DRILLING AND CONSTRUCTION OF OBSERVATION WELL NO'S. 272, 273, 274

(District of Abbotsford, Contract No. 81-11)
(Sumas Prairie ARDSA Program)

ABBOTSFORD, B.C.

Report prepared by:

GROUNDWATER SECTION
WATER MANAGEMENT BRANCH
MINISTRY OF ENVIRONMENT

File: 92 G/1 #30

February 1982

DRILLING AND CONSTRUCTION OF

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(District of Abbotsford, Contract No. 81-11)
(Sumas Prairie ARDSA Program)

ABBOTSFORD, B.C.

INTRODUCTION

In early 1980, the District of Abbotsford received financial approval (i.e., ARDSA assistance) to proceed with the construction of the proposed Sumas Prairie Water System. The source of water for this system is to come from an existing, unused high capacity production well, located about 300 feet south of the present District of Abbotsford Production Well No. 1 off Farmer Road (see Figure 1). Prior to and after production pumping start-up in the presently unused production well, water level monitoring data will be needed to evaluate the effects of additional withdrawals from the aquifer on existing groundwater use in the area; especially, on the groundwater supply for the nearby Provincial fish hatchery. For this reason, observation wells 272, 273 and 274 were established in the vicinity of the presently utilized and unused production wells off Farmer Road (see Figures 1-4).

The following is a report on the drilling, well completion and instrumentation of observation wells 272, 273 and 274. The drilling and well completion program began October 6, 1981 and was completed on October 19, 1982 at a total cost of $22,327.46, which included the cost of manufacturing three recorder housings. The above total cost, however, did not include the cost of the automatic water level recorders, nor supervisory costs.

WELL DRILLING

Pacific Water Wells (1969) Ltd., of Langley, B.C. was retained by the District of Abbotsford to carry out the drilling, construction and development of the three observation wells. The wells were drilled by the air-rotary method, utilizing a casing hammer. Fifteen-foot lengths of 8-inch diameter surface casing were first installed in each well, followed by 6-inch diameter drilling and casing

in sands and gravels to depths of 119 feet in Well 272, 112 feet in Well 273 and 220 feet in Well 274. The lithologic logs and driller's logs for each well are found in Appendix A and B, respectively. Representative formation samples were taken every 5 feet for sieve analysis.

WELL COMPLETION

Following the drilling of each well, the air-rotary drilling rig was moved to the next site and a cable-tool drilling rig was set up over each drilled well to complete and develop the wells. Eight-foot lengths of 20-slot size stainless steel screens for each well were pre-selected on the basis of known subsurface geologic data in the area. Sieve analyses of the screened zones were performed and results (see Appendix C) indicated that the screen slot size selected were undersized for the aquifer materials encountered. The locations of these screens in each well are shown in Appendix A.

Development of each well was by the surge and bail method. Following development, a metal ring was welded between the 8-inch and 6-inch casings, forming a tight seal between the two casings; and, a sanitary cement seal was completed around the surface casing, to a depth of about 1.5 feet below ground level.

HYDROCHEMISTRY

Samples of the well water from each well were taken by the use of a tube sampler and sent to the Environmental Laboratory in Vancouver for analyses. Detailed results of the analyses are found in Appendix D.

The water sampled from Observation Well 272 was found to be soft to moderately hard, low in dissolved mineralization, but high in dissolved Iron (23.1 mg/L) and dissolved Manganese (2.74 mg/L). These concentrations (for Fe and Mn) exceed the B.C. Ministry of Health's Recommended Drinking Water Quality Standards. It is recommended that further sampling by pumping and testing for water quality be performed to verify the dissolved Iron and dissolved Manganese concentrations in the well water.

The water sampled from Observation Well 273 was found to be soft to moderately hard and low in dissolved mineralization. The sample tested met the B.C. Ministry of Health's Recommended Drinking Water Quality Standards for the parameters tested.

. . . 3

The water sampled from Observation Well 274 was found to be moderately hard and low in dissolved mineralization. The sample tested met the B.C. Ministry of Health's Recommended Drinking Water Quality Standards for the parameters tested.

WELL INSTRUMENTATION

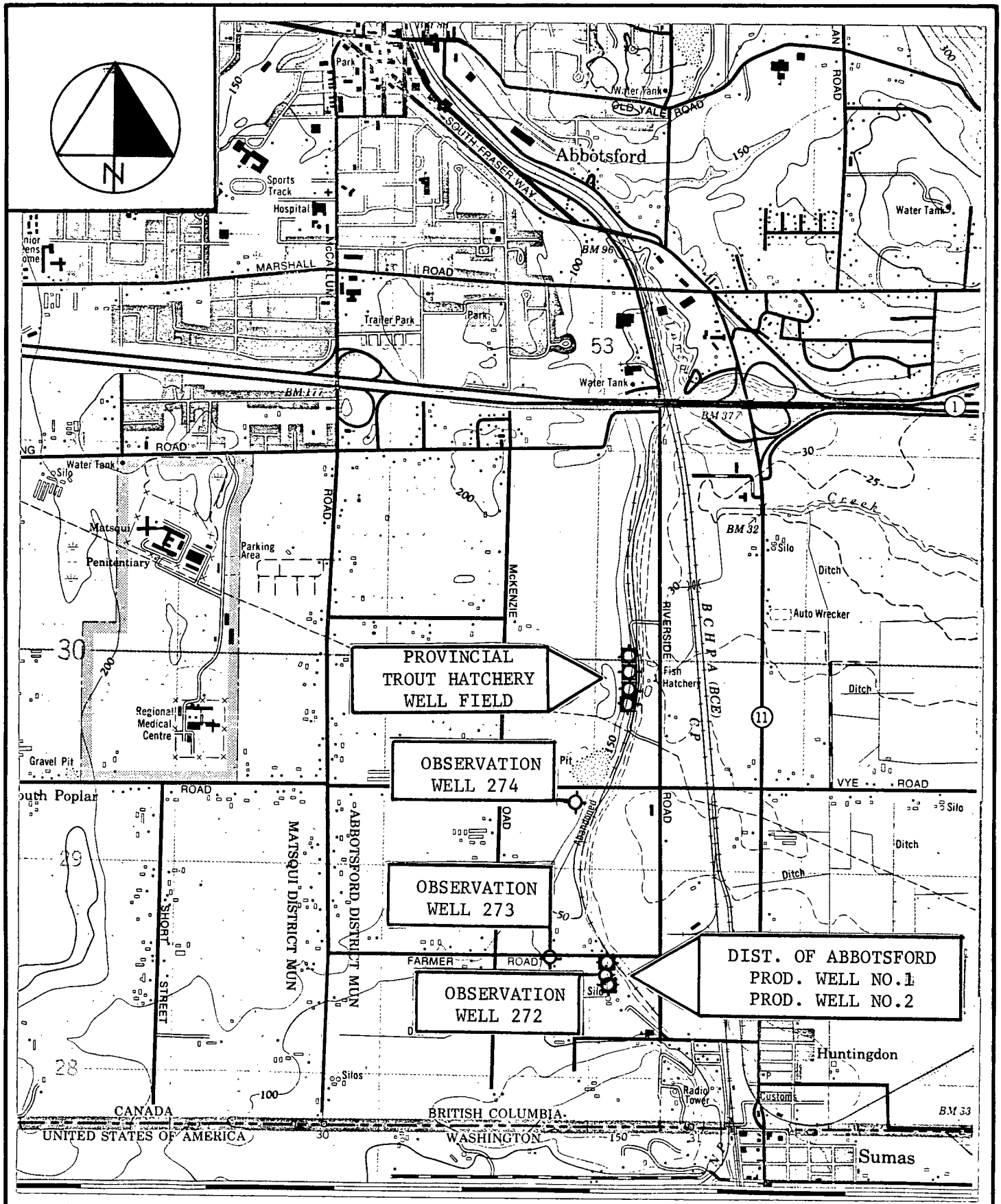
Each well is equipped with 32-day weight driven Stevens F-type automatic water level recorders. These recorders are enclosed in vandal-resistant steel housings.

Marc Zubel.

Marc Zubel
Geological Engineer
Groundwater Section
Water Management Branch

MZ/dma

LIST OF FIGURES



Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

DRILLING & CONSTRUCTION OF
OBSERVATION WELL NOs. 272, 273, 274

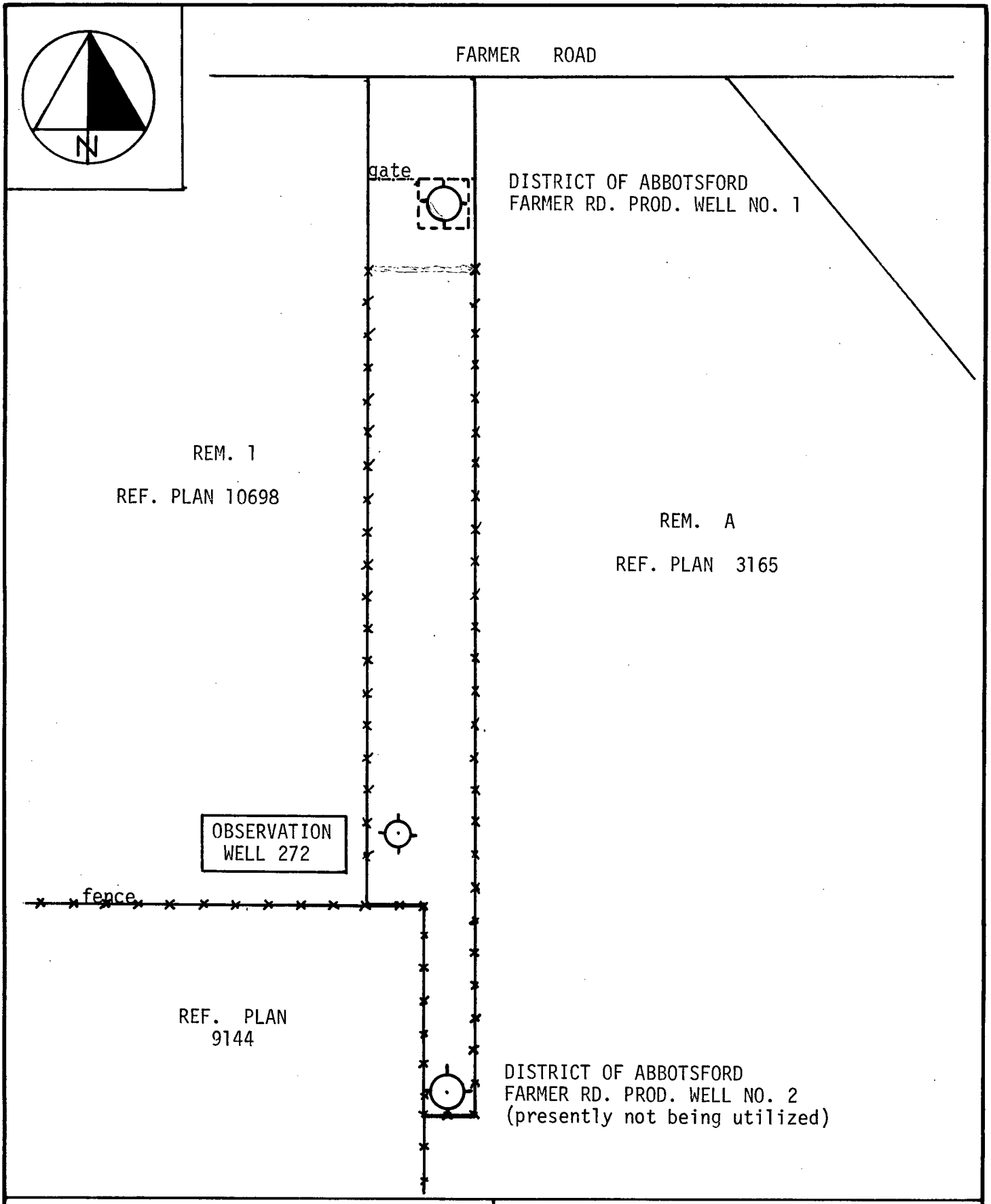
SCALE: VERT. N/A
HOR. 1" = 2000' (approx)

