References

Thai

กรมทรัพยากรธรณี. 2520. พระราชบัญญัติน้ำบาดาล.กรุงเทพมหานคร :บริษัทประชาชนจำกัด.

เจริญ เพียรเจริญ. 2540. น้ำบาดาล-บ่อบาดาล. พิมพ์ครั้งที่ 3. กองควบคุมกิจการ: กรมทรัพยากรธรณี.

วจี รามณรงค์ และคณะ. 2541. วิกฤตการณ์น้ำบาดาลและแผ่นดินทรุดในกรุงเทพมหานครและปริมณฑล. กองน้ำบาดาล : กรมทรัพยากรธรณี.

English

Achalabhuti, C.1975. Petroleum geology of the gulf of Thailand. Economic Geology Bulletin 7: 53.

Alekseev, M. N., Takaya, Y. 1966-1967. An outline of the Upper Cenozoic Deposit in the Chao Phraya Basin, Central Plain Thailand. The Southeast Asian Studies 5 (2): 334-352.

Allen, J.R.L. 1965. A Review of the Origin and Characteristics of alluvial sediment. Journal Sedimentology 5 (2): 91-108.

AquaChem v.3.7 for Windows 95/98/NT. 1998-1999. AquaChem User's Manual. Waterloo Hydrogeologic.

Asian Institute of Technology and Department of Mineral Resources. 1982. Groundwater Resources in Bangkok Area: Development and Management Study. Research Report NO. 137: 250-254.

Babu, S. K., and Sinkha. D. K. 1987. Practical Manual of Sedimentary Petrology.... New Delhi: CBS Publishers & Distributors.

Buapeng, S. 1990. The use of Environmental Iisotope on Groundwater Hydrology in the Selected Areas in Thailand. Final Report Submitted to International Atomic Energy Agency. Vienna: Austria. Bangkok; Department of Mineral Resources: 8-28.

Chapman, D. 1996. Water Quality Assessments: A Guide to the use of Biota, Sediments and Water in Environmental Monitoring. 2nd ed. Cambridge: Chapman & Hall.

Chonglakmani, C., Ingavat, R., Piccoli, G., Robba. 1983. The Last Marine Submersion of the Bangkok Area in Thailand. Mem. Sc. Geol. Padova 36: 343-352.

Chuamthaisong, C., Yuthamanop, A., and Buapeng, S. 1980. Relative Age Dating of Groundwater and the Velocity of Groundwater Flow in the Lower Chao Phraya Basin. Department of Mineral Resources: 25.

Chuamthaisong, C., Yuthamanop, A. 1982. Relative age dating of groundwater and the Velocity of Groundwater Flow in the Vicinity of Bangkok Area. Geological Survey Division. Department of Mineral Resources: 50.

Coleman, M.J., and Prior, B.D. 1980. Deltaic Sand Bodies. Coastal Studies Institute Louisina State University. APPG Bookstore: Julso Oklahoma.

Cooper, H. H., and Jacob, C. E. 1964. A Geralized Grahphical Method for Evaluating Formation Constants and Summarizing Well Field History. Transactions, American Geophysical Union. 27: 200-206.

Cox, B.J. 1968. A Review of the Engineering Characteristics of the Present Marine Clay in South East Asia. Research NO. 6. Asian Institute of Technology

Davis, S.N., and De Wiest. R.J.M. 1966. Hydrogeology. New York: John Wiley & Son

Department of Mineral Resources. 1992. Mitigation of Groundwater Crisis and Land Subsidence in Bangkok MGL) Project. Report N0.1 Record of Groundwater Monitoring Wells in Bang and Adjacent Provinces. Department of Mineral Resources Ministry of Industry Bangkok: 181.

Deutsch, W. J. 1997. Groundwater Geochemistry: Fundamentals and Applications to Contamination. New York: Lewis Publishers.

Dheeradilok, P.,Chaimanee, N., Piccoli, G., Robba, E. 1984. On the Quaternary Stratigraphy and Fossils of Senanivate Housing Project Area Bangkok Metropolis. Mem. Sc. Geol. Padova 36: 413-426.

Dheeradilok, P. 1986. Review of Quaternary Geological Mapping and Research in Thailand. Proceeding of the CCOP Symposium on " Developments in Quaternary Geological Research in East and Southeast Asia During the last Decade". Bangkok Thailand October 27-30: 141-167.

Domenico, P. A., and Schwartz, F. W. 1998. Physical and chemical hydrogeology 2nd ed. New York: John Wiley and Sons.

Driscoll, F. G. 1986. Groundwater and Wells 2nd ed. Minnesota: Johnson Filtration System.

Fetter, W. 1994. Applied Hydrogeology. 3rd ed. New Jersey: Prentice Hall.

Fisher, W. L., Brown, L. F., Scott , A. J., and McGowen, J.H. 1969. Delta System in the Exploration for Oil and Gas. Austin, Texas: Bureau of Economic Geology, the University of Texas Austin.

Folkertsma, Seibolt. 1987. Water Quality Management in Bangkok. International Workshop on Urban Flood Protection and Drainage in East and Southeast Asia. June 22-25: H4.1-H4.15.

Freeze, R.A., and Cherry, A.J. 1979. Groundwater. New Jersey: Prentice Hall.

Fuangswasdi, A. 1991. Hydrochemistry of Groundwater in Bangkok and its vicinity. Master's Thesis. Groundwater Management and Hydrogeology Division, Graduate School. University of New South Wales.

Giao, P.H. 1997. Artificial Recharge of Bangkok Aquifer System for the Mitigation of Land Subsidence. Diss NO. GT-96-2: Asian Institute of Technology.

Gupta, A.D. and Arbhabhirama, A. 1979. Preliminary Investigation of Saltwater Encroachment into the Nakhon Luang Aquifer, Bangkok, Thailand. Journal of Geotechnical Engineering 10: 141-158.

Heath, R. C. 1983. Basic Ground-Water Hydrology. Virginia: Geological Survey Water- Supply Paper.

Jayakrishnan, R. 1993. Evaluation of Groundwater Quality and Monitoring for Bangkok Aquifer System. Mater's Thesis No. IR-92-13 Division of Geotechnology and Transportation, Graduate School. Asian Institute of Technology.

Jica.1995. The Study on Management of Groundwater and Land Subsidence in the Bangkok Metropolitan Area and its Vicinity, Final Report. Department of Mineral Resources, Public Works Department Ministry of Interior The Kingdom of Thailand.

Jitapunkul, S. 1980. Analysis of Sedimentary Facies and Groundwater Potential of some Quaternary Deposits, Bangkok area. Master's Thesis Department of Geology, Graduate School Faculty of Science Chulalongkorn University.

Merkel, R.H. 1979. Well Log Formation Evaluation. Continuing Education Course Note Series # 14.

Palmer, C. 1911. Geochemical Interpretation of Water Analyses. U.S. Geol. Surv. Bull. 479. 31.

Piancharoen, C., and Chuamthaisong, C. 1976. Groundwater of Bangkok Metropolis, Thailand. Proceedings of International Hydrogeological Conference on Hydrogeology of Great Sedimentary Basins, Budapest : 510-526.

Piper, A.M. 1944. A Graphic Procedure in the Geotechnical Interpretation of Water Analysis. Transaction America Geophysical Union 44: 914-928.

Piyasena, W. M. 1979. Analysis of the Extent and the Distribution of Aquifers in Chao Phraya Basin, Thailand. Master's Thesis, No. GT-78-26 Division of Geotechnology and Transportation, Graduate School. Asian Institute of Technology.

Potter, P.E. 1967. Sand Bodies and Sedimentary Environment. Am. Ass. Petrol. Geol. Bull 51: 337-365.

Power, M.C. 1953. A new Roundness Scale for Sedimentary Particles. Jour. Sed. Petrol. 23 pp:117-119.

Pryor, W.A. 1973. Permeability- Porosity Patterns and Variation in some Holocene Sand Bodies. Am. Ass. Petrol. Geol. Bull 57: 162-189.

Ramnarong, V. 1975. Injection of Flood Water into an Underground Reservoir, Bangpoon, Pathum Thani. Jour. Geol. Soc. Thailand 1(1-2): 47-52.

Ramnarong, V. 1976. Pumping Test For Nakhon Luang and Bangkok Aquifers. Hydrogeology section Ground water division Department of Mineral Resource Bangkok, Thailand.

Ramnarong, V. 1983. Environmental impacts of heavy groundwater development in Bangkok,Thailand. Proceedings of International Conference on Groundwater and Man, Sydney. 2: 345-350.

Ramnarong, V., and Buapeng, S. 1985. Groundwater Quality Problems in Thailand. Jour. Geol. Soc. Thailand October 8(1-2): 37-42.

Ramnarong, V. 1991. Saltwater intrusion in Bangkok metropolis. Journal of the Geological Society of Thailand 9(1): 71-86.

Ramnarong, V., and Buapeng, S. 1992. Mitigation of Groundwater Crisis and Land Subsidence in Bangkok. Journal of Thai Geosciences 2: 125-137.

Ramnarong, V., and Buapeng, S. 1992. Groundwater Resources of Bangkok and Its Vicinity: Impact and Management. Proceeding of National Conference on "Geologic Resources of Bangkok of Thailand: Potentail For Future Development". Bangkok Thailand: 172-184.

Reineck, H. E., and Singh, I. B. 1975. Depositional Sedimentary Environment. New York: Springer- Verlag.

Sangsuwan, C., Jongkanjanasoontorn, Y., and Hillen, R. 1986. A Palynological Study of the Bangkok Clay at Senanivate Pit, Bangkok Metropolis "Proceeding of the CCOP Symposium on Developments in Quaternary Geological Research in East and Southeast Asia During the last Decade". October 27-30: 197-205.

Sawyer, C.N. and McCarty, P.L. 1967. Chemistry for Sanitary Engineer, 2nd ed. New York: McGraw-Hill.

Selley, R. C. 1996. Ancient Sedimentary Environments and their Sub-Surface Diagnosis. 4th ed. London: Chapman & Hall.

Sengupta, M., S. 1994. Introduction to Sedimentary. New Delhi: Oxford & IBH Publishing.

Selvakumar, S. 1977. Analysis of Quaternary Terrace Levels of the Chao Phraya-Mae Klong Basins. Master's Thesis, Division of Geotechnical & Transportation Engineering Asian Institute of Technology

. Sinsakul, S. Sansuk, M., and Hasting, J.P. 1985. Holocence Sea Levels in Thailand Evidence and Basis for Interpretation. Jour. Geol. Soc. Thailand 8(1-2) October: 1-12.

Sodsathit, A. 1987. Flood Protection System. International Workshop on Urban Flood Protection and Drainage in East and Southeast Asia, Bangkok Thailand. June 22-25: B1.1-B1.20.

Sodsri, S. 1978. Geohydrology of the Chao Phraya Basin with respect to Subsidence. Master's Thesis, Division of Geotechnology and Transportation, Graduate School. Asian Institute of Technology.

Sriburi, T. 1987. Need foe Environmental Impact Statement on Flood Protection Project in Bangkok. International Workshop on Urban Flood Protection and Drainage in East and Southeast Asia. June 22-25: H2.1-H2.14.

Suphapodok, A. 1987. Land Subsidence and Groundwater Crisis in Bangkok Metropolitan Region. International Workshop on Urban Flood Protection and Drainage in East and Southeast Asia. June 22-25: H3.1-H3.17.

Thai-German Technical Project, Environmental Geology for Regional Planning Department of Mineral Resources. 2001. Remote Sensing Activities within the Thai-German Technical Cooperation Project.

Theis, C.V. 1935. Relation Between the Lowering of the Piezometric Surface and the Rate and the duration of Discharge of a Well using Ground Water Storage. Transactions, American Geophysical Union 30: 519-524.

Thiem, G. 1906. Hydrogeology. New York: McGraw-Hill.

Thiramongkol, N. 1983. Goemorphology of the Lower Central Plain, Thailand. Meeting of the Working Group on Geomorphology of River and Coastal Plains: 13-25.

Todd, D. K. 1980. Groundwater hydrogeology. 2nd ed. New York: John Wiley and Sons.

Udden, J.A. 1914. The mechanical Composition of Clastic Sediments. Geological Society of America Bulletin 25: 655-744.

Visher, G.S. 1965. Use of the Vertical Profile in Environmental Reconstruction. Am. Ass. Petrol. Geol. Bull 49: 41-61.

Walton, W.C. 1970. Groundwater Resource Evaluation. Japan: McGraw-Hill

Woollands, M. A. and Haw, D. 1976. Tertiary Stratigraphy and Sedimentation in the Gulf of Thailand. Offshore South East Asia Conference, February 17-20, Singapore : 1-22.

Yong, N. R., and Nutalaya, P. 1987. Impact of Quaternary Sediments of Urban Development and Land Use on the Central Plain of Thailand. AIT Research Report NO. 225.

Zottl, HH. 1987. Bangkok Flood Protection, The Problem, the Objective, the Solution. International Workshop on Urban Flood Protection and Drainage in East and Southeast Asia. June 22-25: D2.1- D2.12

APPENDICES

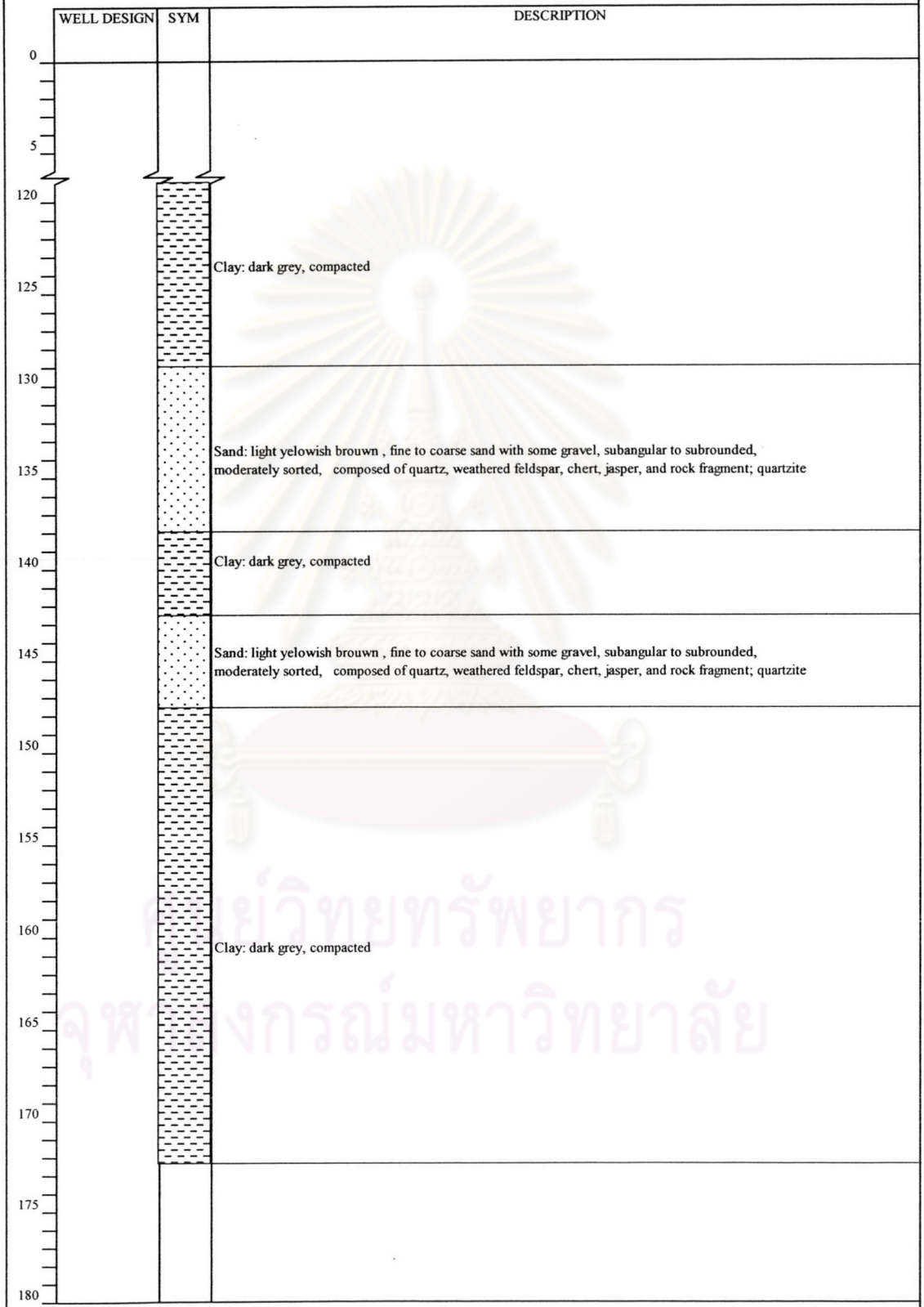
List of appendices

Appendices I 12 Wells Reference Number and Cuttings Information

Appendix I-1 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : G1362PSA119
WELL NO. : 118 **NORTHING** : 1570300 **EASTING** : 685400
LOCATION : Ban Bung Wang Noi, Amphoe Wang Noi, Phra Nakhon Si Ayutthaya Province
WATER LEVEL : - **DEPTH (m.)** : 172.5
DRILL METHOD : - **DRILL BY** : The DMR

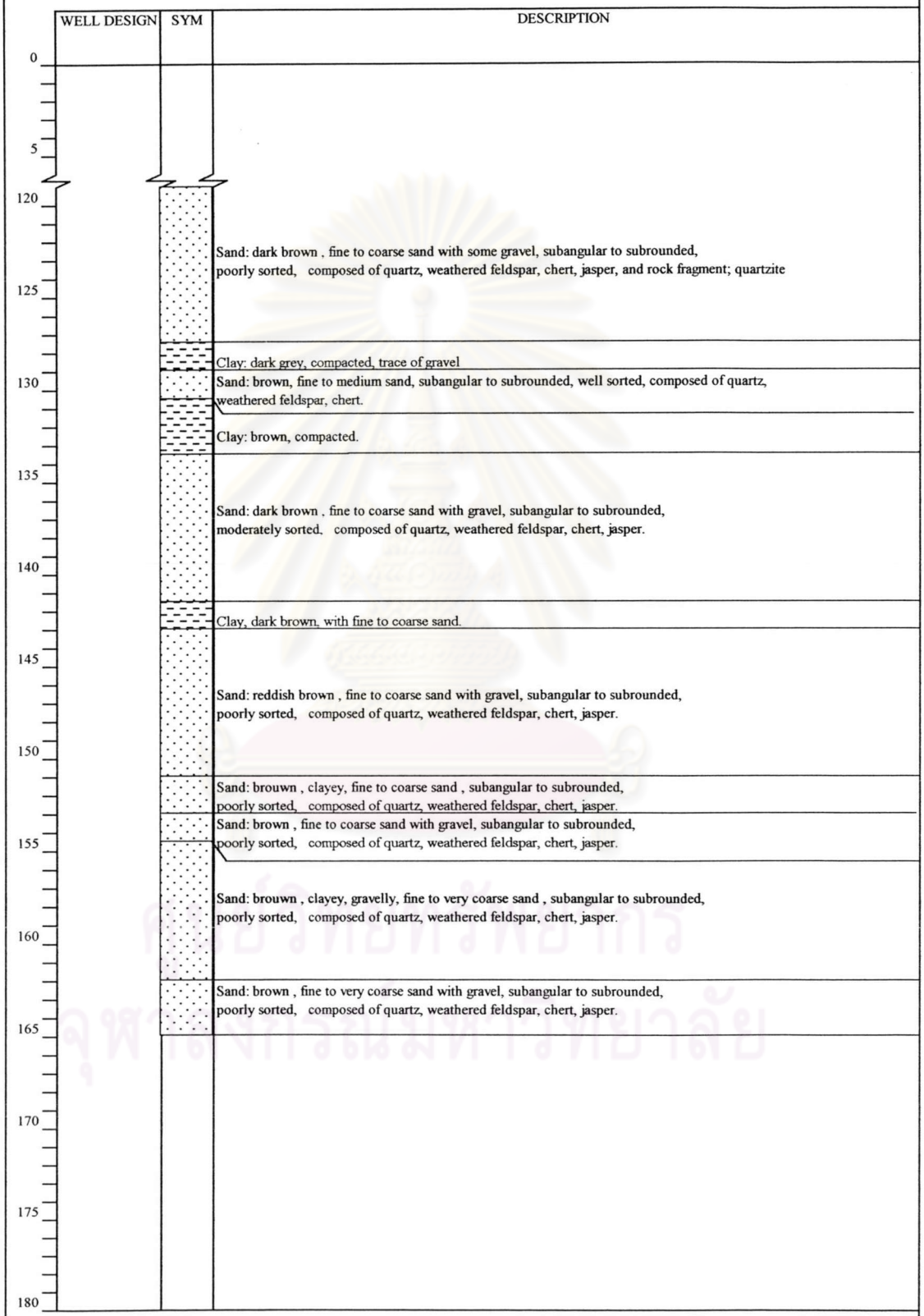


Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-2 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : G1364PSA121
WELL NO. : 119 **NORTHING** : 1571750 **EASTING** : 683200
LOCATION : Ban Bung Wang Noi, Amphoe Wang Noi, Phra Nakhon Si Ayutthaya Province
WATER LEVEL : - **DEPTH (m.)** : 165
DRILL METHOD : - **DRILL BY** : DMR

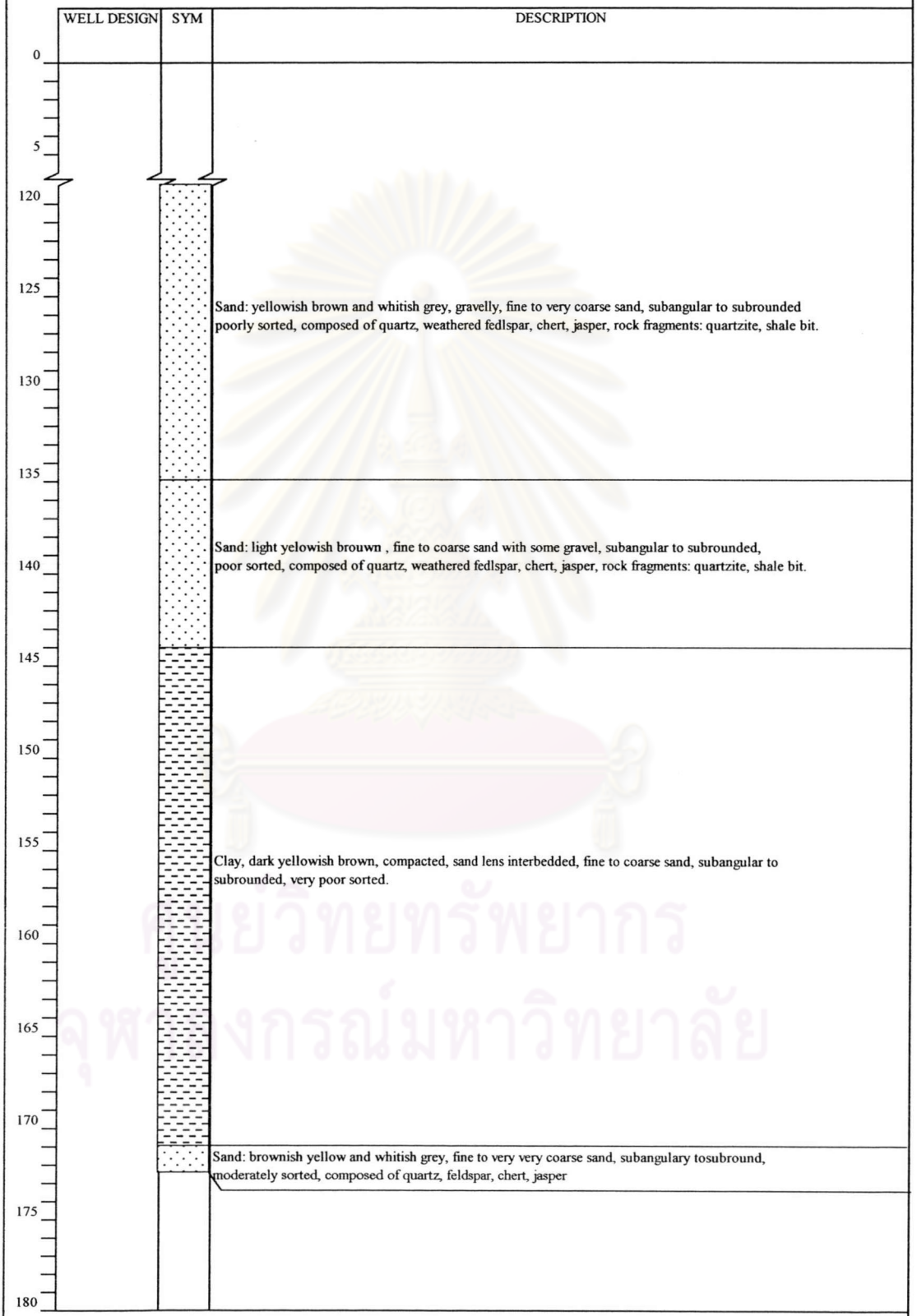


Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-3 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DN37SSN14
WELL NO. : 120 **NORTHING** : 1500300 **EASTING** : 645300
LOCATION : Tombon Khok Makham, Amphoe Muang , Samut Sakhon Province
WATER LEVEL : - **DEPTH (m.)** : 390
DRILL METHOD : - **DRILL BY** : DMR



Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-4 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DN40SSN15
WELL NO. : 121 **NORTHING** : 1501400 **EASTING** : 647900
LOCATION : Wat Rai Charoen Phon, Amphoe Muang, Samut Sakhon Province
WATER LEVEL : - **DEPTH (m.)** : 480
DRILL METHOD : - **DRILL BY** : DMR

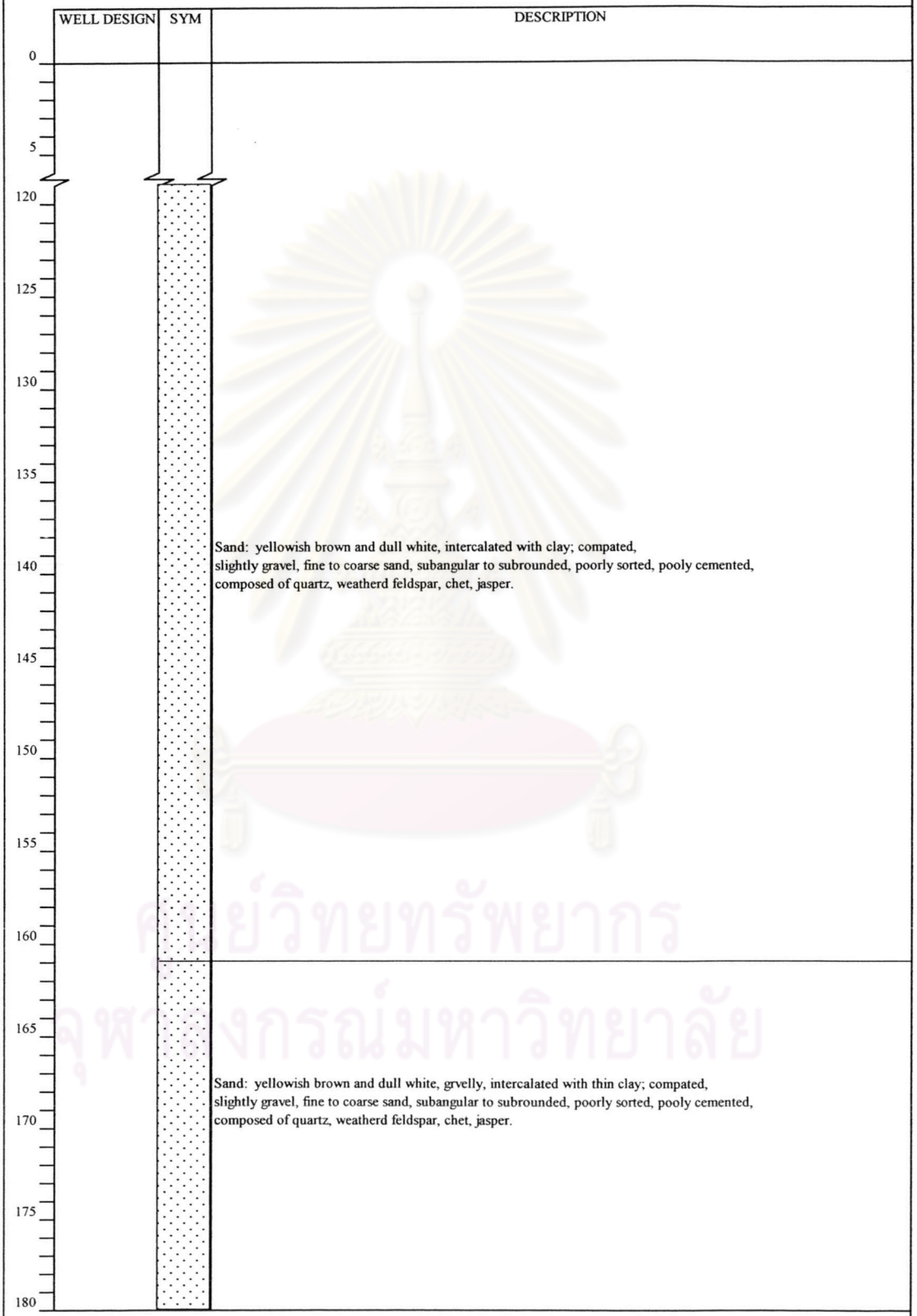
	WELL DESIGN	SYM	DESCRIPTION
0			
5			
120			
125			Sand: brownish grey, medium to very coarse sand with gravel, subangular to subrounded poorly sorted, composed of quartz, weathered fedlspar, chert, jasper, rock fragments: quartzite.
130			
135			Sand: brownish yellow, slightly gravel, fine to very coarse sand , subangular to subrounded poorly sorted, composed of quartz, weathered fedlspar, chert, jasper, rock fragments: quartzite.
140			Sand: brownish yellow, gravelly, intercalted with clay compacted, fine to very coarse sand , subangular to subrounded, poorly sorted, composed of quartz, fedlspar, chert, jasper, rock fragments: quartzite.
145			Sand: yellowish brown, gravelly, fine to coarse sand, subangular to subrounded, poorly sorted, composed of quartz, chert , feldspar, jasper.
150			
155			Clay, dark brownish yellow, compacted, sand lens interbedded, fine to coarse sand, subangular to subrounded, very poor sorted.
160			Sand: yellowish brown, gravelly, fine to coarse sand, subangular to subrounded, poorly sorted, composed of quartz, chert , feldspar, jasper.
165			
170			Clay, dark brownish yellow, compacted, sand lens interbedded, fine to coarse sand, subangular to subrounded, very poor sorted.
175			
180			

Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-5 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DS33BKK1
WELL NO. : 122 **NORTHING** : 1521200 **EASTING** : 660800
LOCATION : Sirat Hospital, Bangkok Metropolis
WATER LEVEL : - **DEPTH (m.)** : 642
DRILL METHOD : - **DRILL BY** : DMR

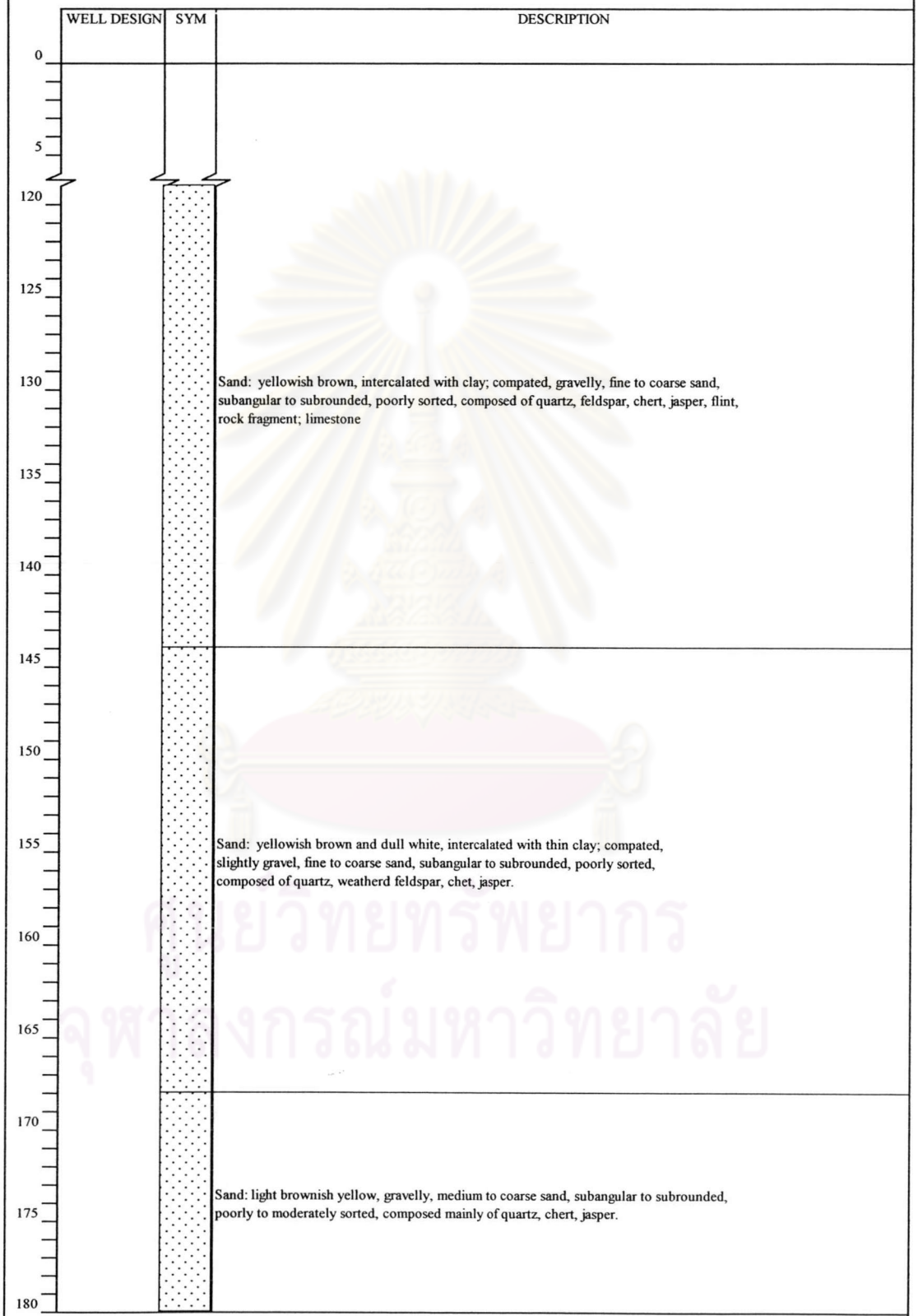


Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-6 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DN58BKK5
WELL NO. : 123 **NORTHING** : 1538750 **EASTING** : 691350
LOCATION : Musayid Darussalama, Bangkok Metropolis
WATER LEVEL : - **DEPTH (m.)** : 186
DRILL METHOD : - **DRILL BY** : DMR

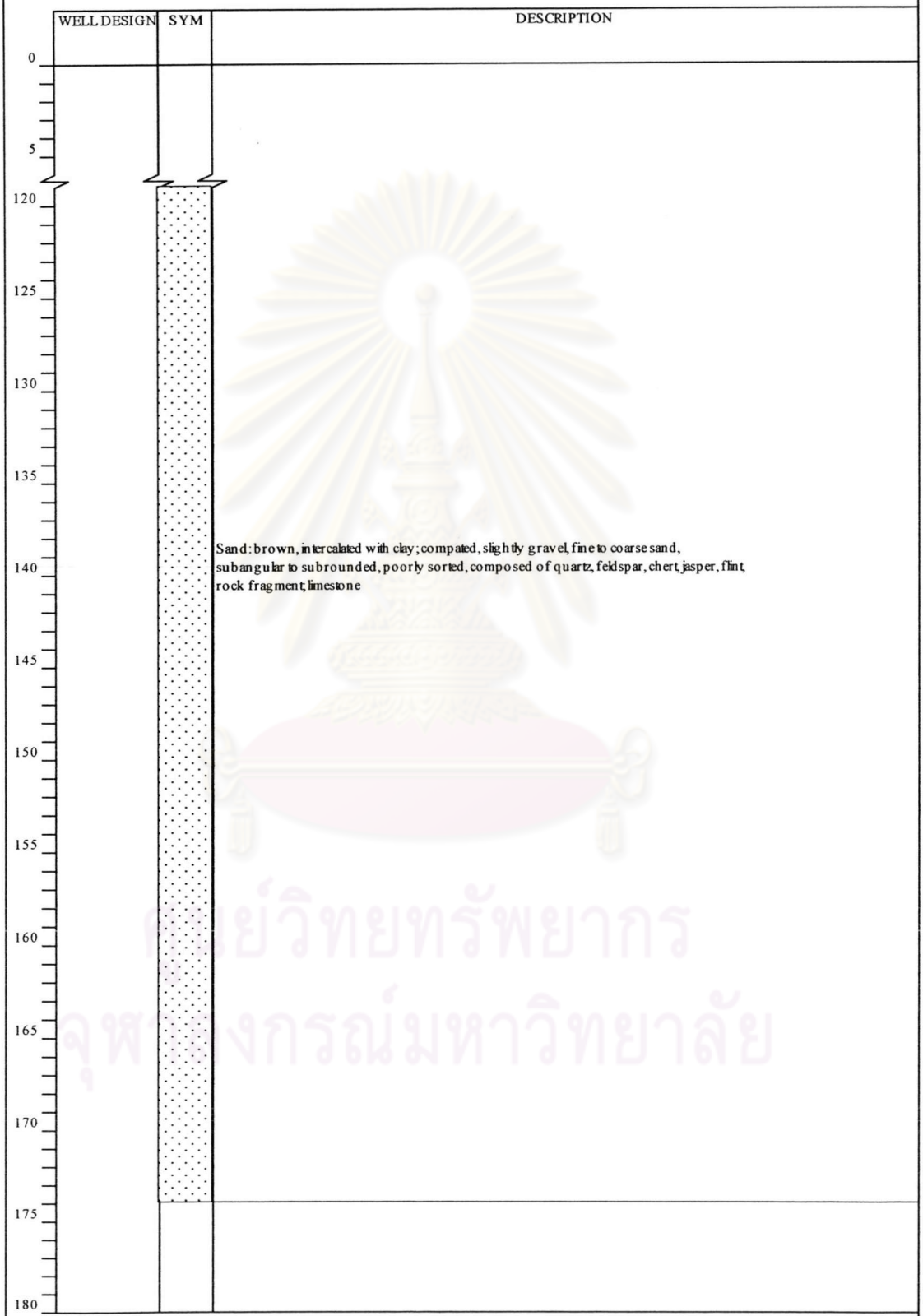


Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-7 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DN59BKK6
WELL NO. : 124 **NORTHING** : 1537600 **EASTING** : 691600
LOCATION : Musayid Marussaah Da, Bangkok Metropolis
WATER LEVEL : - **DEPTH (m.)** : 174
DRILL METHOD : - **DRILL BY** : DMR

