HYDROGEOLOGICAL INVESTIGATION

VILLAGE OF METCALFE
COMMUNAL WATER SUPPLY

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1.0 INTRODUCTION

Water and Earth Science Associates (WESA) was retained by Kostuch Engineering Ltd. on behalf of the Regional Municipality of Ottawa-Carleton to determine the suitability of the aquifers underlying the Village of Metcalfe for development of a communal water supply.

The Village of Metcalfe is located in Osgoode Township in the Regional Municipality of Ottawa-Carleton (RMOC). It is approximately 30 km southeast of Ottawa and is reached by Highway 31 and Regional Road 6. Figure 1 shows the location of the study area.

The population of the village is approximately 900 persons, but the community also services the surrounding agricultural area. The village is presently serviced by private wells and sewage systems.

A Private Services Study (WESA, 1984) indicated that the shallow bedrock aquifer underlying the community is widely contaminated with sewage from private sewage systems. This contamination problem, coupled with an expected large population growth, have necessitated the change to communal water and sewage systems.

1.1 Terms of Reference

The section of the Terms of Reference pertaining to the hydrogeological component of the agreement with RMOC is included in Appendix A. The methodology used to conduct our investigation was based on the Terms of Reference and Section 5 of the RMOC Guidelines for the Design of Communal Water Systems (March, 1990), also included in Appendix A.

1.2 Design Yield

A preliminary projected population of 5000 persons was used by the prime consultant to calculate the design yield for the village. The preliminary design yield is as follows:

$$5000 \text{ persons} \times 450 \text{ l/day/capita} \times 2.0 \text{ (max day factor)}$$
$$= 4.50 \times 10^{6} \text{ l/day}$$
$$= 52.1 \text{ l/s}$$

2.0 BACKGROUND

A review and interpretation of all available geological and hydrogeological information was undertaken prior to the start of the test drilling program. This review included:

- surficial geology (Richard, 1974) and bedrock geology maps (Wilson, 1946) of the study area,
- previous studies conducted in the area by WESA,
- and a statistical analysis of Ontario Ministry of the Environment (MOE) well records for wells within a 2 km radius of Metcalfe.

Three test sites were selected based on the information from the preliminary hydrogeological investigation. The locations of these test sites are shown in Figure 1.

Test Site 1 (TS1) is located approximately 100 m north of Regional Road 6 on the Ontario Hydro easement (see Figure 2). Test Site 2 (TS2) is located along the southern property boundary of the Van Berlo property, approximately 1 km north of the village and 300 m west of the 8th Line Road (see Figure 3). Test Site 3 (TS3) is located along the southern property boundary of the McKellar property, approximately 800 m north of the village and 500 west of the 8th Line Road (see Figure 3).

A total of 52 MOE water well records were statistically analyzed (see Figure 4). These water well records are found in Appendix B. The well locations are shown in Figures 1 and 3.

2.1 Geology

2.1.1 Surficial Geology

The surficial geology of the Metcalfe area is characterized by both Pre-Champlain Sea and Champlain Sea deposits. The thickness of these deposits is generally less than 5 m. In 48% of the MOE well records analyzed the overburden was less than 5 m thick. In 94% of the MOE well records the overburden was less than 10 m thick (see Figure 4).

The Pre-Champlain Sea deposits cover much of the Metcalfe area and consist primarily of lodgement tills deposited as a glacial till plain. These deposits consist of occasional to numerous cobbles and boulders in a sandy silt matrix. Upper portions are weathered and brown while at depth these deposits are unweathered and grey. The topography associated with these deposits is generally flat to hummocky.

The Champlain Sea deposits are found in large pockets to the north, southwest and southeast of the village and comprise mainly offshore marine silts and clay. These deposits are characterized by massive blue-grey clay, silty clay and silt. Upper portions are usually weathered and mottled; however, the clay is unweathered and blue-grey at depth.

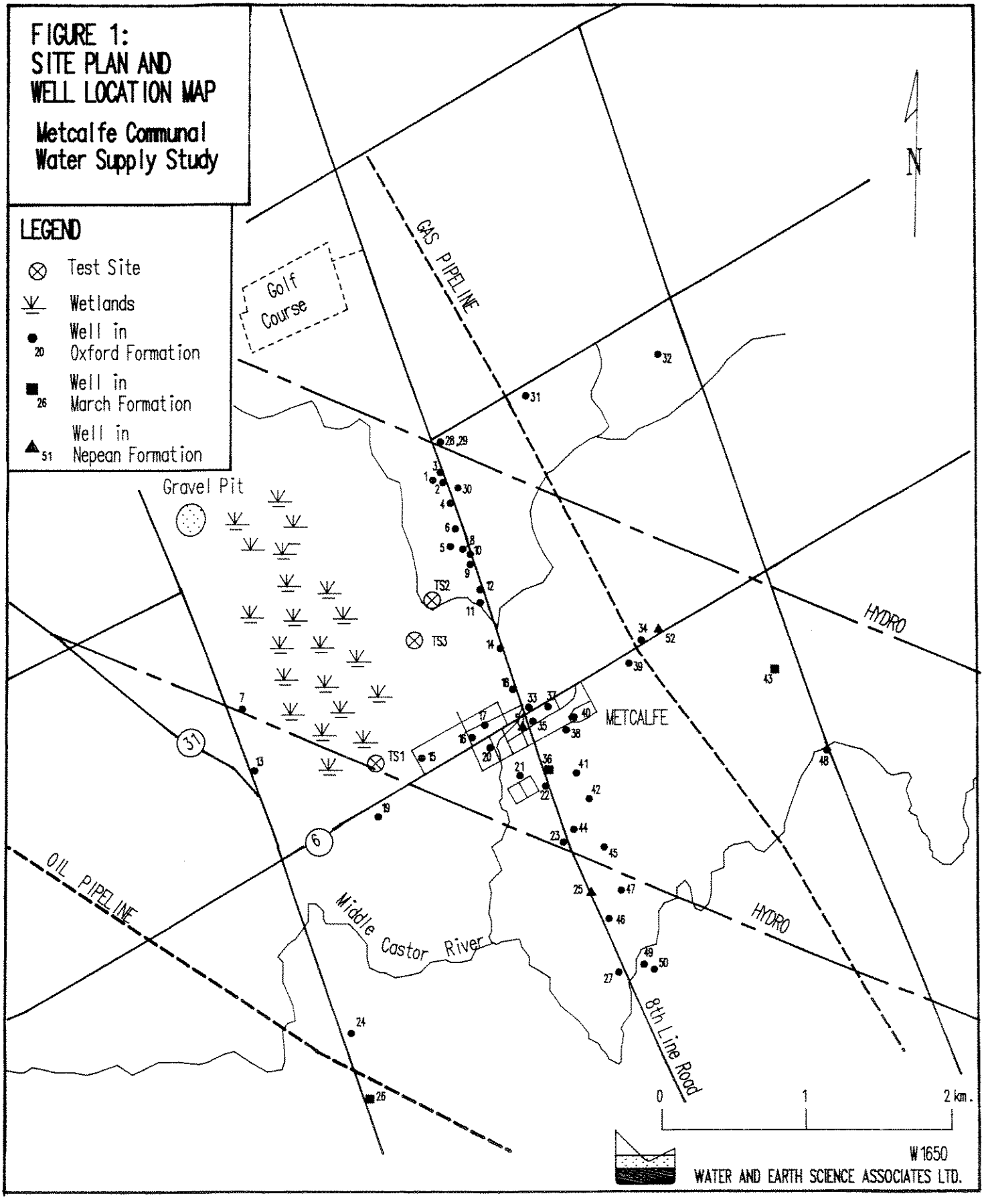
FIGURE 1:
SITE PLAN AND
WELL LOCATION MAP
Metcalfe Communal
Water Supply Study
LEGEND
Test Site
Wetlands
Well in Oxford Formation
Well in March Formation
Well in Nepean Formation
N
Golf Course
GAS PIPELINE
Gravel Pit
TS1
TS2
TS3
HYDRO
METCALFE
OIL PIPELINE
Middle Castor River
8th Line Road
31
6
0
1
2 km.
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WATER AND EARTH SCIENCE ASSOCIATES LTD.

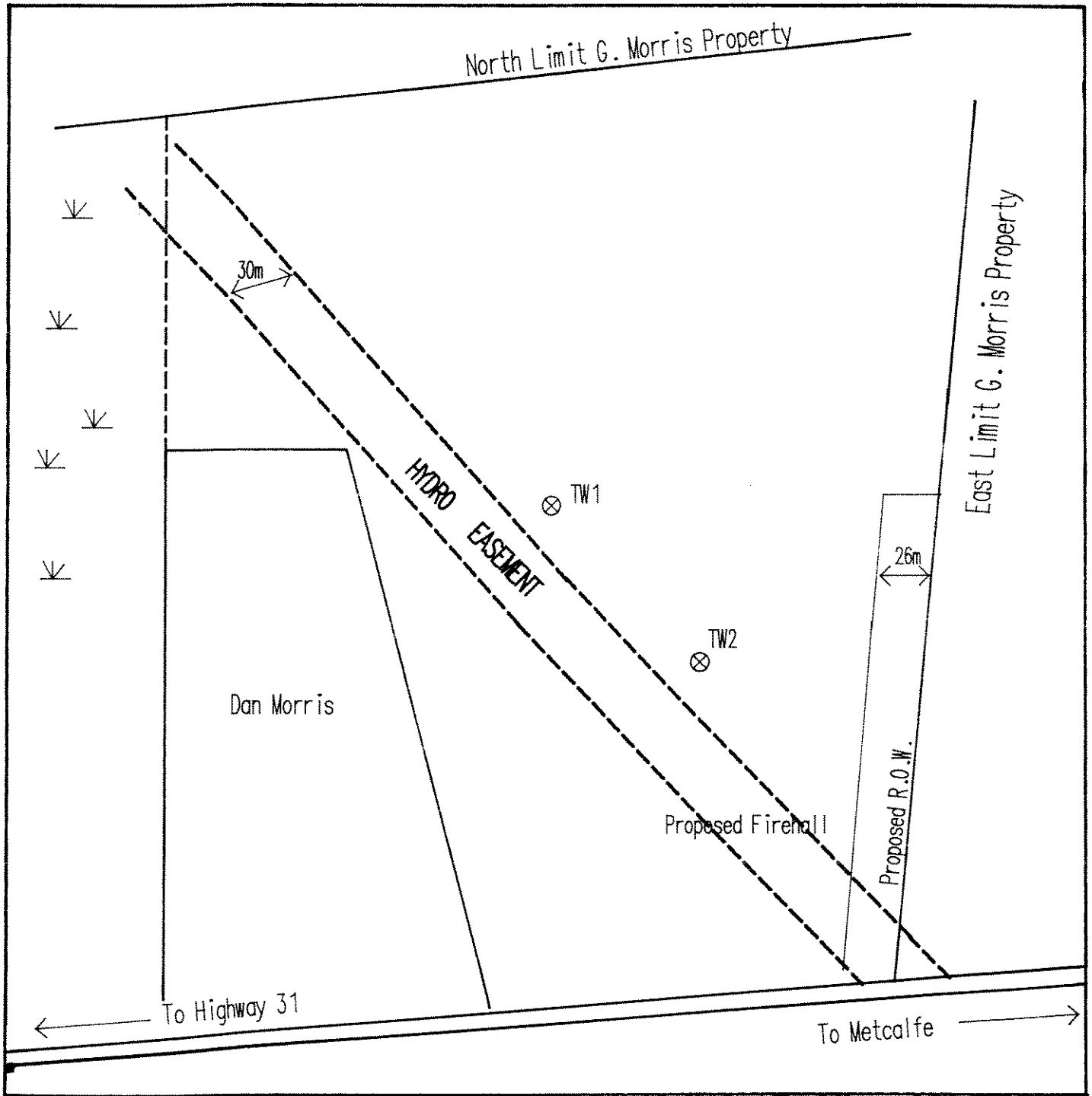

FIGURE 2:
SITE PLAN AND
WELL LOCATION MAP
TEST SITE 1

Metcalfe Communal
Water Supply Study

LEGEND

⊗ Test Well

Wetlands

NOT TO SCALE

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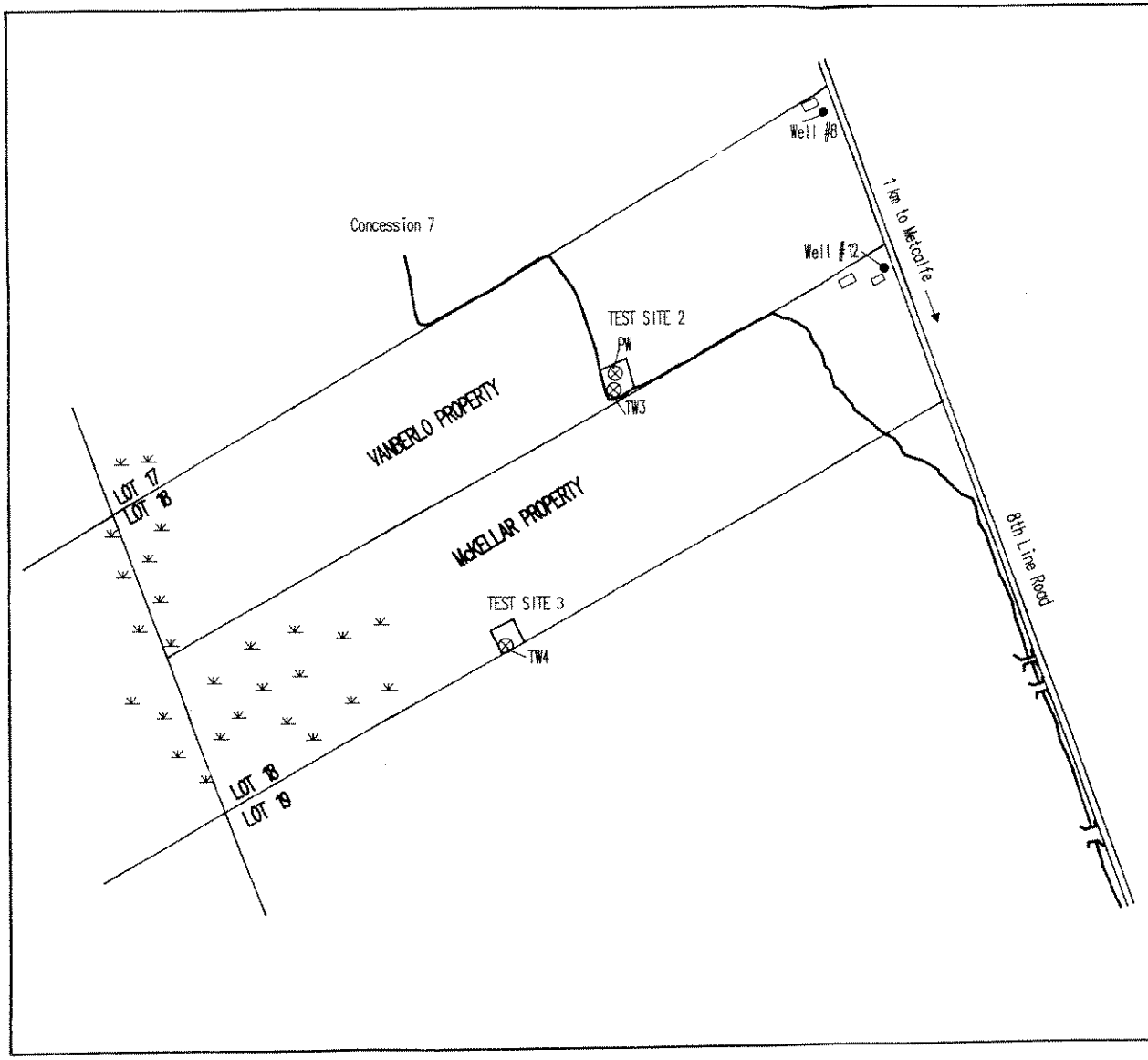

FIGURE 3:

SITE PLAN AND
WELL LOCATION

TEST SITES 2 & 3

Metcalfe Communal Water Supply Study

LEGEND

⊗ Test Well

●8 Well Location & Number

Wetlands

N

0 100 200 m

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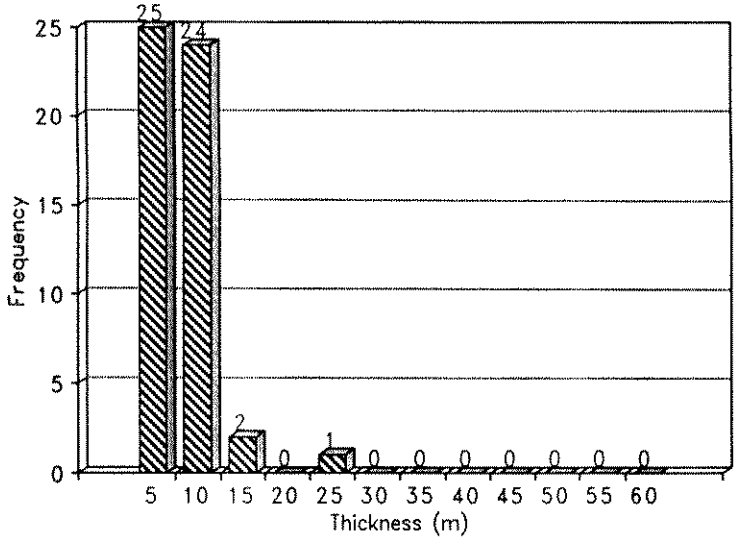
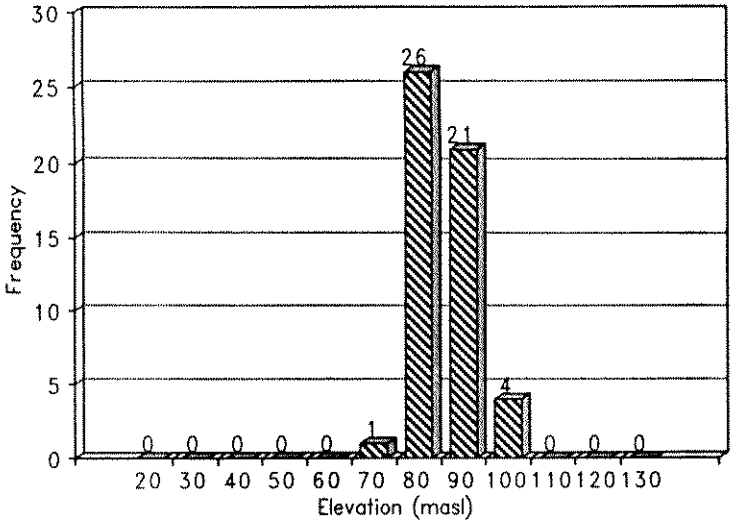
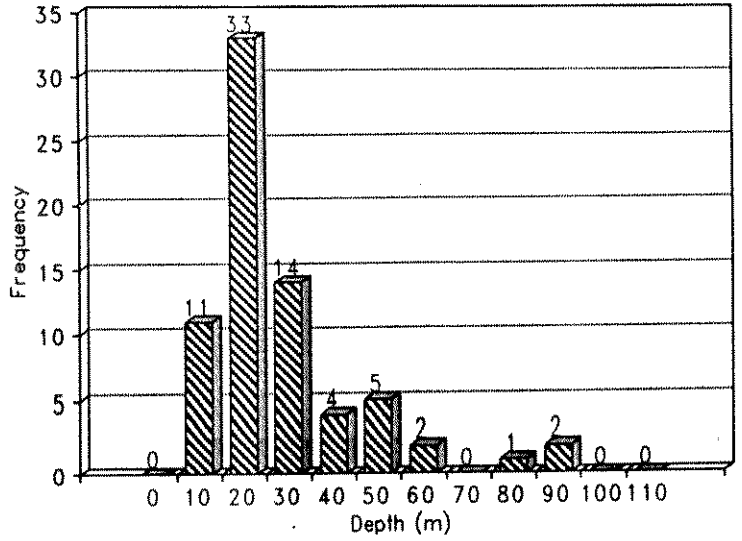
Overburden Thickness



Bedrock Elevation



Groundwater Depth



Groundwater Elevation

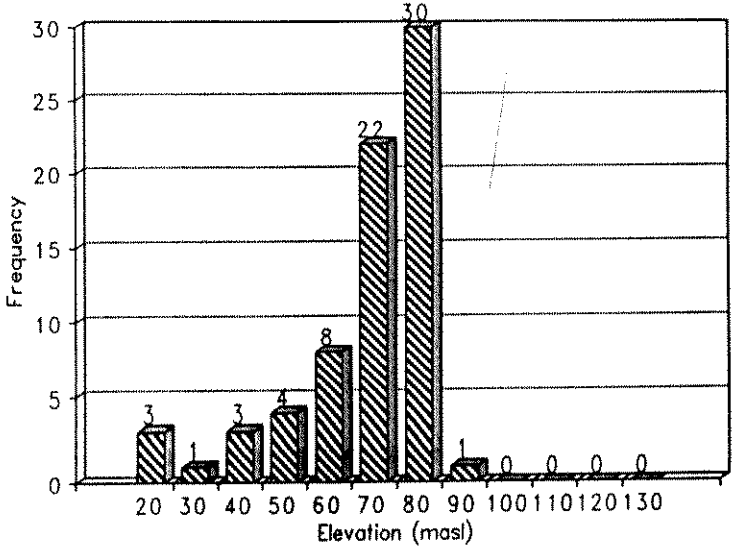


FIGURE 4:
ANALYSIS OF M.O.E. WELL LOG DATA

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A thin veneer of till overlies the bedrock at Test Site 1 while marine silt and clay overlie the bedrock at Test Site 2 and Test Site 3.

2.1.2 Bedrock Geology

The Oxford Formation limestone immediately underlies the overburden in the Metcalfe area. This formation is composed of grey limestone, magnesium-rich limestone and dolomite. The upper beds of this formation are highly fractured due to dissolution of the bedrock and glacial scouring. The Oxford Formation has an approximate thickness of 40 m in the Metcalfe area.

The Oxford Formation is conformably underlain by the March Formation. The March Formation is characterized by interbedded calcareous sandstone and sandy, grey dolomite. It is transitional between the Oxford Formation dolomite above and the Nepean Formation sandstone below. The March Formation is an important regional aquifer and has an approximate thickness of 26.5 m in the Metcalfe area.

The March Formation is conformably underlain by the Nepean Formation. The Nepean Formation is composed of a coarse-grained, cream to grey silica sandstone. It is generally thick-bedded; however, portions are thinly-bedded and water-bearing.

2.2 Regional Hydrogeology

Of the 52 MOE water well records examined, 46 of the wells were constructed in the Oxford Formation, 3 wells were constructed in the March Formation (well numbers 26, 36 and 43) and 3 wells were constructed in the Nepean Formation (well numbers 25, 51 and 52).

There are three water-bearing formations underlying the Metcalfe area which could be suitable for development of a communal water supply. These are the shallow Oxford Formation aquifer, the March Formation aquifer and the Nepean Formation aquifer.

The depth to groundwater distribution (shown on Figure 4) is trimodal, representing the three aquifers underlying the Metcalfe area.

There is a strong correlation in the MOE water well records between bedrock surface elevation and groundwater elevation (see Figure 4). The majority of the wells obtain their water from the upper fractured surface of the Oxford Formation. This is the most highly developed and exploited aquifer in the Metcalfe area.

Regional groundwater flow in the shallow Oxford Formation aquifer is occurring from the west and northwest of the village towards the east. Thin till and local bedrock high areas west of the village recharge the aquifer.

The shallow Oxford Formation aquifer is reportedly contaminated in many residential areas of the village by effluent from private sewage systems (WESA, 1984). The susceptibility of the aquifer to contamination is high due to the aquifer's shallow depth, the permeable nature of the overburden and inadequate grouting of older private water wells.

3.0 METHODOLOGY

Each of the aquifers identified above were examined through a program of test well drilling, hydraulic testing and groundwater sampling in accordance with Section 5 of the RMOC Guidelines for the Design of Communal Water Systems.

3.1 Test Well Drilling and Aquifer Testing

All of the test wells drilled during the study were constructed into the bedrock using the air rotary drilling method. After completion, each well was developed by stop-start compressed air surging. The construction details for each test well is included in the well logs found in Appendix C. The MOE water well record for each test well is also included in Appendix C.

The aquifer testing at each test site involved the following three components: step discharge testing, constant discharge testing and recovery observation.

Water levels in the pumping and observation wells at each test site were measured with electric sounding tapes during each component of testing. Discharges were measured using the orifice weir method.

Approval to Take Water under Section 20 of the Ontario Water Resources Act was obtained prior to each aquifer test conducted for this study. These approvals may be found in Appendix D.

3.1.1 Phase 1

3.1.1.1 Test Site 1

Two 20 cm diameter test wells (TW1 and TW2) were drilled at Test Site 1 by Olympic Drilling Co. Ltd. in January, 1988. These wells are approximately 100 m apart (see Figure 2).

TW1 and TW2 were drilled into the Oxford Formation limestone aquifer to a depth of 18.3 m. Both of these wells obtain their water from the shallow fractured limestone aquifer at a depth of approximately 10 m. A yield of 5.7 l/s was estimated during development of TW1.

Due to hole instability problems, TW1 was installed with 15 cm diameter steel casing to 18.3 m. The annular space between the casing and the hole was not grouted. The last 3.7 m of casing was torch slotted with 1 cm slots.

TW2 was installed with unslotted casing to 13.4 m. Again, hole stability problems necessitated a deeply set casing and prevented grouting of the annular space between the casing and the hole.

Aquifer testing at TS1 was accomplished by installing a 7.5 hp pump in TW1 with an intake depth of 14.0 m. The aquifer was step discharge tested at 3.8, 5.7, 7.6 and 9.47 l/s at 30 min intervals. After the step discharge test the aquifer was allowed to recover. The step discharge test was followed by a 6-hour constant discharge test at 5.7 l/s and 2 hours of recovery monitoring. Water levels in TW1 and TW2 were monitored during testing.

Groundwater samples were collected at the completion of the constant discharge test and were analyzed for general groundwater characteristics.

3.1.1.2 Test Site 2

One 15 cm diameter test well (TW3) was drilled at Test Site 2 by Valley Drilling Inc. in September, 1990 (see Figure 3). 6.7 m of 15 cm diameter steel casing was installed in TW3 and grouted in place with high early cement using the tremie method.

TW3 was first developed into the Oxford Formation limestone aquifer to a depth of 30.5 m. The estimated yield of the well was on the order of 0.23 l/s. This low yield was a result of casing and grouting through the shallow fractured limestone aquifer. No significant water-bearing fractures were encountered below a depth of 6.7 m.

The results of drilling TW4 suggested that deepening TW3 would significantly increase the well yield. Therefore, TW3 was deepened in November, 1990 through the Oxford Formation limestone and 10.9 m into the March Formation sandstone aquifer to a final depth of 53.3 m. Significant water-bearing fractures were intersected at 42.4 m, 50.0 m and 52.7 m. The estimated yield of this well was on the order of 7.58 l/s. The well is artesian and flows at approximately 2.0 l/s.

A 10 hp pump was installed in TW3 with an intake depth of 45.0 m. The aquifer was step discharge tested at 3.8, 5.7, 7.6, 9.47 and 11.4 l/s at 30 min intervals. After the step discharge test the aquifer was allowed to recover. The step discharge test was followed by a 6-hour constant discharge test at 9.47 l/s and 1 hour recovery monitoring. Water levels in TW3 and TW4 were monitored during testing.

Groundwater samples were collected at the completion of the constant discharge test and were analyzed for general groundwater characteristics.

3.1.1.3 Test Site 3

One 15 cm diameter test well (TW4) was drilled at Test Site 3 by Valley Drilling Inc. in September, 1990 (see Figure 3). 6.7 m of 15 cm diameter steel casing was installed in TW4 and grouted in place with high early cement using the tremie method. TW3 and TW4 are approximately 340 m apart.

TW4 was drilled through the Oxford Formation limestone and 1.5 m into the March Formation sandstone aquifer to a final depth of 44.2 m. A significant water-bearing fracture was intersected at the contact between these two formations at a depth of 42.7 m. The estimated yield of this well was on the order of 7.58 l/s. TW4 is artesian and flows at approximately 1.5 l/s.

3.1.2 Phase 2

Based on the results of the Phase 1 test drilling and aquifer testing program, a 25 cm diameter test production well (PW) was drilled at TS2 by Olympic Drilling Co. Ltd. in November, 1990 (see Figure 3). The well was constructed according to Section 5 of the RMOC Guidelines for the Design of Communal Water Systems. A stabilizer and tri-cone bit was used to ensure plumbness and alignment. The test production well is 13 m northeast of TW3.

First a 38 cm diameter hole was drilled to 7.6 m. A 25 cm diameter steel casing was grouted in place using the pressure grout method. The grout was allowed to set for 48 hours before drilling continued. After completion, the well was developed for 2 hours by stop-start compressed air surging.

PW was drilled through the Oxford Formation limestone and 18.3 m into the March Formation sandstone aquifer to a final depth of 61.0 m. Significant water-bearing fractures were intersected at 42.7 m, 50.3 m and 53.3 m. The estimated yield of this well was on the order of 11.4 l/s. PW is artesian and flows at approximately 3.8 l/s.

A 40 hp pump was installed in PW with an intake depth of 41.5 m. The aquifer was step discharge tested at 7.58, 11.4, 15.2 and 17.1 l/s at 30 min intervals. After the step discharge test the aquifer was allowed to fully recover. The step discharge test was followed by a 72-hour constant discharge test at 11.4 l/s. Water levels in PW, TW3 and TW4 were monitored during testing.

Groundwater samples were collected at 1, 24 and 48 hours into the constant discharge test and were analyzed for general groundwater characteristics, including hydrogen sulphide and bacteria. Groundwater samples were collected at the completion of the constant discharge test and were analyzed for all the parameters listed in Tables 1, 1A, 2 and 3 of the MOE's Ontario Drinking Water Objectives, including a complete bacteriological assessment (MOE, 1984).

Data analysis suggested that deepening PW would significantly increase the well yield. Therefore, PW was deepened in December, 1990 through the March Formation sandstone and 22.2 m into the Nepean Formation sandstone aquifer to a final depth of 91.4 m. Major water-bearing fractures were intersected at 79.0 m and 80.8 m. After completion of the well, the yield of the well was estimated to be on the order of 75.76 l/s.

A 15.2 cm vertical shaft turbine pump was installed in PW with an intake depth of 44.2 m. The aquifer was step discharge tested at 37.9, 56.8, 75.76, 94.70 and 106.1 l/s at 30 min intervals. After the step discharge test the aquifer was allowed to recover. The step discharge test was followed by a 72-hour constant discharge test at 75.76 l/s and 3 hours of recovery monitoring. Water levels in PW and TW3 were monitored during testing. Access to TW4 was denied by the property owner.

Groundwater samples were collected at 1, 24 and 48 hours into the constant discharge test and were analyzed for general groundwater characteristics, including hydrogen sulphide and bacteria. Groundwater samples were collected at the completion of the constant discharge test and were analyzed for all the parameters listed in Tables 1, 1A, 2 and 3 of the MOE's Ontario Drinking Water Objectives, including a complete bacteriological assessment (MOE, 1984).

3.2 Aquifer Analysis

3.2.1 Aquifer Hydraulics

The drawdown and recovery data from each aquifer test was plotted on semi-logarithmic paper with time on the log axis. A best fit line was drawn through representative data points.

The Jacob method (Cooper and Jacob, 1946) was applied to the time-drawdown data to calculate aquifer coefficients while the Theis Recovery method (Theis, 1935) was applied to the residual-drawdown data to calculate aquifer coefficients. All aquifer test data, analyses and calculations are included in Appendix E.

The short term yield, safe perennial yield, long term yield, well interference, and expected drawdowns were calculated using these aquifer coefficients.

The theoretical groundwater yields, well interference and expected drawdowns in the Nepean Formation aquifer were calculated using the most conservative transmissivity value for the aquifer and an average storativity value which best described the aquifer. To ensure well stability, a maximum available drawdown of 42.0 m was used. This depth corresponds to the depth of the first major water-bearing fracture in the March Formation. The theoretical groundwater yield calculations are included in Appendix F.

3.2.2 Groundwater Quality

Determining the geochemical and bacteriological characteristics of the groundwater in an aquifer involves sampling and analysis of the groundwater during the constant discharge component of the aquifer test.

All groundwater samples collected during this study were analyzed by Accutest Laboratories Ltd. in Nepean, Ontario. The results of the geochemical and bacteriological analyses of water samples taken during the aquifer tests are given in Appendix G.

The results of the geochemical and bacteriological analyses of the groundwater were compared to Tables 1, 1A, 2 and 3 of the Ontario Drinking Water Objectives (MOE, 1984).

4.0 RESULTS

4.1 Aquifer Analysis

4.1.1 Aquifer Hydraulics

The results of the aquifer analyses on the three aquifers underlying the Metcalfe area are summarized in Table 1. The calculated theoretical groundwater yields from the Nepean Formation aquifer are summarized in Table 2.

TABLE 1 - SUMMARY OF AQUIFER ANALYSIS RESULTS

Aquifer	Test Site	Minimum Transmissivity (m2/day)	Storativity	Safe Perennial Yield (l/s)
Oxford	1	192	1.8E-5	7.87
March	2 & 3	214	9.9E-5	47.2
Nepean	2 & 3	446	3.0E-5	92.0

TABLE 2 - THEORETICAL GROUNDWATER YIELDS
Nepean Formation Aquifer

Design	Theoretical Yield (l/s)
Maximum Day	127
10 year	92.0
20 Year	89.9

4.1.2 Groundwater Quality

The results of the geochemical and bacteriological analysis of the groundwater in the three aquifers underlying the Metcalfe area are summarized in Table 3.

5.0 DISCUSSION OF RESULTS

5.1 Regional Hydrogeology

The Nepean Formation aquifer is the most suitable aquifer for development of a communal water supply in the Metcalfe area.

The Nepean Formation aquifer is very extensive. It is bounded approximately 6.4 km to the north and northeast by the Gloucester Fault and extends for hundreds of kilometres in all other directions (Wilson, 1935). Outcrops of the March and Nepean Formations can be observed just southeast of the village of Leitrim.

