CONSTRUCTION OF

CRUSHER-SITE WELL NP-1C

NORTHUMBERLAND PROJECT

Project No. 81-105

Prepared for

CYPRUS MINES CORPORATION

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TABLE OF CONTENTS

FIGURES

APPENDIX

1.0 SUMMARY AND CONCLUSIONS

1. A 766 feet deep eight-inch cased water-supply well was constructed east of the Northumberland Project crusher plant during the month of June, 1981.

2. The completed well was equipped with a 22-stage Valley pump equipped with a 20-horsepower Franklin submersible electric motor rated at a discharge of 60 gallons per minute at a total dynamic head of 840 feet.

3. A one hour pumping test was conducted to verify the performance of the pumping equipment and the yield of the well. The pump discharged 75 gallons per minute with a drawdown in the well of 3.16 feet, a pumping water level of approximately 630 feet below ground level.

4. The well was found to be capable of meeting the anticipated water-supply demands of the project in the vicinity of the crusher site.

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2.0 INTRODUCTION

In May of 1981 Aqua Drilling and Pump Service, Sparks, Nevada, was selected by CYPRUS MINES CORPORATION to drill and construct a water-supply well at the Northumberland Project crusher site. Well-design criteria and periodic on-site supervision was provided by WILLIAM E. NORK, INC. The well site was located east of the crusher in the unsurveyed $SE\frac{1}{4}SE\frac{1}{4}$ Section 13, Township 13 N., Range 45 E., in northern Nye County, Nevada (Figure 1). The purpose of the well was to replace the existing crusher water-supply well, designated Np-1 (refer to WEN, INC., report dated 2/27/81). Well Np-1 was rendered useless following freezing of water within the discharge pipe and the subsequent fall of pumping equipment and accessories to the bottom of the well. Failure to retrieve the discharge pipe, electrical cable and pump required that the well be abandoned.

The first attempt at constructing a replacement well was unsuccessful. Problems arose during casing operations of the 769 feet deep borehole. The hole, referred to as Np-1b, was formally abandoned after attempts to rectify the problem failed.

Construction of a well was successfully completed on June 30. This well, referred to as Np-1c, was completed to a depth of 766 feet and equipped with production pumping equipment.

This report describes the construction of hole Np-1b, the water-supply well Np-1c, and performance testing of the pumping equipment.