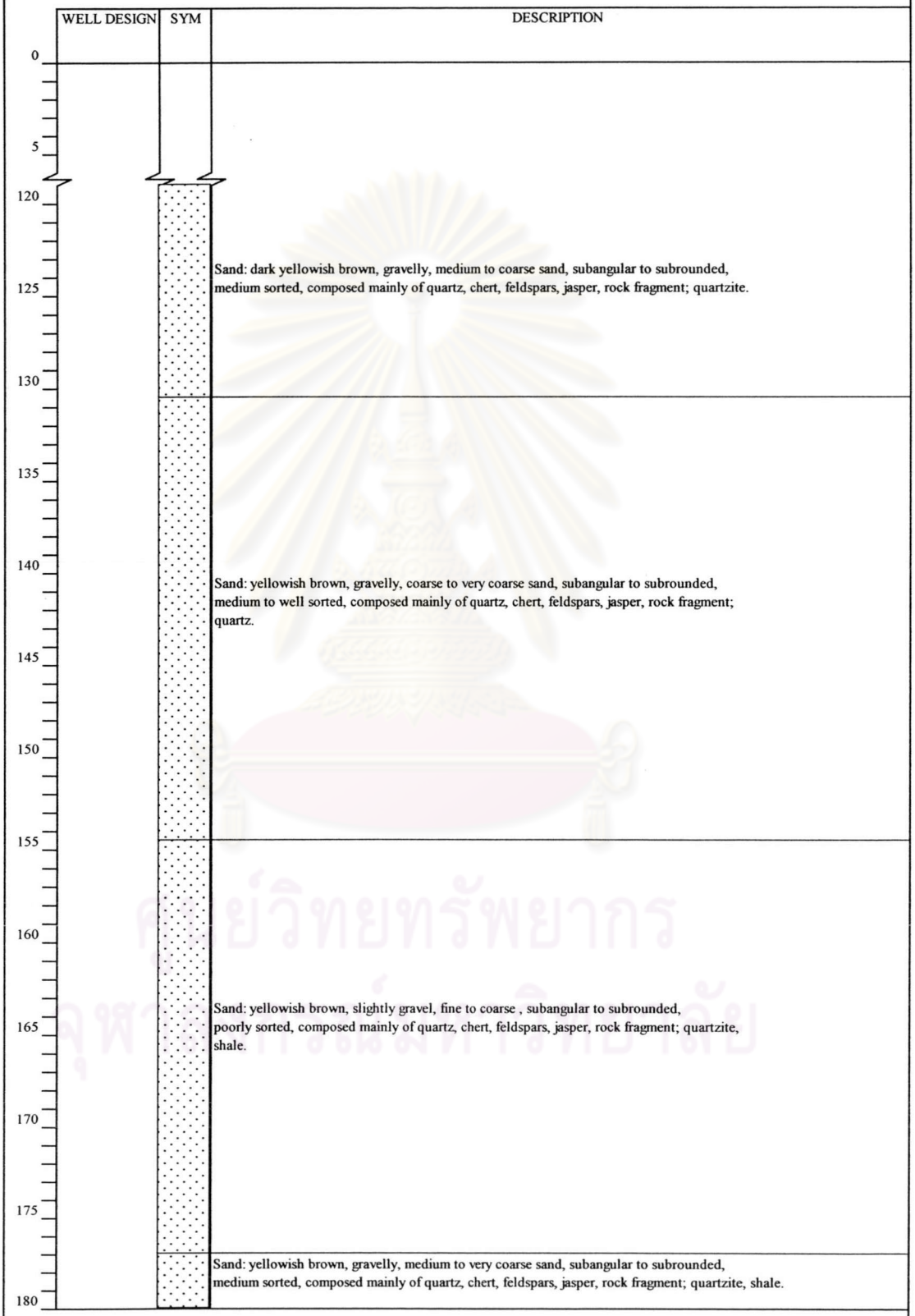


Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-8 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DR51PT5
WELL NO. : 125 **NORTHING** : 1545400 **EASTING** : 675900
LOCATION : Amphoe Lam Luk Ka, Pathum Thani Province
WATER LEVEL : - **DEPTH (m.)** : 264
DRILL METHOD : - **DRILL BY** : DMR

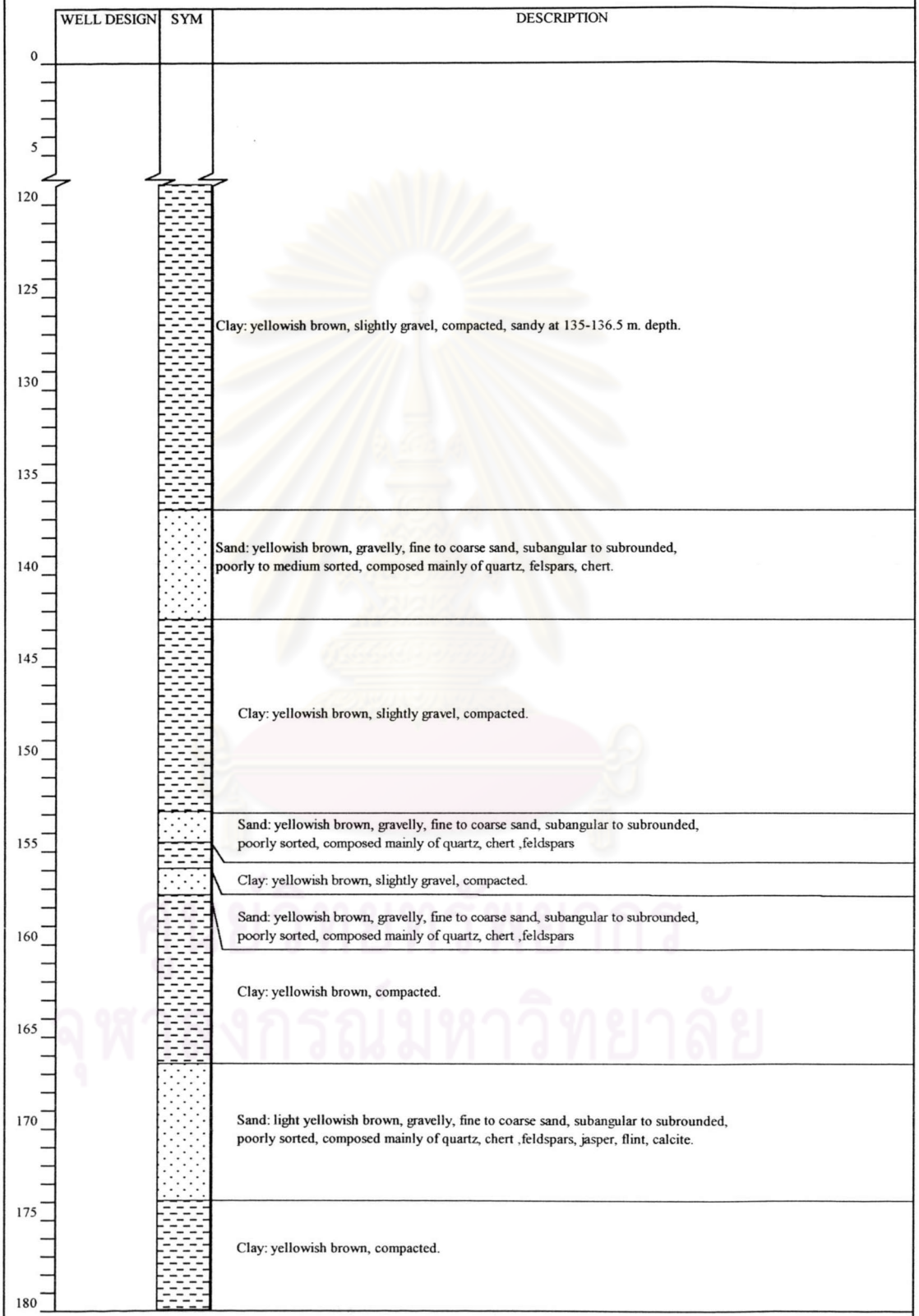


Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-9 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DR43NB5
WELL NO. : 126 **NORTHING** : 1530075 **EASTING** : 645000
LOCATION : Wat ton Chuak, Amphoe Bang Yai, Nonthaburi Province
WATER LEVEL : - **DEPTH (m.)** : 276
DRILL METHOD : - **DRILL BY** : DMR



Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-10 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DR60NB6
WELL NO. : 127 **NORTHING** : 1530175 **EASTING** : 638650
LOCATION : Ban ton Chuak, Amphoe Bang Yai, Nonthaburi Province
WATER LEVEL : - **DEPTH (m.)** : 339
DRILL METHOD : - **DRILL BY** : DMR

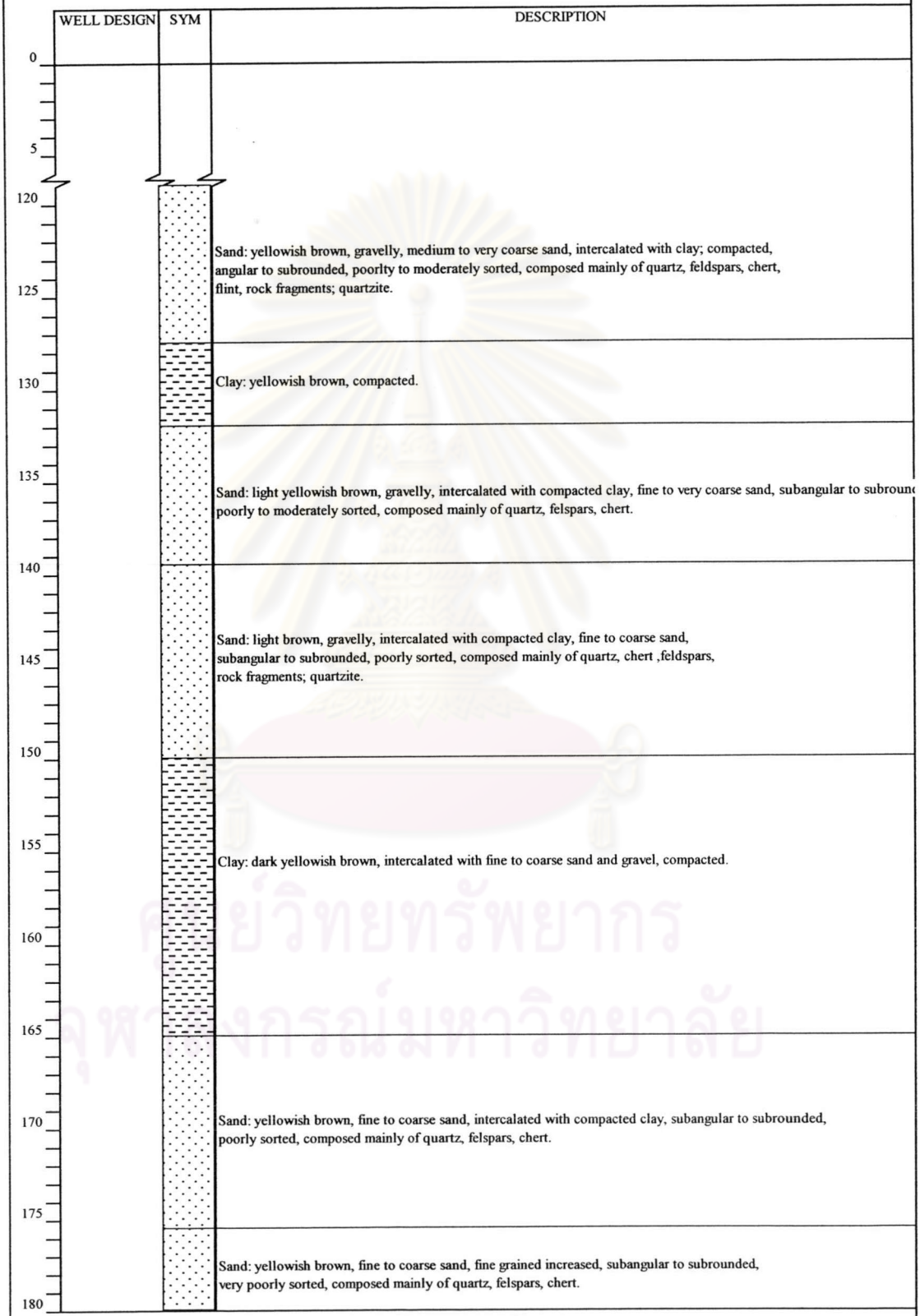
WELL DESIGN	SYM	DESCRIPTION
0		
5		
120		
125		Sand: yellowish brown, slightly gravel, fine to coarse sand, intercalated with clay; compacted, subangular to subrounded, poorlty sorted, composed mainly of quartz, feldspars, chert.
130		Sand: lihth yellowish brown, gravelly, fine to coarse sand, subangular to subrounded, poorlty sorted, composed mainly of quartz, feldspars, chert, flint, rock fragments; limestone, shale.
		Clay: yellowish brown, intercalated with fine to coarse sand and gravel, compacted.
135		Sand: light brown, gravelly, fine to medium sand, slightly coarse sand, subangular to subrounded, poorly to medium sorted, composed mainly of quartz, felspars, chert.
140		Clay: yellowish brown, intercalated with fine to coarse sand and gravel, compacted.
145		Sand: light brown, gravelly, medium to coarse sand, subangular to subrounded, poorly to moderately sorted, composed mainly of quartz, chert ,feldspars, rock fragments; quartzite.
150		
155		Sand: yellowish brown, gravelly, medium to coarse sand, subangular to subrounded, moderately sorted, composed mainly of quartz, chert ,feldspars
160		
		Clay: yellowish brown, intercalated with fine to coarse sand and gravel, compacted.
165		Sand: light brown, gravelly, fine to medium sand, slightly coarse sand, subangular to subrounded, medium sorted, composed mainly of quartz, felspars, chert.
170		
175		Clay: yellowish brown, compacted.
180		

Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-11 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DN35SSN13
WELL NO. : 128 **NORTHING** : 1507250 **EASTING** : 638650
LOCATION : Tombon Khlong Madue, Amphoe Muang, Samut Sakhon Province
WATER LEVEL : - **DEPTH (m.)** : 474
DRILL METHOD : - **DRILL BY** : DMR

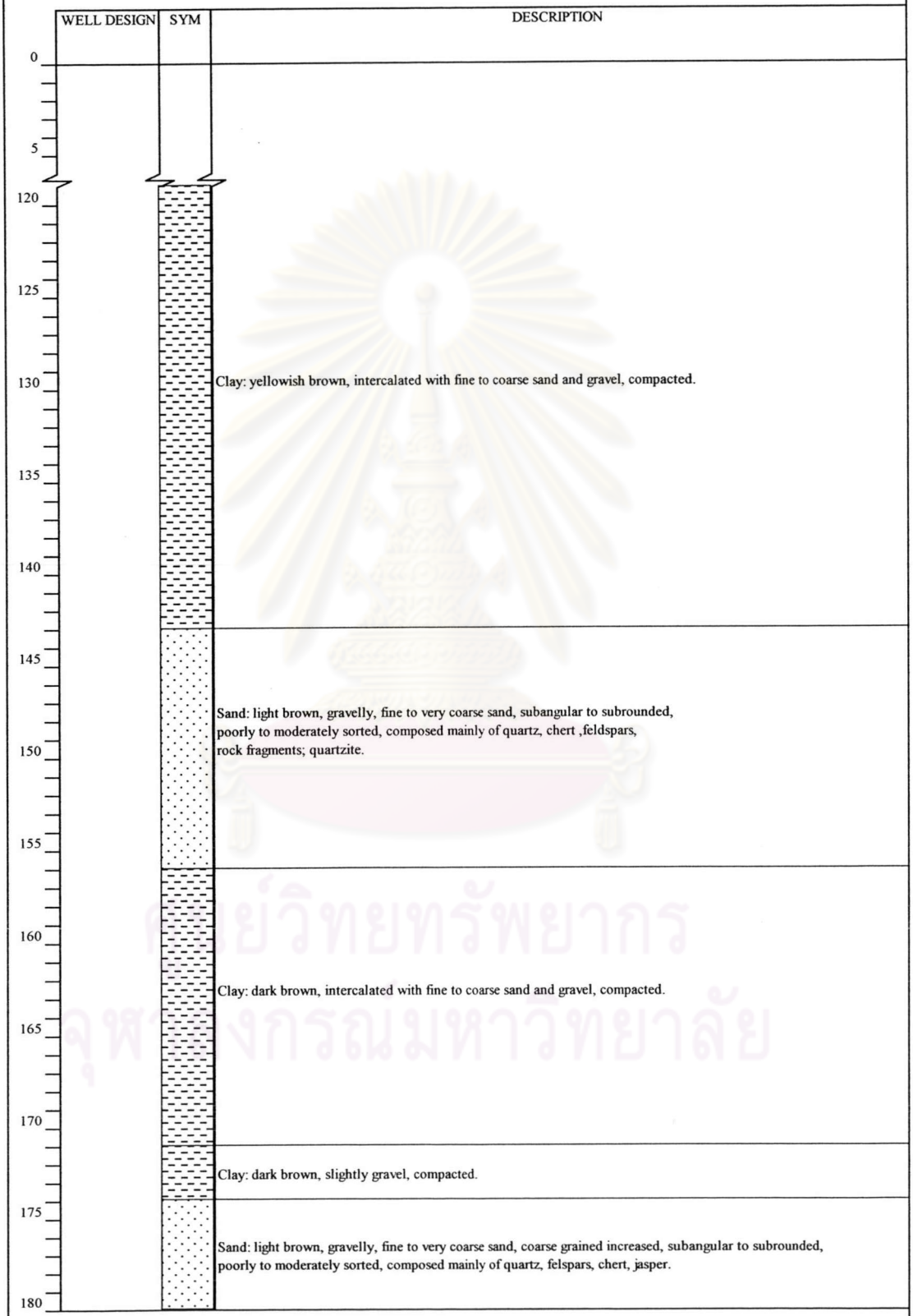


Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendix I-12 : Well reference number and cuttings informations

WELL LOG

WELL CODE. : DN44SSN3
WELL NO. : 129 **NORTHING** : 1495800 **EASTING** : 638375
LOCATION : Wat Khrok Khrak, Amphoe Muang, Samut Sakhon Province
WATER LEVEL : - **DEPTH (m.)** : 465
DRILL METHOD : - **DRILL BY** : DMR



Remark : The lithologic column is pursued from rock cuttings, obtained from DMR.

Appendices II Chemical Analysis of Observation Wells in 1991-2000

Appendix II-a-1 : Chemical analysis of groundwater from groundwater monitoring wells in 1991 (DMR)

Well No.	UTM		Chemical Composition (in ppm)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL01	690600	1494900	950.0	1200.0	8600	200.0	3.5	0.25	16000	1600	0	21	0.2	0.0	34200	7200
NL02	688800	1505600	4.8	6.3	170	4.0	0.4	0.02	170	1	24	157	0.5	0.2	402	38
NL03	683600	1515600	5.0	3.8	180	9.1	5.0	0.00	110	2	34	213	12.0	0.6	488	30
NL04	663884	1505820	1660.0	610.0	2620	27.0	6.1	3.10	8550	730	0	12	0.0	0.0	19200	6650
NL05	654109	1538551	95.0	71.0	180	35.0	15.0	0.07	310	77	0	629	34.0	0.3	1200	530
NL06	677700	1532800	23.0	14.0	170	7.7	0.4	0.00	310	1	0	38	11.0	0.1	692	120
NL07	689100	1540700	0.0	4.1	230	10.0	0.5	0.00	130	28	120	207	0.0	0.6	692	17
NL08	677789	1551413	2.2	2.9	160	1.9	1.0	0.00	26	2	8	398	0.6	0.3	434	18
NL09	665764	1543431	250.0	110.0	430	13.0	2.0	0.03	1400	3	0	22	1.4	0.1	2970	1100
NL10	673100	1503900	200.0	140.0	1550	37.0	346.0	0.04	2940	31	0	42	0.0	0.1	5800	1080
NL12	665126	1569478	450.0	150.0	770	14.0	1.5	0.04	2300	150	0	44	3.4	0.0	5480	1760
NL13	681900	1571400	11.0	31.0	370	5.4	0.4	0.53	470	36	11	374	0.0	0.1	1180	160
NL14	694082	1552844	1.3	2.5	300	2.6	0.3	0.00	220	2	36	367	0.0	0.2	790	14
NL16	688700	1528000	1.8	1.3	150	1.8	1.2	0.01	36	2	58	240	0.5	0.4	440	10
NL17	671000	1517400	50.0	11.0	98	6.3	0.5	0.01	250	1	0	24	0.0	0.5	540	170
NL18	649800	1504800	910.0	910.0	5760	100.0	1.4	0.06	12000	1300	0	25	0.1	0.1	26700	5300
NL19	636700	1513100	18.0	16.0	62	6.2	0.8	0.00	110	3	13	94	0.2	0.6	294	110
NL20	654800	1531600	940.0	150.0	2180	32.0	53.0	0.08	5360	0	0	19	2.1	0.1	12200	2950
NL22	704200	1543500	0.6	2.5	220	2.3	0.9	0.00	150	35	41	308	0.0	0.5	710	12
NL24	639500	1503300	400.0	550.0	3400	60.0	6.0	3.30	7300	31	0	178	0.3	0.3	14300	3300
NL25	670100	1523500	77.0	38.0	240	8.2	1.7	0.03	590	2	0	29	4.9	0.4	1180	350
NL26	673919	1543915	410.0	46.0	510	11.0	0.6	0.00	1700	17	0	23	2.4	0.1	4430	1200
NL27	670400	1509100	8.8	4.1	180	4.5	5.2	0.01	240	2	0	223	0.4	0.1	570	39
NL28	671400	1509700	4.3	4.9	120	4.2	0.2	0.02	37	2	0	313	0.3	0.1	318	31
NL29	672800	1515800	180.0	290.0	660	14.0	95.0	1.60	2050	22	0	55	1.0	0.1	4830	1630
NL30	686800	1512200	12.0	12.0	120	3.2	2.0	0.03	48	3	0	359	3.7	0.2	408	80
NL31	672200	1528900	14.0	9.4	120	4.2	2.3	0.00	48	2	31	250	2.5	0.1	390	74
NL32	637412	1510997	5.3	4.6	110	5.2	0.5	0.01	130	5	0	113	0.2	0.7	340	32
NL33	638300	1497800	21.0	29.0	100	3.5	20.0	0.09	79	1	14	220	0.6	0.6	390	170
NL34	665400	1521800	29.0	25.0	98	8.0	0.4	0.00	310	1	0	19	0.2	0.1	710	180
NL35	673300	1524000	1.4	4.8	130	3.2	0.3	0.00	14	2	38	260	0.1	0.2	340	23
NL36	678800	1522700	2.2	1.1	130	3.2	0.2	0.00	39	2	38	21	0.0	0.2	306	10
NL37	684700	1504700	1.8	3.1	120	5.0	0.4	0.00	34	2	135	71	0.2	0.3	370	17
NL38	665900	1514800	6.4	0.0	190	2.5	0.3	0.00	43	14	42	330	0.2	0.4	520	16
NL39	664500	1514800	31.0	8.4	100	5.5	0.5	0.03	110	2	19	160	0.4	0.1	418	110
NL40	674224	1548714	0.0	16.0	200	5.2	0.1	0.00	220	2	48	148	0.0	0.2	606	66
NL41	666776	1536872	200.0	29.0	310	14.0	0.3	0.00	910	5	0	54	0.1	0.1	2210	620
NL42	677200	1513900	16.0	9.0	180	3.8	0.7	0.04	88	3	31	360	0.3	0.2	510	76
NL43	693800	1502900	8.0	1.2	220	3.9	1.2	0.01	180	16	55	199	0.7	0.4	602	25
NL44	682200	1512600	38.0	20.0	210	4.0	1.1	0.23	220	4	0	380	0.2	0.2	670	180
NL45	676800	1537900	0.0	4.5	170	12.0	0.4	0.00	170	92	45	57	0.0	1.0	524	18
NL46	673300	1539400	190.0	60.0	300	10.0	0.2	0.00	1020	2	0	74	3.3	0.1	2520	730
NL47	690100	1519800	190.0	60.0	300	10.0	0.2	0.00	1020	2	0	74	3.3	0.1	2520	730
NL48	668719	1527356	21.0	13.0	56	8.0	1.7	0.04	38	76	0	86	1.3	0.2	210	100
NL49	676700	1509700	0.0	6.6	130	7.6	0.8	0.00	32	2	32	262	0.0	0.2	372	27
NL50	677700	1500700	6.0	19.0	310	7.5	0.5	0.01	340	21	48	261	0.1	0.3	932	95
NL51	685200	1526200	16.0	24.0	180	3.0	0.2	0.14	150	23	1	362	0.0	0.3	612	140

Appendix II-a-1 : Chemical analysis of groundwater from groundwater monitoring wells in 1991 (DMR) continued

Well No.	UTM		Chemical Composition (in ppm)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL52	683800	1521200	30.0	56.0	460	7.5	1.4	0.18	680	2	0	234	0.0	0.2	1340	300
NL53	657655	1516264	9.3	50.0	480	8.9	0.5	0.06	830	4	0	179	0.3	0.1	1570	230
NL54	685800	1535400	0.0	9.0	100	2.2	0.0	0.00	62	2	65	290	0.5	0.4	510	39
NL56	679400	1525900	1.3	21.0	240	4.9	2.5	0.00	300	2	12	219	0.5	0.3	688	91
NL57	657600	1521400	80.0	42.0	320	11.0	0.7	0.02	710	2	0	37	0.1	0.1	1440	370
NL58	662900	1507500	950.0	150.0	880	4.6	0.6	1.30	3600	30	0	11	0.2	0.0	7460	3000
NL59	671300	1519800	21.0	18.0	400	6.4	0.7	0.00	540	2	26	230	0.3	0.2	1140	120
NL60	676200	1496600	660.0	970.0	6900	230.0	77.0	2.30	13000	640	0	327	4.9	0.5	27400	5700
NL61	682500	1499300	7.2	22.0	350	10.0	1.1	0.02	510	18	42	282	2.6	0.2	1120	110
NL62	681000	1531800	0.0	6.7	160	2.5	2.9	0.00	40	2	87	237	0.1	0.3	444	28
NL63	683700	1508500	6.8	26.0	240	7.4	0.9	0.02	330	8	48	193	1.3	0.2	810	120
NL64	661823	1531565	34.0	14.0	81	7.0	0.4	0.00	74	2	0	279	0.6	0.1	368	140
NL65	665900	1550300	670.0	65.0	1700	79.0	2.2	0.48	4000	50	0	20	0.2	0.1	7630	2000
NL66	674763	1551464	70.0	56.0	240	7.8	0.2	0.00	700	2	30	108	0.0	0.2	756	410
NL67	666036	1500807	1700.0	310.0	2400	35.0	0.9	2.80	7700	110	0	14	0.2	0.0	15700	5500
NL68	643300	1526500	880.0	56.0	150	5.6	0.4	0.35	430	6	0	160	0.3	0.3	1080	390
NL69	638613	1519846	64.0	34.0	110	4.6	0.7	0.20	200	13	0	289	0.1	0.5	634	300
NL70	652166	1511415	860.0	380.0	1470	18.0	1.5	3.30	4600	320	0	18	2.1	0.1	9740	3730
NL71	653800	1552800	46.0	6.3	85	7.3	0.4	0.02	230	17	2	25	0.2	0.1	562	140
NL72	641900	1545400	4.0	2.9	44	3.5	1.1	0.02	27	18	7	67	0.2	0.3	172	22
NL73	640500	1534700	12.0	6.8	100	7.6	2.6	0.01	150	25	10	31	0.1	0.4	354	58
NL74	660565	1547845	420.0	130.0	370	13.0	1.2	0.05	1600	3	0	35	0.1	0.1	3540	1570
NL75	645100	1559400	5.0	3.8	75	8.2	1.0	0.00	12	37	48	61	0.1	0.2	250	28
NL76	687270	1560760	5.6	6.3	120	3.1	0.7	0.00	87	25	5	179	0.0	0.2	342	40
NL77	663979	1562311	120.0	48.0	140	8.7	0.9	0.38	450	38	0	142	2.6	0.2	1190	51
NL78	704688	1556688	6.6	2.2	12	2.9	0.6	0.00	9	3	1	50	0.0	0.1	70	26
NL79	684886	1548833	5.1	12.0	140	5.0	1.3	0.00	86	71	8	175	0.0	0.3	432	63

Appendix II-a-2 : Chemical analysis of groundwater from observation wells in 1992 (DMR)

Well No.	UTM		Chemical Composition (in ppm.)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL01	690600	1494900	880	1100	8100	140	3.4	0.11	16000	2400	0	22	0.2	0	33800	6600
NL03	683600	1515600	7.4	2.9	160	7.8	0.74	0.01	110	2	19	201	13	0.5	498	30
NL04	663884	1505820	1500	580	2100	25	1.5	1.8	8100	790	0	16	0	0	20800	6200
NL05	654109	1538551	80	62	190	30	16	0.01	290	36	0	535	35	0.2	1060	450
NL06	677700	1532800	52	37	67	33	2.6	0.88	52	230	0	159	4	0.1	524	280
NL07	689100	1540700	0	15	260	2	1.7	0	140	18	86	222	0.1	0.4	600	63
NL08	677789	1551413	0.8	5.3	170	1.2	0.34	0	30	3	37	285	1.8	0.4	414	24
NL09	665764	1543431	250	140	480	16	1.3	0.37	1500	2	0	22	2.4	0.1	3530	1200
NL11	680100	1519900	40	10	110	3.5	0.55	0.42	10	5	0	363	15	0.2	430	140
NL12	665126	1569478	400	270	920	15	0.22	2.2	2710	170	0	32	6.4	0.1	5890	2100
NL13	681900	1571400	33	74	350	4.7	0.11	0.42	500	33	48	279	0.6	0.1	1180	390
NL14	694082	1552844	0	6.3	310	1	0.36	0.01	230	2	110	160	1.5	0.3	784	26
NL16	688700	1528000	2.6	4.5	140	2	0.79	0	42	2	38	240	0.4	0.3	366	25
NL17	671000	1517400	63	11	92	5.5	0.68	0.01	290	2	0	15	0.2	0.4	760	190
NL18	649800	1504800	1000	840	5600	100	1.8	0.12	12000	1600	0	32	9.5	0.1	26800	6100
NL19	636700	1513100	14	15	67	5.5	0.85	0.03	110	1	1	95	0	0.5	286	99
NL21	697100	1562800	16	16	280	2.3	2.1	0.08	340	18	0	241	1.5	0.3	806	100
NL22	704200	1543500	0	8	270	1.2	0.12	0	200	4	39	281	0.1	0.5	708	33
NL24	639500	1503300	200	210	850	27	3.6	0.75	2200	12	0	78	3.1	0.4	4740	1400
NL25	670100	1523500	81	41	250	7.4	0.96	0.03	650	2	0	14	0.2	0.2	1570	370
NL26	673919	1543915	480	46	560	8.2	0.48	0.03	1800	8	0	30	0.1	0.1	4540	1400
NL27	670400	1509100	9.3	5.1	220	3.5	2.8	0.1	250	2	0	179	1.5	0.2	612	44
NL28	671400	1509700	3.2	6	130	4.3	0.58	0	39	2	5	259	0.7	0.2	338	33
NL30	686800	1512200	14	10	140	2.3	31	0.05	68	3	21	268	2.7	0.2	468	77
NL31	672200	1528900	15	9.2	130	3.1	0.4	0.01	41	2	30	266	3.2	0.2	322	75
NL32	637412	1510997	11	6.1	120	5.1	0.59	0	140	2	0	119	1.3	0.8	358	52
NL33	665400	1521800	170	50	180	8.6	0.53	3.7	610	16	0	149	2.9	0.1	1960	640
NL35	673300	1524000	3.5	1.7	130	2.3	0.53	0	19	3	13	268	1.4	0.2	342	16
NL36	678800	1522700	0	2.4	120	2.7	0.18	0.01	47	1	66	110	0.1	0.2	334	10
NL37	684700	1504700	0.8	1.8	150	2.3	0.41	0	35	2	47	207	0.1	0.3	372	10
NL38	665900	1514800	5.4	0	130	2	0.26	0	43	2	34	207	0.2	0.4	376	14
NL40	674224	1548714	2.9	11	210	1.6	0.18	0	230	1	33	125	0.1	0.2	544	51
NL41	666776	1536872	210	36	330	12	0.66	0.05	910	3	0	35	0.1	0.1	1880	670
NL42	677200	1513900	21	9.1	160	2.7	3.8	0.08	71	2	36	297	2.2	0.2	532	89
NL43	693800	1502900	5.1	1.7	220	3.1	0.88	0	190	18	47	162	2.3	0.4	644	20
NL44	682200	1512600	47	6.1	150	2.7	1.8	0.21	120	4	0	341	1.6	0.2	588	140
NL45	676800	1537900	4.5	8.5	190	6.3	0.32	0	230	18	21	77	0.1	0.7	526	46
NL46	673300	1539400	210	94	670	11	0.36	0.08	1700	12	0	54	0	0.1	3340	920
NL47	690100	1519800	24	9.1	48	6.6	1.8	0.02	47	61	0	94	1.3	0.2	286	96
NL48	668719	1527356	5.6	6.1	130	3.5	0.94	0.01	26	2	23	244	1.4	0.3	330	39
NL49	676700	1509700	15	7.3	280	8.2	9.4	0.05	200	3	0	459	3.6	0.3	860	67
NL50	677700	1500700	1.6	11	230	3.1	0.72	0.02	180	9	11	326	1.5	0.4	643	50
NL51	685200	1526200	27	25	170	2	0.1	0.01	140	28	0	349	0.3	0.3	610	170
NL52	683800	1521200	4	18	220	3.9	1.4	0.02	210	3	11	279	1.7	0.2	652	84
NL53	657655	1516264	18	16	360	5.5	1	0	520	3	19	198	2.2	0.2	1050	110
NL54	685800	1535400	5.4	14	170	1.2	1.5	0.01	68	4	57	243	0.2	0.3	444	70
NL55	682500	1494700	430	1100	6400	130	120	1.7	13000	1100	0	349	0.1	0.9	26500	5500

Appendix II-a-2 : Chemical analysis of groundwater from observation wells in 1992 (DMR) continued

Well No.	UTM		Chemical Composition (in ppm.)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL56	679400	1525900	2.8	19	190	3.5	0.42	0	190	2	21	199	0.1	0.3	562	86
NL57	657600	1521400	100	22	300	12	0.12	0.01	720	3	0	27	0.6	1	1430	350
NL58	662900	1507500	930	150	870	22	1.2	1.4	3500	25	0	19	0.1	0	7210	3000
NL59	671300	1519800	4.5	14	350	6.3	1.4	0.02	450	2	31	208	0.1	0.2	1080	68
NL60	676200	1496600	920	1000	5000	78	79	2.2	13000	1100	0	205	13	0.2	27000	6500
NL61	682500	1499300	7.4	2	230	3.9	7.4	0.02	170	5	13	301	2.7	0.5	614	27
NL62	681000	1531800	5	18	150	1.6	1.2	0	53	4	51	239	0.9	2	400	88
NL63	683700	1508500	7.4	12	210	3.9	0.88	0	210	3	30	172	0.2	0.2	654	66
NL64	661823	1531565	24	19	85	7	1.8	0.02	77	7	19	149	4.5	0.2	398	140
NL65	665900	1550300	600	160	1400	56	12	0.03	3900	110	0	18	0	0.1	8880	2200
NL66	674763	1551464	6	16	190	2	0.68	0.02	170	2	28	223	0.5	0.3	544	79
NL67	666036	1500807	1700	300	2000	28	1.6	2.7	7400	140	0	12	0	0	18700	5500
NL68	643300	1526500	50	52	160	4.7	0.12	0.05	430	3	0	80	0.5	0.3	972	340
NL69	638613	1519846	41	38	110	4.7	0.5	0.28	200	2	0	227	0.3	0.5	570	260
NL70	652166	1511415	830	310	1400	19	0.28	2.4	4600	65	0	14	0	0.1	10600	3300
NL71	653800	1552800	57	3.5	90	5.1	0.18	0.02	230	13	0	33	0	0.3	646	160
NL72	641900	1545400	6.1	3.9	67	3.1	0.2	0.02	110	3	0	40	0.7	0.3	240	31
NL73	640500	1534700	6.7	0.8	120	7	1	0	160	13	9	25	0	0.6	380	20
NL74	660565	1547845	400	110	410	20	0.94	0.05	1600	3	0	25	4.1	0.1	4440	1400
NL75	645100	1559400	8.3	7.1	100	4.3	0.19	0.02	35	25	22	174	1.7	0.2	266	50
NL76	687270	1560760	0.8	1.7	120	2.3	0.32	0.01	100	13	27	82	0.3	0.3	314	9
NL77	663979	1562311	970	170	1380	16	0.54	0.74	4300	260	0	22	0.1	0.1	9450	3120
NL78	704688	1556688	1.8	1.1	30	2.3	0	0	17	1	12	30	0.1	0.3	62	9
NL79	684886	1548833	0	9.2	200	6.6	1.5	0	220	8	71	32	0.1	0.4	548	38
NL82	657054	1511793	610	270	1100	14	0.51	4.8	3100	220	0	160	4.9	0.2	6710	2600
NL84	695600	1526000	27	12	170	3.5	0.72	0.01	87	190	14	178	1.3	0.6	588	120
NL87	646100	1520200	69	23	110	4.7	0.14	0	160	37	16	242	1	0.6	568	270

Appendix II-a-3 : Chemical analysis of groundwater from observation wells in 1993 (DMR)

Well No.	UTM		Chemical Composition (in ppm.)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL01	690600	1494900	1020	940	7720	140	6.5	0.2	16200	2150	0	27	0.1	0.1	33700	6400
NL02	688800	1505600	10	13	170	3.5	0.25	0.01	180	3	8	170	0	0.3	506	80
NL03	683600	1515600	14	24	230	15	0.66	0.05	250	5	0	273	27	0.9	724	130
NL04	663884	1505820	1500	710	2500	28	1	2.3	8000	830	0	17	7.3	0	17900	6600
NL05	654109	1538551	200	93	440	43	0.26	0.28	600	340	0	773	12	0.1	2300	880
NL06	677700	1532800	39	25	64	25	0.4	0.08	70	180	90	103	2.1	0.1	474	200
NL07	689100	1540700	1.2	5.1	280	1.6	0.36	0	150	8	115	216	0	0.6	638	24
NL08	677789	1551413	5.8	7.2	180	1.6	1.3	0	78	6	20	390	2	0.4	460	44
NL09	665764	1543431	250	120	450	13	0.38	0.28	1500	3	0	22	2.1	0.1	3720	1100
NL10	673100	1503900	210	17	490	8.2	3.9	0	1210	2	0	15	3.3	0.1	2950	600
NL11	680100	1519900	14	10	120	1.6	0.51	0.16	39	2	14	295	12	0.1	416	77
NL12	665126	1569478	380	230	940	15	3	1.3	2700	170	0	37	0	0.16	6250	1900
NL13	681900	1571400	25	35	370	3.9	2.1	0.41	440	4	39	302	0.33	0.2	1240	210
NL14	694082	1552844	0.3	2.4	300	2	0.12	0	230	2	50	342	4	0.2	776	11
NL16	688700	1528000	0.8	3.3	140	1.6	0.56	0.01	43	2	44	263	0.9	0.3	340	16
NL17	671000	1517400	61	29	100	5.9	0.35	0	320	2	0	19	0.4	0.4	525	270
NL18	649800	1504800	660	100	6000	110	0.8	0.06	13000	1500	0	44	0.1	0.1	25900	5800
NL19	636700	1513100	13	18	87	6.6	0.48	0.02	120	4	0	117	0.2	0.5	320	100
NL20	654800	1531600	4.5	8.8	290	2.7	0.44	0	340	29	9	208	0.2	0.2	828	47
NL21	697100	1562800	2.6	4.9	250	1.2	0	0	200	4	14	375	0	0.4	724	26
NL22	704200	1543500	2.6	4.9	250	1.2	0	0	200	4	14	375	0	0.4	724	26
NL24	639500	1503300	150	180	500	18	0.72	0.03	1600	6	0	106	5.3	0.4	3430	1100
NL25	670100	1523500	99	47	280	9.4	1.8	0.02	700	2	0	41	2.5	0.2	1770	440
NL26	673919	1543915	420	58	540	8.2	0.42	0.01	1800	6	0	30	0	0.1	4670	1300
NL28	671400	1509700	5.1	4.3	130	3.9	0.62	0.01	42	2	15	271	0.3	0.2	364	30
NL30	686800	1512200	16	7.8	180	3.1	46	0.01	120	4	25	262	2.5	0.2	560	73
NL31	672200	1528900	29	19	180	3.9	0.68	0.32	180	2	0	349	4.1	0.2	580	150
NL32	637412	1510997	3.8	6	130	5.1	0.54	0.06	180	2	0	80	0.2	0.7	386	34
NL34	665400	1521800	1.9	6	140	1.6	0.91	0	46	4	38	232	0	0.4	414	30
NL35	673300	1524000	0.6	2.8	130	2.7	0.24	0.02	20	2	24	290	0.4	0.2	300	13
NL36	678800	1522700	0.3	4.6	120	3.1	0.08	0	52	3	47	174	0	0.2	330	20
NL37	684700	1504700	3	3.2	150	2.3	0.42	0	36	2	86	175	0	0.3	382	21
NL38	665900	1514800	3.7	0.9	150	1.6	0.52	0	46	3	25	226	0	0.3	390	13
NL39	664500	1514800	12	17	69	1.6	0.01	0.01	8.8	2	18	213	0.6	0.1	296	98
NL40	674224	1548714	6.4	6.8	220	3.1	0.2	0	230	2	22	141	0.1	0.2	576	44
NL41	666776	1536872	180	35	330	12	0.36	0.03	900	3	0	40	0.2	0.1	2300	590
NL42	677200	1513900	6.7	17	170	3.1	0.01	0.01	110	4	27	310	1.2	0.2	484	88
NL43	693800	1502900	200	140	580	10	28	0.01	1460	74	0	103	3.1	0.3	3310	1040
NL44	682200	1512600	28	13	140	3.1	0.31	0.1	98	11	0	369	0.8	0.2	624	120
NL45	676800	1537900	8	1.9	180	6.6	0.3	0	240	4	15	93	0	0.8	514	28
NL46	673300	1539400	250	100	900	11	0.1	0.07	2400	3	0	32	0	0.1	4770	1000
NL47	690100	1519800	19	17	55	8.2	0.23	0.01	52	50	0	127	3.5	0.3	298	120
NL48	668719	1527356	88	20	270	16	0.72	0.01	600	3	0	33	0	0.2	1350	300
NL49	676700	1509700	6.8	14	280	8.2	0.04	0.03	200	3	40	368	3.6	0.3	792	74
NL50	677700	1500700	3.8	7.8	220	3.1	0.72	0.01	140	4	20	370	1.3	0.4	608	42
NL51	685200	1526200	48	24	180	2.3	0.12	0.22	160	29	0	430	0.3	0.3	692	220
NL52	683800	1521200	8	16	180	2	1.4	0.02	140	2	19	315	1.2	0.2	570	84