The actual thickness of the Nepean Formation aquifer is unknown; however, in the Metcalfe area it is more than 10 m thick. The upper portions of the formation are the most water-bearing, where the bedding is thin and the cementing material is calcareous. However, where silica forms the cementing material, the sandstone is hard and water-tight.

The recharge to the aquifer is likely along the Gloucester fault to the north and from the overlying water-bearing formations. Groundwater flow in the aquifer occurs from the area of recharge along the Gloucester Fault and follows the plane of bedding to the south and southwest.

5.2 Aquifer Analysis

5.2.1 Aquifer Hydraulics

The Nepean Formation aquifer responded to pumping in a manner consistent with the response of a confined aquifer. There were no negative or positive recharge boundaries encountered during the 72-hour constant discharge aquifer test. However, the flattened drawdown curve near the end of the test suggests that there is some leakage through the overlying aquitards. This is borne out by the relatively high calculated values for storativity and theoretical groundwater yields (see Tables 1 & 2).

TABLE 3 - SUMMARY OF GROUNDWATER QUALITY RESULTS

Parameter	Units	Oxford	March	March	March	March	Nepean	Nepean	Nepean	Nepean	MOE
		TW1-6hr	PW-1hr	PW-24hr	PW-48hr	PW-72hr	PW-1hr	PW-24hr	PW-48hr	PW-72hr	Objective
		25-1-88	24-11-90	25-11-90	26-11-90	27-11-90	9-1-91	10-1-91	11-1-91	12-1-91	
Fe	mg/l	0.34	0.07	0.07	0.06	0.07	0.06	0.05	<0.05	<0.05	0.3
Mn	mg/l	<0.05				<0.05	<0.05	<0.05	<0.05	<0.05	0.05
Hardness	mg/l CaCO3	280				238	271	285	257	241	-
Alkalinity	mg/l CaCO3	309				220				206	-
pH		7.40				7.88	7.68	7.91	8.02	8.00	6.50-8.50
Conductivity (Fld)	umhos/cm		415	460	470	480	600	600	600		-
Conductivity (Lab)	umhos/cm	867	753	748	749	746	1065	1065	1052	1038	-
F	mg/l	0.26				0.45	0.37	0.38	0.38	0.38	2.4
Na	mg/l	13				60	88	92	90	88	-
N-NO3	mg/l	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	10.0
N-NO2	mg/l	<0.10				<0.10				<0.10	1.0
N-NH3	mg/l	<0.10				<0.10				0.11	-
SO4	mg/l	58	62	58	66	61	95	100	90	90	500
Cl	mg/l	59	58	57	60	59	145	144	135	127	250
Phenols	mg/l	<0.002				<0.002				<0.002	0.002
Turbidity (Fld)	NTU		8.5	0.09	0.13	0.01	0.24	0.05	0.07		1
Turbidity (Lab)	NTU	<1.0				<1.0				<1.0	1
Colour	Pt/Co	<2	2	<2	<2	<2				3	5
Ca	mg/l	64				49				45	-
Mg	mg/l	28				28				31	-
Tannin & Lignin	mg/l	<2.0				<1.0				<1.0	-
Total Nitrogen	mg/l					<0.10				0.28	-
K	mg/l					8				2	-
H2S (Fld)	mg/l										0.05
H2S (Lab)	mg/l		0.33	0.31		0.36	<0.02	<0.02	<0.02	0.06	0.05
TDS	mg/l		442	424	440	442				608	500
TOC	mg/l					1.2				1.1	5.0
Total Coliform		0	0	0	0	0	0	0	0	0	<5
Faecal Coliform		0	0	0	0	0	0	0	0	0	0
Faecal Strep.		0	0	0	0	0	0	0	0	0	0
As	mg/l					<0.01				<0.01	0.05
Ba	mg/l					0.04				0.03	1.0
B	mg/l					0.22				0.20	5.0
Cd	mg/l					<0.002				<0.002	0.005
Cr	mg/l					<0.01				<0.01	0.05
CN-	mg/l					<0.01				<0.01	0.2
Pb	mg/l					<0.002				<0.002	0.05
Hg	mg/l					<0.001				<0.001	0.001
Se	mg/l					<0.01				<0.01	0.01

TABLE 3 - SUMMARY OF GROUNDWATER QUALITY RESULTS

Parameter	Units	Oxford	March	March	March	March	Nepean	Nepean	Nepean	Nepean	MOE
		TW1-6hr	PW-1hr	PW-24hr	PW-48hr	PW-72hr	PW-1hr	PW-24hr	PW-48hr	PW-72hr	Objective
		25-1-88	24-11-90	25-11-90	26-11-90	27-11-90	9-1-91	10-1-91	11-1-91	12-1-91	
Ag	mg/l					<0.01				<0.01	0.05
Cu	mg/l					<0.01				<0.01	1.0
Zn	mg/l					<0.01				<0.01	5.0
U	mg/l					<0.01				<0.02	0.02
Radionuclides											
Cesium 137	Bq/l					<1				<1	50
Iodine 131	Bq/l					<1				<1	10
Radium 226	Bq/l					<0.1				<0.1	1
Strontium 90	Bq/l					<1				<1	10
Tritium	Bq/l					<100				<100	40000
Pesticides											
Aldrin & Dieldrin	mg/l					<0.0007				<0.0007	0.0007
Carbaryl	mg/l					<0.07				<0.07	0.07
Chlordane	mg/l					<0.007				<0.007	0.007
DDT	mg/l					<0.03				<0.03	0.03
Diazinon	mg/l					<0.014				<0.014	0.014
Endrin	mg/l					<0.0002				<0.0002	0.0002
Heptachlor & Heptachlor Epoxide	mg/l					<0.003				<0.003	0.003
Lindane	mg/l					<0.004				<0.004	0.004
Methoxychlor	mg/l					<0.1				<0.1	0.1
Methyl Parathion	mg/l					<0.007				<0.007	0.007
Parathion	mg/l					<0.035				<0.035	0.035
Toxaphene	mg/l					<0.005				<0.005	0.005
2, 4-D	mg/l					<0.1				<0.1	0.1
2, 4, 5-TP	mg/l					<0.01				<0.01	0.01
Trihalomethanes	mg/l					<0.35				<0.35	0.35
Polychlorinated Biphenols	mg/l					<0.003				<0.003	0.003

Partial penetration effects were exhibited by the test wells at TS2. Extra head losses were observed during pumping and the wells were sensitive to small variations in the rate of discharge. Also the wells recovered very quickly after pumping stopped. This suggests that there are vertical flow components in the aquifer near the vicinity of the well.

5.2.2 Groundwater Quality

After 72 hours of continuous pumping, all the geochemical and bacteriological parameters related to health in the groundwater derived from the Nepean Formation aquifer met the Maximum Acceptable Concentrations listed in Tables 1, 1A and 3 of the ODWO.

After 72 hours of continuous pumping, the groundwater derived from the Nepean Formation aquifer had a hydrogen sulphide concentration of 0.06 mg/l and a TDS concentration of 608 mg/l. These concentrations are only slightly above the Maximum Desirable Concentrations of 0.05 mg/l for hydrogen sulphide and 500 mg/l for TDS, listed in Table 2 of the ODWO for parameters related to aesthetic quality. These parameters should not be exceeded whenever a more suitable supply or treatment process is, or can be made available at a reasonable cost (MOE, 1984). The hydrogen sulphide concentration is within the maximum concentration considered reasonably treatable.

The hydrogen sulphide levels greatly improved after PW was deepened into the Nepean Formation aquifer and were below the MOE objective during the first 48 hours of the constant discharge aquifer test. The elevated hydrogen sulphide concentration in the groundwater after 72 hours of continuous pumping indicates there was a greater flow of water into the well from the overlying March Formation aquifer where hydrogen sulphide concentrations are greater.

After 72 hours of continuous pumping, the groundwater derived from the Nepean Formation aquifer had a sodium concentration of 88 mg/l which exceeds the concentration of 20 mg/l recommended by health authorities for individuals on low sodium diets. These levels of sodium are not harmful to the normal healthy individual and are common in other communal water supplies in the Regional Municipality of Ottawa-Carleton. In our 1988 study "Sodium Distribution Study, Carp, Ontario" we measured sodium levels in excess of 20 mg/l in water samples collected from other communal water supplies in the Region (WESA, 1988).

The conductivity values measured in the lab are significantly higher than those measured in the field. This is due to further precipitation of solids as a result of temperature-pH changes and increased reaction time.

The elevated TDS concentrations likely reflect the elevated sodium levels.

5.3 Well Interference

The pumping of a production well developed in the Nepean Formation aquifer at the 20 year design yield of 89.9 l/s for a period of 20 years will result in a theoretical drawdown of 17.2 m in the aquifer at a radius of 1 km. This drawdown is not foreseen to be a significant problem and would only influence the deep drilled wells that the municipal water supply is designed to replace. Drawdowns of 17.2 m are a worst case scenario and reflect pumping conditions which are unlikely to occur over the life of the project.

There is more than 1 km separating the production well and the nearest well developed in the Nepean Formation and more than 1.5 km separating the production well and the nearest well developed in the March Formation.

Little influence on wells outside the serviced community is anticipated. If such influence does occur, redevelopment or deepening of these wells would be a relatively small cost.

If some leakage occurs through the overlying March and Oxford Formations during pumping, it will not have an effect on wells utilizing the shallow fractured limestone aquifer in the vicinity of the production well.

6.0 CONCLUSIONS

Based on the results of this study, the following conclusions can be made:

1. The Nepean Formation aquifer is the most suitable aquifer for development of a communal water supply in the Metcalfe area. The Nepean Formation aquifer has demonstrated the ability to yield in excess of 106.1 l/s to a 25 cm diameter bedrock test well. A theoretical maximum day yield of 127 l/s and a theoretical safe perennial yield of 92.0 l/s was calculated for the aquifer. However, a practical maximum day yield of 106.1 l/s and a practical safe perennial yield of 75.76 l/s is recommended based on proven pumping rates and groundwater quality.

2. All the geochemical and bacteriological parameters related to health in the groundwater derived from the Nepean Formation aquifer meet the Maximum Acceptable Concentrations listed in Tables 1, 1A and 3 of the ODWO. Compared to the Maximum Desirable Concentrations for parameters related to aesthetic quality listed in Table 2 of the ODWO, the groundwater has a hydrogen sulphide concentration in excess of 0.01 mg/l and a TDS concentration in excess of 108 mg/l. The hydrogen sulphide levels are well within the maximum concentration considered reasonably treatable. A Sodium concentration of 88 mg/l exceeds the concentration of 20 mg/l recommended by health authorities for individuals on low sodium diets. These levels of sodium are not harmful to the normal healthy individual.

3. The Nepean Formation is laterally very extensive and at Test Site 2 is more than 10 m thick. The area of recharge to this aquifer is likely along the Gloucester Fault approximately 6.4 km to the north.

4. At Test Site 2 the Nepean Formation aquifer is stratigraphically confined by approximately 77.5 m of thickly-bedded, slightly leaky sandstone and limestone followed by 2.5 m of low permeability clay and till at the surface.

7.0 RECOMMENDATIONS

7.1 Well Design

PW should be used as a standby source for the communal water supply system. A new 30.5 cm diameter well should be constructed and used as the production well. There is no minimum distance required between the standby well and the production well provided the wells are not pumped concurrently. If the wells are to be pumped concurrently, then a minimum distance equal to approximately twice the saturated aquifer thickness is recommended. The recommended well design should follow Section 5 of the RMOC Guidelines for the Design of Communal Water Systems.

Based on further testing at PW, it may be advantageous to case and grout the production well past the last significant water-bearing fracture in the March Formation at a depth of approximately 54.0 m. This would ensure that the well is supplying better quality groundwater from the Nepean Formation.

We recommend the new 30.5 cm diameter well be constructed with 0.250 m diameter steel wall casing with centralizers and pressure grouted to a depth of 54.0 m. It is also recommended that the well be developed and aquifer tested. This should include a step discharge aquifer test, a 24-hour constant discharge aquifer test and complete geochemical and bacteriological analyses.

It is recommended that any tender document for the job be prepared by a competent water supply hydrogeologist in concert with the project engineers prior to circulation to the MOE and the contractors. Preliminary design information from the engineers may be incorporated into the well design and a final specification list and construction drawing be drafted at that time.

A drawdown of approximately 34.5 m is expected in a 30.5 cm diameter production well if the aquifer is pumped continuously at 106.1 l/s for a period of 24 hours while a drawdown of approximately 24.7 m is expected in a 30.5 cm diameter production well if the aquifer is pumped continuously at 75.76 l/s for a period of 24 hours. These expected drawdowns should be used only as a guide when determining the pump intake depth.

7.2 Well Head Protection

At Test Site 2 the Nepean Formation aquifer is stratigraphically confined by approximately 77.5 m of thickly-bedded, slightly leaky sandstone and limestone followed by 2.5 m of low permeability clay and till at the surface. Although there may be some leakage through these layers, they form suitable aquitards, thus preventing contamination of the aquifer from surface-borne inorganic and organic contaminants.

The possibility of surface-borne contaminants gaining access to the aquifer may be reduced by insuring that all wells in the vicinity of the production well are sealed.

A number of land use practices should be barred from the vicinity of the production well and from the areas which recharge the shallow Oxford Formation aquifer. These land uses include solid waste management schemes, hazardous waste disposal, fuel storage and transfer, and wet industry or activities producing liquid or leachable wastes.

An update to our 1984 study "Terrain & Hydrogeological Analysis, Village and Hamlets of Osgoode Township" is to be completed in the future and will include a detailed land use inventory for the Village of Metcalfe and analysis to determine the impact of these land uses on groundwater quality. A groundwater management and protection program for the Village can then be developed using this information.

Respectfully submitted,

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Hydrogeologist

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APPENDIX A

TERMS OF REFERENCE

TERMS OF REFERENCE

VILLAGE OF METCALFE WATER SUPPLY

PREAMBLE

As a first step in the further development of a water supply and distribution system for the Village of Metcalfe a test drilling program is considered necessary to establish that a well supply system can indeed be constructed in the vicinity.

Only after the test drilling program has proven to the satisfaction of the RMOC and the MOE that such a well supply system is feasible, will the planning and design for an Environmental Study Report (ESR) in accordance with the MEA Class EA for Municipal Sewage or Water Projects commence.

These Terms of Reference assume that the test drilling program will be successful and that an ESR will have to be prepared. The ESR should follow the format of an ESR as outlined in the MEA Class EA for Municipal Sewage and Water Projects.

A. Test Drilling Program

1.a) The objective of the test drilling program is to establish potential well sites which are capable, on a safe perennial yield basis, of providing sufficient water to meet the MOE and RMOC guidelines;

1.b) A hydrogeologist shall review and evaluate the data obtained from the test drilling program and other sources, and prepare the Phase I Report. Eight copies of the hydrogeologist's report shall be submitted to the Project Supervisor for RMOC for distribution within RMOC and to the MOE.

1.c) The report submitted shal include, but not be limited to, the following:

i) the geologic logs and geophysical logs of each test hole drilled, and the owner's copy of the Ministry of the Environment's "Water Well Record";

ii) the construction details of each test well;

iii) the hydrologic conditions of the aquifer;

iv) grain-size curves of aquifer soil samples collected;

v) graphs of drawdown and recovery data of the pumped well(s) and all observation wells monitored during any test pumping;

vi) the values of the aquifer coefficients, graphs of the field data used in their calculation and method of calculation;

vii) the safe perennial yield of any proposed well(s) and a discussion of the method used in its calculation. The safe perennial yield is defined as the yield that can be sustained from a well on a continuous basis for a period of not less than ten years (6.7 log cycles) under the conditions prevailing at the time of the aquifer test;

viii) the design and estimated cost of the proposed finished well(s) in the aquifer tested;

ix) comments on the effectthat the operation of any proposed production well(s) will have upon the water levels in the aquifer and in any adjacent domestic wells;

x) a description of the water quality with particular reference to potential problems and treatment requirements;

xi) a map showing the locations of all test wells and other pertinent wells, structures and facilities including precisely measured distances between wells and appropriate property boundaries or reference points (roads, streams, etc.);

xii) the results of the analyses of representative raw water samples collected during test pumping at the individual site(s) for all the parameters listed in Tables 1, 1A, 2 and 3 of the MOE's "Ontario Drinking Water Ojectives";

xiii) the results of bacteriological analyses of the samples collected at the individual sites(s) during the test pumping;

xiv) the results will be expressed in the Metric System which will be the International System of Units (SI).

B. Environmental Study Report

NOTE: This part of the program should only proceed if the test drilling program has established that an adequate supply of potable ground water is available and the proponent is required to prepare an Environmental Study Report in accordance with the MEA's Class EA for Municipal Sewage and Waste Projects.

General Requirements

To prepare an Environmental Study Report in accordance with the MEA Class EA for Municipal Sewage and Water Projects for a communal water supply and distribution system for the Village of Metcalfe.

REGIONAL MUNICIPALITY OF OTTAWA-CARLETON

GUIDELINES FOR THE DESIGN OF COMMUNAL WATER SYSTEMS

MARCH, 1990

SECTION 5 - GROUND WATER SYSTEMS

5.1 General

The well construction and testing requirements shall be as stated in the following Ministry of Environment Publications:

* Guidelines for Design of Sanitary Sewage Works, Storm Sewers (Interim), Water Distribution Systems, Water Storage Facilities

* Servicing in Areas Subject to Adverse Conditions

* Water Supply for Small Residential Developments

* Seasonally Operated Water Supplies

With modifications and additions as herein specified.

5.2 Permit to Take Water

An application to the Ministry of Environment for a permit to take water if the daily withdrawal rate exceeds 50 cubic meters per day (10,000 gal per day) shall be made by the hydrogeological consultant. The RMOC shall be responsible for all conditions imposed by the Ministry including compensation to other persons should the taking of water interfere with any other persons interest in the water.

5.3 Number of Wells

A minimum of two wells are required for a public communal water system. The production wells must have a combined capacity adequate to meet the maximum day demand on the water system.

5.4 Well Design and Construction

The design and construction of each well shall conform with the AWWA "A 100-84-Standard for Water Wells" and with the Ministry of the Environment's Well Regulation 612/84, or subsequent amendment.

5.5 Well Casing Pipe and Well Size

The well size and casing pipe for the production wells shall be comprised of new, low- carbon steel complying with ASTM Specification A-120. The casing pipe shall have a minimum nominal diameter of 250 mm (10 inches) with a minimum wall thickness of 6 mm (0.245 inches).

All casing pipes installed by driving or that terminate at or into the bedrock shall be equipped with a commercially manufactured drive shoe.

5.6 Well Screen

Each well completed in the overburden shall be equipped with a commercially-manufactured stainless steel screen having a nominal diameter equivalent to the casing pipe; having slotted openings suited for the natural formations and/or the artificial gravel pack opposite the screened interval by established screen-selection procedures; and having a theoretical entrance velocity not exceeding 0.03 metres/second (0.1 ft/sec) at the rated peak-hour yield of the production well.

5.7 Grout Seal

The outer casing shall be cement-grouted from the ground surface for a minimum depth of 7.6 metres (25 ft). A deeper grout seal may be required depending on the specific geological and hydrogeological conditions at the site. The grout seal shall have a minimum thickness of 75 mm (3 inches). The cement grout shall have a consistency of not more than one cubic metre of water for every cubic metre of cement (6 gals/cu. ft.) and shall be placed from the bottom of the annular space towards the ground surface.

5.8 Well Alignment

Each well shall have suitable alignment and plumbness to permit the installation and/or removal of a design-capacity, submersible or turbine pump to within 3 metres (10 feet) of the bottom of a bedrock-well or to the top of the well screen in an overburden well.

For submersible pumps, the divergence from plumbness shall not exceed one-third of the inside diameter of the well or that part of the well being tested per 30 m (100 ft) of depth. For vertical turbine pumps, the divergence from plumbness is to be within the manufacturer's requirements.

The alignment and roundness shall permit the free passage of a 6 m (20 ft) dummy (or equivalent) having an outside diameter 13 mm (0.5 inches) less than the inside diameter of the well.

5.9 Well Seal

Each well shall be equipped with a water-tight seal between the pump and casing; having two threaded and plugged access holes to permit direct measurement of the water level within the casing; and having an air vent, extending to the outside atmosphere - unless flowing conditions preclude the installation of an air vent.

5.10 Pump and Well Access

Each well shall be accessible for subsequent rehabilitation/development and pump removal/maintenance within a pump house.

Refer to Section 8 of these guidelines for further requirements with respect to well housings.

5.11 Pitless Adaptors

Any well located outside of an enclosed surface-housing shall be equipped with a pitless adaptor installed below the anticipated frozen-ground depth.

5.12 Well Controls

Each well shall be equipped with a low-level cutoff, to be located 3 metres (10 ft) above the pump intake or above the main water-bearing zone, whichever occurs at shallower depth.

Each well shall be equipped with a pressure control valve and a check valve, adjusted not to exceed the demonstrated or designed sand-free yield of the production well; with a digital flowmeter installed in the discharge header; and with a valve and piping array permitting the free, controlled discharge of water to waste for future testing of the well. In the case of a well discharging directly into a ground level reservoir, the pressure control valve can be omitted.

Refer to clause 8.4 of these guidelines for further details on low-lift pumping controls.

5.13 Well Development

Each well must be fully developed at time of construction to provide an essentially sand-free water supply - as certified by the consulting hydrogeologist during the well testing, and must have a turbidity content at or below the provincial drinking-water standard.

5.14 Pumping Tests

The services of a consulting hydrogeologist shall be retained by the RMOC to supervise the well construction and to undertake the necessary testing required to establish the aquifer and well capacities.

A controlled discharge pumping test shall be conducted on the highest yield production well for a minimum period ranging from 24 hours for an artesian aquifer to 72 hours for a water-table aquifer, according to the site-specific conditions defined by the consulting hydrogeologist. The recovery period shall be for one-third of the pumping period or may be terminated earlier if at least 90 percent recovery is measured in the well. .

Testing of other well(s) may be conducted for similar durations, as determine by the consulting hydrogeologist, but shall be for at least 12 hours, regardless of the prevailing hydraulic conditions.

The pumped water must be directed in a manner that prevents recirculation to the tested aquifer, and the hydrogeologist must clearly advise (in his subsequent report) how this condition was satisfied throughout the pumping period.

The pumping rate for each tested well shall be determined by the hydrogeologist from the results of prior capacity testing, which shall comprise at least three steps at variable pumping rates, each being a minimum of one-half hour duration - and preferably should be at the maximum-day withdrawal rate, or higher if supported by the capacity testing.

If a single well is unable to deliver the maximum-day capacity, then the multiple-well system should be operated concurrently for the duration of the aquifer test. If a single well can deliver the maximum day capacity, then each well shall be tested individually. Water levels shall be recorded in the pumped well, and in selected accessible wells within a distance of 300 metres (1000 ft), at intervals to be determined by the

hydrogeologist that will permit evaluation of the aquifer hydraulic characteristics; the perennial aquifer yield; the individual production-well yields; and the predicted long-term interference with existing groundwater sources and surface-water features.

The hydrogeologist shall obtain prior approval, on behalf of the RMOC, from the Ministry of the Environment for the conductance of any pumping test - if the withdrawal exceeds 50 cubic metres/day (10,000 gallons/day).

Water samples shall be collected and suitably preserved/stored by the hydrogeologist after one hour, six hours, and 12 hours; and at 12 hour intervals thereafter for the pumping-test duration, for bacteriological and chemical analyses of the raw water.

The hydrogeologist shall comment on the observed absence or presence of hydrogen sulphide or methane gas during the pumping test and shall undertake adequate testing and sampling to evaluate the gas concentration and volume per m^3 of pumped water for subsequent determination of acceptable gas removal system.

The sample collected at conclusion of each aquifer test shall be analyzed for the complete list of chemical and physical parameters listed in Tables 1, 1A and 2 of the Ministry of the Environment Drinking-Water Objectives, and for complete bacteriological determinations (Total Coliform and Aeromonas Organisms; Standard Plate Counts; Pseudomonas Aeruginosa; Staphylococcus Aureus; and the Fecal Streptococcus Group). Three other water samples collected at prior intervals during the test, shall be analyzed for the following selected parameters.

Turbidity	Iron	Sulphate
Total Dissolved Solids	Nitrate	Total Coliform Bacteria
Colour	Chloride	Fecal Coliform Bacteria

5.15 Monitoring

The quantity and quality of the water produced by the communal water system will be monitored by the RMOC on a regular basis. As a minimum requirements, the Region will record on a daily basis water pumpage and water depth readings. The Region will collect water samples to be analyzed for iron, chloride, nitrogen cycle, sulphate, total dissolved solids and dissolved organic carbon at four-month intervals; and water samples will be collected and analyzed for bacteriological analysis at the frequency and intensity requested by the Ministry of the Environment. Copies of the monitoring-results will be provided to the Ministry of the Environment at the frequency requested by MOE.

Depending on the characteristics of the aquifer and on the water quality, additional monitoring may be required. The actual monitoring requirements will normally be stated on the Permit to Take Water and on the Certificate of Approval (Water).

APPENDIX B

MOE WATER WELL RECORDS

WELL	ELEV B/R (masl)	OVERBURDN THICKNESS (m)	WATER TABLE ELEVATION (masl)	DEPTH WATER FOUND (m)	ELEVATION WATER FOUND (masl)	WELL DEPTH (m)
1	83.60	0.00	83.63	6.99	76.63	16.12
2	80.56	3.04	81.19	4.26	79.37	4.26
3	81.17	2.43	82.11	30.41	53.22	30.71
4	81.17	3.95	85.15	8.51	76.63	9.12
5	79.04	5.47	82.11	16.42	68.12	16.42
6	78.74	4.87	82.11	8.51	75.11	9.43
7	79.65	8.51	81.50	39.53	48.66	41.97
8	76.61	5.47	81.50	11.25	70.86	12.16
9	76.31	7.30	82.11	17.33	66.29	19.77
10	78.43	6.08	82.41	8.82	75.72	8.82
11	78.13	5.47	80.59	8.51	75.11	9.43
12	76.31	6.99	82.72	15.51	67.81	16.12
13	85.43	2.74	83.63	17.33	70.86	17.94
14	81.78	1.82	80.59	11.56	72.07	12.16
15	79.65	5.47	80.89	12.77 15.21	72.38 69.94	15.51
16	75.39	8.21	80.89	14.90 17.33 20.07	68.73 66.29 63.56	21.29
17	78.43	5.17	83.63	7.60 10.04 11.86	76.03 73.59 71.77	12.16
18	80.87	7.30	86.97	12.16 16.12	76.03 72.07	16.42

WELL	ELEV B/R (masl)	OVERBURDN THICKNESS (m)	WATER TABLE ELEVATION (masl)	DEPTH WATER FOUND (m)	ELEVATION WATER FOUND (masl)	WELL DEPTH (m)
19	76.00	12.16	82.11	18.55	69.64	18.55
20	76.00	9.12	84.84	20.98	64.17	21.29
21	74.79	7.91	80.28	13.08	69.64	13.68
22	81.17	5.47	83.63	12.16	74.50	12.16
23	79.95	5.17	79.98	42.57 82.11	42.57 3.04	91.29
24	78.87	9.73	78.76	13.99 21.29	69.64 62.34	24.33
25	77.83	7.30	81.50	12.77	72.38	13.68
26	82.99	2.13	80.59	5.47 11.25 28.89 59.30	79.67 73.90 56.26 25.85	62.34
27	70.23	8.82	71.46	12.16	66.90	19.46
28	83.60	1.52	83.02	26.15	59.00	26.15
29	82.39	5.17	84.54	10.64	76.94	11.56
30	80.87	4.26	83.93	5.78	79.37	6.39
31	86.03	2.13	82.11	22.81 30.41	65.38 57.78	45.01
32	69.92	21.29	86.36	21.29 26.15	69.94 65.08	27.37
33	80.87	4.87	83.32	13.68	72.07	13.68
34	98.50	0.30	92.14	16.73 26.76	82.11 72.07	27.37
35	82.08	3.65	84.54	9.73 14.60	76.03 71.16	16.73
36	80.26	1.82	80.59	24.33	57.78	48.66

WELL	ELEV B/R (masl)	OVERBURDN THICKNESS (m)	WATER TABLE ELEVATION (masl)	DEPTH WATER FOUND (m)	ELEVATION WATER FOUND (masl)	WELL DEPTH (m)
				39.53	42.57	
				47.14	34.97	
37	88.77	1.82	86.36	13.38	77.24	13.68
38	89.07	3.65	88.49	16.73	76.03	18.25
39	98.50	0.91	82.72	25.54	73.90	27.06
40	93.03	1.22	88.19	15.21	79.07	28.89
				28.59	65.69	
41	88.16	2.43	89.71	25.24	65.38	25.24
42	87.25	0.91	84.54	42.57	45.62	48.66
43	79.65	1.82	66.29	45.92	35.58	87.58
				50.18	31.32	
44	81.17	3.95	84.24	9.12	76.03	10.64
45	74.79	10.34	74.50	27.37	57.78	28.89
46	72.66	9.43	80.89	14.60	67.51	15.21
47	74.79	8.82	79.07	15.81	67.81	17.03
48	75.09	3.95	74.50	19.16	59.91	19.77
49	73.27	5.17	76.03	12.16	66.29	12.77
50	72.66	6.69	75.72	17.64	61.73	19.77
51	79.65	5.47	76.03	74.50	10.64	75.42
52	98.20	0.61	92.75	44.09	54.74	89.10
				82.11	16.73	

CON	LOT	EASTING	NORTHING	SURFACE ELEV	DRILL DATE	CSG DIA	KIND OF WATER	WATER FOUND	STATIC LEVEL	PUMPED LEVEL	TEST RATE	TEST TIME	WATER USE	OWNER GEOLOGIC LOG
7	16	462140	5010730	275	01/47	5	FR	23					DO	CHARLIS H LMSN 0053
7	16	462200	5010720	275	08/59	5	FR	14	8	12	8	1/00	ST DO	VANDERYDT C TPSL STNS 0010 ROCK 0014
7	16	462210	5010750	275	09/67	5	FR	100	5	20	10	1/00	ST DO	VANDERYDT C CLAY MSND TPSL 0003 HPAN BLDR 0008 LMSN 0101
7	16	462277	5010565	280	05/72	5	FR	28	0	5	18	2/00	DO	SCOTT A CLAY 0010 GRVL 0013 SNDS 0030
7	17	462310	5010230	278	09/65	5	FR	54	8	10	6	1/00	ST DO	WADDELL A CLAY TPSL 0016 GRVL 0018 LMSN 0054
7	17	462329	5010378	275	04/73	5	FR	28	5	15	10	1/30	DO	MILLAR MCCUDUYE BLUE CLAY 0011 GREY HPAN 0016 GREY SHLE 0020 GREY SNDS 0031
7	18	460790	5009020	290	11/53	5	FR	130	22	28	17	/30	DO	JEACLE M PRDG 0025 GRVL 0028 GREY LMSN 0138
7	18	462399	5010199	270	05/80	6	FR	37	2	12	20	1/00	DO	VANBERLO G BRWN TPSL CLAY SNDY 0016 BRWN SAND GRVL 0018 BRWN STNS 0040
7	18	462411	5010102	275	09/74	6	FR	57	5	35	10	1/00	DO	STEVENSON C L BRWN FILL FSND 0002 GREY CLAY BLDR 0024 GREY CLAY GRVL 0046 GREY LMSN 0065
7	18	462420	5010130	278	11/56	4	FR	29	7	19	2	2/00	DO	COOPER K BLUE CLAY 0020 GREY LMSN 0029
7	18	462492	5009828	275	07/73	5	FR	28	10	15	15	1/00	DO	SOMERS MAREAN GREY CLAY 0016 BRWN SAND GRVL 0018 GREY LMSN 0031
7	18	462500	5009920	274	11/68	5	FR	51	2	30	8	1/00	DO	MCKELLAR A CLAY 0015 GRVL MSND BLDR 0023 LMSN 0053
7	19	460900	5008640	290	08/57	5	FR	57	15	55	2	1/00	DO	ROBBINS W MSND GRVL 0009 GREY LMSN 0059
7	19	462625	5009524	275	06/74	5	FR	38	10	20	15	1/00	DO	PATTERSON CARMAN BRWN HPAN 0006 BLCK SHLE 0018 BLCK SNDS 0040
7	20	462075	5008750	280	05/77	6	FR	42	14	25	10	1/00	DO	B GJET CONSTR CO LTD
				280			FR	50						BRWN CLAY STNS HARD 0018 RED LMSN 0051
7	20	462440	5008900	275	07/71	6	FR	49	9	20	15	1/00	DO	MATCHETT H W
				275			FR	57						BRWN CLAY STNS BLDR 0007 GREY
				275			FR	66						CLAY SILT STNS 0027 GREY LMSN 0070
7	20	462500	5008980	275	03/72	2	FR	25	0	10	10	2/00	DO	STEELE P
				275			FR	33						BRWN TPSL 0001 GREY CLAY 0017
				275			FR	39						GREY LMSN 0040
7	20	462735	5009255	290	06/63	5	FR	40	4	35	4	1/00	DO	COOPER K
				290			FR	53						TPSL MSND BLDR 0010 HPAN BLDR