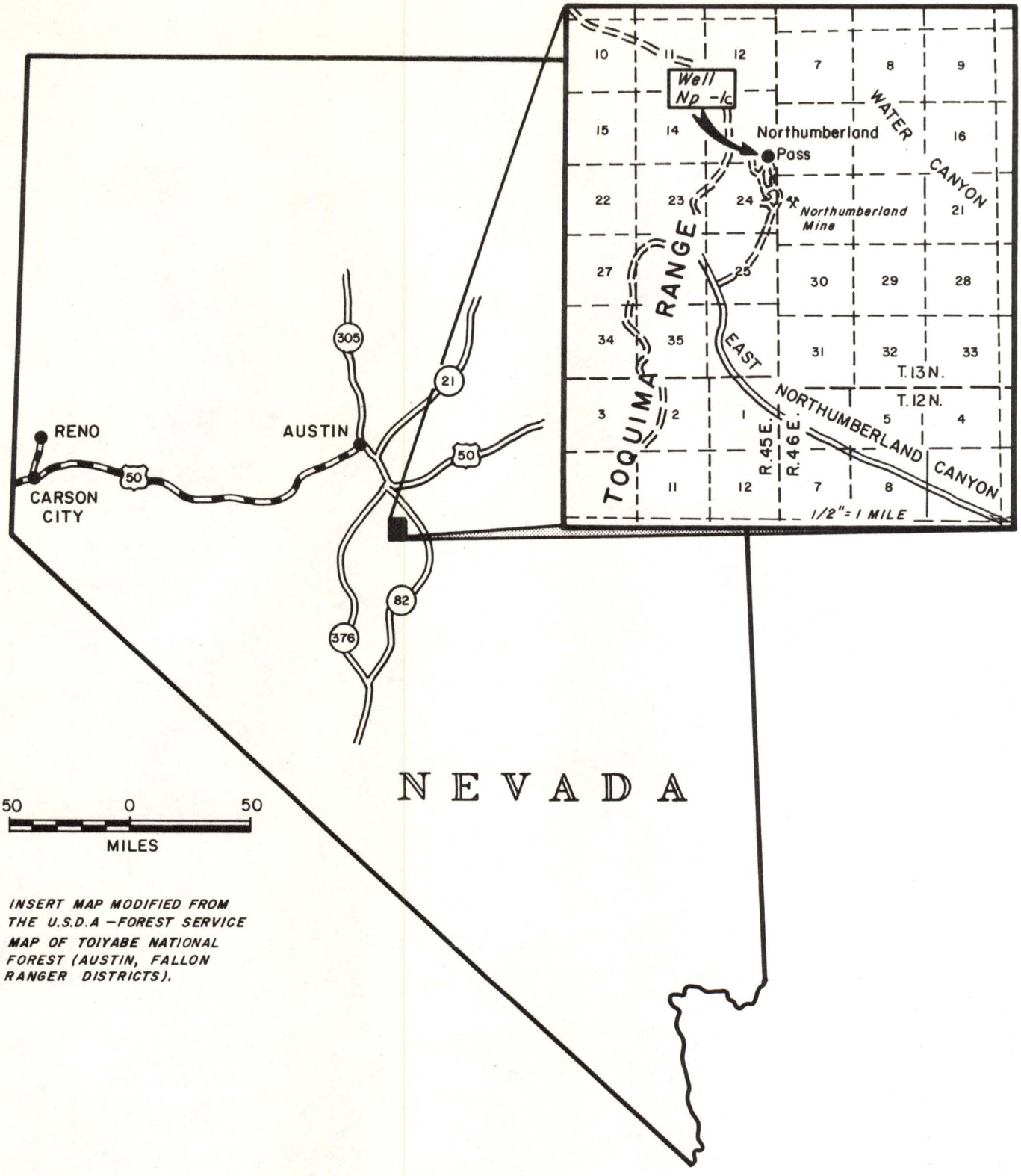

FIG. 1 NORTHUMBERLAND CANYON PROJECT REFERENCE MAP

3.0 WELL CONSTRUCTION

Aqua Drilling and Well Service, Sparks, Nevada, was contracted by CYPRUS-Northumberland to drill a replacement well for the crusher water-supply well Np-1. Two holes were drilled, one of which was completed as a well. Hole Np-1b and well Np-1c were drilled approximately 45 and 90 feet, respectively, east of well no. Np-1.

3.1 CONSTRUCTION OF Np-1B

A nominal 10-inch diameter borehole was drilled to a depth of 769 feet May 5 through 12, 1981. During installation of the 8-5/8-inch O.D. production well casing, a total of 560 feet of casing, was inadvertently dropped down the well bore. The casing became wedged in the borehole about 120 feet below the ground surface. Attempts to retrieve the casing or push it to the bottom of the hole failed.

Plans for salvaging the well provided for the installation of a specially manufactured 8-inch O.D. casing liner which would fit through the casing string and allow casing of the well to the total depth as required by state law. Once the liner was emplaced, 8-5/8-inch O.D. casing equipped with an overshot coupler was to be installed from 110 feet depth to the surface (see Figure 2). This procedure was unsuccessful. The casing liner became wedged inside the 8-5/8-inch O.D. casing. Attempts to drive the casing liner resulted in a rupture of the 8-inch O.D. casing wall. Subsequent attempts to retrieve the liner failed.

The hole was formally abandoned on June 30 according to the procedures outlined by the State of Nevada Division of Water Resources. A cement-grout plug was installed from the bottom of the hole to ground surface. The original crusher water-supply well, Np-1, was also formally abandoned at this time.

3.2 CONSTRUCTION OF Np-1C

A nominal 10-inch diameter borehole was drilled to a depth of 766 feet June 12 through 29, 1981. An abbreviated lithologic log of the geologic materials penetrated is given below.