DATE
FEB. 1982

M. Zubel ENGINEER

FILE No. 92 G/1 (30) DWG. No. FIGURE 1

VANCAL 8569



Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

DRILLING AND CONSTRUCTION OF
OBSERVATION WELL NOs. 272, 273, 274

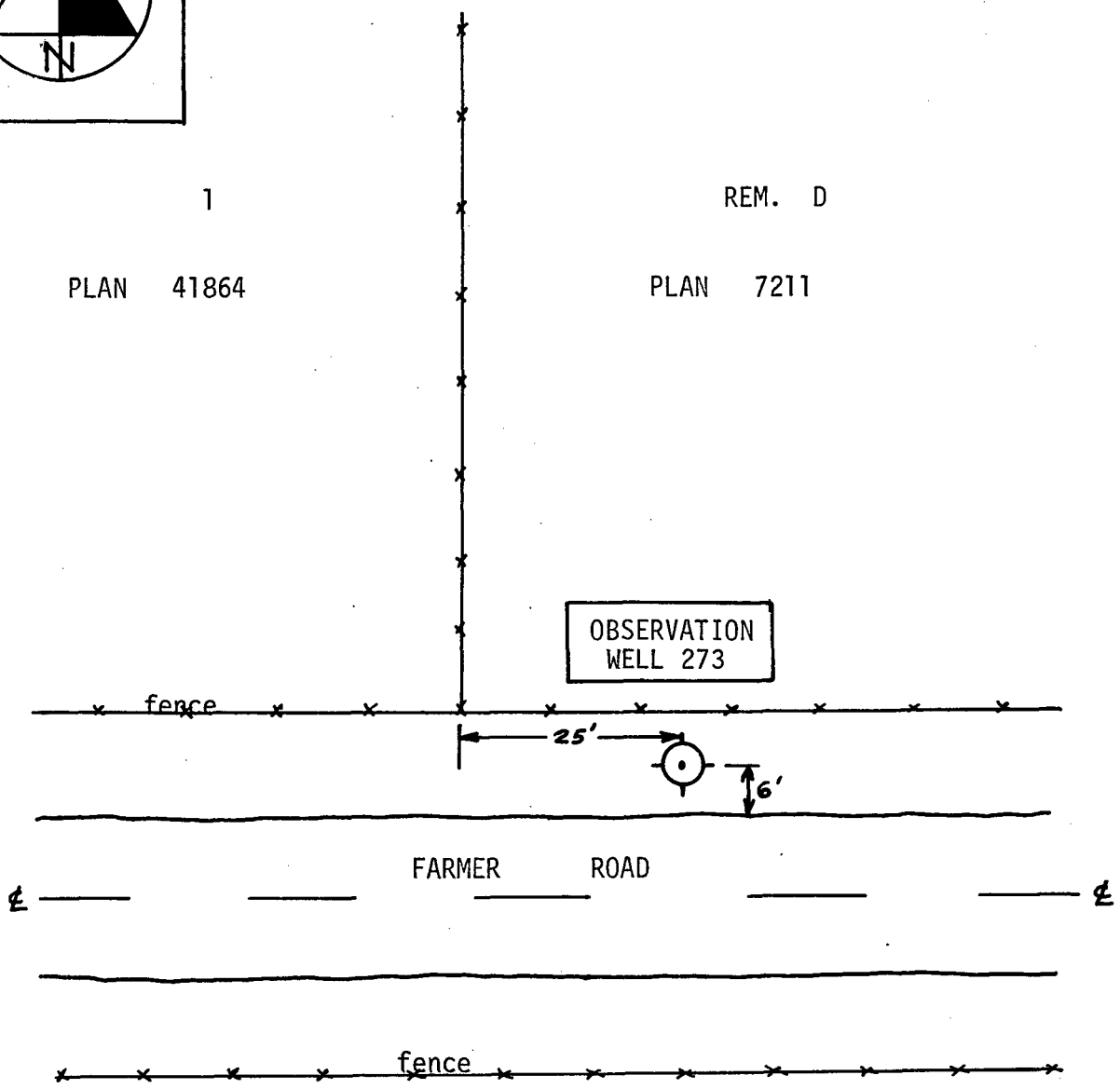
SCALE: VERT. N/A
HOR. 1" = 50'

DATE
FEB. 1982

M. Zubel ENGINEER

FILE No. 92 G/1 (30) DWG. No. FIGURE 2

VANCAL 8569



Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

DRILLING AND CONSTRUCTION OF
OBSERVATION WELL NOs. 272, 273, 274

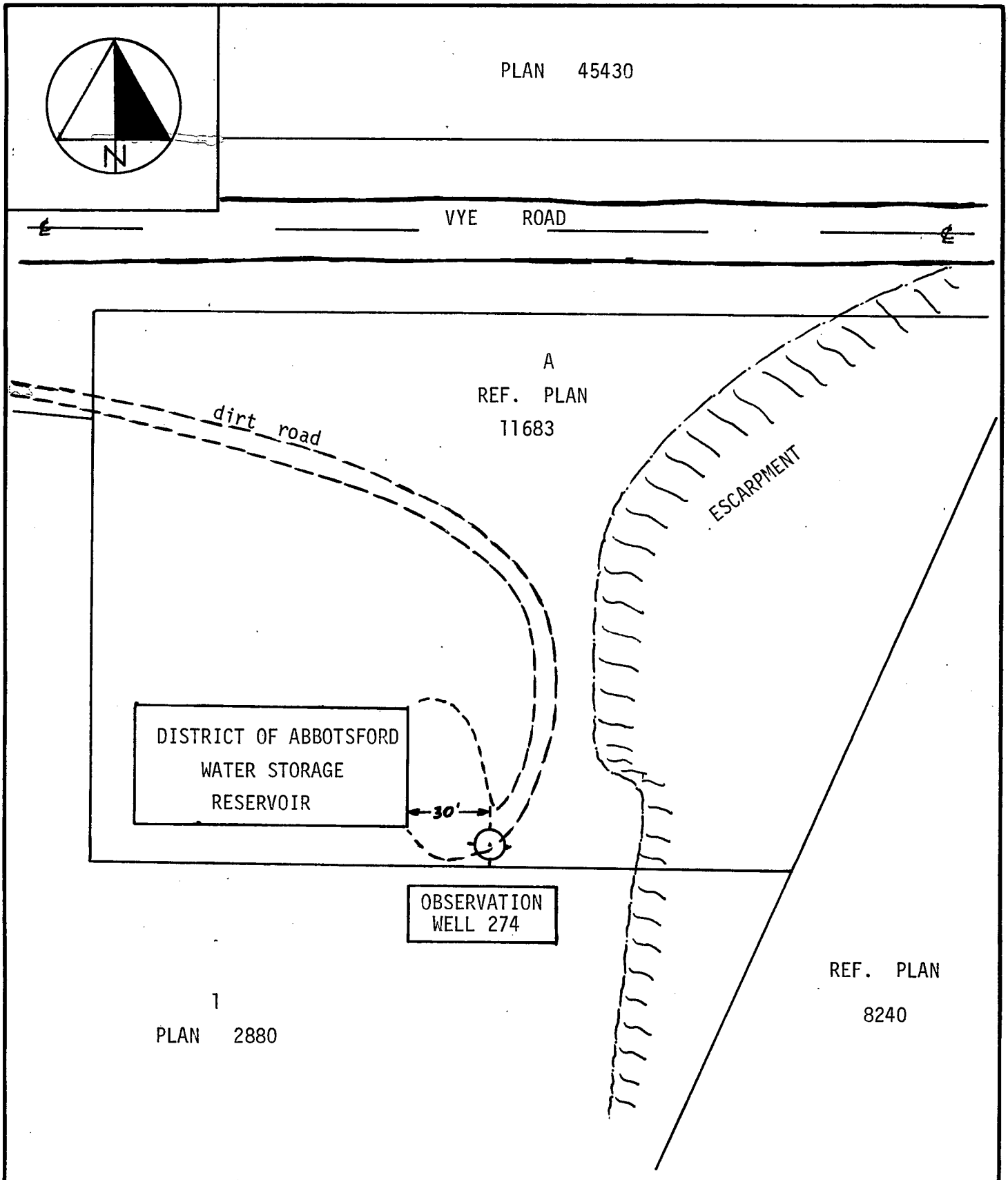
SCALE: VERT. N/A
HOR. 1" = 20'

DATE
FEB. 1982

M. Zubel ENGINEER

FILE No. 92 G/1 (30) DWG. No. FIGURE 3

VANCAL 8569



Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON
DRILLING AND CONSTRUCTION OF
OBSERVATION WELL NOs. 272, 273, 274

SCALE: VERT. N/A
HOR. 1" = 50'

DATE
FEB. 1982

M. Zubel
ENGINEER

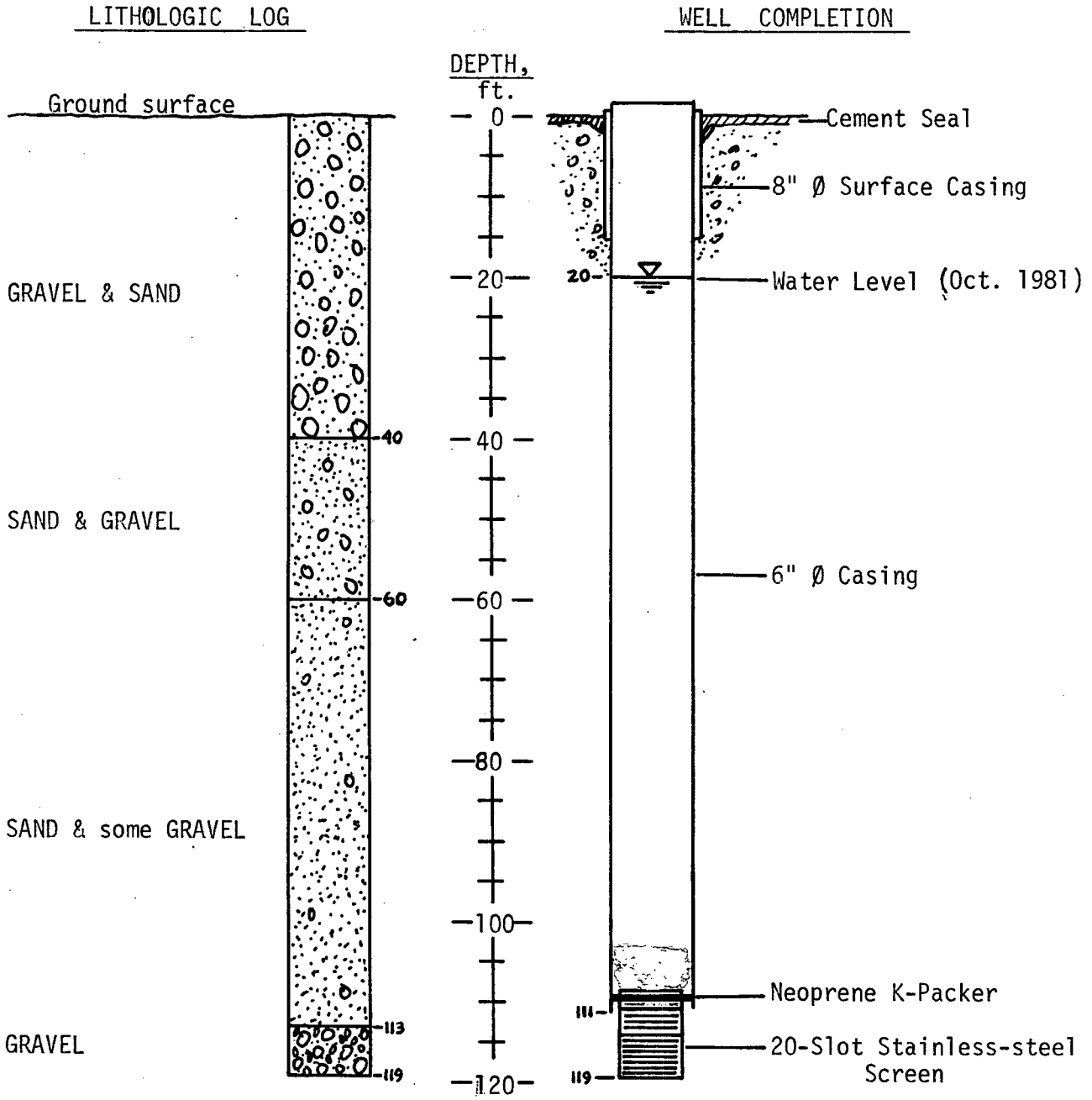
FILE No. 92 G/1 (30) DWG. No. FIGURE 4

VANCAL 8569

APPENDIX A

Figure	Description
1A	Lithologic log and construction details - Observation Well 272
2A	Lithologic log and construction details - Observation Well 273
3A	Lithologic log and construction details - Observation Well 274