CON	LOT	EASTING	NORTHING	SURFACE ELEV	DRILL DATE	CSG DIA	KIND OF WATER	WATER FOUND	STATIC LEVEL	PUMPED LEVEL	TEST RATE	TEST TIME	WATER USE	OWNER GEOLOGIC LOG
														0024 LMSN 0054
7	21	461770	5008350	290	07/61	4	FR	61	20	20	4	1/00	ST DO	WADDELL P STNS FILL 0040 GREY LMSN 0061
7	21	462570	5008820	280	12/69	5	FR	69	1	5	20	4/00	DO	COLIN HUBERT GREY HPAN BLDR 0030 GREY ROCK 0070
7	21	462766	5008621	272	04/73	5	FR	43	8	15	20	1/00	DO	ROBB R BRWN CLAY 0004 BRWN CLAY SAND BLDR 0012 GREY GRVL BLDR 0026 BLCK LMSN 0045
7	22	462980	5008540	285	11/78	6	FR	40	10	30	4		DO	MULLINS G BRWN HPAN 0007 BLCK SHLE STNS 0018 GREY SAND STNS 0040
7	23	463140	5008140	280	07/78	6	FR	140	17	275	4	2/00	DO	MCEWAN M
				280			FR	270						GREY SAND BLDR STNS 0017 GREY LMSN SOFT 0300
7	24	461590	5006790	275	02/61	4	FR	46	16	34	3	3/00	DO	HOPE D
				275			FR	70						GRVL HPAN 0022 GRVL 0032 GREY LMSN 0080
7	24	463299	5007745	280	09/73	5	FR	42	12	25	15	1/00	DO	RAWLINGU J GREY HPAN 0024 BLCK SHLE SNDS 0030 SAND STNS 0045
7	25	461730	5006400	280	12/64	5	FR	18	15	95	2	2/00	ST	REANEY E
				280			FR	37						CLAY TPSL GRVL 0007 GREY LMSN
				280			SU	95						0090 BLCK ROCK 0108 GREY LMSN
				280			FR	195						0140 SNDS 0168 GREY LMSN 0205
7	25	463460	5007220	260	11/78	6	FR	40	25	60	3	1/00	ST	MORRIS M GREY CLAY STNS 0020 GREY GRVL 0029 GREY LMSN 0064
8	16	462217	5010940	280	05/75	5	FR	86	7	18	15	4/00	DO	HIGGINS K BRWN HPAN 0005 GREY LMSN 0086
8	16	462220	5010940	288	07/77	6	FR	35	10	15	25	1/20	DO	LEVESQUE MARC BRWN TPSL 0005 GREY CLAY 0013 GREY HPAN 0017 GREY SNDS 0038
8	16	462330	5010649	280	05/75	6	FR	19	4	10	10		DO	FERGUSON HUGH BRWN HPAN 0014 BLCK SHLE 0021
8	16	462800	5011260	290	09/73	6	FR	75	20	100	5	1/00	DO	BAKER RAY
				290			FR	100						BRWN SAND STNS 0007 BLCK LMSN 0148
8	16	463780	5011550	300	11/61		FR	70	16	36	7	2/00	ST	BAKER A
				300			FR	86						PRDR 0070 GREY LMSN 0090
8	20	462860	5009075	282	07/60	4	FR	45	8	8	5	1/00	DO	PALMER W BLDR HPAN 0016 GREY LMSN 0045
8	20	463675	5009580	325	05/72	5	FR	55	22	60	4	1/00	DO	CHARRON P
				325			FR	88						BRWN CLAY SAND STNS 0001 GREY LMSN 0055 BLCK LMSN 0090
8	21	462895	5008970	282	03/61	5	FR	32	4	18	8	1/00	DO	JOHNSTON C
				282			FR	48						TPSL MSND BLDR 0006 BLUE CLAY BLDR 0012 GREY LMSN 0055
8	21	462995	5008730	270	02/67	6	FR	80	5	160	20	1/00	PS	SCHOOL AREA

CON	LOT	EASTING	NORTHING	SURFACE ELEV	DRILL DATE	CSG DIA	KIND OF WATER FOUND	STATIC LEVEL	PUMPED LEVEL	TEST RATE	TEST TIME	WATER USE	OWNER GEOLOGIC LOG
				270		FR	130						BLDR GRVL 0006 GREY LMSN 0160
				270		FR	155						
8	21	463005	5009105	298	06/63	5 FR	44	14	22	5	/30	DO	CAIN D HPAN BLDR 0006 BLUE LMSN 0045
8	21	463120	5008910	305	10/70	5 FR	55	14	25	10	2/00	DO	MC KENDRY ROY HPAN 0012 LMSN 60
8	21	463589	5009393	327	08/73	5 FR	84	55	70	10	1/30	DO	GARFIELD J BRWN TPSL SAND 0003 GREY LMSN 0084 BLCK SNDS 0089
8	21	463180	5008990	310	08/71	5 FR	50	20	60	6	1/00	DO	DAVID CAIN CONSTR
				310		FR	94						BRWN CLAY BLDR 0004 GREY LMSN 0028 BLCK LMSN 0035 GREY LMSN 0095
8	22	463180	5008630	298	03/49	4 FR	83	3		2	/30	ST DO	COOMBS A CLAY MSND STNS 0008 RDCK LMSN 0083
8	22	463240	5008460	290	08/60	6 FR	140	12	160	2	2/00	ST DO	VANRENS L CLAY 0003 GREY LMSN 0160
8	22	464590	5009330	268	05/71	6 FR	151	50	130	6	1/00	DO	FORD R
				268		FR	165						BRWN CLAY SAND 0006 GREY LMSN 0110 BLCK DLMT 0190 GREY SNDS 0288
8	23	463170	5008240	280	05/60	4 FR	30	3	15	12	2/00	DO	DAVIS B HPAN 0013 GREY LMSN 0035
8	23	463400	5008100	280	12/60	6 FR	90	35	90	2	2/00	ST DO	FITZSIMMONS J BRWN MSND BLDR 0034 GREY LMSN 0095
8	24	463400	5007630	270	05/60	4 FR	48	4	35	5	1/00	DO	HOLTVLUWER H HPAN 0031 GREY LMSN 0050
8	24	463499	5007799	275	10/80	6 FR	52	15	42	8	1/30	DO	SCHOW G BRWN HPAN 0029 GREY LMSN 0056
8	24	465009	5008734	260	10/74	6 FR	63	15	15	10	1/00	DO	MINARD GRANT GREY HPAN BLDR 0013 BLCK LMSN 0060 RED SHLE 0065
8	25	463649	5007261	258	10/73	6 FR	40	8	20		1/20	ST DO	JAMES A GREY HPAN 0017 GREY SHLE 0024 BRWN LMSN 0042
8	25	463707	5007240	261	06/72	6 FR	58	12	50	7	1/30	DO	HOWARD V J BRWN TPSL SAND 0002 GREY CLAY SAND 0008 GREY CLAY BLDR 0022 GREY STNS 0024 GREY LMSN 0065
7	21	462840	5008970	280	07/75	6 FR	245	30	150	4	1/00	CU	ADMIRAL ENGINEERING GREY HPAN BLDR 0018 GREY LMSN 0225 GREY SNDS 0248
8	20	463847	5009639	325	06/75	6 FR	145	20	200	5	1/00	DO	VALLEY STRUCTURES LTD
				325		FR	270						BRWN SAND FILL 0002 BLCK LMSN 0220 GREY SNDS 0290 BLCK LMSN 0293

APPENDIX C

TEST WELL LOGS AND WATER WELL RECORDS

FIGURE	RECORD OF TEST HOLE	DESIGNATION	COMPLETION DATE
		TW 1	January 19, 1988

PROJECT: Metcalfe Communal Water Supply
PROJECT NO.: 1650
DRILLING METHODS: Air Rotary
SUPERVISOR: Cathy Ryan
DRILLING CONTRACTOR: Olympic Drilling Co. Ltd.

DEPTH METRES	ELEVATION METRES	STRATIGRAPHY & HYDROSTRATIGRAPHY	LOG	INSTRUMENTATION	SAMPLING TYPE	SAMPLING INTERVAL	SAMPLING N VALUE
0				15.2 cm; 0.8 steel casing			
0.61		SAND: Brown, silty					
1		Oxford Formation Limestone: Brown to grey; highly fractured and weathered — water at 1.5					
2							
3							
4							
4.3		Oxford Formation Limestone: - Grey, medium-hard, interbedded with black magnesium-rich limestone and dolomite		Open hole			
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15				14.6			
16				15.2 cm steel casing; 1 cm slot size			
17							
18							
18.3		END OF HOLE		18.3; 20.3 cm			
19							
20							
21							

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WATER WELL RECORD

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11 — 1522204

COUNTY OR DISTRICT	TOWNSHIP BOROUGH CITY TOWN VILLAGE	CON BLOCK TRACT SURVEY ETC	LOT
Ottawa-Carleton	Osgoode	Con 07	20

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Municipality of Metcalfe	Metcalfe, Ont	DAY 19 MO 01 YR 88

21 TW-1 — ZONE | EASTING | NORTHING | OC | ELEVATION | DC | BASIN CODE

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH FEET FROM	DEPTH FEET TO
Brown	Sand	Sand	Sand	0	2'
Brown	Limestone	Fractured Limestone		2'	18'
Grey	Limestone	Med. Hard Limestone		18'	60'

31
32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
33'	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS
35'	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 5 ☐ GAS

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH FEET FROM	DEPTH FEET TO
8"	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☒ PLASTIC		0	60'
6"	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	.188	+2	60'
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			

SCREEN

SIZE OF OPENING SLOT NO. | DIAMETER | LENGTH
MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN

61 PLUGGING & SEALING RECORD

DEPTH SET AT FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)

71 PUMPING TEST

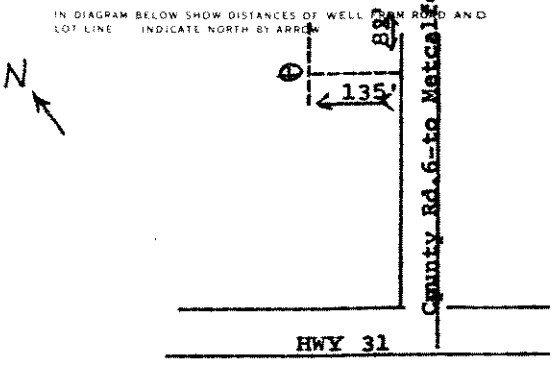
PUMPING TEST METHOD: 1 ☒ PUMP 2 ☐ BAILER
PUMPING RATE: 75 GPM
DURATION OF PUMPING: 6 HOURS
WATER LEVELS DURING: 1 ☐ PUMPING 2 ☐ RECOVERY

STATIC LEVEL	WATER LEVEL END OF PUMPING	15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
5.5m FEET	10.19m	9.5m FEET	9.7m	9.81m FEET	9.82m

IF FLOWING GIVE RATE: GPM
PUMP INTAKE SET AT: 45 FEET
WATER AT END OF TEST: 1 ☐ CLEAR 2 ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP
RECOMMENDED PUMP SETTING: FEET
RECOMMENDED PUMPING RATE: 75 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



22007

DRILLERS REMARKS

FINAL STATUS OF WELL	1 ☒ WATER SUPPLY 2 ☐ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED INSUFFICIENT SUPPLY 6 ☐ ABANDONED POOR QUALITY 7 ☐ UNFINISHED 9 ☐ DEWATERING
WATER USE	1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL 5 ☐ COMMERCIAL 6 ☒ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING ☐ OTHER 9 ☐ NOT USED
METHOD OF CONSTRUCTION	1 ☐ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☒ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING ☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR: OLYMPIC DRILLING CO. LTD.,
WELL CONTRACTOR'S LICENCE NUMBER: 4006
ADDRESS: Box 9180 Terminal '1',Ottawa, Ont
NAME OF WELL TECHNICIAN: Wayne Renwick
WELL TECHNICIAN'S LICENCE NUMBER: TO-327
SIGNATURE OF TECHNICIAN/CONTRACTOR:
SUBMISSION DATE: DAY 09 MO 02 YR 88

OFFICE USE ONLY

DATE SOURCE | CONTRACTOR | DATE RECEIVED: FEB 15 1988
DATE OF INSPECTION | INSPECTOR
REMARKS

MINISTRY OF THE ENVIRONMENT COPY

FORM NO. 0506 (11/86) FORM

FIGURE	RECORD OF TEST HOLE	DESIGNATION	COMPLETION DATE
		TW 2	January 19, 1988

PROJECT: Metcalfe Communal Water Supply
PROJECT NO.: 1650
DRILLING METHODS: Air Rotary
SUPERVISOR: Cathy Ryan
DRILLING CONTRACTOR: Olympic Drilling Co. Ltd.

DEPTH METRES	ELEVATION METRES	STRATIGRAPHY & HYDROSTRATIGRAPHY	LOG	INSTRUMENTATION	SAMPLING TYPE	SAMPLING INTERVAL	SAMPLING N VALUE
0				0.9 — 16.2 cm steel casing			
0.61		SAND: Brown, silty					
1		Oxford Formation Limestone: Grey, weathered, highly fractured — water at 1.5					
2							
3							
3.4		Oxford Formation Limestone: Grey, medium-hard, interbedded with black magnesium-rich limestone and dolomite					
4							
5							
6							
7							
8				Open hole			
9							
10		water at 9.8					
11		water at 10.6					
12							
13							
13.4							
14							
15							
16							
17							
18							
18.3		END OF HOLE		18.3 — 20.3 cm			
19							
20							
21							

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The Ontario Water Resources Act

WATER WELL RECORD

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11 1522203

COUNTY OR DISTRICT	TOWNSHIP BOROUGH CITY TOWN VILLAGE	CON BLOCK TRACT SURVEY ETC	LOT
Ottawa-Carleton	Osgoode	Con 07	20

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Municipality of Metcalfe	Metcalfe, Ont	DAY 22 MO 01 YR 88

2 TW-2

ZONE | EASTING | NORTHING | ELEVATION | BASIN CODE

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH FEET FROM	DEPTH FEET TO
Brown	Sand	Sand	Sand	0	2'
Brown	Limestone	Fractured limestone		2'	16'
Grey	Limestone	Med. Hard Limestone		16'	60'

31

32

41 WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
32'	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
35'	1 ☒ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS
	1 ☐ FRESH 2 ☐ SALTY 3 ☐ SULPHUR 4 ☐ MINERALS 6 ☐ GAS

51 CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCH	DEPTH FEET FROM	DEPTH FEET TO
8"	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☒ OPEN HOLE 5 ☐ PLASTIC		0'	60'
6"	1 ☒ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC	.188	+2	60'
	1 ☐ STEEL 2 ☐ GALVANIZED 3 ☐ CONCRETE 4 ☐ OPEN HOLE 5 ☐ PLASTIC			

SCREEN

SIZE OF OPENING SLOT NO.	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN FEET

61 PLUGGING & SEALING RECORD

DEPTH SET AT FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)

71 PUMPING TEST

PUMPING TEST METHOD: 1 ☐ PUMP 2 ☐ BAILER

PUMPING RATE: 6 GPM

DURATION OF PUMPING: HOURS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING: 15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
6.53m FT	7.46m	7.05m	7.2m	FEET	7.29m

1 ☐ PUMPING 2 ☐ RECOVERY

IF FLOWING GIVE RATE: GPM

PUMP INTAKE SET AT: FEET

WATER AT END OF TEST: 1 ☐ CLEAR 2 ☐ CLOUDY

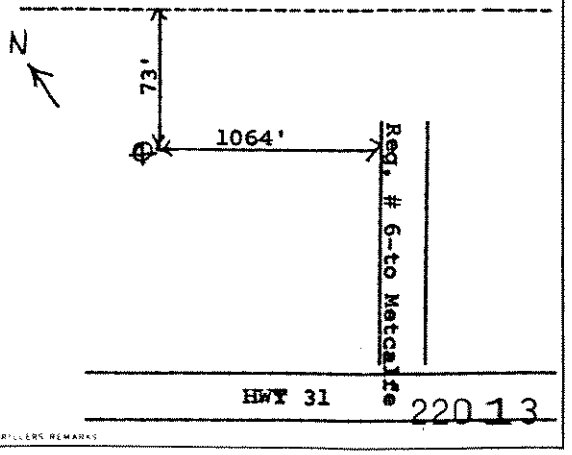
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☐ DEEP

RECOMMENDED PUMP SETTING: FEET

RECOMMENDED PUMPING RATE: GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.



DRILLERS REMARKS

FINAL STATUS OF WELL

1 ☐ WATER SUPPLY 2 ☒ OBSERVATION WELL 3 ☐ TEST HOLE 4 ☐ RECHARGE WELL 5 ☐ ABANDONED INSUFFICIENT SUPPLY 6 ☐ ABANDONED POOR QUALITY 7 ☐ UNFINISHED 9 ☐ DEWATERING

WATER USE

1 ☐ DOMESTIC 2 ☐ STOCK 3 ☐ IRRIGATION 4 ☐ INDUSTRIAL ☐ OTHER 5 ☐ COMMERCIAL 6 ☒ MUNICIPAL 7 ☐ PUBLIC SUPPLY 8 ☐ COOLING OR AIR CONDITIONING 9 ☐ NOT USED

METHOD OF CONSTRUCTION

1 ☐ CABLE TOOL 2 ☐ ROTARY (CONVENTIONAL) 3 ☐ ROTARY (REVERSE) 4 ☒ ROTARY (AIR) 5 ☐ AIR PERCUSSION 6 ☐ BORING 7 ☐ DIAMOND 8 ☐ JETTING 9 ☐ DRIVING ☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR: OLYMPIC DRILLING CO. LTD.,
WELL CONTRACTOR'S LICENCE NUMBER: 4006
ADDRESS: Box 9180 Terminal '1',Ottawa, Ont
NAME OF WELL TECHNICIAN: Wayne Renwick
WELL TECHNICIAN'S LICENCE NUMBER: TO-327
SIGNATURE OF TECHNICIAN/CONTRACTOR: W. W. Renwick
SUBMISSION DATE: DAY 09 MO 02 YR 88

OFFICE USE ONLY

DATA SOURCE | CONTRACTOR | DATE RECEIVED: FEB 15 1988
DATE OF INSPECTION | INSPECTOR
REMARKS

MINISTRY OF THE ENVIRONMENT COPY

FORM NO 0506 (11/83) FORM 9

FIGURE	RECORD OF TEST HOLE	DESIGNATION	COMPLETION DATE
		TW 3	September 12, 1990

PROJECT: Metcalfe Communal Water Supply
PROJECT NO.: 1650
DRILLING METHODS: Air Rotary
SUPERVISOR: Donald Corbett
DRILLING CONTRACTOR: Valley Drilling Inc.

DEPTH METRES	ELEVATION METRES	STRATIGRAPHY & HYDROSTRATIGRAPHY	LOG	INSTRUMENTATION	SAMPLING TYPE	SAMPLING INTERVAL	SAMPLING N VALUE
0				0.5 — 15.2 cm steel casing to 6.7			
0.3		TOPSOIL: Dark brown, silty CLAY: Brown, weathered near surface, grey, unweathered at depth					
2.0			water at 2.4				
2.4							
3.7		Oxford Formation Limestone: - brown to grey, highly fractured					
4.0			water at 4.6	high-early cement grout			
6.0		Oxford Formation Limestone: - Grey, medium-hard; interbedded with black, magnesium-rich limestone and dolomite		6.7 — 20.3 cm			
8.0			water at 10.7				
40							
42							
42.4		March Formation Sandstone: - Interbedded calcareous sandstone					
44							
46				Open hole			
48							
50			water at 50.0				
52			water at 52.7				
53.3				53.3 — 15.2 cm			
54		END OF HOLE					

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Ministry of the Environment
Ontario

Well #1

The Ontario Water Resources Act

WATER WELL RECORD

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2 CHECK ☒ CORRECT BOX WHERE APPLICABLE

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON	LOT
Ottawa Carleton	Osgood Metcalfe	7	18

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Kaufer Eng Ltd.	1481 Cyrville Rd Gloucester	DAY 12 MO 7 YR 84

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	TO
Brown	Topsoil		Packed	0	1
Grey	Clay		Boulders	1	2
Black	Limestone		Fractured	2	12
Grey	Limestone		Med.	12	24
Grey	Limestone	Black Limestone	Med.	24	140
Grey	Sandstone	Grey Limestone	Hard.	140'	150'
Grey & Black	Limestone	Grey Sandstone layers	Hard.	150'	175'

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER	
	☑ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS
15	☑ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS
164	☑ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS
173	☑ FRESH ☐ SALTY	☑ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS

CASING & OPEN HOLE RECORD

INSIDE DIAM. INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	TO
6¼	☑ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC	14"	0	22
6"	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC		12	175
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☑ OPEN HOLE ☐ PLASTIC			

SCREEN

SIZE(S) OF OPENING (SLOT NO.)	DIAMETER	LENGTH

MATERIAL AND TYPE — DEPTH TO TOP OF SCREEN — FEET

PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD, PACKER, ETC.)
0	20	Cement Grout

PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
☑ PUMP ☐ BAILER	100+ GPM	6 HOURS

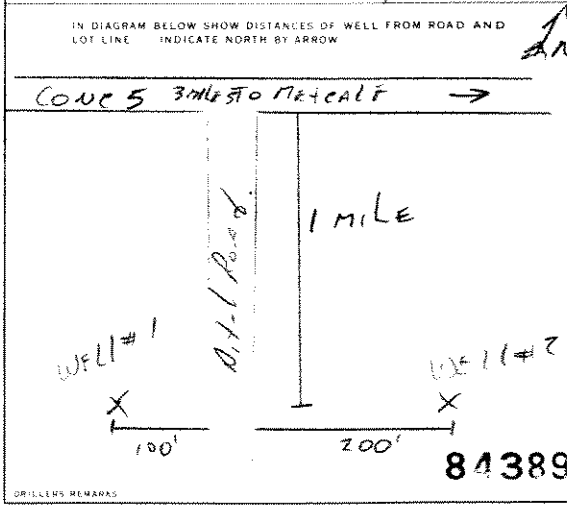
STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING ☑ PUMPING ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
+2 FEET	0 FEET	20 FEET	20 FEET	20 FEET	20 FEET

IF FLOWING GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
20 GPM	20 FEET	☑ CLEAR ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☑ SHALLOW ☐ DEEP	20 FEET	20 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW



DRILLERS REMARKS

84389

FINAL STATUS OF WELL		
	☑ WATER SUPPLY	☐ ABANDONED, INSUFFICIENT SUPPLY
	☐ OBSERVATION WELL	☐ ABANDONED, POOR QUALITY
	☑ TEST HOLE	☐ UNFINISHED
	☐ RECHARGE WELL	☐ DEWATERING
WATER USE	☐ DOMESTIC	☐ COMMERCIAL
	☐ STOCK	☑ MUNICIPAL
	☐ IRRIGATION	☐ PUBLIC SUPPLY
	☐ INDUSTRIAL	☐ COOLING OR AIR CONDITIONING
	☐ OTHER	☐ NOT USED
METHOD OF CONSTRUCTION	☐ CABLE TOOL	☐ BORING
	☐ ROTARY (CONVENTIONAL)	☐ DIAMOND
	☐ ROTARY (REVERSE)	☐ JETTING
	☐ ROTARY (AIR)	☐ DRIVING
	☑ AIR PERCUSSION	☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR	WELL CONTRACTOR'S LICENCE NUMBER
[illegible]	[illegible]
ADDRESS	
[illegible]	
NAME OF WELL TECHNICIAN	WELL TECHNICIAN'S LICENCE NUMBER
[illegible]	[illegible]
SIGNATURE OF TECHNICIAN/CONTRACTOR	SUBMISSION DATE DAY ___ MO ___ YR ___
[illegible]	

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FORM NO. 0506 (11/86) FORM

FIGURE	RECORD OF TEST HOLE	DESIGNATION	COMPLETION DATE
		TW 4	September 19, 1990

PROJECT: Metcalfe Communal Water Supply
PROJECT NO.: 1650
DRILLING METHODS: Air Rotary
SUPERVISOR: Donald Corbett
DRILLING CONTRACTOR: Valley Drilling Inc.

DEPTH METRES	ELEVATION METRES	STRATIGRAPHY & HYDROSTRATIGRAPHY	LOG	INSTRUMENTATION	SAMPLING TYPE	SAMPLING INTERVAL	SAMPLING N VALUE
0				0.4 — 15.2 cm steel casing to 6.7			
1.5		CLAY: Brown, weathered					
2.0		TILL: Silty, bouldery, compact					
2.4		CLAY: Grey, unweathered, occasional cobbles					
3.4		Oxford Formation Limestone: - Grey, highly fractured — water at 4.6		high-early cement grout			
4.0							
6.0							
6.4		Oxford Formation Limestone: - Grey, medium-hard; interbedded with black, magnesium-rich limestone and dolomite — water at 6.9		6.7 — 20.3 cm			
8.0							
10.0							
34.0				Open hole			
36.0							
38.0							
40.0							
42.0							
42.7		water at 42.7 — March Formation Sandstone: Interbedded calcareous sandstone & sandy, grey dolomite					
44.0							
44.2		END OF HOLE		44.2 — 15.2 cm			

Ministry of the Environment
Ontario

WH11 #2

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

COUNTY OR DISTRICT	TOWNSHIP, BOROUGH, CITY, TOWN, VILLAGE	CON	BLOCK, TRACT, SURVEY, ETC.	LOT
Ottawa Carleton	Osgood Metcalfe	7		18

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Eastwich Eng Ltd	1481 Cyrville Rd Gloucester	DAY 14 MO 9 YR 72

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	TO
BROWN	Topsoil		Packed	0	1
BROWN	Sandy		Packed	1'	5'
GREY	Clay	Boulders, Gravel, Silt	Loose	5'	11'
GREY	Limestone	Shale Limestone	MED	11	140'
GREY	Limestone	Grey Sandstone	HARD	140	148

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER		
141	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	
	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	
	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	
	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	
	☐ FRESH ☐ SALTY	☐ SULPHUR ☐ MINERALS ☐ GAS	

CASING & OPEN HOLE RECORD

INSIDE DIAM. (INCHES)	MATERIAL	WALL THICKNESS (INCH)	DEPTH - FEET FROM	TO
6¼"	☒ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC	.188	0	122
6"	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☒ OPEN HOLE ☐ PLASTIC		22	148
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC			

SCREEN

SLOT NO.	DIAMETER (INCHES)	LENGTH

MATERIAL AND TYPE:

DEPTH TO TOP OF SCREEN (FEET):

PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT, LEAD, PACKER, ETC.)
0	20	TYPE #10 PORTLAND GROUT

PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
☒ PUMP ☐ BAILER	100 GPM	HOURS MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING ☐ PUMPING ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
+3 FEET	0 FEET	10 FEET	10 FEET	10 FEET	10 FEET

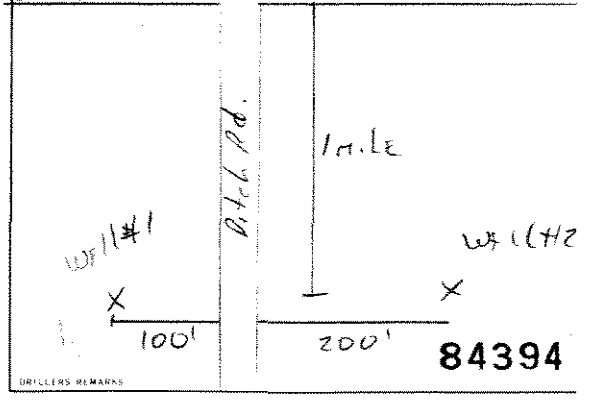
IF FLOWING GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
20 GPM	20 FEET	☒ CLEAR ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☒ SHALLOW ☐ DEEP	20 FEET	20 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE. INDICATE NORTH BY ARROW.

Zone 5. 3 miles to Metcalfe



DRILLERS REMARKS

84394

FINAL STATUS OF WELL		
	☒ WATER SUPPLY	☐ ABANDONED, INSUFFICIENT SUPPLY
	☒ OBSERVATION WELL	☐ ABANDONED, POOR QUALITY
	☐ TEST HOLE	☐ UNFINISHED
	☐ RECHARGE WELL	☐ DEWATERING
WATER USE	☐ DOMESTIC	☐ COMMERCIAL
	☐ STOCK	☒ MUNICIPAL
	☐ IRRIGATION	☐ PUBLIC SUPPLY
	☐ INDUSTRIAL	☐ COOLING OR AIR CONDITIONING
	☐ OTHER	☐ NOT USED
METHOD OF CONSTRUCTION	☐ CABLE TOOL	☐ BORING
	☐ ROTARY (CONVENTIONAL)	☐ DIAMOND
	☐ ROTARY (REVERSE)	☐ JETTING
	☐ ROTARY (AIR)	☐ DRIVING
	☒ AIR PERCUSSION	☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR	WELL CONTRACTOR'S LICENCE NUMBER
Valley Drilling Inc.	4222
ADDRESS: P.O. Box 407 Carp, Ont.	
NAME OF WELL TECHNICIAN	WELL TECHNICIAN'S LICENCE NUMBER
[illegible]	
SIGNATURE OF TECHNICIAN/CONTRACTOR	SUBMISSION DATE: DAY MO YR
[signature]	

OFFICE USE ONLY

OWNER'S COPY

FORM NO. 0506 (11/86) FORM

FIGURE	RECORD OF TEST HOLE	DESIGNATION	COMPLETION DATE
		PW	November 26, 1990

PROJECT: Metcalfe Communal Water Supply
PROJECT NO.: 1650
DRILLING METHODS: Air Rotary
SUPERVISOR: Donald Corbett
DRILLING CONTRACTOR: Olympic Drilling Co. Ltd.

DEPTH METRES	ELEVATION METRES	STRATIGRAPHY & HYDROSTRATIGRAPHY	LOG	INSTRUMENTATION	SAMPLING TYPE	SAMPLING INTERVAL	SAMPLING N VALUE
0				0.57 m; 25.4 cm steel casing to 7.6 m			
0.3		CLAY: Brown, weathered near surface, grey, unweathered at depth					
		water at 2.4 m					
2.0							
2.4		Oxford Formation Limestone: Brown to grey, highly fractured, weathered					
4.0				high-early cement grout; 38.1 cm			
6.0		Oxford Formation Limestone: - Grey, medium-hard; interbedded with black, magnesium-rich limestone and dolomite		7.6 m			
8.0							
40							
42.7		water at 42.7 m					
45		March Formation Sandstone: - interbedded calcareous sandstone and sandy, grey dolomite					
50		water at 50.3 m					
55		water at 53.3 m		Open hole			
60							
65							
69.2		Nepean Formation Sandstone: Coarse-grained, cream to grey silica sandstone; thickly bedded					
70							
75							
79.0		water at 79.0 m					
80		major water at 80.8 m					
85							
88.4		Nepean Formation Sandstone: Same, grey, weathered, thinly bedded; water bearing					
90							
91.4		END OF HOLE		91.4 m; 25.5 cm			
95							

WATER AND EARTH SCIENCE ASSOCIATES LTD.

Ministry of the Environment
Ontario

The Ontario Water Resources Act

WATER WELL RECORD

1 PRINT ONLY IN SPACES PROVIDED
2 CHECK ☒ CORRECT BOX WHERE APPLICABLE

COUNTY OR DISTRICT	TOWNSHIP BOROUGH CITY TOWN VILLAGE	CON BLOCK TRACT SURVEY ETC	LOT
Ottawa-Carleton	OSGOODE	Con. 7	18

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
Town of Metcalfe	c/o Water & Earth Science Assoc.Ltd.	DAY 26 MO 11 YR 90

Box 430 CARP, ONTARIO KOA 1LO

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH FEET FROM	DEPTH FEET TO
Brown	Topsoil		Packed	0'	1'
Grey	Blue Clay		Packed	1'	13'
Grey	Limestone	Black Limestone	Layered	13'	140'
Brown	Sandstone	Grey Sandstone	Layered	140'	200'

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER		
140'	☐ FRESH ☐ SALTY		☒ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY		☐ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY		☐ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY		☐ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY		☐ SULPHUR ☐ MINERALS ☐ GAS

CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH FEET FROM	DEPTH FEET TO
15"	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☒ OPEN HOLE ☐ PLASTIC		0'	25'
10"	☒ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC	.375	± 2'	25'
10"	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☒ PLASTIC		25'	200'

SCREEN

SIZE OF OPENING SLOT NO.	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN FEET

PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)
0'	25'	Cement Grout 24 sacks of High Early Cement

PUMPING TEST

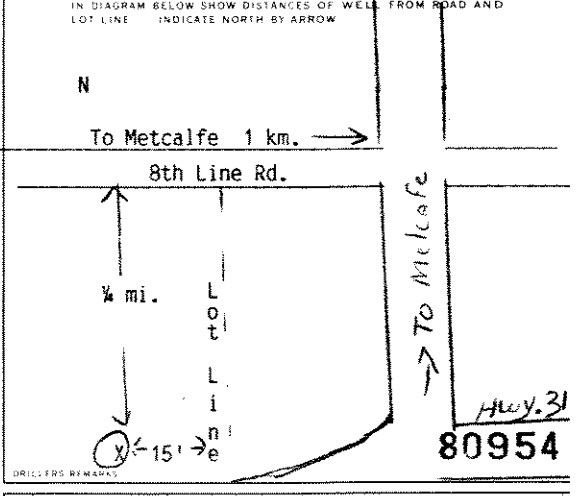
PUMPING TEST METHOD: ☒ PUMP ☐ BAILER
PUMPING RATE: 150 GPM
DURATION OF PUMPING: 72 HOURS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING PUMPING ☐ RECOVERY: 15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
+ 8' FEET	52' FEET	33.2' FEET	36.8' FEET	38 39.1' FEET	42' FEET

IF FLOWING GIVE RATE: GPM
PUMP INTAKE SET AT: 140' FEET
WATER AT END OF TEST: ☒ CLEAR ☐ CLOUDY
RECOMMENDED PUMP TYPE: ☐ SHALLOW ☒ DEEP
RECOMMENDED PUMP SETTING: 146' FEET
RECOMMENDED PUMPING RATE: 150 GPM

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE INDICATE NORTH BY ARROW



DRILLERS REMARKS

FINAL STATUS OF WELL

☑ WATER SUPPLY ☐ ABANDONED INSUFFICIENT SUPPLY
☐ OBSERVATION WELL ☐ ABANDONED POOR QUALITY
☐ TEST HOLE ☐ UNFINISHED
☐ RECHARGE WELL ☐ DEWATERING

WATER USE

☐ DOMESTIC ☐ COMMERCIAL
☐ STOCK ☒ MUNICIPAL
☐ IRRIGATION ☐ PUBLIC SUPPLY
☐ INDUSTRIAL ☐ COOLING OR AIR CONDITIONING
☐ OTHER ☐ NOT USED

METHOD OF CONSTRUCTION

☐ CABLE TOOL ☐ BORING
☐ ROTARY (CONVENTIONAL) ☐ DIAMOND
☐ ROTARY (REVERSE) ☐ JETTING
☒ ROTARY (AIR) ☐ DRIVING
☐ AIR PERCUSSION ☐ DIGGING ☐ OTHER

CONTRACTOR

NAME OF WELL CONTRACTOR: OLYMPIC DRILLING CO. LIMITED
WELL CONTRACTOR'S LICENCE NUMBER: 4006
ADDRESS: Box 9180 OTTAWA, Ontario K1G 3T9
NAME OF WELL TECHNICIAN: Jodie Renwick
WELL TECHNICIAN'S LICENCE NUMBER: TO-327
SIGNATURE OF TECHNICIAN/CONTRACTOR: [signature] (Sec.)
SUBMISSION DATE: DAY 28 MO 11 90

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FORM NO. 0506 (11/86) FORM

Ontario of the Environment

The Ontario Water Resources Act

WATER WELL RECORD

1. PRINT ONLY IN SPACES PROVIDED
2. CHECK ☒ CORRECT BOX WHERE APPLICABLE

COUNTY OR DISTRICT	TOWNSHIP BOROUGH CITY TOWN VILLAGE	CON BLOCK TRACT SURVEY ETC	LOT
Ottawa-Carleton	Osgoode	Con. 7	18

OWNER (SURNAME FIRST)	ADDRESS	DATE COMPLETED
TOWN OF METCALFE	C/o Water & Earth Science Assoc.Ltd.	DAY 10 MO 01 YR 91

DEEPING WELL FROM 200' to 300'

LOG OF OVERBURDEN AND BEDROCK MATERIALS (SEE INSTRUCTIONS)

GENERAL COLOUR	MOST COMMON MATERIAL	OTHER MATERIALS	GENERAL DESCRIPTION	DEPTH - FEET FROM	DEPTH - FEET TO
Grey	Sandstone	Limestone layers		200'	243'
Grey	Sandstone	Hard ~~stonestone~~ layers sandstonee		243.	265'
Grey	Sandstone	Limestones Layers		265'	290'
Grey	Sandstone	Med. sanstone layers		290'	300'

WATER RECORD

WATER FOUND AT - FEET	KIND OF WATER
263'	☒ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS
268'	☒ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS
273'	☒ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS
	☐ FRESH ☐ SALTY ☐ SULPHUR ☐ MINERALS ☐ GAS

CASING & OPEN HOLE RECORD

INSIDE DIAM INCHES	MATERIAL	WALL THICKNESS INCHES	DEPTH - FEET FROM	DEPTH - FEET TO
6"	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☒ PLASTIC		200'	300'
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC			
	☐ STEEL ☐ GALVANIZED ☐ CONCRETE ☐ OPEN HOLE ☐ PLASTIC			

SCREEN

SIZE OF OPENING (SLOT NO.)	DIAMETER INCHES	LENGTH FEET

MATERIAL AND TYPE | DEPTH TO TOP OF SCREEN FEET

PLUGGING & SEALING RECORD

DEPTH SET AT - FEET FROM	TO	MATERIAL AND TYPE (CEMENT GROUT LEAD PACKER ETC.)