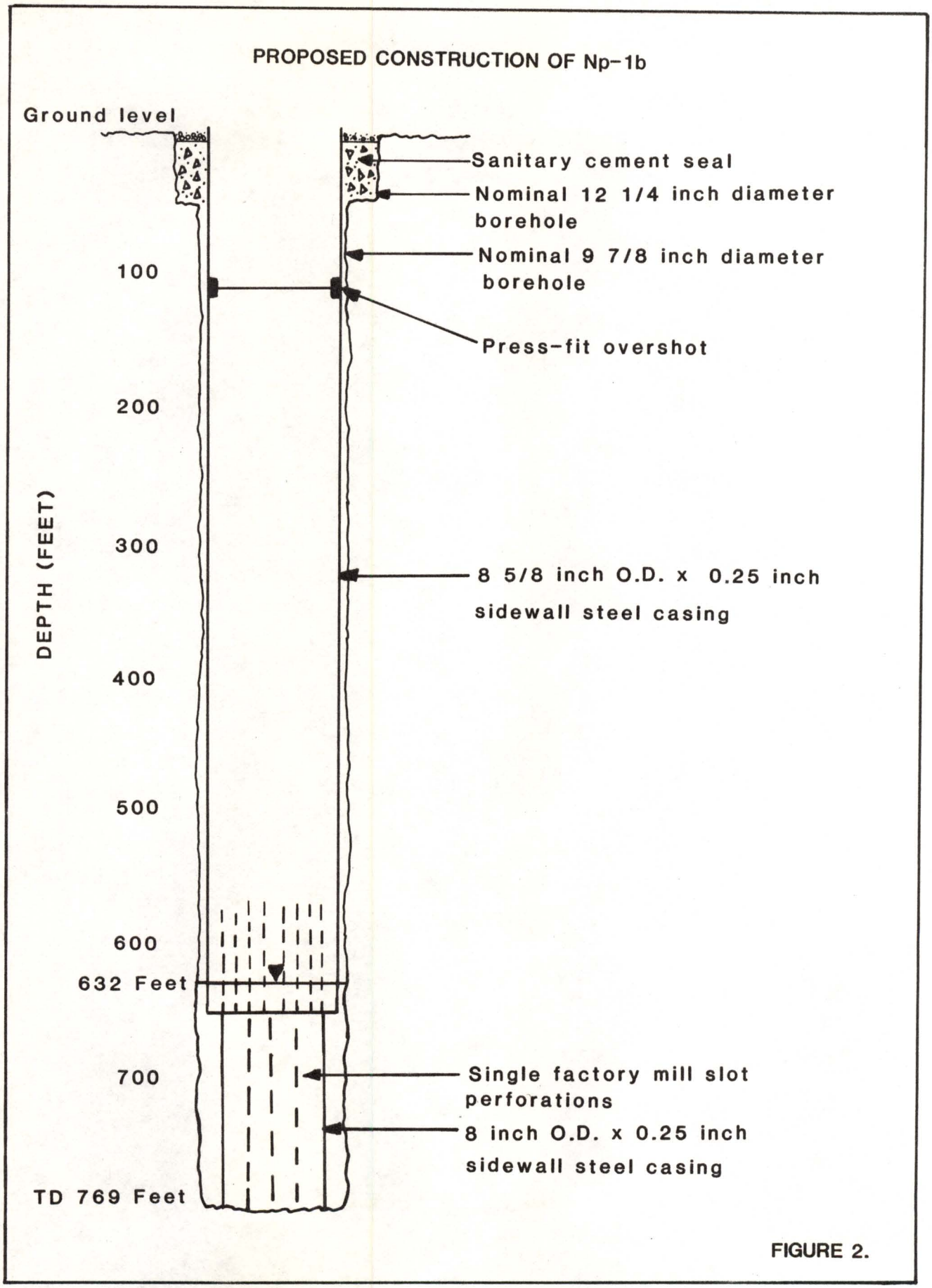
PROPOSED CONSTRUCTION OF Np-1b
Ground level
Sanitary cement seal
Nominal 12 1/4 inch diameter borehole
Nominal 9 7/8 inch diameter borehole
Press-fit overshot
8 5/8 inch O.D. x 0.25 inch sidewall steel casing
Single factory mill slot perforations
8 inch O.D. x 0.25 inch sidewall steel casing
DEPTH (FEET)
100
200
300
400
500
600
632 Feet
700
TD 769 Feet

FIGURE 2.

Depth interval	Lithologic description
0-48	Light to medium brown limestone, weathered and highly fractured.
48-220	Medium gray to black carbonaceous limestone, some quartz veins.
220-420	Light gray to white limestone.
420-495	Gray limestone, iron stained and fractured.
495-766	No return; rock exceedingly fractured.

Installation of casing to 766 feet was completed June 29. A cement sanitary seal was emplaced in the annular space between the casing and formation walls June 30. Final well construction is shown in Figure 3. The completed well was developed with the drill-rig mounted air compressor to remove residual drilling foam and cuttings prior to installation of pumping equipment.

A 22-stage Valley pump powered by a 20-horsepower Franklin submersible motor was installed by Aqua Drilling and Well Service July 13. The pump failed to operate due to an apparent short in the submersible electrical cable. The pump was subsequently removed from the well, the submersible electrical cable replaced and the pump reinstalled. Final pump installation included a wire-rope safety cable connected to the pump and anchored at the surface. A three-quarter-inch diameter stilling well to enable accurate water-level measurement was also installed.

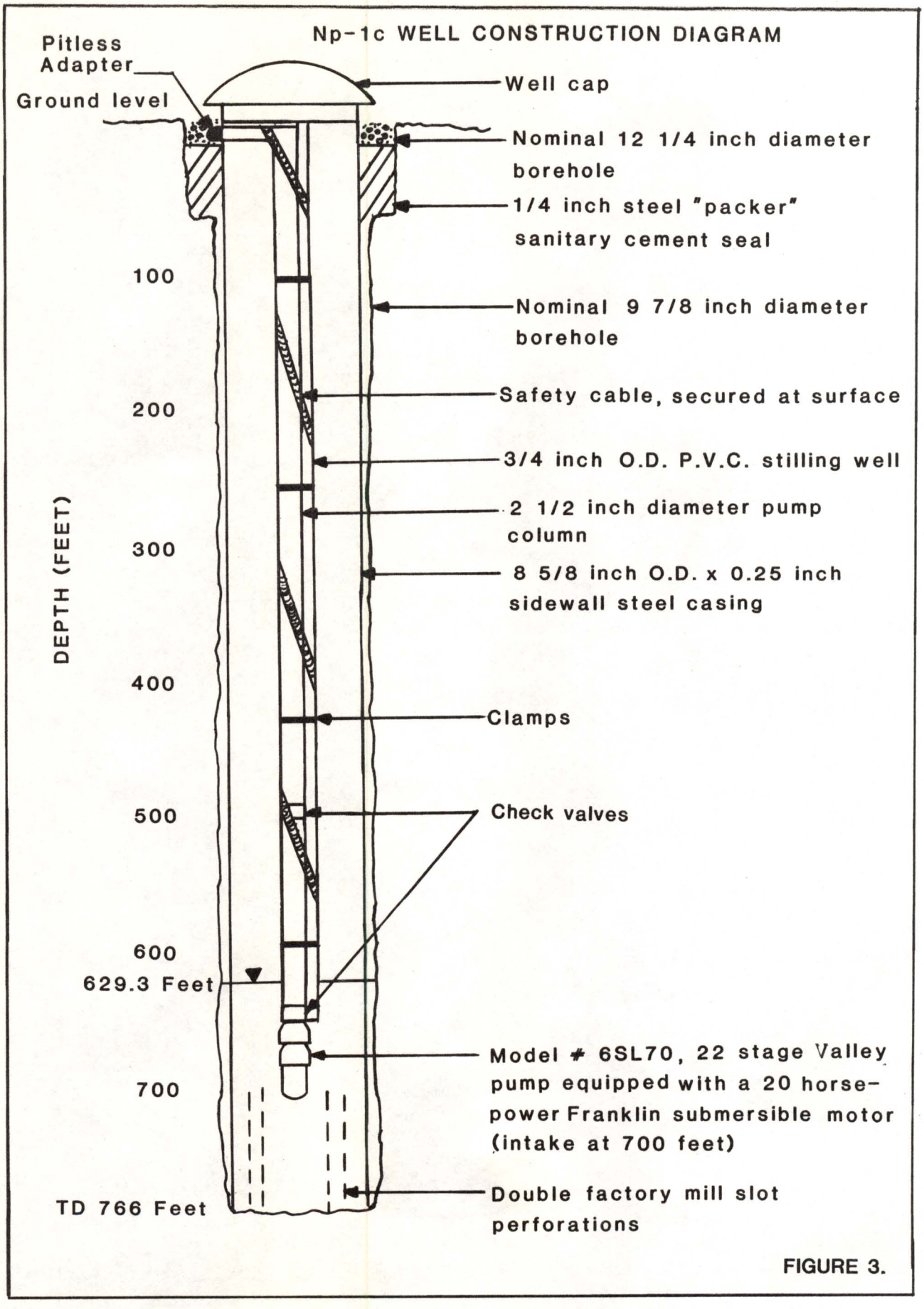
Np-1c WELL CONSTRUCTION DIAGRAM
Pitless Adapter
Ground level
Well cap
Nominal 12 1/4 inch diameter borehole
1/4 inch steel "packer" sanitary cement seal
Nominal 9 7/8 inch diameter borehole
Safety cable, secured at surface
3/4 inch O.D. P.V.C. stilling well
2 1/2 inch diameter pump column
8 5/8 inch O.D. x 0.25 inch sidewall steel casing
Clamps
Check valves
Model # 6SL70, 22 stage Valley pump equipped with a 20 horse-power Franklin submersible motor (intake at 700 feet)
Double factory mill slot perforations
DEPTH (FEET)
100
200
300
400
500
600
629.3 Feet
700
TD 766 Feet