OBSERVATION WELL 272



Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

DRILLING AND CONSTRUCTION OF
OBSERVATION WELL NOs. 272, 273, 274

SCALE: VERT. N/A
HOR. 1" = 20'

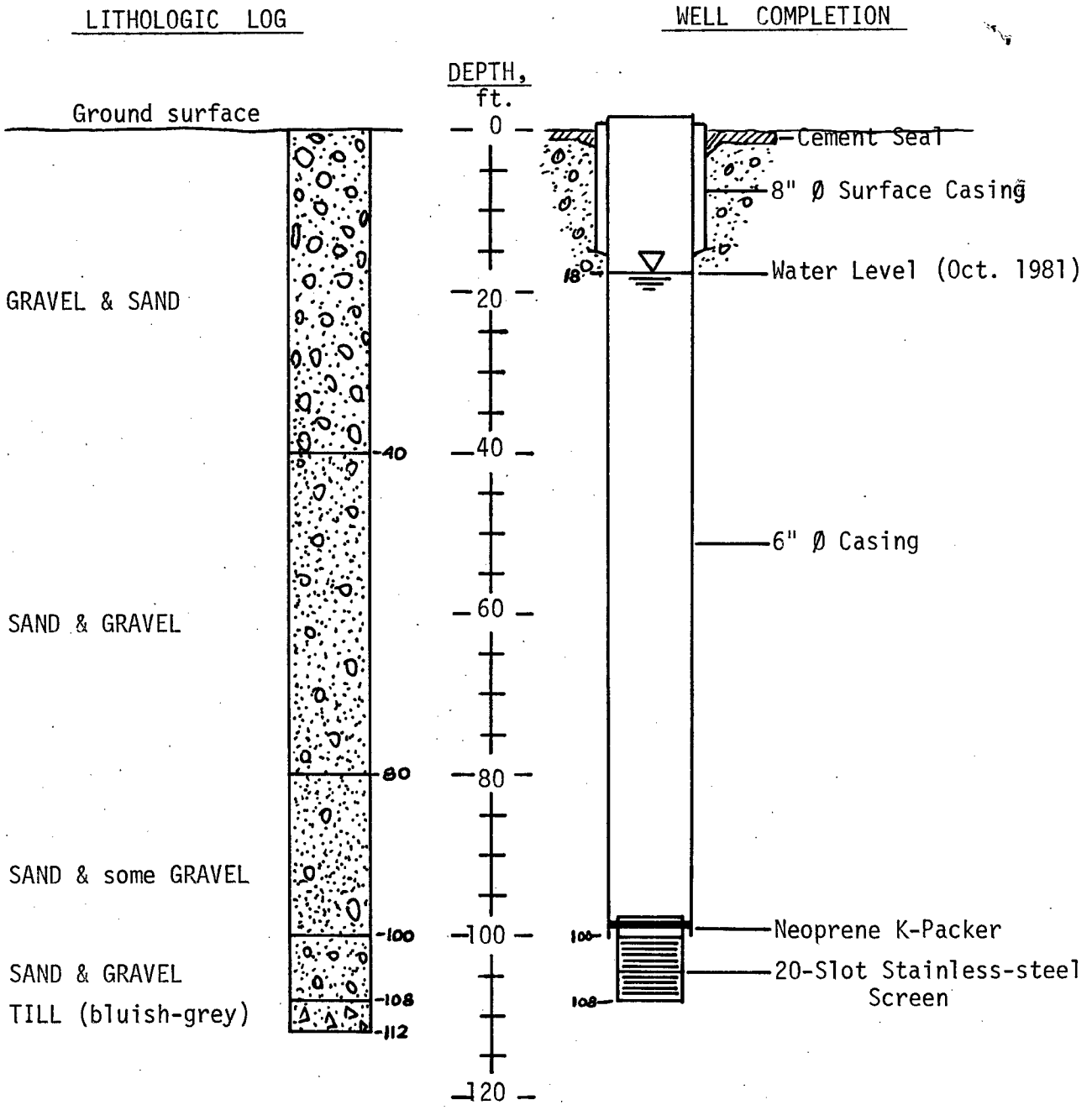
DATE
FEB. 1982

M. ZUBEL ENGINEER

FILE No. 92 G/1 (30) DWG. No. APPENDIX 1A

VANCAL 8569

OBSERVATION WELL 273



Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

DRILLING AND CONSTRUCTION OF
OBSERVATION WELL NOs. 272, 273, 274

SCALE: VERT. N/A
HOR. 1" = 20'

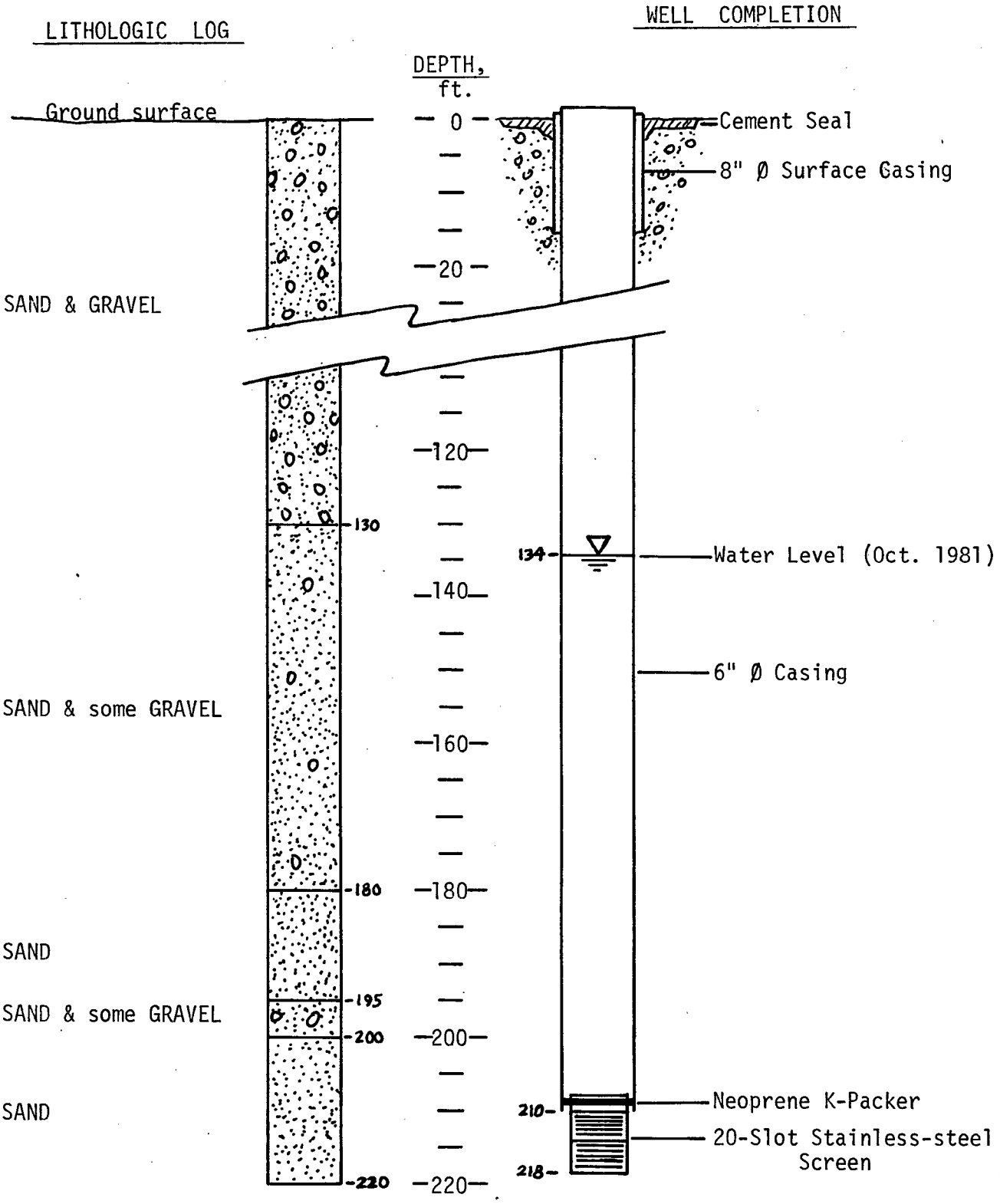
DATE
FEB. 1982

M. Zubel
ENGINEER

FILE No. 92 G/1 (30)
DWG. No. APPENDIX 2A

VANCAL 8569

OBSERVATION WELL 274



Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

DRILLING AND CONSTRUCTION OF
OBSERVATION WELL NOs. 272, 273, 274

SCALE: VERT. N/A
HOR. 1" = 20'

DATE
FEB. 1982

M. Zubel ENGINEER

FILE No. 92 G/1 (30) DWG. No. APPENDIX 3A

VANCAL 8569

APPENDIX B

Figure	Description
	Driller's logs and daily time sheets for drilling and developing Observation Wells 272, 273 and 274

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct 6/81 Shift Day Rig No. 20

Customer _____ Location _____ Hole No. _____

Name	Trade	Rate	Regular Time	Travel Time	Overtime
Larry					
Barry.			7½		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size	8"	6"
Hole Depth		119'
Casing Length		120'8"
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size . . . . . .

Length . . . . . Top . . . . . Bottom . . . . .

Fittings . . . . . .

Static Water Level . . . . . .

Pumping Level . . . . . at . . . . . GPM

LOG OF FORMATIONS

Casing Tally	Depth From	Depth To	
8" casing 16 12"	0	15	8"
① 6" 20'4"	0	1	Top soil
	1	4	Clay
② 20'1"	4	50'	Gravel and sand.
③ 20'5"	50'	114	Coarse sand and some Gravel.
④ 20'5"	114	119	Gravel
⑤ 20'½"			
⑥ 20'1½"			

Approved Marc Zubel

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct 7/81 Shift Day Rig No. 20

Customer _____ Location _____ Hole No. _____

Name	Trade	Rate	Regular Time	Travel Time	Overtime
Larry					
Barry.			7½		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size	8"	6"
Hole Depth	0	112'
Casing Length		113½"
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size . . . . . .

Length . . . . . Top . . . . . Bottom . . . . .

Fittings . . . . . .

Static Water Level . . . . . .

Pumping Level . . . . . at . . . . . GPM

LOG OF FORMATIONS

Casing Tally	Depth From	Depth To	
8" Casing.			set Rig Down.. Moved to the side set up.
16'2"	0	15'	8"
6"			
①20'4½"	0	5'	Gravel some Clay.
②20'1½"	5'	30'	Gravel sand &
③20'1"	30	108'	Gravel SAND. wate.
④20'2"	108	112'	TILL
⑤20'			
⑥20'			

Approved Marc Zubel

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct 8/81 Shift Day Rig No. 20

Customer _____ Location ABBOTSFORD. Hole No. 301

Name	Trade	Rate	Regular Time	Travel Time	Overtime
Larry					
Barry.			7½		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size		
Hole Depth		
Casing Length		
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size . . . . . .

Length . . . . . Top . . . . . Bottom . . . . .

Fittings . . . . . .

Static Water Level . . . . . .

Pumping Level . . . . . at . . . . . GPM

LOG OF FORMATIONS

Depth: Casing Tally	From	To	
			took rods off truck. Got more Pipe, threaded rods. fill water tank. set rig up.
8" Casing. 16'3¼"	0	15'	SAND AND GRAVEL.
① 20'5"	15	60'	SAND & Gravel.
② 20'			
③ 20'1½"			
④ 20'			

Approved Fred Chwojka

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct 9/81 Shift Day Rig No. 20

Customer _____ Location ABBOTSFORD. Hole No. 301

Name	Trade	Rate	Regular Time	Travel Time	Overtime
Larry					
Barry			7½		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size	8"	6"
Hole Depth	220'	
Casing Length	220'7"	
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size . . . . . .