Appendix II-a-3 : Chemical analysis of groundwater from observation wells in 1993 (DMR) continued

Well No.	UTM		Chemical Composition (in ppm.)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL53	657655	1516264	10	23	330	5.1	0.36	0	470	3	10	236	2.1	0.2	1030	120
NL54	685800	1535400	1	4.9	180	1.6	0.22	0	67	4	46	267	1.5	4	474	22
NL55	682500	1494700	530	970	5800	130	230	1.5	13000	1300	0	294	0	0.9	26600	5300
NL56	679400	1525900	3.8	25	200	3.1	1.3	0.02	180	3	7	275	0.01	0.3	556	110
NL57	657600	1521400	70	35	320	11	0.27	0.12	730	2	0	47	1.3	0.1	1590	320
NL58	662900	1507500	880	150	860	20	0.88	1.3	3400	28	0	25	0	0	7550	2800
NL59	671300	1519800	8.5	33	360	6.3	1.9	0	460	2	28	256	4.3	0.2	1070	160
NL60	676200	1496600	870	1240	4600	67	2.4	1.7	10700	810	0	293	0	0.2	22500	7280
NL61	682500	1499300	3.8	5.1	210	3.1	2.9	0	130	4	19	345	0.9	0.5	576	30
NL62	681000	1531800	0.8	3.6	180	1.2	0.88	0.01	61	2	61	241	0	0.3	404	17
NL63	683700	1508500	1.6	34	230	3.9	0.74	0	250	3	31	224	0.6	0.2	682	140
NL64	661823	1531565	60	15	76	5.5	0.94	0.45	72	6	0	344	2.3	0.1	404	210
NL65	665900	1550300	580	110	1400	52	3.6	0.07	3400	120	0	40	15	0	8220	1900
NL66	674763	1551464	2	17	200	2.7	0.72	0	220	3	15	267	0.8	0.2	534	75
NL67	666036	1500807	1600	390	2400	30	0.6	2.3	7600	190	0	11	7.4	0	18900	5500
NL68	643300	1526500	60	45	150	47	0.16	0.12	440	2	0	64	0.6	0.8	1100	340
NL69	638613	1519846	38	60	250	16	2.1	0.04	340	180	15	128	8.8	0.3	1040	340
NL70	652166	1511415	720	300	1900	18	0.72	1.7	4400	46	0	22	0	0.1	10600	3000
NL71	653800	1552800	54	3.1	92	6.6	0.16	0.02	230	9	0	25	0.5	0.2	694	150
NL72	641900	1545400	440	170	540	12	0.55	4.5	2000	140	0	200	1.2	0.2	4420	1800
NL73	640500	1534700	14	3.2	120	7	0.91	0.02	170	16	0	77	1.8	0.6	420	47
NL75	645100	1559400	2.6	3.4	100	3.5	0.55	0	32	3	18	209	1.2	0.2	300	20
NL76	687270	1560760	4.5	0	130	3.1	0.4	0	110	9	30	92	1	0.2	354	11
NL78	663979	1562311	900	180	1400	15	0.32	2.2	4400	180	0	29	3	0	10300	3000
NL79	704688	1556688	3.2	2.8	37	1.6	0.08	0	20	2	1	71	0	0.2	100	20
NL80	684886	1548833	3.6	9.2	200	6.6	1.8	0	230	3	47	69	0	0.3	566	47
NL81	700500	1515000	3.2	4.4	210	3.5	2.2	0	140	34	89	128	0	0.4	596	26
NL82	657054	1511793	790	250	1300	22	0.58	0.4	4200	230	0	21	7.6	0.1	10900	3000
NL83	657900	1523400	180	59	170	6.3	1.2	0.02	680	48	0	70	2.9	0.1	1860	680
NL84	695600	1526000	15	9.7	130	5.1	1.2	0.01	98	150	0	53	0.1	0.3	468	78
NL85	704600	1521200	7.2	9.8	180	13	0.53	0.01	140	140	38	177	0	0.4	566	58

Appendix II-a-4 : Chemical analysis of groundwater from observation wells in 1994 (DMR)

Well No.	UTM		Chemical Composition (in ppm.)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL01	690600	1494900	1100	1000	8000	120	3.9	0.52	1600	2000	0	37	1.7	0	33100	7000
NL02	688800	1505600	10	7.1	180	2.3	0.64	0	190	3	8	186	0.3	0.3	480	54
NL03	683600	1515600	11	20	230	13	3.8	0	230	5	8	258	33	1.1	694	76
NL06	677700	1532800	29	26	74	25	0.52	0.05	93	200	0	49	5.6	0.1	500	180
NL07	689100	1540700	0	3.2	320	0.8	0.57	0.01	170	73	120	225	0	0.5	884	13
NL08	677789	1551413	13	12	200	0.5	0.88	0	120	8	24	392	25	0.4	570	83
NL09	665764	1543431	100	210	970	19	5.8	0.18	2100	8	18	165	57	0.4	4480	1100
NL11	680100	1519900	170	110	850	11	1.6	1.2	1900	8	0	156	11	0.2	3770	860
NL12	665126	1569478	430	190	1000	15	10	3.6	2700	190	0	53	4.8	0.1	6020	1860
NL13	681900	1571400	12	24	360	4.7	0.62	0.16	370	3	31	368	0.01	0.01	1090	130
NL14	694082	1552844	0	4.4	310	4.3	0.21	0	210	20	46	343	0.9	0.2	822	18
NL16	688700	1528000	6.1	3.6	160	2.3	0.67	0.02	22	7	22	384	1.9	0.3	420	30
NL17	671000	1517400	62	110	150	9.4	2.1	0.04	620	2	0	22	11	0.2	1430	620
NL18	649800	1504800	1600	440	6200	120	5.5	0.06	12000	1200	0	45	0.1	0.1	26000	5800
NL19	636700	1513100	20	27	83	5.1	9.8	0.02	100	3	4	190	0.5	0.6	414	160
NL21	697100	1562800	7.8	13	310	3.1	1.1	0.01	380	21	14	161	0.4	0.2	842	74
NL22	704200	1543500	0	6.6	260	0.88	0.34	0	200	4	34	334	0.4	0.4	814	27
NL24	639500	1503300	420	410	1100	3.9	3.5	1.4	3300	13	0	75	1.2	0.3	7050	2700
NL25	670100	1523500	150	110	480	11	1.5	0.16	1200	3	0	24	4.1	0.1	2660	820
NL26	673919	1543915	430	62	600	9	0.57	0.07	1800	7	0	22	0	0.1	3830	1330
NL27	670400	1509100	10	7.8	230	3.1	1.4	0	260	3	18	168	0.8	0.2	644	57
NL28	671400	1509700	3.2	5.6	130	2.7	0.5	0	40	3	32	244	0	0.2	348	31
NL30	686800	1512200	6.1	2.1	230	2.7	4.4	0	220	4	13	293	3.8	0.2	670	100
NL31	672200	1528900	34	11	150	3.9	0.74	0.3	110	4	0	376	2.6	0.2	540	130
NL32	637412	1510997	12	13	140	3.5	0.21	0.03	190	2	6	93	0	0.8	420	84
NL34	665400	1521800	70	39	150	8.2	0.42	0	420	1	0	32	0	0.1	1000	330
NL35	673300	1524000	6.6	6.4	130	3.9	0.12	0	13	4	0	348	0.5	0.2	336	43
NL36	678800	1522700	3.5	4.9	140	3.1	0.14	0	84	5	23	209	0.02	0.2	402	29
NL37	684700	1504700	5.4	6.7	150	2.7	0.02	0	24	2	48	292	0.1	0.4	416	41
NL38	665900	1514800	3.5	3.5	160	0	0.64	0	41	3	13	320	0.9	0.4	410	23
NL39	664500	1514800	16	8.7	83	5.5	0.48	0.01	9.2	1	13	242	0.7	0.1	262	76
NL40	674224	1548714	0	5.3	210	1.2	0.16	0	240	3	23	148	0.1	0.1	670	22
NL41	666776	1536872	180	56	340	13	0.28	0.27	960	5	0	38	1.5	0.1	1960	680
NL42	677200	1513900	58	88	280	5.5	4.7	0.97	600	3	0	169	1.3	0.1	1400	510
NL43	693800	1502900	4.8	10	240	2.7	0.78	0	170	47	16	251	1.8	0.5	646	54
NL44	682200	1512600	25	48	420	9	1.5	0.15	670	31	10	165	0.7	0.1	1400	260
NL45	676800	1537900	0	5.3	200	7	0.19	0	270	2	18	56	0	0.8	608	22
NL46	673300	1539400	300	130	640	8.6	1.4	1.6	1900	2	0	53	4.1	0.1	4130	1300
NL47	690100	1519800	23	8	78	5.5	1.9	0	57	48	6	143	4.2	0.3	304	90
NL48	668719	1527356	8	6.8	120	3.1	0.88	0	15	2	18	316	0.8	0.2	380	48
NL50	677700	1500700	4.2	4.7	190	2	1	0.02	68	4	40	338	0.3	0.5	524	30
NL51	685200	1526200	40	24	180	3.1	0.11	0.15	180	31	0	385	0.1	0.3	700	200
NL52	683800	1521200	27	27	290	3.1	1.8	0.34	360	10	15	293	1.6	0.2	928	180
NL53	657655	1516264	2	50	310	3.9	0.43	0	410	2	89	264	0.2	0.2	866	210

Appendix II-a-4 : Chemical analysis of groundwater from observation wells in 1994 (DMR) continued

Well No.	UTM		Chemical Composition (in ppm.)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL54	685800	1535400	3.2	7	180	2.3	1.7	0.02	44	15	33	351	1.3	0.3	450	37
NL55	682500	1494700	460	890	4700	81	120	2.5	10000	790	0	235	0.5	0.5	21300	4800
NL56	679400	1525900	10	23	17	2	2.3	0.08	180	5	0	298	2	0.3	548	120
NL57	657600	1521400	100	90	200	16	0.23	0.08	700	1	0	84	0.5	0.1	1440	630
NL59	671300	1519800	11	24	350	5.1	1.6	0.01	430	1	31	256	0.7	0.1	994	120
NL60	676200	1496600	260	110	940	17	6.3	0.84	2400	98	0	59	1.5	0.1	4770	1100
NL61	682500	1499300	3.4	7.3	200	3.5	5.6	0	92	12	15	363	2.4	0.5	564	38
NL62	681000	1531800	3.5	5.4	180	2	0.69	0	86	6	34	273	1	0.2	474	31
NL63	683700	1508500	4.5	16	280	3.5	2.8	0	350	4	14	200	0.2	0.2	800	74
NL66	674763	1551464	0	15	200	2.3	0.46	0	160	3	13	290	0.4	0.2	604	62
NL68	643300	1526500	120	150	64	5.9	0.25	0.11	670	1	0	66	0.4	0.3	1550	930
NL70	652166	1511415	800	290	1400	18	0.31	2.6	4500	51	0	90	0.1	0.1	9160	3200
NL71	653800	1552800	56	18	150	5.1	0.35	0.05	340	2	0	81	1.9	0.2	754	210
NL73	640500	1534700	66	26	94	7.4	0.2	0.01	280	6	0	78	0.1	0.4	602	270
NL74	660565	1547845	460	110	400	14	0.41	0.04	1600	3	0	135	0.5	0.1	3460	1600
NL76	687270	1560760	0	6.6	180	5.5	0.16	0.01	200	2	11	163	0.3	0.2	522	27
NL77	705900	1500900	33	33	660	20	0.53	0.02	1200	73	0	66	0	0.3	2300	220
NL78	663979	1562311	1100	40	1400	20	0.67	1.9	4200	47	0	36	0.1	0.1	8780	3000
NL79	704688	1556688	0.8	0.5	83	1.7	0.8	0.02	53	4	41	23	0	0.4	192	4
NL80	684886	1548833	81	63	480	3.9	1.1	0.05	990	7	0	84	0.4	0.2	2000	460
NL81	700500	1515000	64	530	3400	130	6.6	0.03	5800	9	380	0	120	0.4	12410	2360
NL82	657054	1511793	750	150	1300	20	0.89	0.61	3800	62	0	81	0.3	0.1	8200	2500
NL83	657900	1523400	0.8	7.8	160	9.4	0.24	0.01	200	2	15	138	0	0.1	440	34
NL84	695600	1526000	0	9	380	4.3	1.3	0	480	3	15	184	0	1	1120	37
NL85	704600	1521200	0	1.9	200	10	1.1	0	150	4	100	63	0.1	0.5	640	8

Appendix II-a-5 : Chemical analysis of groundwater from observation wells in 1995 (DMR)

Well No.	UTM		Chemical Composition (in ppm.)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL01	690600	1494900	480	4400	3700	130	12.0	0.05	17000	1500	0	51	2.7	0.1	27500	19000
NL02	688800	1505600	0	21	160	7	0.2	0.02	180	3	0	240	0.2	0.2	597	110
NL06	677700	1532800	27	18	37	16	0.3	0.05	62	82	0	73	4.5	0.0	338	140
NL07	689100	1540700	5	7	260	0	2.5	0.01	140	12	46	355	1.3	0.6	663	41
NL08	677789	1551413	10	11	200	4	0.5	0.00	150	5	20	306	2.3	0.4	638	69
NL12	665126	1569478	92	440	1200	25	3.7	3.90	3100	230	0	35	7.7	0.0	6810	2000
NL13	681900	1571400	5	55	420	14	0.2	0.41	600	52	15	356	0.2	0.1	1440	230
NL14	694082	1552844	2	11	310	47	0.7	0.00	230	4	34	393	2.2	0.2	880	50
NL15	701400	1532300	2	66	420	4	1.2	0.01	450	64	19	346	0.9	0.9	1250	90
NL16	688700	1528000	1	5	160	2	0.5	0.04	20	6	40	324	0.0	0.3	470	24
NL19	636700	1513100	26	30	57	4	0.4	0.02	70	2	12	230	0.4	0.7	332	190
NL21	697100	1562800	5	9	270	3	4.2	0.00	330	39	6	144	0.1	0.2	886	50
NL22	704200	1543500	1	4	260	0	0.1	0.00	210	5	24	336	0.1	0.4	678	19
NL23	675126	1562150	5	92	160	1	0.8	0.11	120	5	39	286	0.5	0.3	634	130
NL26	673919	1543915	190	37	480	12	0.4	0.01	1200	5	0	29	2.6	0.1	2140	640
NL30	686800	1512200	980	710	4500	56	34.0	6.40	11000	600	0	318	8.8	0.1	22700	5300
NL31	672200	1528900	32	23	170	6	0.4	0.39	200	4	0	324	4.1	0.1	648	170
NL34	665400	1521800	50	62	110	10	0.4	0.00	400	1	0	51	0.1	0.1	819	380
NL35	673300	1524000	5	3	120	1	0.1	0.00	12	4	0	335	0.0	0.1	342	24
NL36	678800	1522700	3	9	140	4	3.4	0.01	120	7	15	211	0.8	0.2	405	42
NL37	684700	1504700	4	6	150	3	0.4	0.00	24	4	26	325	0.9	0.3	398	34
NL38	665900	1514800	3	13	140	4	0.1	0.03	38	2	18	340	0.7	0.4	381	62
NL40	674224	1548714	2	9	240	0	0.3	0.00	300	2	6	151	0.3	0.1	656	39
NL41	666776	1536872	180	75	350	10	0.2	0.03	1000	3	0	38	1.3	0.1	1880	770
NL42	677200	1513900	53	62	210	8	1.6	0.86	470	3	0	227	0.9	0.2	1180	380
NL43	693800	1502900	4	6	210	0	0.6	0.00	180	45	19	226	3.1	0.4	618	33
NL44	682200	1512600	21	14	190	3	11.0	0.01	180	15	18	291	1.8	0.2	606	110
NL45	676800	1537900	16	21	230	5	0.3	0.00	380	2	0	71	0.7	0.8	780	130
NL46	673300	1539400	340	150	660	0	0.4	0.75	2100	3	0	43	0.5	0.1	3570	1500
NL48	668719	1527356	16	18	120	0	2.4	0.00	66	3	0	355	1.4	0.2	347	120
NL50	677700	1500700	2	16	170	4	0.2	0.00	68	4	41	340	0.1	0.4	484	74
NL51	685200	1526200	21	130	270	1	0.3	1.80	760	42	2	139	0.2	0.1	1880	590
NL54	685800	1535400	1	8	170	0	0.6	0.02	50	5	45	312	0.7	0.2	466	33
NL56	679400	1525900	8	83	300	5	1.1	0.04	650	3	3	141	0.6	0.2	1510	350
NL59	671300	1519800	10	16	320	4	1.4	0.04	370	2	9	302	1.3	0.2	882	87
NL60	676200	1496600	180	260	640	9	0.2	0.23	1800	66	0	75	3.0	0.1	3740	1500
NL61	682500	1499300	2	13	180	0	0.5	0.04	80	4	41	320	2.1	0.4	584	60
NL62	681000	1531800	8	14	170	3	1.9	0.02	130	4	37	237	0.6	0.1	522	77
NL63	683700	1508500	8	46	230	10	0.9	0.00	380	4	27	170	0.1	0.2	1040	210
NL64	661823	1531565	19	13	76	1	0.5	0.25	83	2	12	159	1.2	0.0	328	100
NL66	674763	1551464	10	33	230	11	0.3	0.01	260	6	0	270	0.9	0.2	734	170
NL76	687270	1560760	4	18	200	1	0.4	0.00	260	5	12	147	0.8	0.2	618	84
NL77	705900	1500900	64	110	340	11	0.6	0.00	680	82	32	320	1.8	0.5	1560	600
NL79	704688	1556688	1	0	76	2	0.3	0.00	53	3	33	51	0.1	0.4	288	4

Appendix II-a-5 : Chemical analysis of groundwater from observation wells in 1995 (DMR) continued

Well No.	UTM		Chemical Composition (in ppm.)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL80	684886	1548833	2	4	190	5	1.9	0.00	170	22	28	191	0.5	0.3	600	21
NL84	695600	1526000	1	0	140	2	0.2	0.00	100	4	78	36	0.1	0.5	388	3
NL85	704600	1521200	2	12	220	5	0.4	0.01	200	5	139	14	2.1	0.5	750	20
NL88	632900	1524800	44	31	57	7	0.2	0.01	98	12	0	246	0.3	0.5	408	230
NL90	629200	1534700	80	36	62	3	0.1	0.08	170	27	0	271	0.4	0.7	686	350
NL91	615200	1543100	24	12	160	3	0.7	0.03	56	46	0	380	5.4	1.7	580	110
NL92	618400	1528100	-	-	-	-	0.3	0.00	4.8	-	-	-	-	-	261	180
NL93	609400	1524350	-	-	-	-	0.9	0.09	430	-	-	-	-	-	1330	560
NL94	627100	1550500	-	-	-	-	2.6	0.00	6	-	-	-	-	-	325	34

Appendix II-a-6 : Chemical analysis of groundwater from observation wells in 1996 (DMR)

Well No.	UTM		Chemical Composition (in ppm.)					
	Northing	Easting	Fe	Mn	Cl	SO4	TDS	TOH
NL01	690600	1494900	3.30	0.11	16000	2220	27000	13000
NL02	688800	1505600	0.46	0.00	190	3	564	78
NL03	683600	1515600	0.92	0.00	150	7	676	32
NL04	663884	1505820	0.10	0.61	7900	660	13500	7500
NL05	654109	1538551	6.40	0.96	64	25	473	260
NL09	665764	1543431	55.00	3.20	3880	140	7040	2570
NL11	680100	1519900	28.00	4.70	4500	19	7860	2900
NL17	671000	1517400	2.30	0.07	750	2	1530	730
NL18	649800	1504800	3.80	1.00	12000	22	21100	6200
NL19	636700	1513100	0.74	0.01	60	3	340	130
NL22	704200	1543500	0.48	0.00	290	9	1080	72
NL24	639500	1503300	1.60	1.20	2200	6	4210	1700
NL25	670100	1523500	12.00	0.27	930	1	1860	480
NL28	671400	1509700	9.80	0.01	93	6	478	180
NL32	637412	1510997	0.16	0.07	1700	4	3500	970
NL33	638300	1497800	0.78	0.01	180	2	650	240
NL34	665400	1521800	0.76	0.13	340	1	715	230
NL37	684700	1504700	0.40	0.00	16	2	395	41
NL38	665900	1514800	0.16	0.01	49	2	419	33
NL39	664500	1525700	0.34	0.01	15	2	248	68
NL42	677200	1513900	3.70	0.01	240	2	708	170
NL43	693800	1502900	0.42	0.01	200	51	696	63
NL44	682200	1512600	0.02	0.01	91	14	479	69
NL47	690100	1519800	0.52	0.05	63	31	365	99
NL50	677700	1500700	0.28	0.00	47	3	500	41
NL52	683800	1521200	0.06	0.02	160	11	633	91
NL53	657655	1516264	0.88	0.00	240	4	850	200
NL57	657600	1521400	0.48	0.05	720	4	1420	540
NL58	662900	1507500	0.10	0.08	3440	28	6170	3300
NL59	671300	1519800	0.16	0.03	220	2	780	100
NL61	682500	1499300	8.80	0.00	64	3	516	35
NL63	683700	1508500	0.04	0.03	440	5	1070	120
NL65	665900	1550300	58.00	0.07	4430	210	7970	3480
NL67	666036	1500807	3.60	0.72	3880	500	13100	4170
NL68	643300	1526500	0.24	0.11	1200	7	2300	970
NL69	638613	1519846	0.72	0.23	190	3	650	280
NL70	652166	1511415	0.70	0.45	4500	96	8000	3100
NL71	653800	1552800	1.80	0.05	320	8	696	180
NL72	641900	1545400	0.20	0.00	430	11	897	210
NL73	640500	1534700	0.52	0.00	280	10	625	120
NL74	660565	1547845	0.06	0.04	1600	3	3040	1580
NL75	645100	1559400	0.62	0.00	72	6	380	49
NL77	705900	1500900	1.00	0.03	890	54	2030	370
NL78	663979	1562311	0.50	1.90	4460	58	7940	3860
NL82	657054	1511793	0.86	0.65	160	10	656	140
NL83	657900	1523400	0.80	0.00	160	9	490	10

Appendix II-a-7 : Chemical analysis of groundwater from observation wells in 1997 (DMR)

Well No.	UTM		Chemical Composition (in ppm.)					
	Northing	Easting	Fe	Mn	Cl	SO4	TDS	TOH
NL01	690600	1494900	4.90	0.15	15400	2000	27200	6900
NL02	688800	1505600	0.27	0.00	200	2	597	52
NL03	683600	1515600	64.00	15.00	8820	600	15600	5600
NL06	677700	1532800	0.29	0.02	50	32	226	99
NL09	665764	1543431	77.00	4.30	4500	200	8640	2700
NL11	680100	1519900	13.00	3.70	4000	5	7220	1960
NL16	688700	1528000	0.17	0.00	52	6	754	24
NL18	649800	1504800	0.56	0.04	12000	1300	22400	5600
NL19	636700	1513100	0.84	0.03	26	17	343	130
NL25	670100	1523500	2.30	0.17	870	2	1810	390
NL29	672800	1515800	0.55	0.00	76	7	511	46
NL31	672200	1528900	0.44	0.54	120	2	573	160
NL35	673300	1524000	0.18	0.00	72	2	358	28
NL37	684700	1504700	0.28	0.00	77	3	513	73
NL43	693800	1502900	0.30	0.00	190	35	689	40
NL50	677700	1500700	0.57	0.00	45	3	494	32
NL57	657600	1521400	0.16	0.00	680	2	1500	330
NL61	682500	1499300	0.75	0.00	64	7	516	26
NL63	683700	1508500	0.44	0.00	477	2	1120	120
NL65	665900	1550300	1.40	0.02	4400	210	8380	2800
NL66	674763	1551464	0.24	7.20	3820	280	7280	2900
NL67	666036	1500807	0.52	1.60	9000	740	16200	7100
NL68	643300	1526500	0.24	0.11	1200	7	2300	970
NL69	638613	1519846	0.24	0.19	66	2	464	200
NL70	652166	1511415	0.18	0.14	4500	90	8450	3200
NL71	653800	1552800	0.32	0.02	370	1	851	220
NL72	641900	1545400	0.38	0.03	320	5	793	200
NL73	640500	1534700	0.50	0.00	270	4	648	120
NL74	660565	1547845	0.56	0.27	1700	0	3400	1500
NL75	645100	1559400	0.10	0.01	48	2	369	60
NL77	705900	1500900	0.06	0.00	850	3	1900	230
NL78	663979	1562311	18.00	7.50	7200	970	13700	5500
NL82	657054	1511793	0.24	0.36	2900	34	5700	1600
NL83	657900	1523400	0.18	0.00	160	1	544	9
NL88	632900	1524800	0.16	0.01	66	2	395	160
NL89	626100	1515900	0.22	0.00	8	1	183	74
NL90	629200	1534700	0.18	0.00	28	2	278	110
NL91	615200	1543100	0.40	0.00	100	2	531	15
NL92	618400	1528100	0.20	0.00	120	1	197	120
NL93	609400	1524350	0.22	0.03	190	1	614	370
NL94	627100	1550500	0.20	0.00	32	2	347	24

Appendix II-a-8 : Chemical analysis of groundwater from observation wells in 1998 (DMR)

Well No.	UTM		Chemical Composition (in ppm.)					
	Northing	Easting	Fe	Mn	Cl	SO4	TDS	TOH
NL0001	690600	1494900	2.10	0.06	16000	2400	26700	6400
NL0002	688800	1505600	0.40	0.00	260	4	683	61
NL0003	683600	1515600	19.00	6.30	9200	420	15600	4800
NL0004	663884	1505820	0.96	0.45	5200	10	8900	4500
NL0005	654109	1538551	3.70	0.01	470	490	1730	690
NL0006	677700	1532800	1.10	0.39	320	500	1270	680
NL0007	689100	1540700	0.30	0.00	190	110	956	18
NL0008	677789	1551413	0.04	0.01	220	8	774	91
NL0009	665764	1543431	1.70	0.05	1800	0	3730	790
NL0010	673100	1503900	24.00	0.00	25	34	225	120
NL0011	680100	1519900	11.00	5.40	4200	3	7870	2100
NL0012	665126	1569478	16.00	6.30	3600	250	6660	2300
NL0013	681900	1571400	0.52	0.00	800	27	1740	380
NL0014	694082	1552844	0.00	0.01	220	2	897	52
NL0015	701400	1532300	0.92	0.00	540	3	1480	28
NL0016	688700	1528000	0.38	0.00	54	2	494	24
NL0017	671000	1517400	0.08	0.02	780	0	1610	730
NL0018	649800	1504800	5.20	1.50	13000	2600	20000	5200
NL0019	636700	1513100	0.62	0.02	51	2	315	150
NL0022	704200	1543500	0.18	0.00	290	2	1030	54
NL0024	639500	1503300	1.00	0.11	2200	1	3900	400
NL0025	670100	1523500	1.50	0.04	680	0	1460	320
NL0026	673919	1543915	0.62	0.01	530	0	1090	140
NL0028	671400	1509700	110.00	3.60	9800	170	16800	4200
NL0031	672200	1528900	0.90	0.91	810	10	1920	550
NL0032	637412	1510997	1.60	0.00	110	1	425	180
NL0033	638300	1497800	1.00	0.00	240	1	594	320
NL0034	665400	1521800	0.32	0.00	310	6	676	240
NL0035	673300	1524000	0.54	0.01	28	7	385	39
NL0036	678800	1522700	0.24	0.03	89	6	447	54
NL0037	684700	1504700	1.20	0.00	93	2	534	62
NL0038	665900	1514800	0.58	0.00	42	2	415	21
NL0039	664500	1525700	0.52	0.00	1900	6	3670	1300
NL0040	674224	1548714	0.00	0.00	410	1	923	65
NL0041	666776	1536872	1.60	0.01	1000	0	2070	790
NL0042	677200	1513900	0.24	0.13	62	1	518	92
NL0043	693800	1502900	0.28	0.00	210	29	741	44
NL0044	682200	1512600	3.50	0.00	470	32	1160	110
NL0045	676800	1537900	0.74	0.03	1200	0	2420	810
NL0046	673300	1539400	0.28	1.10	2320	5	4070	1800
NL0047	690100	1519800	2.40	0.00	65	19	451	91
NL0048	668719	1527356	1.20	0.00	42	1	339	89
NL0049	676700	1509700	0.72	0.00	150	2	715	110
NL0050	677700	1500700	0.38	0.00	48	2	495	28

Appendix II-a-8 : Chemical analysis of groundwater from observation wells in 1998 (DMR) continued

Well No.	UTM		Chemical Composition (in ppm.)					
	Northing	Easting	Fe	Mn	Cl	SO4	TDS	TOH
NL0051	685200	1526200	0.68	4.00	1100	15	2480	1000
NL0052	683800	1521200	2.00	0.20	360	24	1030	180
NL0053	657655	1516264	0.88	0.00	240	19	825	130
NL0054	685800	1535400	0.42	0.02	140	6	616	51
NL0056	679400	1525900	1.50	4.10	1200	0	2460	960
NL0057	657600	1521400	0.32	0.03	670	1	1300	470
NL0058	662900	1507500	0.32	0.04	3400	2	5770	3200
NL0059	671300	1519800	1.40	0.00	140	1	586	42
NL0061	682500	1499300	0.22	0.00	46	3	476	22
NL0062	681000	1531800	0.26	4.40	8700	75	14900	6100
NL0063	683700	1508500	0.28	0.00	530	2	1220	120
NL0064	661823	1531565	0.48	0.01	160	2	456	120
NL0065	665900	1550300	7.10	0.02	4500	19	7860	3100
NL0066	674763	1551464	3.30	8.10	6200	240	10500	4900
NL0067	666036	1500807	3.10	0.91	8100	450	13200	6500
NL0069	638613	1519846	1.20	0.03	100	4	382	160
NL0070	652166	1511415	1.60	0.05	4700	180	7800	3300
NL0071	653800	1552800	2.10	0.02	400	6	839	250
NL0072	641900	1545400	0.42	0.00	200	1	463	62
NL0073	640500	1534700	0.78	0.00	330	1	722	190
NL0075	645100	1559400	0.82	0.00	44	1	333	56
NL0076	687270	1560760	0.36	0.00	260	2	754	36
NL0077	705900	1500900	0.60	0.00	870	2	1900	240
NL0078	663979	1562311	0.66	0.28	5100	220	8900	4000
NL0079	704688	1556688	0.00	0.00	100	2	442	2
NL0080	684886	1548833	0.00	0.01	260	300	1250	350
NL0083	657900	1523400	0.70	0.00	180	1	348	28
NL0084	695600	1526000	0.28	0.00	180	2	518	31
NL0085	704600	1521200	0.12	0.00	210	2	858	4

Appendix II-a-9 : Chemical analysis of groundwater from observation wells in 1999 (DMR)

Well No.	UTM		Chemical Composition (in ppm.)					
	Northing	Easting	Fe	Mn	Cl	SO4	TDS	TOH
NL0004	663884	1505820	2.20	0.32	7800	700	14200	6800
NL0009	665764	1543431	1.50	0.01	1800	10	3950	1000
NL0012	665126	1569478	0.52	0.10	370	50	904	240
NL0013	681900	1571400	0.36	0.03	800	10	1880	230
NL0014	694082	1552844	0.42	0.01	240	10	910	61
NL0015	701400	1532300	4.50	0.00	650	10	1620	110
NL0018	649800	1504800	1.50	0.11	12000	1300	21900	6400
NL0019	636700	1513100	0.42	0.00	48	10	354	140
NL0022	704200	1543500	0.70	1.20	1100	110	2370	880
NL0023	675126	1562150	1.40	0.03	42	10	539	110
NL0024	639500	1503300	0.82	0.26	1500	27	3020	1500
NL0026	673919	1543915	0.84	0.00	580	10	1280	170
NL0028	671400	1509700	27.00	2.40	5800	120	11000	4000
NL0032	637412	1510997	2.40	0.12	260	10	728	280
NL0033	638300	1497800	0.98	0.15	300	10	852	330
NL0034	665400	1521800	3.80	6.20	950	30	2150	1150
NL0037	684700	1504700	0.20	0.02	1.5	24	409	56
NL0038	665900	1514800	0.30	0.01	36	10	408	29
NL0040	674224	1548714	0.58	0.01	500	10	1120	120
NL0041	666776	1536872	0.12	0.00	110	10	496	66
NL0042	677200	1513900	7.60	0.02	38	10	467	65
NL0046	673300	1539400	1.60	0.05	510	10	1090	250
NL0048	668719	1527356	2.90	0.28	10	7	367	110
NL0050	677700	1500700	0.12	0.00	34	10	486	30
NL0051	685200	1526200	0.48	1.50	440	34	1100	320
NL0053	657655	1516264	1.20	0.01	240	10	916	160
NL0057	657600	1521400	3.90	1.70	640	19	1260	640
NL0058	662900	1507500	5.40	8.60	3400	130	6560	3500
NL0059	671300	1519800	1.00	0.01	110	10	582	56
NL0064	661823	1531565	1.90	0.00	150	10	601	240
NL0065	665900	1550300	14.00	0.00	2400	96	4750	1300
NL0066	674763	1551464	1.40	1.50	850	59	2130	650
NL0067	666036	1500807	15.00	22.00	10000	1000	18000	8000
NL0069	638613	1519846	0.66	0.12	48	10	441	200
NL0070	652166	1511415	17.00	6.20	4800	340	8000	4200
NL0071	653800	1552800	8.60	1.70	420	11	906	470
NL0072	641900	1545400	1.50	0.36	62	10	400	170
NL0073	640500	1534700	0.94	0.01	430	10	949	270
NL0074	660565	1547845	2.70	0.08	1700	10	3410	1600
NL0076	687270	1560760	0.80	0.00	240	10	767	8
NL0078	663979	1562311	9.90	2.10	4900	210	9300	3500
NL0079	704688	1556688	0.60	0.01	110	10	436	10
NL0089	626100	1515900	0.28	0.02	11	10	302	220
NL0090	629200	1534700	4.90	0.06	28	21	342	210
NL0091	615200	1543100	1.70	0.02	110	1	508	35

Appendix II-a-10 : Chemical analysis of groundwater from observation wells in 2000

Well No.	UTM		Chemical Composition (in ppm.)													
	Northing	Easting	Ca	Mg	Na	K	Fe	Mn	Cl	SO4	CO3	HCO3	NO3	F	TDS	TOH
NL0019	636700	1513100	320	86	290	10.0	2.0	3.40	1100	21.0	0	289	2.20	0.40	1940	1200
NL0031	672200	1528900	120	61	100	3.9	0.5	0.14	320	24.0	16	252	2.20	0.50	330	772
NL0034	665400	1521800	33	8.8	100	2.3	0.2	0.30	3.2	11.0	0	385	2.20	0.40	314	120
NL0034	665400	1521800	300	79	220	10.0	1.3	5.60	890	31.0	0	240	2.10	0.30	2140	1100
NL0035	673300	1524000	300	79	220	10.0	1.3	5.60	890	31.0	0	240	2.10	0.30	2140	1100
NL0036	678800	1522700	13	9.6	120	2.0	0.1	0.10	3.6	11.0	37	304	2.20	0.40	352	72
NL0051	685200	1526200	21	11	120	2.4	0.6	0.10	4	20.0	42	299	2.20	0.40	367	99
NL0054	685800	1535400	52	15	190	1.7	3.6	0.30	170	38.0	48	295	2.20	0.40	657	190
NL0056	679400	1525900	15	13	170	1.1	1.7	0.20	17	42.0	34	388	2.20	0.50	484	90
NL0061	682500	1499300	35	11	130	1.7	0.3	0.20	23	60.0	39	334	2.20	0.40	464	140
NL0064	661823	1531565	5.3	5.2	240	3.1	3.8	0.00	170	5.0	39	252	2.20	0.40	664	34
NL0065	665900	1550300	57	11	75	6.3	0.5	0.71	22	25.0	20	340	2.20	0.40	0	382
NL0074	660565	1547845	1000	490	2400	46.0	19.0	7.40	6300	420.0	0	327	2.20	0.40	4300	10900
NL0078	663979	1562311	580	210	480	17.0	15.0	6.00	2200	56.0	0	175	2.20	0.40	3100	3600
NL0085	704600	1521200	1200	650	3000	27.0	16.0	6.50	7500	19.0	0	308	8.90	0.40	5500	12600
NL0089	626100	1515900	16	18	350	1.6	45.0	0.10	220	110.0	0	510	0.40	1.00	964	110
NL0094	627100	1550500	68	22	25	4.3	0.8	0.06	24	10.0	17	276	2.20	0.40	16	301

Appendix II-b: Milliequivalent Calculation

Ionic concentration can be converted into milliequivalent unit as follows:

$$\text{meq/L} = \frac{\text{ppm of ion x valency of ion}}{\text{Molecular weight}} \text{ meq/L}$$

For cation

$$\text{Ca} = \frac{\text{ppm of Ca x 2}}{40.08} \text{ meq/L}$$

$$\text{Mg} = \frac{\text{ppm of Mg x 2}}{24.31} \text{ meq/L}$$

$$\text{Na} = \frac{\text{ppm of Na x 1}}{22.99} \text{ meq/L}$$

$$\text{K} = \frac{\text{ppm of K x 1}}{39.1} \text{ meq/L}$$

For anion

$$HCO_3 = \frac{\text{ppm of } HCO_3 \text{ x 1}}{61} \text{ meq/L}$$

$$CO_3 = \frac{\text{ppm of } CO_3 \text{ x 2}}{60} \text{ meq/L}$$

$$\text{Cl} = \frac{\text{ppm of Cl x 1}}{35.45} \text{ meq/L}$$

$$SO_4 = \frac{\text{ppm of } SO_4 \text{ x 2}}{96} \text{ meq/L}$$

Percent of cation (% meq/L)

$$\%\ \text{meq/L of Ca+Mg} = \frac{\text{meq/L of (Ca+Mg)x100}}{\text{meq/L of (Ca+Mg+Na+k)}}$$

$$\%\ \text{meq/L of Na+K} = \frac{\text{meq/L of (Na+K)x100}}{\text{meq/L of (Ca+Mg+Na+k)}}$$

$$\%\ \text{meq/L of } HCO_3+CO_3 = \frac{\text{meq/L of } (HCO_3+CO_3)\text{x100}}{\text{meq/L of } (HCO_3+CO_3+\text{Cl}+SO_4)}$$

$$\%\ \text{meq/L of Cl+}SO_4 = \frac{\text{meq/L of (Cl+}SO_4\text{)x100}}{\text{meq/L of } (HCO_3+CO_3+\text{Cl}+SO_4)}$$

Appendix II-c-1 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-1 data in 1991