FIGURE 3.

4.0 TESTING OF WELL NP-1C

Upon completion of the well construction and installation of production pumping equipment, a one hour performance test was conducted. A formal aquifer pumping test was not required. The drilling conditions and geologic materials penetrated were virtually identical to those encountered in Np-1 which was test-pumped for a period of 72 hours (WEN, INC., 2/27/81). Consequently, hydrologic characteristics were not expected to change dramatically over the short distance between Np-1 and -1c. The performance test is summarized below.

> Static water level prior to testing was 627.29 feet below top of stilling well. Testing commenced at 1450 hours 7/18/81. Np-1c was pumped at a rate of 75 gpm for 60 minutes. Drawdown at the conclusion of testing was 3.16 feet, a depth of 630.45 feet. The water level in the well recovered fully within 10 minutes of terminating pumping.

Testing results are illustrated in Figure 4 and test data provided in Appendix B. These results confirmed the supposition that the performance of wells Np-1 and NP-1c was similar.

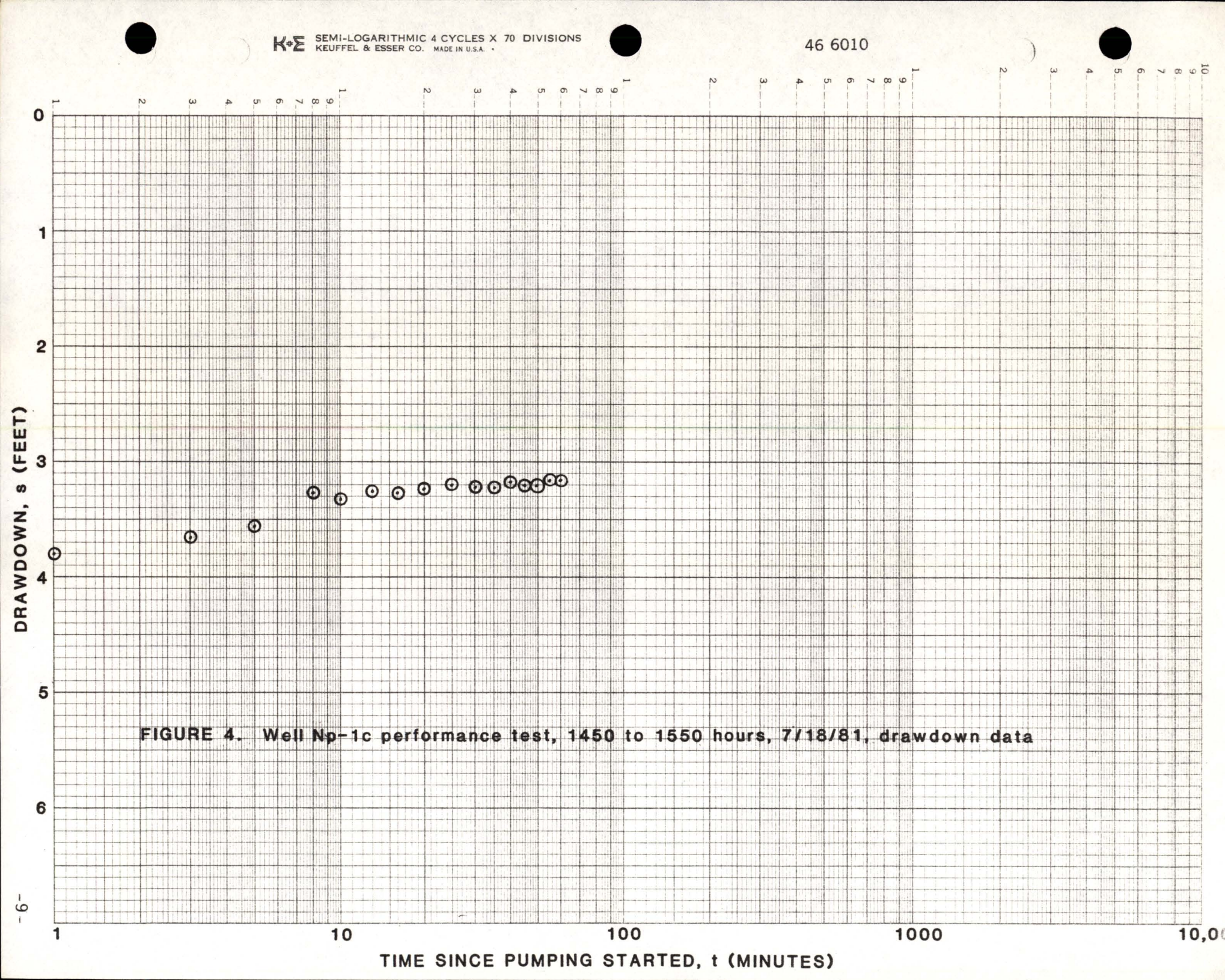

FIGURE 4. Well Np-1c performance test, 1450 to 1550 hours, 7/18/81, drawdown data

6.0 YIELD RATING OF WELL NP-1C

Pumping test results indicate that the limestone aquifer in the vicinity of Np-1c is capable of yielding more than 1,500 gpm. However, well yield of Np-1c is limited by design of the well. The maximum discharge of pumps capable of fitting inside of the 8-5/8-inch O.D. x 0.250-inch side wall casing operating with a pumping lift greater than 650 feet is about 300 gpm.

Production pumping equipment installed in the well was sized to comply with the water-supply requirements at the mine (crusher, pit, haul roads, equipment shop, etc.). Lumos and Associates (1981 correspondence) suggested that 60 gallons per minute would meet these demands. A pump capable of 60 gpm at a total dynamic head (TDH) of 860 feet was selected. At this pumping rate, drawdown in the well will be approximately three feet, a pumping water level of about 630 feet below ground surface. It was recommended that the pump intake be set at a depth of approximately 700 feet to allow for seasonal and cyclical variations in water level.

6.0 CHEMICAL QUALITY OF WELL WATER

The chemical quality of the ground water derived from crusher Well Np-1c is expected to be identical to Well Np-1. For discussion of water chemistry refer to Section 4.0 "Exploration and Development of Ground Water, Northumberland Project Crusher Site" (WEN, INC., 2/27/81).

SOURCES OF INFORMATION

Lumos and Associates, correspondence to Cyprus Mines Corporation.

Nork, William E., Inc. Exploration and Development of Ground Water, Northumberland Project Crusher Site, private report prepared for Cyprus Mines Corporation, February 27, 1981.

APPENDIX A

Driller's Report

WILLIAM E. NORK, Inc.

Reno, Nevada 89503

WHITE—DIVISION OF WATER RESOURCES
CANARY—CLIENT'S COPY
PINK—WELL DRILLER'S COPY

STATE OF NEVADA
DIVISION OF WATER RESOURCES

WELL DRILLERS REPORT

Please complete this form in its entirety

OFFICE USE ONLY
Log No.
Permit No.
Basin

1. OWNER CYPRUS MINES ADDRESS Northumberland Canyon Monitor Valley

2. LOCATION SE ¼ SE ¼ Sec. 13 T. 13 (N)S R. 45 E. / NYE County
PERMIT NO.

3. TYPE OF WORK
New Well ☒ Recondition ☐
Deepen ☐ Other ☐

PROPOSED USE (MINING)
Domestic ☐ Irrigation ☐ Test ☐
Municipal ☐ Industrial ☐ Stock ☐