Length . . . . . Top . . . . . Bottom . . . . .

Fittings . . . . . .

Static Water Level . . . . . .

Pumping Level . . . . . at . . . . . GPM

LOG OF FORMATIONS

Casing Tally	Depth From	Depth To	
⑤ 20'	60'	130	sand & Gravel.
⑥ 20'	130	180'	fine sand some Gravel compack with clay Layers.
⑦ 20' 1½"	180'	195'	fine sand
⑧ 20'	195	200'	sand & Coral Gravel.
⑨ 20'	200'	280'	fine sand.
⑩ 20'			
⑪ 20'			

Approved Fred Chrostka

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date: Oct 7th Shift: Day Rig No.: 3

Customer: Abbotsford Water Works Department Location: Farmer Rd. Hole No.: #1

Name	Trade	Rate	Regular Time	Travel Time	Overtime
[illegible]			7 1/2	[redacted]	
[illegible]			7 1/2	[redacted]	

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size		
Hole Depth		
Casing Length		
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size ....

Length .... Top ....

Bottom ....

Fittings ....

Static Water Level ....

Pumping Level .... at ...... GPM

LOG OF FORMATIONS

Casing Tally	Depth From	Depth To	
			Moved to no #1 hole Set Rig up Drilled & Bailed 4 ft Plug Put Screen togethr with Rizer Lower in hole 1½ ft. stick up Bottom of hole 120'-8" with 1½ ft stick up Over all Length of screen with rizer 10'-10¾" Set Rig up 9-30 (2½ hrs) Developed on well 12-30 to 4.00 (3½ hrs)

Approved ____________________

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct 8 Shift Day Rig No. 3

Customer Abbotsford Water Works Department Location Farmer Rd. Hole No. 1

Name	Trade	Rate	Regular Time	Travel Time	Overtime
George Needham			7 1/2		
~~[illegible]~~			7 1/2		
Fleming Sorensen					

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size		
Hole Depth		
Casing Length		
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size . . . .

Length . . . . Top . . . . Bottom . . . .

Fittings . . . .

Static Water Level . . . .

Pumping Level . . . . at . . . . . . GPM

LOG OF FORMATIONS

Casing Tally	Depth From	Depth To	
			Put on new surge Blocks.
			Started developing 8.00
			1/2 hr surging 2 ft Sand
			1/2 hr 2 ft Sand
			Developed until 3.15
			Put metering Box together
			put on well.

Approved ______________________

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct. 9/81 Shift DAY Rig No. 3

Customer Abbotsford Water Works Department Location Farmers Road Abbotsford Hole No. 2

Name	Trade	Rate	Regular Time	Travel Time	Overtime
D Sing Needham			7 1/2		
His Royal Highness Fleming Arneson			7 1/2		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size		
Hole Depth		
Casing Length		
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size . . . . . .

Length . . . . . Top . . . . . Bottom . . . . .

Fittings . . . . . .

Static Water Level . . . . . .

Pumping Level . . . . . at . . . . . GPM.

LOG OF FORMATIONS

Depth			
Casing Tally	From	To	
			RIG DOWN + move + set up on hole #2. Developing well with swage Block Bringing lots of fine sand. 5 ft sand in 15 minutes 7 ft in 1/2 hrs. Started 7:30 finished 3. o'clock

Approved _____

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date: Oct 13th Shift: Day Rig No. #3

Customer: Abbotsford Water Works Department Location: Farmer Rd Hole No. 2

Name	Trade	Rate	Regular Time	Travel Time	Overtime
George Needham			7½		
Fleming Sorensen			7½		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size		
Hole Depth		
Casing Length		
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size ....

Length .... Top .... Bottom ....

Fittings ....

Static Water Level ....

Pumping Level .... at ...... GPM

LOG OF FORMATIONS

Casing Tally	Depth From	Depth To	
			Started 8.00 Developing getting 6 to 7 ft (1 hr) 7½ hrs sand never cut down
			7½ developing

Approved ______________________

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct 14th Shift Day Rig No. #3

Customer Abbotsford Water Works Department Location Fairmont Rd. Hole No. #2

Name	Trade	Rate	Regular Time	Travel Time	Overtime
Chris Redbeam			7 1/2		
Fleming Jensen			7 1/2		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size		
Hole Depth		
Casing Length		
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size . . . . . .

Length . . . . . Top . . . . . Bottom . . . . .

Fittings . . . . . .

Static Water Level . . . . . .

Pumping Level . . . . . at . . . . . GPM

LOG OF FORMATIONS

Depth			
Casing Tally	From	To	
			started 8.00 oclock surging developing with surgeblocks sand went from 7 ft in/ to 3'-ft in five (7 1/2) developing

Approved _____

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct 15 Shift Day Rig No. 3

Customer Abbotsford Water Works Department Location Farmer Rd. Hole No. ~~2~~ 3

Name	Trade	Rate	Regular Time	Travel Time	Overtime
Georg [illegible]			7½		
[illegible]			7½		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size		
Hole Depth		
Casing Length		
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size #2-10 000

Length 8'-8" Top 209.1' Bottom 218'

Fittings 2 ft Rizer - K-Packer

Static Water Level ....

Pumping Level .... at ...... GPM

LOG OF FORMATIONS

Casing Tally	Depth From	Depth To	
			Developed from 8. to 9.00 1 hr.
			got 2½ ft sand
			Disassembled Rig
			Put on metering Box
			moved to no #3 well
			set rig up started drilling
			out 35 ft Plug
			Pulled casing Back to 210 ft
		Set	Screen 8'-8"
			2'-3" rizer + Packer
			Develop well.

Approved ______________

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct. 16/81 Shift day Rig No. 3

Customer Abb. Water Works Dept. Location _____ Hole No. 3

Name	Trade	Rate	Regular Time	Travel Time	Overtime
Henry Swenson			7½		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size		
Hole Depth		
Casing Length		
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size . . . . . .

Length . . . . . Top . . . . . Bottom . . . . .

Fittings . . . . . .

Static Water Level . . . . . .

Pumping Level . . . . . at . . . . . GPM

LOG OF FORMATIONS

Depth			
Casing Tally	From	To	
			Develop well.

Approved _____

PACIFIC WATER WELLS (1969) LTD.

22314 Fraser Highway, Langley, B.C. V3A 4H6

Phone 534-8581

DAILY TIME SHEET

Date Oct 19 Shift Day Rig No. #3

Customer Abbotsford Water Works Department Location ______ Hole No. 3

Name	Trade	Rate	Regular Time	Travel Time	Overtime
Gerry Hudson			7½		
Danny Lowes			7½		

TIME SUMMARY

	HOURS
Drilling	
Hourly Work	
Rep. & Maint.	

HOLE INFORMATION

	START	FINISH
Hole Size		
Hole Depth		
Casing Length		
Water Level		
Stick Up Above Ground Surface		

PRODUCTION INFORMATION

Screen Slot Size . . . .

Length . . . . Top . . . . Bottom . . . .

Fittings . . . .

Static Water Level . . . .

Pumping Level . . . . at . . . . . . GPM

LOG OF FORMATIONS

Depth			
Casing Tally	From	To	
			Developing well with surge Blocks Finnished Developing well 7½ hrs

Approved ______________________

APPENDIX C

Figure	Description
1C	Sieve analyses - Observation Well 272
2C	Sieve analyses - Observation Well 273
3C	Sieve Analyses - Observation Well 274

SIEVE ANALYSIS

1C

PROJECT: SUMAS PRAIRIE WATER SUPPLY
LOCATION: ABBOTSFORD
WELL NO.: 1
ANALYSIS BY: F. Chwojka DATE: Feb. 17/82

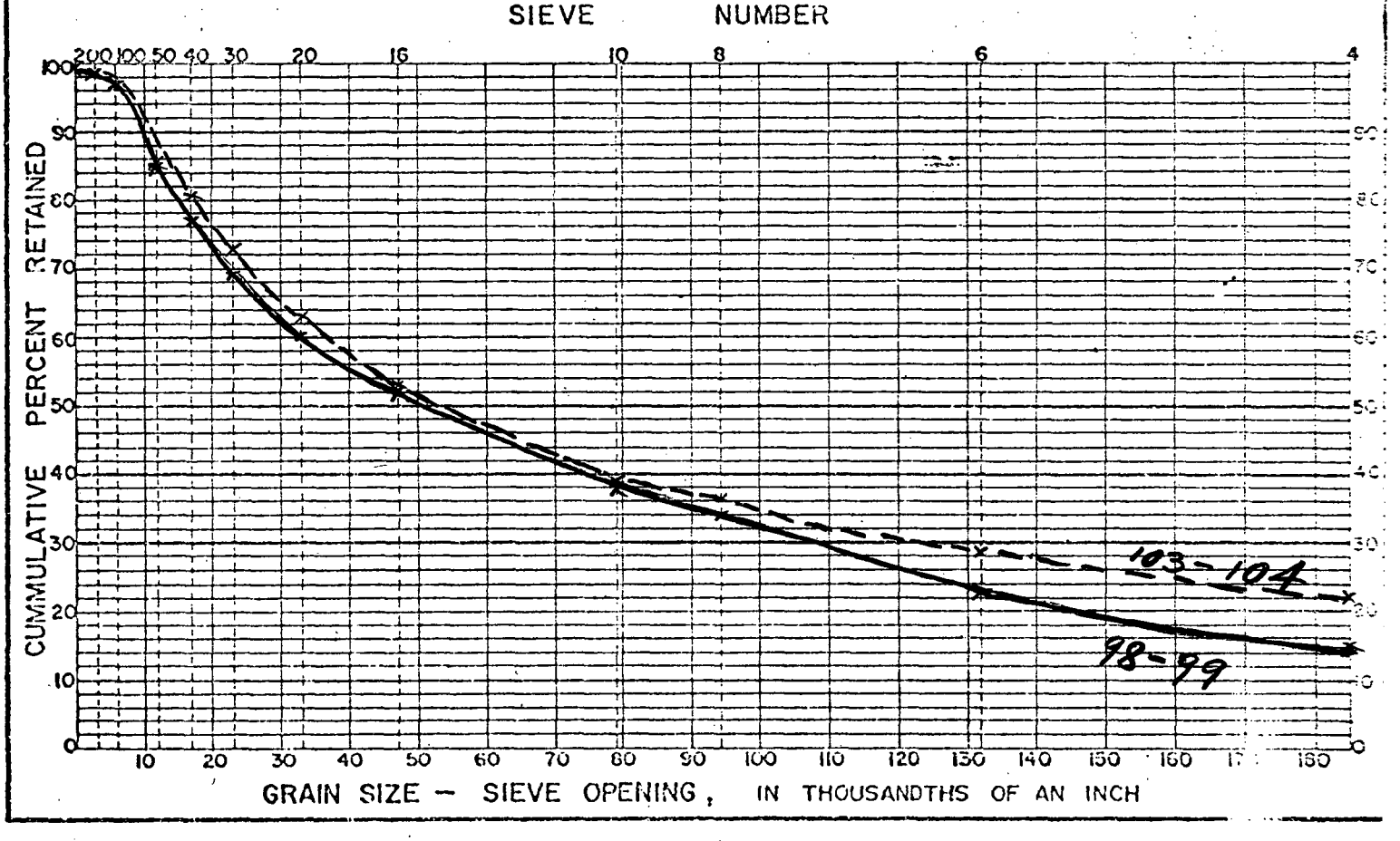
SAMPLE WEIGHT, IN grams	INTERVAL 98 - 99	INTERVAL 103 - 104
1. WT. CONTAINER + SAMPLE		
2. WT. CONTAINER		
3. WT. SAMPLE less than 1/2" size	1624.8	1743.4
4. WT. SAMPLE 1/2" size and over	51.3	71.3
5. WT. ENTIRE SAMPLE (i.e 3. + 4.)	1676.1	1814.7
6. PERCENT SAMPLE 1/2" size and over	3.1 %	3.9 %

DEPTH INTERVAL (FEET)	SCREEN OPENING 90%	50%	40%	30%
98 - 99	10	50	75	108
103 - 104	12	53	77	120

NOTE: The following sieve analysis does not include the 1/2" size and over.