PUMPING TEST

PUMPING TEST METHOD	PUMPING RATE	DURATION OF PUMPING
☐ PUMP ☐ BAILER	1000 GPM	72 HOURS MINS

STATIC LEVEL	WATER LEVEL END OF PUMPING	WATER LEVELS DURING ☐ PUMPING ☐ RECOVERY			
		15 MINUTES	30 MINUTES	45 MINUTES	60 MINUTES
+ 2m FEET	9.63m FEET	4m FEET	4.15m FEET	9.50m FEET	9.63m FEET

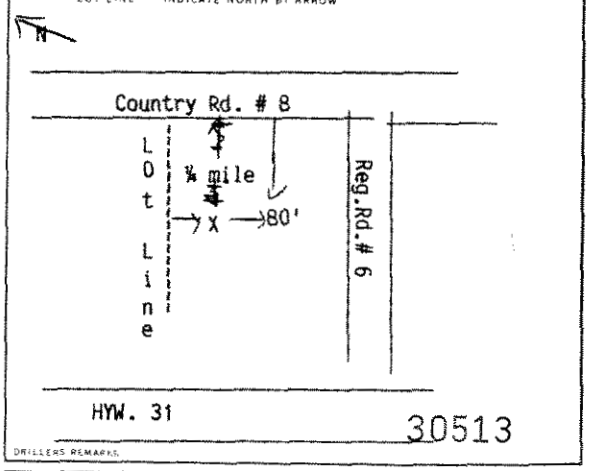
IF FLOWING GIVE RATE	PUMP INTAKE SET AT	WATER AT END OF TEST
GPM	150' FEET	☐ CLEAR ☐ CLOUDY

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
☐ SHALLOW ☐ DEEP	150' FEET	1000 GPM

FINAL STATUS OF WELL	☒ WATER SUPPLY ☐ OBSERVATION WELL ☐ TEST HOLE ☐ RECHARGE WELL	☐ ABANDONED, INSUFFICIENT SUPPLY ☐ ABANDONED, POOR QUALITY ☐ UNFINISHED ☐ DEWATERING
WATER USE	☐ DOMESTIC ☐ STOCK ☐ IRRIGATION ☐ INDUSTRIAL ☐ OTHER	☒ COMMERCIAL ☒ MUNICIPAL ☐ PUBLIC SUPPLY ☐ COOLING OR AIR CONDITIONING ☐ NOT USED
METHOD OF CONSTRUCTION	☐ CABLE TOOL ☐ ROTARY (CONVENTIONAL) ☐ ROTARY (REVERSE) ☐ ROTARY (AIR) ☒ AIR PERCUSSION	☐ BORING ☐ DIAMOND ☐ JETTING ☐ DRIVING ☐ DIGGING ☐ OTHER

LOCATION OF WELL

IN DIAGRAM BELOW SHOW DISTANCES OF WELL FROM ROAD AND LOT LINE INDICATE NORTH BY ARROW



30513

DRILLERS REMARKS

CONTRACTOR

NAME OF WELL CONTRACTOR	WELL CONTRACTOR'S LICENCE NUMBER
OLYMPIC DRILLING CO. LIMITED	4006

ADDRESS: Box 9180 Ottawa, ontario K1G 3T9

NAME OF WELL TECHNICIAN	WELL TECHNICIAN'S LICENCE NUMBER
Wayne Renwick ~~T9x887~~	~~X~~-87-068

SIGNATURE OF TECHNICIAN / CONTRACTOR (Sec.) SUBMISSION DATE DAY 8 MO 02 YR 91

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FORM NO. 0506 (11/86) FORM 7

APPENDIX D

PERMITS TO TAKE WATER

Ontario

Ministry of the Environment | Ministère de l'Environnement

Southeastern Region | Région du Sud-Est

Mailing Address
PO Box 820
Kingston Ontario
K7L 4X6

Adresse postale
C.P. 820
Kingston (Ontario)
K7L 4X6

133 Dalton Avenue
Kingston Ontario
K7K 6C2
613 549-4000

133, avenue Dalton
Kingston (Ontario)
K7K 6C2
613 549-4000

2 November 1990

Donald B. Corbett, B.Sc.
Hydrogeologist
Water & Earth Science Associates Limited
Box 430
CARP, Ontario
K0A 1L0

Dear Sir:

Re: Approval to Take Water Under Section 20
of the Ontario Water Resources Act
as Requested in Your Letter of October 29, 1990

Metcalfe Communal Water Supply Project
Preliminary Aquifer Test
Lot 18, Concession 17, Township of Osgoode

Test date: November 1990
Rate : 545 L/min
Duration : Up to 24 Hours

This letter constitutes approval to take water under Section 20 of the Ontario Water Resources Act. This approval is subject to the following conditions:

1) The pumping rate and period of pumping must not exceed the total water withdrawal requested without the approval of this Ministry.

2) All supply wells within 300 metres of the test well(s) shall be located and monitored for water quality and water levels prior to test pumping. Water level drawdown during pumping and recovery after pumping shall also be monitored.

The well owners must be contacted and permission obtained to access their well at least 10 days prior to the test pumping. If the owner agrees, water level and quality sampling shall be carried out. The accessibility of the well is the responsibility of the owner. If the owner does not agree to the testing, the owner's refusal should be recorded.

3) All well supply water and surface discharge problems associated with the testing must be reported to this Ministry.

4) All water supplies adversely affected during the testing must be replaced with temporary water supplies until the testing has been completed and/or the affected water supplies are restored.

5) A report of the pumping test must be submitted to this Ministry.

6) When the water taken is discharged to a watercourse, the quality and temperature of the groundwater shall be substantially the same as the receiving stream to ensure that the stream's water quality, flora and fauna are not adversely affected by the discharge. If the rate of discharge is substantial, energy absorbing padding shall be used to prevent erosion. The rate of discharge shall be controlled to prevent downstream flooding and property damage.

7) The Ministry of the Environment must be advised of any intent to abandon the test well(s).

8) If the test well(s) is abandoned or not used for any extended period of time, it shall be properly sealed to prevent any groundwater contamination.

The testing shall be carried out under these general conditions. The reason for the imposition of these conditions is to ensure that the water quality and quantity of all surface water, groundwater and water supplies in the area of the testing are protected.

You may, by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this approval, require a hearing by the Board. Section 63 of the Ontario Water Resources Act, as amended in 1983, provides that the Notice requiring the hearing shall state the portions of each Term or Condition in the approval in respect of which the hearing is required and the grounds on which you intend to rely at the hearing.

This approval is for the temporary taking only (24 hours). If the well(s) is put into service for an extended period of time, a Permit to Take Water will be required if the taking is in excess of 50,000 litres per day. This approval does not release you from any legal liability or obligation imposed by law and should not be construed as limiting any legal claims or rights of action that any person, including the Crown in Right of Ontario or any agency thereof, has or may have against you, your officers, employees, agents and your contractors.

Yours truly,

G.I. Macey, Evaluator
Approvals and Planning
Technical Assessment Section
Southeastern Region
PLS/km

Ontario
Ministry of the Environment
Ministère de l'Environnement
Southeastern Region
Région du Sud-Est

Mailing Address
PO Box 820
Kingston Ontario
K7L 4X6

Adresse postale
C.P. 820
Kingston (Ontario)
K7L 4X6

133 Dalton Avenue
Kingston Ontario
K7K 6C2
613 · 549-4000

133, avenue Dalton
Kingston (Ontario)
K7K 6C2
613 / 549-4000

21 November 1990

Donald B. Corbett, B.Sc, Hydrogeologist
Water and Earth Science Associates Limited
Box 430
CARP, Ontario
K0A 1L0

Dear Sir:

Re: Approval to Take Water Under Section 20 of the Ontario Water Resources Act as Requested in Your Letter of November 16, 1990

Metcalfe Communal Water Supply Project, Lot 18, Concession VII, Township of Osgoode

Test date:		November 1990
Type	:	Aquifer Test
Rate	:	2.73×10^3 litres per minute (3.93×10^6 litres per day)
Duration	:	72 Hours

This letter constitutes approval to take water under Section 20 of the Ontario Water Resources Act. This approval is subject to the following conditions:

1) The pumping rate and period of pumping must not exceed the total water withdrawal requested without the approval of this Ministry.

2) All supply wells within 300 metres of the test well(s) shall be located and monitored for water quality and water levels prior to test pumping. Water level drawdown during pumping and recovery after pumping shall also be monitored.

   The well owners must be contacted and permission obtained to access their well at least 10 days prior to the test pumping. If the owner agrees, water level and quality sampling shall be carried out. The accessibility of the well is the responsibility of the owner. If the owner does not agree to the testing, the owner's refusal should be recorded.

3) All well supply water and surface discharge problems associated with the testing must be reported to this Ministry.

4) All water supplies adversely affected during the testing must be replaced with temporary water supplies until the testing has been completed and/or the affected water supplies are restored.

5) A report of the pumping test must be submitted to this Ministry.

6) When the water taken is discharged to a watercourse, the quality and temperature of the groundwater shall be substantially the same as the receiving stream to ensure that the stream's water quality, flora and fauna are not adversely affected by the discharge. If the rate of discharge is substantial, energy absorbing padding shall be used to prevent erosion. The rate of discharge shall be controlled to prevent downstream flooding and property damage.

7) The Ministry of the Environment must be advised of any intent to abandon the test well(s).

8) If the test well(s) is abandoned or not used for any extended period of time, it shall be properly sealed to prevent any groundwater contamination.

The testing shall be carried out under these general conditions. The reason for the imposition of these conditions is to ensure that the water quality and quantity of all surface water, groundwater and water supplies in the area of the testing are protected.

You may, by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this approval, require a hearing by the Board. Section 63 of the Ontario Water Resources Act, as amended in 1983, provides that the Notice requiring the hearing shall state the portions of each Term or Condition in the approval in respect of which the hearing is required and the grounds on which you intend to rely at the hearing.

This approval is for the temporary taking only (72 hours). If the well(s) is put into service for an extended period of time, a Permit to Take Water will be required if the taking is in excess of 50,000 litres per day. This approval does not release you from any legal liability or obligation imposed by law and should not be construed as limiting any legal claims or rights of action that any person, including the Crown in Right of Ontario or any agency thereof, has or may have against you, your officers, employees, agents and your contractors.

Yours truly,

G.I. Macey, Evaluator
Approvals and Planning
Technical Assessment Section
Southeastern Region
PLS/sh

Ontario

Ministry of the Environment | Ministère de l'Environnement

Southeastern Region | Région du Sud-Est

Mailing Address
PO Box 820
Kingston Ontario
K7L 4X6

Adresse postale
C.P. 820
Kingston (Ontario)
K7L 4X6

133 Dalton Avenue
Kingston Ontario
K7K 6C2
613 . 549-4000

133, avenue Dalton
Kingston (Ontario)
K7K 6C2
613 / 549-4000

9 January 1991

Donald B. Corbett, B.Sc.
Hydrogeologist
Water and Earth Science Associates Limited
Box 430
CARP, Ontario
K0A 1L0

Dear Sir:

Re: Approval to Take Water Under Section 20 of the Ontario Water Resources Act as Requested in Your Letter of January 8, 1991 - Metcalfe Communal Water Supply Project

Test date:		January 1991
Type	:	72 Hour Aquifer Test
Rate	:	4.55×10^3 litres per minute (6.55×10^6 litres per day)
Duration	:	72 Hours

This letter constitutes approval to take water under Section 20 of the Ontario Water Resources Act. This approval is subject to the following conditions:

1) The pumping rate and period of pumping must not exceed the total water withdrawal requested without the approval of this Ministry.

2) All supply wells within 300 metres of the test well(s) shall be located and monitored for water quality and water levels prior to test pumping. Water level drawdown during pumping and recovery after pumping shall also be monitored.

   The well owners must be contacted and permission obtained to access their well at least 10 days prior to the test pumping. If the owner agrees, water level and quality sampling shall be carried out. The accessibility of the well is the responsibility of the owner. If the owner does not agree to the testing, the owner's refusal should be recorded.

3) All well supply water and surface discharge problems associated with the testing must be reported to this Ministry.

4) All water supplies adversely affected during the testing must be replaced with temporary water supplies until the testing has been completed and/or the affected water supplies are restored.

5) A report of the pumping test must be submitted to this Ministry.

6) When the water taken is discharged to a watercourse, the quality and temperature of the groundwater shall be substantially the same as the receiving stream to ensure that the stream's water quality, flora and fauna are not adversely affected by the discharge. If the rate of discharge is substantial, energy absorbing padding shall be used to prevent erosion. The rate of discharge shall be controlled to prevent downstream flooding and property damage.

7) The Ministry of the Environment must be advised of any intent to abandon the test well(s).

8) If the test well(s) is abandoned or not used for any extended period of time, it shall be properly sealed to prevent any groundwater contamination.

The testing shall be carried out under these general conditions. The reason for the imposition of these conditions is to ensure that the water quality and quantity of all surface water, groundwater and water supplies in the area of the testing are protected.

You may, by written notice served upon me and the Environmental Appeal Board within 15 days after receipt of this approval, require a hearing by the Board. Section 63 of the Ontario Water Resources Act, as amended in 1983, provides that the Notice requiring the hearing shall state the portions of each Term or Condition in the approval in respect of which the hearing is required and the grounds on which you intend to rely at the hearing.

This approval is for the temporary taking only (72 hours). If the well(s) is put into service for an extended period of time, a Permit to Take Water will be required if the taking is in excess of 50,000 litres per day. This approval does not release you from any legal liability or obligation imposed by law and should not be construed as limiting any legal claims or rights of action that any person, including the Crown in Right of Ontario or any agency thereof, has or may have against you, your officers, employees, agents and your contractors.

Yours truly,

G.I. Macey, Evaluator
Approvals and Planning
Technical Assessment Section
Southeastern Region
PLS/sh

APPENDIX E

AQUIFER TEST DATA AND ANALYSES

IFER TEST DATA WELL#: 1650-TW1

e of aquifer test:	Step Q	Well type:	Production
Q Measured:	Orifice	Data type:	Pumping
tance from pumping well:	0 m	Depth well:	24.0 m
s. point for w. l.'s:	T.O.C.	Pump on:	22-1-88
vation of Measuring Pt.:	0.76 m	Pump off:	22-1-88
tic Water Level:	5.34	Discharge rate:	50-125 igpm

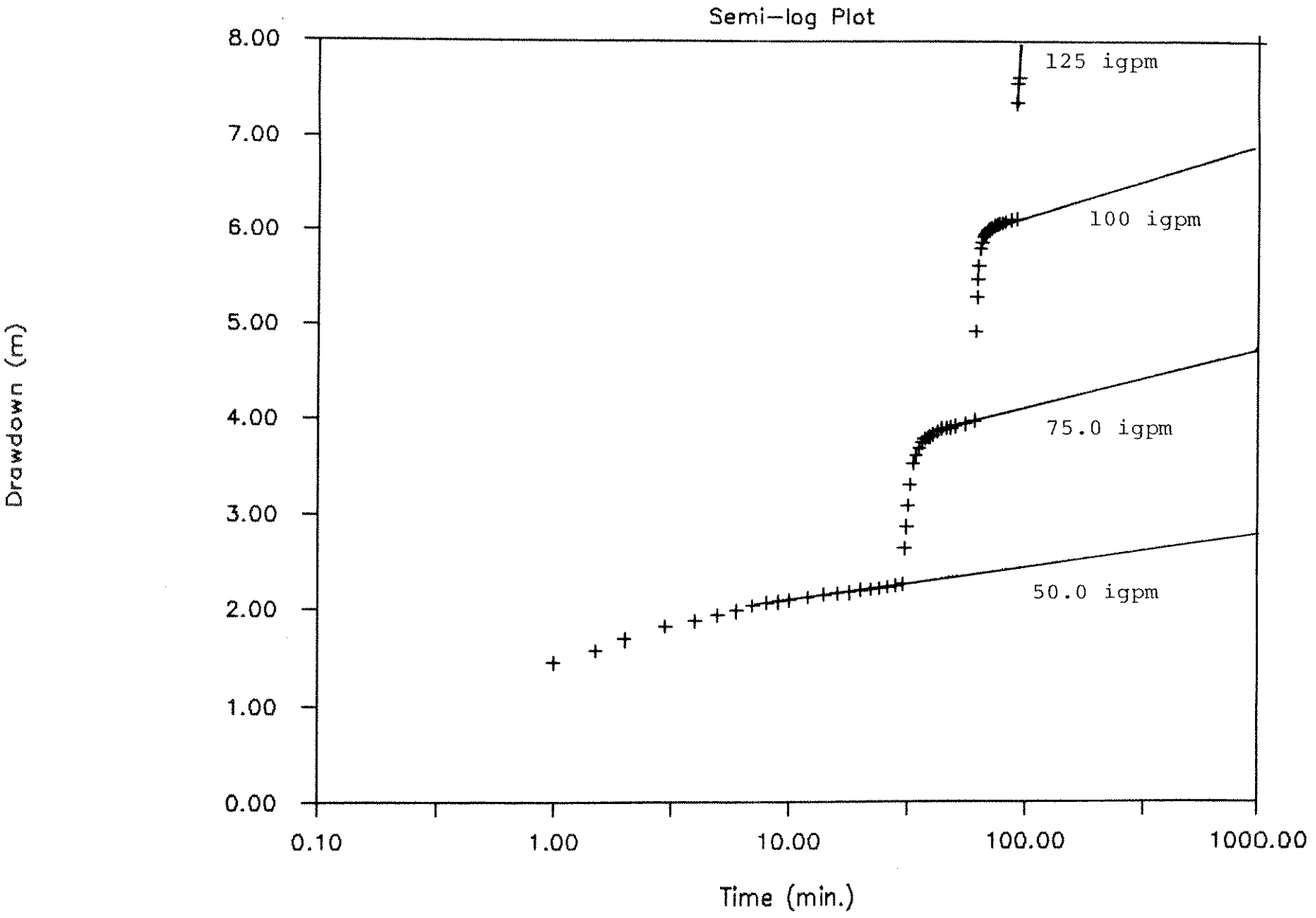
Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
1.00	6.79	1.45	50.00	
1.50	6.92	1.58		
2.00	7.04	1.70		
3.00	7.17	1.83		
4.00	7.23	1.89		
5.00	7.29	1.95		
6.00	7.34	2.00		
7.00	7.39	2.05		
8.00	7.42	2.08		
9.00	7.44	2.10		
10.00	7.45	2.11		
12.00	7.48	2.14		
14.00	7.51	2.17		
16.00	7.53	2.19		
18.00	7.54	2.20		
20.00	7.56	2.22		
22.00	7.57	2.23		
24.00	7.58	2.24		
26.00	7.59	2.25		
28.00	7.61	2.27		
30.00	7.63	2.29		
30.50	8.00	2.66	75.00	
31.00	8.23	2.89		
31.40	8.45	3.11		
32.00	8.67	3.33		
33.00	8.90	3.56		
34.00	8.99	3.65		
35.00	9.06	3.72		
36.00	9.12	3.78		
37.00	9.16	3.82		
38.00	9.17	3.83		
39.00	9.18	3.84		
40.00	9.20	3.86		
42.00	9.23	3.89		
44.00	9.26	3.92		
46.00	9.27	3.93		
48.00	9.28	3.94		
50.00	9.29	3.95		
55.00	9.32	3.98		
60.00	9.35	4.01		
60.50	10.29	4.95	100.00	
61.00	10.66	5.32		
61.50	10.85	5.51		

UIFER TEST DATA WELL#: 1650-TW1

pe of aquifer test:	Step Q	Well type:	Production
w Q Measured:	Orifice	Data type:	Pumping
stance from pumping well:	0 m	Depth well:	24.0 m
as. point for w. l.'s:	T.O.C.	Pump on:	22-1-88
evation of Measuring Pt.:	0.76 m	Pump off:	22-1-88
atic Water Level:	5.34	Discharge rate:	50-125 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
62.00	11.00	5.66		
63.00	11.18	5.84		
64.00	11.25	5.91		
65.00	11.31	5.97		
66.00	11.34	6.00		
67.00	11.36	6.02		
68.00	11.38	6.04		
69.00	11.40	6.06		
70.00	11.41	6.07		
72.00	11.43	6.09		
74.00	11.44	6.10		
76.00	11.45	6.11		
78.00	11.46	6.12		
80.00	11.47	6.13		
85.00	11.49	6.15		
90.00	11.50	6.16		
90.50	12.70	7.36	125.00	
91.00	12.90	7.56		
92.00	12.96	7.62		Pump taking air

STEP DRAWDOWN DATA FOR 1650–TW1



AQUIFER TEST DATA JOB#1650 WELL#: TW1

Type of aquifer test: CONST.DISCH. Well type: PUMPING
How Q Measured: ORIFICE WEIR Data type: PUMPING
Distance from pumping well: 0 m Depth pump: 14 m
Meas. point for w. l.'s: T.O.C. Pump on: 25-01-88 08:53
Elevation of Measuring Pt.: 0.76 Pump off: 25-01-88 14:53
Static Water Level (m): 5.59 Discharge rate: 75 IGPM

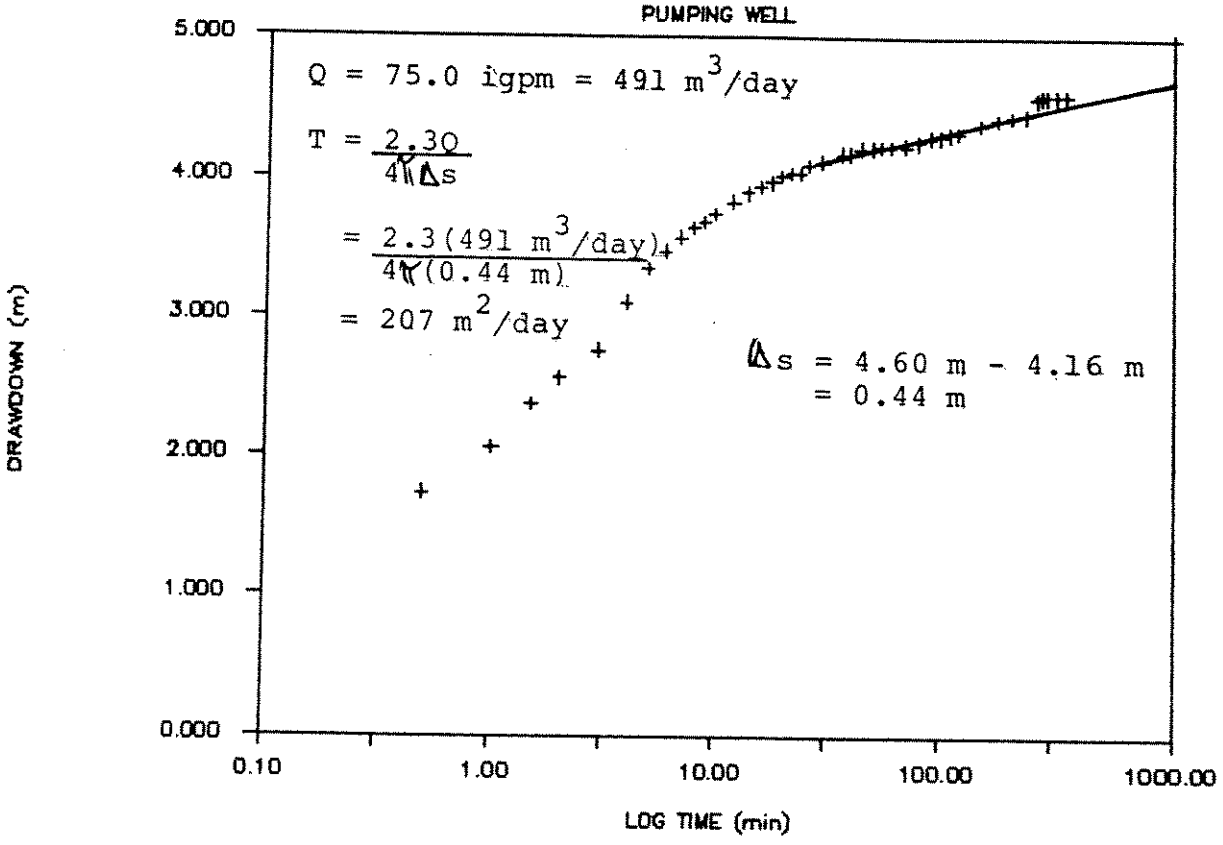
Time from start of test (minutes)	W.L. reading (m)	Drawdown (m)	Discharge rate IGPM	Comments
0.5	7.32	1.730	75.00	
1.0	7.65	2.060		discharge
1.5	7.95	2.360		brown
2.0	8.14	2.550		coloured
3.0	8.35	2.760		
4.0	8.70	3.110		
5.0	8.94	3.350		
6.0	9.07	3.480		
7.0	9.17	3.580		
8.0	9.23	3.640		
9.0	9.28	3.690		
10.0	9.34	3.750		
12.0	9.42	3.830		
14.0	9.48	3.890		
16.0	9.53	3.940		
18.0	9.56	3.970		
20.0	9.61	4.020		
22.0	9.62	4.030		
24.0	9.62	4.030		
26.0	9.68	4.090		
30.0	9.71	4.120		
37.0	9.77	4.180		
40.0	9.77	4.180		
45.0	9.81	4.220		
50.0	9.81	4.220		
55.0	9.82	4.230		
60.0	9.82	4.225		
70.0	9.83	4.240		
80.0	9.85	4.260		
90.0	9.89	4.295		
100.0	9.89	4.300		
110.0	9.91	4.320		
120.0	9.92	4.330		discharge
150.0	9.97	4.380		clear
180.0	10.02	4.430		
210.0	10.03	4.440		
240.0	10.05	4.455		
270.0	10.16	4.570		discharge
285.0	10.18	4.590		adjusted
300.0	10.18	4.590		slightly
330.0	10.18	4.590		
360.0	10.19	4.600		

AQUIFER TEST DATA JOB#1650 WELL#: TW2

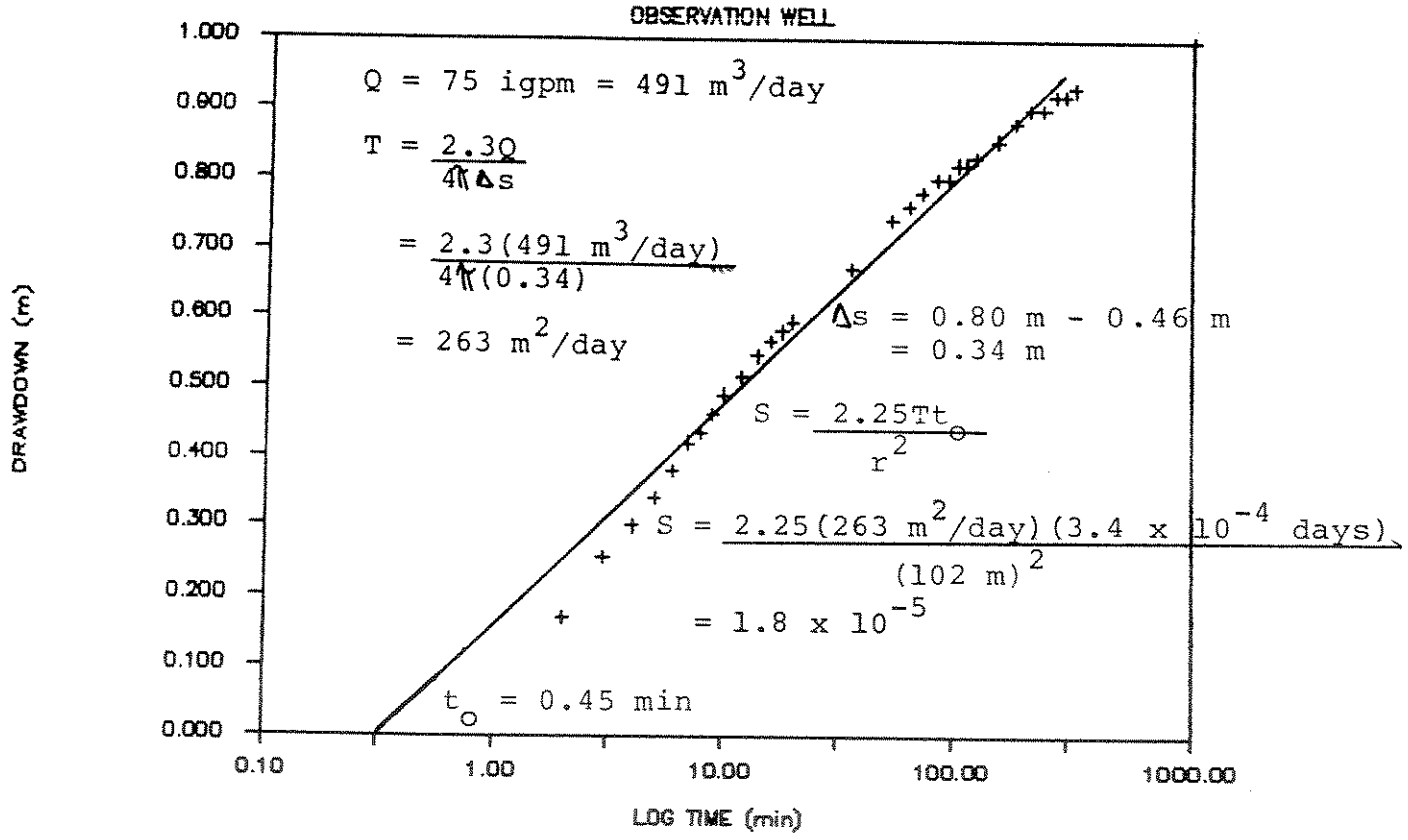
Type of aquifer test:	CONST.DISCH.	Well type:	OBSERVATION
How Q Measured:	ORIFICE WEIR	Data type:	PUMPING
Distance from pumping well:	102 m	Depth pump:	14 m
Meas. point for w. l.'s:	T.O.C.	Pump on:	25-01-88 08:53
Elevation of Measuring Pt.:	0.90	Pump off:	25-01-88 14:53
Static Water Level (m):	6.53	Discharge rate:	75 IGPM

Time from start of test (minutes)	W.L. reading (m)	Drawdown (m)	Discharge rate IGPM	Comments
2.0	6.700	0.170	75.00	
3.0	6.785	0.255		
4.0	6.830	0.300		
5.0	6.870	0.340		
6.0	6.910	0.380		
7.0	6.950	0.420		
8.0	6.965	0.435		
9.0	6.990	0.460		
10.0	7.020	0.490		
12.0	7.045	0.515		
14.0	7.075	0.545		
16.0	7.095	0.565		
18.0	7.110	0.580		
20.0	7.125	0.595		
36.0	7.200	0.670		
53.0	7.270	0.740		
63.0	7.290	0.760		
72.0	7.310	0.780		
83.0	7.330	0.800		
93.0	7.330	0.800		
103.0	7.350	0.820		
113.0	7.350	0.820		
123.0	7.360	0.830		
153.0	7.385	0.855		
184.0	7.410	0.880		
212.0	7.430	0.900		
243.0	7.430	0.900		
273.0	7.450	0.920		
302.0	7.450	0.920		
333.0	7.460	0.930		