5. TYPE WELL
Cable ☐ Rotary ☒
Other ☐

6. LITHOLOGIC LOG

Material	Water Strata	From	To	Thickness
Brown Weathered medium hard limestone		0	48	
Hard Black limestone - lite fractures Large chips		48	100	
Black limestone with quarty chips		100	140	
Black - scattered gray with yellowish chips		140	220	
Gray with yellowish and black chips		220	420	
Gray with yellowish and rust colored chips		420	495	
lost circulation to total Depth 766				

Date started May 5, 1981
Date completed July 2, 1981

8. WELL CONSTRUCTION
14 3/4 for 5
Diameter hole 9 5/8 inches Total depth 766 feet
Casing record 8" Casing
Weight per foot 22.36 Thickness .250

Diameter	From	To
8 5/8 inches	+2 feet	766 feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet
inches	feet	feet

Surface seal: Yes ☒ No ☐ Type Concrete
Depth of seal 50 feet
Gravel packed: Yes ☐ No ☒
Gravel packed from feet to feet

Perforations:
Type perforation 3/32 x 3 Factory
Size perforation
From 766 feet to 766 feet
From feet to feet
From feet to feet
From feet to feet
From feet to feet

9. WATER LEVEL
Static water level — Feet below land surface
Flow ?? G.P.M.
Water temperature Cool ° F. Quality

7. WELL TEST DATA

Pump RPM	G.P.M.	Draw Down	After Hours Pump
Blow Well with 750 cfm at 250# - would blow about 80 gallons water with foam then quit each time air was turned on			

BAILER TEST
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours
G.P.M. Draw down feet hours

10. DRILLERS CERTIFICATION
This well was drilled under my supervision and the report is true to the best of my knowledge.

Name Aqua Drilling & Well Service
Address 2255 Glendale Rd
Nevada contractor's license number 3291
Nevada driller's license number 1132
Signed Ruth
Date 8-19-81

RECEIVED AUG 26 1981

USE ADDITIONAL SHEETS IF NECESSARY

APPENDIX B

Performance test data sheet

William Nolde

Data for Well Np-1b (81-105) Page 1 of 1

Distance, r, to pumping well _____ ft. Date 7-18-81

Pumping well _____ Other observation wells _____

Location NORTHUMBERLAND - CYPRUS MINES CORP. Observers D. CAVE

DATE	time in hours	time, t, since pump started--mins.	time, t', since pump stopped--mins.	ratio t/t'	WATER: depth -- ft.	WATER: drawdown, s -- ft.	WATER: residual DD, s' -- ft.	WATER: distance to well (r)^2 -- ft^2	WATER: r^2/t -- ft^2/min	PUMPING: motor - RPM	PUMPING: flow -- GPM	temp. -- o C	REMARKS
7-18-81	1450	0			627.29		TEST- PUMP WELL WIDE OPEN AFTER PULLING PUMP						DICHARGE
	1451	1			631.10	3.81							SANDY FOR
	1453	3			630.95	3.66							1st/ SEVERAL
	1455	5			630.86	3.57							MINS. - CLEAR
	1458	8			630.55	3.26							AFTER 4th/
	1500	10			630.60	3.31					75		READING
	1503	13			630.56	3.27							TOP OF
	1506	16			630.57	3.28							STILLING
	1510	20			630.50	3.21							WELL - 2.42'
	1515	25			630.49	3.20							ABOVE G.L.
	1520	30			630.52	3.23					75		H_2O VERY
	1525	35			630.51	3.22							CLEAR - FINE
	1530	40			630.48	3.19							SILT GRAINS
	1535	45			630.49	3.20							ONLY
	1540	50			630.49	3.20							
	1545	55			630.46	3.17							
	1550	60			630.45	3.16							
	1551	61	1	61.0	627.62		.33						
	1553	63	3	21.0	627.60		.31						
	1555	65	5	13.0	627.50		.21						
	1557	67	7	9.57	627.48		.19						99.97 %
	1560	70	10	7.0	627.50		.21						RECOVERY
	1563	73	13	5.62									
	1566	76	16	4.75									

WILLIAM E. NORK, Inc.

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