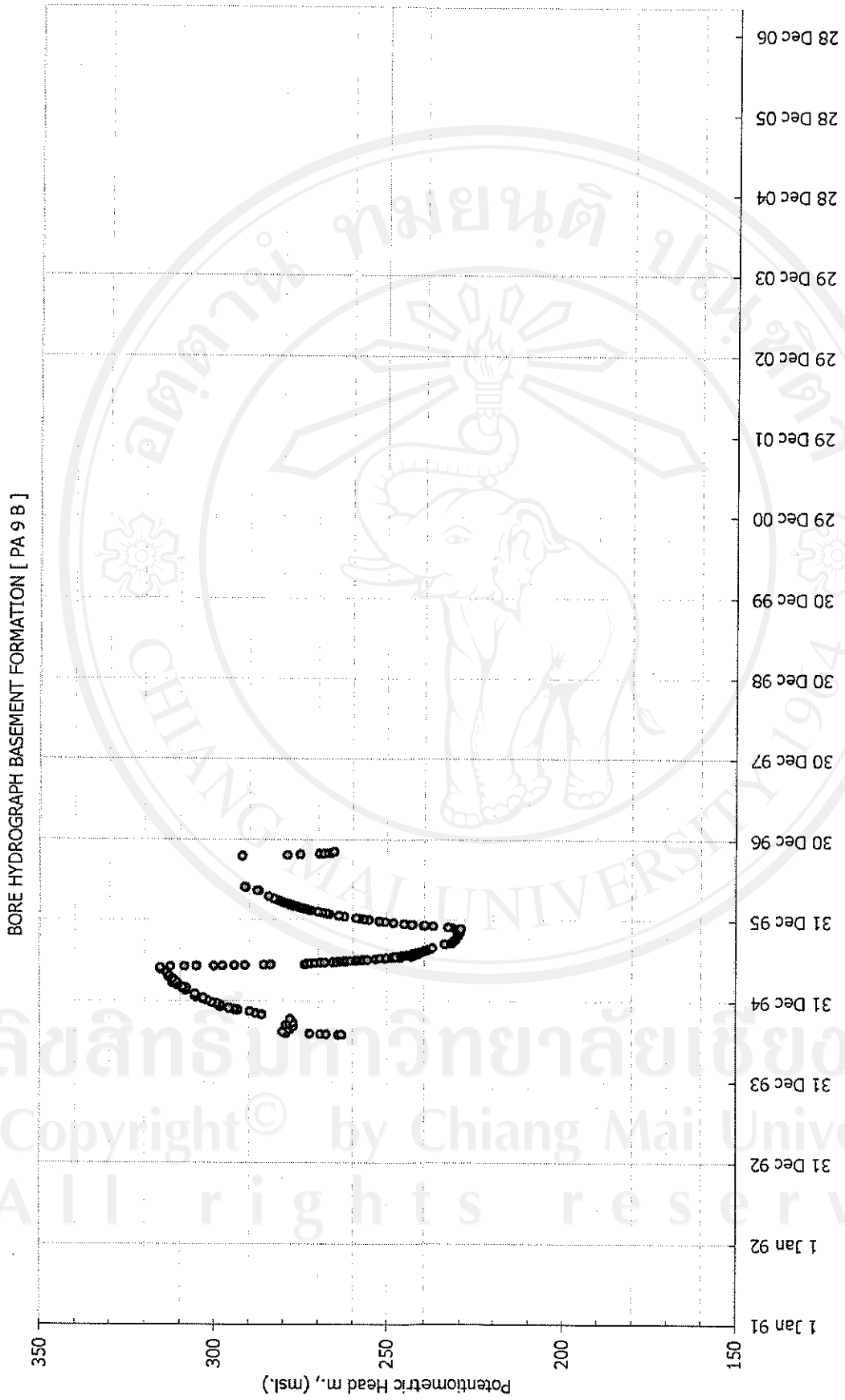
ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



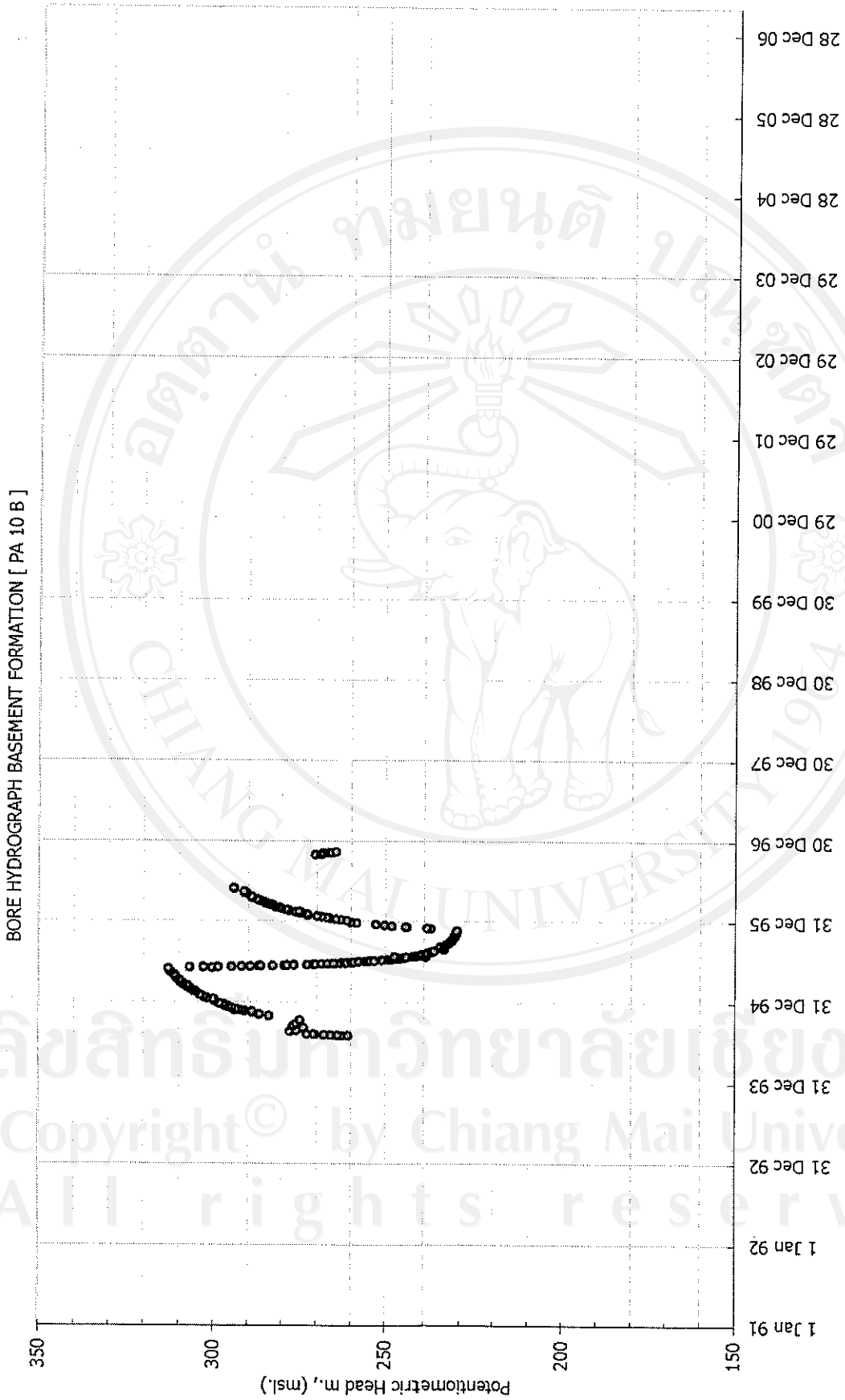
ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



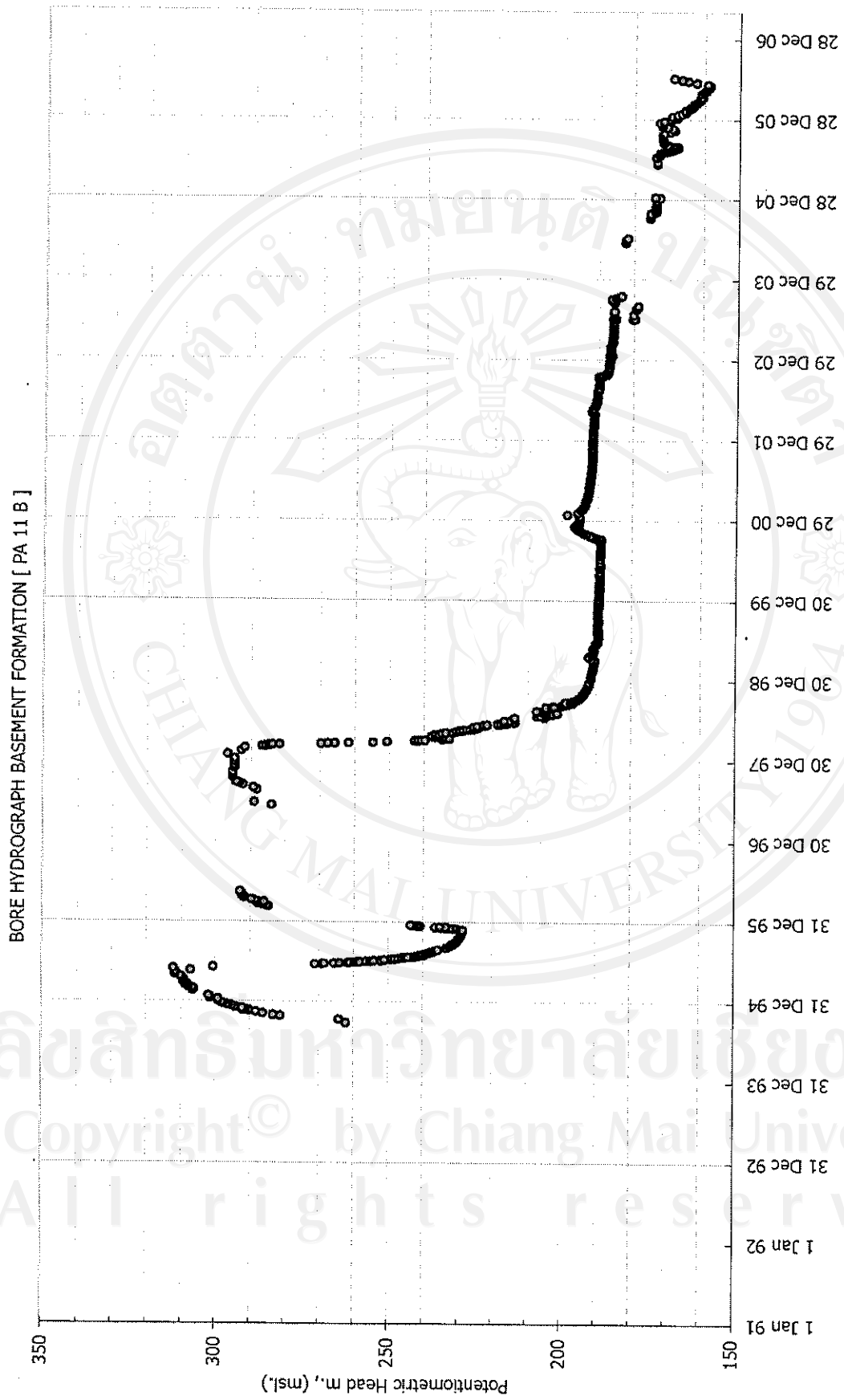
ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



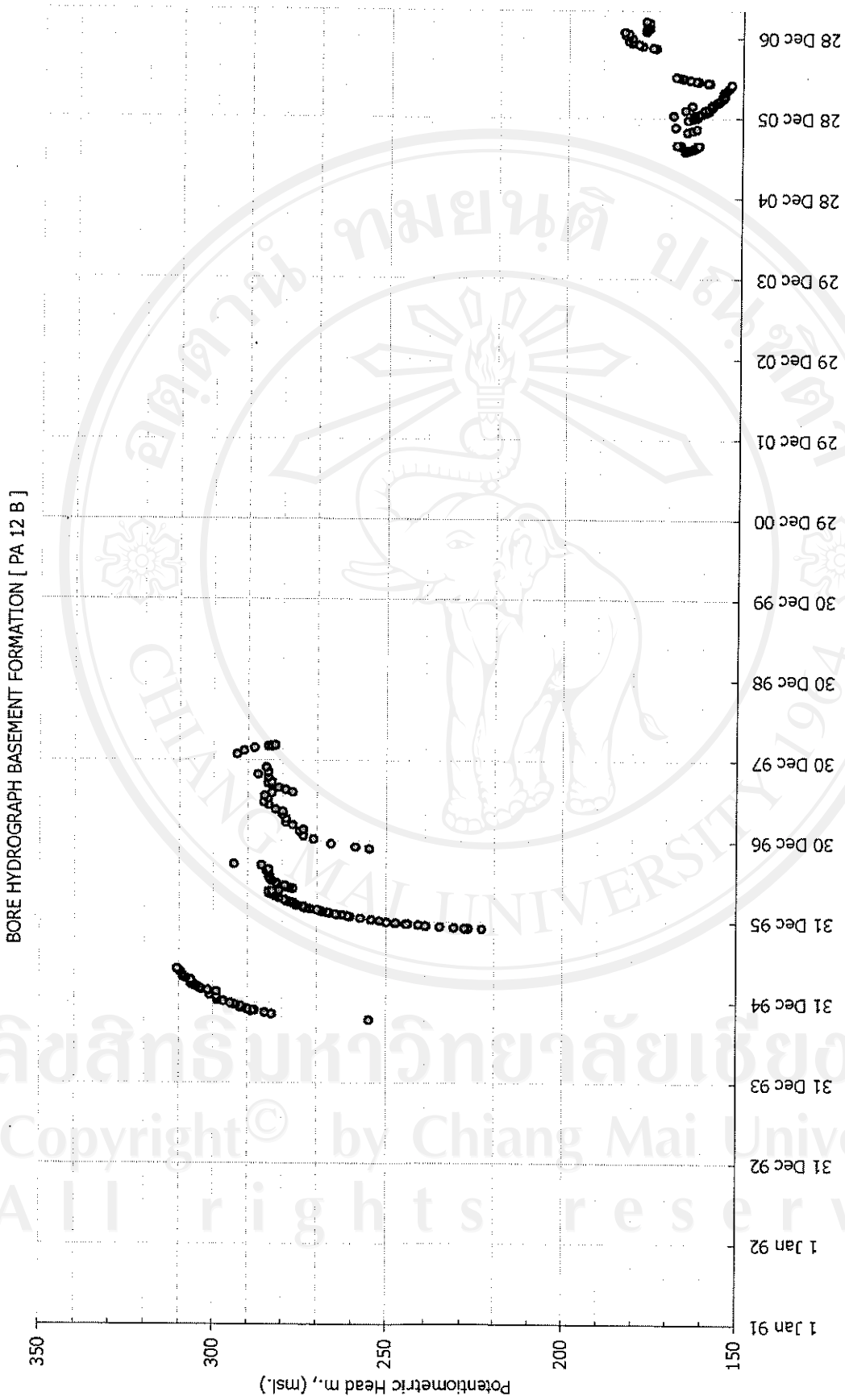
ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



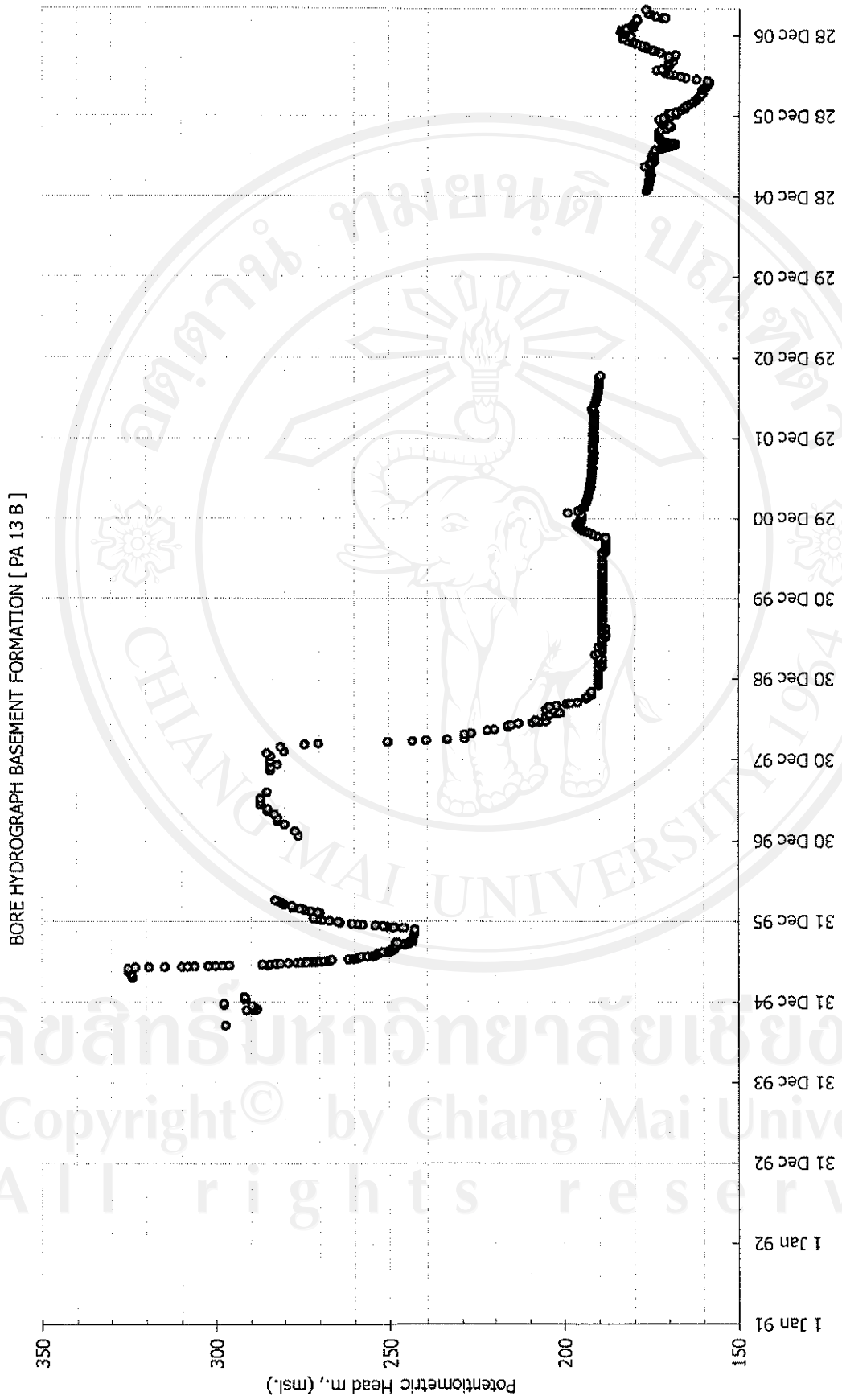
ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



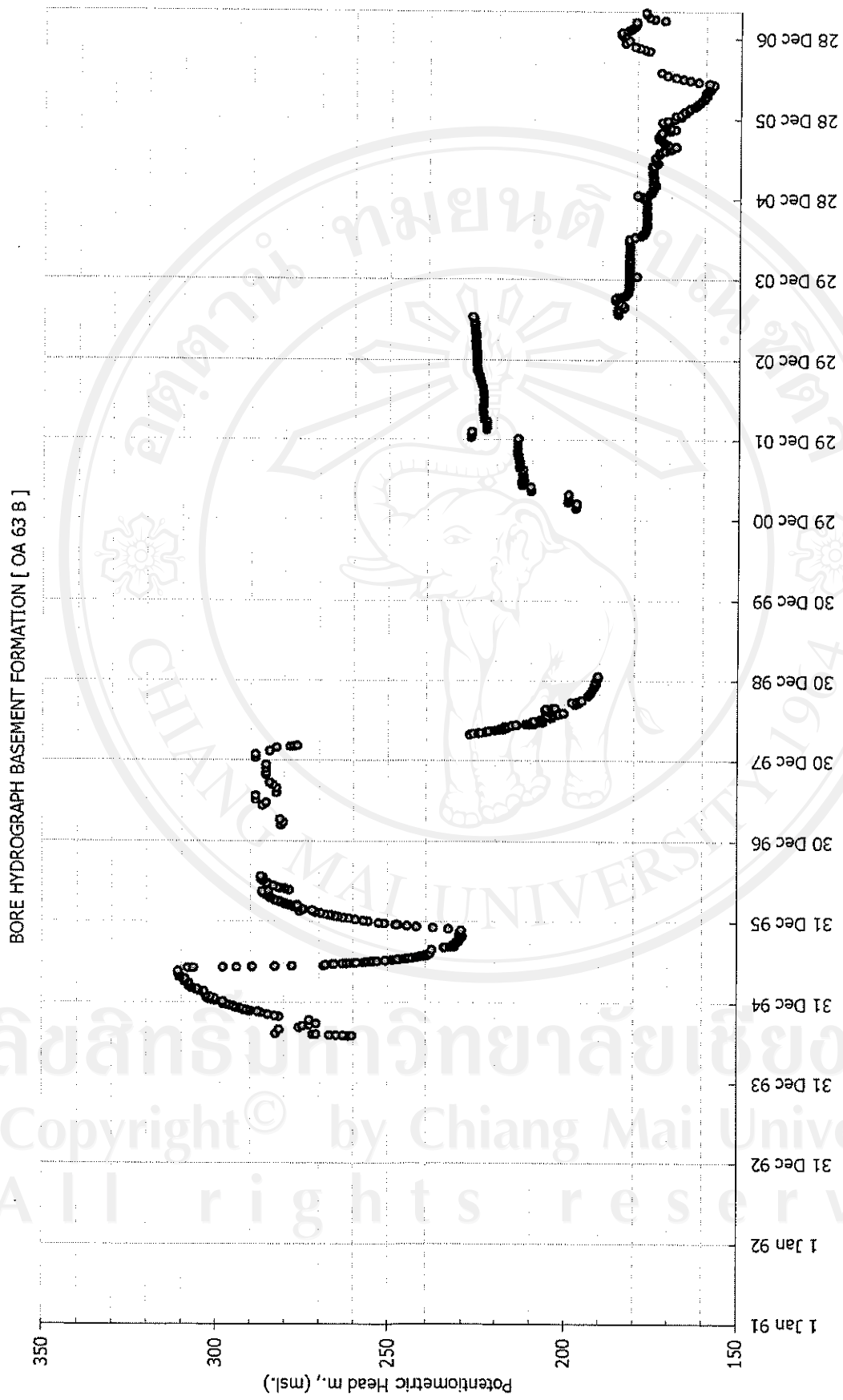
ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved

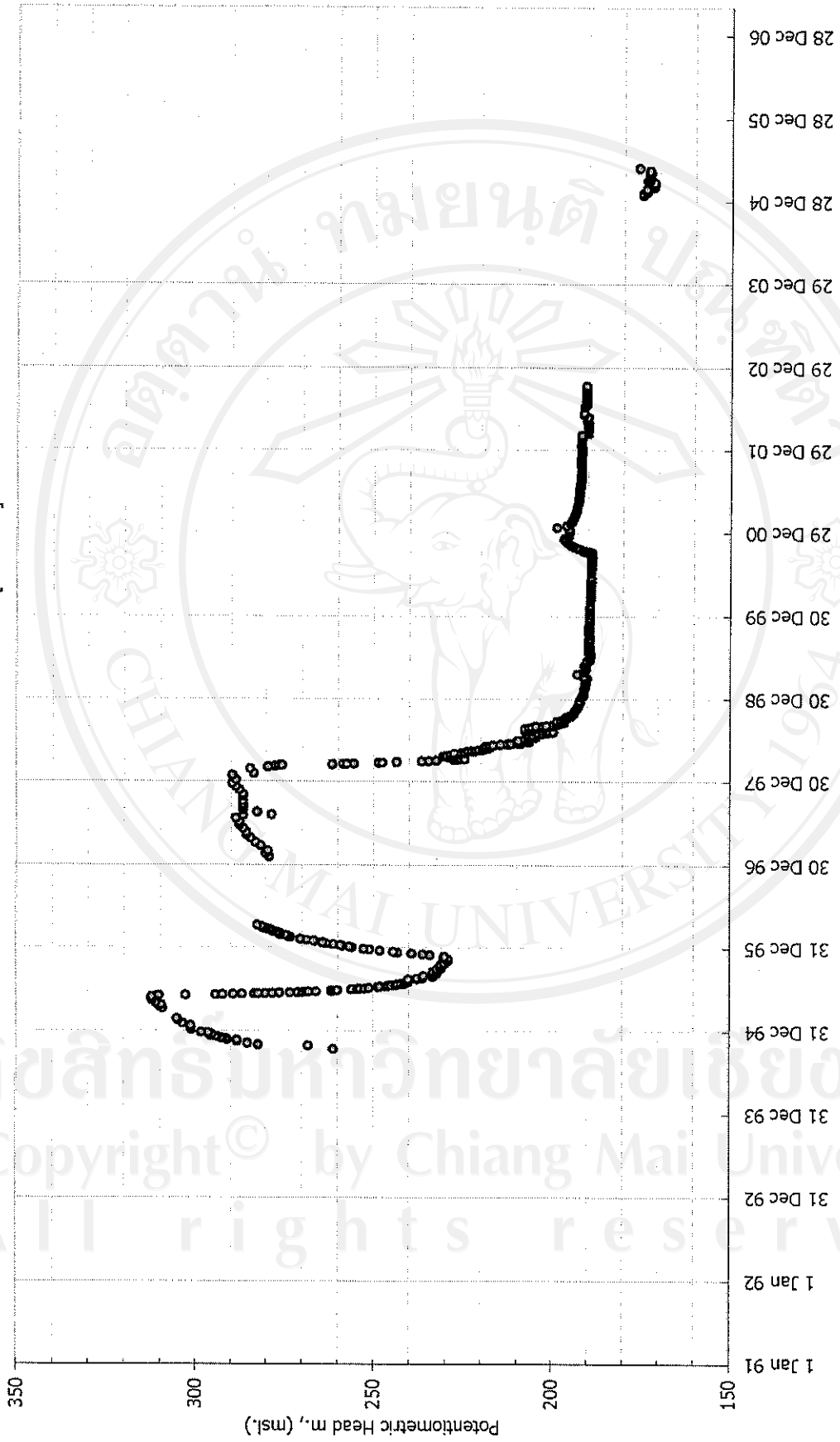


ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved

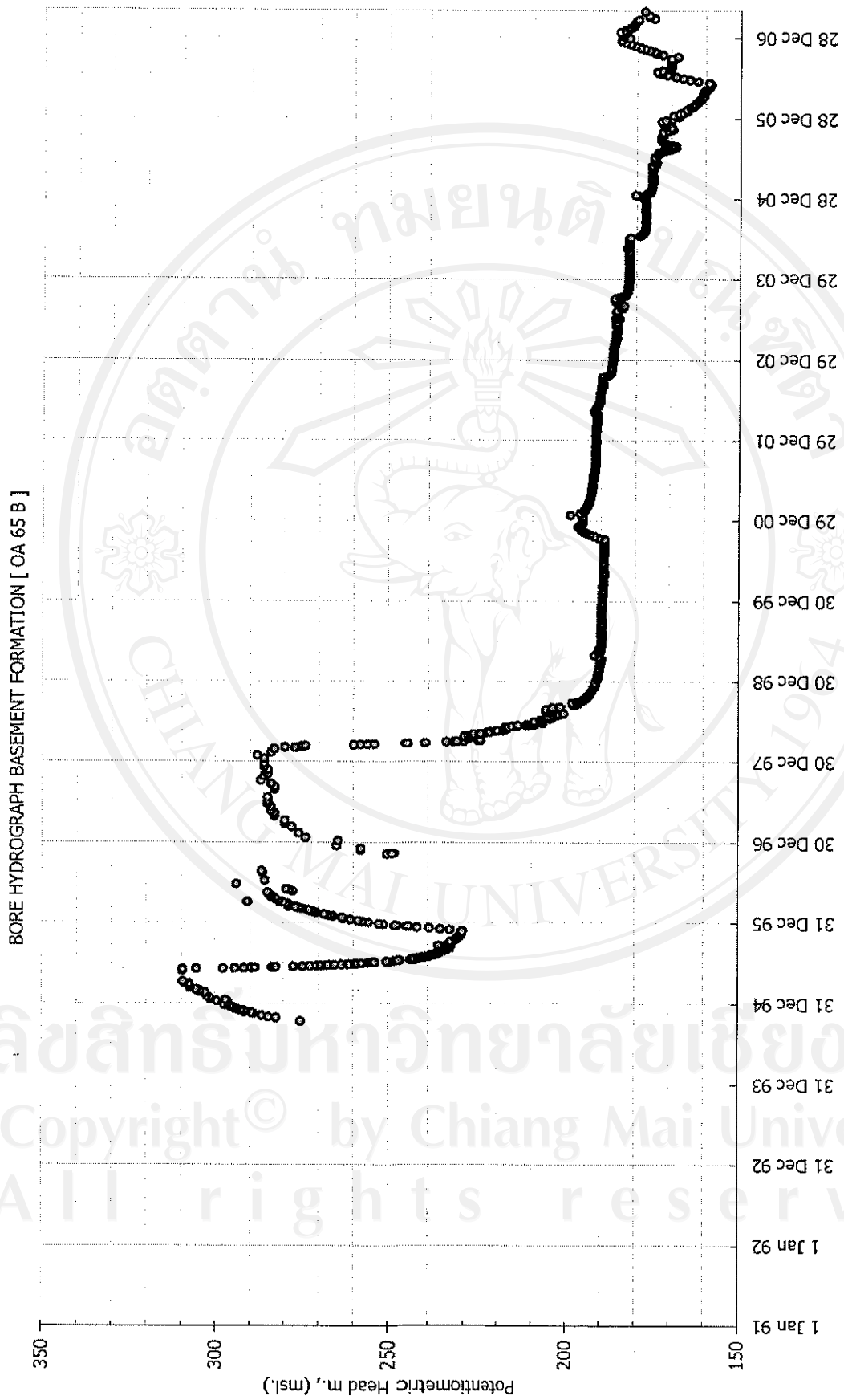


ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved

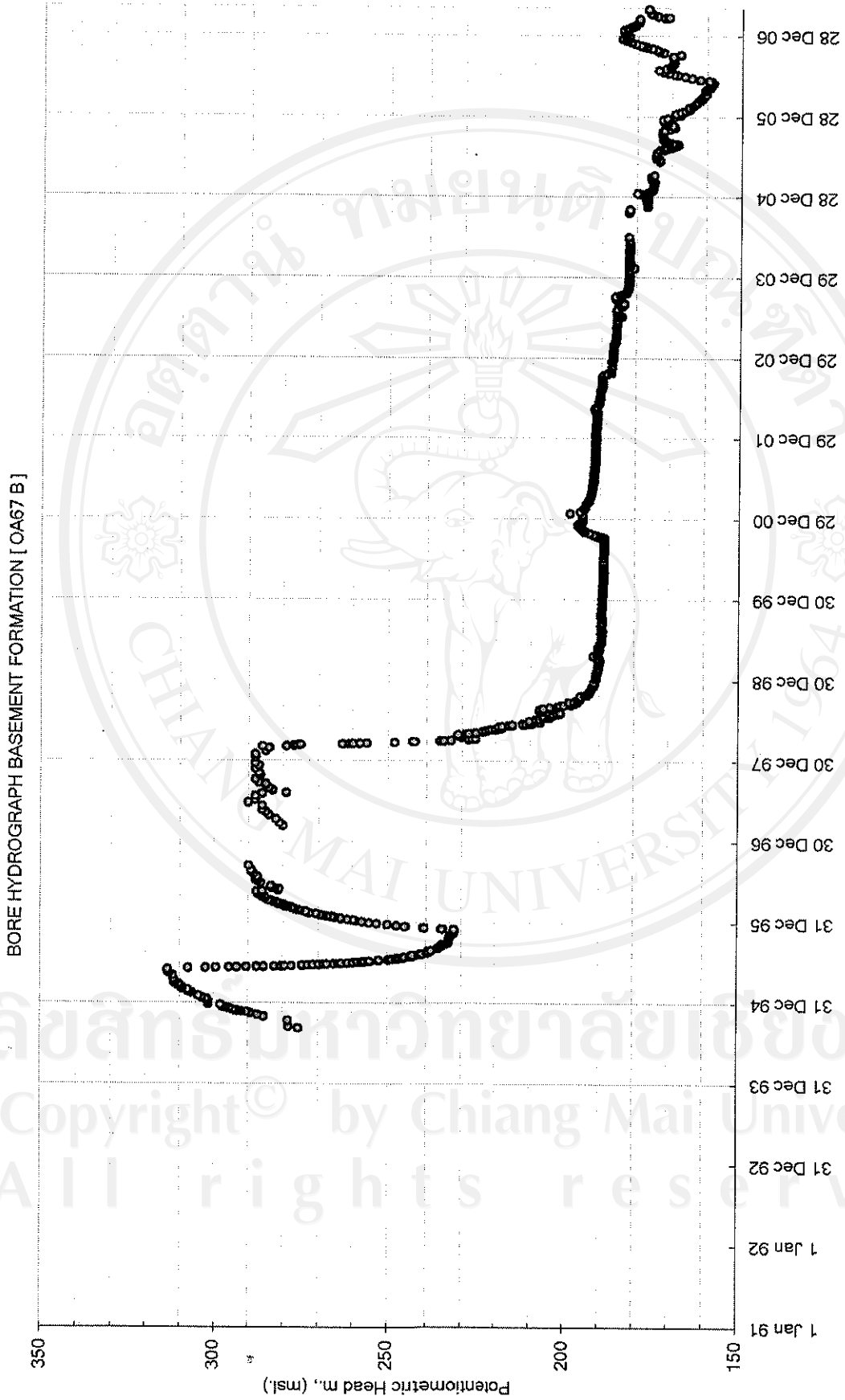
BORE HYDROGRAPH BASEMENT FORMATION [OA 64 B]



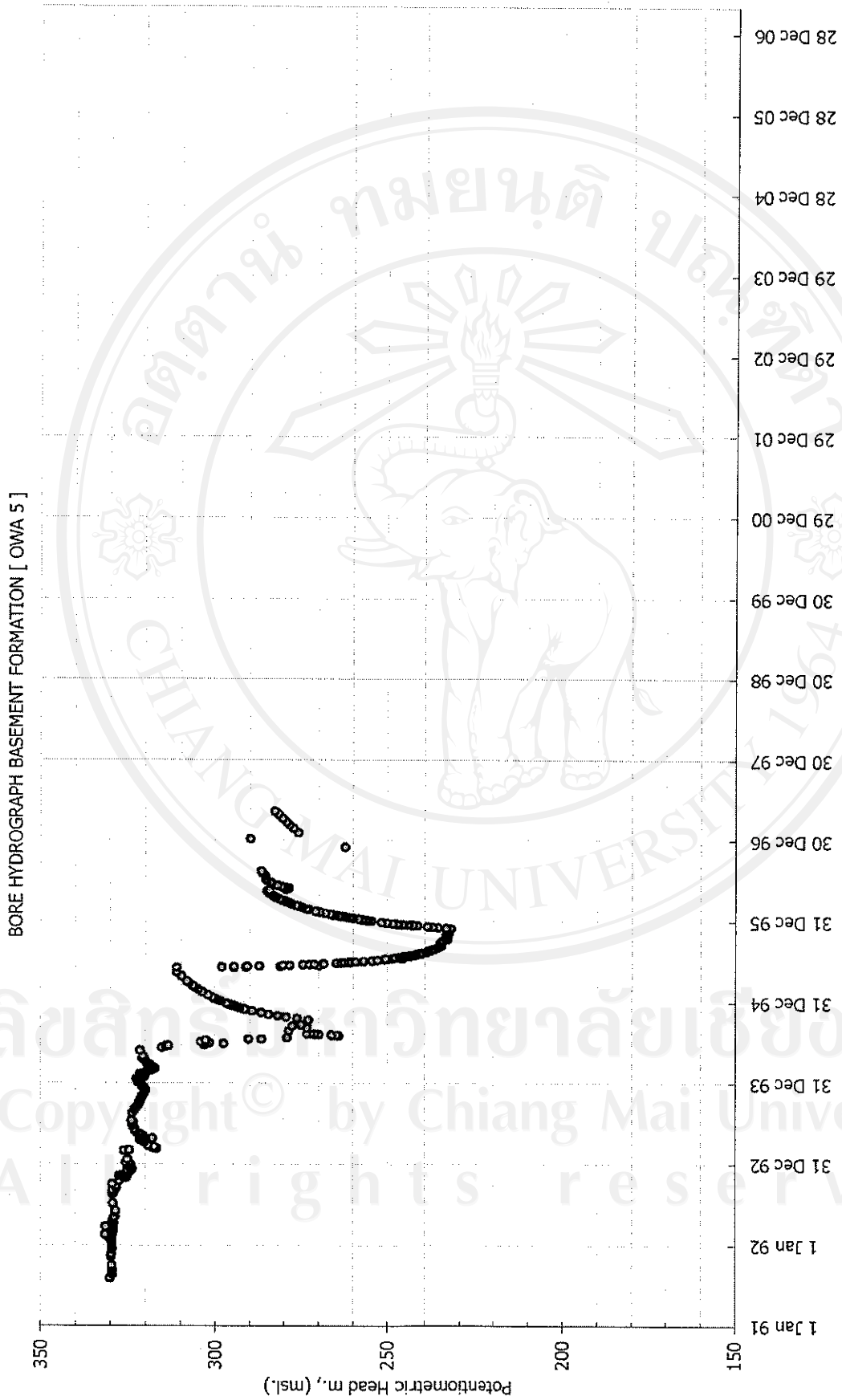
ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright © by Chiang Mai University
All rights reserved

ประวัติผู้เขียน

ชื่อ	นายพรชัย พงศ์พันธุ์ลาภ
วัน เดือน ปี เกิด	17 สิงหาคม 2507