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	$Cl+SO_4$	HCO_3+CO_3
NL01	690600	1494900	27.82	72.18	99.93	0.07
NL02	688800	1505600	9.18	90.82	61.83	38.17
NL03	683600	1515600	6.52	93.48	43.66	56.34
NL04	663884	1505820	53.71	46.29	99.92	0.08
NL05	654109	1538551	54.81	45.19	50.09	49.91
NL06	677700	1532800	23.25	76.75	93.36	6.64
NL07	689100	1540700	3.18	96.82	44.07	55.93
NL08	677789	1551413	4.74	95.26	10.43	89.57
NL09	665764	1543431	53.07	46.93	99.10	0.90
NL10	673100	1503900	23.92	76.08	99.18	0.82
NL12	665126	1569478	50.69	49.31	98.95	1.05
NL13	681900	1571400	16.03	83.97	68.93	31.07
NL14	694082	1552844	2.02	97.98	48.57	51.43
NL16	688700	1528000	2.91	97.09	17.74	82.26
NL17	671000	1517400	43.46	56.54	94.73	5.27
NL18	649800	1504800	32.21	67.79	99.89	0.11
NL19	636700	1513100	43.68	56.32	64.30	35.70
NL20	654800	1531600	38.25	61.75	99.79	0.21
NL22	704200	1543500	2.39	97.61	46.39	53.61
NL24	639500	1503300	30.38	69.62	98.61	1.39
NL25	670100	1523500	39.35	60.45	97.23	2.77
NL26	673919	1543915	51.90	48.10	99.23	0.77
NL27	670400	1509100	8.90	91.10	65.08	34.92
NL28	671400	1509700	10.39	89.61	17.46	82.54
NL29	672800	1515800	53.05	46.95	98.48	1.52
NL30	686800	1512200	23.03	76.97	19.40	80.60
NL31	672200	1528900	21.65	78.35	23.22	76.78
NL32	637412	1510997	11.56	88.44	67.06	32.94
NL33	638300	1497800	43.61	56.39	36.94	63.06
NL34	665400	1521800	43.96	56.04	96.57	3.43
NL35	673300	1524000	7.49	92.51	8.19	91.81
NL36	678800	1522700	3.37	96.63	53.87	46.13
NL37	684700	1504700	6.06	93.94	22.67	77.33
NL38	665900	1514800	3.69	96.31	19.76	80.24
NL39	664500	1514800	33.26	66.74	51.68	48.32
NL40	674224	1548714	12.97	87.03	65.95	34.05
NL41	666776	1536872	47.18	52.82	96.68	3.32
NL42	677200	1513900	16.26	83.74	28.39	71.61
NL43	693800	1502900	4.90	95.10	56.42	43.58
NL44	682200	1512600	27.72	72.28	50.24	49.76
NL45	676800	1537900	4.59	95.41	79.94	20.06

Appendix II-c-1 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-1 data in 1991 continued

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	$Cl+SO_4$	HCO_3+CO_3
NL46	673300	1539400	52.01	47.99	95.96	4.04
NL48	668719	1527356	44.50	55.50	65.32	34.68
NL49	676700	1509700	8.49	91.51	16.36	83.64
NL50	677700	1500700	11.99	88.01	66.38	33.62
NL51	685200	1526200	25.97	74.03	44.18	55.82
NL52	683800	1521200	23.21	76.79	83.36	16.64
NL53	657655	1516264	17.82	82.18	88.90	11.10
NL54	685800	1535400	14.39	85.61	23.47	76.53
NL56	679400	1525900	14.51	85.49	69.17	30.83
NL57	657600	1521400	34.40	65.60	97.07	2.93
NL58	662900	1507500	60.88	36.12	99.82	0.18
NL59	671300	1519800	12.59	87.41	78.42	21.58
NL60	676200	1496600	26.92	73.08	98.61	1.39
NL61	682500	1499300	12.29	87.71	73.50	26.50
NL62	681000	1531800	7.28	92.72	17.99	82.01
NL63	683700	1508500	18.91	81.09	70.51	29.49
NL64	661823	1531565	43.48	56.52	31.76	68.24
NL65	665900	1550300	33.80	66.20	99.71	0.29
NL66	674763	1551464	43.23	56.77	89.71	10.29
NL67	666036	1500807	51.17	48.83	99.90	0.10
NL68	643300	1526500	87.92	12.08	82.37	17.63
NL69	638613	1519846	55.00	45.00	55.52	44.48
NL70	652166	1511415	53.53	46.47	99.78	0.22
NL71	653800	1552800	42.01	57.99	93.92	6.08
NL72	641900	1545400	17.95	82.05	48.33	51.67
NL73	640500	1534700	20.31	79.69	87.56	12.44
NL74	660565	1547845	65.83	34.17	98.75	1.25
NL75	645100	1559400	13.93	86.07	38.13	61.87
NL76	687270	1560760	13.08	86.92	49.64	50.36
NL77	663979	1562311	61.15	38.85	85.28	14.72
NL78	704688	1556688	46.12	53.88	27.45	72.55
NL79	684886	1548833	16.65	83.35	56.54	43.46

Appendix II-c-2 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-2 data in 1992

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	Cl+SO4	HCO3+CO3
NL01	690600	1494900	27.41	72.59	99.93	0.07
NL03	683600	1515600	7.83	92.17	44.46	55.54
NL04	663884	1505820	57.13	42.87	99.89	0.11
NL05	654109	1538551	50.17	49.83	50.45	49.55
NL06	677700	1532800	60.01	39.99	70.60	29.40
NL07	689100	1540700	9.80	90.20	39.93	60.07
NL08	677789	1551413	6.02	93.98	13.34	86.66
NL09	665764	1543431	52.99	47.01	99.16	0.84
NL11	680100	1519900	36.64	63.36	6.10	93.90
NL12	665126	1569478	51.07	48.93	99.35	0.65
NL13	681900	1571400	33.51	66.49	70.55	29.45
NL14	694082	1552844	3.69	96.31	50.94	49.06
NL16	688700	1528000	7.53	92.47	19.08	80.92
NL17	671000	1517400	49.43	50.57	97.10	2.90
NL18	649800	1504800	32.59	67.41	99.86	0.14
NL19	636700	1513100	38.75	61.25	66.26	33.74
NL21	697100	1562800	14.73	85.27	71.61	28.39
NL22	704200	1543500	5.29	94.71	49.22	50.78
NL24	639500	1503300	41.99	58.01	97.99	2.01
NL25	670100	1523500	40.13	59.87	98.77	1.23
NL26	673919	1543915	53.03	46.97	99.04	0.96
NL27	670400	1509100	8.38	91.62	70.74	29.26
NL28	671400	1509700	10.18	89.82	20.56	79.44
NL30	686800	1512200	19.84	80.16	28.00	72.00
NL31	672200	1528900	20.79	79.21	18.27	81.73
NL32	637412	1510997	16.42	83.58	67.17	32.83
NL33	665400	1521800	61.01	38.99	87.78	12.22
NL35	673300	1524000	5.22	94.78	11.03	88.97
NL36	678800	1522700	3.60	96.40	25.17	74.83
NL37	684700	1504700	2.78	97.22	17.18	82.82
NL38	665900	1514800	4.51	95.49	21.70	78.30
NL40	674224	1548714	10.27	89.73	67.39	32.61
NL41	666776	1536872	47.83	52.17	97.82	2.18
NL42	677200	1513900	20.36	79.64	25.20	74.80
NL43	693800	1502900	3.93	96.07	57.59	42.41
NL44	682200	1512600	30.16	69.84	38.29	61.71
NL45	676800	1537900	9.88	90.12	77.77	22.23
NL46	673300	1539400	38.23	61.77	98.20	1.80
NL47	690100	1519800	46.31	53.69	62.76	37.24
NL48	668719	1527356	11.97	88.03	13.99	86.01
NL49	676700	1509700	9.82	90.18	43.12	56.88

Appendix II-c-2 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-2 data in 1992 continued

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	Cl+SO4	HCO3+CO3
NL50	677700	1500700	8.90	91.10	47.97	52.03
NL51	685200	1526200	31.37	68.63	44.20	55.80
NL52	683800	1521200	14.81	85.19	54.79	45.21
NL53	657655	1516264	12.29	87.71	79.16	20.84
NL54	685800	1535400	16.07	83.93	25.38	74.62
NL55	682500	1494700	28.44	71.56	98.55	1.45
NL56	679400	1525900	16.93	83.07	57.68	42.32
NL57	657600	1521400	33.74	66.26	97.87	2.13
NL58	662900	1507500	60.47	39.53	99.69	0.31
NL59	671300	1519800	8.21	91.79	74.14	25.86
NL60	676200	1496600	36.87	63.13	99.14	0.86
NL61	682500	1499300	5.02	94.98	47.72	52.28
NL62	681000	1531800	20.86	79.14	21.93	78.07
NL63	683700	1508500	12.81	87.19	61.05	38.95
NL64	661823	1531565	41.60	58.40	42.97	57.03
NL65	665900	1550300	40.88	59.12	99.74	0.26
NL66	674763	1551464	16.27	83.73	51.32	48.68
NL67	666036	1500807	55.53	44.47	99.91	0.09
NL68	643300	1526500	48.89	51.11	90.29	9.71
NL69	638613	1519846	51.33	48.67	60.43	39.57
NL70	652166	1511415	52.16	47.84	99.83	0.17
NL71	653800	1552800	43.64	56.36	92.59	7.41
NL72	641900	1545400	17.28	82.72	82.84	17.16
NL73	640500	1534700	6.90	93.10	87.08	12.92
NL74	660565	1547845	61.26	38.74	99.10	0.90
NL75	645100	1559400	18.29	81.71	29.61	70.39
NL76	687270	1560760	3.29	96.71	57.94	42.06
NL77	663979	1562311	50.80	49.20	99.72	0.28
NL78	704688	1556688	11.68	88.32	35.94	64.06
NL79	684886	1548833	7.86	92.14	68.79	31.21
NL82	657054	1511793	52.20	47.80	97.23	2.77
NL84	695600	1526000	23.78	76.22	65.45	34.55
NL87	646100	1520200	52.10	47.90	54.00	46.00

Appendix II-c-3 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-3 data in 1993

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	Cl+SO4	HCO3+CO3
NL01	690600	1494900	27.42	72.58	99.91	0.09
NL02	688800	1505600	17.33	82.67	62.73	37.27
NL03	683600	1515600	20.47	79.53	61.52	38.48
NL04	663884	1505820	54.90	45.10	99.89	0.11
NL05	654109	1538551	46.56	53.44	65.45	34.55
NL06	677700	1532800	53.90	46.10	54.97	45.03
NL07	689100	1540700	3.78	96.22	37.36	62.64
NL08	677789	1551413	10.07	89.93	24.78	75.22
NL09	665764	1543431	52.89	47.11	99.16	0.84
NL10	673100	1503900	35.56	64.44	99.29	0.71
NL11	680100	1519900	22.43	77.57	17.72	82.28
NL12	665126	1569478	47.86	52.14	99.24	0.76
NL13	681900	1571400	20.31	79.69	66.66	33.34
NL14	694082	1552844	1.60	98.40	47.31	52.69
NL16	688700	1528000	4.83	95.17	17.84	82.16
NL17	671000	1517400	54.68	45.32	96.68	3.32
NL18	649800	1504800	13.50	86.50	99.82	0.18
NL19	636700	1513100	35.01	64.99	64.39	35.61
NL20	654800	1531600	6.96	93.04	73.32	26.68
NL21	697100	1562800	4.66	95.34	46.40	53.60
NL24	639500	1503300	50.10	49.90	96.30	3.70
NL25	670100	1523500	41.49	58.51	96.71	3.29
NL26	673919	1543915	52.06	47.94	99.04	0.96
NL28	671400	1509700	9.56	90.44	19.88	80.12
NL30	686800	1512200	15.40	84.60	40.35	59.65
NL31	672200	1528900	27.52	72.48	47.22	52.78
NL32	637412	1510997	10.56	89.44	79.61	20.39
NL34	665400	1521800	8.76	91.24	21.41	78.59
NL35	673300	1524000	4.35	95.65	9.84	90.16
NL36	678800	1522700	6.91	93.09	25.71	74.29
NL37	684700	1504700	5.90	94.10	15.56	84.44
NL38	665900	1514800	3.79	96.21	23.06	76.94
NL39	664500	1514800	39.63	60.37	6.62	93.38
NL40	674224	1548714	8.35	91.65	68.20	31.80
NL41	666776	1536872	44.72	55.28	97.49	2.51
NL42	677200	1513900	18.82	81.18	34.75	65.25
NL43	693800	1502900	45.76	54.24	96.20	3.80
NL44	682200	1512600	28.56	71.44	33.11	66.89
NL45	676800	1537900	6.49	93.51	77.20	22.80
NL46	673300	1539400	34.43	65.57	99.23	0.77

Appendix II-c-3 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-3 data in 1993 continued

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	Cl+SO4	HCO3+CO3
NL47	690100	1519800	47.42	52.58	54.65	45.35
NL48	668719	1527356	33.19	66.81	96.91	3.09
NL49	676700	1509700	10.74	89.26	43.64	56.36
NL50	677700	1500700	7.93	92.07	37.46	62.54
NL51	685200	1526200	35.65	64.35	42.06	57.94
NL52	683800	1521200	17.88	82.12	40.77	59.23
NL53	657655	1516264	14.17	85.83	76.02	23.98
NL54	685800	1535400	5.44	94.56	25.03	74.97
NL55	682500	1494700	29.36	70.64	98.79	1.21
NL56	679400	1525900	20.38	79.62	52.02	47.98
NL57	657600	1521400	30.98	69.02	96.40	3.60
NL58	662900	1507500	59.73	40.27	99.58	0.42
NL59	671300	1519800	16.56	83.44	71.73	28.27
NL60	676200	1496600	41.88	58.12	98.52	1.48
NL61	682500	1499300	6.20	93.80	37.36	62.64
NL62	681000	1531800	4.10	95.90	22.75	77.25
NL63	683700	1508500	22.16	77.84	60.19	39.81
NL64	661823	1531565	55.09	44.91	27.66	72.34
NL65	665900	1550300	37.91	62.09	99.34	0.66
NL66	674763	1551464	14.59	85.41	56.24	43.76
NL67	666036	1500807	51.56	48.44	99.92	0.08
NL68	643300	1526500	46.43	53.57	92.23	7.77
NL69	638613	1519846	37.72	62.28	83.70	16.30
NL70	652166	1511415	42.17	57.83	99.71	0.29
NL71	653800	1552800	41.43	58.57	94.22	5.78
NL72	641900	1545400	60.17	39.83	94.76	5.24
NL73	640500	1534700	15.12	84.88	80.25	19.75
NL75	645100	1559400	8.44	91.56	19.34	80.66
NL76	687270	1560760	3.77	96.23	56.75	43.25
NL78	663979	1562311	49.36	50.64	99.63	0.37
NL79	704688	1556688	19.12	80.88	33.60	66.40
NL80	684886	1548833	9.55	90.45	70.83	29.17
NL81	700500	1515000	5.35	94.65	47.90	52.10
NL82	657054	1511793	51.23	48.77	99.72	0.28
NL83	657900	1523400	64.68	35.32	94.62	5.38
NL84	695600	1526000	21.09	78.91	87.14	12.86
NL85	704600	1521200	12.50	87.50	62.22	37.78

Appendix II-c-4 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-4 data in 1994

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	Cl+SO4	HCO3+CO3
NL02	688800	1505600	12.07	87.93	62.05	37.95
NL03	683600	1515600	17.51	82.49	59.45	40.45
NL06	677700	1532800	48.17	51.83	89.42	10.58
NL07	689100	1540700	1.85	98.15	45.10	54.90
NL08	677789	1551413	15.81	84.19	32.95	67.05
NL09	665764	1543431	34.29	65.71	94.73	5.27
NL11	680100	1519900	32.00	68.00	95.46	4.54
NL12	665126	1569478	45.81	54.19	98.93	1.07
NL13	681900	1571400	14.02	85.98	59.77	40.23
NL14	694082	1552844	2.59	97.41	46.98	53.02
NL16	688700	1528000	7.88	92.12	9.83	90.17
NL17	671000	1517400	64.22	35.78	97.98	2.02
NL18	649800	1504800	29.85	70.15	99.80	0.20
NL19	636700	1513100	46.25	53.75	47.03	52.97
NL21	697100	1562800	9.71	90.29	78.22	21.78
NL22	704200	1543500	4.57	95.43	46.42	53.58
NL24	639500	1503300	53.28	46.72	98.70	1.30
NL25	670100	1523500	43.86	56.14	98.85	1.15
NL26	673919	1543915	50.22	49.78	99.30	0.70
NL27	670400	1509100	10.16	89.84	68.80	31.20
NL28	671400	1509700	9.78	90.22	19.03	80.97
NL30	686800	1512200	4.52	95.48	54.57	45.43
NL31	672200	1528900	28.20	71.80	34.08	65.92
NL32	637412	1510997	21.26	78.74	75.80	24.20
NL34	665400	1521800	49.88	50.12	95.77	4.23
NL35	673300	1524000	12.95	87.05	7.31	92.69
NL36	678800	1522700	8.56	91.44	37.11	62.89
NL37	684700	1504700	11.07	88.93	10.11	89.89
NL38	665900	1514800	6.23	93.77	17.67	82.33
NL39	664500	1514800	28.76	71.24	5.99	94.01
NL40	674224	1548714	4.54	95.46	68.15	31.85
NL41	666776	1536872	47.33	52.67	97.76	2.24
NL42	677200	1513900	45.13	54.87	85.98	14.02
NL43	693800	1502900	9.18	90.82	55.40	44.60
NL44	682200	1512600	21.93	78.07	86.55	13.45
NL45	676800	1537900	4.68	95.32	83.46	16.54
NL46	673300	1539400	47.77	52.23	98.41	1.59
NL47	690100	1519800	33.82	66.18	50.62	49.38
NL48	668719	1527356	15.32	84.68	7.44	92.56

Appendix II-c-4 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-4 data in 1994 continued

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	Cl+SO4	HCO3+CO3
NL50	677700	1500700	6.69	93.31	22.55	77.45
NL51	685200	1526200	33.42	66.58	47.56	52.44
NL52	683800	1521200	21.94	78.06	66.15	33.85
NL53	657655	1516264	23.67	76.33	61.41	38.59
NL54	685800	1535400	8.53	91.47	18.48	81.52
NL55	682500	1494700	31.77	68.23	98.73	1.27
NL56	679400	1525900	75.15	24.85	51.47	48.53
NL57	657600	1521400	57.64	42.36	93.49	6.51
NL59	671300	1519800	14.11	85.89	69.91	30.09
NL60	676200	1496600	34.77	65.23	98.63	1.37
NL61	682500	1499300	8.06	91.94	30.61	69.39
NL62	681000	1531800	7.28	92.72	31.26	68.74
NL63	683700	1508500	11.16	88.84	72.67	27.33
NL66	674763	1551464	12.35	87.65	46.87	53.13
NL68	643300	1526500	86.20	13.80	94.59	5.41
NL70	652166	1511415	50.97	49.03	98.86	1.14
NL71	653800	1552800	39.11	60.89	87.88	12.12
NL73	640500	1534700	55.94	44.06	86.25	13.75
NL74	660565	1547845	64.32	35.68	95.33	4.67
NL76	687270	1560760	6.38	93.62	65.16	34.84
NL77	705900	1500900	12.99	87.01	97.03	2.97
NL78	663979	1562311	48.65	51.35	99.51	0.49
NL79	704688	1556688	2.17	97.83	47.51	52.49
NL80	684886	1548833	30.54	69.46	95.32	4.68
NL81	700500	1515000	23.63	76.37	92.82	7.18
NL82	657054	1511793	46.59	53.41	98.79	1.21
NL83	657900	1523400	8.65	91.35	67.29	32.71
NL84	695600	1526000	4.26	95.74	79.46	20.54
NL85	704600	1521200	1.72	98.28	49.70	50.30

Appendix II-c-5 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-5 data in 1995

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	Cl+SO4	HCO3+CO3
NL01	690600	1494900	70.15	29.85	99.84	0.16
NL02	688800	1505600	19.51	80.49	56.64	43.36
NL06	677700	1532800	58.35	41.65	74.29	25.71
NL07	689100	1540700	6.79	93.21	36.35	63.65
NL08	677789	1551413	13.70	86.30	43.27	56.73
NL12	665126	1569478	43.57	56.43	99.38	0.62
NL13	681900	1571400	20.33	79.67	73.97	26.03
NL14	694082	1552844	6.46	93.54	46.45	53.55
NL15	701400	1532300	23.14	76.86	68.99	31.01
NL16	688700	1528000	6.54	93.46	9.40	90.60
NL19	636700	1513100	59.25	40.75	32.59	67.41
NL21	697100	1562800	7.98	92.02	79.81	20.19
NL22	704200	1543500	3.30	96.70	48.86	51.14
NL23	675126	1562150	52.76	47.24	36.81	63.19
NL26	673919	1543915	37.15	62.85	98.62	1.38
NL30	686800	1512200	35.24	64.76	98.41	1.59
NL31	672200	1528900	31.59	68.41	51.87	48.13
NL34	665400	1521800	60.14	39.86	93.11	6.89
NL35	673300	1524000	8.21	91.79	7.13	92.87
NL36	678800	1522700	12.20	87.80	47.14	52.86
NL37	684700	1504700	9.51	90.49	10.93	89.07
NL38	665900	1514800	16.57	83.43	15.28	84.72
NL40	674224	1548714	7.08	92.92	76.07	23.93
NL41	666776	1536872	49.47	50.53	97.84	2.16
NL42	677200	1513900	45.35	54.65	78.16	21.84
NL43	693800	1502900	7.05	92.95	58.10	41.90
NL44	682200	1512600	20.86	79.14	50.09	49.91
NL45	676800	1537900	19.97	80.03	90.24	9.76
NL46	673300	1539400	50.52	49.48	98.83	1.17
NL48	668719	1527356	30.39	69.61	24.85	75.15
NL50	677700	1500700	16.08	83.92	22.38	77.62
NL51	685200	1526200	49.93	50.07	90.49	9.51
NL54	685800	1535400	8.27	91.73	18.63	81.37
NL56	679400	1525900	35.37	64.63	88.41	11.59
NL59	671300	1519800	11.46	88.54	66.62	33.38
NL60	676200	1496600	51.96	48.04	97.70	2.30
NL61	682500	1499300	13.19	86.81	26.14	73.86
NL62	681000	1531800	17.05	82.95	42.29	57.71
NL63	683700	1508500	28.97	71.03	74.55	25.45

Appendix II-c-5 : Majors cation and anion in millequivalents per liter calculated from the Appendix II-a-5 data in 1995 continued

Well No.	UTM		Major Cation (%meq/L)		Major Anion (%meq/L)	
	Northing	Easting	Ca+Mg	Na+K	Cl+SO4	HCO3+CO3
NL64	661823	1531565	37.76	62.24	44.22	55.78
NL66	674763	1551464	23.81	76.19	62.76	37.24
NL76	687270	1560760	15.94	84.06	72.58	27.42
NL77	705900	1500900	44.82	55.18	76.79	23.21
NL79	704688	1556688	2.17	97.83	44.58	55.42
NL80	684886	1548833	4.83	95.17	56.38	43.62
NL84	695600	1526000	1.04	98.96	47.65	52.35
NL85	704600	1521200	10.08	89.92	54.16	45.84
NL88	632900	1524800	64.01	35.99	42.77	57.23
NL90	629200	1534700	71.54	28.46	54.67	45.33
NL91	615200	1543100	23.69	76.31	28.95	71.05

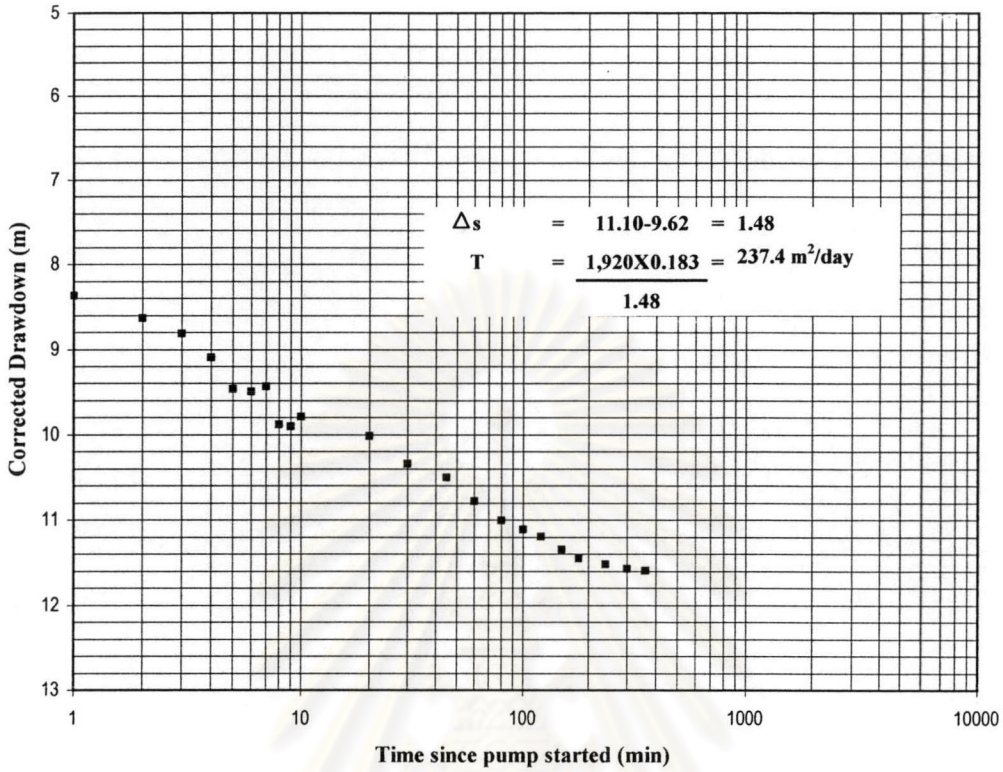
Appendices III Pumping Test Data

Appendix III-a-1: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 1		Hole Depth (m) : 230		Duration Time of Test (min) : 360	
UTM N : 1511550		Type of Test : Constant Rate		Screen Interval (m) : 185-191, 212-218	
E : 635625		Date of Pumping Test : 14/09/1988		Static Water Level (m) : 30.70	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
10.00	0	80	30.70	0.00	
10.01	1	80	39.14	8.44	8.37
10.02	2	80	39.40	8.70	8.63
10.03	3	80	39.58	8.88	8.81
10.04	4	80	39.86	9.16	9.09
10.05	5	80	40.23	9.53	9.46
10.06	6	80	40.26	9.56	9.49
10.07	7	80	40.20	9.50	9.43
10.08	8	80	40.65	9.95	9.88
10.09	9	80	40.67	9.97	9.90
10.10	10	80	40.56	9.86	9.79
10.20	20	80	40.78	10.08	10.01
10.30	30	80	41.11	10.41	10.34
10.45	45	80	41.27	10.57	10.50
11.00	60	80	41.55	10.85	10.78
11.20	80	80	41.77	11.07	11.00
11.40	100	80	41.88	11.18	11.11
12.00	120	80	41.96	11.26	11.19
12.30	150	80	42.11	11.41	11.34
13.00	180	80	42.22	11.52	11.45
14.00	240	80	42.29	11.59	11.52
15.00	300	80	42.34	11.64	11.57
16.00	360	80	42.36	11.66	11.59

Appendix III-a-1 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-1



Appendix III-a-2 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 2		Hole Depth (m) : 177		Duration Time of Test (min) : 360	
UTM N : 1564972		Type of Test : Constant Rate		Screen Interval (m) : 126-132, 159-162	
E : 674300		Date of Pumping Test : 08/01/1999		Static Water Level (m) : 36.18	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
10.00	0	90	36.18	0.00	
10.01	1	90	40.12	3.94	3.92
10.02	2	90	40.21	4.03	4.01
10.03	3	90	40.23	4.05	4.03
10.04	4	90	40.24	4.06	4.04
10.05	5	90	40.27	4.09	4.07
10.06	6	90	40.30	4.12	4.10
10.07	7	90	40.32	4.14	4.12
10.08	8	90	40.35	4.17	4.15
10.09	9	90	40.36	4.18	4.16
10.10	10	90	40.38	4.20	4.18
10.12	12	90	40.41	4.23	4.21
10.14	14	90	40.45	4.27	4.25
10.16	16	90	40.48	4.30	4.28
10.18	18	90	40.50	4.32	4.30
10.20	20	90	40.51	4.33	4.31
10.22	22	90	40.53	4.35	4.33
10.24	24	90	40.53	4.35	4.33
10.26	26	90	40.54	4.36	4.34
10.28	28	90	40.54	4.36	4.34
10.30	30	90	40.55	4.37	4.35
10.35	35	90	40.54	4.36	4.34
10.40	40	90	40.55	4.37	4.35
10.45	45	90	40.55	4.37	4.35
10.50	50	90	40.56	4.38	4.36
10.55	55	90	40.56	4.38	4.36
11.00	60	90	40.58	4.40	4.38
11.10	70	90	40.62	4.44	4.42
11.20	80	90	40.62	4.44	4.42
11.30	90	90	40.62	4.44	4.42
11.40	100	90	40.62	4.44	4.42
12.00	120	90	40.63	4.45	4.43
12.30	150	90	40.63	4.45	4.43
13.00	180	90	40.62	4.44	4.42
13.45	225	90	40.63	4.45	4.43
14.30	270	90	40.63	4.45	4.43
15.15	315	90	40.62	4.44	4.42
16.00	360	90	40.62	4.44	4.42

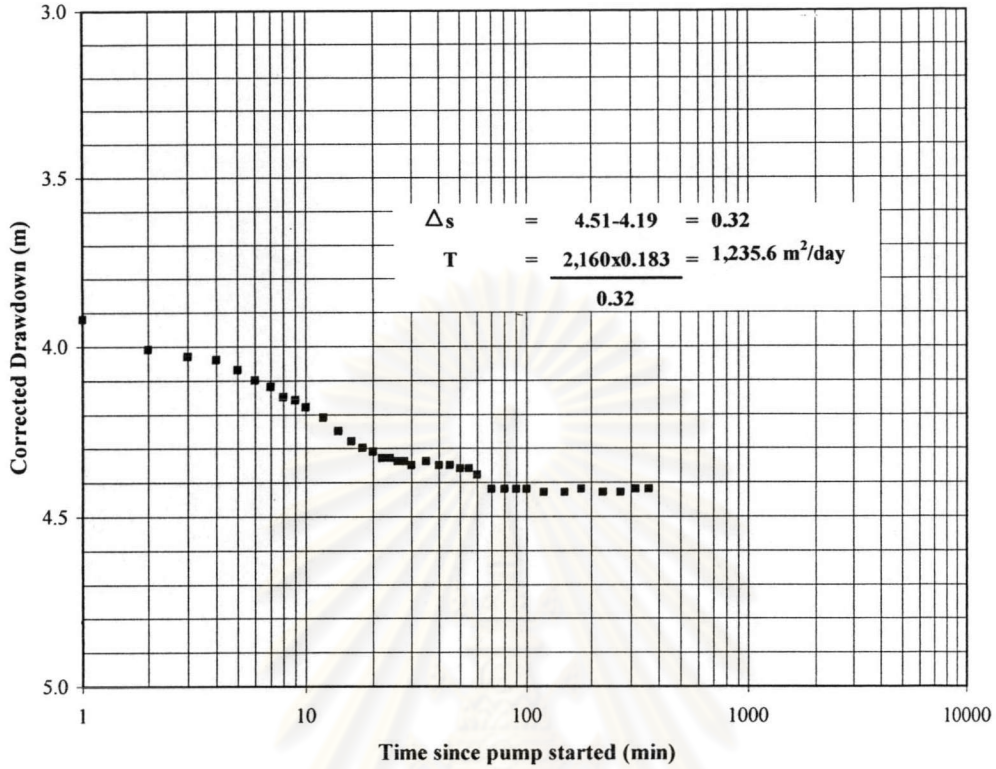
Appendix III-a-2: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 2	Hole Depth (m) : 177	Duration Time of Test (min) : 60.00
UTM N : 1564972	Type of Test : Recovery	Screen Interval (m) : 126-132, 159-162
E : 674300	Date of Pumping Test :	Static Water Level (m) : 36.18

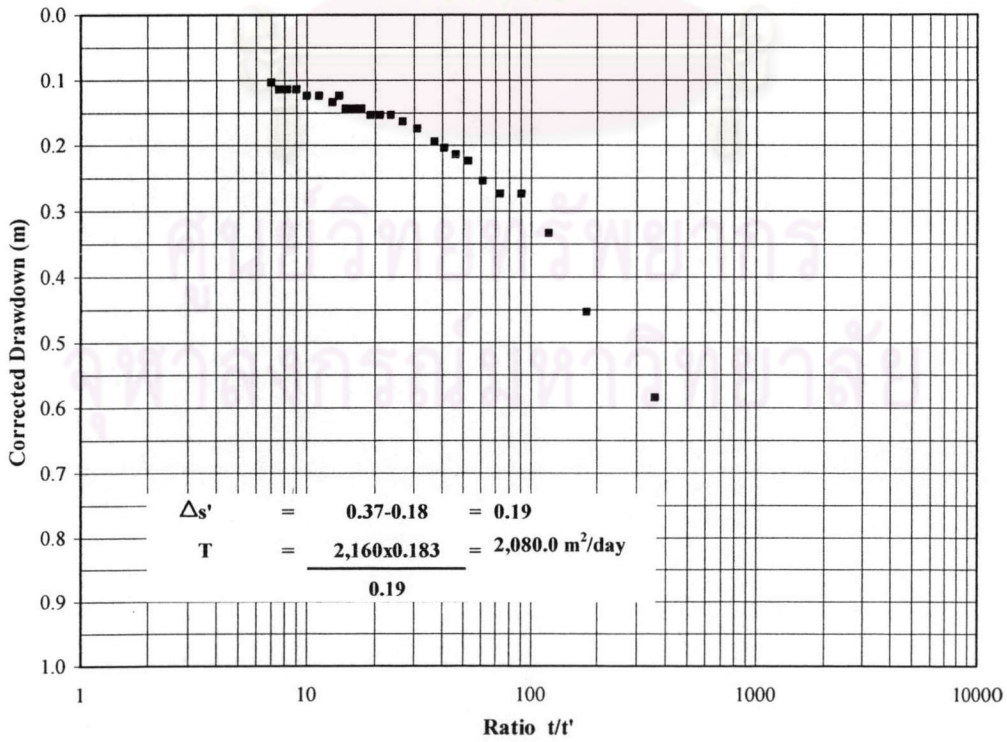
Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
16.00	0	360	-	40.62	4.44	4.486
16.01	1	361	361.00	36.81	0.63	0.584
16.02	2	362	181.00	36.68	0.50	0.454
16.03	3	363	121.00	36.56	0.38	0.334
16.04	4	364	91.00	36.50	0.32	0.274
16.05	5	365	73.00	36.50	0.32	0.274
16.06	6	366	61.00	36.48	0.30	0.254
16.07	7	367	52.43	36.45	0.27	0.224
16.08	8	368	46.00	36.44	0.26	0.214
16.09	9	369	41.00	36.43	0.25	0.204
16.10	10	370	37.00	36.42	0.24	0.194
16.12	12	372	31.00	36.40	0.22	0.174
16.14	14	374	26.71	36.39	0.21	0.164
16.16	16	376	23.50	36.38	0.20	0.154
16.18	18	378	21.00	36.38	0.20	0.154
16.20	20	380	19.00	36.38	0.20	0.154
16.22	22	382	17.36	36.37	0.19	0.144
16.24	24	384	16.00	36.37	0.19	0.144
16.26	26	386	14.85	36.37	0.19	0.144
16.28	28	388	13.86	36.35	0.17	0.124
16.30	30	390	13.00	36.36	0.18	0.134
16.35	35	395	11.29	36.35	0.17	0.124
16.40	40	400	10.00	36.35	0.17	0.124
16.45	45	405	9.00	36.34	0.16	0.114
16.50	50	410	8.20	36.34	0.16	0.114
16.55	55	415	7.55	36.34	0.16	0.114
17.00	60	420	7.00	36.33	0.15	0.104

Appendix III-a-2 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-2



Recovery Test BH-2



Appendix III-a-3 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 3		Hole Depth (m) : 190		Duration Time of Test (min) : 540	
UTM N : 1551825		Type of Test : Step Drawdown		Screen Interval (m) :	156-162, 170-176
E : 685200		Date of Pumping Test : 04/10/1997		Static Water Level (m) :	76.00
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
11.00	0	5	76.00	0.00	-
11.01	1	5	79.13	3.13	-
11.02	2	5	78.04	2.04	-
11.03	3	5	77.86	1.86	-
11.04	4	5	77.89	1.89	-
11.05	5	5	77.89	1.89	-
11.06	6	5	77.74	1.74	-
11.07	7	5	77.78	1.78	-
11.08	8	5	77.75	1.75	-
11.09	9	5	77.81	1.81	-
11.10	10	5	77.82	1.82	-
11.12	12	5	77.82	1.82	-
11.14	14	5	77.81	1.81	-
11.16	16	5	77.84	1.84	-
11.18	18	5	77.84	1.84	-
11.20	20	5	77.83	1.83	-
11.22	22	5	77.83	1.83	-
11.24	24	5	77.84	1.84	-
11.26	26	5	77.84	1.84	-
11.28	28	5	77.85	1.85	-
11.30	30	5	77.86	1.86	-
11.35	35	5	77.87	1.87	-
11.40	40	5	77.88	1.88	-
11.45	45	5	77.89	1.89	-
11.50	50	5	77.90	1.90	-
11.55	55	5	77.91	1.91	-
12.00	60	5	77.92	1.92	-
12.10	70	5	77.93	1.93	-
12.20	80	5	77.94	1.94	-
12.30	90	5	77.93	1.93	-
12.40	100	5	77.95	1.95	-
12.50	110	5	77.94	1.94	-
13.00	120	5	77.93	1.93	-
13.20	140	5	77.95	1.95	-
13.40	160	5	77.94	1.94	-
14.00	180	5	77.95	1.95	-
14.00	0	10	77.95	1.95	-
14.01	1	10	78.64	2.64	-
14.02	2	10	78.69	2.69	-
14.03	3	10	78.72	2.72	-
14.04	4	10	78.73	2.73	-
14.05	5	10	78.71	2.71	-
14.06	6	10	78.73	2.73	-
14.07	7	10	78.75	2.75	-
14.08	8	10	78.76	2.76	-
14.09	9	10	78.78	2.78	-
14.10	10	10	78.79	2.79	-
14.12	12	10	78.80	2.80	-
14.14	14	10	78.78	2.78	-
14.16	16	10	78.79	2.79	-
14.18	18	10	78.80	2.80	-
14.20	20	10	78.81	2.81	-
14.22	22	10	78.81	2.81	-
14.24	24	10	78.82	2.82	-
14.26	26	10	78.80	2.80	-
14.28	28	10	78.83	2.83	-
14.30	30	10	78.81	2.81	-

Appendix III-a-3 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

Well No. : 3	Hole Depth (m) : 190	Duration Time of Test (min) : 540
UTM N : 1551825	Type of Test : Step Drawdown	Screen Interval (m) : 156-162, 170-176
E : 685200	Date of Pumping Test :	Static Water Level (m) : 76.00