CONSTANT DISCHARGE TEST 1650–TW1



CONSTANT DISCHARGE TEST 1650–TW2



AQUIFER TEST DATA JOB#1650 WELL#: TW1

Type of aquifer test:	CONST. Q	Well type:	PUMPING	
How Q Measured:	ORIFICE WEIR	Data type:	RECOVERY	
Distance from pumping well:	0 m	Depth pump:	14 m	
Meas. point for w. l.'s:	T.O.C.	Pump on:	25-01-88	08:53
Elevation of Measuring Pt.:	0.76	Pump off:	25-01-88	14:53
Static Water Level (m):	5.59	Discharge rate:	0.00	

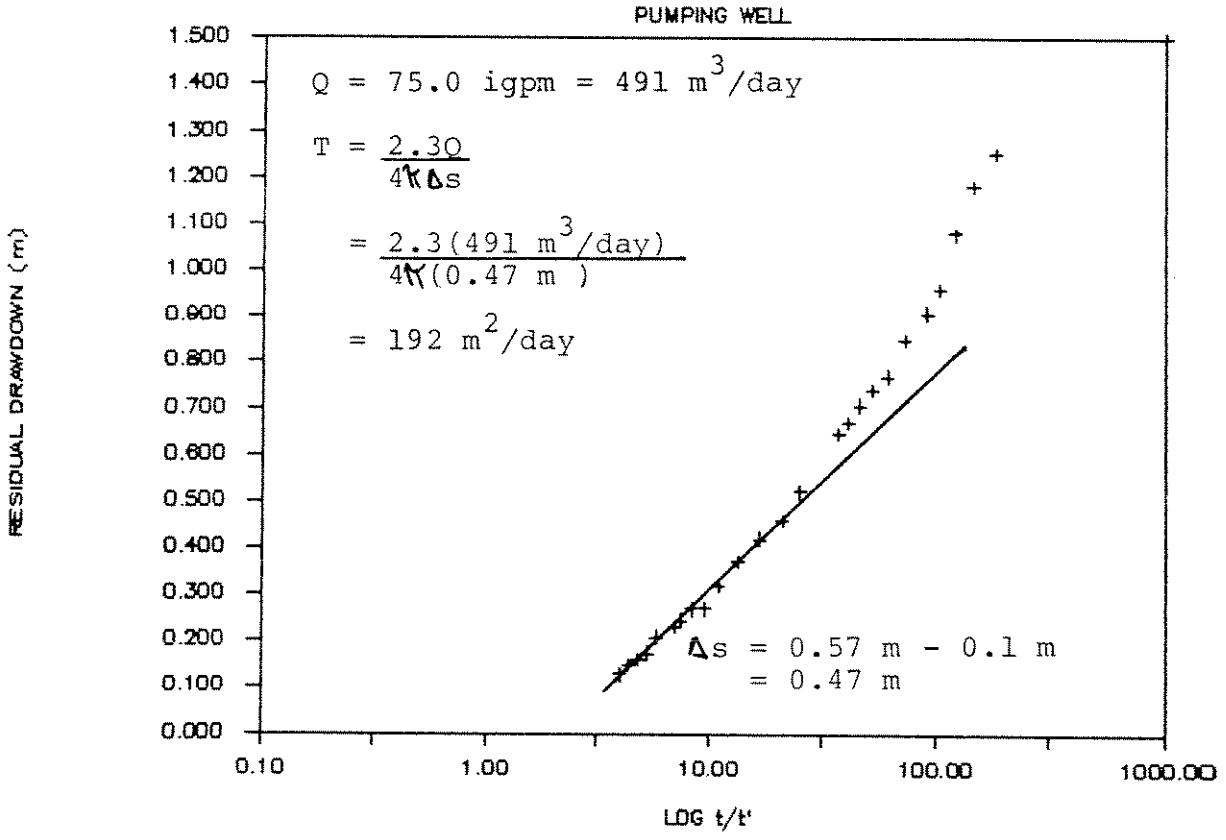
Time since well shut off (minutes)	t/t'	W.L. reading (m)	Residual drawd own (m)
2.0	181.00	6.84	1.25
2.5	145.00	6.77	1.18
3.0	121.00	6.67	1.08
3.5	103.86	6.55	0.96
4.0	91.00	6.50	0.91
5.0	73.00	6.44	0.85
6.0	61.00	6.36	0.77
7.0	52.43	6.33	0.74
8.0	46.00	6.30	0.71
9.0	41.00	6.26	0.67
10.0	37.00	6.24	0.65
15.0	25.00	6.11	0.52
18.0	21.00	6.05	0.46
23.0	16.65	6.01	0.42
29.0	13.41	5.96	0.37
36.0	11.00	5.91	0.32
42.0	9.57	5.86	0.27
49.0	8.35	5.86	0.27
56.0	7.43	5.84	0.25
60.0	7.00	5.82	0.23
75.0	5.80	5.80	0.21
84.0	5.29	5.77	0.17
95.0	4.79	5.75	0.16
107.0	4.36	5.74	0.15
120.0	4.00	5.72	0.13

AQUIFER TEST DATA JOB#1650 WELL#: TW2

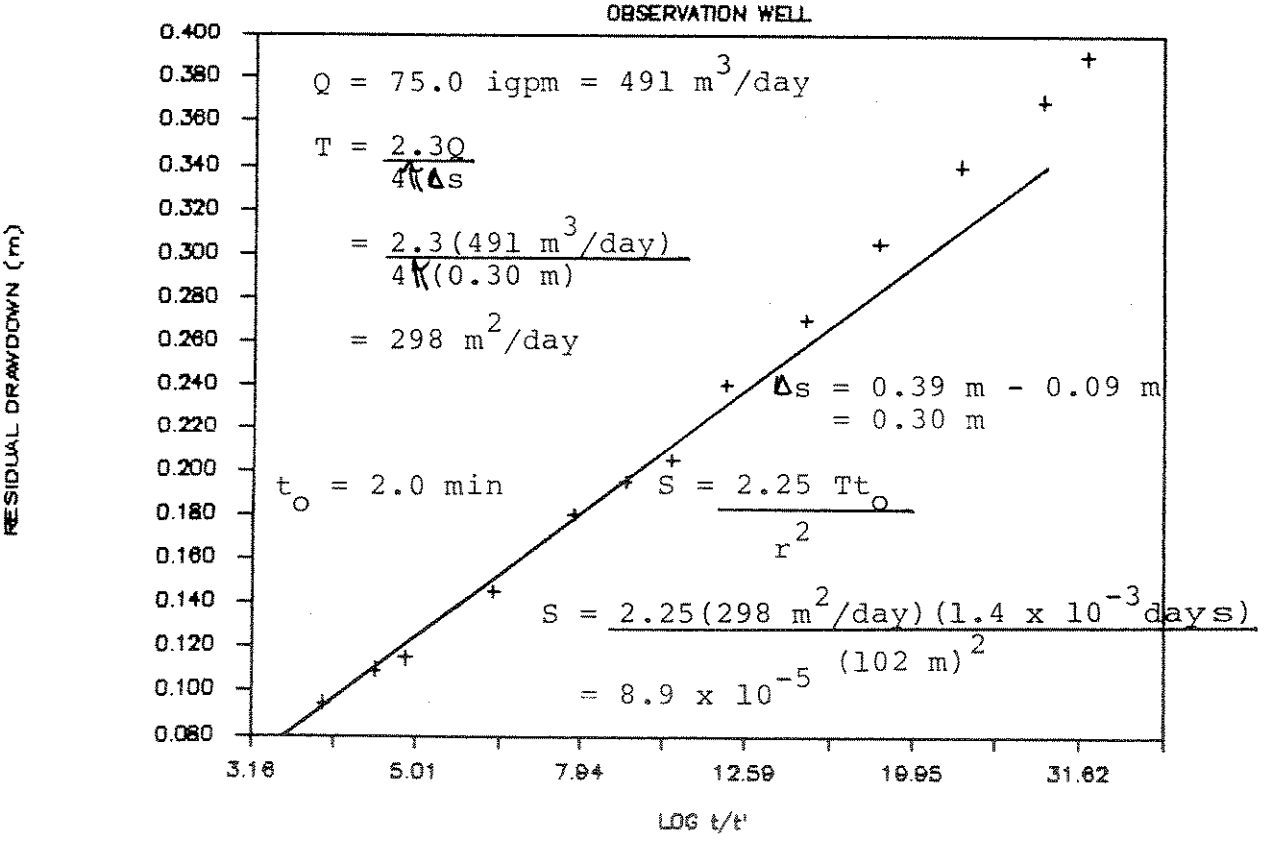
Type of aquifer test: CONST. Q		Well type:	OBSERVATION
How Q Measured: ORIFICE WEIR		Data type:	RECOVERY
Distance from pumping well:	102 m	Depth pump:	14 m
Meas. point for w. l.'s:	T.O.C.	Pump on:	25-01-88 08:53
Elevation of Measuring Pt.:	0.90 m	Pump off:	25-01-88 14:53
Static Water Level (m):	6.53	Discharge rate:	0.00

Time since well shut off (minutes)	t/t'	W.L. reading (m)	Residual drawd own (m)
11.5	32.30	6.92	0.39
13.0	28.69	6.90	0.37
16.5	22.82	6.87	0.34
21.0	18.14	6.84	0.30
26.0	14.85	6.80	0.27
33.0	11.91	6.77	0.24
39.0	10.23	6.74	0.21
45.0	9.00	6.73	0.19
53.0	7.79	6.71	0.18
69.0	6.22	6.68	0.14
93.0	4.87	6.65	0.11
104.0	4.46	6.64	0.11
126.0	3.86	6.63	0.09

RECOVERY 1650–TW1



RECOVERY 1650–TW2



FER TEST DATA WELL#: 1650-TW3

of aquifer test:	Step Q	Well type:	Production
Q Measured:	Orifice	Data type:	Pumping
ance from pumping well:	0 m	Depth pump:	47.0 m
. point for w. l.'s:	T.O.P.	Pump on:	9h10 14-11-90
ation of Measuring Pt.:	0.65 m	Pump off:	11h40 14-11-90
ic Water Level:	-2.38	Discharge rate:	50-150 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
7.00	0.59	2.97	50.00	
9.00	1.96	4.34		
12.00	0.65	3.03		
16.00	2.06	4.44		
18.50	2.08	4.46		
20.00	2.12	4.50		
25.00	2.26	4.64		
29.00	2.30	4.68		Q increase
32.00	5.86	8.24	75.00	
33.00	5.87	8.25		
34.00	5.91	8.29		
35.00	5.99	8.37		
38.50	6.34	8.72		
40.00	6.36	8.74		
42.00	6.41	8.79		
44.00	6.47	8.85		
46.00	6.46	8.84		
48.50	6.49	8.87		
50.00	6.50	8.88		
55.00	6.66	9.04		Q increase
72.00	16.66	19.04	100.00	
76.00	16.99	19.37		
78.00	17.20	19.58		
80.00	17.18	19.56		
86.00	17.48	19.86		
89.00	17.65	20.03		Q increase
93.50	25.42	27.80	125.00	
95.00	25.55	27.93		
97.00	25.88	28.26		
98.00	26.02	28.40		
100.00	26.12	28.50		
102.00	26.22	28.60		
104.00	26.16	28.54		
106.50	26.45	28.83		
108.00	26.58	28.96		
110.00	26.76	29.14		
115.00	26.95	29.33		
119.50	27.25	29.63		Q increase
122.50	37.74	40.12	150.00	
123.00	38.05	40.43		
124.00	38.64	41.02		
126.00	39.79	42.17		
127.00	40.52	42.90		

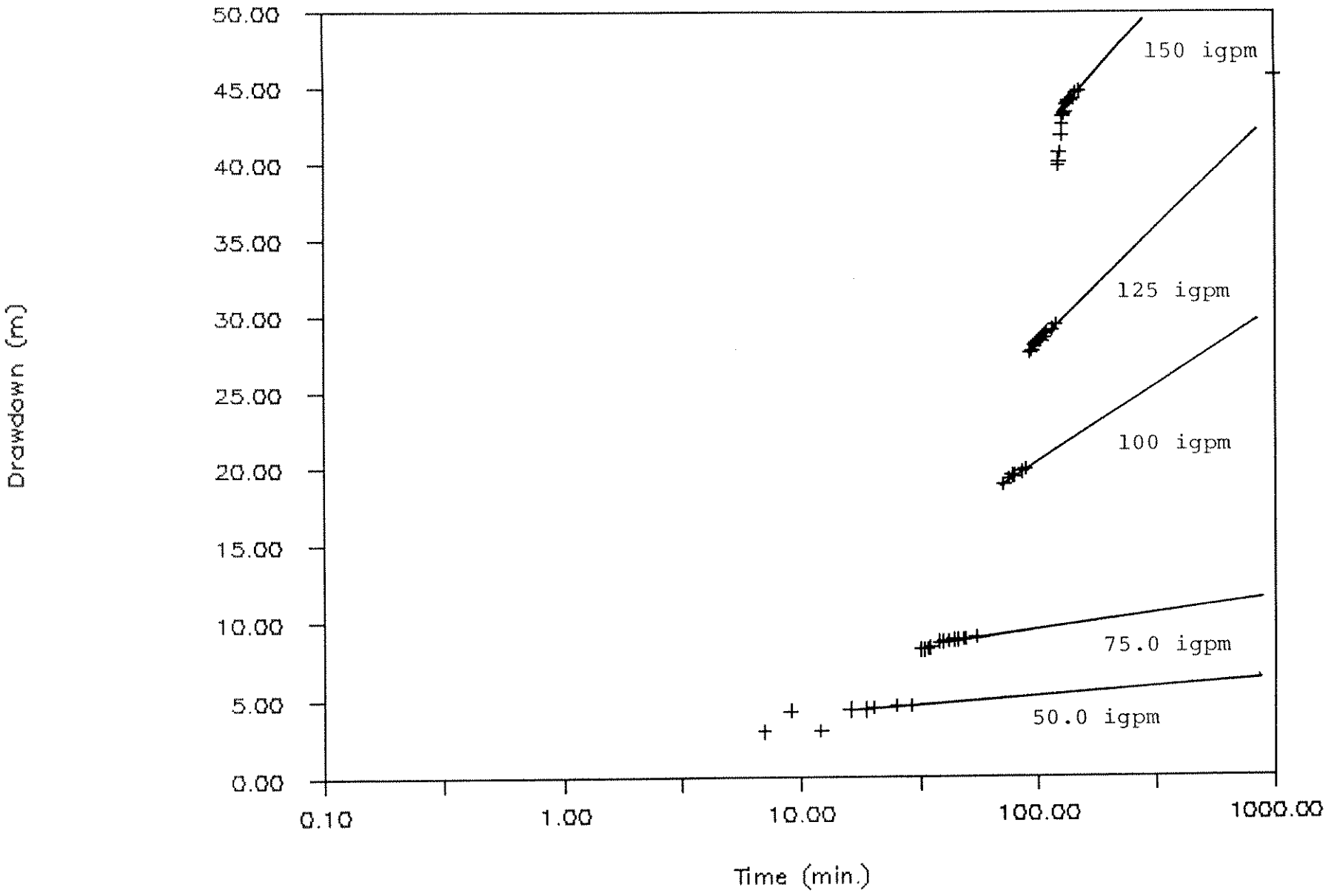
FER TEST DATA WELL#: 1650-TW3

of aquifer test:	Step Q	Well type:	Production
Q Measured:	*Orifice*	*Data type:*	*Pumping*
ance from pumping well:	0 m	Depth pump:	47.0 m
. point for w. l.'s:	T.O.P.	Pump on:	9h10 14-11-90
ation of Measuring Pt.:	0.65 m	Pump off:	11h40 14-11-90
ic Water Level:	-2.38	Discharge rate:	50-150 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
128.00	41.00	43.38		
129.00	41.11	43.49		
130.00	41.26	43.64		
132.00	41.68	44.06		
134.50	41.87	44.25		
136.00	42.03	44.41		
138.00	41.98	44.36		
140.00	42.17	44.55		
145.00	42.46	44.84		
149.50	42.61	44.99		stop pumping

STEP DISCHARGE ANALYSIS FOR 1650-TW3

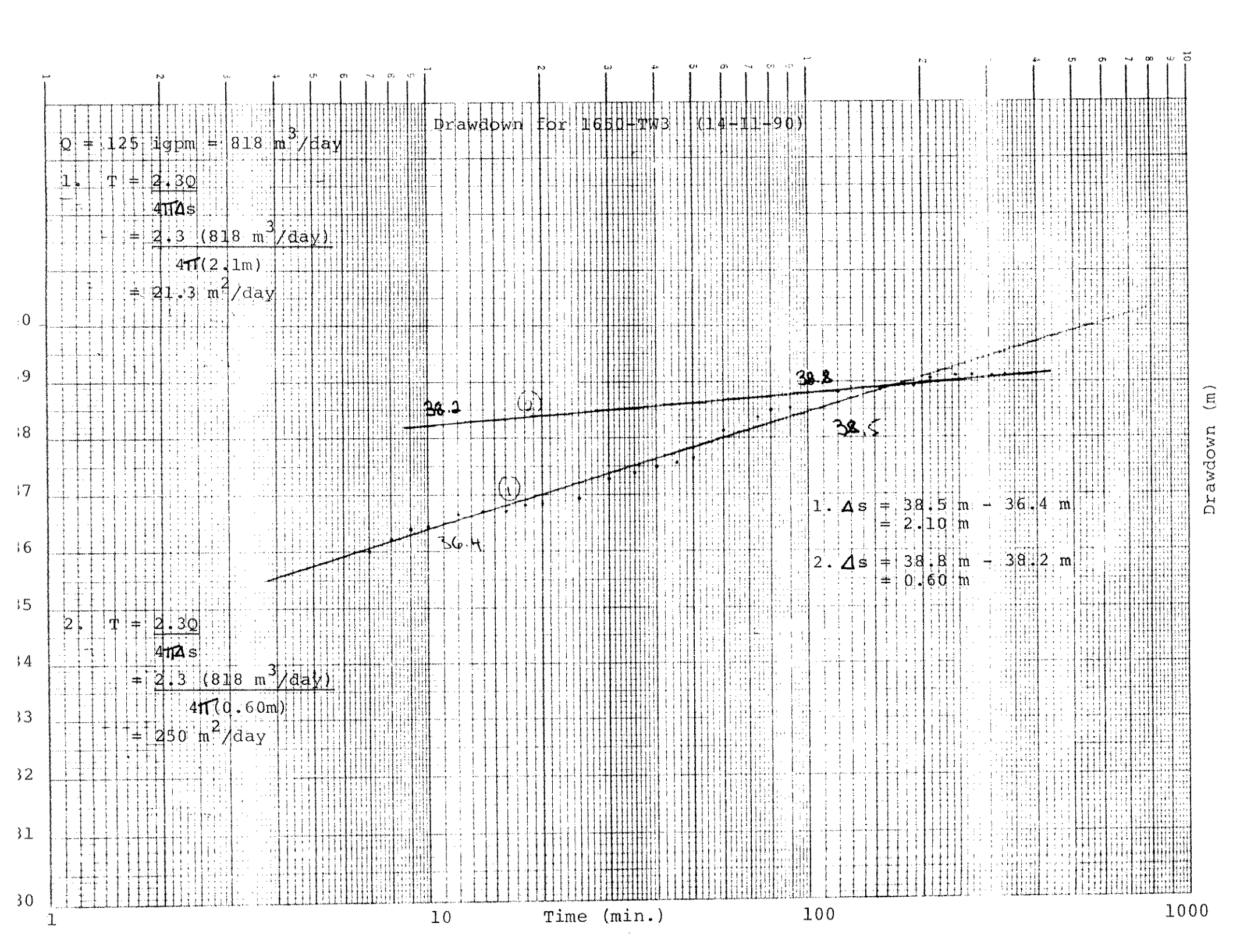
14 November 1990



IFER TEST DATA WELL#: 1650-TW3

e of aquifer test:	Constant Q	Well type:	Production
Q Measured:	Bucket	Data type:	Pumping
tance from pumping well:	0 m	Depth pump:	47.0 m
s. point for w. l.'s:	T.O.P.	Pump on:	12h00 14-11-90
vation of Measuring Pt.:	0.645 m	Pump off:	18h00 14-11-90
tic Water Level:	-2.38	Discharge rate:	125 igpm

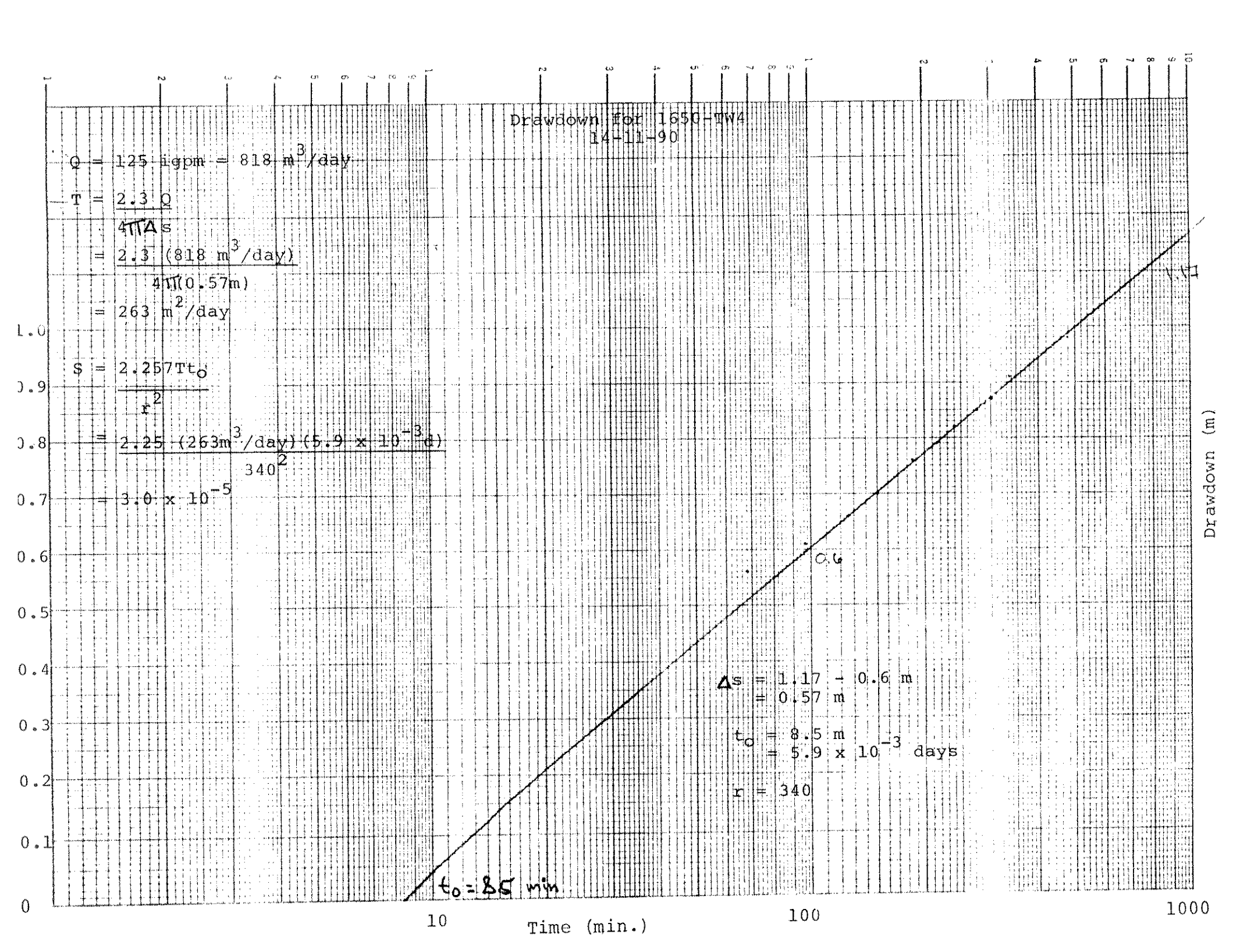
Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
5.00	31.47	33.85	125	
7.00	33.63	36.01	125	Increase Q
8.00	33.84	36.22		
9.00	34.00	36.38		
10.00	34.06	36.44		
12.00	34.26	36.64		
14.00	34.31	36.69		
16.00	34.31	36.69		
18.00	34.44	36.82		
20.00	34.46	36.84		
25.00	34.57	36.95		
30.00	34.90	37.28		
35.00	35.01	37.39		
40.00	35.10	37.48		
45.50	35.18	37.56		
50.00	35.25	37.63		
55.00	35.55	37.93	125	Increase Q
60.00	35.75	38.13		
74.00	35.98	38.36		
80.00	36.09	38.47		
90.00	36.15	38.53		
120.00	36.43	38.81		
155.00	36.47	38.85		
190.50	36.55	38.93		
210.00	36.68	39.06		
246.00	36.72	39.10		
270.00	36.73	39.11		
306.00	36.73	39.11		
330.00	36.74	39.12		
360.00	36.75	39.13		


Drawdown for 1650-TW3 (14-11-90)
Q = 125 igpm = 818 m³/day
1. T = 2.30 Q / 4π Δs
= 2.3 (818 m³/day) / 4π(2.1m)
= 21.3 m²/day
2. T = 2.30 Q / 4π Δs
= 2.3 (818 m³/day) / 4π(0.60m)
= 250 m²/day
38.2
38.8
38.5
36.4
(1)
(2)
1. Δs = 38.5 m - 36.4 m
= 2.10 m
2. Δs = 38.8 m - 38.2 m
= 0.60 m
Drawdown (m)
Time (min.)
1
10
100
1000

IFER TEST DATA WELL#: 1650-TW4

e of aquifer test:	Constant Q	Well type:	Observation
Q Measured:	Bucket	Data type:	Pumping
tance from pumping well:	340 m	Depth well:	44.2 m
s. point for w. l.'s:	T.O.C.	Pump on:	12h00 14-11-90
vation of Measuring Pt.:	0.27 m	Pump off:	12h00 14-11-90
tic Water Level:	-2.11	Discharge rate:	125 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
68.00	-1.55	0.56	125.00	
97.00	-1.50	0.61		
126.00	-1.45	0.66		
150.00	-1.41	0.70		
186.00	-1.36	0.76		
216.00	-1.32	0.79		
240.00	-1.29	0.82		
275.00	-1.26	0.85		
300.00	-1.24	0.87		
336.00	-1.20	0.91		

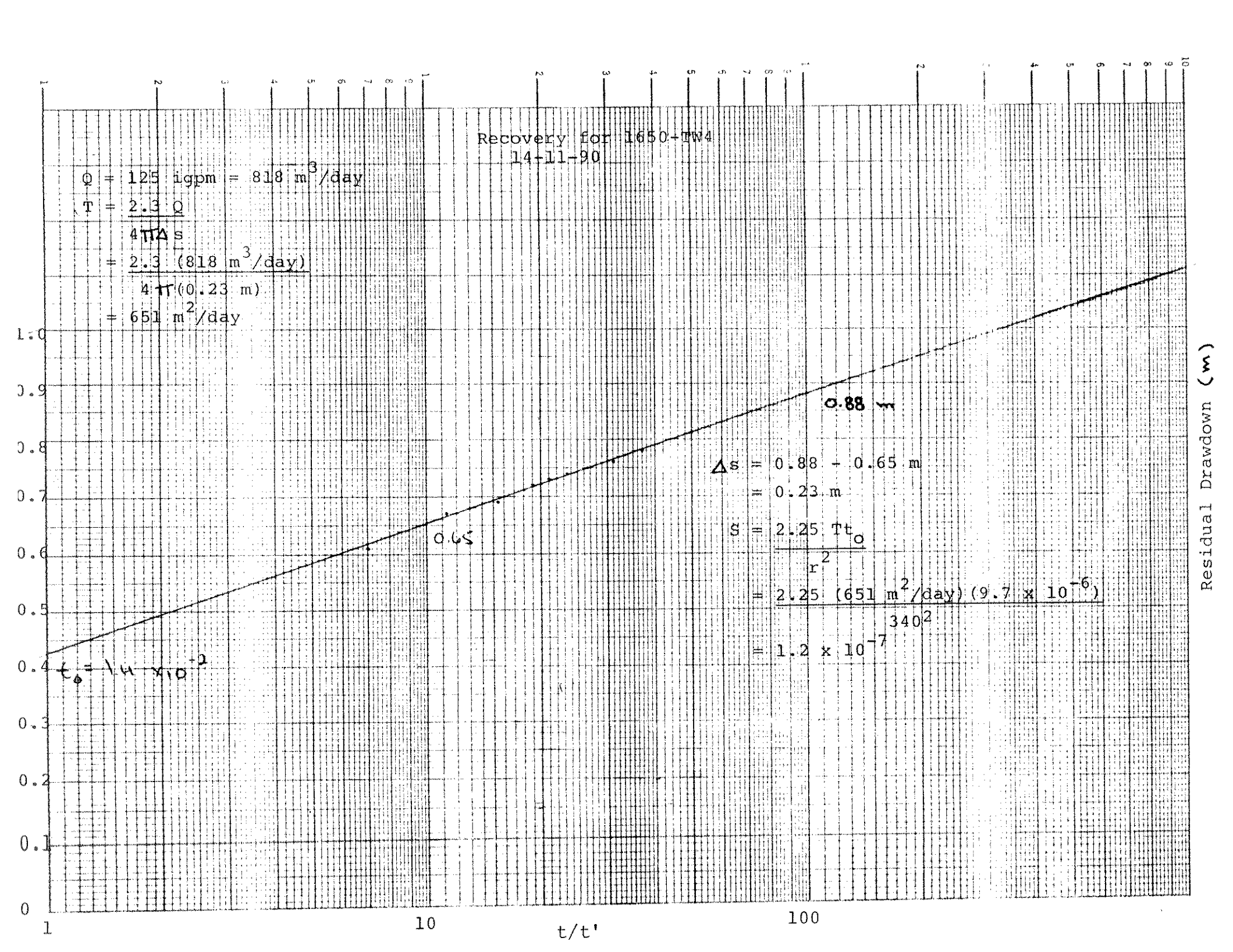

Drawdown for 1650-TW4
14-11-90
Q = 125 igpm = 818 m³/day
T = 2.3 Q / 4πΔs
= 2.3 (818 m³/day) / 4π(0.57m)
= 263 m²/day
S = 2.25Tt_o / r²
= 2.25 (263m³/day)(5.9 x 10⁻³d) / 340²
= 3.0 x 10⁻⁵
Δs = 1.17 - 0.6 m
= 0.57 m
t_o = 8.5 m
= 5.9 x 10⁻³ days
r = 340
t_o = 85 min
Drawdown (m)
Time (min.)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
10
100
1000

FER TEST DATA WELL#: 1650-TW4

of aquifer test:	Constant Q	Well type:	Observation
Q Measured:	Bucket	Data type:	Recovery
ance from pumping well:	340.0 m	Depth well:	44.2 m
. point for w. l.'s:	T.O.C.	Pump on:	12h00 14-11-90
ation of Measuring Pt.:	0.27 m	Pump off:	18h00 14-11-90
ic Water Level:	-2.11	Discharge rate:	125 igpm

At t' = 0, t = 360.00

Time (min.)	t/t'	Water Level (m)	Residual Drawdown (m)	Comments
10.00	37.00	-1.33	0.78	
12.00	31.00	-1.36	0.76	
14.00	26.71	-1.36	0.75	
16.00	23.50	-1.37	0.74	
18.00	21.00	-1.38	0.73	
20.00	19.00	-1.39	0.72	
25.00	15.40	-1.42	0.69	
30.00	13.00	-1.43	0.68	
35.00	11.29	-1.44	0.67	
60.00	7.00	-1.50	0.61	


Recovery for 1650-TW4
14-11-90
Q = 125 igpm = 818 m³/day
T = 2.3 Q / 4πΔs
= 2.3 (818 m³/day) / 4π(0.23 m)
= 651 m²/day
0.88
0.65
Δs = 0.88 - 0.65 m
= 0.23 m
S = 2.25 Tt₀ / r²
= 2.25 (651 m²/day)(9.7 x 10⁻⁶) / 340²
= 1.2 x 10⁻⁷
t₀ = 9.7 x 10⁻³
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
1
10
100
t/t'
Residual Drawdown (m)