SIEVE NO.	INTERVAL 98 - 99 CUMM. WT. RET. IN grams	CUMM. % RET.	INTERVAL 103 - 104 CUMM. WT. RET. IN grams	CUMM. % RET.
4	250.1	15	385.2	22.1
6	370.1	23	505.2	29.0
8	551.9	34	630.0	36.1
10	616.5	38	674.4	38.7
16	848.4	52	921.1	52.8
20	982.6	60	1101.1	63.2
30	1120.5	69	1278.0	73.3
40	1256.5	77	1401.0	80.4
50	1384.3	85	1494.4	85.7
100	1568.9	97	1687.6	96.8
200	1615.0	99	1729.9	99.2
PAN	1624.7	100	1741.0	99.9

REMARKS:



SIEVE ANALYSIS

1C

PROJECT: SUMAS PRAIRIE WATER SUPPLY
LOCATION: ABBOTSFORD
WELL NO.: 1
ANALYSIS BY: F. Chwojka DATE: Feb. 17/82

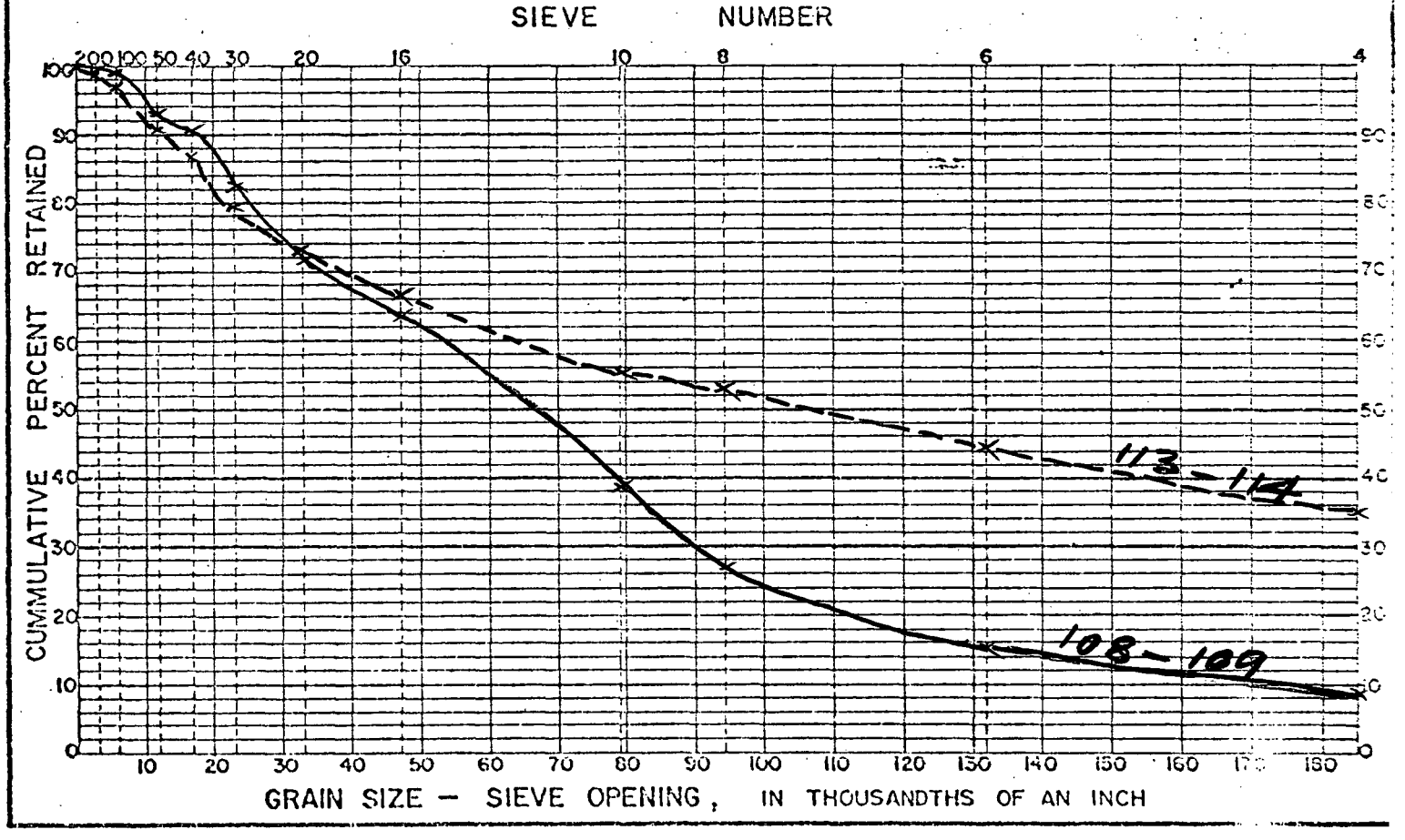
SAMPLE WEIGHT, IN grams	INTERVAL 108 – 109	INTERVAL 113 – 114
1. WT. CONTAINER + SAMPLE		
2. WT. CONTAINER		
3. WT. SAMPLE less than 1/2" size	1541.9	692.6
4. WT. SAMPLE 1/2" size and over	0.0	220.9
5. WT. ENTIRE SAMPLE (i.e 3. + 4.)	1541.9	913.5
6. PERCENT SAMPLE 1/2" size and over	0.0%	24.2 %

DEPTH INTERVAL (FEET)	SCREEN OPENING 90%	50%	40%	30%
108 – 109	18	67	78	89
113 – 114	12	106	155	+200

NOTE: The following sieve analysis does not include the 1/2" size and over.

SIEVE NO.	INTERVAL 108 – 109 CUMM. WT. RET. IN grams	CUMM. % RET.	INTERVAL 113 – 114 CUMM. WT. RET. IN grams	CUMM. % RET.
4	136.2	8.8	245.9	35.5
6	235.7	15.3	305.9	44.2
8	422.7	27.4	366.8	53.0
10	588.0	38.1	384.1	55.5
16	985.5	63.9	458.4	66.2
20	1104.9	71.7	506.1	73.1
30	1265.9	82.1	552.9	79.8
40	1393.6	90.4	602.9	87.0
50	1435.5	93.1	632.9	91.4
100	1527.8	99.1	675.7	97.6
200	1539.5	99.8	685.7	99.0
PAN	1540.5	99.9	688.1	99.4

REMARKS:



SIEVE ANALYSIS

PROJECT: SUMAS PRAIRIE WATER SUPPLY
LOCATION: ABBOTSFORD
WELL NO.: 1
ANALYSIS BY: F. Chwojka DATE: Feb. 17/82

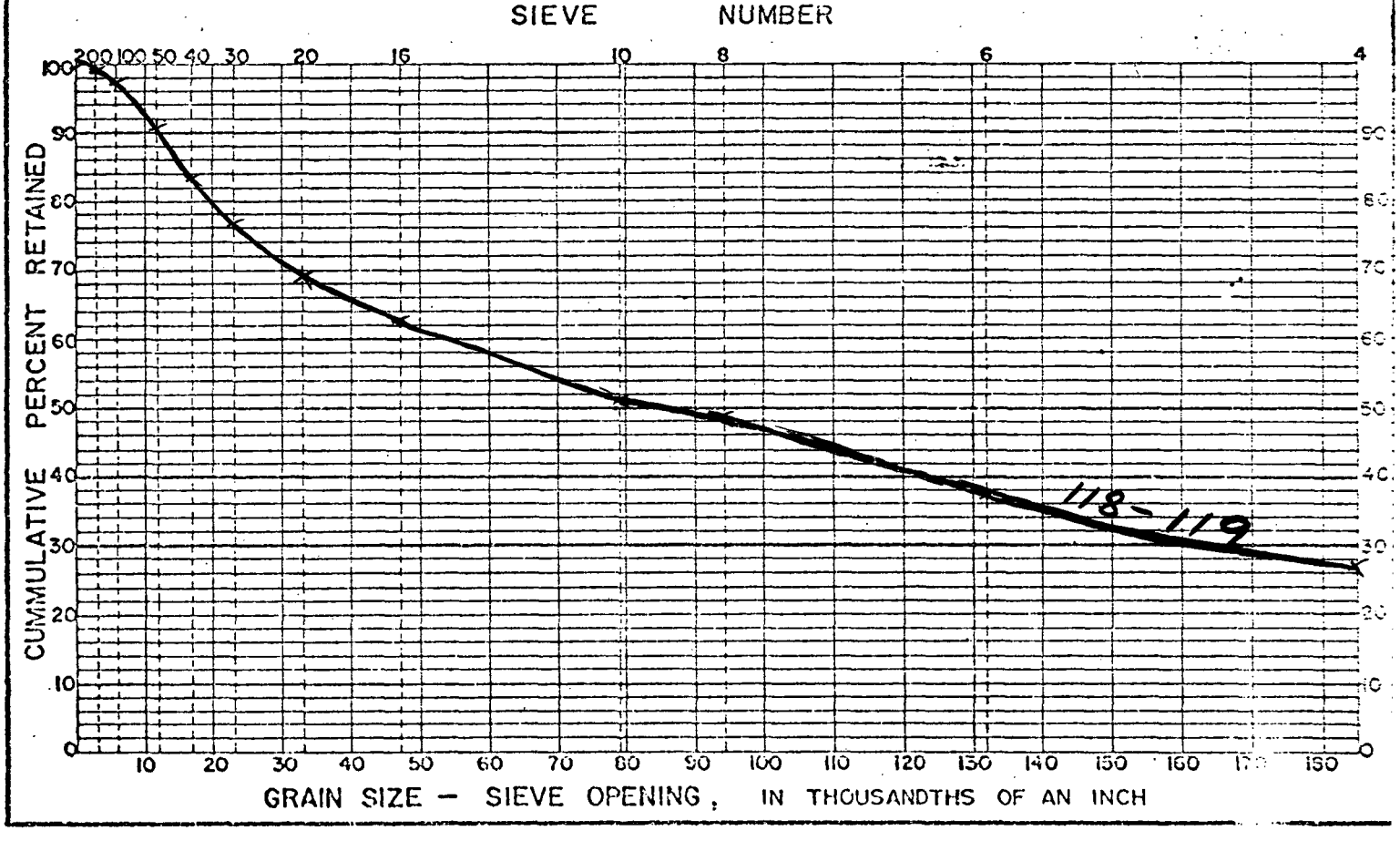
NOTE: The following sieve analysis does not include the 1/2" size and over.

SAMPLE WEIGHT, IN grams	INTERVAL 118 - 119	INTERVAL -
1. WT. CONTAINER + SAMPLE		
2. WT. CONTAINER		
3. WT. SAMPLE less than 1/2" size	1187.3	
4. WT. SAMPLE 1/2" size and over	189.4	
5. WT. ENTIRE SAMPLE (i.e 3. + 4.)	1376.7	
6. PERCENT SAMPLE 1/2" size and over	13.8 %	%

DEPTH INTERVAL (FEET)	SCREEN OPENING 90%	50%	40%	30%
118 - 119	12	85	123	160

SIEVE NO.	INTERVAL 118 - 119 CUMM. WT. RET. IN grams	CUMM. % RET.	INTERVAL - CUMM. WT. RET. IN grams	CUMM. % RET.
4	319.4	26.9		
6	442.5	37.3		
8	571.7	48.2		
10	610.1	51.4		
16	746.3	62.9		
20	824.4	69.4		
30	911.3	76.8		
40	995.9	83.9		
50	1072.6	90.3		
100	1160.9	97.8		
200	1179.2	99.3		
PAN	1182.8	99.6		

REMARKS:



SIEVE ANALYSIS

2C

PROJECT: SUMAS PRAIRIE WATER SUPPLY
LOCATION: ABBOTSFORD
WELL NO.: 2
ANALYSIS BY: F. Chwojka DATE: Feb. 17/82

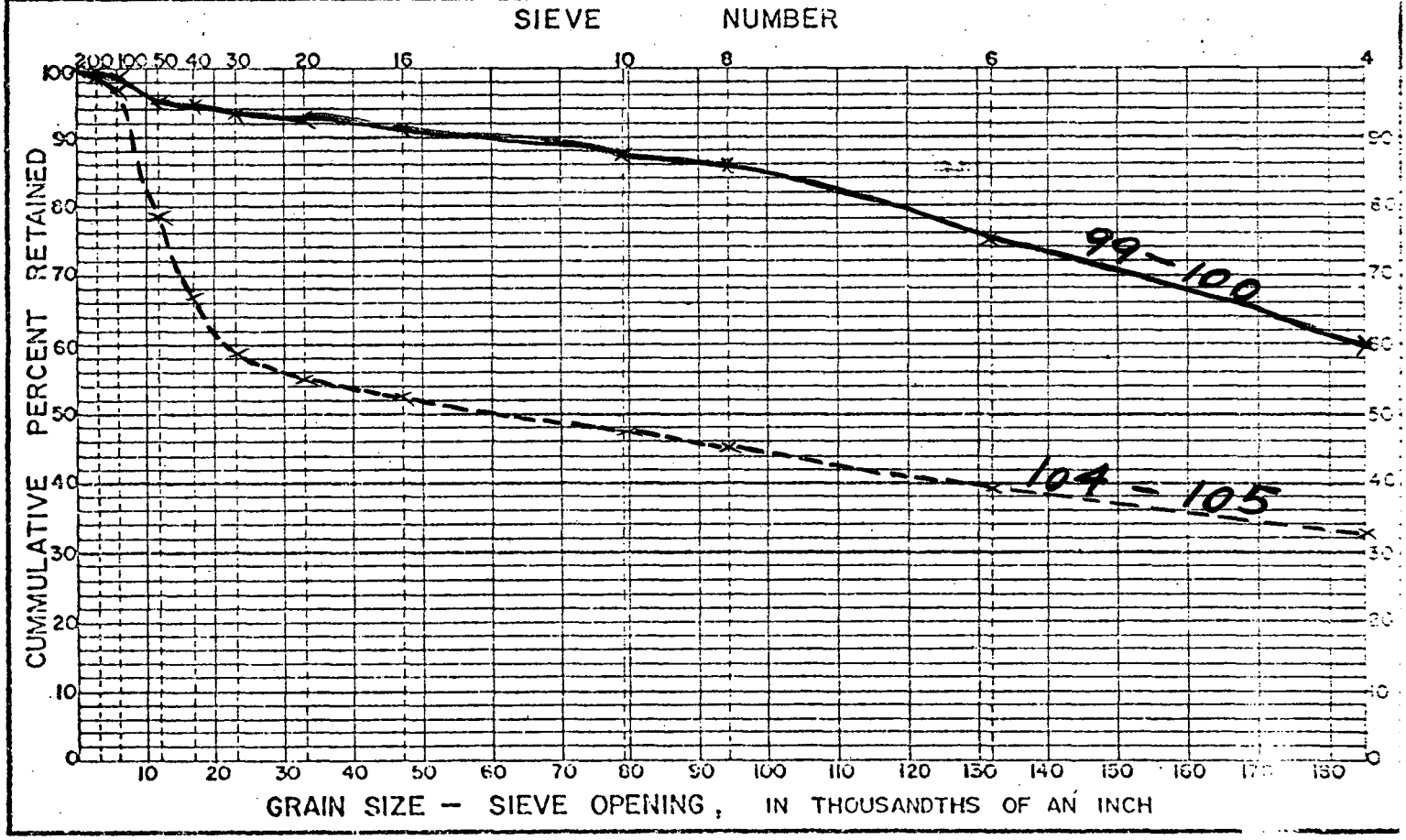
SAMPLE WEIGHT, IN grams	INTERVAL 99-100	INTERVAL 104-105
1. WT. CONTAINER + SAMPLE		
2. WT. CONTAINER		
3. WT. SAMPLE less than 1/2" size	1248.6	907.9
4. WT. SAMPLE 1/2" size and over	283.7	276.2
5. WT. ENTIRE SAMPLE (i.e 3. + 4.)	1532.3	1184.1
6. PERCENT SAMPLE 1/2" size and over	18.5 %	23.3 %

DEPTH INTERVAL (FEET)	SCREEN OPENING 90%	50%	40%	30%
99 - 100	55	+200	+200	+200
104 - 105	8	60	128	+200

NOTE: The following sieve analysis does not include the 1/2" size and over.

SIEVE NO.	INTERVAL 99 - 100 CUMM. WT. RET. IN grams	CUMM. % RET.	INTERVAL 104 - 105 CUMM. WT. RET. IN grams	CUMM. % RET.
4	749.1	60.0	295.3	32.5
6	937.1	75.1	359.9	39.6
8	1073.9	86.0	415.0	45.7
10	1096.7	87.8	429.3	47.3
16	1143.6	91.6	473.3	52.1
20	1154.9	92.5	499.4	55.0
30	1163.6	93.2	533.6	58.8
40	1178.6	94.4	605.3	66.7
50	1195.3	95.7	713.0	78.5
100	1231.9	98.7	876.7	96.6
200	1243.1	99.6	899.0	99.0
PAN	1244.6	99.7	901.4	99.3

REMARKS:



SIEVE ANALYSIS

2C

PROJECT: SUMAS PRAIRIE WATER SUPPLY
LOCATION: ABBOTSFORD
WELL NO.: 2
ANALYSIS BY: F. Chwojka DATE: Feb. 17/82

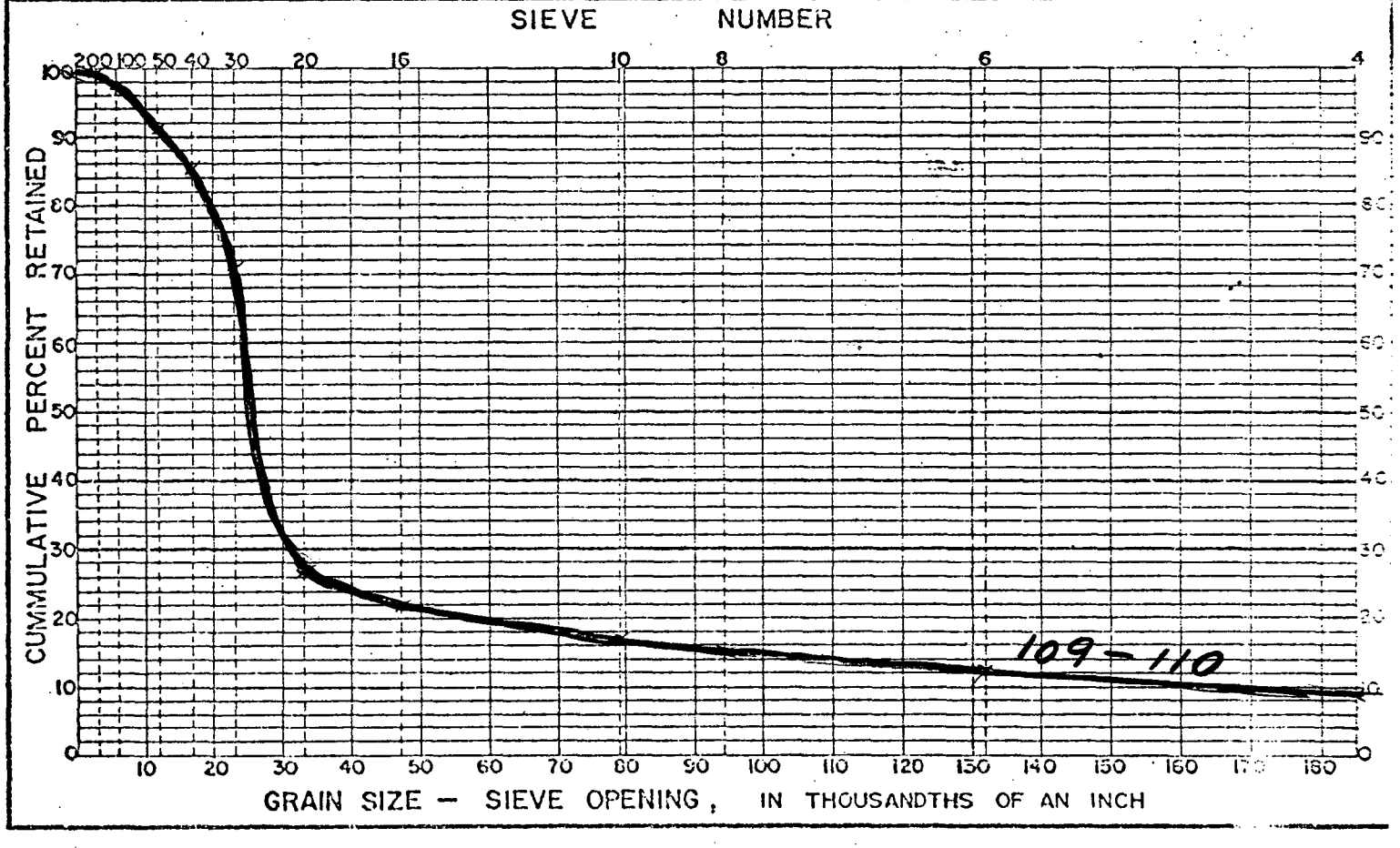
NOTE: The following sieve analysis does not include the 1/2" size and over.

SAMPLE WEIGHT, IN grams	INTERVAL 109 - 110	INTERVAL -
1. WT. CONTAINER + SAMPLE		
2. WT. CONTAINER		
3. WT. SAMPLE less than 1/2" size	1369.9	
4. WT. SAMPLE 1/2" size and over	247.9	
5. WT. ENTIRE SAMPLE (i.e 3. + 4.)	1617.8	
6. PERCENT SAMPLE 1/2" size and over	15.3 %	%

DEPTH INTERVAL (FEET)	SCREEN OPENING 90%	50%	40%	30%
109 - 110	13	25	27	31

SIEVE NO.	INTERVAL 109 - 110 CUMM. WT. RET. IN grams	CUMM. % RET.	INTERVAL - CUMM. WT. RET. IN grams	CUMM. % RET.
4	131.5	9.6		
6	166.8	12.2		
8	213.3	15.6		
10	230.0	16.8		
16	300.0	21.9		
20	360.5	26.3		
30	964.4	70.4		
40	1175.7	85.8		
50	1245.4	90.9		
100	1329.9	97.1		
200	1360.8	99.3		
PAN	1365.1	99.6		

REMARKS:



SIEVE ANALYSIS

PROJECT: SUMAS PRAIRIE WATER SUPPLY

LOCATION: ABBOTSFORD

WELL NO.: 3

ANALYSIS BY: F. Chwojka DATE: Feb. 17/82

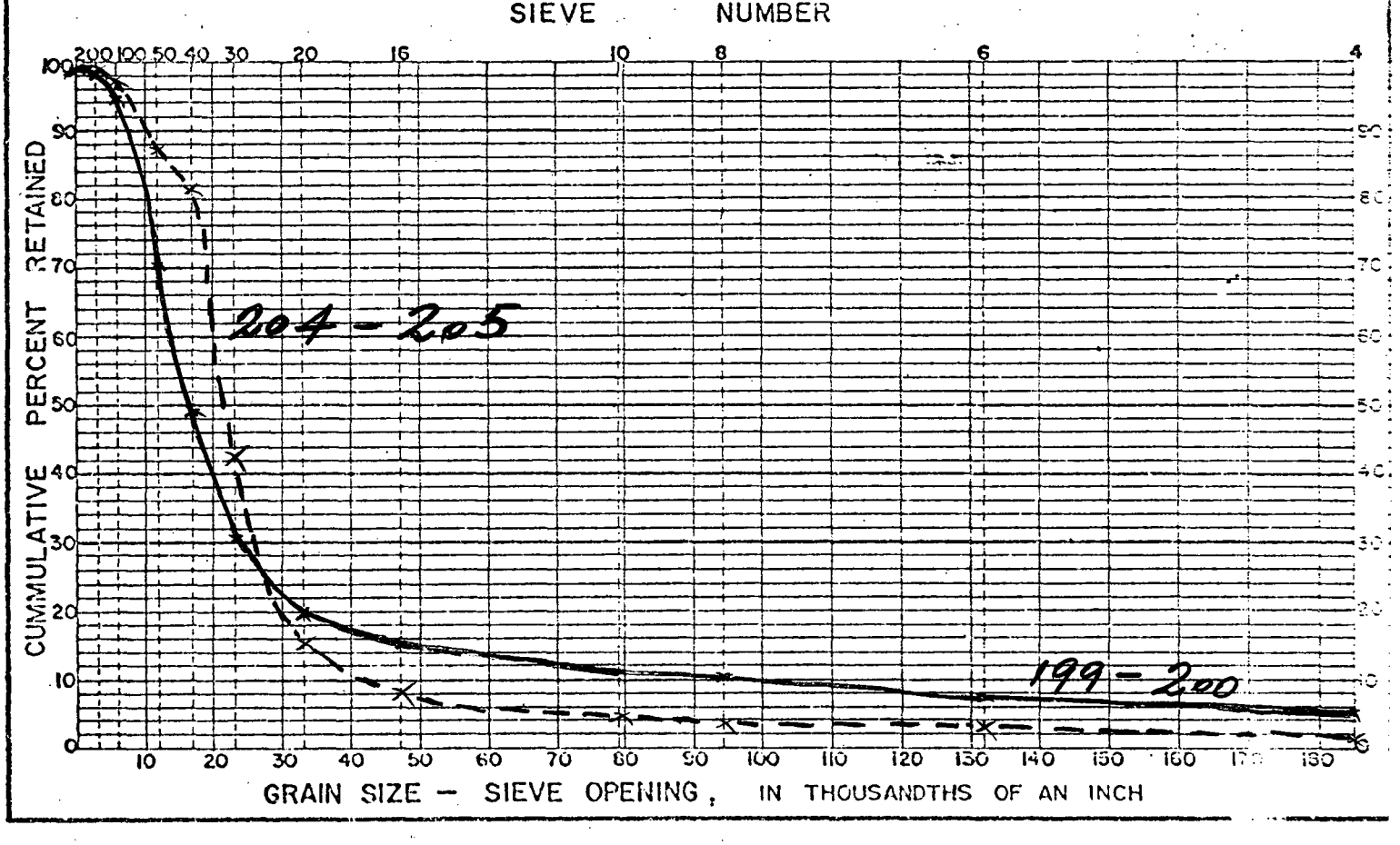
NOTE: The following sieve analysis does not include the 1/2" size and over.