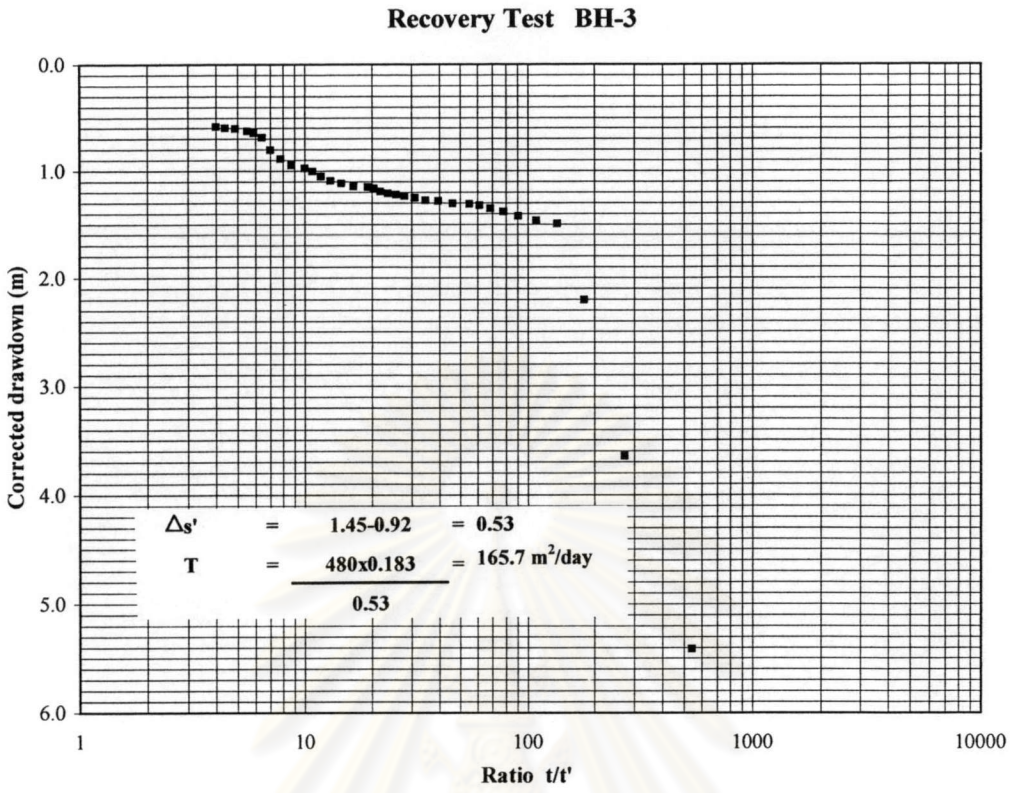
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
14.35	35	10	78.81	2.81	-
14.40	40	10	78.82	2.82	-
14.45	45	10	78.83	2.83	-
14.50	50	10	78.8	2.80	-
14.55	55	10	78.82	2.82	-
15.00	60	10	78.81	2.81	-
15.10	70	10	78.81	2.81	-
15.20	80	10	78.83	2.83	-
15.30	90	10	78.82	2.82	-
15.40	100	10	78.82	2.82	-
15.50	110	10	78.81	2.81	-
16.00	120	10	78.83	2.83	-
16.20	140	10	78.83	2.83	-
16.40	160	10	78.82	2.82	-
17.00	180	10	78.83	2.83	-
17.00	0	20	78.83	2.83	-
17.01	1	20	81.49	5.49	-
17.02	2	20	81.65	5.65	-
17.03	3	20	81.71	5.71	-
17.04	4	20	81.86	5.86	-
17.05	5	20	81.95	5.95	-
17.06	6	20	82.14	6.14	-
17.07	7	20	82.26	6.26	-
17.08	8	20	82.39	6.39	-
17.09	9	20	82.47	6.47	-
17.10	10	20	82.53	6.53	-
17.12	12	20	82.61	6.61	-
17.14	14	20	82.70	6.70	-
17.16	16	20	82.75	6.75	-
17.18	18	20	82.81	6.81	-
17.20	20	20	82.89	6.89	-
17.22	22	20	82.93	6.93	-
17.24	24	20	82.98	6.98	-
17.26	26	20	83.04	7.04	-
17.28	28	20	83.07	7.07	-
17.30	30	20	83.12	7.12	-
17.35	35	20	83.16	7.16	-
17.40	40	20	83.18	7.18	-
17.45	45	20	83.20	7.20	-
17.50	50	20	83.24	7.24	-
17.55	55	20	83.26	7.26	-
18.00	60	20	83.25	7.25	-
18.10	70	20	83.26	7.26	-
18.20	80	20	83.26	7.26	-
18.30	90	20	83.26	7.26	-
18.40	100	20	83.26	7.26	-
18.50	110	20	83.25	7.25	-
19.00	120	20	83.24	7.24	-
19.20	140	20	83.25	7.25	-
19.40	160	20	83.26	7.26	-
20.00	180	20	83.26	7.26	-

Appendix III-a-3: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 3	Hole Depth (m) 180	Duration Time of Test (min) : 180
UTM N : 1551825	Type of Test Recovery	Screen Interval (m) : 156-162, 170-176
E : 685200	Date of Pumping Test : 04/10/1997	Static Water Level (m) : 76

Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
20.00	0	540	-	83.26	7.26	7.22584
20.01	1	541	541.00	81.45	5.45	5.42
20.02	2	542	271.00	79.68	3.68	3.65
20.03	3	543	181.00	78.24	2.24	2.21
20.04	4	544	136.00	77.53	1.53	1.50
20.05	5	545	109.00	77.50	1.50	1.47
20.06	6	546	91.00	77.46	1.46	1.43
20.07	7	547	78.14	77.42	1.42	1.39
20.08	8	548	68.50	77.39	1.39	1.36
20.09	9	549	61.00	77.36	1.36	1.33
20.10	10	550	55.00	77.35	1.35	1.32
20.12	12	552	46.00	77.34	1.34	1.31
20.14	14	554	39.57	77.32	1.32	1.29
20.16	16	556	34.75	77.31	1.31	1.28
20.18	18	558	31.00	77.29	1.29	1.26
20.20	20	560	28.00	77.27	1.27	1.24
20.22	22	562	25.55	77.26	1.26	1.23
20.24	24	564	23.50	77.25	1.25	1.22
20.26	26	566	21.77	77.23	1.23	1.20
20.28	28	568	20.29	77.20	1.20	1.17
20.30	30	570	19.00	77.19	1.19	1.16
20.35	35	575	16.43	77.18	1.18	1.15
20.40	40	580	14.50	77.15	1.15	1.12
20.45	45	585	13.00	77.13	1.13	1.10
20.50	50	590	11.80	77.09	1.09	1.06
20.55	55	595	10.82	77.04	1.04	1.01
21.00	60	600	10.00	77.01	1.01	0.98
21.10	70	610	8.71	76.98	0.98	0.95
21.20	80	620	7.75	76.92	0.92	0.89
21.30	90	630	7.00	76.84	0.84	0.81
21.40	100	640	6.40	76.72	0.72	0.69
21.50	110	650	5.91	76.68	0.68	0.65
22.00	120	660	5.50	76.66	0.66	0.63
22.20	140	680	4.86	76.64	0.64	0.61
22.40	160	700	4.38	76.63	0.63	0.60
23.00	180	720	4.00	76.62	0.62	0.59

Appendix III-a-3 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)



Appendix III-a-4 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 4	Hole Depth (m) : 140	Duration Time of Test (min) : 540
UTM N : 1518700	Type of Test : Step Drawdown	Screen Interval (m) : 128-134
E : 639550	Date of Pumping Test : 03/02/1989	Static Water Level (m) : 45.65

Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
10.00	0	32.5	45.65	0.00	-
10.01	1	32.5	49.10	3.45	-
10.02	2	32.5	49.29	3.64	-
10.03	3	32.5	49.68	4.03	-
10.04	4	32.5	49.80	4.15	-
10.05	5	32.5	49.80	4.15	-
10.06	6	32.5	49.80	4.15	-
10.07	7	32.5	49.80	4.15	-
10.08	8	32.5	49.83	4.18	-
10.09	9	32.5	49.82	4.17	-
10.10	10	32.5	49.82	4.17	-
10.12	12	32.5	49.82	4.17	-
10.14	14	32.5	49.82	4.17	-
10.16	16	32.5	49.85	4.20	-
10.18	18	32.5	49.89	4.24	-
10.20	20	32.5	49.86	4.21	-
10.25	25	32.5	49.87	4.22	-
10.30	30	32.5	49.83	4.18	-
10.35	35	32.5	49.84	4.19	-
10.40	40	32.5	49.88	4.23	-
10.45	45	32.5	49.91	4.26	-
10.50	50	32.5	49.94	4.29	-
10.55	55	32.5	49.89	4.24	-
11.00	60	32.5	49.90	4.25	-
11.15	75	32.5	49.88	4.23	-
11.30	90	32.5	49.86	4.21	-
11.45	105	32.5	49.91	4.26	-
12.00	120	32.5	49.89	4.24	-
12.20	140	32.5	49.87	4.22	-
12.40	160	32.5	49.86	4.21	-
13.00	180	32.5	49.86	4.21	-
13.01	181	40.45	50.83	5.18	-
13.02	182	40.45	50.87	5.22	-
13.03	183	40.45	50.88	5.23	-
13.04	184	40.45	50.90	5.25	-
13.05	185	40.45	50.94	5.29	-
13.06	186	40.45	50.95	5.30	-
13.07	187	40.45	50.95	5.30	-
13.08	188	40.45	50.95	5.30	-
13.09	189	40.45	50.95	5.30	-
13.10	190	40.45	50.95	5.30	-
13.12	192	40.45	50.95	5.30	-
13.14	194	40.45	50.93	5.28	-
13.16	196	40.45	50.93	5.28	-
13.18	198	40.45	50.94	5.29	-
13.20	200	40.45	50.94	5.29	-
13.25	205	40.45	50.95	5.30	-
13.30	210	40.45	50.97	5.32	-
13.35	215	40.45	50.97	5.32	-
13.40	220	40.45	50.97	5.32	-
13.45	225	40.45	51.00	5.35	-
13.50	230	40.45	51.00	5.35	-
13.55	235	40.45	51.01	5.36	-
14.00	240	40.45	51.02	5.37	-
14.15	255	40.45	51.00	5.35	-
14.30	270	40.45	51.03	5.38	-
14.45	285	40.45	51.07	5.42	-

Appendix III-a-4 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

Well No. : 4	Hole Depth (m) : 140	Duration Time of Test (min) : 540
UTM N : 1518700	Type of Test : Step Drawdown	Screen Interval (m) : 128-134
E : 639550	Date of Pumping Test : 03/02/1989	Static Water Level (m) : 45.65

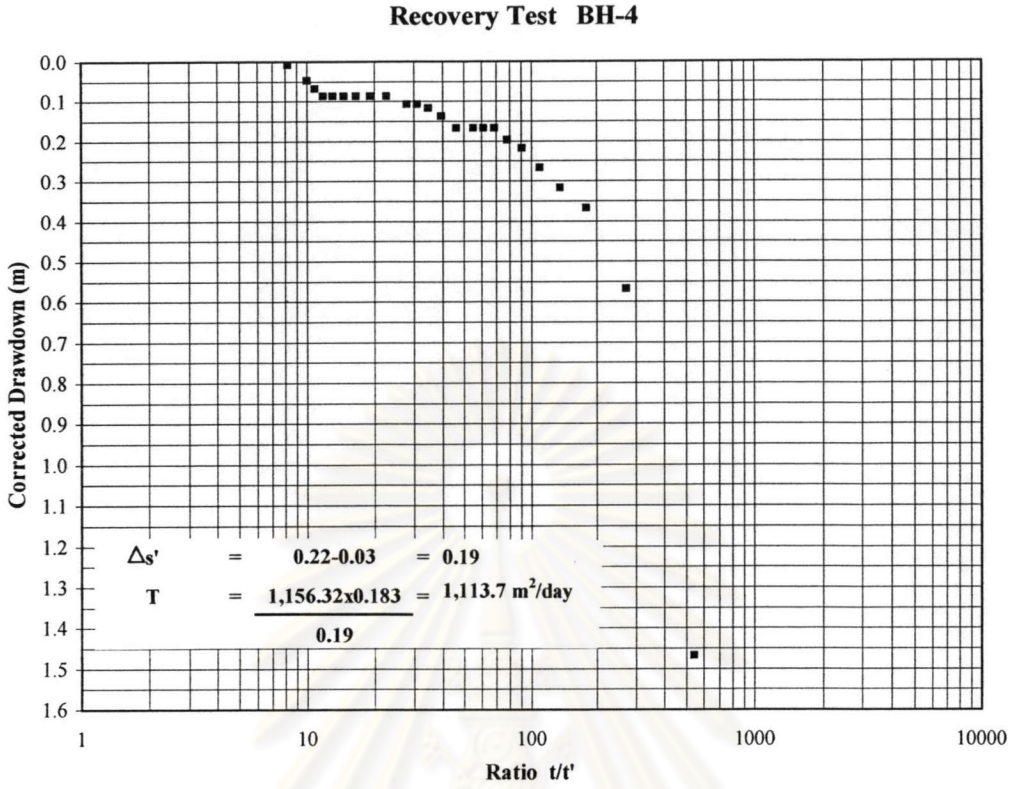
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
15.00	300	40.45	51.12	5.47	-
15.20	320	40.45	51.12	5.47	-
15.40	340	40.45	51.10	5.45	-
16.00	360	40.45	51.10	5.45	-
16.01	361	48.18	52.00	6.35	-
16.02	362	48.18	52.10	6.45	-
16.03	363	48.18	52.10	6.45	-
16.04	364	48.18	52.10	6.45	-
16.05	365	48.18	52.08	6.43	-
16.06	366	48.18	52.10	6.45	-
16.07	367	48.18	52.13	6.48	-
16.08	368	48.18	52.14	6.49	-
16.09	369	48.18	52.14	6.49	-
16.10	370	48.18	52.12	6.47	-
16.12	372	48.18	52.10	6.45	-
16.14	374	48.18	52.09	6.44	-
16.16	376	48.18	52.07	6.42	-
16.18	378	48.18	52.07	6.42	-
16.20	380	48.18	52.06	6.41	-
16.25	385	48.18	52.06	6.41	-
16.30	390	48.18	52.04	6.39	-
16.35	395	48.18	52.04	6.39	-
16.40	400	48.18	52.04	6.39	-
16.45	405	48.18	52.04	6.39	-
16.50	410	48.18	52.08	6.43	-
16.55	415	48.18	52.10	6.45	-
17.00	420	48.18	52.10	6.45	-
17.15	435	48.18	52.10	6.45	-
17.30	450	48.18	52.10	6.45	-
17.45	465	48.18	52.10	6.45	-
18.00	480	48.18	52.10	6.45	-
18.20	500	48.18	52.11	6.46	-
18.40	520	48.18	52.11	6.46	-
19.00	540	48.18	52.11	6.46	-

Appendix III-a-4: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 4	Hole Depth (m) : 140	Duration Time of Test (min) : 300
UTM N : 1518700	Type of Test : Recovery	Screen Interval (m) : 128-134
E : 693550	Date of Pumping Test : 03/02/1989	Static Water Level (m) : 45.61

Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
19.00	0	540	-	52.11	6.5	6.48
19.01	1	541	541.00	47.10	1.49	1.47
19.02	2	542	271.00	46.20	0.59	0.57
19.03	3	543	181.00	46.00	0.39	0.37
19.04	4	544	136.00	45.95	0.34	0.32
19.05	5	545	109.00	45.90	0.29	0.27
19.06	6	546	91.00	45.85	0.24	0.22
19.07	7	547	78.14	45.83	0.22	0.20
19.08	8	548	68.50	45.80	0.19	0.17
19.09	9	549	61.00	45.80	0.19	0.17
19.10	10	550	55.00	45.80	0.19	0.17
19.12	12	552	46.00	45.80	0.19	0.17
19.14	14	554	39.57	45.77	0.16	0.14
19.16	16	556	34.75	45.75	0.14	0.12
19.18	18	558	31.00	45.74	0.13	0.11
19.20	20	560	28.00	45.74	0.13	0.11
19.25	25	565	22.60	45.72	0.11	0.09
19.30	30	570	19.00	45.72	0.11	0.09
19.35	35	575	16.43	45.72	0.11	0.09
19.40	40	580	14.50	45.72	0.11	0.09
19.45	45	585	13.00	45.72	0.11	0.09
19.50	50	590	11.80	45.72	0.11	0.09
19.55	55	595	10.82	45.70	0.09	0.07
20.00	60	600	10.00	45.68	0.07	0.05
20.15	75	615	8.20	45.64	0.03	0.01
20.30	90	630	7.00	45.63	0.02	0.00
20.45	105	645	6.14	45.62	0.01	-0.01
21.00	120	660	5.50	45.61	0.00	-0.02
21.20	140	680	4.86	45.61	0.00	-0.02
21.40	160	700	4.38	45.61	0.00	-0.02
22.00	180	720	4.00	45.61	0.00	-0.02
22.30	210	750	3.57	45.61	0.00	-0.02
23.00	240	780	3.25	45.61	0.00	-0.02
23.30	270	810	3.00	45.61	0.00	-0.02
24.00	300	840	2.80	45.61	0.00	-0.02

Appendix III-a-4 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)



Appendix III-a-5 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 5		Hole Depth (m) : 160.4		Duration Time of Test (min) : 720	
UTM N : 1529900		Type of Test : Step Drawdown		Screen Interval (m) :120.3-126.7,150.8-154.3	
E : 693650		Date of Pumping Test :31/01-02/02/1989		Static Water Level (m) : 46.64	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
6.00	0		46.64	0.00	-
6.01	1	86.36	51.00	4.36	-
6.02	2	86.36	51.22	4.58	-
6.03	3	86.36	51.31	4.67	-
6.04	4	86.36	51.39	4.75	-
6.05	5	86.36	51.49	4.85	-
6.06	6	86.36	51.52	4.88	-
6.07	7	86.36	52.62	5.98	-
6.08	8	86.36	51.65	5.01	-
6.09	9	86.36	51.84	5.20	-
6.10	10	86.36	52.00	5.36	-
6.12	12	86.36	52.15	5.51	-
6.14	14	86.36	52.17	5.53	-
6.16	16	86.36	52.2	5.56	-
6.18	18	86.36	52.41	5.77	-
6.20	20	86.36	52.45	5.81	-
6.22	22	86.36	52.47	5.83	-
6.24	24	86.36	52.40	5.76	-
6.26	26	86.36	52.20	5.56	-
6.28	28	86.36	51.88	5.24	-
6.30	30	86.36	51.84	5.20	-
6.35	35	86.36	51.80	5.16	-
6.40	40	86.36	51.78	5.14	-
6.45	45	86.36	51.70	5.06	-
6.50	50	86.36	51.65	5.01	-
6.55	55	86.36	51.62	4.98	-
7.00	60	86.36	51.48	4.84	-
7.10	70	86.36	51.44	4.80	-
7.20	80	86.36	51.49	4.85	-
7.30	90	86.36	51.60	4.96	-
7.40	100	86.36	51.74	5.10	-
7.50	110	86.36	51.82	5.18	-
8.00	120	86.36	52.00	5.36	-
8.10	130	86.36	52.14	5.50	-
8.20	140	86.36	52.20	5.56	-
8.30	150	86.36	52.23	5.59	-
8.40	160	86.36	52.33	5.69	-
8.50	170	86.36	52.40	5.76	-
9.00	180	86.36	52.44	5.80	-
9.01	181	121.14	54.86	8.22	-
9.02	182	121.14	55.07	8.43	-
9.03	183	121.14	55.31	8.67	-
9.04	184	121.14	55.52	8.88	-
9.05	185	121.14	55.54	8.90	-
9.06	186	121.14	55.58	8.94	-
9.07	187	121.14	55.59	8.95	-
9.08	188	121.14	55.60	8.96	-
9.09	189	121.14	55.61	8.97	-
9.10	190	121.14	55.62	8.98	-
9.12	192	121.14	55.66	9.02	-
9.14	194	121.14	55.74	9.10	-
9.16	196	121.14	55.77	9.13	-
9.18	198	121.14	55.82	9.18	-
9.20	200	121.14	55.84	9.20	-
9.22	202	121.14	55.89	9.25	-
9.24	204	121.14	88.92	42.28	-
9.26	206	121.14	56.00	9.36	-
9.28	208	121.14	52.02	5.38	-
9.30	210	121.14	56.05	9.41	-
9.35	215	121.14	56.07	9.43	-
9.40	220	121.14	56.08	9.44	-
9.45	225	121.14	56.00	9.36	-
9.50	230	121.14	56.02	9.38	-
9.55	235	121.14	56.06	9.42	-
10.00	240	121.14	56.07	9.43	-
10.10	250	121.14	56.01	9.37	-
10.20	260	121.14	56.04	9.40	-
10.30	270	121.14	56.02	9.38	-
10.40	280	121.14	56.01	9.37	-
10.50	290	121.14	56.00	9.36	-
11.00	300	121.14	56.08	9.44	-
11.10	310	121.14	56.14	9.50	-
11.20	320	121.14	56.22	9.58	-
11.30	330	121.14	56.46	9.82	-
11.40	340	121.14	56.48	9.84	-
11.50	350	121.14	56.44	9.80	-
12.00	360	121.14	56.46	9.82	-
9.01	361	160.91	51.53	4.89	-
9.02	362	160.91	53.60	6.96	-

Appendix III-a-5 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

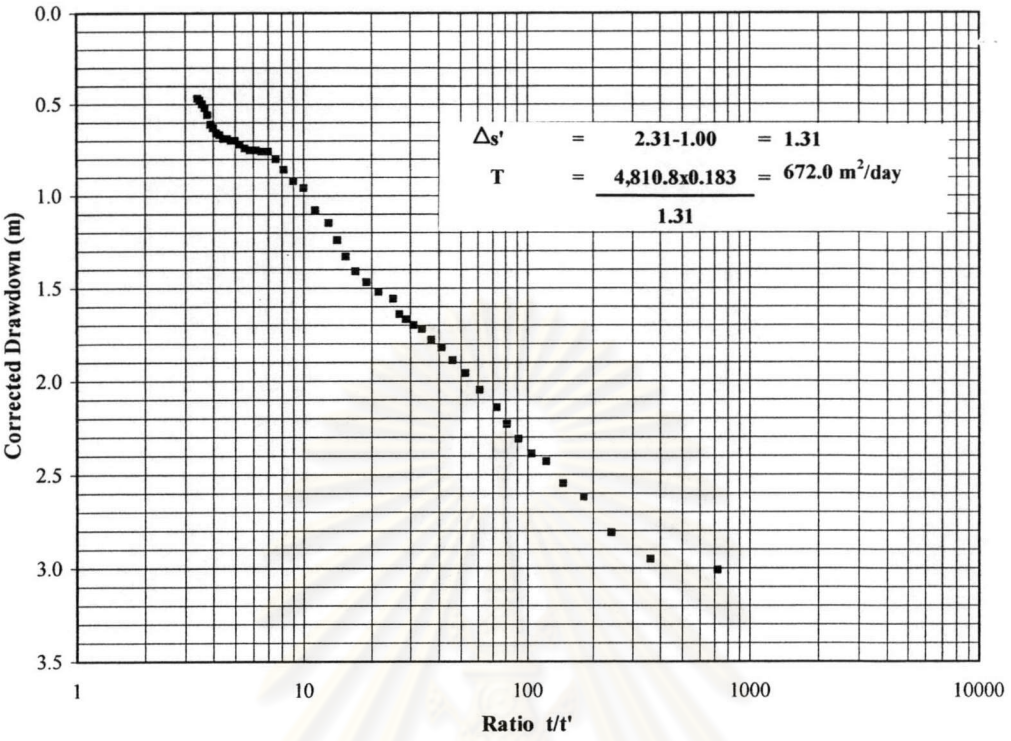
Well No. : 6		Hole Depth (m) : 160.4		Duration Time of Test (min) : 720	
UTM N : 1529900		Type of Test : Step Drawdown		Screen Interval (m) :120.3-126.7,150.8-154.3	
E : 693650		Date of Pumping Test :31/01-02/02/1989		Static Water Level (m) : 46.64	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
9.03	363	160.91	55.00	8.36	-
9.04	364	160.91	56.10	9.46	-
9.05	365	160.91	56.40	9.76	-
9.06	366	160.91	56.70	10.06	-
9.07	367	160.91	56.85	10.21	-
9.08	368	160.91	56.87	10.23	-
9.09	369	160.91	56.92	10.28	-
9.10	370	160.91	56.94	10.30	-
9.12	372	160.91	56.98	10.34	-
9.14	374	160.91	57.04	10.40	-
9.16	376	160.91	57.18	10.54	-
9.18	378	160.91	57.23	10.59	-
9.20	380	160.91	57.31	10.67	-
9.22	382	160.91	57.32	10.68	-
9.24	384	160.91	57.33	10.69	-
9.26	386	160.91	57.36	10.72	-
9.28	388	160.91	57.43	10.79	-
9.30	390	160.91	57.49	10.85	-
9.35	395	160.91	57.60	10.96	-
9.40	400	160.91	57.78	11.14	-
9.45	405	160.91	57.82	11.18	-
9.50	410	160.91	57.90	11.26	-
9.55	415	160.91	57.94	11.30	-
10.00	420	160.91	58.01	11.37	-
10.10	430	160.91	58.36	11.72	-
10.20	440	160.91	58.44	11.80	-
10.30	450	160.91	58.61	11.97	-
10.40	460	160.91	58.74	12.10	-
10.50	470	160.91	58.82	12.18	-
11.00	480	160.91	58.80	12.16	-
11.10	490	160.91	58.78	12.14	-
11.20	500	160.91	58.79	12.15	-
11.30	510	160.91	58.82	12.18	-
11.40	520	160.91	58.85	12.21	-
11.50	530	160.91	58.82	12.18	-
12.00	540	160.91	58.87	12.23	-
12.01	541	200.45	60.72	14.08	-
12.02	542	200.45	61.70	15.06	-
12.03	543	200.45	61.83	15.19	-
12.04	544	200.45	61.85	15.21	-
12.05	545	200.45	61.90	15.26	-
12.06	546	200.45	62.00	15.36	-
12.07	547	200.45	62.02	15.38	-
12.08	548	200.45	62.09	15.45	-
12.09	549	200.45	62.11	15.47	-
12.10	550	200.45	62.14	15.50	-
12.12	552	200.45	62.20	15.56	-
12.14	554	200.45	62.22	15.58	-
12.16	556	200.45	62.27	15.63	-
12.18	558	200.45	62.32	15.68	-
12.20	560	200.45	62.35	15.71	-
12.22	562	200.45	62.40	15.76	-
12.24	564	200.45	62.39	15.75	-
12.26	566	200.45	62.37	15.73	-
12.28	568	200.45	62.35	15.71	-
12.30	570	200.45	62.36	15.72	-
12.35	575	200.45	62.39	15.75	-
12.40	580	200.45	62.40	15.76	-
12.45	585	200.45	62.37	15.73	-
12.50	590	200.45	62.44	15.80	-
12.55	595	200.45	62.42	15.78	-
13.00	600	200.45	62.41	15.77	-
13.10	610	200.45	62.40	15.76	-
13.20	620	200.45	62.44	15.80	-
13.30	630	200.45	62.52	15.88	-
13.40	640	200.45	62.48	15.84	-
13.50	650	200.45	62.54	15.90	-
14.00	660	200.45	62.60	15.96	-
14.10	670	200.45	62.58	15.94	-
14.20	680	200.45	62.61	15.97	-
14.30	690	200.45	62.52	15.88	-
14.40	700	200.45	62.46	15.82	-
14.50	710	200.45	62.53	15.89	-
15.00	720	200.45	62.46	15.82	-

Appendix III-a-5: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 5	Hole Depth (m) : 160.4		Duration Time of Test (min) : 300		
UTM N : 1529900	Type of Test Recovery		Screen Interval (m) : 1 20.3-126.7,150.8-154.3		
E : 693650	Date of Pumping Test : 31/01-02/02/1989		Static Water Level (m) : 46.64		
Time	Time since Pumping		Ratio	Depth to	Resodual	Corrected
(hr.min)	STOPPED t' (min.)	STARTED t = t+t' (min.)	t/t'	Water (m.)	Drawdown (m.)	Drawdown
15.00	0	720	-	62.46	15.82	-
15.01	1	721	721.00	49.65	3.01	-
15.02	2	722	361.00	49.59	2.95	-
15.03	3	723	241.00	49.45	2.81	-
15.04	4	724	181.00	49.26	2.62	-
15.05	5	725	145.00	49.19	2.55	-
15.06	6	726	121.00	49.07	2.43	-
15.07	7	727	103.86	49.03	2.39	-
15.08	8	728	91.00	48.95	2.31	-
15.09	9	729	81.00	48.87	2.23	-
15.10	10	730	73.00	48.78	2.14	-
15.12	12	732	61.00	48.69	2.05	-
15.14	14	734	52.43	48.60	1.96	-
15.16	16	736	46.00	48.53	1.89	-
15.18	18	738	41.00	48.46	1.82	-
15.20	20	740	37.00	48.42	1.78	-
15.22	22	742	33.73	48.36	1.72	-
15.24	24	744	31.00	48.34	1.70	-
15.26	26	746	28.69	48.31	1.67	-
15.28	28	748	26.71	48.28	1.64	-
15.30	30	750	25.00	48.20	1.56	-
15.35	35	755	21.57	48.16	1.52	-
15.40	40	760	19.00	48.11	1.47	-
15.45	45	765	17.00	48.05	1.41	-
15.50	50	770	15.40	47.97	1.33	-
15.55	55	775	14.09	47.88	1.24	-
16.00	60	780	13.00	47.79	1.15	-
16.10	70	790	11.29	47.72	1.08	-
16.20	80	800	10.00	47.60	0.96	-
16.30	90	810	9.00	47.56	0.92	-
16.40	100	820	8.20	47.50	0.86	-
16.50	110	830	7.55	47.44	0.80	-
17.00	120	840	7.00	47.40	0.76	-
17.10	130	850	6.54	47.40	0.76	-
17.20	140	860	6.14	47.39	0.75	-
17.30	150	870	5.80	47.39	0.75	-
17.40	160	880	5.50	47.38	0.74	-
17.50	170	890	5.24	47.36	0.72	-
18.00	180	900	5.00	47.34	0.70	-
18.10	190	910	4.79	47.34	0.70	-
18.20	200	920	4.60	47.33	0.69	-

Appendix III-a-5 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Recovery Test BH-5



Appendix III-a-6 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 6		Hole Depth (m) : 226		Duration Time of Test (min) : 2160	
UTM N : 675949		Type of Test : Constant Rate		Screen Interval (m) : 163-172	
E : 1541535		Date of Pumping Test : 17/02/1989		Static Water Level (m) : 39.07	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
23.00	0		34.96	0.00	0.00
23.01	1	150.68	38.09	3.13	3.11
23.02	2	150.68	38.19	3.23	3.21
23.03	3	150.68	38.32	3.36	3.34
23.04	4	150.68	38.50	3.54	3.52
23.05	5	150.68	38.51	3.55	3.53
23.06	6	150.68	38.55	3.59	3.57
23.07	7	150.68	38.59	3.63	3.61
23.08	8	150.68	38.66	3.70	3.68
23.09	9	150.68	38.74	3.78	3.76
23.10	10	150.68	38.78	3.82	3.80
23.12	12	150.68	38.81	3.85	3.83
23.14	14	150.68	38.84	3.88	3.86
23.16	16	150.68	38.89	3.93	3.91
23.18	18	150.68	38.54	3.58	3.56
23.20	20	150.68	38.62	3.66	3.64
23.25	25	150.68	38.68	3.72	3.70
23.30	30	150.68	38.74	3.78	3.76
23.35	35	150.68	38.80	3.84	3.82
23.40	40	150.68	38.68	3.72	3.70
23.45	45	150.68	38.55	3.59	3.57
23.50	50	150.68	38.60	3.64	3.62
23.55	55	150.68	38.88	3.92	3.90
24.00	60	150.68	38.88	3.92	3.90
24.15	75	150.68	38.89	3.93	3.91
24.30	90	150.68	38.90	3.94	3.92
24.45	105	150.68	38.91	3.95	3.93
1.00	120	150.68	38.92	3.96	3.94
1.15	135	150.68	38.92	3.96	3.94
1.30	150	150.68	38.91	3.95	3.93
1.45	165	150.68	38.91	3.95	3.93
2.00	180	150.68	38.91	3.95	3.93
2.15	195	150.68	38.92	3.96	3.94
2.30	210	150.68	38.91	3.95	3.93
2.45	225	150.68	38.93	3.97	3.95
3.00	240	150.68	38.93	3.97	3.95
3.15	255	150.68	38.94	3.98	3.96
3.30	270	150.68	38.95	3.99	3.97
3.45	285	150.68	38.95	3.99	3.97
4.00	300	150.68	38.95	3.99	3.97
4.15	315	150.68	38.95	3.99	3.97
4.30	330	150.68	38.95	3.99	3.97
4.45	345	150.68	38.96	4.00	3.98
5.00	360	150.68	38.97	4.01	3.99
5.15	375	150.68	38.97	4.01	3.99
5.30	390	150.68	38.98	4.02	4.00
5.45	405	150.68	38.99	4.03	4.01
6.00	420	150.68	39.02	4.06	4.04
6.15	435	150.68	39.04	4.08	4.06
6.30	450	150.68	39.04	4.08	4.06
6.45	465	150.68	39.05	4.09	4.07
7.00	480	150.68	39.06	4.10	4.08
7.15	495	150.68	39.06	4.10	4.08
7.30	510	150.68	39.05	4.09	4.07
7.45	525	150.68	39.02	4.06	4.04
8.00	540	150.68	39.03	4.07	4.05
8.15	555	150.68	39.00	4.04	4.02

Appendix III-a-6 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

Well No. : 6		Hole Depth (m) : 226		Duration Time of Test (min) : 2160	
UTM N : 675949		Type of Test : Constant Rate		Screen Interval (m) : 163-172	
E : 1541535		Date of Pumping Test : 17/02/1989		Static Water Level (m) : 39.07	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
8.30	570	150.68	39.00	4.04	4.02
8.45	585	150.68	39.00	4.04	4.02
9.00	600	150.68	39.02	4.06	4.04
9.15	615	150.68	39.00	4.04	4.02
9.30	630	150.68	39.00	4.04	4.02
9.45	645	150.68	38.99	4.03	4.01
10.00	660	150.68	38.99	4.03	4.01
10.15	675	150.68	38.98	4.02	4.00
10.30	690	150.68	38.99	4.03	4.01
10.45	705	150.68	38.98	4.02	4.00
11.00	720	150.68	38.97	4.01	3.99
11.15	735	150.68	38.96	4.00	3.98
11.30	750	150.68	38.96	4.00	3.98
11.45	765	150.68	38.98	4.02	4.00
12.00	780	150.68	38.98	4.02	4.00
12.15	795	150.68	38.98	4.02	4.00
12.30	810	150.68	38.96	4.00	3.98
12.45	825	150.68	38.95	3.99	3.97
13.00	840	150.68	38.96	4.00	3.98
13.15	855	150.68	38.95	3.99	3.97
13.30	870	150.68	38.94	3.98	3.96
13.45	885	150.68	38.92	3.96	3.94
14.00	900	150.68	38.91	3.95	3.93
14.15	915	150.68	38.93	3.97	3.95
14.30	930	150.68	38.95	3.99	3.97
14.45	945	150.68	38.95	3.99	3.97
15.00	960	150.68	39.03	4.07	4.05
15.15	975	150.68	39.03	4.07	4.05
15.30	990	150.68	39.08	4.12	4.10
15.45	1005	150.68	39.08	4.12	4.10
16.00	1020	150.68	39.05	4.09	4.07
16.15	1035	150.68	39.05	4.09	4.07
16.30	1050	150.68	39.05	4.09	4.07
16.45	1065	150.68	39.06	4.10	4.08
17.00	1080	150.68	39.07	4.11	4.09
17.15	1095	150.68	39.08	4.12	4.10
17.30	1110	150.68	39.07	4.11	4.09
17.45	1125	150.68	39.07	4.11	4.09
18.00	1140	150.68	39.08	4.12	4.10
18.15	1155	150.68	39.08	4.12	4.10
18.30	1170	150.68	39.09	4.13	4.11
18.45	1185	150.68	39.09	4.13	4.11
19.00	1200	150.68	39.10	4.14	4.12
19.15	1215	150.68	39.11	4.15	4.13
19.30	1230	150.68	39.11	4.15	4.13
19.45	1245	150.68	39.10	4.14	4.12
20.00	1260	150.68	39.11	4.15	4.13
20.15	1275	150.68	39.12	4.16	4.14
20.30	1290	150.68	39.12	4.16	4.14
20.45	1305	150.68	39.13	4.17	4.15
21.00	1320	150.68	39.13	4.17	4.15
21.15	1335	150.68	39.13	4.17	4.15
21.30	1350	150.68	39.14	4.18	4.16
21.45	1365	150.68	39.15	4.19	4.17
22.00	1380	150.68	39.16	4.20	4.18
22.15	1395	150.68	39.16	4.20	4.18
22.30	1410	150.68	39.17	4.21	4.19

Appendix III-a-6 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

Well No. : 6	Hole Depth (m) : 226	Duration Time of Test (min) : 2160
UTM N : 675949	Type of Test : Constant Rate	Screen Interval (m) : 163-172
E : 1541535	Date of Pumping Test : 17/02/1989	Static Water Level (m) : 39.07

Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
22.45	1425	150.68	39.17	4.21	4.19
23.00	1440	150.68	39.17	4.21	4.19
23.15	1455	150.68	39.16	4.20	4.18
23.30	1470	150.68	39.16	4.20	4.18
23.45	1485	150.68	39.17	4.21	4.19
24.00	1500	150.68	39.17	4.21	4.19
24.15	1515	150.68	39.17	4.21	4.19
24.30	1530	150.68	39.17	4.21	4.19
24.45	1545	150.68	39.17	4.21	4.19
1.00	1560	150.68	39.17	4.21	4.19
1.15	1575	150.68	39.16	4.20	4.18
1.30	1590	150.68	39.17	4.21	4.19
1.45	1605	150.68	39.16	4.20	4.18
2.00	1620	150.68	39.15	4.19	4.17
2.15	1635	150.68	39.18	4.22	4.20
2.30	1650	150.68	39.20	4.24	4.22
2.45	1665	150.68	39.20	4.24	4.22
3.00	1680	150.68	39.18	4.22	4.20
3.15	1695	150.68	39.20	4.24	4.22
3.30	1710	150.68	39.17	4.21	4.19
3.45	1725	150.68	39.16	4.20	4.18
4.00	1740	150.68	39.16	4.20	4.18
4.15	1755	150.68	39.16	4.20	4.18
4.30	1770	150.68	39.16	4.20	4.18
4.45	1785	150.68	39.16	4.20	4.18
5.00	1800	150.68	39.16	4.20	4.18
5.15	1815	150.68	39.17	4.21	4.19
5.30	1830	150.68	39.17	4.21	4.19
5.45	1845	150.68	39.16	4.20	4.18
6.00	1860	150.68	39.16	4.20	4.18
6.15	1875	150.68	39.17	4.21	4.19
6.30	1890	150.68	39.16	4.20	4.18
6.45	1905	150.68	39.16	4.20	4.18
7.00	1920	150.68	39.17	4.21	4.19
7.15	1935	150.68	39.16	4.20	4.18
7.30	1950	150.68	39.17	4.21	4.19
7.45	1965	150.68	39.16	4.20	4.18
8.00	1980	150.68	39.17	4.21	4.19
8.15	1995	150.68	39.16	4.20	4.18
8.30	2010	150.68	39.13	4.17	4.15
8.45	2025	150.68	39.12	4.16	4.14
9.00	2040	150.68	39.12	4.16	4.14
9.15	2055	150.68	39.10	4.14	4.12
9.30	2070	150.68	39.09	4.13	4.11
9.45	2085	150.68	39.08	4.12	4.10
10.00	2100	150.68	39.03	4.07	4.05
10.15	2115	150.68	39.05	4.09	4.07
13.00	2130	150.68	39.07	4.11	4.09
10.45	2145	150.68	39.06	4.10	4.08
11.00	2160	150.68	39.07	4.11	4.09

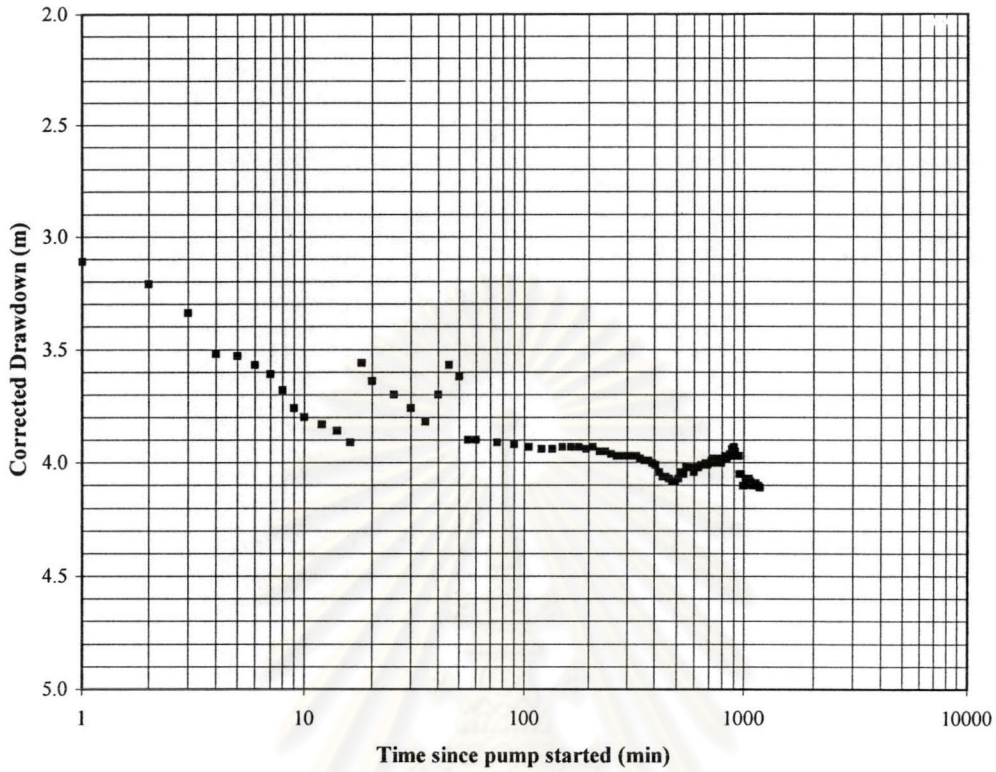
Appendix III-a-6: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 6	Hole Depth (m) : 226	on Time of Test (min) : 2160.00
UTM N : 675949	Type of Test : Recovery	erval (m) : 163-172
E : 1541535	of Pumping Test : 18/02/1989	Static Water Level (m) : 480.00

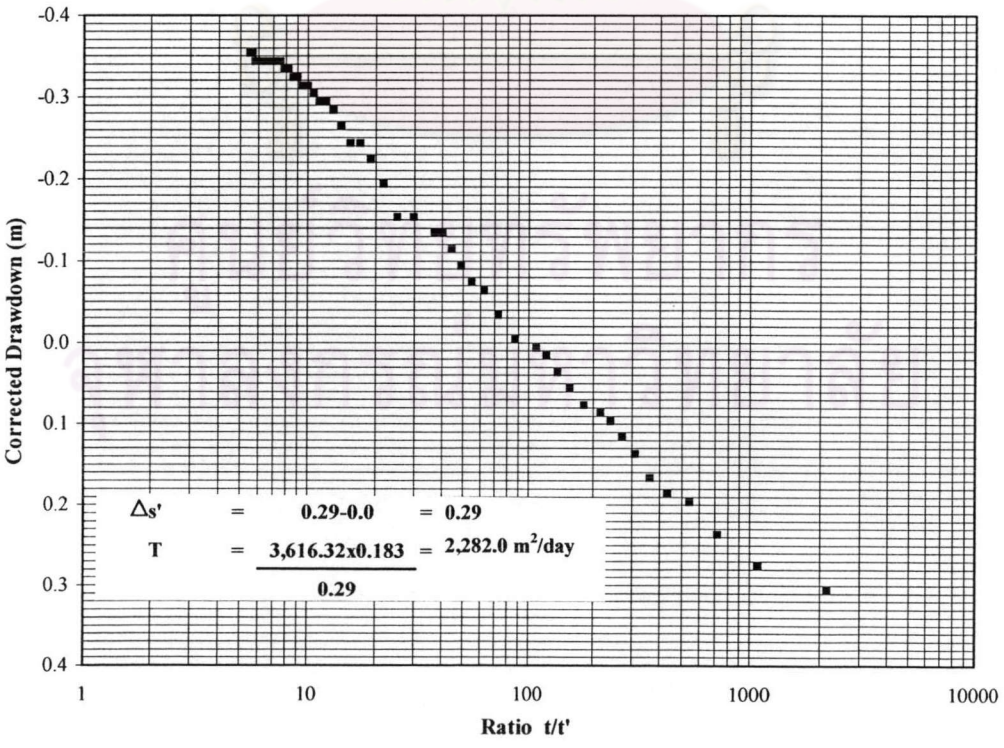
Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
11.00	0	2160	-	39.07	4.11	4.09
11.01	1	2161	2161.00	35.29	0.33	0.31
11.02	2	2162	1081.00	35.26	0.30	0.28
11.03	3	2163	721.00	35.22	0.26	0.24
11.04	4	2164	541.00	35.18	0.22	0.20
11.05	5	2165	433.00	35.17	0.21	0.19
11.06	6	2166	361.00	35.15	0.19	0.17
11.07	7	2167	309.57	35.12	0.16	0.14
11.08	8	2168	271.00	35.10	0.14	0.12
11.09	9	2169	241.00	35.08	0.12	0.10
11.10	10	2170	217.00	35.07	0.11	0.09
11.12	12	2172	181.00	35.06	0.10	0.08
11.14	14	2174	155.29	35.04	0.08	0.06
11.16	16	2176	136.00	35.02	0.06	0.04
11.18	18	2178	121.00	35.00	0.04	0.02
11.20	20	2180	109.00	34.99	0.03	0.01
11.25	25	2185	87.40	34.98	0.02	0.00
11.30	30	2190	73.00	34.95	0.00	-0.03
11.35	35	2195	62.71	34.92	-0.03	-0.06
11.40	40	2200	55.00	34.91	-0.04	-0.07
11.45	45	2205	49.00	34.89	-0.06	-0.09
11.50	50	2210	44.20	34.87	-0.08	-0.11
11.55	55	2215	40.27	34.85	-0.10	-0.13
12.00	60	2220	37.00	34.85	-0.10	-0.13
12.15	75	2235	29.80	34.83	-0.12	-0.15
12.30	90	2250	25.00	34.83	-0.12	-0.15
12.45	105	2265	21.57	34.79	-0.16	-0.19
13.00	120	2280	19.00	34.76	-0.19	-0.22
13.15	135	2295	17.00	34.74	-0.21	-0.24
13.30	150	2310	15.40	34.74	-0.21	-0.24
13.45	165	2325	14.09	34.72	-0.23	-0.26
14.00	180	2340	13.00	34.70	-0.25	-0.28
14.15	195	2355	12.08	34.69	-0.26	-0.29
14.30	210	2370	11.29	34.69	-0.26	-0.29
14.45	225	2385	10.60	34.68	-0.27	-0.30
15.00	240	2400	10.00	34.67	-0.28	-0.31
15.15	255	2415	9.47	34.67	-0.28	-0.31
15.30	270	2430	9.00	34.66	-0.29	-0.32
15.45	285	2445	8.58	34.66	-0.29	-0.32
16.00	300	2460	8.20	34.65	-0.30	-0.33
16.15	315	2475	7.86	34.65	-0.30	-0.33

Appendix III-a-6 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-6



Recovery Test BH-6



Appendix III-a-7 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 7	Hole Depth (m) : 180.5	Duration Time of Test (min) : 720			
UTM N : 6864565	Type of Test : Step Drawdown	Screen Interval (m) : 165.5-174.5			
E : 1552088	Date of Pumping Test : 19/06/1988	Static Water Level (m) : 42.50			
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
10.00	0		42.50	0.00	-
10.01	1	45.1	56.01	13.51	-
10.02	2	45.1	65.32	22.82	-
10.03	3	45.1	66.80	24.30	-
10.04	4	45.1	67.60	25.10	-
10.05	5	45.1	68.00	25.50	-
10.06	6	45.1	68.05	25.55	-
10.07	7	45.1	68.15	25.65	-
10.08	8	45.1	68.18	25.68	-
10.09	9	45.1	68.17	25.67	-
10.10	10	45.1	68.18	25.68	-
10.12	12	45.1	68.20	25.70	-
10.14	14	45.1	68.24	25.74	-
10.16	16	45.1	68.26	25.76	-
10.18	18	45.1	68.26	25.76	-
10.20	20	45.1	68.28	25.78	-
10.22	22	45.1	68.30	25.80	-
10.24	24	45.1	68.30	25.80	-
10.26	26	45.1	68.30	25.80	-
10.28	28	45.1	68.30	25.80	-
10.30	30	45.1	68.29	25.79	-
10.35	35	45.1	68.30	25.80	-
10.40	40	45.1	68.30	25.80	-
10.45	45	45.1	68.30	25.80	-
10.50	50	45.1	68.30	25.80	-
10.55	55	45.1	68.31	25.81	-
11.00	60	45.1	68.30	25.80	-
11.10	70	45.1	68.30	25.80	-
11.20	80	45.1	68.30	25.80	-
11.30	90	45.1	68.30	25.80	-
11.40	100	45.1	68.31	25.81	-
11.50	110	45.1	68.30	25.80	-
12.00	120	45.1	68.30	25.80	-
12.10	130	45.1	68.31	25.81	-
12.20	140	45.1	68.30	25.80	-
12.30	150	45.1	68.30	25.80	-
12.40	160	45.1	68.30	25.80	-
12.50	170	45.1	68.31	25.81	-
13.00	180	45.1	68.30	25.80	-
13.10	190	45.1	68.30	25.80	-
13.20	200	45.1	68.30	25.80	-
13.30	210	45.1	68.31	25.81	-
13.40	220	45.1	68.30	25.80	-
13.50	230	45.1	68.30	25.80	-
14.00	240	45.1	68.30	25.80	-
14.01	241	58.22	72.30	29.80	-
14.02	242	58.22	76.50	34.00	-
14.03	243	58.22	76.50	34.00	-
14.04	244	58.22	76.50	34.00	-
14.05	245	58.22	76.51	34.01	-
14.06	246	58.22	76.50	34.00	-
14.07	247	58.22	76.50	34.00	-
14.08	248	58.22	76.50	34.00	-
14.09	249	58.22	76.50	34.00	-
14.10	250	58.22	76.51	34.01	-
14.12	252	58.22	76.50	34.00	-
14.14	254	58.22	76.50	34.00	-
14.16	256	58.22	76.50	34.00	-
14.18	258	58.22	76.50	34.00	-
14.20	260	58.22	76.51	34.01	-
14.22	262	58.22	76.51	34.01	-
14.24	264	58.22	76.51	34.01	-
14.26	266	58.22	76.51	34.01	-
14.28	268	58.22	76.51	34.01	-
14.30	270	58.22	76.51	34.01	-
14.40	280	58.22	76.51	34.01	-
14.45	285	58.22	76.52	34.02	-
14.50	290	58.22	76.52	34.02	-
15.00	300	58.22	76.52	34.02	-
15.10	310	58.22	76.52	34.02	-

Appendix III-a-7 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

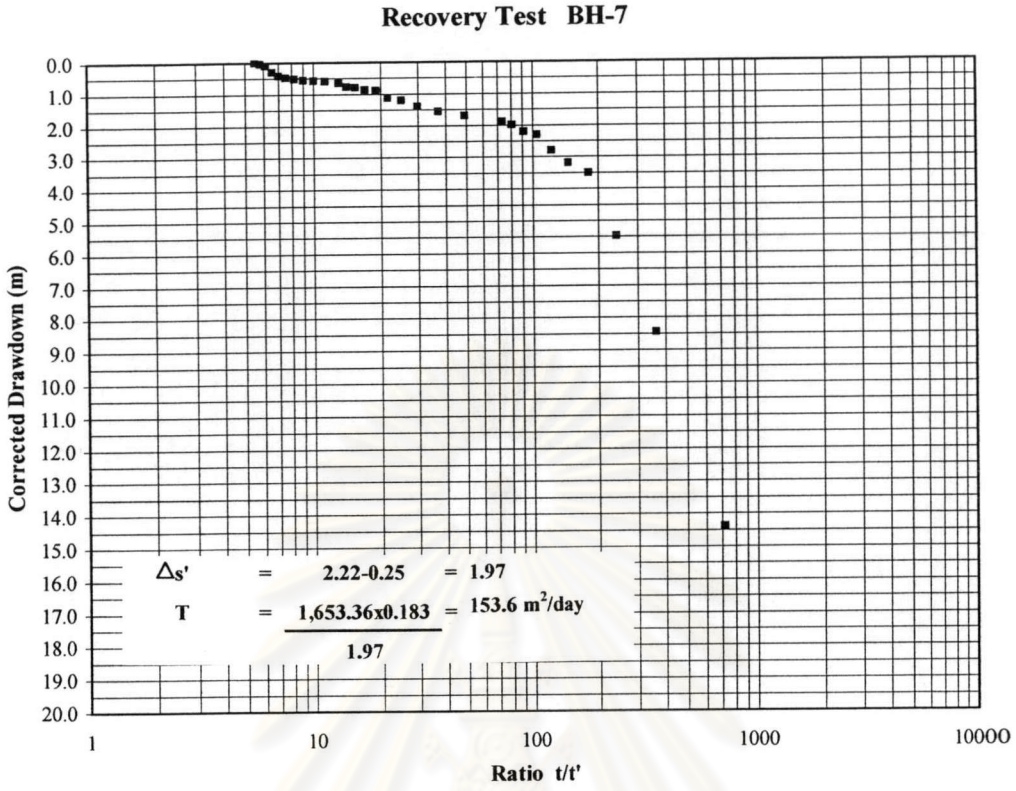
Well No. : 7		Hole Depth (m) : 180.5		Duration Time of Test (min) : 720	
UTM N : 6864565		Type of Test : Step Drawdown		Screen Interval (m) : 165.5-174.5	
E : 1552088		Date of Pumping Test : 19/06/1988		Static Water Level (m) : 42.50	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
15.20	320	58.22	76.52	34.02	-
15.30	330	58.22	76.52	34.02	-
15.40	340	58.22	76.52	34.02	-
15.50	350	58.22	76.52	34.02	-
16.00	360	58.22	76.52	34.02	-
16.10	370	58.22	76.51	34.01	-
16.20	380	58.22	76.52	34.02	-
16.30	390	58.22	76.52	34.02	-
16.40	400	58.22	76.52	34.02	-
16.50	410	58.22	76.52	34.02	-
17.00	420	58.22	76.52	34.02	-
17.10	430	58.22	76.52	34.02	-
17.20	440	58.22	76.52	34.02	-
17.30	450	58.22	76.52	34.02	-
17.40	460	58.22	76.52	34.02	-
17.50	470	58.22	76.52	34.02	-
18.00	480	58.22	76.52	34.02	-
18.01	481	68.89	83.00	40.50	-
18.02	482	68.89	84.00	41.50	-
18.03	483	68.89	84.10	41.60	-
18.04	484	68.89	84.20	41.70	-
18.05	485	68.89	84.20	41.70	-
18.06	486	68.89	84.22	41.72	-
18.07	487	68.89	84.25	41.75	-
18.08	488	68.89	84.30	41.80	-
18.09	489	68.89	84.33	41.83	-
18.10	490	68.89	84.38	41.88	-
18.12	492	68.89	84.40	41.90	-
18.14	494	68.89	84.45	41.95	-
18.16	496	68.89	84.48	41.98	-
18.18	498	68.89	84.50	42.00	-
18.20	500	68.89	84.50	42.00	-
18.22	502	68.89	84.55	42.05	-
18.24	504	68.89	84.56	42.06	-
18.26	506	68.89	84.56	42.06	-
18.28	508	68.89	84.58	42.08	-
18.30	510	68.89	84.57	42.07	-
18.35	515	68.89	84.58	42.08	-
18.40	520	68.89	84.58	42.08	-
18.45	525	68.89	84.58	42.08	-
18.50	530	68.89	84.59	42.09	-
18.55	535	68.89	84.60	42.10	-
19.00	540	68.89	84.60	42.10	-
19.10	550	68.89	84.59	42.09	-
19.20	560	68.89	84.60	42.10	-
19.30	570	68.89	84.60	42.10	-
19.40	580	68.89	84.60	42.10	-
19.50	590	68.89	84.59	42.09	-
20.00	600	68.89	84.60	42.10	-
20.10	610	68.89	84.59	42.09	-
20.20	620	68.89	84.60	42.10	-
20.30	630	68.89	84.60	42.10	-
20.40	640	68.89	84.60	42.10	-
20.50	650	68.89	84.60	42.10	-
21.00	660	68.89	84.60	42.10	-
21.10	670	68.89	84.60	42.10	-
21.20	680	68.89	84.60	42.10	-
21.30	690	68.89	84.60	42.10	-
21.40	700	68.89	84.60	42.10	-
21.50	710	68.89	84.59	42.09	-
22.00	720	68.89	84.59	42.09	-

Appendix III-a-7: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 7	Hole Depth (m) : 180.5	Duration Time of Test (min) : 240
UTM N : 6864565	Type of Test : Recovery	Screen Interval (m) : 165.5-174.5
E : 1552088	Pumping Test : 19-20/02/1989	Static Water Level (m) : 42.50

Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
22.00	0	720	-	84.59	42.09	41.99
22.01	1	721	721.00	57.00	14.50	14.40
22.02	2	722	361.00	51.05	8.55	8.45
22.03	3	723	241.00	48.08	5.58	5.48
22.04	4	724	181.00	46.10	3.60	3.50
22.05	5	725	145.00	45.80	3.30	3.20
22.06	6	726	121.00	45.40	2.90	2.80
22.07	7	727	103.86	44.90	2.40	2.30
22.08	8	728	91.00	44.80	2.30	2.20
22.09	9	729	81.00	44.60	2.10	2.00
22.10	10	730	73.00	44.50	2.00	1.90
22.15	15	735	49.00	44.30	1.80	1.70
22.20	20	740	37.00	44.15	1.65	1.55
22.25	25	745	29.80	44.00	1.50	1.40
22.30	30	750	25.00	43.80	1.30	1.20
22.35	35	755	21.57	43.72	1.22	1.12
22.40	40	760	19.00	43.50	1.00	0.90
22.45	45	765	17.00	43.47	0.97	0.87
22.50	50	770	15.40	43.40	0.90	0.80
22.55	55	775	14.09	43.38	0.88	0.78
23.00	60	780	13.00	43.25	0.75	0.65
23.10	70	790	11.29	43.19	0.69	0.59
23.20	80	800	10.00	43.18	0.68	0.58
23.30	90	810	9.00	43.15	0.65	0.55
23.40	100	820	8.20	43.12	0.62	0.52
23.50	110	830	7.55	43.08	0.58	0.48
24.00	120	840	7.00	43.01	0.51	0.41
24.10	130	850	6.54	42.90	0.40	0.30
24.20	140	860	6.14	42.70	0.20	0.10
24.30	150	870	5.80	42.65	0.15	0.05
24.40	160	880	5.50	42.60	0.10	0.00
24.50	170	890	5.24	42.55	0.05	-0.05
1.00	180	900	5.00	42.50	0.00	-0.10
1.10	190	910	4.79	42.50	0.00	-0.10
1.20	200	920	4.60	42.50	0.00	-0.10
1.30	210	930	4.43	42.50	0.00	-0.10
1.40	220	940	4.27	42.50	0.00	-0.10
1.50	230	950	4.13	42.50	0.00	-0.10
2.00	240	960	4.00	42.50	0.00	-0.10

Appendix III-a-7 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)



Appendix III-a-8 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 8		Hole Depth (m) : 139.14		Duration Time of Test (min) : 3360	
UTM N : 1552300		Type of Test : Step Drawdown		Screen Interval (m) : 126.76-132.81	
E : 668400		Date of Pumping Test : 08-10/08/1987		Static Water Level (m) : 19.98	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
9.05	0	11	19.98	0.00	-
9.06	1	11	21.91	1.93	-
9.07	2	11	21.04	1.06	-
9.08	3	11	21.93	1.95	-
9.09	4	11	21.49	1.51	-
9.10	5	11	21.46	1.48	-
9.15	10	11	20.70	0.72	-
9.20	15	11	20.72	0.74	-
9.25	20	11	20.70	0.72	-
9.30	25	11	20.72	0.74	-
9.35	30	11	20.71	0.73	-
9.40	35	11	20.72	0.74	-
9.45	40	11	20.72	0.74	-
9.50	45	11	20.69	0.71	-
9.55	50	11	20.69	0.71	-
10.00	55	11	20.70	0.72	-
10.05	60	11	20.72	0.74	-
10.15	70	11	20.73	0.75	-
10.25	80	11	20.73	0.75	-
10.35	90	11	20.74	0.76	-
10.45	100	11	20.73	0.75	-
10.55	110	11	20.74	0.76	-
11.05	120	11	20.74	0.76	-
11.06	121	13.1	21.02	1.04	-
11.07	122	13.1	21.01	1.03	-
11.08	123	13.1	21.02	1.04	-
11.09	124	13.1	20.97	0.99	-
11.10	125	13.1	20.90	0.92	-
11.15	130	13.1	20.92	0.94	-
11.20	135	13.1	20.92	0.94	-
11.25	140	13.1	20.93	0.95	-
11.30	145	13.1	20.93	0.95	-
11.35	150	13.1	20.92	0.94	-
11.40	155	13.1	20.93	0.95	-
11.45	160	13.1	20.92	0.94	-
11.50	165	13.1	20.92	0.94	-
11.55	170	13.1	20.93	0.95	-
12.05	180	13.1	20.93	0.95	-
12.15	190	13.1	20.92	0.94	-
12.25	200	13.1	20.94	0.96	-
12.35	210	13.1	20.93	0.95	-
12.45	220	13.1	20.93	0.95	-
12.55	230	13.1	20.94	0.96	-
13.05	240	13.1	20.93	0.95	-
13.06	241	15.3	21.00	1.02	-
13.07	242	15.3	21.13	1.15	-
13.08	243	15.3	21.15	1.17	-
13.09	244	15.3	21.16	1.18	-
13.10	245	15.3	21.03	1.05	-
13.15	250	15.3	21.07	1.09	-
13.20	255	15.3	21.10	1.12	-
13.25	260	15.3	21.13	1.15	-
13.30	265	15.3	21.12	1.14	-
13.35	270	15.3	21.13	1.15	-
13.40	275	15.3	21.14	1.16	-
13.45	280	15.3	21.13	1.15	-
13.55	290	15.3	21.13	1.15	-
14.05	300	15.3	21.12	1.14	-
14.15	310	15.3	21.11	1.13	-
14.25	320	15.3	21.13	1.15	-
14.35	330	15.3	21.13	1.15	-
14.45	340	15.3	21.14	1.16	-
13.50	285	15.3	21.14	1.16	-

Appendix III-a-8 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

Well No. : 8		Hole Depth (m) : 139.14		Duration Time of Test (min) : 3360	
UTM N : 1552300		Type of Test : Step Drawdown		Screen Interval (m) : 126.76-132.81	
E : 668400		Date of Pumping Test : 08-10/08/1987		Static Water Level (m) : 19.98	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
14.55	350	15.3	21.14	1.16	-
15.05	360	15.3	21.14	1.16	-
15.06	361	15.3	21.15	1.17	-
15.07	362	18	21.22	1.24	-
15.08	363	18	21.25	1.27	-
15.09	364	18	21.24	1.26	-
15.10	365	18	21.24	1.26	-
15.15	370	18	21.24	1.26	-
15.20	375	18	21.22	1.24	-
15.25	380	18	21.22	1.24	-
15.30	385	18	21.22	1.24	-
15.35	390	18	21.23	1.25	-
15.40	395	18	21.22	1.24	-
15.45	400	18	21.23	1.25	-
15.55	405	18	21.24	1.26	-
16.00	410	18	21.24	1.26	-
16.05	420	18	21.22	1.24	-
16.15	430	18	21.22	1.24	-
16.25	440	18	21.23	1.25	-
16.35	450	18	21.23	1.25	-
16.45	460	18	21.23	1.25	-
16.55	470	18	21.22	1.24	-
17.05	480	18	21.23	1.25	-
17.35	510	18	21.23	1.25	-
18.05	540	18	21.22	1.24	-
18.35	570	18	21.22	1.24	-
19.05	600	18	21.23	1.25	-
19.35	630	18	21.23	1.25	-
20.05	660	18	21.23	1.25	-
20.35	690	18	21.02	1.04	-
21.05	720	18	21.02	1.04	-
21.35	750	18	21.01	1.03	-
22.05	780	18	21.01	1.03	-
22.35	810	18	21.01	1.03	-
23.05	840	18	21.00	1.02	-
23.35	870	18	21.00	1.02	-
24.05	900	18	21.00	1.02	-
24.35	930	18	21.02	1.04	-
1.05	960	18	21.00	1.02	-
1.35	990	18	21.00	1.02	-
2.05	1020	18	21.00	1.02	-
2.35	1050	18	21.01	1.03	-
3.05	1080	18	21.01	1.03	-
3.35	1110	18	21.01	1.03	-
4.05	1140	18	21.01	1.03	-
4.35	1170	18	21.01	1.03	-
5.05	1200	18	21.01	1.03	-
5.35	1230	18	21.01	1.03	-
6.05	1260	18	21.02	1.04	-
6.35	1290	18	21.03	1.05	-
7.05	1320	18	21.04	1.06	-
7.35	1350	18	21.05	1.07	-
8.05	1380	18	21.07	1.09	-
8.35	1410	18	21.07	1.09	-
9.05	1440	18	21.06	1.08	-
9.35	1470	18	21.07	1.09	-
10.05	1500	18	21.05	1.07	-
10.35	1530	18	21.07	1.09	-
11.05	1560	18	21.08	1.10	-
11.35	1590	18	21.08	1.10	-
12.05	1620	18	21.10	1.12	-
12.35	1650	18	21.12	1.14	-
13.05	1680	18	21.12	1.14	-

Appendix III-a-8 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

Well No. : 8		Hole Depth (m) : 139.14		Duration Time of Test (min) : 3360	
UTM N : 1552300		Type of Test : Step Drawdown		Screen Interval (m) : 126.76-132.81	
E : 668400		Date of Pumping Test : 08-10/08/1987		Static Water Level (m) : 19.98	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
13.35	1710	18	21.13	1.15	-
14.05	1740	18	21.13	1.15	-
14.35	1770	18	21.14	1.16	-
15.05	1800	18	21.13	1.15	-
15.35	1830	18	21.14	1.16	-
16.05	1860	18	21.15	1.17	-
16.35	1890	18	21.14	1.16	-
17.05	1920	18	21.13	1.15	-
17.35	1950	18	21.10	1.12	-
18.05	1980	18	21.09	1.11	-
18.35	2010	18	21.08	1.10	-
19.05	2040	18	21.08	1.10	-
19.35	2070	18	21.09	1.11	-
20.05	2100	18	21.06	1.08	-
20.35	2130	18	21.05	1.07	-
21.05	2160	18	21.04	1.06	-
21.35	2190	18	21.04	1.06	-
22.05	2220	18	21.03	1.05	-
22.35	2250	18	21.04	1.06	-
23.05	2280	18	21.03	1.05	-
23.35	2310	18	21.03	1.05	-
24.05	2340	18	21.02	1.04	-
24.35	2370	18	21.00	1.02	-
1.05	2400	18	21.02	1.04	-
1.35	2430	18	21.01	1.03	-
2.05	2460	18	21.01	1.03	-
2.35	2490	18	21.02	1.04	-
3.05	2520	18	21.02	1.04	-
3.35	2550	18	21.08	1.10	-
4.05	2580	18	21.08	1.10	-
4.35	2610	18	21.02	1.04	-
5.05	2640	18	21.03	1.05	-
5.35	2670	18	21.02	1.04	-
6.05	2700	18	21.01	1.03	-
6.35	2730	18	21.03	1.05	-
7.05	2760	18	21.02	1.04	-
7.35	2790	18	21.03	1.05	-
8.05	2820	18	21.02	1.04	-
8.35	2850	18	21.04	1.06	-
9.05	2880	18	21.05	1.07	-
9.35	2910	18	21.05	1.07	-
10.05	2940	18	21.07	1.09	-
10.35	2970	18	21.07	1.09	-
11.05	3000	18	21.06	1.08	-
11.35	3030	18	21.07	1.09	-
12.05	3060	18	21.08	1.10	-
12.35	3090	18	21.06	1.08	-
13.05	3120	18	21.09	1.11	-
13.35	3150	18	21.09	1.11	-
14.05	3180	18	21.10	1.12	-
14.35	3210	18	21.10	1.12	-
15.05	3240	18	21.09	1.11	-
15.35	3270	18	21.12	1.14	-
16.05	3300	18	21.13	1.15	-
16.35	3330	18	21.13	1.15	-
17.05	3360	18	21.13	1.15	-

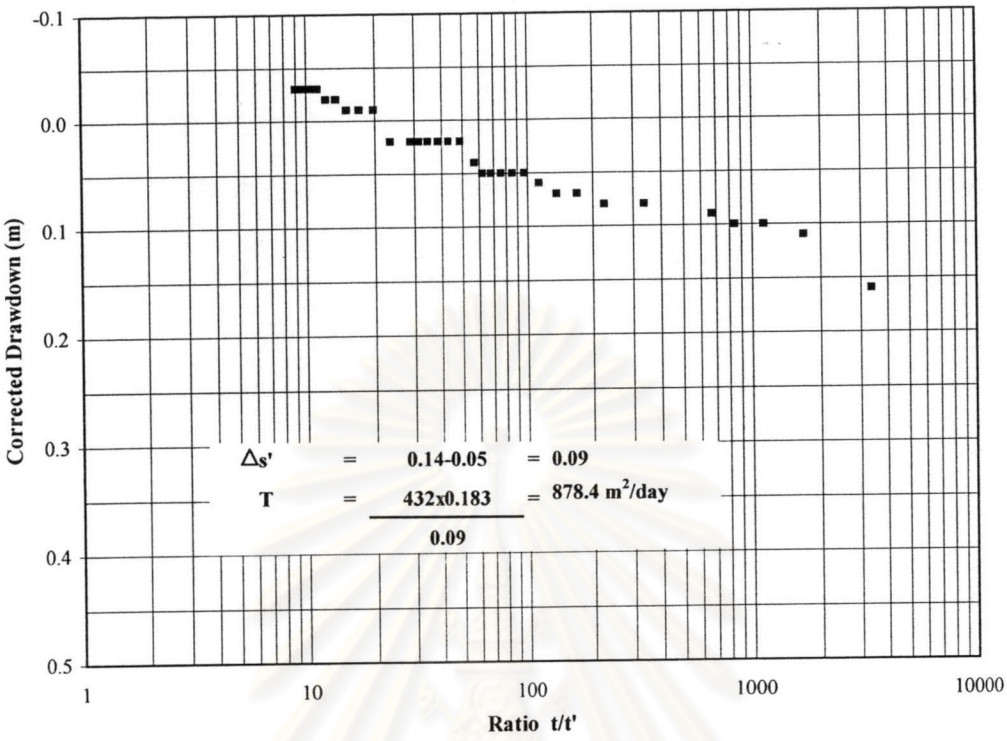
Appendix III-a-8: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 8	Hole Depth (m) : 139.14	Duration Time of Test (min) : 420
UTM N : 1552300	Type of Test Recovery	Screen Interval (m) : 126.76-132.81
E : 668400	Date of Pumping Test : 10/08/1987	Static Water Level (m) : 46.64

Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
17.05	0	3360	-	21.13	1.15	1.14
17.06	1	3361	3361.00	20.14	0.16	0.15
17.07	2	3362	1681.00	20.09	0.11	0.10
17.08	3	3363	1121.00	20.08	0.10	0.09
17.09	4	3364	841.00	20.08	0.10	0.09
17.10	5	3365	673.00	20.07	0.09	0.08
17.15	10	3370	337.00	20.06	0.08	0.07
17.20	15	3375	225.00	20.06	0.08	0.07
17.25	20	3380	169.00	20.05	0.07	0.06
17.30	25	3385	135.40	20.05	0.07	0.06
17.35	30	3390	113.00	20.04	0.06	0.05
17.40	35	3395	97.00	20.03	0.05	0.04
17.45	40	3400	85.00	20.03	0.05	0.04
17.50	45	3405	75.67	20.03	0.05	0.04
17.55	50	3410	68.20	20.03	0.05	0.04
18.00	55	3415	62.09	20.03	0.05	0.04
18.05	60	3420	57.00	20.02	0.04	0.03
18.15	70	3430	49.00	20.00	0.02	0.01
18.25	80	3440	43.00	20.00	0.02	0.01
18.35	90	3450	38.33	20.00	0.02	0.01
18.45	100	3460	34.60	20.00	0.02	0.01
18.55	110	3470	31.55	20.00	0.02	0.01
19.05	120	3480	29.00	20.00	0.02	0.01
19.35	150	3510	23.40	20.00	0.02	0.01
20.05	180	3540	19.67	19.97	-0.01	-0.02
20.35	210	3570	17.00	19.97	-0.01	-0.02
21.05	240	3600	15.00	19.97	-0.01	-0.02
21.35	270	3630	13.44	19.96	-0.02	-0.03
22.05	300	3660	12.20	19.96	-0.02	-0.03
22.35	330	3690	11.18	19.95	-0.03	-0.04
23.05	360	3720	10.33	19.95	-0.03	-0.04
23.35	390	3750	9.62	19.95	-0.03	-0.04
24.05	420	3780	9.00	19.95	-0.03	-0.04

Appendix III-a-8 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Recovery Test BH-8



Appendix III-a-9 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 9		Hole Depth (m) : 166		Duration Time of Test (min) : 900	
UTM N : 685925		Type of Test : Step Drawdown		Screen Interval (m) : 146-149	
E : 1541175		Date of Pumping Test : 03-04/12/1993		Static Water Level (m) : 46.90	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
18.00	0		46.90	0.00	-
18.01	1	3	48.70	1.80	-
18.02	2	3	47.70	0.80	-
18.03	3	3	47.74	0.84	-
18.04	4	3	47.75	0.85	-
18.05	5	3	47.76	0.86	-
18.06	6	3	47.77	0.87	-
18.07	7	3	47.77	0.87	-
18.08	8	3	47.76	0.86	-
18.09	9	3	47.74	0.84	-
18.10	10	3	47.74	0.84	-
18.12	12	3	47.76	0.86	-
18.14	14	3	47.74	0.84	-
18.16	16	3	47.76	0.86	-
18.18	18	3	47.74	0.84	-
18.20	20	3	47.74	0.84	-
18.22	22	3	47.74	0.84	-
18.24	24	3	47.73	0.83	-
18.26	26	3	47.73	0.83	-
18.28	28	3	47.73	0.83	-
18.30	30	3	47.72	0.82	-
18.35	35	3	47.74	0.84	-
18.40	40	3	47.72	0.82	-
18.45	45	3	47.74	0.84	-
18.50	50	3	47.74	0.84	-
19.00	60	3	47.72	0.82	-
19.10	70	3	47.78	0.88	-
19.20	80	3	47.72	0.82	-
19.30	90	3	47.72	0.82	-
19.40	100	3	47.74	0.84	-
19.50	110	3	47.73	0.83	-
20.00	120	3	47.72	0.82	-
20.20	140	3	47.74	0.84	-
20.40	160	3	47.74	0.84	-
21.00	180	3	47.73	0.83	-
21.30	210	3	47.75	0.85	-
22.00	240	3	47.74	0.84	-
22.01	241	5	48.25	1.35	-
22.02	242	5	48.35	1.45	-
22.03	243	5	48.31	1.41	-
22.04	244	5	48.30	1.40	-
22.05	245	5	48.30	1.40	-
22.06	246	5	48.36	1.46	-
22.07	247	5	48.43	1.53	-
22.08	248	5	48.45	1.55	-
22.09	249	5	48.46	1.56	-
22.10	250	5	48.30	1.40	-
22.12	252	5	48.33	1.43	-
22.14	254	5	48.36	1.46	-
22.16	256	5	48.34	1.44	-
22.18	258	5	48.35	1.45	-
22.20	260	5	48.37	1.47	-
22.22	262	5	48.36	1.46	-
22.24	264	5	48.39	1.49	-
22.26	266	5	48.42	1.52	-
22.28	268	5	48.39	1.49	-
22.30	270	5	48.40	1.50	-

Appendix III-a-9 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

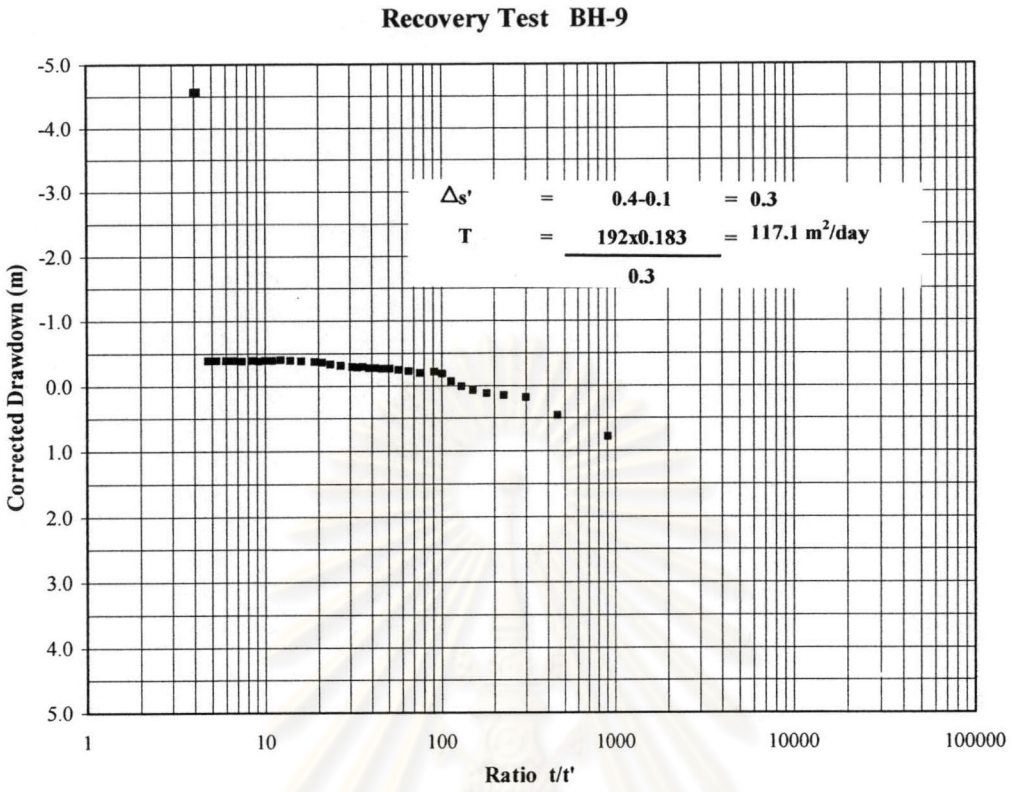
Well No. : 9		Hole Depth (m) : 166		Duration Time of Test (min) : 900	
UTM N : 685925		Type of Test : Step Drawdown		Screen Interval (m) : 146-149	
E : 1541175		Date of Pumping Test : 03-04/12/1993		Static Water Level (m) : 46.90	
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
22.35	275	5	48.38	1.48	-
22.40	280	5	48.40	1.50	-
22.45	285	5	48.39	1.49	-
22.50	290	5	48.40	1.50	-
23.00	300	5	48.39	1.49	-
23.10	310	5	48.38	1.48	-
23.20	320	5	48.39	1.49	-
23.30	330	5	48.40	1.50	-
23.40	340	5	48.38	1.48	-
23.50	350	5	48.40	1.50	-
24.00	360	5	48.39	1.49	-
24.20	380	5	48.38	1.48	-
2.09	489	8	49.98	3.08	-
2.10	490	8	49.99	3.09	-
2.12	492	8	50.00	3.10	-
2.14	494	8	49.99	3.09	-
2.16	496	8	49.98	3.08	-
2.18	498	8	49.97	3.07	-
2.20	500	8	49.97	3.07	-
2.22	502	8	49.97	3.07	-
2.24	504	8	49.98	3.08	-
2.26	506	8	49.98	3.08	-
2.28	508	8	49.98	3.08	-
2.30	510	8	49.97	3.07	-
2.35	515	8	49.98	3.08	-
2.40	520	8	49.98	3.08	-
2.45	525	8	49.97	3.07	-
2.50	530	8	49.97	3.07	-
3.00	540	8	49.98	3.08	-
3.10	550	8	49.97	3.07	-
3.20	560	8	49.98	3.08	-
3.30	570	8	49.98	3.08	-
3.40	580	8	49.97	3.07	-
3.50	590	8	49.98	3.08	-
4.00	600	8	49.97	3.07	-
4.20	620	8	49.97	3.07	-
4.40	640	8	49.98	3.08	-
5.00	660	8	49.97	3.07	-
5.30	690	8	49.97	3.07	-
6.00	720	8	49.98	3.08	-
7.00	780	8	49.98	3.08	-
8.00	840	8	49.97	3.07	-
9.00	900	8	49.97	3.07	-

Appendix III-a-9: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 9	Hole Depth (m) : 166	Duration Time of Test (min) : 240
UTM N : 686000	Type of Test : Recovery	Screen Interval (m) : 146-149
E : 1541175	Date of Pumping Test : 04/12-1993	Static Water Level (m) : 46.90

Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
18.00	0	900	-	49.97	3.07	2.90
18.01	1	901	901.00	47.85	0.95	0.78
18.02	2	902	451.00	47.53	0.63	0.46
18.03	3	903	301.00	47.25	0.35	0.18
18.04	4	904	226.00	47.22	0.32	0.15
18.05	5	905	181.00	47.19	0.29	0.12
18.06	6	906	151.00	47.14	0.24	0.07
18.07	7	907	129.57	47.08	0.18	0.01
18.08	8	908	113.50	47.00	0.10	-0.07
18.09	9	909	101.00	46.88	-0.02	-0.19
18.10	10	910	91.00	46.86	-0.04	-0.21
18.12	12	912	76.00	46.87	-0.03	-0.20
18.14	14	914	65.29	46.85	-0.05	-0.22
18.16	16	916	57.25	46.83	-0.07	-0.24
18.18	18	918	51.00	46.81	-0.09	-0.26
18.20	20	920	46.00	46.81	-0.09	-0.26
18.22	22	922	41.91	46.80	-0.10	-0.27
18.24	24	924	38.50	46.80	-0.10	-0.27
18.26	26	926	35.62	46.78	-0.12	-0.29
18.28	28	928	33.14	46.79	-0.11	-0.28
18.30	30	930	31.00	46.78	-0.12	-0.29
18.35	35	935	26.71	46.76	-0.14	-0.31
18.40	40	940	23.50	46.74	-0.16	-0.33
18.45	45	945	21.00	46.71	-0.19	-0.36
18.50	50	950	19.00	46.70	-0.20	-0.37
19.00	60	960	16.00	46.69	-0.21	-0.38
19.10	70	970	13.86	46.68	-0.22	-0.39
19.20	80	980	12.25	46.67	-0.23	-0.40
19.30	90	990	11.00	46.68	-0.22	-0.39
19.40	100	1000	10.00	46.68	-0.22	-0.39
19.50	110	1010	9.18	46.69	-0.21	-0.38
20.00	120	1020	8.50	46.68	-0.22	-0.39
20.20	140	1040	7.43	46.69	-0.21	-0.38
20.40	160	1060	6.63	46.68	-0.22	-0.39
21.00	180	1080	6.00	46.68	-0.22	-0.39
21.30	210	1110	5.29	46.68	-0.22	-0.39
22.00	240	1140	4.75	46.68	-0.22	-0.39
1.50	230	950	4.13	42.50	-4.40	-4.57
2.00	240	960	4.00	42.50	-4.40	-4.57

Appendix III-a-9 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)



Appendix III-a-10 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 10	Hole Depth (m) : 207	Duration Time of Test (min) : 420
UTM N : 700685	Type of Test : Constant Rate	Screen Interval (m) : 146-149
E : 1548175	Date of Pumping Test : 27/04/1992	Static Water Level (m) : 9.40

Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
9.30	0		9.40	0.00	0.00
9.32	2	48	13.22	3.82	2.38
9.34	4	48	15.35	5.95	4.51
9.36	6	48	19.50	10.10	8.66
9.38	8	48	21.31	11.91	10.47
9.40	10	48	25.50	16.10	14.66
9.42	12	48	26.42	17.02	15.58
9.44	14	48	27.36	17.96	16.52
9.46	16	48	28.10	18.70	17.26
9.48	18	48	29.00	19.60	18.16
9.50	20	48	29.46	20.06	18.62
9.55	25	48	30.19	20.79	19.35
10.00	30	48	30.55	21.15	19.71
10.10	40	48	30.86	21.46	20.02
10.20	50	48	31.56	22.16	20.72
10.30	60	48	32.20	22.80	21.36
10.40	70	48	32.60	23.20	21.76
10.50	80	48	33.16	23.76	22.32
11.00	90	48	33.64	24.24	22.80
11.10	100	48	34.00	24.60	23.16
11.30	120	48	34.42	25.02	23.58
11.50	140	48	35.05	25.65	24.21
12.10	160	48	35.52	26.12	24.68
12.30	180	48	35.98	26.58	25.14
13.00	210	48	36.10	26.70	25.26
13.30	240	48	36.18	26.78	25.34
14.00	270	48	35.26	25.86	24.42
14.30	300	48	35.51	26.11	24.67
15.00	330	48	35.73	26.33	24.89
15.30	360	48	35.85	26.45	25.01
16.30	420	48	36.08	26.68	25.24

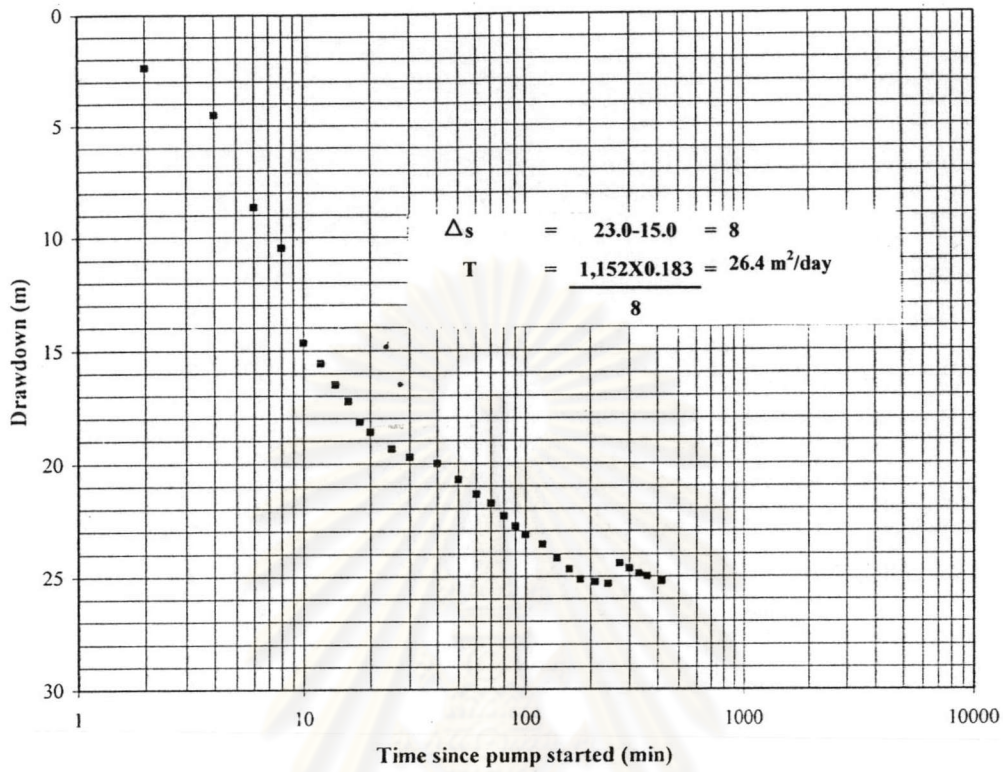
Appendix III-a-10: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 10	Hole Depth (m) : 207	Duration Time of Test (min) : 240
UTM N : 700685	Type of Test : Recovery	Screen Interval (m) : 146-149
E : 1548175	Date of Pumping Test : 27/04/1992	Static Water Level (m) : 9.40

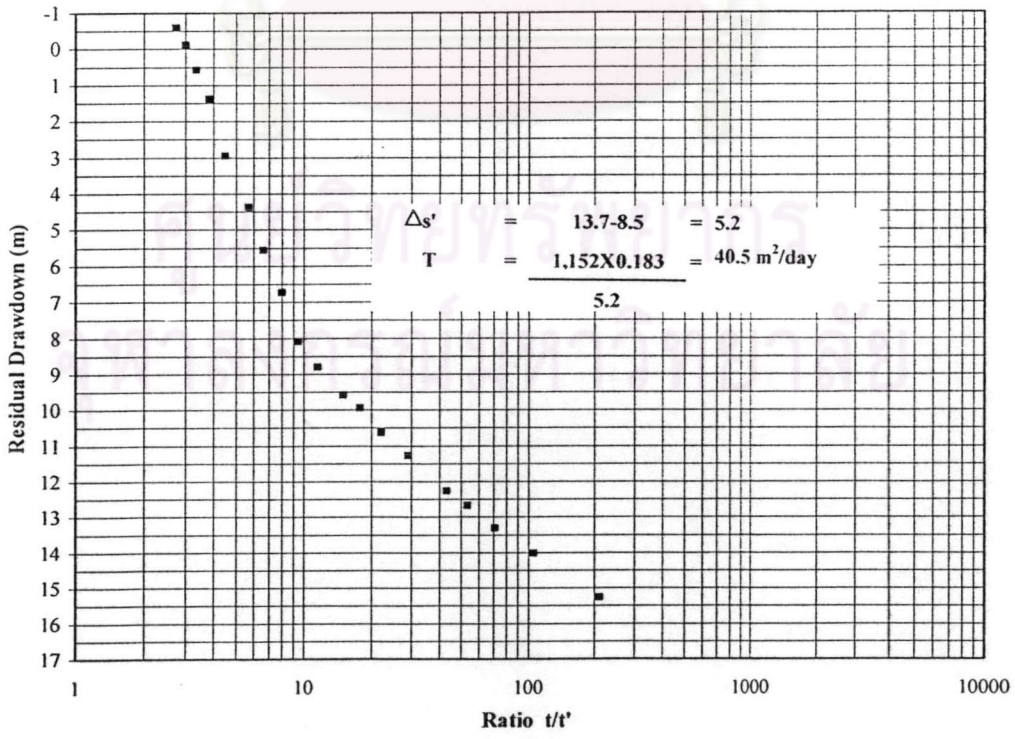
Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
16.30	0	420	-	36.08	26.68	25.35
16.32	2	422	211.00	26.00	16.60	15.27
16.34	4	424	106.00	24.75	15.35	14.02
16.36	6	426	71.00	24.05	14.65	13.32
16.38	8	428	53.50	23.40	14.00	12.67
16.40	10	430	43.00	23.00	13.60	12.27
16.45	15	435	29.00	22.00	12.60	11.27
16.50	20	440	22.00	21.36	11.96	10.63
16.55	25	445	17.80	20.68	11.28	9.95
17.00	30	450	15.00	20.32	10.92	9.59
17.10	40	460	11.50	19.53	10.13	8.80
17.20	50	470	9.40	18.82	9.42	8.09
17.30	60	480	8.00	17.47	8.07	6.74
17.45	75	495	6.60	16.30	6.90	5.57
18.00	90	510	5.67	15.10	5.70	4.37
18.30	120	540	4.50	13.68	4.28	2.95
19.00	150	570	3.80	12.10	2.70	1.37
19.30	180	600	3.33	11.31	1.91	0.58
20.00	210	630	3.00	10.62	1.22	-0.11
20.30	240	660	2.75	10.13	0.73	-0.60

Appendix III-a-10 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-10



Recovery Test BH-10



Appendix III-a-11 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 11	Hole Depth (m) : 250	Duration Time of Test (min) : 2880
UTM N : 674256	Type of Test : Constant Rate	Screen Interval (m) : 168.4-174.82
E : 1547045	Date of Pumping Test : 15-17/05/1993	Static Water Level (m) : 49.72

Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
12.00	0		49.70	0.00	-
12.01	1	160	55.10	5.40	-
12.02	2	160	55.70	6.00	-
12.03	3	160	55.70	6.00	-
12.04	4	160	55.80	6.10	-
12.05	5	160	55.80	6.10	-
12.06	6	160	55.70	6.00	-
12.07	7	160	55.70	6.00	-
12.08	8	160	55.70	6.00	-
12.09	9	160	55.70	6.00	-
12.10	10	160	55.60	5.90	-
12.12	12	160	55.50	5.80	-
12.14	14	160	55.60	5.90	-
12.16	16	160	55.70	6.00	-
12.18	18	160	55.90	6.20	-
12.20	20	160	55.80	6.10	-
12.25	25	160	55.80	6.10	-
12.30	30	160	55.60	5.90	-
12.40	40	160	54.30	4.60	-
12.50	50	160	54.30	4.60	-
13.00	60	160	54.30	4.60	-
13.20	80	160	55.40	5.70	-
13.40	100	160	55.80	6.10	-
14.00	120	160	55.80	6.10	-
14.20	140	160	55.80	6.10	-
14.40	160	160	55.80	6.10	-
15.00	180	160	55.80	6.10	-
15.30	210	160	56.00	6.30	-
16.00	240	160	56.00	6.30	-
17.00	300	160	56.20	6.50	-
18.00	360	160	56.30	6.60	-
19.00	420	160	56.30	6.60	-
20.00	480	160	56.30	6.60	-
21.00	540	160	56.40	6.70	-
22.00	600	160	56.40	6.70	-
23.00	660	160	56.50	6.80	-

Appendix III-a-11 : Pumping Test Data (Layne (Thailand) Ltd., unpublished) continued

Well No. : 11	Hole Depth (m) : 250	Duration Time of Test (min) : 2880
UTM N : 674256	Type of Test : Constant Rate	Screen Interval (m) : 168.4-174.82
E : 1547045	Date of Pumping Test : 15-17/05/1993	Static Water Level (m) : 49.72

Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
24.00	720	160	56.50	6.80	-
1.00	780	160	56.50	6.80	-
2.00	840	160	56.60	6.90	-
3.00	900	160	56.60	6.90	-
4.00	960	160	56.60	6.90	-
5.00	1020	160	56.70	7.00	-
6.00	1080	160	56.70	7.00	-
7.00	1140	160	56.70	7.00	-
8.00	1200	160	56.90	7.20	-
9.00	1260	160	56.90	7.20	-
10.00	1320	160	56.30	6.60	-
11.00	1380	160	56.40	6.70	-
12.00	1440	160	56.40	6.70	-
13.00	1500	160	56.80	7.10	-
14.00	1560	160	57.10	7.40	-
15.00	1620	160	56.30	6.60	-
16.00	1680	160	56.60	6.90	-
17.00	1740	160	56.30	6.60	-
18.00	1800	160	56.20	6.50	-
19.00	1860	160	55.10	5.40	-
20.00	1920	160	55.10	5.40	-
21.00	1980	160	55.20	5.50	-
22.00	2040	160	54.90	5.20	-
23.00	2100	160	54.80	5.10	-
24.00	2160	160	54.80	5.10	-
1.00	2220	160	54.80	5.10	-
2.00	2280	160	54.80	5.10	-
3.00	2340	160	54.80	5.10	-
4.00	2400	160	54.80	5.10	-
5.00	2460	160	54.80	5.10	-
6.00	2520	160	54.80	5.10	-
7.00	2580	160	54.80	5.10	-
8.00	2640	160	56.90	7.20	-
9.00	2700	160	56.50	6.80	-
10.00	2760	160	54.60	4.90	-
11.00	2820	160	56.90	7.20	-
12.00	2880	160	56.50	6.80	-

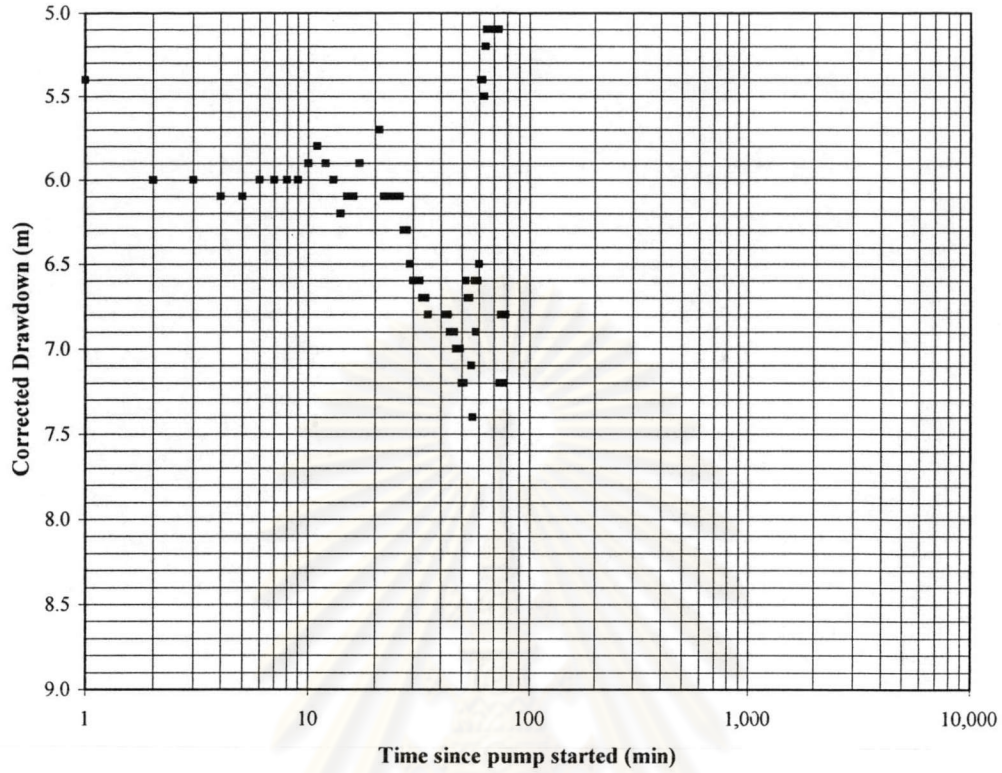
Appendix III-a-11: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 11	Hole Depth (m) : 250	Duration Time of Test (min) : 1440
UTM N : 674256	Type of Test Recovery	Screen Interval (m) : 168.4-174.28
E : 1547045	Date of Pumping Test : 17-18/05/1993	Static Water Level (m) : 49.72

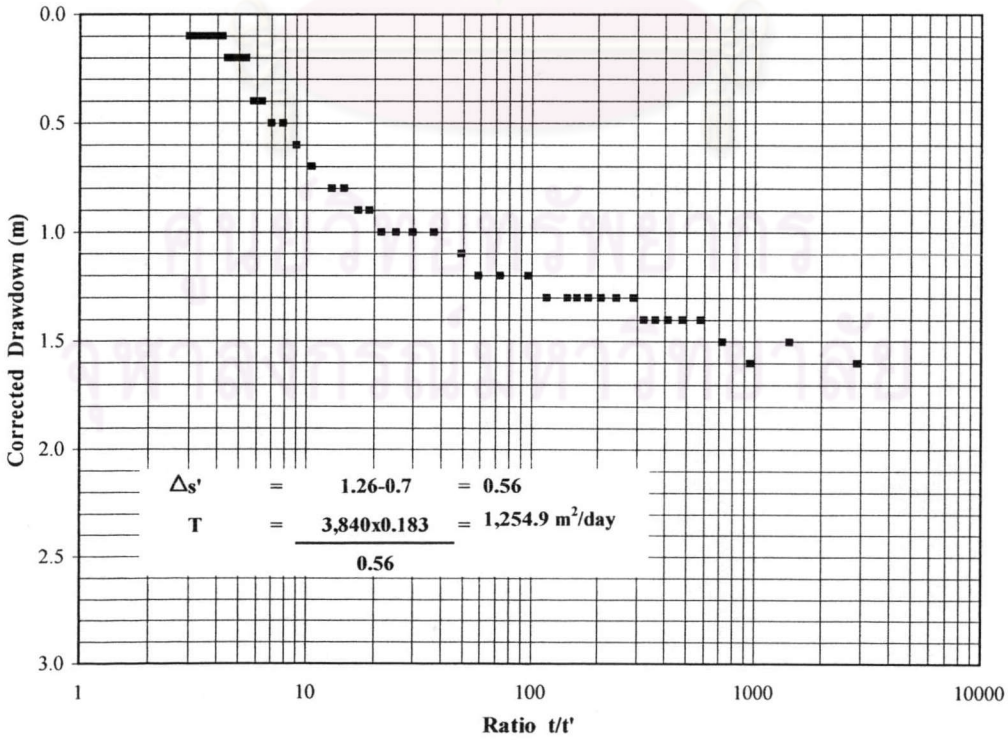
Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
12.00	0	2880	-	56.50	6.8	-
12.01	1	2881	2881.00	51.30	1.60	-
12.02	2	2882	1441.00	51.20	1.50	-
12.03	3	2883	961.00	51.30	1.60	-
12.04	4	2884	721.00	51.20	1.50	-
12.05	5	2885	577.00	51.10	1.40	-
12.06	6	2886	481.00	51.10	1.40	-
12.07	7	2887	412.43	51.10	1.40	-
12.08	8	2888	361.00	51.10	1.40	-
12.09	9	2889	321.00	51.10	1.40	-
12.10	10	2890	289.00	51.00	1.30	-
12.12	12	2892	241.00	51.00	1.30	-
12.14	14	2894	206.71	51.00	1.30	-
12.16	16	2896	181.00	51.00	1.30	-
12.18	18	2898	161.00	51.00	1.30	-
12.20	20	2900	145.00	51.00	1.30	-
12.25	25	2905	116.20	51.00	1.30	-
12.30	30	2910	97.00	50.90	1.20	-
12.40	40	2920	73.00	50.90	1.20	-
12.50	50	2930	58.60	50.90	1.20	-
13.00	60	2940	49.00	50.80	1.10	-
13.20	80	2960	37.00	50.70	1.00	-
13.40	100	2980	29.80	50.70	1.00	-
14.00	120	3000	25.00	50.70	1.00	-
14.20	140	3020	21.57	50.70	1.00	-
14.40	160	3040	19.00	50.60	0.90	-
15.00	180	3060	17.00	50.60	0.90	-
15.30	210	3090	14.71	50.50	0.80	-
16.00	240	3120	13.00	50.50	0.80	-
17.00	300	3180	10.60	50.40	0.70	-
18.00	360	3240	9.00	50.30	0.60	-
19.00	420	3300	7.86	50.20	0.50	-
20.00	480	3360	7.00	50.20	0.50	-
21.00	540	3420	6.33	50.10	0.40	-
22.00	600	3480	5.80	50.10	0.40	-
23.00	660	3540	5.36	49.90	0.20	-
24.00	720	3600	5.00	49.90	0.20	-
1.00	780	3660	4.69	49.90	0.20	-
2.00	840	3720	4.43	49.90	0.20	-
3.00	900	3780	4.20	49.80	0.10	-
4.00	960	3840	4.00	49.80	0.10	-

Appendix III-a-11 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-11



Recovery Test BH-11



Appendix III-a-12 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 12	Hole Depth (m) : 192.5	Duration Time of Test (min) : 360
UTM N : 674200	Type of Test : Constant Rate	Screen Interval (m) : 156-160.5, 176-189.5
E : 1535200	Date of Pumping Test : 05/06/1994	Static Water Level (m) : 41.88

Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
17.10	0		41.88	0.00	0.00
17.20	10	68	47.25	5.37	5.36
17.30	20	68	47.26	5.38	5.37
17.40	30	68	47.30	5.42	5.41
17.55	45	68	47.32	5.44	5.43
18.10	60	68	47.33	5.45	5.44
18.30	80	68	47.36	5.48	5.47
18.50	100	68	47.40	5.52	5.51
19.10	120	68	47.41	5.53	5.52
19.40	150	68	47.52	5.64	5.63
20.10	180	68	47.37	5.49	5.48
20.55	225	68	47.37	5.49	5.48
21.40	270	68	47.37	5.49	5.48
22.25	315	68	47.37	5.49	5.48
23.10	360	68	47.37	5.49	5.48

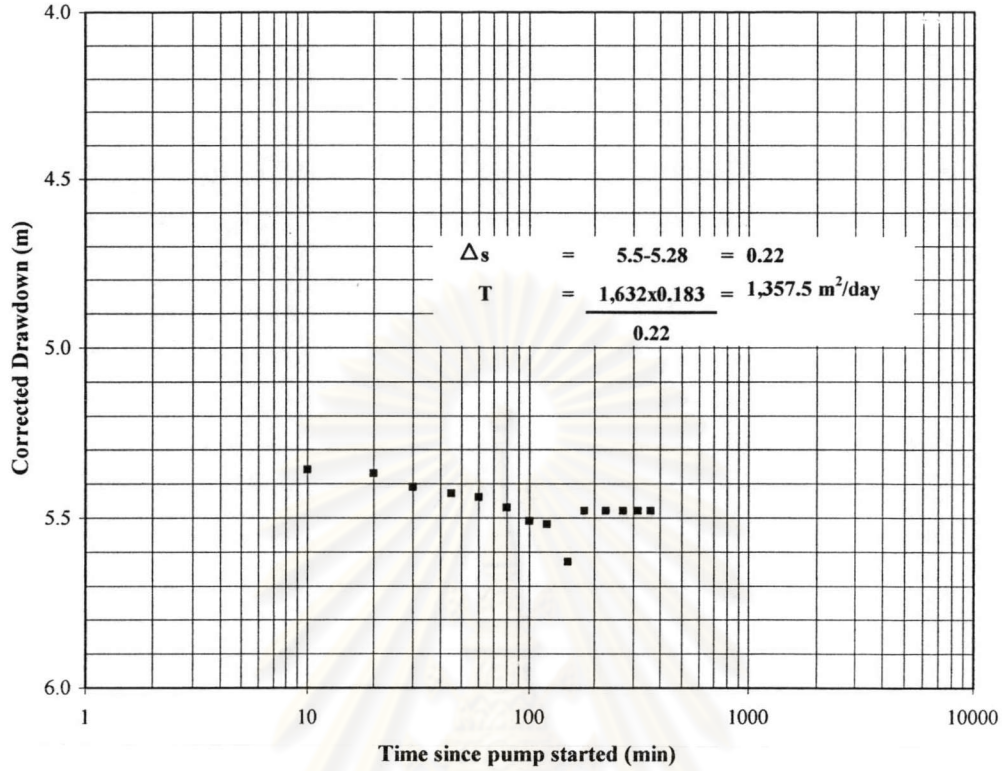
Appendix III-a-12: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 12	Hole Depth (m) : 192.5	Duration Time of Test (min) : 360
UTM N : 674200	Type of Test Recovery	Screen Interval (m) : 156-160.5, 176-189.5
E : 1535200	Date of Pumping Test : 25/6/94	Static Water Level (m) : 41.88

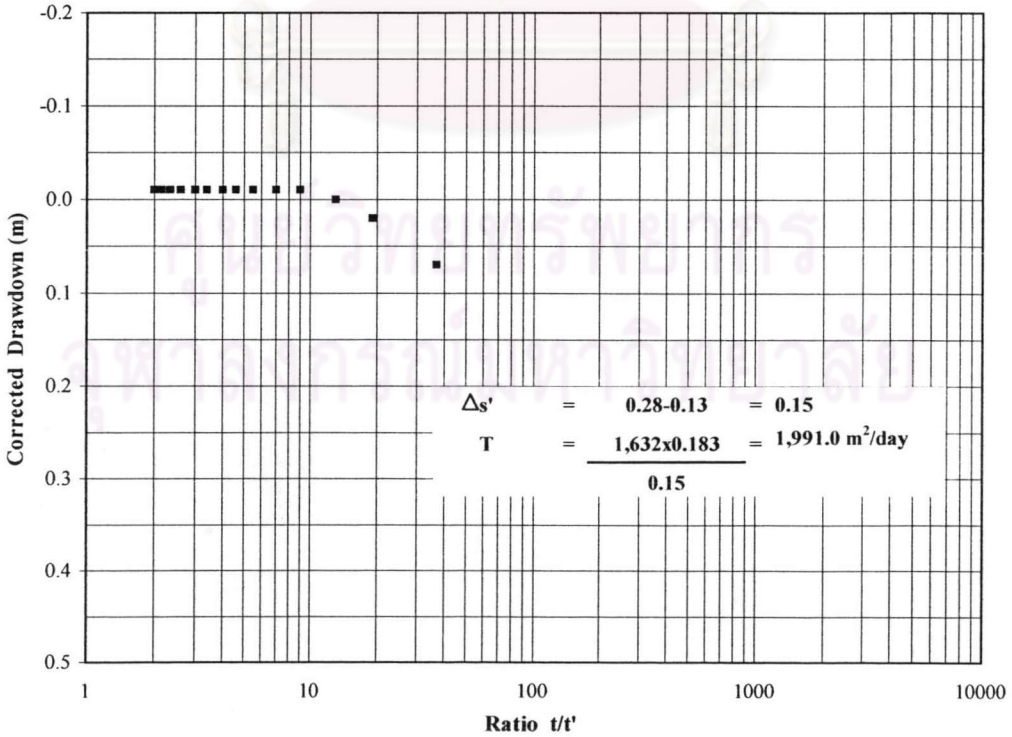
Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
23.10	0	360	-	47.37	18.45	18.44
23.20	10	370	37.00	29.00	0.08	0.07
23.30	20	380	19.00	28.95	0.03	0.02
23.40	30	390	13.00	28.93	0.01	0.00
23.55	45	405	9.00	28.92	0.00	-0.01
24.10	60	420	7.00	28.92	0.00	-0.01
24.30	80	440	5.50	28.92	0.00	-0.01
24.50	100	460	4.60	28.92	0.00	-0.01
1.10	120	480	4.00	28.92	0.00	-0.01
1.40	150	510	3.40	28.92	0.00	-0.01
2.10	180	540	3.00	28.92	0.00	-0.01
2.55	225	585	2.60	28.92	0.00	-0.01
3.40	270	630	2.33	28.92	0.00	-0.01
4.25	315	675	2.14	28.92	0.00	-0.01
5.10	360	720	2.00	28.92	0.00	-0.01

Appendix III-a-12 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-12



Recovery Test BH-12



Appendix III-a-13 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 13	Hole Depth (m) : 207	Duration Time of Test (min) : 360
UTM N : 1536550	Type of Test : Constant Rate	Screen Interval (m) : 173-182.45, 193-202.45
E : 675600	Date of Pumping Test : 10/07/1994	Static Water Level (m) : 38.20

Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
8.00	0		38.20	0.00	0.00
8.10	10	142	47.53	9.33	9.30
8.20	20	142	50.62	12.42	12.39
8.30	30	142	51.46	13.26	13.23
8.45	45	142	51.46	13.26	13.23
9.00	60	142	51.48	13.28	13.25
9.20	80	142	51.49	13.29	13.26
9.40	100	142	51.49	13.29	13.26
10.00	120	142	51.49	13.29	13.26
10.30	150	142	51.50	13.30	13.27
11.00	180	142	51.50	13.30	13.27
11.45	225	142	51.50	13.30	13.27
12.30	270	142	51.50	13.30	13.27
13.15	315	142	51.50	13.30	13.27
14.00	360	142	51.50	13.30	13.27

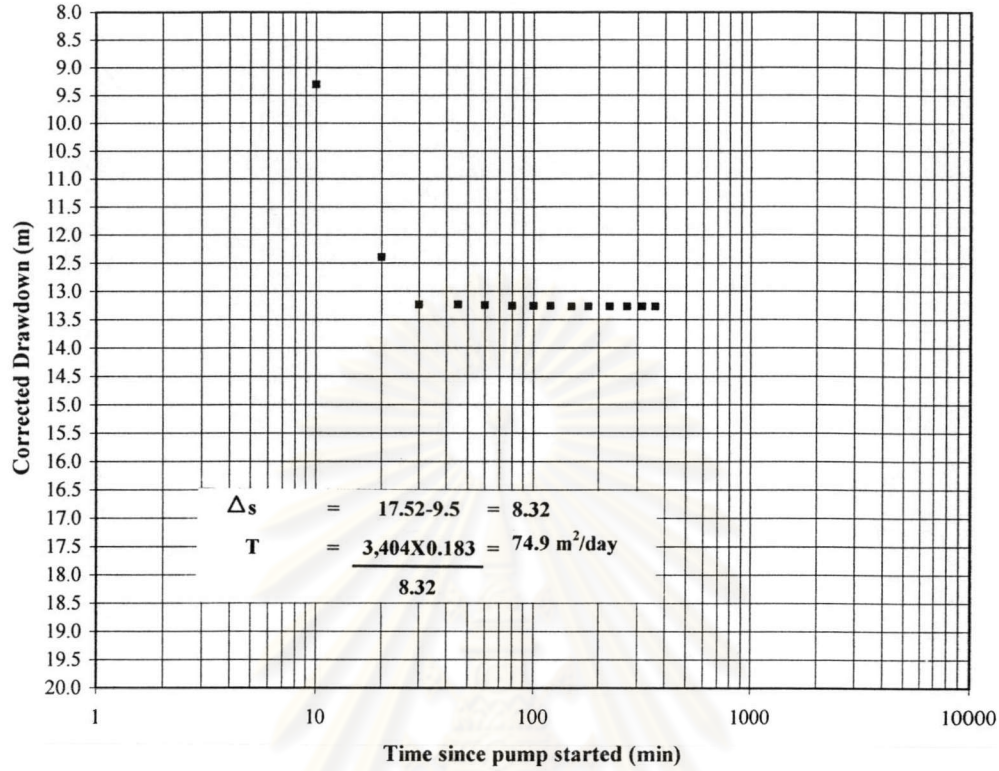
Appendix III-a-13: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 13	Hole Depth (m) : 207	Duration Time of Test (min) : 360.00
UTM N : 1536550	Type of Test Recovery	Screen Interval (m) : 173-182.45, 193-202.45
E : 675600	Date of Pumping Test : 10/07/1994	Static Water Level (m) : 38.20

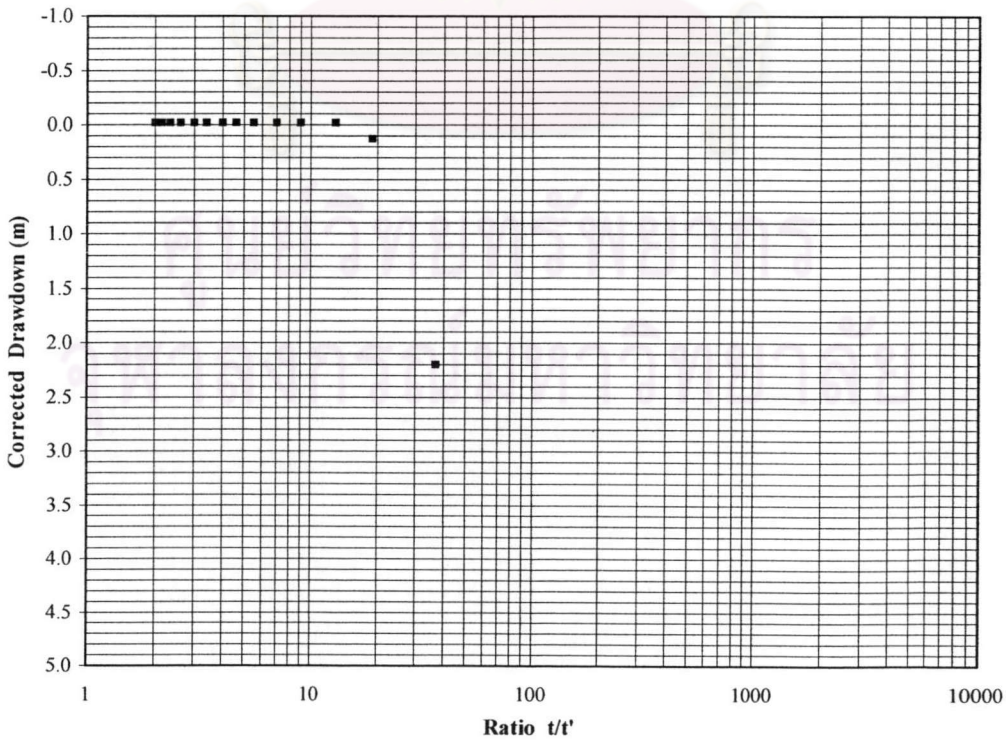
Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
14.00	0	360	-	51.50	13.3	13.28
14.10	10	370	37.00	40.42	2.22	2.20
14.20	20	380	19.00	38.35	0.15	0.13
14.30	30	390	13.00	38.20	0.00	-0.02
14.45	45	405	9.00	38.20	0.00	-0.02
15.00	60	420	7.00	38.20	0.00	-0.02
15.20	80	440	5.50	38.20	0.00	-0.02
15.40	100	460	4.60	38.20	0.00	-0.02
16.00	120	480	4.00	38.20	0.00	-0.02
16.30	150	510	3.40	38.20	0.00	-0.02
17.00	180	540	3.00	38.20	0.00	-0.02
17.45	225	585	2.60	38.20	0.00	-0.02
18.30	270	630	2.33	38.20	0.00	-0.02
19.15	315	675	2.14	38.20	0.00	-0.02
20.00	360	720	2.00	38.20	0.00	-0.02

Appendix III-a-13 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-13



Recovery Test BH-13



Appendix III-a-14 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 14	Hole Depth (m) : 207	Duration Time of Test (min) : 360
UTM N : 675600	Type of Test : Constant Rate	Screen Interval (m) : 162-172, 186-195
E : 1536175	Date of Pumping Test : 02/08/1994	Static Water Level (m) : 40.27

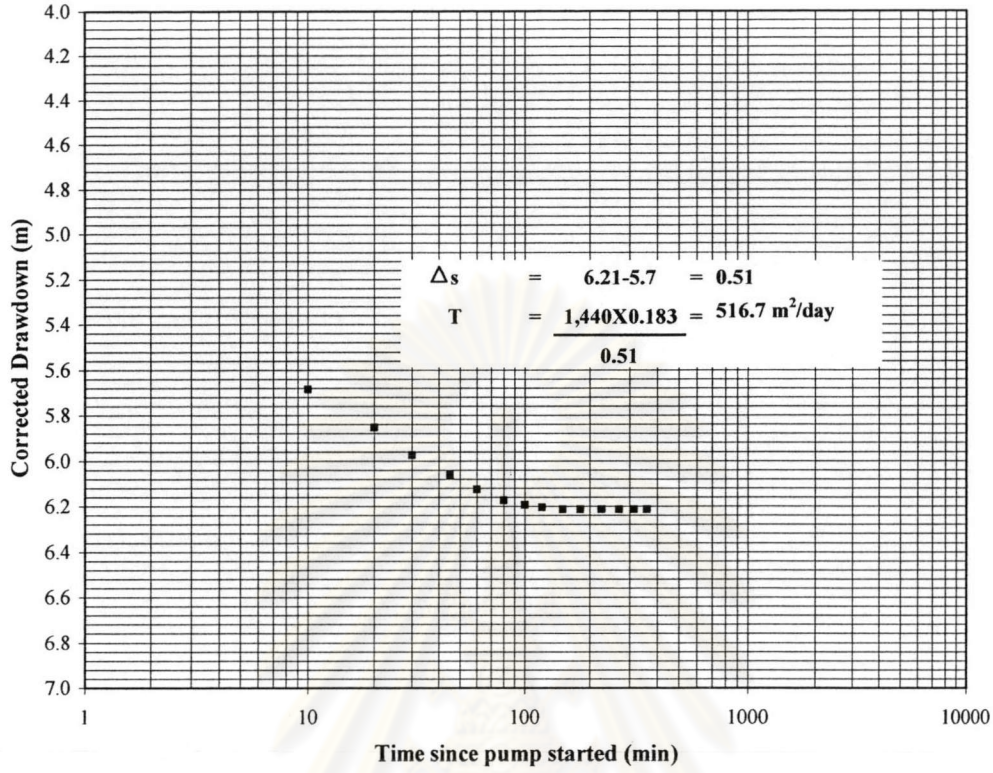
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
9.00	0		40.27	0.00	0.00
9.10	10	60	46.02	5.75	5.68
9.20	20	60	46.19	5.92	5.85
9.30	30	60	46.31	6.04	5.97
9.45	45	60	46.40	6.13	6.06
10.00	60	60	46.46	6.19	6.12
10.20	80	60	46.51	6.24	6.17
10.40	100	60	46.53	6.26	6.19
11.00	120	60	46.54	6.27	6.20
11.30	150	60	46.55	6.28	6.21
12.00	180	60	46.55	6.28	6.21
12.45	225	60	46.55	6.28	6.21
13.30	270	60	46.55	6.28	6.21
14.15	315	60	46.55	6.28	6.21
15.00	360	60	46.55	6.28	6.21

Appendix III-a-14: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

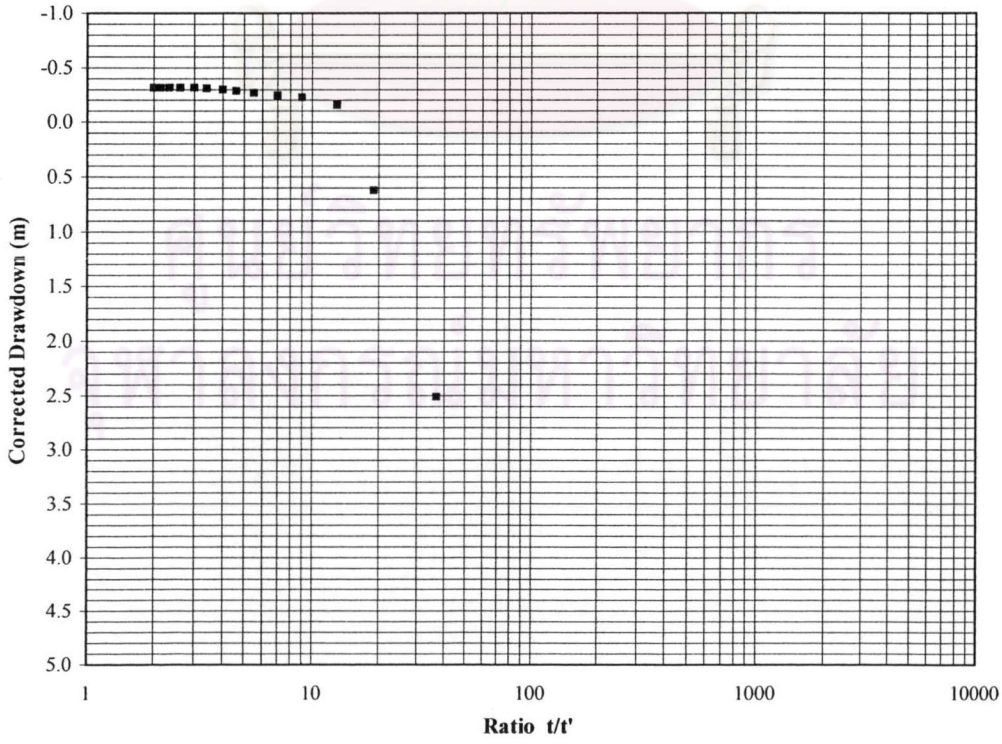
Well No. : 14	Hole Depth (m) : 207		Duration Time of Test (min) : 360.00		
UTM N : 675600	Type of Test Recovery		Screen Interval (m) : 162-171, 186-195		
E : 1536175	Date of Pumping Test : 2/8/94		Static Water Level (m) : 40.27		
Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
15.00	0	360	-	46.55	6.28	5.96
15.10	10	370	37.00	43.10	2.83	2.51
15.20	20	380	19.00	41.21	0.94	0.62
15.30	30	390	13.00	40.43	0.16	-0.16
15.45	45	405	9.00	40.36	0.09	-0.23
16.00	60	420	7.00	40.34	0.07	-0.25
16.20	80	440	5.50	40.32	0.05	-0.27
16.40	100	460	4.60	40.30	0.03	-0.29
17.00	120	480	4.00	40.29	0.02	-0.30
17.30	150	510	3.40	40.28	0.01	-0.31
18.00	180	540	3.00	40.27	0.00	-0.32
18.45	225	585	2.60	40.27	0.00	-0.32
19.30	270	630	2.33	40.27	0.00	-0.32
20.15	315	675	2.14	40.27	0.00	-0.32
21.00	360	720	2.00	40.27	0.00	-0.32

Appendix III-a-14 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-14



Recovery Test BH-14



Appendix III-a-15 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 15	Hole Depth (m) : 216	Duration Time of Test (min) : 360
UTM N : 677250	Type of Test : Constant Rate	Screen Interval (m) : 180-184.5, 192.5-201.5
E : 1531000	Date of Pumping Test : 05/07/1994	Static Water Level (m) : 44.20

Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
-	0		44.20	0.00	0.00
-	10	74	50.40	6.20	6.08
-	20	74	55.50	11.30	11.18
-	30	74	55.50	11.30	11.18
-	45	74	55.50	11.30	11.18
-	60	74	55.50	11.30	11.18
-	80	74	55.50	11.30	11.18
-	100	74	55.50	11.30	11.18
-	120	74	55.50	11.30	11.18
-	150	74	55.50	11.30	11.18
-	180	74	55.50	11.30	11.18
-	225	74	55.50	11.30	11.18
-	270	74	55.50	11.30	11.18
-	315	74	55.50	11.30	11.18
-	360	90	55.50	11.30	11.18

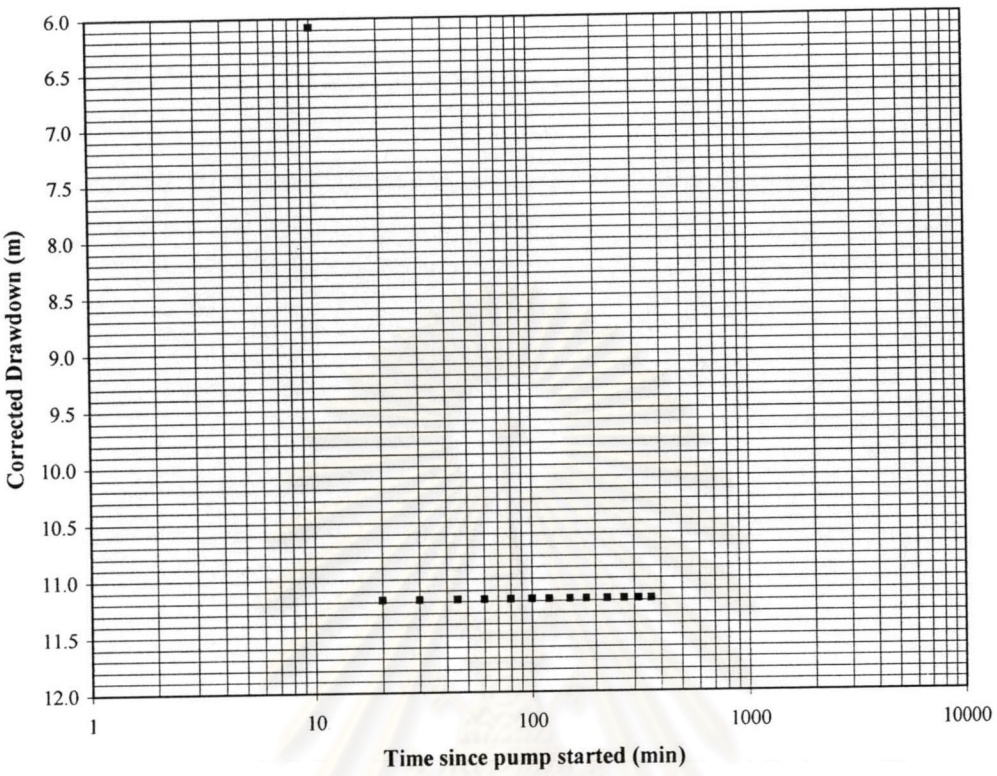
Appendix III-a-15: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 15	Hole Depth (m) : 216	Duration Time of Test (min) : 360.00
UTM N : 677250	Type of Test Recovery	Screen Interval (m) : 180-184.5, 192.5-201.5
E : 1531000	Date of Pumping Test : 5/7/94	Static Water Level (m) : 44.20

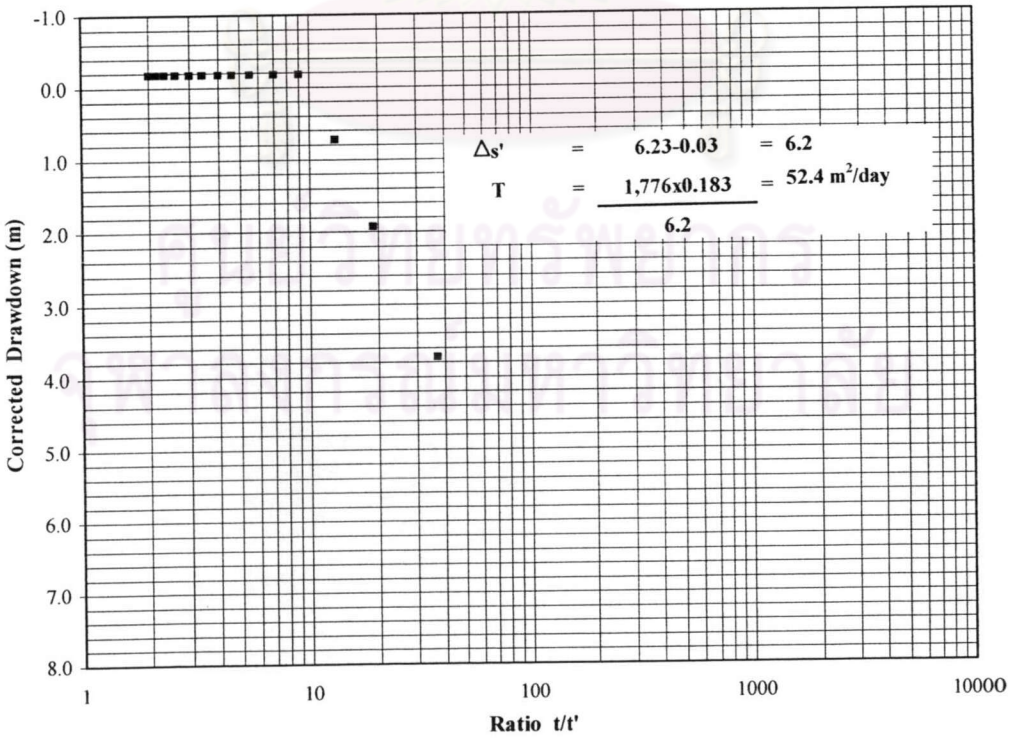
Time (hr.min)	Time since Pumping STOPPED t' (min.)	Time since Pumping STARTED t = t+t' (min.)	Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
-	0	360	-	55.50	11.3	11.13
-	10	370	37.00	48.10	3.90	3.73
-	20	380	19.00	46.30	2.10	1.93
-	30	390	13.00	45.10	0.90	0.73
-	45	405	9.00	44.20	0.00	-0.17
-	60	420	7.00	44.20	0.00	-0.17
-	80	440	5.50	44.20	0.00	-0.17
-	100	460	4.60	44.20	0.00	-0.17
-	120	480	4.00	44.20	0.00	-0.17
-	150	510	3.40	44.20	0.00	-0.17
-	180	540	3.00	44.20	0.00	-0.17
-	225	585	2.60	44.20	0.00	-0.17
-	270	630	2.33	44.20	0.00	-0.17
-	315	675	2.14	44.20	0.00	-0.17
-	360	720	2.00	44.20	0.00	-0.17

Appendix III-a-15 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-15



Recovery Test BH-15



Appendix III-a-16 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 16	Hole Depth (m) : 220	Duration Time of Test (min) : 360
UTM N : 675600	Type of Test : Constant Rate	Screen Interval (m) : 170-176
E : 1537150	Date of Pumping Test : 22/02/1994	Static Water Level (m) : 38.00

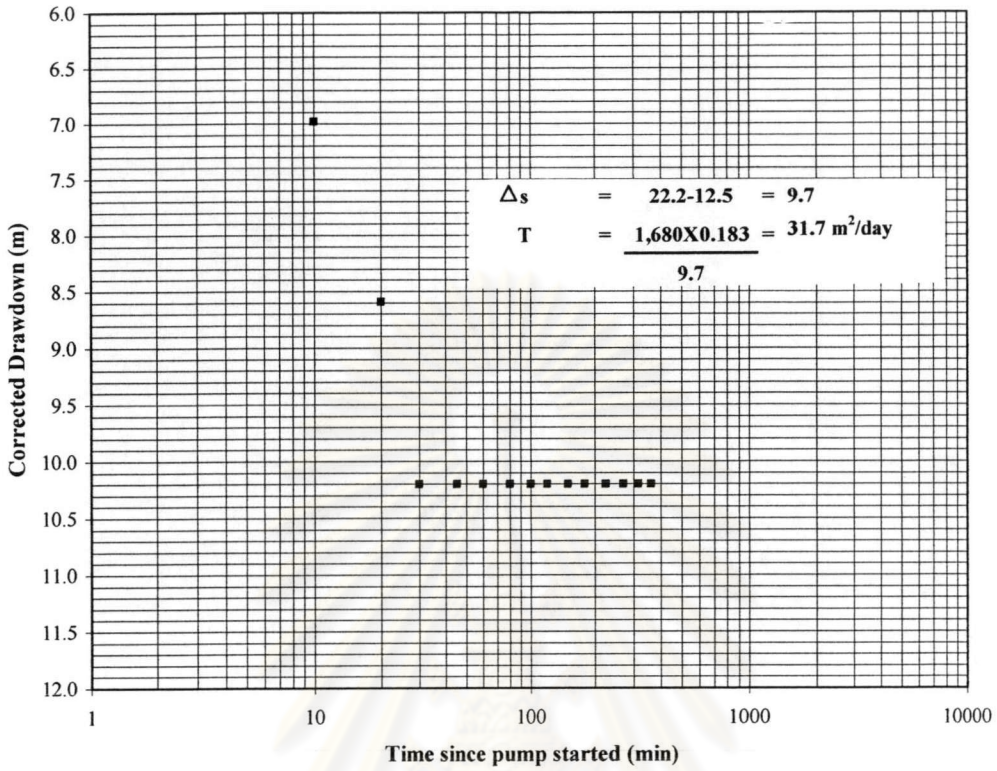
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
11.00	0		38.06	0.00	0.00
11.10	10	100	45.16	7.10	6.98
11.20	20	100	46.77	8.71	8.59
11.30	30	100	48.38	10.32	10.20
11.45	45	100	48.38	10.32	10.20
12.00	60	100	48.38	10.32	10.20
12.20	80	100	48.38	10.32	10.20
12.40	100	100	48.38	10.32	10.20
13.00	120	100	48.38	10.32	10.20
13.30	150	100	48.38	10.32	10.20
14.00	180	100	48.38	10.32	10.20
14.40	225	100	48.38	10.32	10.20
15.30	270	100	48.38	10.32	10.20
16.15	315	100	48.38	10.32	10.20
17.00	360	100	48.38	10.32	10.20

Appendix III-a-16: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

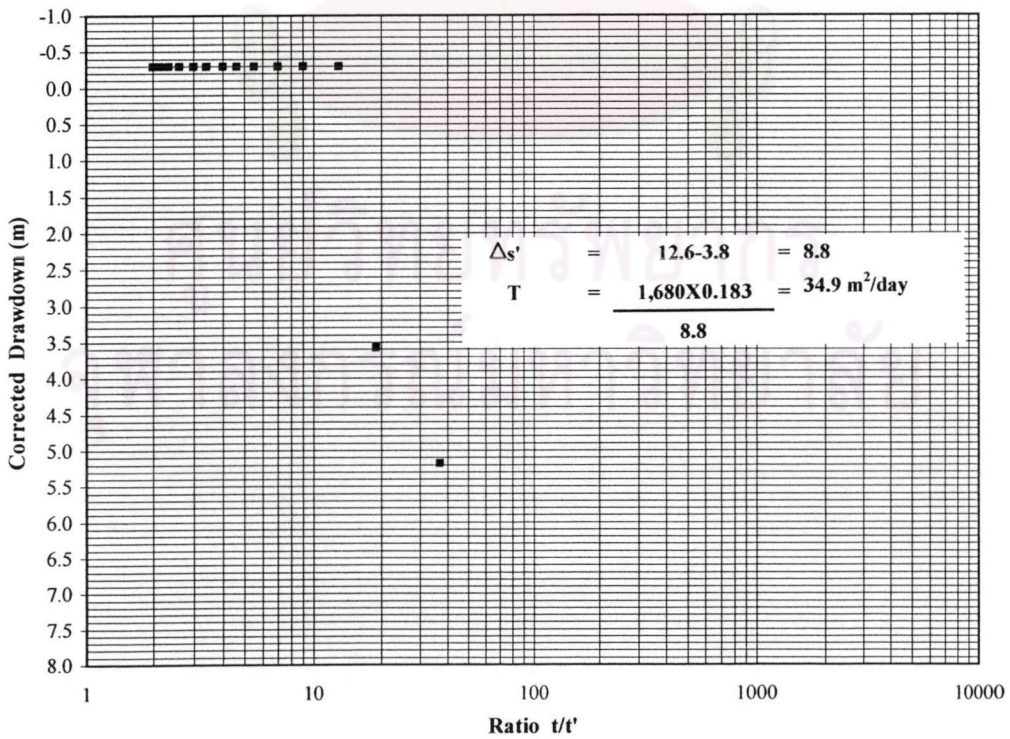
Well No. : 16	Hole Depth (m) : 220		Duration Time of Test (min) : 360.00		
UTM N : 675600	Type of Test Recovery		Screen Interval (m) : 170-176		
E : 1537150	Date of Pumping Test : 22/02/1994		Static Water Level (m) : 38.00		
Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
17.00	0	360	-	48.38	10.32	10.02
17.10	10	370	37.00	43.54	5.48	5.18
17.20	20	380	19.00	41.93	3.87	3.57
17.30	30	390	13.00	38.06	0.00	-0.30
17.45	45	405	9.00	38.06	0.00	-0.30
18.00	60	420	7.00	38.06	0.00	-0.30
18.20	80	440	5.50	38.06	0.00	-0.30
18.40	100	460	4.60	38.06	0.00	-0.30
19.00	120	480	4.00	38.06	0.00	-0.30
19.30	150	510	3.40	38.06	0.00	-0.30
20.00	180	540	3.00	38.06	0.00	-0.30
20.45	225	585	2.60	38.06	0.00	-0.30
21.30	270	630	2.33	38.06	0.00	-0.30
22.15	315	675	2.14	38.06	0.00	-0.30
23.00	360	720	2.00	38.06	0.00	-0.30

Appendix III-a-16 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-16



Recovery Test BH-16



Appendix III-a-17 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Well No. : 17	Hole Depth (m) : 209	Duration Time of Test (min) : 360
UTM N : 678975	Type of Test : Constant Rate	Screen Interval (m) : 187-196, 201.5-206.5
E : 1533450	Date of Pumping Test : 29/06/1994	Static Water Level (m) : 46.90

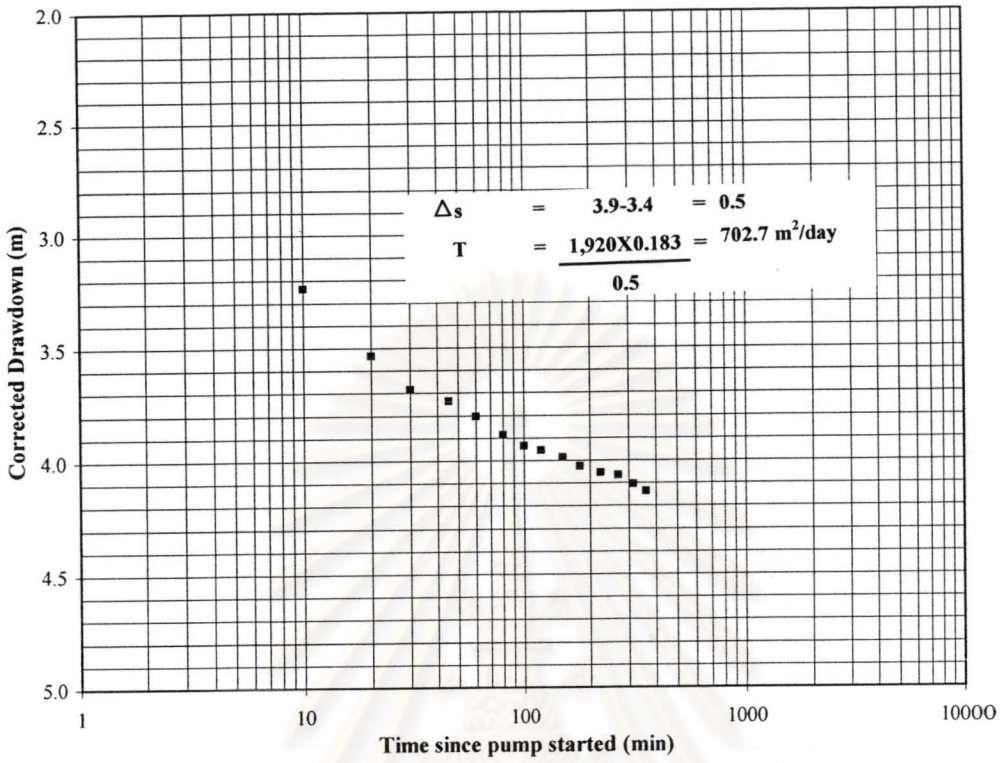
Time (hr.min)	Elapsed Time (min)	Pumping Rate (m^3/hr)	Depth to Water (m.)	Measured Drawdown (m.)	Corrected Drawdown
8.00	0		46.90	0.00	0.00
8.10	10	80	50.20	3.30	3.24
8.20	20	80	50.50	3.60	3.54
8.30	30	80	50.65	3.75	3.69
8.45	45	80	50.70	3.80	3.74
9.00	60	80	50.77	3.87	3.81
9.20	80	80	50.85	3.95	3.89
9.40	100	80	50.90	4.00	3.94
10.00	120	80	50.92	4.02	3.96
10.30	150	80	50.95	4.05	3.99
11.00	180	80	50.99	4.09	4.03
11.45	225	80	51.02	4.12	4.06
12.30	270	80	51.03	4.13	4.07
13.15	315	80	51.07	4.17	4.11
14.00	360	80	51.10	4.20	4.14

Appendix III-a-17: Pumping Test Data (Layne (Thailand) Ltd., unpublished)

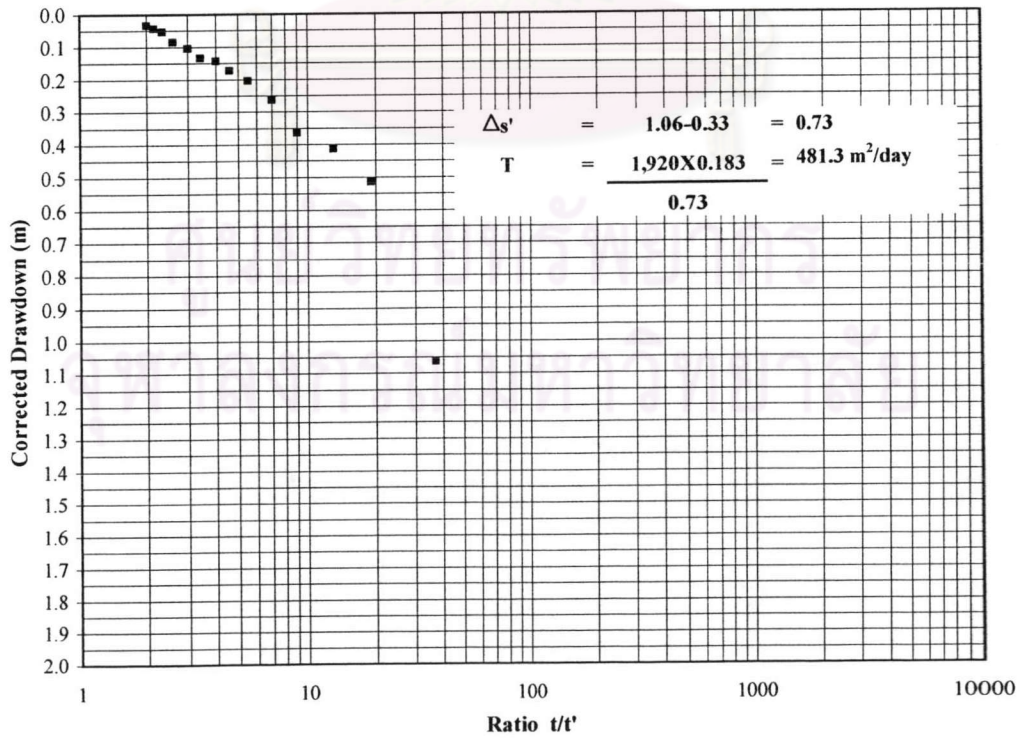
Well No. : 17	Hole Depth (m) : 209		Duration Time of Test (min) : 360.00		
UTM N : 678975	Type of Test Recovery		Screen Interval (m) : 187-196, 201.5-206.5		
E : 1533450	Date of Pumping Test : 29/06/1994		Static Water Level (m) : 46.90		
Time (hr.min)	Time since Pumping		Ratio t/t'	Depth to Water (m.)	Resodual Drawdown (m.)	Corrected Drawdown
	STOPPED t' (min.)	STARTED t = t+t' (min.)				
14.00	0	360	-	51.10	4.20	4.11
14.10	10	370	37.00	48.05	1.15	1.06
14.20	20	380	19.00	47.50	0.60	0.51
14.30	30	390	13.00	47.40	0.50	0.41
14.45	45	405	9.00	47.35	0.45	0.36
15.00	60	420	7.00	47.25	0.35	0.26
15.20	80	440	5.50	47.19	0.29	0.20
15.40	100	460	4.60	47.16	0.26	0.17
16.00	120	480	4.00	47.13	0.23	0.14
16.30	150	510	3.40	47.12	0.22	0.13
17.00	180	540	3.00	47.09	0.19	0.10
17.45	225	585	2.60	47.07	0.17	0.08
18.30	270	630	2.33	47.04	0.14	0.05
19.15	315	675	2.14	47.03	0.13	0.04
20.00	360	720	2.00	47.02	0.12	0.03

Appendix III-a-17 : Pumping Test Data (Layne (Thailand) Ltd., unpublished)

Constatnt Rate Pumping Test BH-17



Recovery Test BH-17



Appendix III-b : Specific Capacity in the study area (Public Works Department)

Well No.	UTM		Depth Drill	Yield	Static Water Level	Drawdown	Specific Capacity
	Northing	Easting	(m.)	(m3/hr)	(m.)	(m.)	(m3/hr/m)
1	663450	1535400	150.0	63.2	11.3	9.0	6.99
2	645125	1549250	171.0	25.0	19.50	10.00	2.50
3	640900	1560900	140.0	25.0	15.00	20.00	1.25
4	661150	1528600	181.0	40.0	30.00	10.00	4.00
5	645500	1551500	183.0	30.0	20.50	10.00	3.00
6	625050	1499575	182.0	14.0	42.00	12.00	1.17
7	630150	1502450	145.5	18.0	45.00	3.00	6.00
8	619775	1504450	163.0	25.0	28.70	4.80	5.21
9	633900	1508200	129.0	13.0	43.50	20.00	0.65
10	635625	1510525	160.0	25.0	54.00	4.00	6.25
11	635500	1507750	162.0	30.0	49.00	2.0	15.00
12	636000	1507450	144.0	25.0	50.00	5.0	5.00
13	641300	1511405	156.0	20.0	42.00	2.0	10.00
14	621300	1497100	126.0	30.0	44.00	1.00	30.00
15	621625	1495350	138.0	30.0	47.00	1.00	30.00
16	627725	1506650	132.0	25.0	42.00	3.00	8.33
17	617000	1508000	138.0	30.0	33.00	2.00	15.00
18	623800	1498775	138.0	12.0	51.00	8.00	1.50
19	621350	1497450	164.0	20.0	47.00	4.00	5.00
20	613900	1494750	132.0	25.0	17.00	7.00	3.57
21	631950	1498700	138.0	20.0	66.00	4.00	5.00
22	625000	1496225	144.0	30.0	55.00	1.00	30.00
23	625200	1496225	138.0	25.0	52.00	3.00	8.33
24	628425	1493875	144.0	20.0	55.00	2.00	10.00
25	632400	1510550	180.0	20.0	58.00	1.00	20.00
26	632500	1503050	150.0	25.0	67.00	2.00	12.50
27	625050	1499575	182.0	14.0	42.00	12.00	1.17
28	630150	1502450	145.5	18.0	45.00	3.00	6.00
29	619775	1504450	163.0	25.0	28.70	4.80	5.21
30	633900	1508200	129.0	13.0	43.50	20.00	0.65
31	635625	1510525	160.0	25.0	54.00	4.00	6.25
32	635500	1507750	162.0	30.0	49.00	2.0	15.00
33	636000	1507450	144.0	25.0	50.00	5.0	5.00
34	641300	1511405	156.0	20.0	42.00	2.0	10.00
35	621300	1497100	126.0	30.0	44.00	1.00	30.00
36	621625	1495350	138.0	30.0	47.00	1.00	30.00
37	627725	1506650	132.0	25.0	42.00	3.00	8.33
38	617000	1508000	138.0	30.0	33.00	2.00	15.00
39	623800	1498775	138.0	12.0	51.00	8.00	1.50
40	621350	1497450	164.0	20.0	47.00	4.00	5.00
41	613900	1494750	132.0	25.0	17.00	7.00	3.57
42	631950	1498700	138.0	20.0	66.00	4.00	5.00
43	625000	1496225	144.0	30.0	55.00	1.00	30.00
44	625200	1496225	138.0	25.0	52.00	3.00	8.33
45	628425	1493875	144.0	20.0	55.00	2.00	10.00
46	632400	1510550	180.0	20.0	58.00	1.00	20.00
47	632500	1503050	150.0	25.0	67.00	2.00	12.50

Appendix III-b : Specific Capacity in the study area (Public Works Department) continued

Well No.	UTM		Depth Drill	Yield	Static Water Level	Drawdown	Specific Capacity
	Northing	Easting	(m.)	(m3/hr)	(m.)	(m.)	(m3/hr/m)
48	705750	1500400	20.0	24.00	0.40	50.0	0.48
49	704500	1511400	8.0	33.90	2.00	4.0	8.48
50	705750	1500400	20.0	24.00	0.40	50.0	0.48
51	704500	1511400	8.0	33.90	2.00	4.0	8.48
52	691475	1503600	15.0	47.00	13.00	1.2	40.73
53	678500	1500500	32.0	39.00	16.00	2.0	19.50
54	678700	1499275	35.0	39.00	21.00	1.7	23.40
55	693800	1502900	20.0	46.50	8.50	2.4	19.76
56	693900	1503800	153.0	18.2	21.9	9.6	1.89
57	691475	1503600	15.0	47.00	13.00	1.2	40.73
58	680050	1557250	152.5	15.0	33.30	2.70	5.56
59	691925	1543000	130.5	5.0	42.00	14.50	0.34
60	677400	1561650	180.0	20.0	35.10	9.90	2.02
61	684900	1552800	177.0	8.0	59.70	15.70	0.51
62	691900	1542500	144.0	10.0	45.20	1.80	5.56
63	684625	1550825	186.0	15.0	76.00	14.00	1.07
64	689500	1551000	150.0	20.0	48.0	8.0	2.50
65	677750	1552940	145.5	24.0	31.8	13.3	1.81
66	682650	1553150	156.0	2.5	24.5	6.3	0.39
67	684950	1552800	174.0	30.0	54.3	1.8	16.67
68	681090	1548500	172.5	45.5	31.5	24.0	1.89
69	684886	1548833	160.0	36.0	32.5	2.5	14.40
70	685807	1549996	174.0	16.0	75.4	8.9	1.81
71	697040	1562690	159.0	14.4	5.2	3.2	4.48
72	675950	1545500	141.0	22.7	3.9	4.5	5.05
73	680750	1540650	184.5	22.7	7.5	30.0	0.76
74	685415	1540457	150.0	5.7	54.0	12.0	0.47
75	691840	1541650	11.0	22.7	45.0	6.0	3.79
76	642090	1563400	162.0	18.0	14.9	0.9	20.01
77	646040	1563800	162.0	34.1	13.5	10.5	3.25
78	689750	1563900	162.0	18.0	14.5	1.0	17.32
79	655200	1564500	159.0	9.2	11.7	0.6	14.30
80	648250	1569400	160.5	54.6	12.6	12.9	4.23
81	680050	1557250	152.5	15.0	33.30	2.70	5.56
82	691925	1543000	130.5	5.0	42.00	14.50	0.34
83	677400	1561650	180.0	20.0	35.10	9.90	2.02
84	684900	1552800	177.0	8.0	59.70	15.70	0.51
85	691900	1542500	144.0	10.0	45.20	1.80	5.56
86	684625	1550825	186.0	15.0	76.00	14.00	1.07
87	689500	1551000	150.0	20.0	48.0	8.0	2.50
88	682600	1574750	140.0	32.0	15.0	20.0	1.60
89	685400	1570300	172.5	8.0	35.0	13.0	0.62
90	638200	1571750	165.0	10.0	31.0	11.0	0.91
91	671650	1575100	160.0	15.0	30.0	10.0	1.50
92	674150	1563650	150.0	44.2	17.4	1.8	25.25
93	668700	1570100	174.0	20.0	27.0	3.0	6.67
94	669840	1570500	144.0	22.7	19.8	12.3	1.85

Appendix III-b : Specific Capacity in the study area (Public Works Department) continued

Well No.	UTM		Depth Drill	Yield	Static Water Level	Drawdown	Specific Capacity
	Northing	Easting	(m.)	(m3/hr)	(m.)	(m.)	(m3/hr/m)
95	683425	1571650	130.0	20.0	12.00	4.00	5.00
96	679900	1566600	156.2	30.0	24.50	12.00	2.50
97	668500	1570450	138.5	30.0	21.00	1.50	20.00
98	674100	1564275	144.0	30.0	30.00	15.00	2.00
99	677425	1565225	170.0	30.0	35.00	15.00	2.00
100	679500	1575300	129.0	20.0	25.0	5.30	3.77
101	669150	1569375	162.0	20.0	16.00	14.00	1.43
103	681200	1573495	128.0	10.0	25.00	12.00	0.83
104	683425	1571650	130.0	20.0	12.00	4.00	5.00
105	674790	1534090	151.5	30.1	57.5	31.1	0.97
106	691600	1537600	186.0	30.0	58.0	32.0	0.94
107	691600	1538750	178.0	40.0	51.0	30.0	1.33
108	666540	1522090	163.2	18.6	42.0	4.2	4.44
109	666650	1522090	159.0	28.4	63.0	7.2	3.95
110	666700	1522090	189.0	142.2	30.7	21.9	6.48
111	667900	1522090	186.0	68.2	28.5	8.1	8.42
112	667090	1522090	159.0	68.2	28.5	15.7	4.33
113	666900	1522090	184.5	38.8	31.1	15.7	2.47
114	634575	1514700	157.0	8.0	47.00	15.00	0.53
115	622250	1540900	189.0	12.0	43.50	9.50	1.26
116	631700	1513700	142.0	7.0	50.40	3.30	2.12
117	623325	1532600	145.0	17.0	21.50	3.50	4.86
118	626000	1521275	160.0	20.0	26.00	2.00	10.00
119	617825	1531725	145.0	20.0	35.50	2.10	9.52
120	622550	1536600	132.0	15.0	22.70	23.90	0.63
121	631300	1535400	182.0	20.0	22.00	25.10	0.80
122	626875	1534425	131.0	30.0	27.00	5.00	6.00
123	625750	1526650	127.0	20.0	25.30	26.97	0.74
124	628200	1517700	128.0	20.0	19.00	23.00	0.87
125	621250	1526650	162.0	15.0	28.30	32.40	0.46
126	612675	1517500	180.0	20.0	20.00	22.30	0.90
127	611300	1522200	174.0	20.0	19.00	22.50	0.89
128	617125	1532650	144.0	25.0	24.60	26.90	0.93
129	616150	1533250	140.0	25.0	24.50	27.10	0.92
130	613200	1523700	155.0	20.0	18.00	22.35	0.89
131	622100	1528875	164.0	20.0	25.20	9.80	2.04
132	620000	1528900	174.0	30.0	26.57	27.30	1.10
133	632925	1521755	129.0	20.0	33.50	14.50	1.38
134	633875	1523325	184.0	20.0	44.00	16.00	1.25
135	615300	1538800	161.0	26.0	22.60	1.10	23.64
136	632475	1528600	163.0	15.0	15.00	10.00	1.50
137	617175	1521150	145.0	20.0	23.50	19.50	1.03
138	617050	1522575	168.0	20.0	24.00	20.00	1.00
139	609100	1530700	131.0	20.0	23.00	25.00	0.80
140	611250	1528125	138.0	20.0	20.20	22.60	0.88
141	612150	1528500	141.0	12.0	25.50	45.00	0.27
142	633100	1514550	173.0	12.0	48.00	2.50	4.80

Appendix III-b : Specific Capacity in the study area (Public Works Department) continued

Well No.	UTM		Depth Drill	Yield	Static Water Level	Drawdown	Specific Capacity
	Northing	Easting	(m.)	(m3/hr)	(m.)	(m.)	(m3/hr/m)
143	612925	1521750	176.0	15.0	27.00	32.00	0.47
144	635625	1511550	230.0	80.0	30.7	14.4	5.55
145	674300	1564972	177.0	90.0	30.7	4.4	20.27
146	691650	1529150	222.0	4.0	67.5	23.2	0.17
147	685200	1551825	190.0	20.0	76.0	7.3	2.75
148	685200	1511350	151.5	56.8	45.5	7.9	7.17
149	693550	1518700	140.0	48.2	45.7	6.5	7.46
150	668400	1552300	155.0	18.0	20.0	1.2	15.65
151	693650	1529900	160.4	200.5	46.6	15.8	12.67
152	675949	1541535	226.0	210.2	34.6	6.5	32.59
153	668450	1552300	155.0	20.8	20.0	5.4	3.87
154	686465	1552088	224.0	68.9	42.5	42.1	1.64
155	685925	1541175	166.0	8.0	46.9	3.1	2.61
156	686000	1541175	163.0	9.0	46.7	1.0	8.65
157	700685	1548175	152.0	48.0	9.4	26.7	1.80
158	687448	1507519	165.0	17.0	43.7	4.0	4.27
159	674256	1547045	150.0	200.0	49.5	9.4	21.34
160	681150	1547500	195.0	160.0	44.0	5.9	27.26
161	685800	1504750	228.0	66.0	49.4	15.3	4.31
162	675400	1533750	236.0	70.0	45.2	2.4	29.17
163	682550	1540000	182.0	120.0	19.7	15.7	7.66
164	674200	1535200	192.5	68.0	41.9	5.5	12.39
165	675500	1536550	207.0	142.0	38.2	13.3	10.68
166	675600	1536175	218.0	60.0	40.3	6.3	9.55
167	675600	1537150	220.0	100.0	38.1	10.3	9.69
168	677250	1531000	152.0	74.0	44.2	11.3	6.55
169	674000	1506200	178.2	174.0	38.4	8.9	19.55
170	677225	1505700	224.0	60.4	39.0	4.1	14.92
171	676200	1518650	196.0	70.0	43.7	19.9	3.52
172	652357	1527386	138.0	15.0	24.0	15.0	1.00
173	661017	1528697	181.0	40.0	30.0	10.0	4.00
174	661120	1529807	176.0	30.0	33.0	7.0	4.29
175	660538	1528115	165.0	45.0	34.0	2.0	22.50
176	659281	1529003	183.0	50.0	31.0	9.0	5.56
177	643441	1558874	160.0	90.0	12.0	3.0	30.00
178	644052	1554881	183.0	30.0	30.0	10.0	3.00
179	644532	1552251	183.0	30.0	20.5	10.0	3.00
180	639522	1554259	170.0	20.0	18.0	5.0	4.00
181	640038	1556648	163.0	4.0	19.0	41.0	0.10
182	641477	1559598	140.0	25.0	15.0	20.0	1.25
183	646571	1545120	171.0	25.0	20.0	10.0	2.50
184	644956	1530072	183.0	40.0	20.0	15.0	2.67

Appendices IV Flow Nets Analysis

Appendix IV : Flow Nets Analysis

From equation 2.19

$$Q = \frac{K\,nf\,h}{ne}$$

Within the area of closed system (Fig. 4.116, blue color) for flow net analysis, covering 1,612 square kilometers:

1. The flow channel can be constructed into 12 channels
2. The number of equipotential drops; ne, = 4
3. The number of flow channels; nf, in this study is calculated for each flow channel. Thus, the nf is equal to 1
4. The head drops; h = 55-35 = 20
5. The hydraulic conductivity; K, in each channel is equal 87 m/day

Flow channel # 1

$$Q1 = \frac{87X20X1}{4} = 435\ m^3/day$$

Flow channel # 2

$$Q2 = \frac{87X20X1}{4} = 435\ m^3/day$$

Flow channel # 3

$$Q3 = \frac{87X20X1}{4} = 435\ m^3/day$$

Flow channel # 4

$$Q4 = \frac{87X20X1}{4} = 435\ m^3/day$$

Flow channel # 5

$$Q5 = \frac{87X20X1}{4} = 435\ m^3/day$$

Flow channel # 6

$$Q6 = \frac{87X20X1}{4} = 435 \ m^3/day$$

Flow channel # 7

$$Q7 = \frac{87X20X1}{4} = 435 \ m^3/day$$

Flow channel # 8

$$Q8 = \frac{87X20X1}{4} = 435 \ m^3/day$$

Flow channel # 9

$$Q9 = \frac{87X20X1}{4} = 435 \ m^3/day$$

Flow channel # 10

$$Q10 = \frac{87X20X1}{4} = 435 \ m^3/day$$

Flow channel # 11

$$Q11 = \frac{87X20X1}{4} = 435 \ m^3/day$$

Flow channel # 12

$$Q12 = \frac{87X20X1}{4} = 435 \ m^3/day$$

Q total = Q1+Q2+Q3+Q4+Q5+Q6+Q7+Q8+Q9+Q10+Q11+Q12

= 435X12

= 5,220 m^3/day

Since the average thickness of the NL aquifer is 50 m.

Total Q = 5,220 x 50

= 261,000 m^3/day

BIOGRAPHY

Miss Udomporn Chuangcham was born in Amphoe Prasat, Surin Province, in August 18, 1973. She received the degree of B. Sc. in Geotechnology from the Department of Geotechnology, Faculty of Technology, Khon Kaen University in 1995 and began graduate work here in 1998.