FER TEST DATA WELL#: 1650-PW

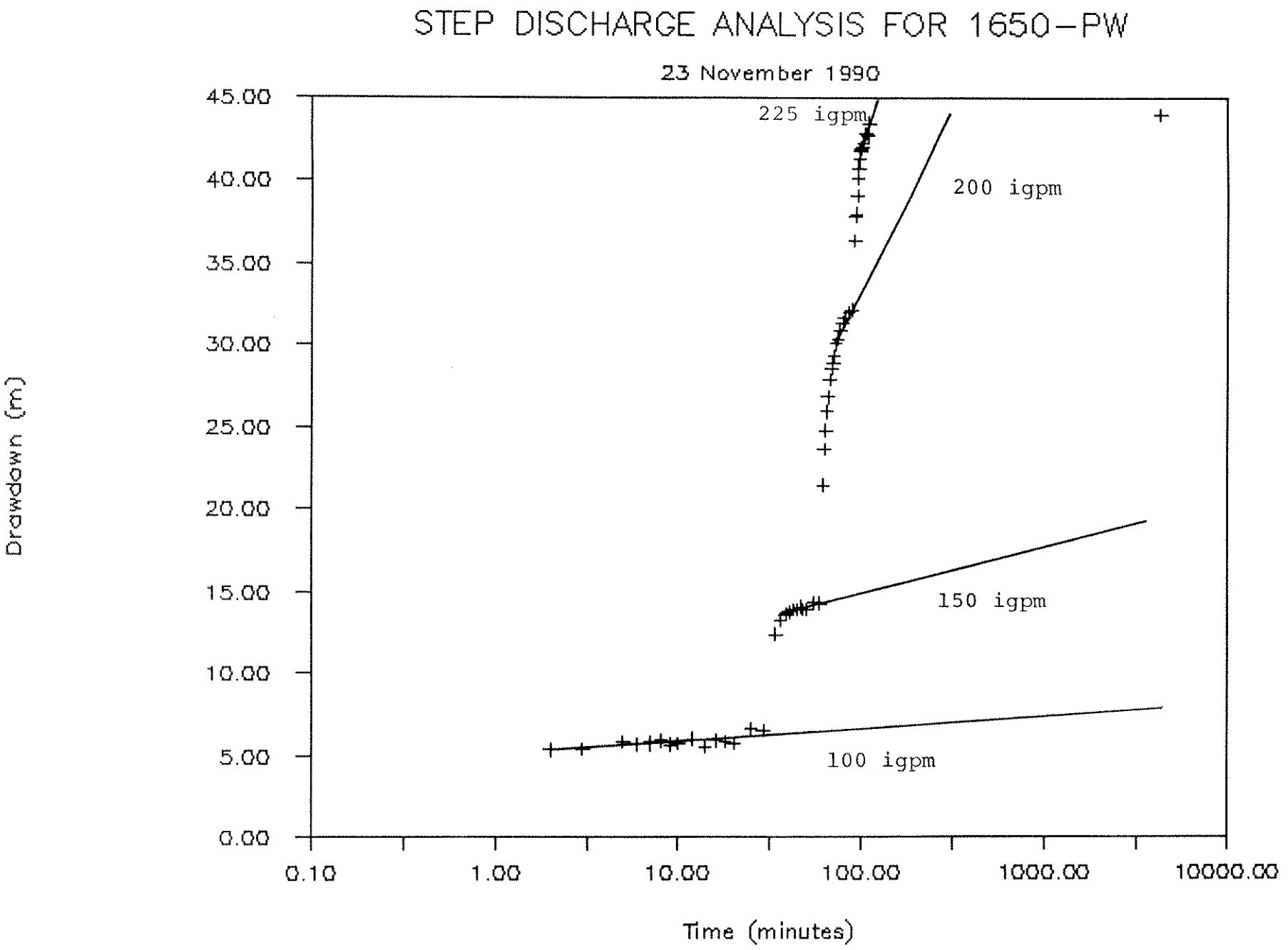
of aquifer test:	Step Q	Well type:	Production
] Measured:	Orifice	Data type:	Pumping
ince from pumping well:	0 m	Depth pump:	41.5 m
point for w. l.'s:	T.O.P.	Pump on:	9h22 23-11-90
ition of Measuring Pt.:	0.61 m	Pump off:	11h12 23-11-90
c Water Level:	-2.15	Discharge rate:	100-225 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
2.00	3.24	5.39	100.00	dirty
3.00	3.25	5.40		
5.00	3.76	5.91		Q increase
6.00	3.59	5.74		
7.00	3.70	5.85		
8.00	3.79	5.94		
9.00	3.52	5.67		
10.00	3.64	5.79		Q increase
12.00	3.88	6.03		
14.00	3.44	5.59		
16.00	3.81	5.96		
18.00	3.74	5.89		
20.00	3.64	5.79		Q increase
25.00	4.47	6.62		
29.00	4.42	6.57		Q increase
34.00	10.29	12.44	150.00	
36.00	11.19	13.34		Q increase
38.50	11.50	13.65		
39.00	11.63	13.78		
40.00	11.68	13.83		
42.00	11.85	14.00		
44.00	11.85	14.00		
46.00	12.00	14.15		
48.00	11.85	14.00		
50.00	11.85	14.00		Q increase
55.00	12.27	14.42		
59.00	12.21	14.36		Q increase
61.00	19.40	21.55	200.00	
62.00	21.58	23.73		
63.00	22.75	24.90		Q increase
64.00	23.92	26.07		
65.00	24.82	26.97		
66.50	25.88	28.03		
68.00	26.59	28.74		
69.00	26.92	29.07		
70.00	27.30	29.45		
72.00	28.10	30.25		
74.00	28.40	30.55		
76.00	28.95	31.10		
78.00	29.40	31.55		
80.00	29.75	31.90		
85.00	30.00	32.15		
89.00	30.19	32.34		Q increase

ER TEST DATA WELL#: 1650-PW

of aquifer test:	Step Q	Well type:	Production
Measured:	Orifice	Data type:	Pumping
nce from pumping well:	0 m	Depth pump:	41.5 m
point for w. l.'s:	T.O.P.	Pump on:	9h22 23-11-90
tion of Measuring Pt.:	0.61 m	Pump off:	11h12 23-11-90
c Water Level:	-2.15	Discharge rate:	100-225 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
91.00	34.45	36.60	225.00	
92.00	35.90	38.05		
93.00	36.05	38.20		
94.00	37.10	39.25		
95.00	38.10	40.25		
96.00	38.75	40.90		
97.00	39.20	41.35		
98.00	39.65	41.80		
99.00	39.80	41.95		
100.00	39.90	42.05		
102.00	40.19	42.34		
105.50	40.70	42.85		cascading
106.00	40.70	42.85		
108.00	40.60	42.75		
110.00	41.29	43.44		stop pumping


STEP DISCHARGE ANALYSIS FOR 1650-PW
23 November 1990
225 igpm
200 igpm
150 igpm
100 igpm
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
0.10
1.00
10.00
100.00
1000.00
10000.00
Drawdown (m)
Time (minutes)

ER TEST DATA WELL#: 1650-PW

of aquifer test:	Constant Q	Well type:	Production
Measured:	Orifice	Data type:	Pumping
nce from pumping well:	0 m	Depth pump:	41.5 m
point for w. l.'s:	T.O.P.	Pump on:	12h10 24-11-90
tion of Measuring Pt.:	0.61 m	Pump off:	12h10 27-11-90
c Water Level:	-2.01	Discharge rate:	150 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
1.00	9.70	11.71	150.00	
2.00	9.99	12.00		
3.00	9.48	11.49		Q increase
4.00	10.30	12.31		
5.00	10.65	12.66		Q increase
6.00	11.58	13.59		
7.00	11.82	13.83		
8.00	12.15	14.16		
9.00	12.77	14.78		
10.00	13.12	15.13		
12.00	13.55	15.56		
14.00	13.73	15.74		
16.00	13.75	15.76		
18.00	13.66	15.67		
20.00	13.52	15.53		
25.00	13.36	15.37		
30.00	12.96	14.97		Q increase
35.00	13.16	15.17		Q increase
40.00	13.35	15.36		Q increase
45.00	13.50	15.51		
50.00	13.09	15.10		Q increase
55.00	14.56	16.57		
60.00	14.53	16.54		T=7C; C=415umho
70.00	14.47	16.48		Turb.=8.5NTU
81.00	14.10	16.11		
90.00	14.18	16.19		
120.00	11.21	13.22		Q increase
150.00	12.76	14.77		Q increase
180.00	14.81	16.82		
210.00	13.93	15.94		Q increase
240.00	14.55	16.56		
270.00	14.76	16.77		
300.00	14.70	16.71		
330.00	14.85	16.86		
360.00	15.55	17.56		T=11C; C=460umho
420.00	15.42	17.43		Turb.=0.69NTU
480.00	15.50	17.51		
540.00	15.56	17.57		
600.00	15.51	17.52		
660.00	15.44	17.45		
720.00	15.45	17.46		
780.00	15.43	17.44		
840.00	15.30	17.31		

ER TEST DATA WELL#: 1650-PW

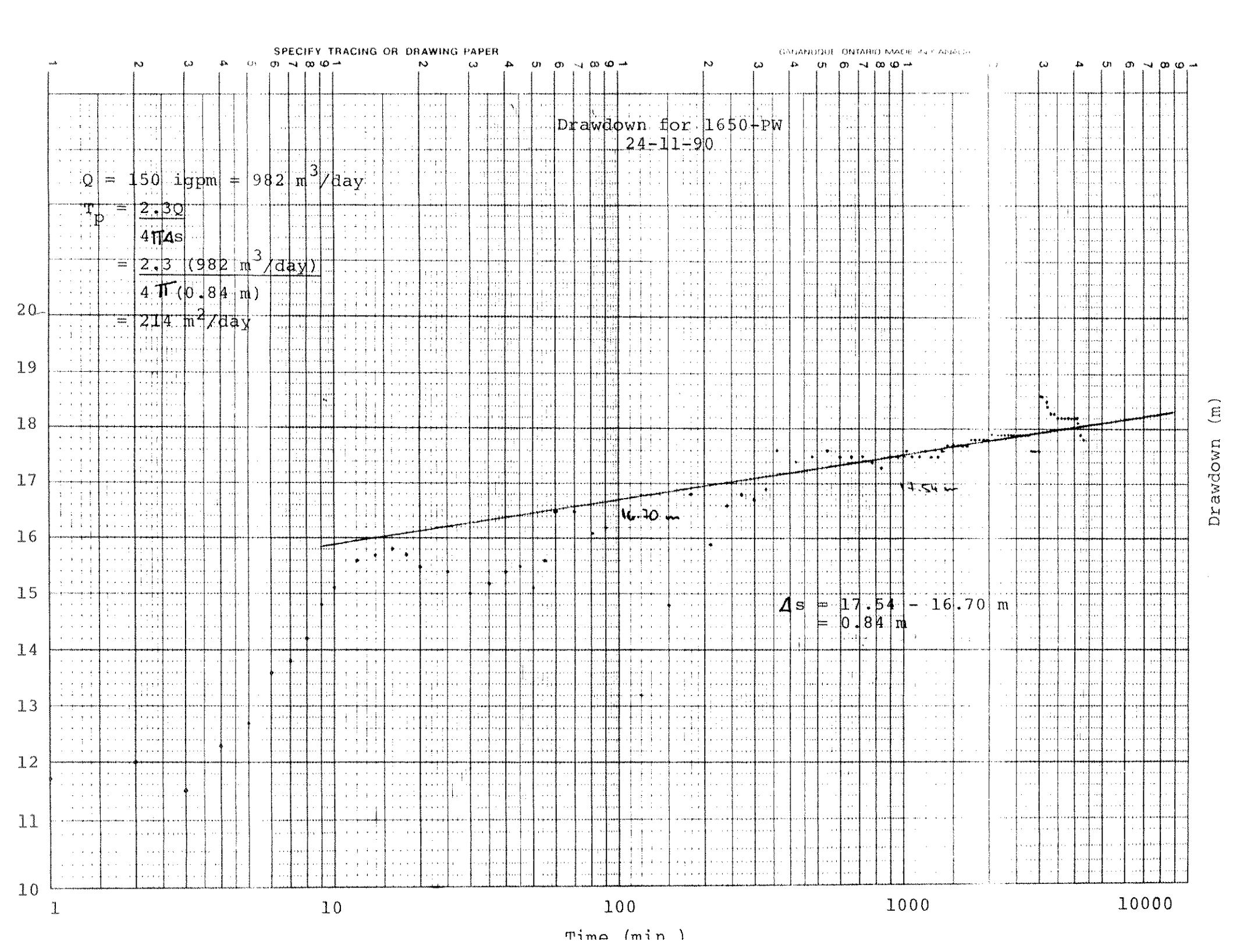
of aquifer test: Constant Q Well type: Production
Measured: Orifice Data type: Pumping
ice from pumping well: 0 m Depth pump: 41.5 m
point for w. l.'s: T.O.P. Pump on: 12h10 24-11-90
tion of Measuring Pt.: 0.61 m Pump off: 12h10 27-11-90
c Water Level: -2.01 Discharge rate: 150 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
900.00	15.51	17.52		
960.00	15.52	17.53		
1020.00	15.55	17.56		
1080.00	15.52	17.53		
1140.00	15.51	17.52		
1200.00	15.58	17.59		
1260.00	15.53	17.54		
1320.00	15.53	17.54		
1380.00	15.63	17.64		
1440.00	15.64	17.65		T=10C; C=380umho
1500.00	15.65	17.66		Turb.=0.09NTU
1560.00	15.69	17.70		
1620.00	15.70	17.71		
1680.00	15.70	17.71		
1740.00	15.75	17.76		
1800.00	15.74	17.75		
1860.00	15.74	17.75		
1920.00	15.74	17.75		
1980.00	15.78	17.79		
2041.00	15.85	17.86		
2112.00	15.80	17.81		
2160.00	15.84	17.85		
2220.00	15.84	17.85		
2280.00	15.90	17.91		
2340.00	15.85	17.86		
2400.00	15.84	17.85		
2460.00	15.88	17.89		
2520.00	15.89	17.90		
2580.00	15.90	17.91		
2640.00	15.90	17.91		
2700.00	15.90	17.91		
2760.00	15.85	17.86		Q steady
2820.00	15.60	17.61		
2880.00	15.55	17.56		T=10C; C=470umho
2940.00	15.54	17.55		Turb.=0.13NTU
3000.00	15.58	17.59		Q increase
3060.00	16.60	18.61		
3120.00	16.56	18.57		
3180.00	16.53	18.54		
3240.00	16.34	18.35		Q steady
3300.00	16.31	18.32		
3360.00	16.24	18.25		
3420.00	16.25	18.26		

'ER TEST DATA WELL#: 1650-PW

of aquifer test:	Constant Q	Well type:	Production
! Measured:	Orifice	Data type:	Pumping
nce from pumping well:	0 m	Depth pump:	41.5 m
point for w. l.'s:	T.O.P.	Pump on:	12h10 24-11-90
tion of Measuring Pt.:	0.61 m	Pump off:	12h10 27-11-90
c Water Level:	-2.01	Discharge rate:	150 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
3480.00	16.22	18.23		
3540.00	16.18	18.19		
3600.00	16.22	18.23		
3660.00	16.22	18.23		
3720.00	16.20	18.21		
3780.00	16.16	18.17		
3840.00	16.18	18.19		
3900.00	16.20	18.21		
3960.00	16.17	18.18		
4020.00	16.15	18.16		
4080.00	16.15	18.16		
4140.00	16.10	18.11		
4200.00	15.85	17.86		Q steady
4260.00	15.83	17.84		T=10C; C=480umho
4320.00	15.82	17.83		Turb.=<0.01NTU


SPECIFY TRACING OR DRAWING PAPER
Drawdown for 1650-PW
24-11-90
Q = 150 igpm = 982 m³/day
Tp = 2.3Q / 4πΔs
= 2.3 (982 m³/day) / 4π (0.84 m)
= 214 m²/day
16.70 m
17.54 m
Δs = 17.54 - 16.70 m
= 0.84 m
Drawdown (m)
Time (min)
1
10
100
1000
10000
10
11
12
13
14
15
16
17
18
19
20

'ER TEST DATA WELL#: 1650-TW3

of aquifer test:	Constant Q	Well type:	Observation
l Measured:	Orifice	Data type:	Pumping
ınce from pumping well:	13.0 m	Depth well:	53.3 m
point for w. l.'s:	T.O.C.	Pump on:	12h10 24-11-90
ıtion of Measuring Pt.:	0.50 m	Pump off:	12h10 27-11-90
.c Water Level:	-2.09	Discharge rate:	150 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
11.00	-1.02	1.08	150.00	
13.00	-1.00	1.09		
15.00	-0.98	1.11		
17.00	-0.98	1.11		
19.00	-0.98	1.11		
21.00	-0.98	1.12		
26.00	-0.96	1.13		
31.00	-0.93	1.16		Q increase
36.00	-0.96	1.13		Q increase
41.00	-0.95	1.15		Q increase
46.00	-0.87	1.22		
51.00	-0.87	1.22		Q increase
56.00	-0.88	1.21		
61.00	-0.88	1.22		
71.00	-0.87	1.22		
82.00	-0.84	1.25		
91.00	-0.81	1.28		
121.00	-0.72	1.37		Q increase
151.00	-0.70	1.39		Q increase
181.00	-0.71	1.39		
211.00	-0.68	1.41		Q increase
241.00	-0.66	1.43		
271.00	-0.63	1.46		
301.00	-0.60	1.49		
331.00	-0.58	1.51		
361.00	-0.55	1.54		
421.00	-0.51	1.58		
481.00	-0.47	1.62		
542.00	-0.44	1.65		
602.00	-0.41	1.68		
662.00	-0.39	1.70		
723.00	-0.37	1.72		
782.00	-0.35	1.74		
841.00	-0.34	1.75		
901.00	-0.33	1.76		
961.00	-0.32	1.77		
1021.00	-0.30	1.79		
1081.00	-0.31	1.78		
1141.00	-0.31	1.78		
1201.00	-0.31	1.78		
1262.00	-0.32	1.77		
1321.00	-0.32	1.77		
1383.00	-0.32	1.77		

'ER TEST DATA WELL#: 1650-TW3

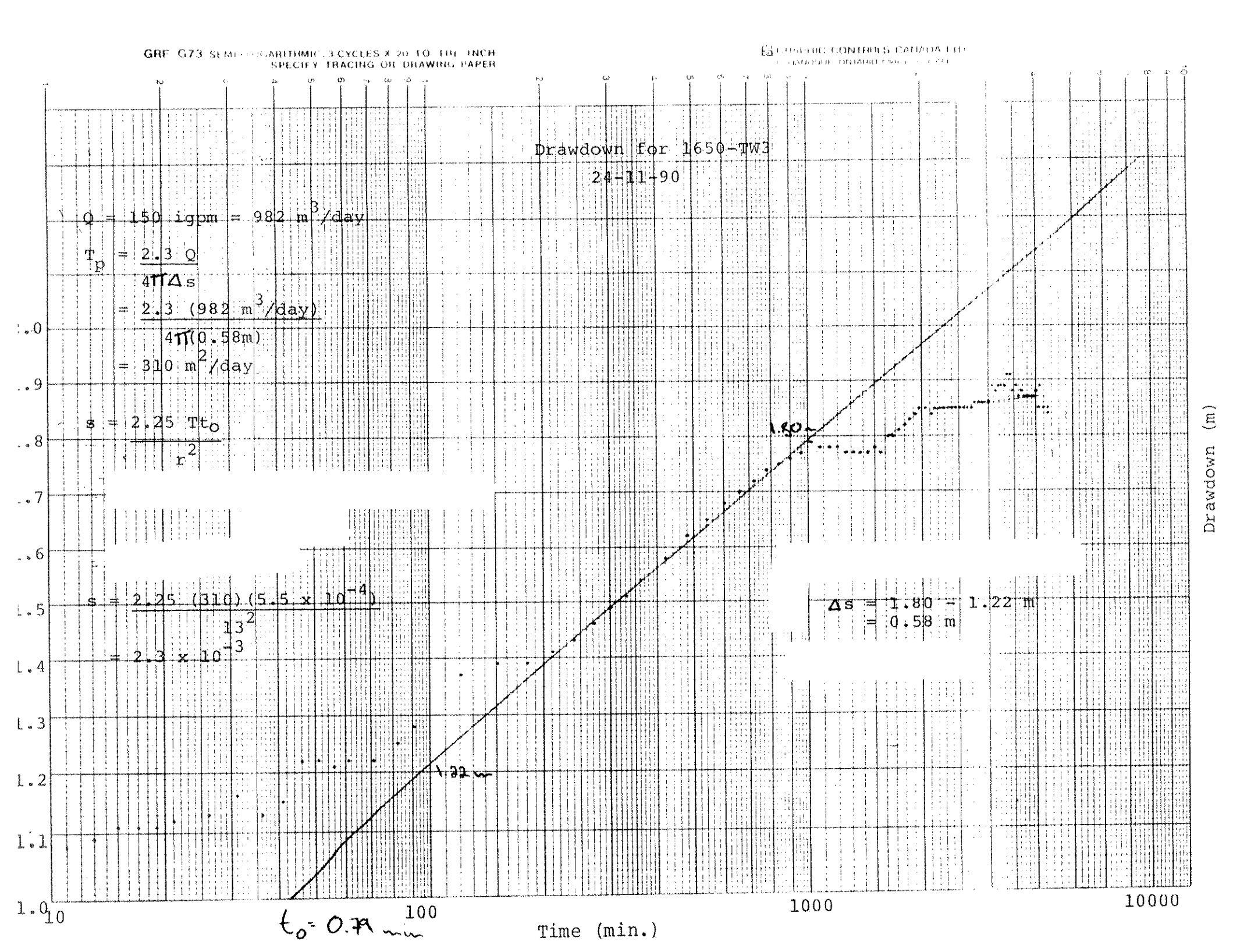
of aquifer test:	Constant Q	Well type:	Observation
ł Measured:	Orifice	Data type:	Pumping
ınce from pumping well:	13.0 m	Depth well:	53.3 m
point for w. l.'s:	T.O.C.	Pump on:	12h10 24-11-90
ıtion of Measuring Pt.:	0.50 m	Pump off:	12h10 27-11-90
.c Water Level:	-2.09	Discharge rate:	150 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
1441.00	-0.32	1.77		flow stopped
1501.00	-0.61	1.48		
1561.00	-0.32	1.77		
1621.00	-0.30	1.80		
1681.00	-0.29	1.80		
1741.00	-0.29	1.81		
1801.00	-0.27	1.82		
1861.00	-0.26	1.83		
1921.00	-0.25	1.84		
1981.00	-0.24	1.85		
2042.00	-0.24	1.85		
2113.00	-0.25	1.84		
2161.00	-0.24	1.85		
2221.00	-0.24	1.85		
2281.00	-0.24	1.85		
2341.00	-0.24	1.85		
2401.00	-0.24	1.85		
2461.00	-0.24	1.85		
2521.00	-0.24	1.85		
2581.00	-0.24	1.85		
2641.00	-0.24	1.85		
2701.00	-0.24	1.85		
2761.00	-0.24	1.86		Q steady
2821.00	-0.23	1.86		
2881.00	-0.23	1.86		
2941.00	-0.23	1.86		
3001.00	-0.23	1.86		Q increase
3061.00	-0.21	1.89		
3121.00	-0.21	1.88		
3181.00	-0.20	1.89		
3241.00	-0.20	1.89		Q steady
3301.00	-0.20	1.89		
3361.00	-0.19	1.91		
3421.00	-0.19	1.91		
3481.00	-0.21	1.88		
3541.00	-0.20	1.89		
3601.00	-0.22	1.87		
3661.00	-0.21	1.88		
3721.00	-0.22	1.87		
3781.00	-0.22	1.87		
3841.00	-0.22	1.87		
3901.00	-0.22	1.87		
3961.00	-0.22	1.87		

'ER TEST DATA WELL#: 1650-TW3

of aquifer test:	Constant Q	Well type:	Observation
l Measured:	Orifice	Data type:	Pumping
ınce from pumping well:	13.0 m	Depth well:	53.3 m
point for w. l.'s:	T.O.C.	Pump on:	12h10 24-11-90
ıtion of Measuring Pt.:	0.50 m	Pump off:	12h10 27-11-90
.c Water Level:	-2.09	Discharge rate:	150 igpm

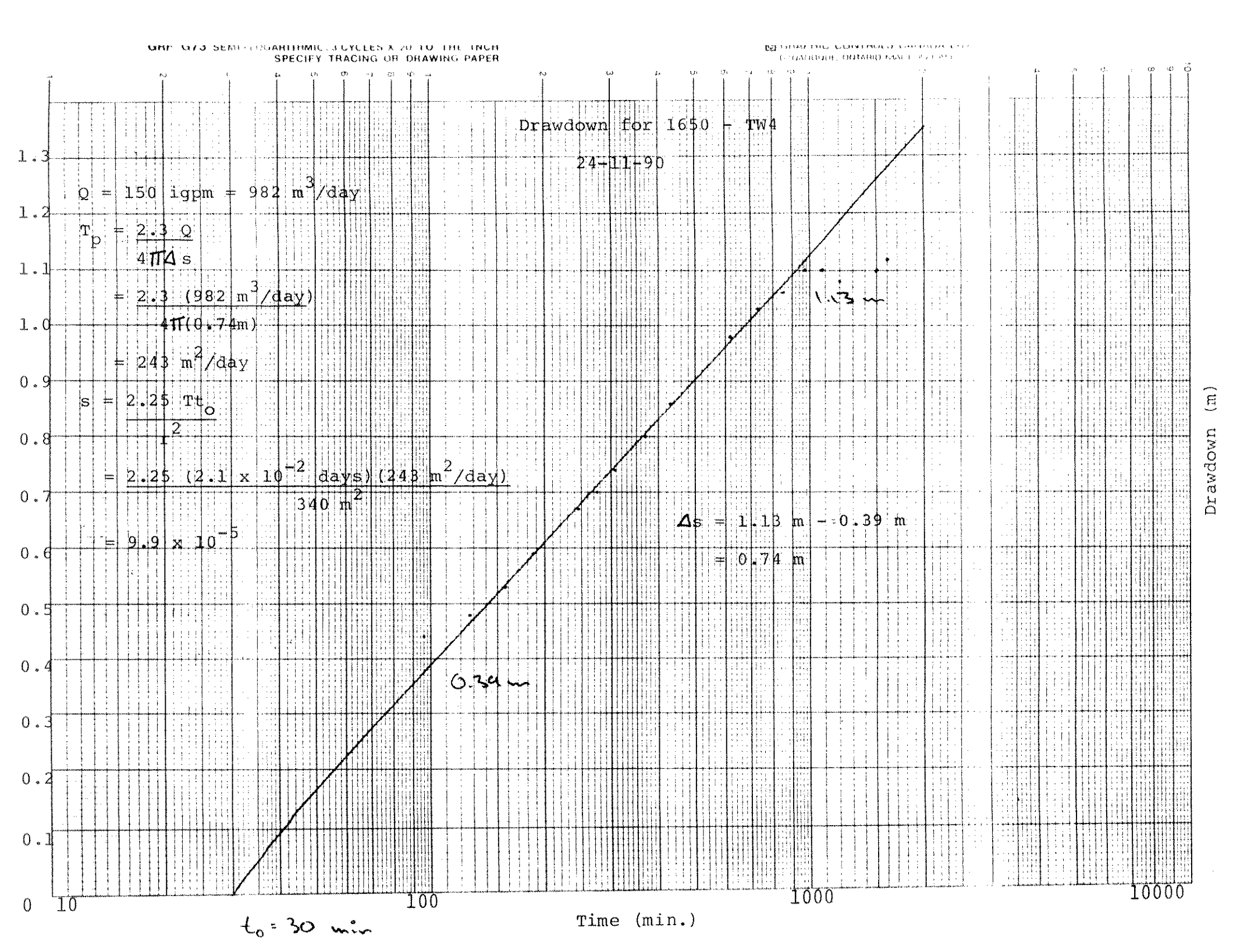
Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
4021.00	-0.21	1.88		
4081.00	-0.24	1.85		
4141.00	-0.20	1.89		
4201.00	-0.25	1.85		Q steady
4261.00	-0.25	1.85		
4321.00	-0.25	1.84		


GRF G73 SEMI-LOGARITHMIC 3 CYCLES X 20 TO THE INCH
SPECIFY TRACING OR DRAWING PAPER
GEOTECHNIC CONTROLS CANADA LTD
Drawdown for 1650-TW3
24-11-90
Q = 150 igpm = 982 m3/day
Tp = 2.3 Q / 4πΔs
= 2.3 (982 m3/day) / 4π(0.58m)
= 310 m2/day
s = 2.25 Tto / r2
s = 2.25 (310)(5.5 x 10-4) / 132
= 2.3 x 10-3
Δs = 1.80 - 1.22 m
= 0.58 m
1.80
1.22
to = 0.79 min
Time (min.)
Drawdown (m)
10
100
1000
10000
1.0
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
1.9
2.0

ER TEST DATA WELL#: 1650-TW4

of aquifer test:	Constant Q	Well type:	Observation
Measured:	Drifice	Data type:	Pumping
nce from pumping well:	340 m	Depth well:	45.0 m
point for w. l.'s:	T.O.C.	Pump on:	12h10 24-11-90
tion of Measuring Pt.:	0.27 m	Pump off:	12h10 27-11-90
c Water Level:	-1.92	Discharge rate:	150 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
96.00	-1.48	0.44	150.00	
127.00	-1.44	0.48		
157.00	-1.39	0.53		
187.00	-1.33	0.59		
246.00	-1.26	0.67		
276.00	-1.22	0.70		
306.00	-1.19	0.74		
369.00	-1.12	0.80		
430.00	-1.06	0.86		
617.00	-0.94	0.98		
731.00	-0.89	1.03		
847.00	-0.87	1.06		
968.00	-0.82	1.10		
1084.00	-0.83	1.10		
1208.00	-0.84	1.08		
1534.00	-0.83	1.10		
1633.00	-0.80	1.12		well access denied


Drawdown for 1650 - TW4
24-11-90
Q = 150 igpm = 982 m³/day
Tp = 2.3 Q / 4πΔs
= 2.3 (982 m³/day) / 4π(0.74m)
= 243 m²/day
s = 2.25 Tt0 / r²
= 2.25 (2.1 x 10⁻² days)(243 m²/day) / 340 m²
= 9.9 x 10⁻⁵
Δs = 1.13 m - 0.39 m
= 0.74 m
1.13 m
0.39 m
t0 = 30 min
Time (min.)
Drawdown (m)
10
100
1000
10000
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1
1.2
1.3

'ER TEST DATA WELL#: 1650-PW

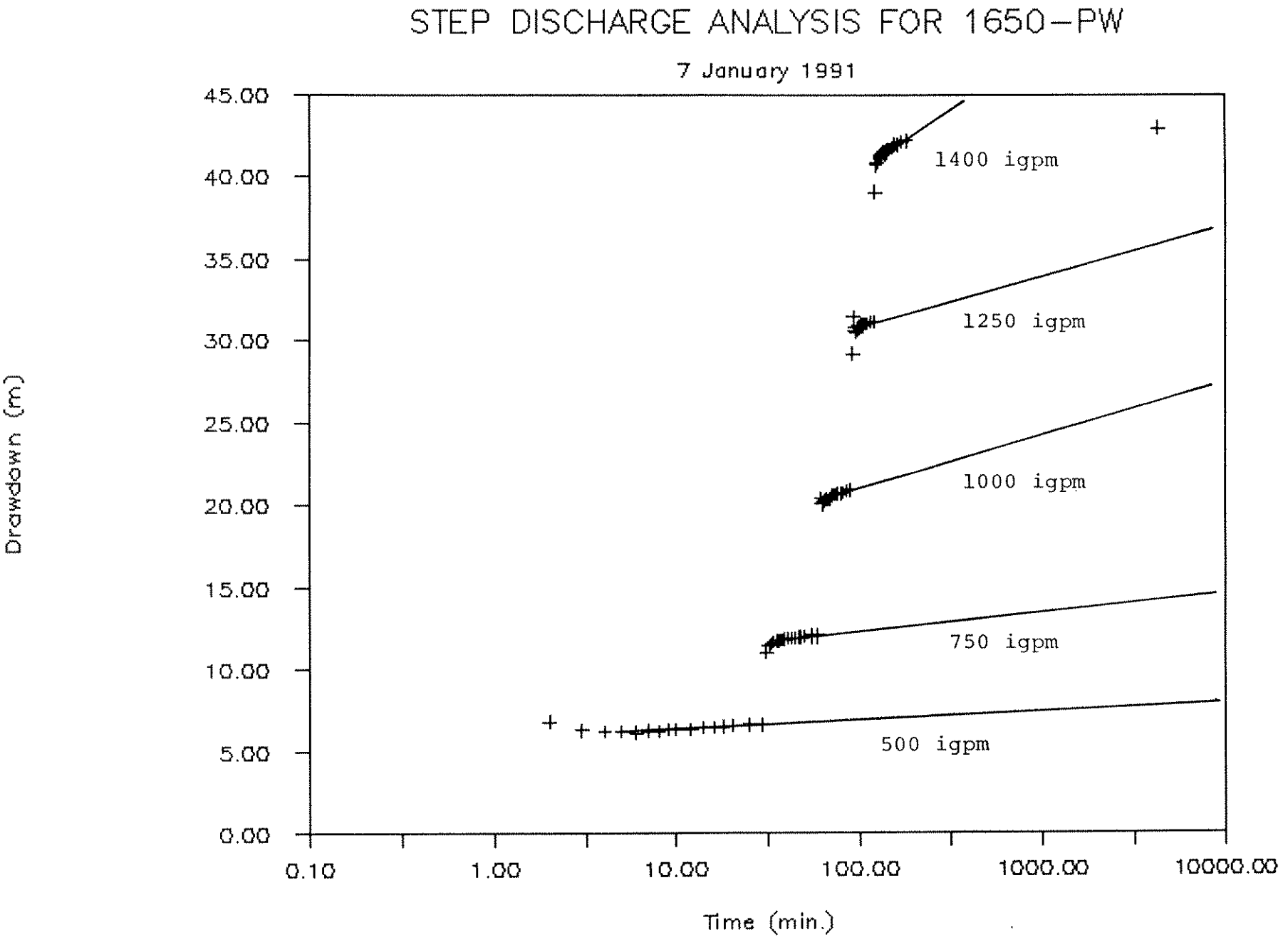
of aquifer test:	Step Q	Well type:	Production
l Measured:	Orifice	Data type:	Pumping
ınce from pumping well:	0 m	Depth pump:	44.2 m
point for w. l.'s:	T.O.P.	Pump on:	10h00 7-1-91
ıtion of Measuring Pt.:	0.61 m	Pump off:	13h00 7-1-91
c Water Level:	-2.50	Discharge rate:	500-1400 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
2.00	4.30	6.80		
3.00	3.80	6.30		
4.00	3.70	6.20		
5.00	3.70	6.20		
6.00	3.64	6.14		
7.00	3.75	6.25		
8.00	3.72	6.22		
9.00	3.84	6.34		
10.00	3.83	6.33		
12.00	3.85	6.35		
14.00	3.93	6.43		
16.00	3.95	6.45		
18.00	3.99	6.49		
20.00	4.05	6.55		
25.00	4.12	6.62		
29.00	4.15	6.65		
31.00	8.60	11.10	750.00	
32.00	8.97	11.47		
33.00	9.10	11.60		
34.00	9.24	11.74		
35.00	9.25	11.75		
36.00	9.28	11.78		
37.00	9.35	11.85		
38.00	9.36	11.86		
39.00	9.38	11.88		
40.00	9.43	11.93		
42.00	9.46	11.96		
44.00	9.46	11.96		
46.00	9.50	12.00		
48.00	9.51	12.01		
50.00	9.57	12.07		
55.00	9.62	12.12		
59.00	9.63	12.13		
61.00	18.00	20.50	1000.00	
62.00	17.68	20.18		
63.00	17.75	20.25		
64.00	17.83	20.33		
65.00	17.89	20.39		
66.00	17.93	20.43		
67.00	17.85	20.35		
68.00	17.90	20.40		
69.00	17.93	20.43		
70.00	18.14	20.64		

'ER TEST DATA WELL#: 1650-PW

of aquifer test:	Step Q	Well type:	Production
] Measured:	Orifice	Data type:	Pumping
ance from pumping well:	0 m	Depth pump:	44.2 m
. point for w. l.'s:	T.O.P.	Pump on:	10h00 7-1-91
ation of Measuring Pt.:	0.61 m	Pump off:	13h00 7-1-91
ic Water Level:	-2.50	Discharge rate:	500-1400 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
72.00	18.20	20.70		
74.00	18.23	20.73		
76.00	18.25	20.75		
78.00	18.30	20.80		
80.00	18.35	20.85		
85.00	18.45	20.95		
89.00	18.50	21.00		
91.00	26.80	29.30	1250.00	
92.00	29.10	31.60		
93.00	28.45	30.95		
94.00	28.18	30.68		
96.00	28.14	30.64		
97.00	28.25	30.75		
98.00	28.45	30.95		
99.00	28.53	31.03		
100.00	28.55	31.05		
102.00	28.60	31.10		
104.00	28.60	31.10		
106.00	28.67	31.17		
108.00	28.68	31.18		
110.00	28.68	31.18		
115.00	28.78	31.28		
119.00	28.79	31.29		
121.00	36.70	39.20	1400.00	
122.00	38.38	40.88		
123.00	38.45	40.95		
125.00	38.45	40.95		
128.00	38.86	41.36		
129.00	38.70	41.20		
130.00	38.82	41.32		
132.00	39.00	41.50		
134.00	39.13	41.63		
136.00	39.09	41.59		
138.00	38.97	41.47		
140.00	39.20	41.70		
145.00	39.25	41.75		
150.00	39.35	41.85		
155.00	39.50	42.00		
160.00	39.52	42.02		
170.00	39.68	42.18		
179.50	39.75	42.25		


STEP DISCHARGE ANALYSIS FOR 1650-PW
7 January 1991
Drawdown (m)
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1400 igpm
1250 igpm
1000 igpm
750 igpm
500 igpm
0.10
1.00
10.00
100.00
1000.00
10000.00
Time (min.)