SAMPLE WEIGHT, IN grams	INTERVAL 199 -200	INTERVAL 204-205
1. WT. CONTAINER + SAMPLE		
2. WT. CONTAINER		
3. WT. SAMPLE less than 1/2" size	651.4	880.9
4. WT. SAMPLE 1/2" size and over	27.3	14.2
5. WT. ENTIRE SAMPLE (i.e 3. + 4.)	678.7	895.1
6. PERCENT SAMPLE 1/2" size and over	4.0 %	1.6 %

DEPTH INTERVAL (FEET)	SCREEN OPENING 90%	50%	40%	30%
199 -200	7	16	20	23
204 -205	10	21	23	25

SIEVE NO.	INTERVAL 199 -200 CUMM. WT. RET. IN grams	CUMM. % RET.	INTERVAL 204 -205 CUMM. WT. RET. IN grams	CUMM. % RET.
4	37.0	5.7	16.4	1.9
6	51.1	7.8	23.5	2.7
8	66.4	10.2	33.5	3.8
10	72.5	11.1	37.8	4.3
16	100.2	15.4	70.2	8.0
20	130.2	20.0	133.6	15.2
30	197.7	30.4	371.4	42.2
40	323.0	49.6	719.2	81.6
50	457.6	70.2	772.2	87.7
100	613.5	94.2	856.2	97.2
200	638.6	98.0	874.6	99.3
PAN	646.7	99.3	877.5	99.6

REMARKS:



SIEVE ANALYSIS

PROJECT: SUMAS PRAIRIE WATER SUPPLY
LOCATION: ABBOTSFORD
WELL NO.: 3
ANALYSIS BY: F. Chwojka DATE: Feb. 17/82

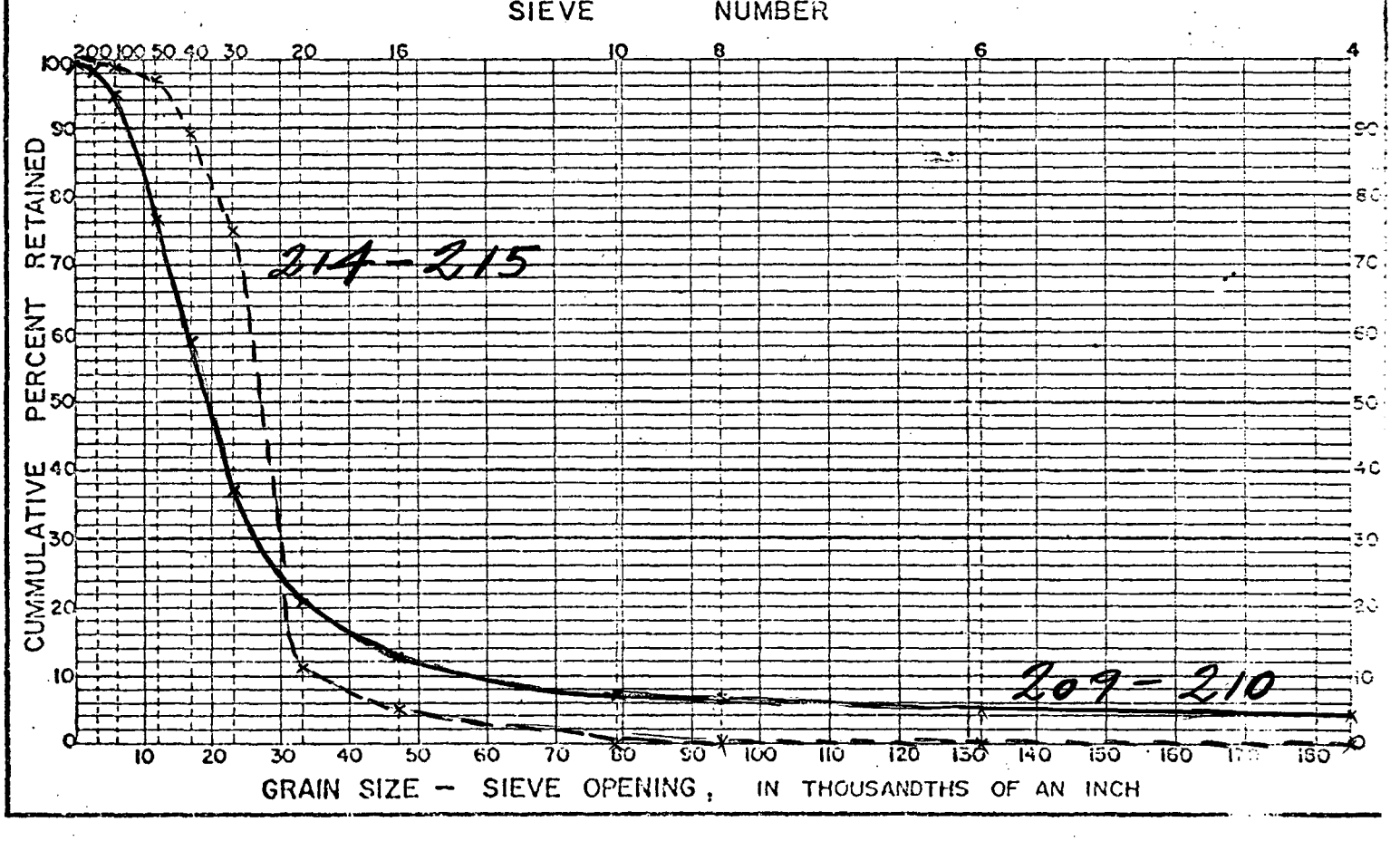
SAMPLE WEIGHT, IN grams	INTERVAL 209-210	INTERVAL 214-215
1. WT. CONTAINER + SAMPLE		
2. WT. CONTAINER		
3. WT. SAMPLE less than 1/2" size	1028.9	943.5
4. WT. SAMPLE 1/2" size and over	3.2	0.0
5. WT. ENTIRE SAMPLE (i.e 3. + 4.)	1032.1	943.5
6. PERCENT SAMPLE 1/2" size and over	0.3 %	0.0%

DEPTH INTERVAL (FEET)	SCREEN OPENING 90%	50%	40%	30%
209 - 210	7	19	22	26
214 - 215	16	27	28	30

NOTE: The following sieve analysis does not include the 1/2" size and over.

SIEVE NO.	INTERVAL 209-210 CUMM. WT. RET. IN grams	CUMM. % RET.	INTERVAL 214-215 CUMM. WT. RET. IN grams	CUMM. % RET.
4	42.9	4.2	0.0	0.0
6	52.9	5.1	0.9	0.1
8	70.5	6.9	1.6	0.2
10	78.1	7.6	2.8	0.3
16	132.9	12.9	47.4	5.0
20	213.0	20.7	106.5	11.3
30	387.0	37.6	706.5	74.9
40	603.3	58.6	844.5	89.5
50	782.9	76.1	901.8	95.6
100	980.0	95.2	940.0	99.6
200	1010.1	98.2	948.1	100.5
PAN	1022.0	99.3	949.3	100.6

REMARKS:



SIEVE ANALYSIS

3C

PROJECT: SUMAS PRAIRIE WATER SUPPLY
LOCATION: ABBOTSFORD
WELL NO.: 3
ANALYSIS BY: F. Chwojka DATE: Feb. 17/82

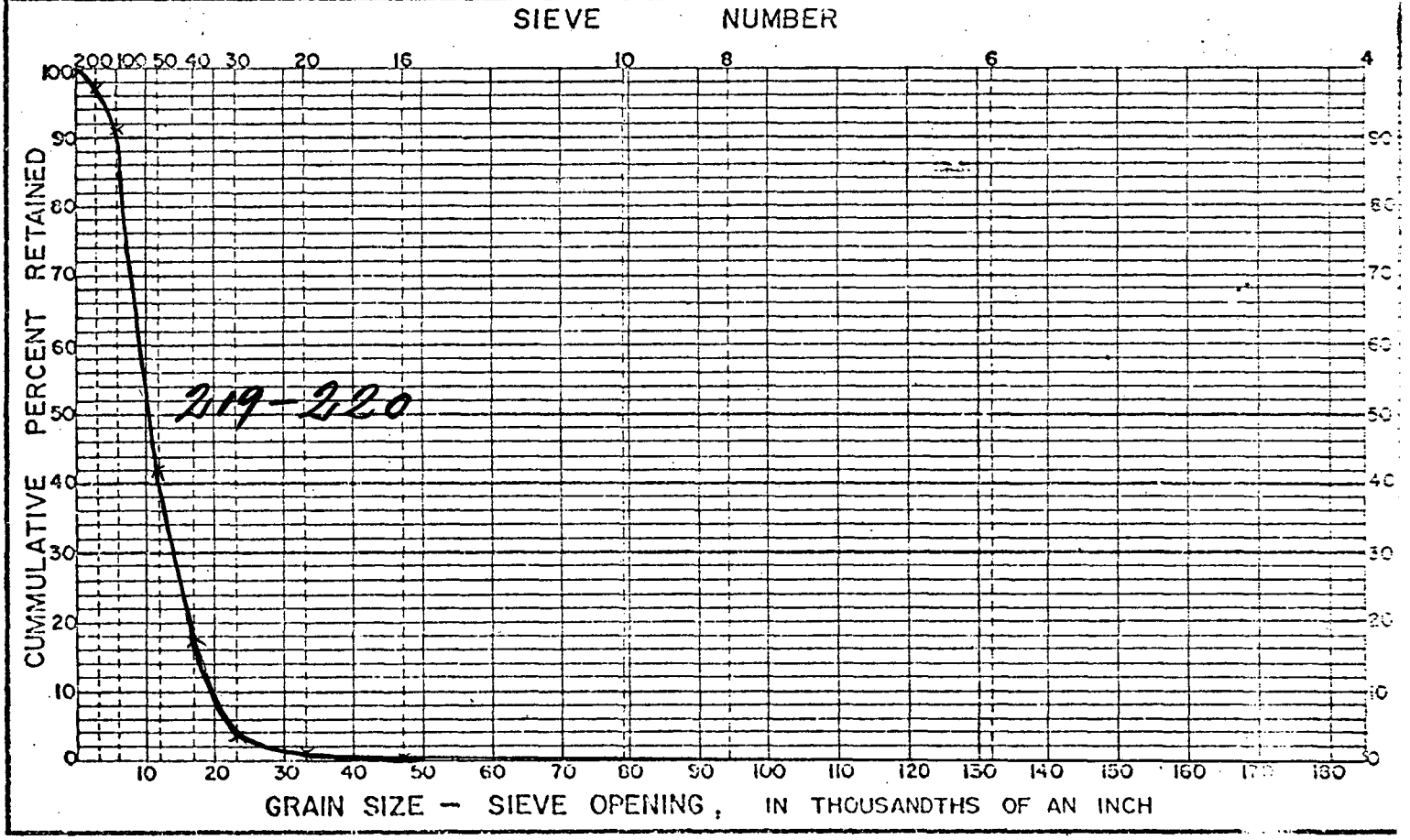
NOTE: The following sieve analysis does not include the 1/2" size and over.

SAMPLE WEIGHT, IN grams	INTERVAL 219-220	INTERVAL -
1. WT. CONTAINER + SAMPLE		
2. WT. CONTAINER		
3. WT. SAMPLE less than 1/2" size	779.7	
4. WT. SAMPLE 1/2" size and over	0.0	
5. WT. ENTIRE SAMPLE (i.e 3. + 4.)	779.7	
6. PERCENT SAMPLE 1/2" size and over	%	%

DEPTH INTERVAL (FEET)	SCREEN OPENING 90%	50%	40%	30%
219-220	5	11	12	14

SIEVE NO.	INTERVAL 219-220 CUMM. WT. RET. IN grams	CUMM. % RET.	INTERVAL - CUMM. WT. RET. IN grams	CUMM. % RET.
4	1.0	0.1		
6	1.1	0.1		
8	1.7	0.2		
10	2.1	0.3		
16	4.2	0.5		
20	9.8	1.3		
30	30.4	3.9		
40	136.8	17.5		
50	328.2	42.1		
100	707.0	90.7		
200	756.0	97.0		
PAN	777.1	99.7		

REMARKS:



APPENDIX D

Figure	Description
1D	Water quality analyses - Observation Well 272
2D	Water quality analyses - Observation Well 273
3D	Water quality analyses - Observation Well 274

WATER QUALITY REPORT FOR SAMPLE 116630W

TO: INVENTORY & ENGIN. BR.
765 BROUGHTON 5TH FLOOR
VICTORIA, B.C.
ATTENTION OF: F CHWOJKA

APPENDIX 1D

FOR SITE: 1401922 ABBOTSFORD-SUMAS 119 FEET (OBS. WELL 272)

SAMPLING DATE(S): OCT 20/81 1500 HRS
SAMPLE TYPE: FRESH WATER
SAMPLING DEPTH: 120
SAMPLED BY: I & E - WATER MANAGEMENT
DATE RECEIVED BY LABORATORY: OCT 22/81

0040101	PH	6.8 REL UNIT	0071701	RES:FILT.105C	132. MG/L
0110101	SPECIFIC CONDUC	196. UMHO/CM	0300101	COMP.DIL.COND.	203. UMHO/CM
1010101	ALKALINITY:PHNL	L 0.5 MG/L	1020101	ALKALINITY:TOT	60.2 MG/L
1041702	CHLORIDE:DISSOL	9.2 MG/L	1061701	FLUORIDE:DISSOL	L 0.1 MG/L
1070002	HARDNES.T:CACO3	75.1 MG/L	1091703	NITROGN:NO2 NO3	4. MG/L
1130101	NITROGN:KJELDAH	0.71 MG/L	1191703	PHOSPHORUS :TOT DISSOLVED	L 0.003 MG/L
1201702	SILICA:REACTIVE	13. MG/L	1211701	SULPHATE:DISSOL	8.6 MG/L
2541802	CALCIUM DISSOLVED	19.9 MG/L	2570209	IRON TOTAL	24. MG/L
2571413	IRON DISSOLVED	23.1* MG/L	2591413	MAGNESIUM DISSOLVED	6.18 MG/L
2600209	MANGANESE TOTAL	2.9* MG/L	2601413	MANGANESE DISSOLVED	2.74* MG/L
2641703	POTASSIUM DISSOLVED	1.1 MG/L	2651703	SODIUM DISSOLVED	4.5 MG/L

THE APPROXIMATE COST OF THE ABOVE TESTS IS $ 183.00

SAMPLE NO. 116630W CONTINUED ON NEXT PAGE.

WATER QUALITY REPORT FOR SAMPLE 116630W

REMARKS:

FOR ENVIRONMENTAL LABORATORY

WATER QUALITY REPORT FOR SAMPLE 116631W

TO: INVENTORY & ENGIN. BR.
765 BROUGHTON 5TH FLOOR
VICTORIA, B.C.
ATTENTION OF: F CHWOJKA

APPENDIX 2D

FOR SITE: 1401923 ABBOTSFORD-SUMAS 112 FEET (OBS. WELL 273)

SAMPLING DATE(S): OCT 20/81 1400 HRS
SAMPLE TYPE: FRESH WATER
SAMPLING DEPTH: 120
SAMPLED BY: I & E - WATER MANAGEMENT
DATE RECEIVED BY LABORATORY: OCT 22/81

0040101	PH	8.5 REL UNIT	0071701	RES:FILT.105C	110. MG/L
0110101	SPECIFIC CONDUC	190. UMHO/CM	0300101	COMP.DIL.COND.	201. UMHO/CM
1010101	ALKALINITY:PHNL	2.1 MG/L	1020101	ALKALINITY:TOT	68.5 MG/L
1041702	CHLORIDE:DISSOL	4.6 MG/L	1061701	FLUORIDE:DISSOL	L 0.10 MG/L
1070002	HARDNES.T:CACO3	78.4 MG/L	1091703	NITROGN:NO2 NO3	0.73 MG/L
1130101	NITROGN:KJELDAH	0.63 MG/L	1191703	PHOSPHORUS :TOT DISSOLVED	0.003 MG/L
1201702	SILICA:REACTIVE	4.3 MG/L	1211701	SULPHATE:DISSOL	17.8 MG/L
2541802	CALCIUM DISSOLVED	23.8 MG/L	2570209	IRON TOTAL	13.5 MG/L
2571413	IRON DISSOLVED	0.09 MG/L	2591413	MAGNESIUM DISSOLVED	4.61 MG/L
2600209	MANGANESE TOTAL	0.21 MG/L	2601413	MANGANESE DISSOLVED	0.08 MG/L
2641703	POTASSIUM DISSOLVED	2.0 MG/L	2651703	SODIUM DISSOLVED	4.9 MG/L

THE APPROXIMATE COST OF THE ABOVE TESTS IS $ 183.00

SAMPLE NO. 116631W CONTINUED ON NEXT PAGE.

ENVIRONMENTAL LABORATORY
MINISTRY OF THE ENVIRONMENT

WATER QUALITY REPORT FOR SAMPLE 116631W

REMARKS:

FOR ENVIRONMENTAL LABORATORY

WATER QUALITY REPORT FOR SAMPLE 116632W

TO: INVENTORY & ENGIN. BR.
765 BROUGHTON 5TH FLOOR
VICTORIA, B.C.
ATTENTION OF: F CHWOJKA

APPENDIX 3D

FOR SITE: 1401924 ABBOTSFORD-SUMAS 220 FEET (OBS. WELL 274)

SAMPLING DATE(S): OCT 20/81 1200 HRS
SAMPLE TYPE: FRESH WATER
SAMPLING DEPTH: 210
SAMPLED BY: I & E - WATER MANAGEMENT
DATE RECEIVED BY LABORATORY: OCT 22/81

0040101	PH	8.3 REL UNIT	0071701	RES:FILT.105C	156. MG/L
0110101	SPECIFIC CONDUC	242. UMHO/CM	0300101	COMP.DIL.COND.	263. UMHO/CM
1010101	ALKALINITY:PHNL	L 0.5 MG/L	1020101	ALKALINITY:TOT	70.9 MG/L
1041702	CHLORIDE:DISSOL	6.4 MG/L	1061701	FLUORIDE:DISSOL	L 0.10 MG/L
1070002	HARDNES.T:CACO3	101. MG/L	1091703	NITROGN:NO2 NO3	6.20 MG/L
1130101	NITROGN:KJELDAH	0.63 MG/L	1191703	PHOSPHORUS :TOT DISSOLVED	0.005 MG/L
1201702	SILICA:REACTIVE	7.4 MG/L	1211701	SULPHATE:DISSOL	19.8 MG/L
2541802	CALCIUM DISSOLVED	30.4 MG/L	2570209	IRON TOTAL	22.0 MG/L
2571413	IRON DISSOLVED	0.05 MG/L	2591413	MAGNESIUM DISSOLVED	6.04 MG/L
2600209	MANGANESE TOTAL	0.41 MG/L	2601413	MANGANESE DISSOLVED	0.17 MG/L
2641703	POTASSIUM DISSOLVED	1.8 MG/L	2651703	SODIUM DISSOLVED	6.3 MG/L

THE APPROXIMATE COST OF THE ABOVE TESTS IS $ 183.00

SAMPLE NO. 116632W CONTINUED ON NEXT PAGE.

WATER QUALITY REPORT FOR SAMPLE 116632W

REMARKS:

FOR ENVIRONMENTAL LABORATORY

PHOTOGRAPHS

DRILLING AND CONSTRUCTION OF OBSERVATION
WELL NOS. 272, 273 AND 274 (OCTOBER, 1981)
SUMAS PRAIRIE WATER SUPPLY PROJECT, ABBOTSFORD, B.C.

1. Drilling of Observation Well No. 272. (View from Farmer Road)

2. Drilling of Observation Well No. 272.

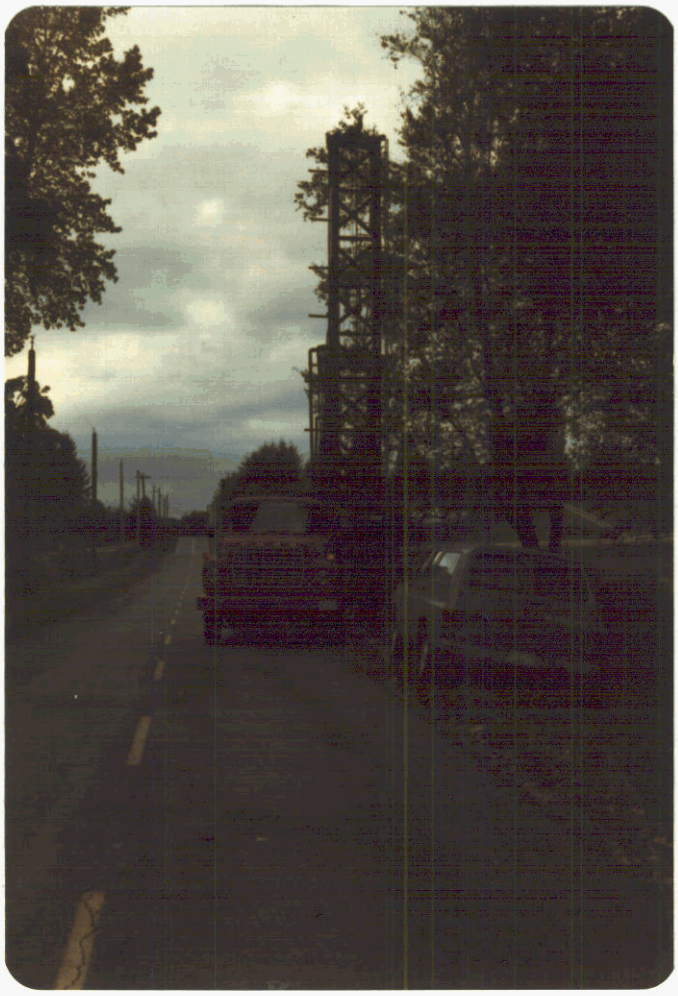
3. Dark brown-black discharge from Obs. Well No. 272, at completion of drilling and flushing.

4. Obs. Well No. 272
Screen assembly

5. Lowering screen down
Obs. Well No. 272

6. Observation Well No.272
Recorder installation

7. Drilling of Observation Well
No. 273 - along Farmer Road



8. Drilling of Obs. Well No. 273

9. Development of Observation Well No. 273

10. Obs. Well No. 273 - Recorder installation

11. Vye Road and access road to Obs. Well No. 274 site

12. Drilling of Obs. Well No. 274

(near water reservoir)

13. Screen assembly for
Obs. Well No. 274

14. Obs. Well No. 274 - Recorder installation