ประวัติการศึกษา	สำเร็จการศึกษาระดับมัธยมศึกษาตอนปลาย โรงเรียนทวิธาภิเศก ปีการศึกษา 2525
สำเร็จการศึกษา	ระดับปริญญาตรีเทคโนโลยี(ธรณี) มหาวิทยาลัยขอนแก่น ปีการศึกษา 2529
ทุนการศึกษา	ได้รับทุนการศึกษาระดับบัณฑิตศึกษาจากการไฟฟ้าฝ่ายผลิตแห่งประเทศไทย ในโครงการความร่วมมือทางด้านวิชาการระหว่าง การไฟฟ้าฝ่ายผลิตแห่งประเทศไทยกับมหาวิทยาลัยเชียงใหม่ พ.ศ. 2546-2549
ประสบการณ์	นักธรณีวิทยา รับผิดชอบงานด้านอุทกธรณีวิทยา สำรวจ ศึกษา และป้องกันการพังทลายของผนังบ่อเหมืองเนื่องจากแรงดันน้ำใต้ดิน
ตำแหน่งปัจจุบัน	นักธรณีวิทยาระดับ 8 แผนกตรวจสอบเสถียรภาพผนังบ่อเหมืองแม่เมาะ กองวิศวกรรมธรณี ฝ่ายวางแผนและบริหารเหมืองแม่เมาะ การไฟฟ้าฝ่ายผลิตแห่งประเทศไทย