FER TEST DATA WELL#: 1650-PW

of aquifer test:	Constant Q	Well type:	Production
Q Measured:	Orifice	Data type:	Pumping
ance from pumping well:	0 m	Depth pump:	44.2 m
. point for w. l.'s:	T.O.C.	Pump on:	9h00 9-1-91
ation of Measuring Pt.:	0.57 m	Pump off:	9h00 12-1-91
ic Water Level:	-2.50	Discharge rate:	1000 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
1.00	15.60	18.10	1000.00	
2.00	16.96	19.46		
3.00	17.38	19.88		
4.00	17.80	20.30		
5.00	17.75	20.25		
6.00	17.78	20.28		
7.00	17.83	20.33		
8.00	17.90	20.40		
9.00	18.03	20.53		
10.00	18.04	20.54		
12.00	18.13	20.63		
14.00	18.27	20.77		
16.00	18.48	20.98		
18.00	18.50	21.00		
20.00	18.65	21.15		
25.00	18.88	21.38		Q decrease
30.00	18.89	21.39		
35.00	19.00	21.50		Q decrease
40.00	19.03	21.53		
45.00	19.19	21.69		Q decrease
50.00	18.88	21.38		Q increase
55.00	18.90	21.40		
60.00	19.05	21.55		T=10C; C=600umho
74.00	19.36	21.86		Turb.=0.24NTU
80.00	19.40	21.90		
90.00	19.47	21.97		
120.00	19.88	22.38		Q decrease
150.00	20.00	22.50		
180.00	20.03	22.53		
210.00	20.17	22.67		
240.00	20.28	22.78		
270.00	20.40	22.90		
300.00	20.36	22.86		Q increase
330.00	20.58	23.08		
360.00	20.66	23.16		
420.00	20.85	23.35		
480.00	21.00	23.50		
540.00	21.10	23.60		
600.00	21.29	23.79		
660.00	21.30	23.80		
720.00	21.20	23.70		Q increase
780.00	21.85	24.35		
840.00	21.98	24.48		

FER TEST DATA WELL#: 1650-PW

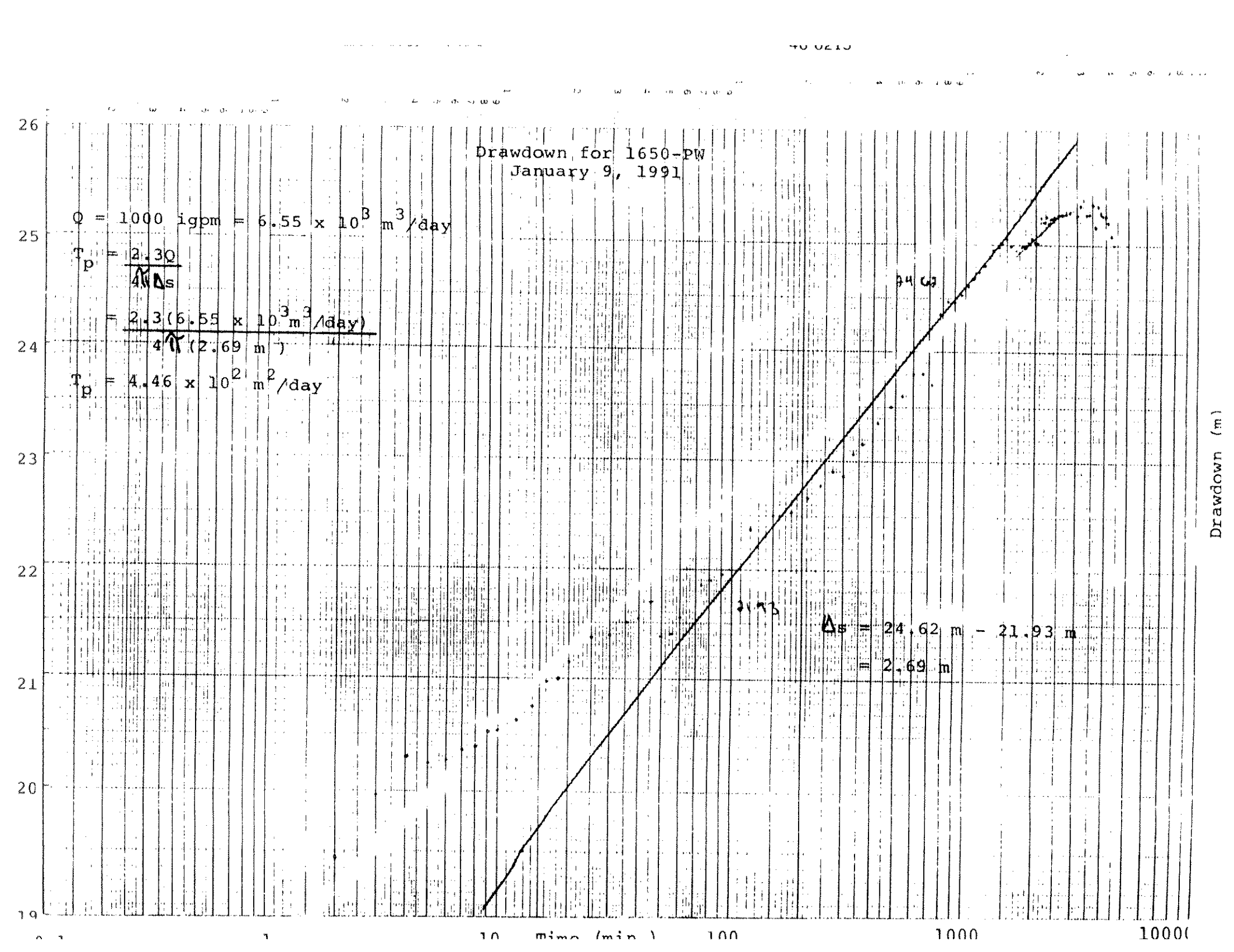
of aquifer test:	Constant Q	Well type:	Production
Q Measured:	Orifice	Data type:	Pumping
ance from pumping well:	0 m	Depth pump:	44.2 m
. point for w. l.'s:	T.O.C.	Pump on:	9h00 9-1-91
ation of Measuring Pt.:	0.57 m	Pump off:	9h00 12-1-91
ic Water Level:	-2.50	Discharge rate:	1000 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
900.00	21.96	24.46		
960.00	22.02	24.52		
1020.00	22.11	24.61		
1080.00	22.18	24.68		
1140.00	22.25	24.75		
1200.00	22.31	24.81		
1260.00	22.38	24.88		
1320.00	22.45	24.95		
1380.00	22.48	24.98		
1440.00	22.51	25.01		T=10C; C=600umho
1500.00	22.55	25.05		Turb.=0.05NTU
1560.00	22.49	24.99		
1620.00	22.45	24.95		
1680.00	22.50	25.00		
1740.00	22.48	24.98		
1800.00	22.48	24.98		
1860.00	22.52	25.02		
1920.00	22.56	25.06		
1980.00	22.52	25.02		
2041.00	22.51	25.01		
2112.00	22.73	25.23		
2160.00	22.70	25.20		
2220.00	22.75	25.25		
2280.00	22.69	25.19		
2340.00	22.73	25.23		
2400.00	22.75	25.25		
2460.00	22.76	25.26		
2520.00	22.77	25.27		
2580.00	22.77	25.27		
2640.00	22.78	25.28		
2700.00	22.78	25.28		
2760.00	22.79	25.29		
2820.00	22.80	25.30		
2880.00	22.97	25.47		T=8C; C=600umho
2940.00	22.91	25.41		Turb.=0.07NTU
3000.00	22.76	25.26		Q steady
3060.00	22.84	25.34		
3120.00	22.80	25.30		
3180.00	22.89	25.39		
3240.00	22.73	25.23		
3300.00	22.76	25.26		
3360.00	22.88	25.38		
3420.00	22.77	25.27		

ER TEST DATA WELL#: 1650-PW

of aquifer test:	Constant Q	Well type:	Production
Measured:	Orifice	Data type:	Pumping
nce from pumping well:	0 m	Depth pump:	44.2 m
point for w. l.'s:	T.O.C.	Pump on:	9h00 9-1-91
tion of Measuring Pt.:	0.57 m	Pump off:	9h00 12-1-91
ic Water Level:	-2.50	Discharge rate:	1000 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
3480.00	22.85	25.35		
3540.00	22.75	25.25		
3600.00	22.67	25.17		
3660.00	22.76	25.26		
3720.00	22.83	25.33		
3780.00	22.78	25.28		
3840.00	22.78	25.28		
3900.00	22.78	25.28		
3960.00	22.76	25.26		
4020.00	22.73	25.23		
4080.00	22.69	25.19		
4140.00	22.63	25.13		
4200.00	22.58	25.08		
4260.00	22.50	25.00		
4320.00	22.60	25.10		

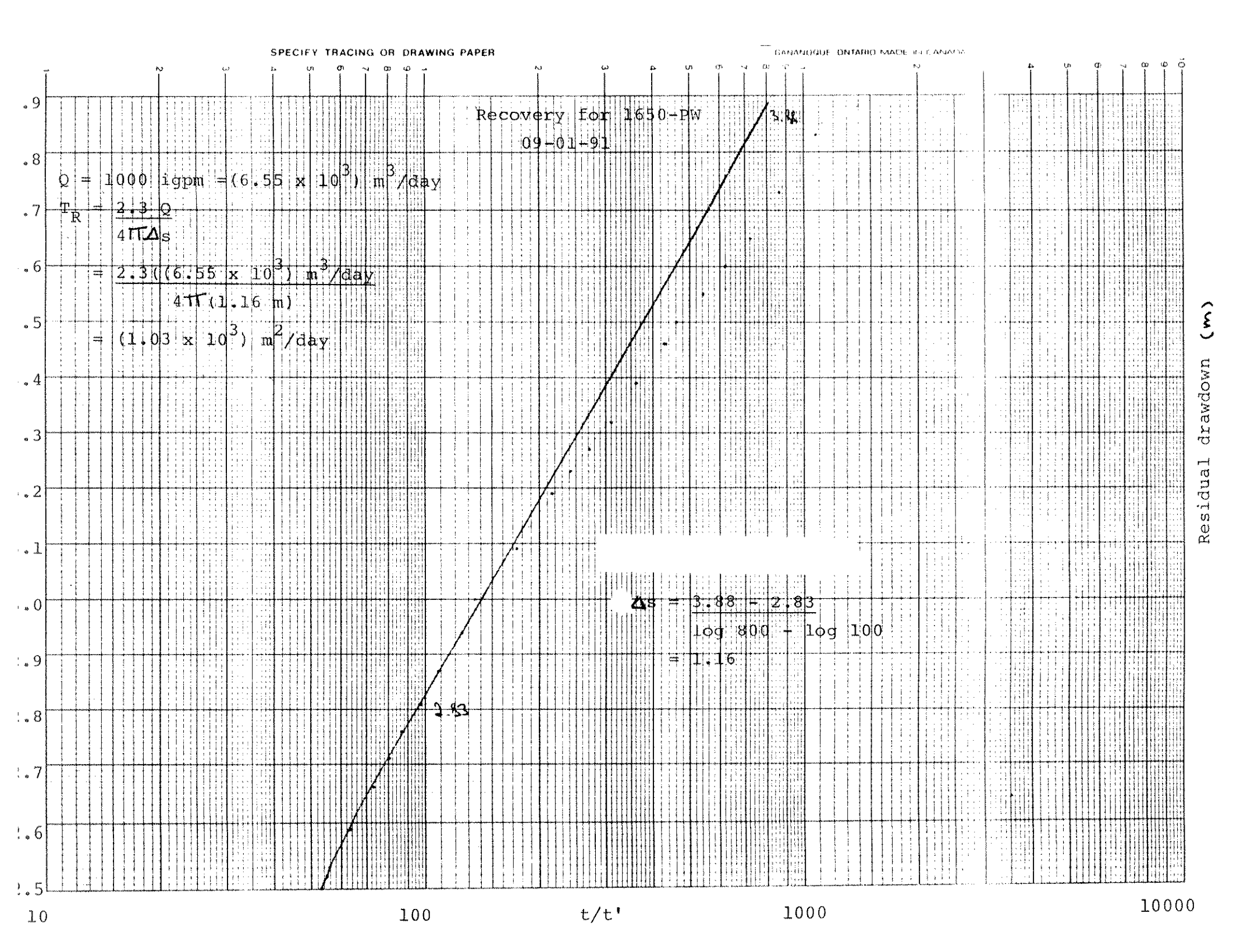

Drawdown for 1650-PW
January 9, 1991
Q = 1000 igpm = 6.55 x 10^3 m^3/day
T_p = 2.3Q / 4πΔs
= 2.3(6.55 x 10^3 m^3/day) / 4π(2.69 m)
T_p = 4.46 x 10^2 m^2/day
Δs = 24.62 m - 21.93 m
= 2.69 m
Drawdown (m)
Time (min)
26
25
24
23
22
21
20
19
1
10
100
1000
10000

FER TEST DATA WELL#: 1650-PW

of aquifer test:	Constant Q	Well type:	Production
Q Measured:	Orifice	Data type:	Recovery
ance from pumping well:	0 m	Depth pump:	44.2 m
. point for w. l.'s:	T.O.C.	Pump on:	9h00 9-1-91
ation of Measuring Pt.:	0.57 m	Pump off:	9h00 12-1-91
ic Water Level:	-2.50	Discharge rate:	1000 igpm

At t' = 0, t = 4320.00

Time (min.)	t/t'	Water Level (m)	Residual Drawdown (m)	Comments
4.00	1081.00	1.33	3.83	
5.00	865.00	1.23	3.73	
6.00	721.00	1.15	3.65	
7.00	618.14	1.10	3.60	
8.00	541.00	1.05	3.55	
9.00	481.00	1.00	3.50	
10.00	433.00	0.96	3.46	
12.00	361.00	0.89	3.39	
14.00	309.57	0.82	3.32	
16.00	271.00	0.77	3.27	
18.00	241.00	0.73	3.23	
20.00	217.00	0.69	3.19	
25.00	173.80	0.59	3.09	
30.00	145.00	0.50	3.00	
35.00	124.43	0.44	2.94	
40.00	109.00	0.37	2.87	
45.00	97.00	0.31	2.81	
50.00	87.40	0.26	2.76	
55.00	79.55	0.21	2.71	
60.00	73.00	0.16	2.66	
70.00	62.71	0.09	2.59	
80.00	55.00	0.02	2.52	
83.00	53.05	0.00	2.50	



FER TEST DATA WELL#: 1650-TW3

of aquifer test:	Constant Q	Well type:	Observation
Q Measured:	Orifice	Data type:	Pumping
ance from pumping well:	13.0 m	Depth well:	53.3 m
. point for w. l.'s:	T.O.C.	Pump on:	9h00 9-1-91
ation of Measuring Pt.:	0.50 m	Pump off:	9h00 12-1-91
ic Water Level:	-1.42	Discharge rate:	1000 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
11.00	-0.04	1.38		
13.00	-0.01	1.41		Well no longer flowing
15.00	0.03	1.45		
16.50	0.05	1.47		
18.50	0.08	1.50		
20.50	0.12	1.54		
26.00	0.20	1.62		
30.50	0.27	1.69		
35.50	0.34	1.76		
40.50	0.39	1.81		
45.50	0.43	1.85		
51.00	0.50	1.92		
55.00	0.52	1.94		
60.00	0.56	1.98		
74.00	0.67	2.09		
80.00	0.70	2.12		
90.00	0.77	2.19		
120.00	0.93	2.35		
150.00	1.07	2.49		
180.00	1.18	2.60		
210.00	1.29	2.71		
240.00	1.37	2.79		
270.00	1.41	2.83		
300.00	1.54	2.96		
330.00	1.60	3.02		
360.00	1.67	3.09		
420.00	1.77	3.19		
480.00	1.85	3.27		
540.00	1.95	3.37		
600.00	1.96	3.38		
660.00	2.06	3.48		
720.00	2.12	3.54		
780.00	2.18	3.60		
840.00	2.23	3.65		
900.00	2.28	3.70		
960.00	2.30	3.72		
1020.00	2.32	3.74		
1080.00	2.35	3.77		
1140.00	2.38	3.80		
1200.00	2.40	3.82		
1260.00	2.43	3.85		
1320.00	2.46	3.88		
1380.00	2.47	3.89		

FER TEST DATA WELL#: 1650-TW3

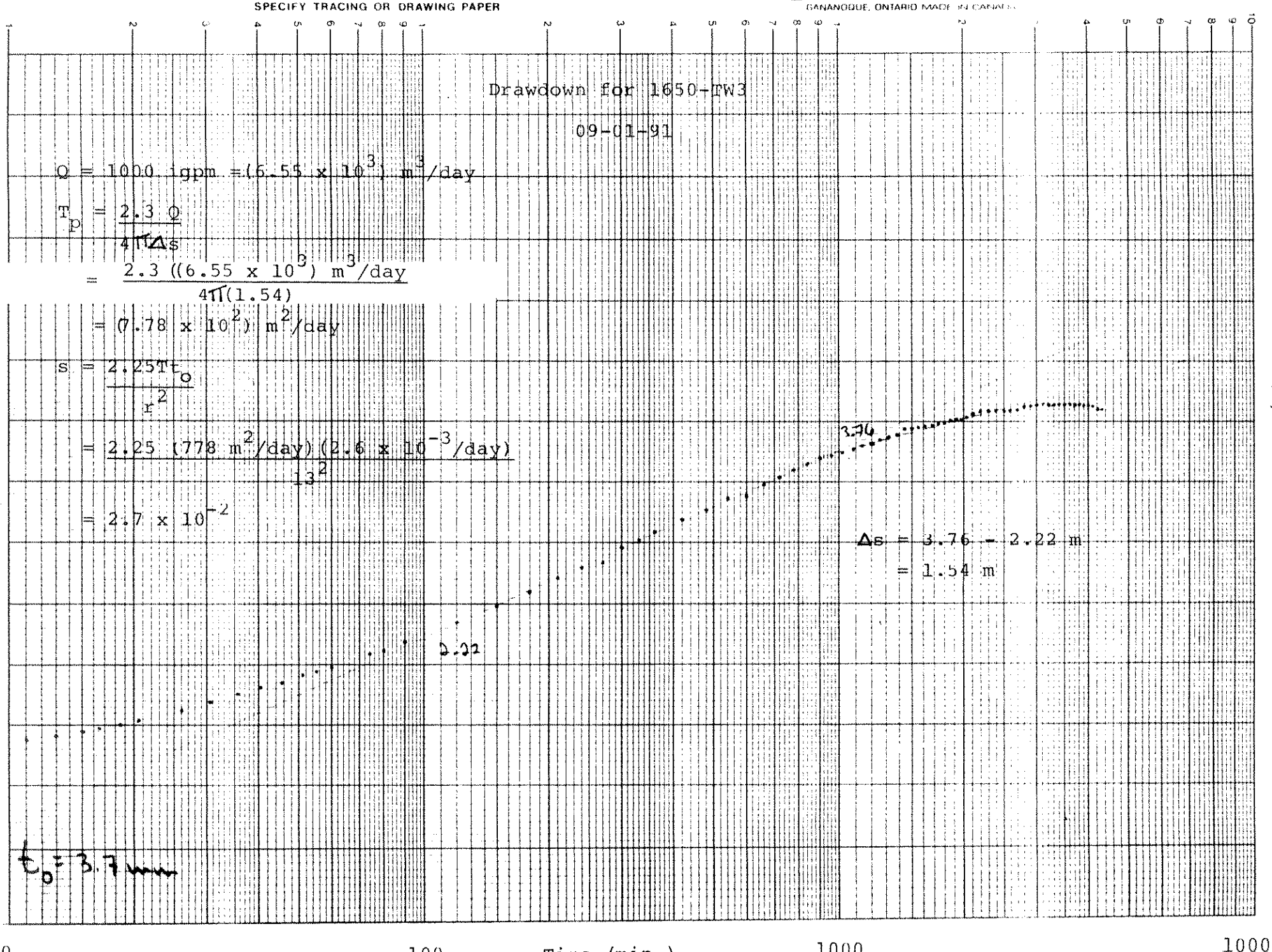
of aquifer test:	Constant Q	Well type:	Observation
Q Measured:	Orifice	Data type:	Pumping
ance from pumping well:	13.0 m	Depth well:	53.3 m
. point for w. l.'s:	T.O.C.	Pump on:	9h00 9-1-91
ation of Measuring Pt.:	0.50 m	Pump off:	9h00 12-1-91
ic Water Level:	-1.42	Discharge rate:	1000 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
1440.00	2.52	3.94		
1500.00	2.52	3.94		
1560.00	2.53	3.95		
1620.00	2.54	3.96		
1680.00	2.55	3.97		
1740.00	2.56	3.98		
1800.00	2.57	3.99		
1860.00	2.59	4.01		
1920.00	2.60	4.02		
1980.00	2.61	4.03		
2040.00	2.62	4.04		
2100.00	2.64	4.06		
2160.00	2.65	4.07		
2220.00	2.67	4.09		
2280.00	2.67	4.09		
2340.00	2.67	4.09		
2400.00	2.67	4.09		
2460.00	2.67	4.09		
2520.00	2.67	4.09		
2580.00	2.67	4.09		
2640.00	2.67	4.09		
2700.00	2.67	4.09		
2760.00	2.67	4.09		
2820.00	2.71	4.13		
2880.00	2.71	4.13		
2940.00	2.71	4.13		
3000.00	2.72	4.14		
3060.00	2.72	4.14		
3120.00	2.72	4.14		
3180.00	2.72	4.14		
3240.00	2.72	4.14		
3300.00	2.72	4.14		
3360.00	2.73	4.15		
3420.00	2.72	4.14		
3480.00	2.75	4.17		
3540.00	2.72	4.14		
3600.00	2.71	4.13		
3660.00	2.72	4.14		
3720.00	2.72	4.14		
3780.00	2.72	4.14		
3840.00	2.71	4.13		
3900.00	2.71	4.13		
3960.00	2.71	4.13		

FER TEST DATA WELL#: 1650-TW3

of aquifer test:	Constant Q	Well type:	Observation
Q Measured:	Orifice	Data type:	Pumping
ance from pumping well:	13.0 m	Depth well:	53.3 m
. point for w. l.'s:	T.O.C.	Pump on:	9h00 9-1-91
ation of Measuring Pt.:	0.50 m	Pump off:	9h00 12-1-91
ic Water Level:	-1.42	Discharge rate:	1000 igpm

Time (min.)	Water Level (m)	Drawdown (m)	Discharge (i.g.p.m.)	Comments
4020.00	2.71	4.13		
4080.00	2.71	4.13		
4140.00	2.69	4.11		
4200.00	2.68	4.10		
4260.00	2.68	4.10		
4320.00	2.68	4.10		

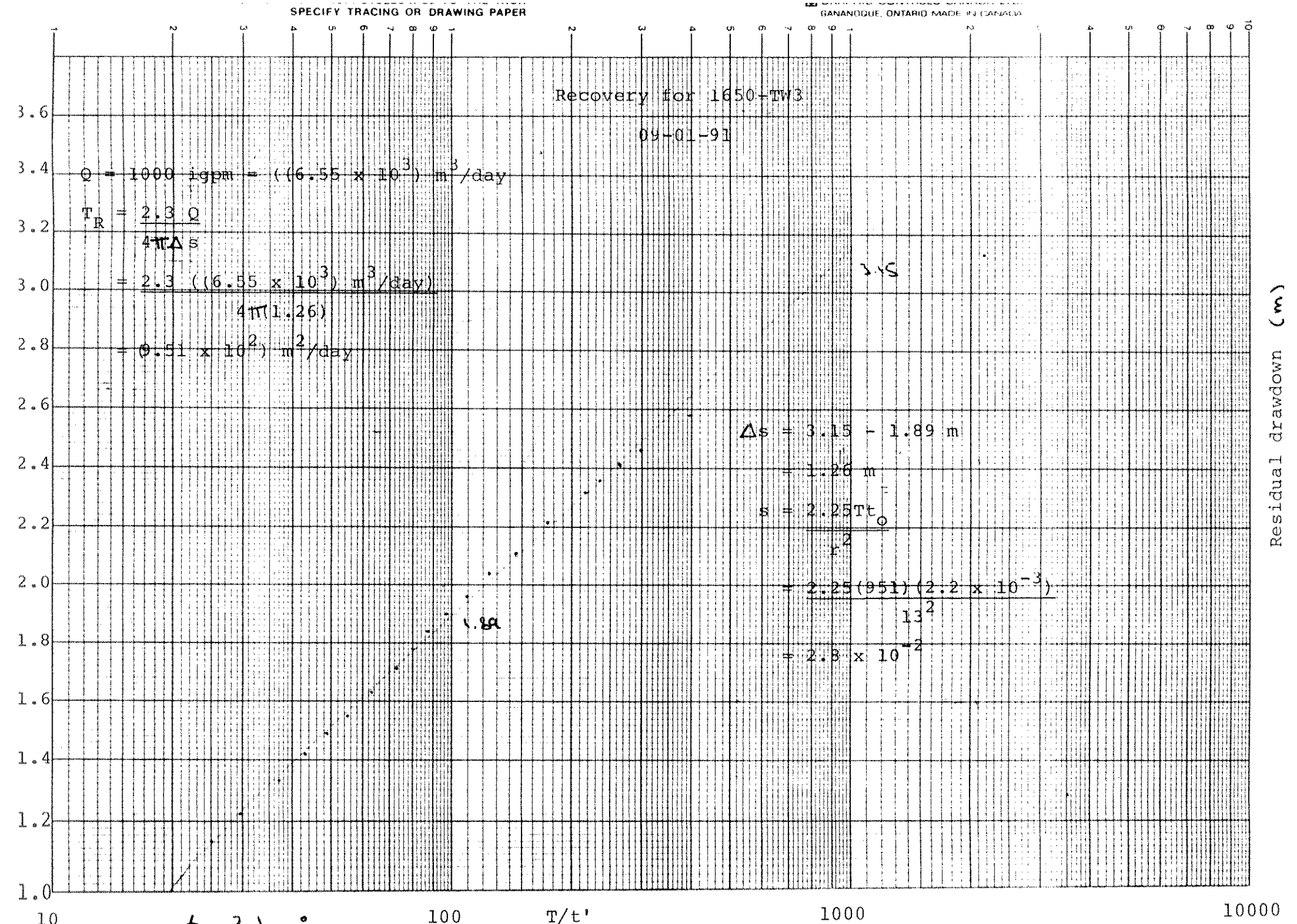


FER TEST DATA WELL#: 1650-TW3

of aquifer test:	Constant Q	Well type:	Observation
Q Measured:	Orifice	Data type:	Recovery
ance from pumping well:	13.0 m	Depth well:	53.3 m
. point for w. l.'s:	T.O.C.	Pump on:	9h00 9-1-91
ation of Measuring Pt.:	0.50 m	Pump off:	9h00 12-1-91
ic Water Level:	-1.42	Discharge rate:	1000 igpm

At t' = 0, t = 4320.00

Time (min.)	t/t'	Water Level (m)	Residual Drawdown (m)	Comments
2.00	2161.00	1.71	3.13	
11.00	393.73	1.16	2.58	
14.50	298.93	1.04	2.46	
16.50	262.82	0.99	2.41	
18.50	234.51	0.94	2.36	
20.00	217.00	0.90	2.32	
25.00	173.80	0.79	2.21	
30.00	145.00	0.69	2.11	
35.00	124.43	0.62	2.04	
40.00	109.00	0.54	1.96	
45.00	97.00	0.48	1.90	
50.00	87.40	0.42	1.84	
55.00	79.55	0.36	1.78	
60.00	73.00	0.29	1.71	
70.00	62.71	0.21	1.63	
80.00	55.00	0.13	1.55	
90.00	49.00	0.07	1.49	
102.00	43.35	0.00	1.42	
120.00	37.00	-0.09	1.33	
150.00	29.80	-0.20	1.22	
180.00	25.00	-0.28	1.14	



$Q = 1000$ igpm $= ((6.55 \times 10^{3})\ m^3/day$

$$T_R = \frac{2.3\,Q}{4\pi\Delta s}$$

$$= \frac{2.3\ ((6.55 \times 10^{3})\ m^3/day)}{4\pi(1.26)}$$

$$= (0.51 \times 10^{2})\ m^2/day$$

$\Delta s = 3.15 - 1.89$ m

$= 1.26$ m

$$s = \frac{2.25 T t_o}{r^2}$$

$$= \frac{2.25(951)(2.2 \times 10^{-3})}{13^2}$$

$= 2.8 \times 10^{-2}$

1.89

$t_o = 3.1$ min

APPENDIX F

THEORETICAL GROUNDWATER YIELD CALCULATIONS

Theoretical Groundwater Yield Calculations

A. Nepean Formation Aquifer

$T = 446\ m^2/day$

$S = 3.0 \times 10^{-5}$

$\Delta_{smax} = 42.0\ m$

$r = 0.13\ m$

Assume 100% well efficiency during pumping.
i.e. no entrance losses (bedrock well).

$$u = \frac{r^2 S}{4Tt} \qquad Q = \frac{4\P\ T\Delta_{smax}}{W(u)}$$

1. Maximum Day Design, t = 1 day

$$u = \frac{(0.13\ m)^2(3.0 \times 10^{-5})}{4(446\ m^2/day)}$$

$= 2.8 \times 10^{-10}$ W(u) = 21.419 (from table of values)

$$Q = \frac{4\P\ (446\ m^2/day)(42.0\ m)}{21.419}$$

$= 1.10 \times 10^4\ m^3/day$

$= 127\ l/s$

2. Safe Perennial Yield (10 year design), t = 3650 days

$$u = \frac{(0.13\ m)^2(3.0 \times 10^{-5})}{4(446\ m^2/day)(3650\ days)}$$

$= 7.8 \times 10^{-14}$ W(u) = 29.6048 (from table of values)

$$Q = \frac{4\P\ (446\ m^2/day)(42.0\ m)}{29.6048}$$

$= 7.95 \times 10^3\ m^3/day$

$= 92.0\ l/s$

3. 20 Year Design, t = 7300 days

$$u = \frac{(0.13\ m)^2(3.0 \times 10^{-5})}{4(446\ m^2/day)(7300\ days)}$$

$= 3.9 \times 10^{-14}$ W(u) = 30.298 (from table of values)

$$Q = \frac{4\P\ (446\ m^2/day)(42.0\ m)}{30.298}$$

$$= 7.77 \times 10^3\ m^3/day$$

$$= 89.9\ l/s$$

B. March Formation Aquifer

$T = 214\ m^2/day$

$S = 9.9 \times 10^{-5}$

$\Delta_{smax} = 42.0\ m$

$r = 0.13\ m$

Assume 100% well efficiency during pumping.
i.e. no entrance losses (bedrock well).

$$u = \frac{r^2 S}{4Tt} \qquad Q = \frac{4\P\ T\Delta_{smax}}{W(u)}$$

Safe Perennial Yield (10 year design), t = 3650 days

$$u = \frac{(0.13\ m)^2(9.9 \times 10^{-5})}{4(214\ m^2/day)(3650\ days)}$$

$= 5.4 \times 10^{-13}$ $\qquad W(u) = 27.67$ (from table of values)

$$Q = \frac{4\P\ (214\ m^2/day)(42.0\ m)}{27.67}$$

$$= 4.08 \times 10^3\ m^3/day$$

$$= 47.2\ l/s$$

C. Oxford Formation Aquifer

$T = 192\ m^2/day$

$S = 1.8 \times 10^{-5}$

$\Delta_{smax} = 8.40\ m$

$r = 0.10\ m$

Assume 100% well efficiency during pumping.
i.e. no entrance losses (bedrock well).

$$u = \frac{r^2 S}{4Tt} \qquad Q = \frac{4\pi T \Delta_{smax}}{W(u)}$$

Safe Perennial Yield (10 year design), t = 3650 days

$$u = \frac{(0.10\ m)^2 (1.8 \times 10^{-5})}{4(192\ m^2/day)(3650\ days)}$$

$= 6.4 \times 10^{-14}$ $\qquad W(u) = 29.8027$ (from table of values)

$$Q = \frac{4\pi\ (192\ m^2/day)(8.40\ m)}{29.8027}$$

$= 680\ m^3/day$

$= 7.87\ l/s$

Well Interference Calculations

$Q = 89.9$ l/s
$= 7.77 \times 10^3$ m^3/day

$t = 7300$ days

$$u = \frac{r^2 S}{4Tt} \qquad \Delta_{smax} = \frac{QW(u)}{4\P T}$$

1. 500 m Radius

$$u = \frac{(500 \text{ m})^2 (3.0 \times 10^{-5})}{4(446 \text{ m}^2/\text{day})(7300 \text{ days})}$$

$= 5.8 \times 10^{-7}$ $\quad W(u) = 13.783$ (from table of values)

$$\Delta_{smax} = \frac{(7.77 \times 10^3)(13.783)}{4\P (446 \text{ m}^2/\text{day})}$$

$= 19.1$ m

2. 1000 m Radius

$$u = \frac{(1000 \text{ m})^2 (3.0 \times 10^{-5})}{4(446 \text{ m}^2/\text{day})(7300 \text{ days})}$$

$= 2.3 \times 10^{-6}$ $\quad W(u) = 12.4054$ (from table of values)

$$\Delta_{smax} = \frac{(7.77 \times 10^3)(12.4054)}{4\P (446 \text{ m}^2/\text{day})}$$

$= 17.2$ m

Predicted Drawdown Calculations

$r = 0.15$ m

$t = 1$ day

$$u = \frac{r^2 S}{4Tt} \qquad \Delta_{smax} = \frac{QW(u)}{4\P T}$$

1. $Q = 106.1$ l/s
   $= 9.170 \times 10^3$ m^3/day

$$u = \frac{(0.15 \text{ m})^2 (3.0 \times 10^{-5})}{4(446 \text{ m}^2/\text{day})}$$

$= 3.8 \times 10^{-10}$ $\quad W(u) = 21.1136$ (from table of values)

$$\Delta_{smax} = \frac{(9.170 \times 10^3)(21.1136)}{4\P\ (446 \text{ m}^2/\text{day})}$$

$= 34.5$ m

2. $Q = 75.76$ l/s
   $= 6.548 \times 10^3$ m^3/day

$$u = \frac{(0.15 \text{ m})^2 (3.0 \times 10^{-5})}{4(446 \text{ m}^2/\text{day})}$$

$= 3.8 \times 10^{-10}$ $\quad W(u) = 21.1136$ (from table of values)

$$\Delta_{smax} = \frac{(6.548 \times 10^3)(21.1136)}{4\P\ (446 \text{ m}^2/\text{day})}$$

$= 24.7$ m

APPENDIX G

GROUNDWATER QUALITY RESULTS

Received 4/02/88

ACCUTEST LABORATORIES LTD.

Report No: A8-0040

Client:

Water & Earth Science Assoc.

Date : Feb.2/88

Attn: C. Ryan

Project: Metcalfe-TW1

Parameter	Units	Sample TW1	Sample	Sample	Sample
Fe	mg/L	0.34			
Mn	mg/L	<0.05			
Hardness	mg/L $CaCO_3$	280			
Alkalinity	mg/L $CaCO_3$	309			
pH		7.40			
Conductivity	umhos	867			
F	mg/L	0.26			
Na	mg/L	13			
$N\text{-}NO_3$	mg/L	<0.10			
$N\text{-}NO_2$	mg/L	<0.10			
$N\text{-}NH_3$	mg/L	<0.10			
SO_4	mg/L	58			
CL	mg/L	59			
Phenols	mg/L	<0.002			
Turbidity	NTU	<1.0			
Colour	Pt/Co Units	<2			
Ca	mg/L	64			
Mg	mg/L	28			
Tannin&Lignin	mg/L	<2.0			

146 Colonnade Rd., Suite 202, Nepean, Ontario K2E 7Y3 (613) 727-5692

LAB REPORT NO.: A8-0040

ACCUTEST Laboratories Ltd.

146 Colonnade Road, Suite 202, Nepean, Ontario K2E 7Y3 (613) 727-5692

BACTERIOLOGICAL ASSESSMENT OF WATER
ASSESSMENT BACTERIOLOGIQUE DE L'EAU

NAME/NOM: C. RYAN	
COMPANY/SOCIÉTÉ: WATER & EARTH SCIENCE ASSOCIATES	
STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL: P.O. BOX 430	CITY, TOWN/VILLE: CARP
PROVINCE: ONTARIO	POSTAL CODE/CODE POSTAL:
TELEPHONE/TÉLÉPHONE Area Code/Indicatif Régional: 831-1883	Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
METCALFE	METCALFE-TW1	25 JAN 88	

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE	NON-DRINKING WATER/EAU NON POTABLE
☐ Treated/Épuré ☐ Non-treated/Non épuré	☐ River/Rivière ☐ Pool/Piscine
☐ Existing well/Puits existant	☐ Sewage/Égout ☐ Lake/Lac
☒ New well/Puits nouveau	☐ Other/Autre
	Specify/à décrire:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. *Fill bottle to about ½ inch from the top.*
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Remettre l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: *Les échantillons doivent être arrivés au laboratoire dans les 48 heures après le prélèvement, les échantillons d'eau non potable doivent* être délivrés dans les 6 heures ou, si réfrigérées, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DE TESTS				COMMENTS/REMARQUES
BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES Based on 100 ml volume/Base sur un volume de 100 ml				
Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond	
0	0	0		

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au dos

Date: Jan 28/88 Analyst: P. Hall

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel (613) 727-5692 Fax (613) 727-5222

LAB REPORT NO.: A0-1692

REPORT OF ANALYSES

Client: W E S A

Date: September 28, 1990

Attn: Mr. D. B. Corbett

Project: 1650

Parameter	Units	Sample	Sample	Sample	Sample	Sample
		TW 4				
Fe	mg/L	0.09				
Mn	mg/L	<0.05				
Hardness	mg/L $CaCO_3$	229				
Alkalinity	mg/L $CaCO_3$					
pH		7.89				
Conductivity	umhos	623				
F	mg/L	0.43				
Na	mg/L	51				
$N\text{-}NO_3$	mg/L	0.10				
$N\text{-}NO_2$	mg/L					
$N\text{-}NH_3$	mg/L					
SO_4	mg/L	42				
CL	mg/L	26				
Phenols	mg/L					
Turbidity	NTU					
Colour	Pt/Co Units					
Ca	mg/L					
Mg	mg/L					
Tannin & Lignin	mg/L					
Total Nitrogen	mg/L					
K	mg/L					
H_2S	mg/L	0.7				

ANALYST: _____

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: W E S A

LAB REPORT NO: A0-1906

DATE: Oct.26,1990

Attn: D. B. Corbett

PROJECT:

PARAMETER	UNITS	Sample TW 3	Sample	Sample	Sample	Sample
Fe	mg/L	<0.05				
Mn	mg/L	<0.05				
Hardness	mg/L CaCO3	231				
Alkalinity	mg/L CaCO3					
pH		7.66				
Conductivity	umhos/cm	667				
F	mg/L	0.40				
Na	mg/L	56				
N-NO3	mg/L	<0.10				
N-NO2	mg/L					
N-NH3	mg/L					
SO4	mg/L	48				
Cl	mg/L	38				
Phenols	mg/L					
Turbidity	NTU					
Colour	Pt/Co Units					
Ca	mg/L					
Mg	mg/L					
Tann./Lig.	mg/L					
Total N	mg/L					
K	mg/L					

ANALYST: _____

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: Water & Earth Sc. Assoc.

LAB REPORT NO: A0-2205

DATE: Dec.3,1990

Attention: D.B. Corbett

PROJECT: 1650

PARAMETER	UNITS	Sample TW 3	Sample	Sample	Sample	Sample
Fe	mg/L	<0.05				
Mn	mg/L	<0.05				
Hardness	mg/L CaCO3	242				
Alkalinity	mg/L CaCO3	214				
pH		7.82				
Conductivity	umhos/cm	738				
F	mg/L	0.40				
Na	mg/L	56				
N-NO3	mg/L	<0.10				
N-NO2	mg/L	<0.10				
N-NH3	mg/L	<0.10				
SO4	mg/L	55				
Cl	mg/L	56				
Phenols	mg/L	<0.002				
Turbidity	NTU	<1.0				
Colour	Pt/Co Units	<2				
Ca	mg/L	49				
Mg	mg/L	29				
Tann./Lig.	mg/L	<1.0				
Total N	mg/L	<0.10				
K	mg/L	8				
TOC	mg/L	0.9				

ANALYST: _____

LAB REPORT NO.:
Numéro de rapport: A0-2205

(1)

ACCUTEST Laboratories Ltd.

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y1 (613) 727-5692

BACTERIOLOGICAL ASSESSMENT OF WATER
ÉVALUATION BACTÉRIOLOGIQUE DE L'EAU

NAME/NOM: J.B Corbett

COMPANY/SOCIÉTÉ: WESA

STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL — CITY, TOWN/VILLE

PROVINCE — POSTAL CODE/CODE POSTAL

TELEPHONE/TÉLÉPHONE
Area Code/Indicatif Régional: — Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
	1650 - TW3	14-11-90	

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE

☐ Treated/Épurée ☐ Non-treated/Non-épurée

☐ Existing well/Puits existant

☐ New well/Nouveau puits

NON-DRINKING WATER/EAU NON POTABLE

☐ River/Rivière ☐ Pool/Piscine

☐ Sewage/Égout ☐ Lake/Lac

☐ Other/Autre

Specify: ____________
Spécifiez:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate de sodium.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. Fill bottle to about ½ inch from the top.
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Retourner l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: Les échantillons doivent arriver au laboratoire dans les 48 heures après le prélèvement; les échantillons d'eau non-potable doivent être retournés dans les 6 heures ou, si réfrigérés, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DES TESTS				COMMENTS/REMARQUES
BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES Based on 100 ml volume/Basé sur un volume de 100 ml				
Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond	
0	0	0	—	

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au verso

Date: Nov 19/90

Analyst:
Technologue: [signature]

LAB REPORT NO.:
Numéro de rapport: 40-2205

① duplicate

ACCUTEST Laboratories Ltd.

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y1 (613) 727-5692

BACTERIOLOGICAL ASSESSMENT OF WATER
ÉVALUATION BACTÉRIOLOGIQUE DE L'EAU

NAME/NOM: D.E. Corbett	
COMPANY/SOCIÉTÉ: WESA	
STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL	CITY, TOWN/VILLE
PROVINCE	POSTAL CODE/CODE POSTAL
TELEPHONE/TÉLÉPHONE Area Code/Indicatif Régional:	Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
	1450-TW3	14-11-90	

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE	NON-DRINKING WATER/EAU NON POTABLE
☐ Treated/Épurée ☐ Non-treated/Non-épurée	☐ River/Rivière ☐ Pool/Piscine
☐ Existing well/Puits existant	☐ Sewage/Égout ☐ Lake/Lac
☐ New well/Nouveau puits	☐ Other/Autre
	Specify: ______ Spécifiez:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate de sodium.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. Fill bottle to about ½ inch from the top.
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Retourner l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: Les échantillons doivent arriver au laboratoire dans les 48 heures après le prélèvement; les échantillons d'eau non-potable doivent être retournés dans les 6 heures ou, si réfrigérés, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DES TESTS				COMMENTS/REMARQUES
BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES Based on 100 ml volume/Basé sur un volume de 100 ml				
Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond	
0	0	0	/	

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au verso

Date: Nov 18/90

Analyst:
Technologue: [signature]

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: Water & Earth Sc.Assoc.

LAB REPORT NO: A0-2328

DATE: Dec.13,1990

Attention: D.B.Corbett

PROJECT: 1650

PARAMETER	UNITS	Sample PW-1hr.	Sample PW-24hrs	Sample	Sample	Sample
Fe	mg/L	0.07	0.07			
Mn	mg/L					
Hardness	mg/L CaCO3					
Alkalinity	mg/L CaCO3					
pH						
Conductivity	umhos/cm	753	748			
F	mg/L					
Na	mg/L					
N-NO3	mg/L	<0.10	<0.10			
N-NO2	mg/L					
N-NH3	mg/L					
SO4	mg/L	62	58			
Cl	mg/L	58	57			
Phenols	mg/L					
Turbidity	NTU					
Colour	Pt/Co Units	2	<2			
Ca	mg/L					
Mg	mg/L					
Tann./Lig.	mg/L					
Total N	mg/L					
K	mg/L					
TDS	mg/L	442	424			
H2S	mg/L	0.33	0.31			

ANALYST: _____

LAB REPORT NO.:
Numéro de rapport: A0-2328 (1)

ACCUTEST Laboratories Ltd.

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y1 (613) 727-5692

BACTERIOLOGICAL ASSESSMENT OF WATER
ÉVALUATION BACTÉRIOLOGIQUE DE L'EAU

NAME/NOM: J B CORBETT

COMPANY/SOCIÉTÉ:

STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL:

CITY, TOWN/VILLE:

PROVINCE:

POSTAL CODE/CODE POSTAL:

TELEPHONE/TÉLÉPHONE
Area Code/Indicatif Régional:
Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
	1650-PW-1HOUR	24-11-90	

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE

- ☐ Treated/Épurée
- ☐ Non-treated/Non-épurée
- ☐ Existing well/Puits existant
- ☐ New well/Nouveau puits

NON-DRINKING WATER/EAU NON POTABLE

- ☐ River/Rivière
- ☐ Pool/Piscine
- ☐ Sewage/Égout
- ☐ Lake/Lac
- ☐ Other/Autre

Specify:
Spécifiez:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate de sodium.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. Fill bottle to about ½ inch from the top.
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Retourner l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: Les échantillons doivent arriver au laboratoire dans les 48 heures après le prélèvement; les échantillons d'eau non-potable doivent être retournés dans les 6 heures ou, si réfrigérés, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DES TESTS

BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES
Based on 100 ml volume/Basé sur un volume de 100 ml

Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond
0	0	0	—

COMMENTS/REMARQUES

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au verso

Date: Nov 28 / 90

Analyst/Technologue: [signature]

LAB REPORT NO.:
Numéro de rapport: AC-2328

(2)

ACCUTEST Laboratories Ltd.

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y1 (613) 727-5692

BACTERIOLOGICAL ASSESSMENT OF WATER
ÉVALUATION BACTÉRIOLOGIQUE DE L'EAU

NAME/NOM: DB CUMBERTT

COMPANY/SOCIÉTÉ: USA

STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL

CITY, TOWN/VILLE

PROVINCE

POSTAL CODE/CODE POSTAL

TELEPHONE/TÉLÉPHONE
Area Code/Indicatif Régional: Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
	1250-PW-24 Hour	25-11-90	

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE

- ☐ Treated/Épurée
- ☐ Non-treated/Non-épurée
- ☐ Existing well/ Puits existant
- ☐ New well/Nouveau puits

NON-DRINKING WATER/EAU NON POTABLE

- ☐ River/Rivière
- ☐ Pool/ Piscine
- ☐ Sewage/ Égout
- ☐ Lake/Lac
- ☐ Other/Autre

Specify: _____
Spécifiez:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate de sodium.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. Fill bottle to about ½ inch from the top.
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Retourner l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: Les échantillons doivent arriver au laboratoire dans les 48 heures après le prélèvement; les échantillons d'eau non-potable doivent être retournés dans les 6 heures ou, si réfrigérés, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DES TESTS

BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES
Based on 100 ml volume/Basé sur un volume de 100 ml

Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond
0	0	0	✓

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au verso

COMMENTS/REMARQUES

Date: NOV 28 / 90

Analyst: P. Malone
Technologue:

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: Water & Earth Sc. Assoc.

LAB REPORT NO: A0-2344

DATE: Dec.11,1990

Attention: D.B. Corbett

PROJECT: 1650

PARAMETER	UNITS	Sample PW 48 hrs	Sample PW 72 hrs.	Sample	Sample	Sample
Fe	mg/L	0.06	0.07			
Mn	mg/L		<0.05			
Hardness	mg/L CaCO3		238			
Alkalinity	mg/L CaCO3		220			
pH			7.88			
Conductivity	umhos/cm	749	746			
F	mg/L		0.45			
Na	mg/L		60			
N-NO3	mg/L	<0.10	<0.10			
N-NO2	mg/L		<0.10			
N-NH3	mg/L		<0.10			
SO4	mg/L	66	61			
Cl	mg/L	60	59			
Phenols	mg/L		<0.002			
Turbidity	NTU		<1.0			
Colour	Pt/Co Units	<2	<2			
Ca	mg/L		49			
Mg	mg/L		28			
Tann./Lig.	mg/L		<1.0			
Total N	mg/L		<0.10			
K	mg/L		8			
TDS	mg/L	440				

ANALYST: _____

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: Water & Earth Sc.Assoc.

LAB REPORT NO: A0--2344

DATE: Dec.11,1990

Attention: D.B.Corbett

PROJECT: 1650

PARAMETER	UNITS	Sample PW 72 hrs.	Sample	Sample	Sample	Sample
As	mg/L	<0.01				
Ba	mg/L	0.04				
B	mg/L	0.22				
Cd	mg/L	<0.002				
Cr	mg/L	<0.01				
CN-	mg/L	<0.01				
Pb	mg/L	<0.002				
Hg	mg/L	<0.001				
Se	mg/L	<0.01				
Ag	mg/L	<0.01				
Cu	mg/L	<0.01				
H2S	mg/L	0.36				
TDS	mg/L	442				
TOC	mg/L	1.2				
Zn	mg/L	<0.01				
U	mg/L	<0.01				
Radionuclides						
Cs 137	Bq/L	<1				
I 131	Bq/L	<1				
Ra 226	Bq/L	<0.1				
Sr 90	Bq/L	<1				
Tritium	Bq/L	<100				

ANALYST: _____

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: WESA

LAB REPORT NO: A0-2344

DATE: Dec.11,1990

D.B.Corbett

PROJECT: 1650

PARAMETER	UNITS	Sample PW 72 hrs.	Sample	Sample	Sample	Sample
Pesticides						
Aldrin & Dieldrin	mg/L	<0.0007				
Carbaryl	mg/L	<0.07				
Chlordane	mg/L	<0.007				
DDT	mg/L	<0.03				
Diazinon	mg/L	<0.014				
Endrin	mg/L	<0.0002				
Heptachlor + Heptachlor Epoxide	mg/L	<0.003				
Lindane	mg/L	<0.004				
Methoxychlor	mg/L	<0.1				
Methyl Parathion	mg/L	<0.007				
Parathion	mg/L	<0.035				
Toxaphene	mg/L	<0.005				
2,4-D	mg/L	<0.1				
2,4,5-TP	mg/L	<0.01				
Trihalomethanes	mg/L	<0.35				
PCB's	mg/L	<0.003				

ANALYST: _____

LAB REPORT NO.: AO-2344
Numéro de rapport:

ACCUTEST Laboratories Ltd.

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y1 (613) 727-5692

BACTERIOLOGICAL ASSESSMENT OF WATER
ÉVALUATION BACTÉRIOLOGIQUE DE L'EAU

NAME/NOM: D B CORBETT

COMPANY/SOCIÉTÉ: WESA

STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL | CITY, TOWN/VILLE

PROVINCE | POSTAL CODE/CODE POSTAL

TELEPHONE/TÉLÉPHONE: Area Code/Indicatif Régional | Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
	1650-PW-48 Hours	26-11-90	

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE

- ☐ Treated/Épurée
- ☐ Non-treated/Non-épurée
- ☐ Existing well/ Puits existant
- ☐ New well/Nouveau puits

NON-DRINKING WATER/EAU NON POTABLE

- ☐ River/Rivière
- ☐ Pool/ Piscine
- ☐ Sewage/ Égout
- ☐ Lake/Lac
- ☐ Other/Autre

Specify: _____
Spécifiez:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate de sodium.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. Fill bottle to about ½ inch from the top.
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Retourner l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: Les échantillons doivent arriver au laboratoire dans les 48 heures après le prélèvement; les échantillons d'eau non-potable doivent être retournés dans les 6 heures ou, si réfrigérés, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DES TESTS

BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES
Based on 100 ml volume/Basé sur un volume de 100 ml

Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond
0	0	0	<10/ml

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au verso

COMMENTS/REMARQUES

Nov 30 /90

P. Rankin

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: WESA

LAB REPORT NO: A0-2571

DATE: Dec.31.1990

Attention: D.B. Corbett

PROJECT: 1650

PARAMETER	UNITS	Sample PW	Sample	Sample	Sample	Sample
Fe	mg/L	0.19				
Mn	mg/L	<0.05				
Hardness	mg/L CaCO3	307				
Alkalinity	mg/L CaCO3					
pH		7.69				
Conductivity	umhos/cm	980				
F	mg/L	0.40				
Na	mg/L	92				
N-NO3	mg/L	<0.10				
N-NO2	mg/L					
N-NH3	mg/L					
SO4	mg/L	90				
Cl	mg/L	130				
Phenols	mg/L					
Turbidity	NTU					
Colour	Pt/Co Units					
Ca	mg/L					
Mg	mg/L					
Tann./Lig.	mg/L					
Total N	mg/L					
K	mg/L					
H2S	mg/L	0.07				

ANALYST: _____

ACCUTEST LABORATORIES LTD.
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REPORT OF ANALYSES

CLIENT: Water & Earth Sc. Assoc.
LAB REPORT NO: A1-0060
DATE: Jan.21,1991
Attention: D.B. Corbett
PROJECT: 1650

PARAMETER	UNITS	Sample PW 1hr.	Sample PW 24hrs	Sample	Sample	Sample
Fe	mg/L	0.06	0.05			
Mn	mg/L	<0.05	<0.05			
Hardness	mg/L CaCO3	271	285			
Alkalinity	mg/L CaCO3					
pH		7.68	7.91			
Conductivity	umhos/cm	1065	1065			
F	mg/L	0.37	0.38			
Na	mg/L	88	92			
N-NO3	mg/L	<0.10	<0.10			
N-NO2	mg/L					
N-NH3	mg/L					
SO4	mg/L	95	100			
Cl	mg/L	145	144			
Phenols	mg/L					
Turbidity	NTU					
Colour	Pt/Co Units					
Ca	mg/L					
Mg	mg/L					
Tann./Lig.	mg/L					
Total N	mg/L					
K	mg/L					
H2S	mg/L	<0.02	<0.02			

ANALYST: _____

LAB REPORT NO.:
Numéro de rapport: A1-0060

ACCUTEST Laboratories Ltd.

(1)

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

BACTERIOLOGICAL ASSESSMENT OF WATER
ÉVALUATION BACTÉRIOLOGIQUE DE L'EAU

NAME/NOM: D B Corbett	
COMPANY/SOCIÉTÉ: WESA	
STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL	CITY, TOWN/VILLE
PROVINCE	POSTAL CODE/CODE POSTAL
TELEPHONE/TÉLÉPHONE Area Code/Indicatif Régional:	Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
	1650 - PW - 1 HOUR		

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE	NON-DRINKING WATER/EAU NON POTABLE
☐ Treated/Épurée ☐ Non-treated/Non-épurée	☐ River/Rivière ☐ Pool/Piscine
☐ Existing well/Puits existant	☐ Sewage/Égout ☐ Lake/Lac
☐ New well/Nouveau puits	☐ Other/Autre Specify: / Spécifiez:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate de sodium.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. Fill bottle to about ½ inch from the top.
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Retourner l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: Les échantillons doivent arriver au laboratoire dans les 48 heures après le prélèvement; les échantillons d'eau non-potable doivent être retournés dans les 6 heures ou, si réfrigérés, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DES TESTS				COMMENTS/REMARQUES
BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES Based on 100 ml volume/Basé sur un volume de 100 ml				
Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond	
0	0	0	✓	

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au verso

Date: Jan 14 / 91

Analyst: / Technologue: P. Raulene

LAB REPORT NO.: 91-0060
Numéro de rapport:

(2)

ACCUTEST Laboratories Ltd.

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

BACTERIOLOGICAL ASSESSMENT OF WATER
ÉVALUATION BACTÉRIOLOGIQUE DE L'EAU

NAME/NOM: DB Cobett	
COMPANY/SOCIÉTÉ: WESA	
STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL	CITY, TOWN/VILLE
PROVINCE	POSTAL CODE/CODE POSTAL
TELEPHONE/TÉLÉPHONE Area Code/Indicatif Régional:	Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
	1650 - PW - 24 HOUR		

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE	NON-DRINKING WATER/EAU NON POTABLE
☐ Treated/Épurée ☐ Non-treated/Non-épurée	☐ River/Rivière ☐ Pool/ Piscine
☐ Existing well/ Puits existant	☐ Sewage/ Égout ☐ Lake/Lac
☐ New well/Nouveau puits	☐ Other/Autre
	Specify: _____ Spécifiez:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate de sodium.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. Fill bottle to about ½ inch from the top.
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Retourner l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: Les échantillons doivent arriver au laboratoire dans les 48 heures après le prélèvement; les échantillons d'eau non-potable doivent être retournés dans les 6 heures ou, si réfrigérés, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DES TESTS				COMMENTS/REMARQUES
BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES Based on 100 ml volume/Basé sur un volume de 100 ml				
Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond	
0	0	0	✓	

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au verso

Date: Jan 14/91

Analyst: C. Boudreau
Technologue:

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: Water & Earth Sc. Assoc.

LAB REPORT NO: A1-0068

DATE: Jan.23.1991

Attention: D.B.Corbett

PROJECT: 1650

PARAMETER	UNITS	Sample	Sample	Sample	Sample	Sample
		PW 48hrs				
Fe	mg/L	<0.05				
Mn	mg/L	<0.05				
Hardness	mg/L CaCO3	257				
Alkalinity	mg/L CaCO3					
pH		8.02				
Conductivity	umhos/cm	1052				
F	mg/L	0.38				
Na	mg/L	90				
N-NO3	mg/L	<0.10				
N-NO2	mg/L					
N-NH3	mg/L					
SO4	mg/L	90				
Cl	mg/L	135				
Phenols	mg/L					
Turbidity	NTU					
Colour	Pt/Co Units					
Ca	mg/L					
Mg	mg/L					
Tann./Lig.	mg/L					
Total N	mg/L					
K	mg/L					
H2S	mg/L	<0.02				

ANALYST: _____

LAB REPORT NO.:
Numéro de rapport: A1-0068

ACCUTEST Laboratories Ltd.

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y1 (613) 727-5692

BACTERIOLOGICAL ASSESSMENT OF WATER
ÉVALUATION BACTÉRIOLOGIQUE DE L'EAU

NAME/NOM: DB Corbett	
COMPANY/SOCIÉTÉ: WESA	
STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL	CITY, TOWN/VILLE
PROVINCE	POSTAL CODE/CODE POSTAL
TELEPHONE/TÉLÉPHONE Area Code/Indicatif Régional:	Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
	1650-PW-48 Hours	11-1-91	

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE	NON-DRINKING WATER/EAU NON POTABLE
☐ Treated/Épurée ☐ Non-treated/Non-épurée	☐ River/Rivière ☐ Pool/ Piscine
☐ Existing well/ Puits existant	☐ Sewage/ Égout ☐ Lake/Lac
☐ New well/Nouveau puits	☐ Other/Autre
	Specify: _____ Spécifiez:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate de sodium.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. Fill bottle to about ½ inch from the top.
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Retourner l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: Les échantillons doivent arriver au laboratoire dans les 48 heures après le prélèvement; les échantillons d'eau non-potable doivent être retournés dans les 6 heures ou, si réfrigérés, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DES TESTS				COMMENTS/REMARQUES
BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES Based on 100 ml volume/Basé sur un volume de 100 ml				
Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond	
0	0	0	—	

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au verso

Date: Jan 14/91

Analyst: L. Coulson
Technologue:

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: Water & Earth Sc. Assoc.

LAB REPORT NO: A1-0070

DATE: Jan.24.1991

Attention: D.B.Corbett

PROJECT: 1650

PARAMETER	UNITS	Sample PW 72hrs	Sample	Sample	Sample	Sample
Fe	mg/L	<0.05				
Mn	mg/L	<0.05				
Hardness	mg/L CaCO3	241				
Alkalinity	mg/L CaCO3	206				
pH		8.00				
Conductivity	umhos/cm	1038				
F	mg/L	0.38				
Na	mg/L	88				
N-NO3	mg/L	<0.10				
N-NO2	mg/L	<0.10				
N-NH3	mg/L	0.11				
SO4	mg/L	90				
Cl	mg/L	127				
Phenols	**mg/L**	**<0.002**				
Turbidity	NTU	<1.0				
Colour	Pt/Co Units	3				
Ca	mg/L	45				
Mg	mg/L	31				
Tann./Lig.	mg/L	<1.0				
Total N	mg/L	0.28				
K	mg/L	2				

ANALYST: _____

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: Water & Earth Sc. Assoc.

LAB REPORT NO: A1-0070

DATE: Jan.24,1991

Attention: D.B. Corbett

PROJECT: 1650

PARAMETER	UNITS	Sample PW 72hrs	Sample	Sample	Sample	Sample
As	mg/L	<0.01				
Ba	mg/L	0.03				
B	mg/L	0.20				
Cd	mg/L	<0.002				
Cr	mg/L	<0.01				
CN-	mg/L	<0.01				
Pb	mg/L	<0.002				
Hg	mg/L	<0.001				
Se	mg/L	<0.01				
Ag	mg/L	<0.01				
Cu	mg/L	<0.01				
H2S	mg/L	0.06				
TDS	mg/L	608				
TOC	mg/L	..1				
Zn	mg/L	<0.01				
U	mg/L	<0.02				
Radionuclides						
Cs 137	Bq/L	<1				
I 131	Bq/L	<1				
Ra 226	Bq/L	<0.1				
Sr 90	Bq/L	<1				
Tritium	Bq/L	<100				

ANALYST: _____

ACCUTEST LABORATORIES LTD.
146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y3 Tel.: (613) 727-5692 Fax: (613) 727-5222

REPORT OF ANALYSES

CLIENT: Water & Earth Sc. Assoc.
LAB REPORT NO: A1-0070
DATE: Jan.24,1991
Attention: D.B. Corbett
PROJECT: 1650

PARAMETER	UNITS	Sample	Sample	Sample	Sample	Sample
Pesticides						
Aldrin & Dieldrin	mg/L	<0.0007				
Carbaryl	mg/L	<0.07				
Chlordane	mg/L	<0.007				
DDT	mg/L	<0.03				
Diazinon	mg/L	<0.014				
Endrin	mg/L	<0.0002				
Heptachlor + Heptachlor Epoxide	mg/L	<0.003				
Lindane	mg/L	<0.004				
Methoxychlor	mg/L	<0.1				
Methyl Parathion	mg/L	<0.007				
Parathion	mg/L	<0.035				
Toxaphene	mg/L	<0.005				
2,4-D	mg/L	<0.1				
2,4,5-TP	mg/L	<0.01				
Trihalomethanes	mg/L	<0.35				
PCB's	mg/L	<0.003				

ANALYST: _____

LAB REPORT NO.: 41-0070
Numéro de rapport:

ACCUTEST Laboratories Ltd.

146 Colonnade Road, Unit 8, Nepean, Ontario K2E 7Y1 (613) 727-5692

BACTERIOLOGICAL ASSESSMENT OF WATER
ÉVALUATION BACTÉRIOLOGIQUE DE L'EAU

NAME/NOM: A B Corbett	
COMPANY/SOCIÉTÉ: WESA	
STREET, R.R., BOX NO./RUE, R.R., CASIER POSTAL	CITY, TOWN/VILLE
PROVINCE	POSTAL CODE/CODE POSTAL
TELEPHONE/TÉLÉPHONE — Area Code/Indicatif Régional:	Number/Numéro:

SAMPLE INFORMATION/RENSEIGNEMENTS SUR L'ÉCHANTILLON

Sample location/Lieu de prélèvement	Sample number/No. d'échantillon	Date collected/Date de prélèvement	Reference number/ No. de référence
	1650-PW-77 HOURS	12-1-91	

CHECK APPROPRIATE BOXES/COCHER LA CASE APPROPRIÉE

DRINKING WATER/EAU POTABLE

- ☐ Treated/Épurée
- ☐ Non-treated/Non-épurée
- ☐ Existing well/ Puits existant
- ☐ New well/Nouveau puits

NON-DRINKING WATER/EAU NON POTABLE

- ☐ River/Rivière
- ☐ Pool/ Piscine
- ☐ Sewage/ Égout
- ☐ Lake/Lac
- ☐ Other/Autre

Specify: _____
Spécifiez:

SAMPLING INSTRUCTIONS
DIRECTIVES POUR LE PRÉLÈVEMENT

1. Do NOT rinse sample container — it contains sodium thiosulphate preservative.
   NE PAS rincer la bouteille car elle contient l'agent préservateur sodium thiosulphate de sodium.
2. Water must run for 2 to 3 minutes before collecting sample.
   Laisser couler l'eau pendant 2 ou 3 minutes avant de remplir la bouteille.
3. Fill bottle to about ½ inch from the top.
   Remplir la bouteille jusqu'à 2 cm du bouchon.
4. Deliver sample to laboratory immediately. Refrigerate if possible.
   Retourner l'échantillon immédiatement au laboratoire, réfrigéré si possible.

NOTE: Samples must be submitted to the laboratory within 48 hours of collection.
Non potable samples MUST be received within 6 hours if unrefrigerated or within 24 hours if refrigerated.

IMPORTANT: Les échantillons doivent arriver au laboratoire dans les 48 heures après le prélèvement; les échantillons d'eau non-potable doivent être retournés dans les 6 heures ou, si réfrigérés, dans les 24 heures qui suivent le prélèvement.

TEST RESULTS/RÉSULTATS DES TESTS				COMMENTS/REMARQUES
BACTERIAL COUNT/NUMÉRATION DES BACTÉRIES Based on 100 ml volume/Basé sur un volume de 100 ml				
Total coliform/ Total des colibacilles	Faecal Coliform/ Colibacilles Fécaux	Faecal Strep./ Streptocoques Fécaux	Background/ Teneurs de Fond	
0	0	0	<10/ml	

RESULT INTERPRETATION ON REVERSE
Interprétation des Résultats au verso

Date: Jan 16/91

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Technologue: