01-20-1971: letter to nps western service center from geological survey water resources division regarding reports of the wells drill

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 340
Rolla, Missouri 65401

January 20, 1971

Mr. Don Barrett
U.S. Department of Interior
National Park Service
Western Service Center
450 Golden Gate Ave., Box 36035
San Francisco, California 94102

Dear Mr. Barrett:

Enclosed are reports of the wells drilled at Round Spring, Alley Spring and Big Spring. Each report consists of:

1. *Location map of well with respect to the 50-year flood.*
2. *Description of the drilling and completion of the well.*
3. *Insoluble residue log by Missouri Geological Survey.*
4. *Driller's log.*
5. *Pump test data and drawdown curves.*
6. *Water analysis by Missouri Geological Survey.*
7. *Copy of strip chart from observation well at Round Spring only.*

In addition we are furnishing a summary of the data obtained from the ~~six~~ 7 wells drilled to date and their relationships to the knobs area in the vicinity of Eminence and Two Rivers and to the specific capacity map of the southern part of Missouri taken from Mineral and Water Resources of Missouri.

Time spent on the well drilling activities at the three sites consisting of well location, drilling, pump testing and report writing is summarized below:

Walter Oakes	*34 days well location, drilling & pump testing.*
Gerald Feder	*2 days pump testing.*
Leo Emmett	*4 days pump testing & data analysis.*
E. J. Harvey	*6 days, drilling, pump testing & report writing.*

It has been a pleasure to work with you on the drilling activities. If you have any questions regarding these reports or the data gathered please do not hesitate to write us.

Sincerely,

E. J. Harvey

E. J. Harvey
Assistant District Chief

Enclosures

ROUND SPRING WELL

The well at Round Spring was drilled in an area where a considerable number of voids exist in the section below the surface. The outcropping formation at the well site is the Eminence Dolomite which bottomed in the well at 180 feet. The Potosi Dolomite underlies the Eminence and extends to a depth of 404 feet. See the accompanying log. Openings from which water drains to the well are probably numerous though small and many exist in the drusy beds in the Potosi. Some openings are large, perhaps located at intersections of joints and bedding planes and joint intersections. Notable in the drilling were openings at 119-120 feet depth; 202-203 feet just below the point at which the casing was set; and at 300 feet where a large opening occurred. Drilling at 200 feet was in hard cherty dolomite and this was determined to be a good casing point.

Casing was set at 200 feet based on a determination by a geologist at the Missouri Geological Survey by microscopic examination of the cuttings. Three hundred pounds of bentonite gel were pumped in behind the casing before pressure grouting with 70 sacks of neat cement. The open character of the formation above the casing point resulted in much of the cement filling the voids so that the cement did not reach the surface. This is a common occurrence in cementing operations in the Ozarks. The water level rose to 17.5 feet below the top of the outer casing then receded at the end of the grouting operation to 76 feet. Top of cement was found at 178 feet at the time the plug was drilled out indicating a 22-foot seal around the lower end of the casing. When the plug was drilled out 72 hours after grouting the water level inside the casing was 10 feet below the water level outside the casing. The upper portion of the annular space outside the casing was filled to the surface with 60 sacks of neat cement. It is believed that the grouting operation resulted in a satisfactory seal at the bottom of the casing.

A continuous recorder was installed in an unused well located 371 feet northeast of the new well. Changes in water level in the observation well occurred during the grouting operation reflecting some connection through a joint-bedding plane system of openings. The unused well was reported to be 120 feet deep but the measured depth was only 70 feet. Static water levels in the two wells were approximately the same based on sea level elevations.

A 10-inch hole was drilled to the depth at which the casing was set and an 8-inch hole from there to total depth.

The pumping test was started on September 22, 1970 at 9 a.m. and continued for a period of 24 hours. The pumping rate was increased from the initial rate of 25 gpm to a final rate of 120 gpm. The driller did not wish to pump the well at a maximum rate because of the probability of injuring the pump by pulling in too much fine material from the cave at 300 feet depth. We agreed with him. The turbidity of the water increased at times from the start of the test until about 12:40 or 220 minutes after the start. By 9:00 p.m., or 720 minutes from the start, the water was clear and remained clear until the end of the test.

The drawdown graph shows depth to water versus time. Along the top of the graph yields in gpm are plotted at the times from start of test at which changes in yield were made. For example, the yield was 25 gpm from the beginning of the test until 14 minutes at which time the yield was increased to 40 gpm. The yield was raised to 50 gpm at 16 minutes, to 60 gpm at 20 minutes, 80 gpm at 45 minutes, 90 gpm at 100 minutes, 103-105 gpm at 225 minutes, 110 gpm at 365 minutes, 115 gpm at 825 minutes, 120 gpm at 1,095 minutes, and continued at this rate until the end of the test. The plot of recovery is included on a separate graph.

The specific capacity of the well for the entire test was 2.8 gpm per foot of drawdown and the pumping level was essentially stabilized at 123 feet from about 400 minutes to 1,440 minutes. The specific capacity was 3.8 gpm per foot of drawdown when the pumping rate was 60 gpm and was about 2.0 to 2.2 gpm per foot of drawdown for individual steps up to 105 gpm.

Recovery was measured for three hours after the pump was shut off. The water level had essentially recovered in the pumped well to its original level by the end of the first hour.

Assuming a long-term specific capacity of 2 gpm per foot of drawdown and a static water level of 80 feet, 240 gpm could be pumped from the well resulting in a decline in water level to 200 feet, the bottom of the casing. The well proved to be one of the better wells drilled so far in the project.

The transmissivity was not determined from either the drawdown or recovery data. The water level in the observation well was affected by the grouting operation. See attached copy of chart. During the pumping test the water level in the observation well declined 1.3 feet, and on completion of the test the water level recovered to its original static level within a day. Because of the hydraulic connection between the wells it would be advisable to cap or fill the unused well. A similar test made at the Alley

Spring site since completion of the Round Spring well indicated no interference in an observation well located 333 feet from the new well. It should be noted also that as a whole the rock section at Alley Spring was much harder and tighter than that at Round Spring and the well yield was lower.

In the pump test made at Pulltite Spring in July 1968, an observation well 188 feet from the new well drilled for the National Park Service showed a drawdown of about 0.8 foot. The Pulltite well has the highest specific capacity of any of the wells drilled to date, and it is suspected that some hydraulic connection vertically as well as horizontally exists in the vicinity of that well. At the Austin House site, measurements in the existing domestic well 143 feet deep, 200 feet southeast of the pumped well showed no drawdown and indicates little or no hydraulic connection.

The response or lack of response of the observation wells may be indicative of the open or tight conditions existing at the several sites and may correlate with the existence of or lack of open connections between the surface and depth.

ROUND SPRING WELL
(Started Aug. 19, 1970)

Clark & Clark
Driller: Lester Sohn

Driller's Log

Lime		-110'
Lime, white, hard, mud		119-120'
Lime, white, hard, mud		135-136'
Lime, grey, hard, mud		146-174 1/2'
Lime, grey, hard, mud		161-162'
Lime and flint, mud		174-176'
Lime, flint, iron, soft		203-204'
Lime, chert, brown, hard, mud		290-293 1/2'
Lime, chert, brown, hard, slide, mud		300-330'
	Open	345-348'
Chert	Open	374-380'

Total depth 404 feet.

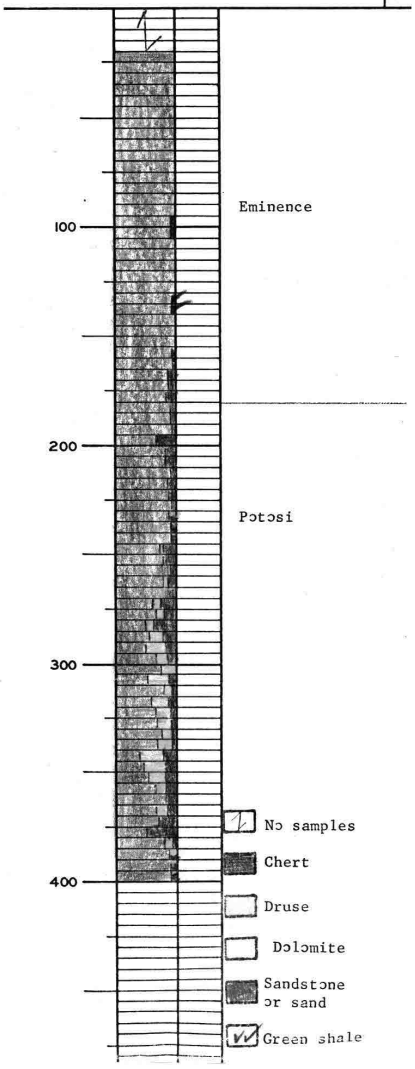
08-19-1970: division of geological survey and water resources; log no. 26637

STATE OF MISSOURI
DIVISION OF
GEOLOGICAL SURVEY AND WATER RESOURCES

LOG NO. 26637	OWNER U.S. National Scenic Riverways	
COUNTY Shannon	FARM Round Spring Park	WELL NO.
T 30N R 4W sec. 20	DRILLER Clark & Clark	
	DATE Sept. 1970	
	ELEV.	PROD.
	LOGGED BY H. Groves 9-21-70	

REMARKS

INDEX SHEET NO. ____



C

Round Spring Well - Pump Test
Sept. 22-23, 1970

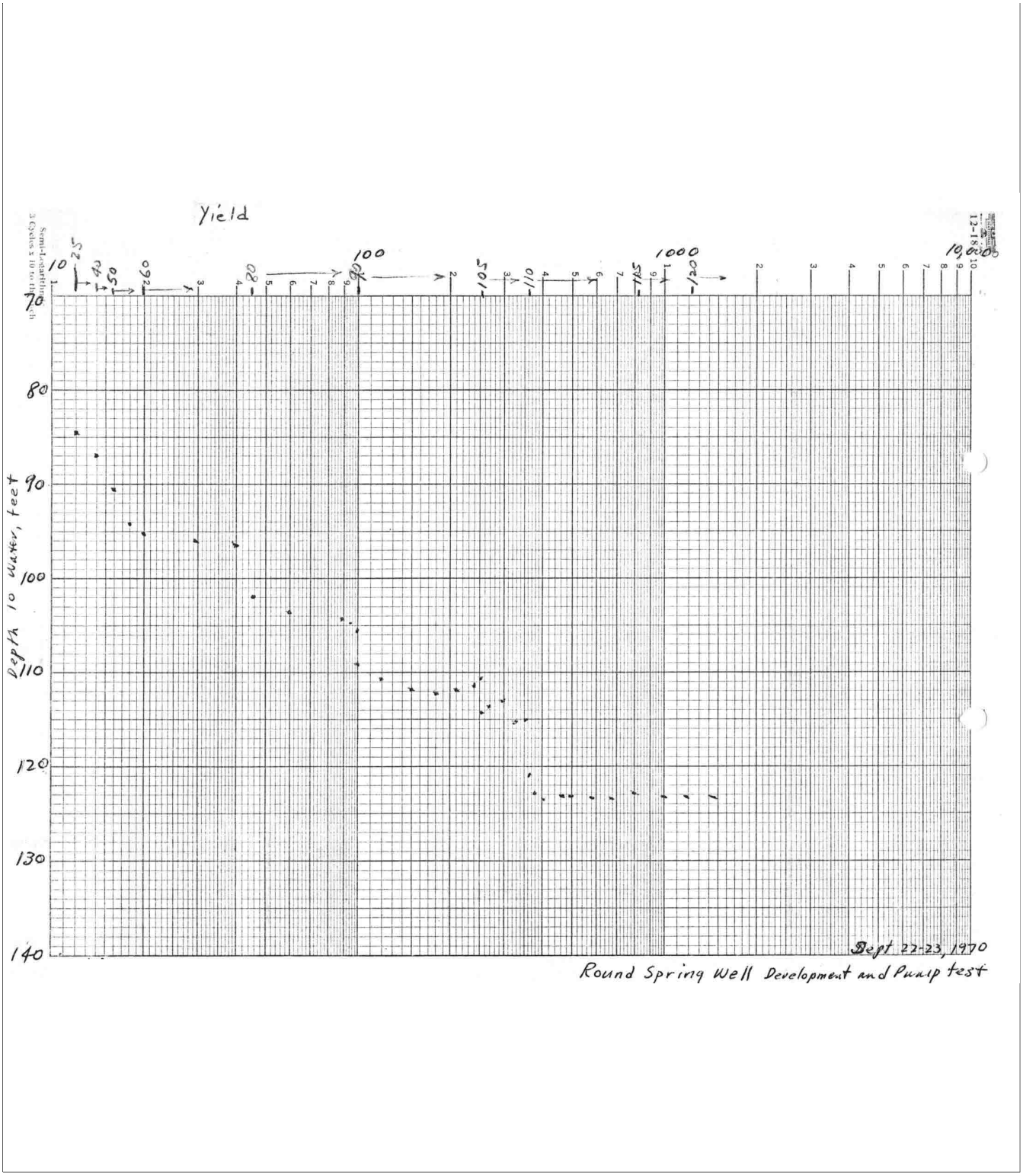
Date	Hour	Time minutes	Depth to water (feet)	Yield (gpm)	Remarks
9/21/70	1200		87.15		
	1830		82.02		
9/22/70	0900		79.73		
	0905		79.25		
		1	85.40	25	Pump on 0907
		2	85.70		
		3	84.85		
		4	84.70		
		5	84.62		
		6	84.62		
		7	84.70		
		8	84.70		
		9	84.67		
		10	84.73		
		12	84.66		
		14	87.05	40	
		16	90.60	50	
		18	94.37	50	
		20	95.07	60	
		26	95.65		
		30	96.02		
		36	96.30		
		40	96.50		
		45	102.05	80	
		50	103.05		
		60	103.70		
		70	104.18		
	10:28	80	104.42		Cleared up considerably
		90	104.50		Cond. 360 μmho @ 15°C
		100	109.28	90	
		115	110.45		
		120	110.82		
	11:48	150	111.97		Cond. 300 μmhos @ 14°C
		180	112.15		
		210	111.95		Water clearing
		240	111.55		
		255	114.35	105	
	13:38	270	113.77	100	Cond. 260 @ 14°C
		300	113.82	103	Continuing to clear
	14:43	335	115.34	103	Cond. 320 @ 14°C
		365	121.96	110	
	15:37	395	123.38		Cond. 340 a 14°C
		425	123.49		
		475	123.26		
		495	123.29	112	

c

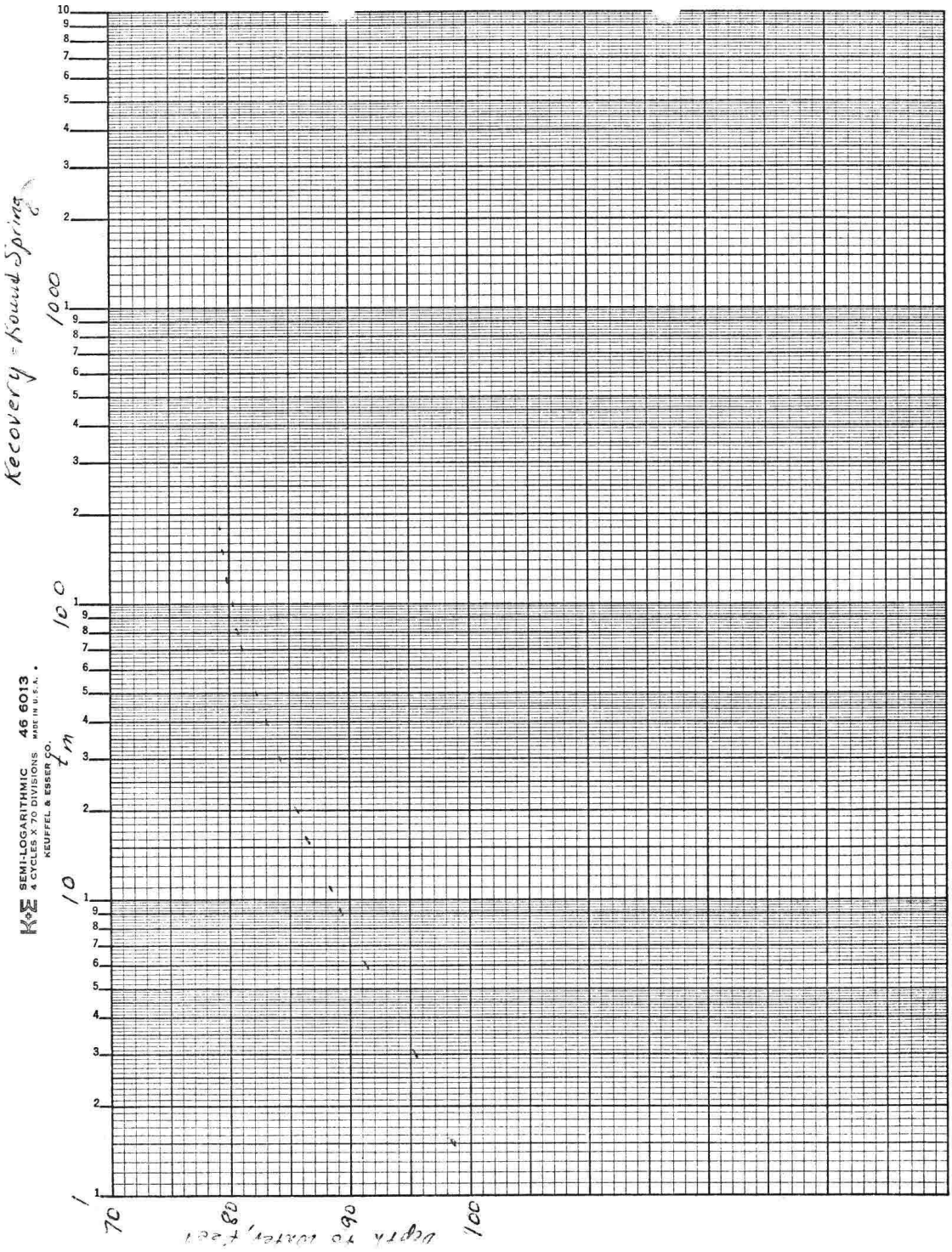
Round Spring Well - Pump Test--continued

Date	Hour	Time minutes	Depth to water (feet)	Yield (gpm)	Remarks
	15:37	555	123.30	112	
		615	123.44		
		705	123.49		
		765	123.39		
		825	123.22		
		885	123.28		
		945	123.29		
		1,005	123.18	115	
		1,125	123.20	120	Cond. 450 µmhos @ 14°C
	0553	1,245	123.20		
		1,365	123.17		
	9:18	1,450	123.16		
9/23/70	9:23	Pump off.	Recovery		
		3	95.45		
		6	91.32		
		9	89.40		
		15.5	86.72		
		20	85.75		
		30	84.08		
		55	81.96		
		70	81.25		
		90	80.60		
		120	79.95		
		150	79.60		
		180	79.33		

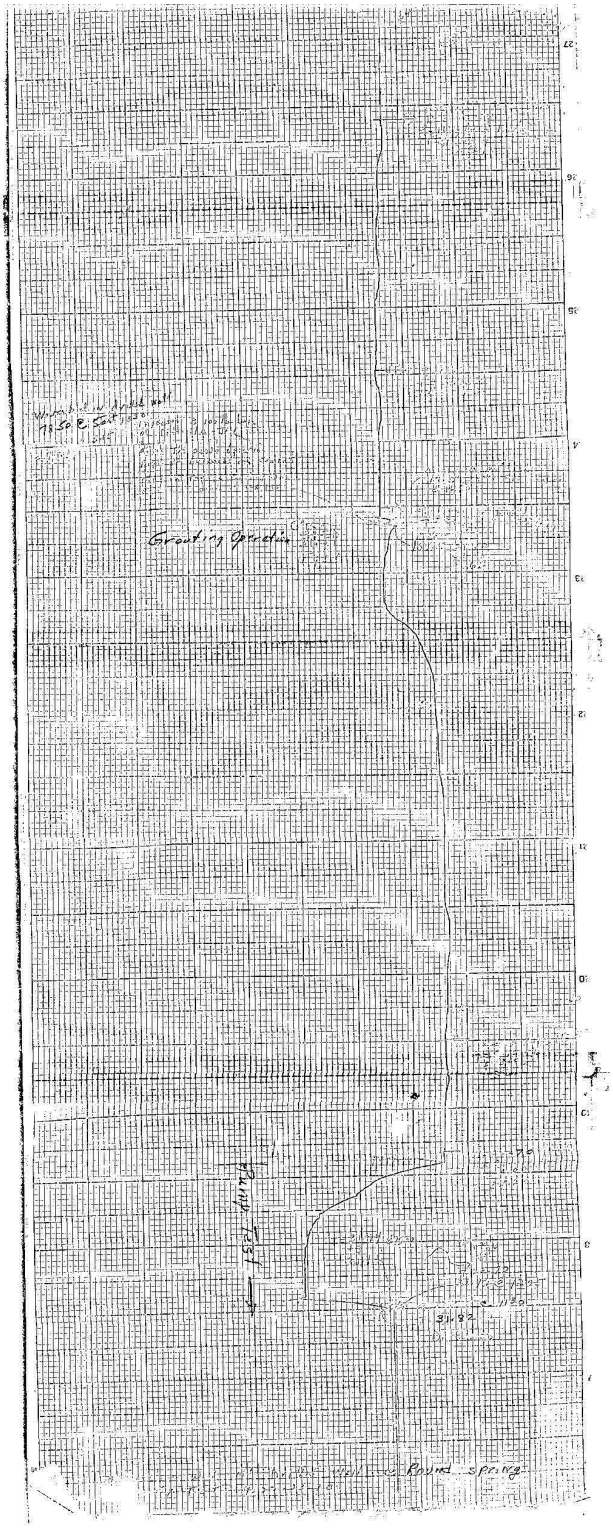
09-22-1970: graph for round spring well development and pump test



09-22-1970: graph for recovery - round spring



00-00-0000: rouns spring well - pump test data



MISSOURI GEOLOGICAL SURVEY AND WATER RESOURCES

Box 250

Rolla, Missouri 65401

County: Shannon

Owner: National Park Service, Van Buren, Mo.

Location: NE¼ NW¼ SW¼ Sec. 20, T30N, R4W at Round Spring

Analysis No.: 6783

Collector: E.J. Harvey, W. Oakes Date Collected: 11-24-70

Well T.D. 400' T. 13°C, Cond. 390, Yield 10 gpm. (measured) clear when collected at well after 2½ hrs pumping water level (pumping) 80.6' below M.P. Potosi formation! Drilled 9-70.

Analyst: M.E. Phillips, E. Lynge

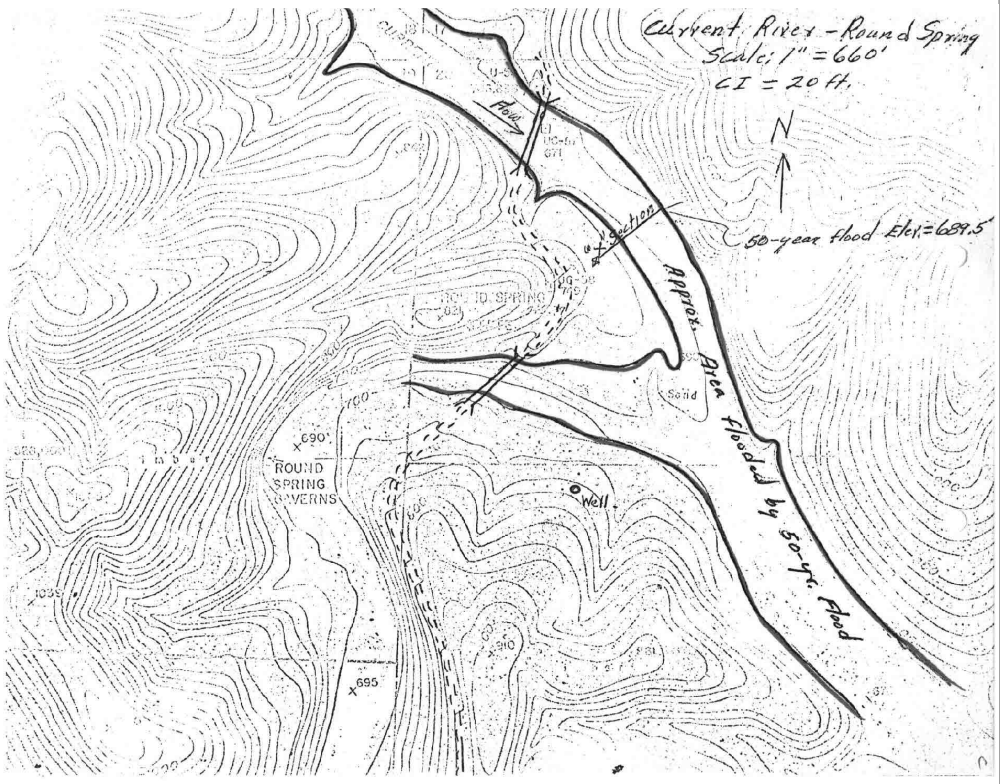
Date Analyzed: 1-19-71

CONSTITUENTS	IN PARTS PER MILLION
Turbidity	Light-colored Suspended Matter
Odor	None
pH	—
Alkalinity ($CaCO_3$)	216.5
Phenolpthalein	8.0
Methyl Orange	208.5
Carbonate (CO_3)	4.8
Bicarbonate (HCO_3)	254.4
Silica (SiO_2)	10.2
Aluminum (Al)	0.0
Calcium (Ca)	34.2
Magnesium (Mg)	26.0
Sodium (Na)	2.3
Potassium (K)	2.2
Total Manganese (Mn)	0.00
Total Iron (Fe)	0.07
Sulfate (SO_4)	4.8
Chloride (Cl)	3.7
Nitrate (NO_3)	0.4
Fluoride (F)	0.0
Total Dissolved Solids	210.
Total Hardness	192.4
Carbonate Hardness	192.4
Non-carbonate Hardness	0.0

Remarks:

Copies To:




Current River - Round Spring
Scale: 1" = 660'
CI = 20 ft.
N
50-year flood Elev = 689.5'
Approx. Area flooded by 50-yr. flood
Flow
Section
ROUND SPRING
Well
Sand
690'
695'

10-02-1970: memorandum to western service center from hydrologist, wsc-lww regarding trip report to ozark national scenic riverw

561-10-12-70

AS42B
~~L54~~(WSC)LWW
OZAR
MW

October 2, 1970

Memorandum

To: Director, Western Service Center
Through: Chief, Office of Land Acquisition and Water Resources
Chief, Water Resources Section

From: Hydrologist, WSC-LWW

Subject: Trip report to Ozark National Scenic Riverways

1. Purpose of trip: To meet with the Contractor regarding the contract administration, pump test, and completion of the developed well in accordance with contract specifications. Also to consult with the U. S. Geological Survey regarding the hydraulics of the formation, and other technical matters involved in testing of the well. In addition, a visit was made to the Missouri Geologic Survey to have a discussion with Mr. R. Knight who is the senior ground-water hydrologist for the State.

2. Accomplishments: On the evening of September 21, and during the following morning, I had talks with Chief Hydrologist E. Harvey of the U. S. Geological Survey and with Mr. R. Knight of the Missouri Geologic Survey. On September 22, I drove to Round Spring well site. On hand to supervise the water level measurements and test pumping were U. S. Geological Survey Hydrologist G. Feder and Hydraulic Engineering Technician W. Oaks. Mr. W. Clark of Clark Bros. was present managing the pumping equipment. The test began about 9:00 a.m. September 22 and continued for 24 hours. The pumping rate was started at 25 gpm. This was increased to 30 gpm and then in 10 gpm increments to 70 gpm. The rate was then increased to 90 gpm, 100 gpm, 110 gpm, and 115 gpm. The last rate increased gradually up to a maximum of 120 gpm. Each pumping rate was maintained until the turbidity as indicated by the specific conductance and visual observation had cleared. The drawdown to a stable level at each rate was generally quite rapid. During the night, a moderately heavy rain fell at the site (a measured 0.8 inches was recorded at Pull Tight Springs nearby). This apparently caused some recharge of

OZAR

the aquifer which affected the water level of the pumped well during the test and also the nearby observation well. The observation well, which is about 300 feet NE of the test well, had a maximum drawdown of 1.3 feet just prior to the rain. The maximum drawdown in the test well was 43.8 feet at 120 gpm.

The dimensions of the test well are:

Diameter of boring,	Total depth,	Casing depth,	I.D.,	4-inch grout ring
10" to 200'	400'	Surface to 200'	6"	202' to surface*

The lower 200 feet of the well is an uncased 8 inch diameter open hole in dolomite(potosi formation).

On September 23, after the recovery test was begun, I drove to Park Headquarters in Van Buren, Missouri. Enroute I looked at the proposed sites for the next two wells at Alley and Big Springs. At the Park Headquarters I talked to Maintenance Foreman M. Terry and Ranger V. Adams. We discussed the well and its characteristics. Mr. Adams asked about the technical problems involved in back filling old existing wells (some 50 have been located). I told him we could probably provide technical assistance in this matter if they wished.

3. Observations: There should be no major problems involved in these wells. The trip was useful in providing this office with firsthand knowledge about the unique hydrologic conditions of this area.

4. Future work: The driller will finish grouting and clean up at Round Springs on September 24 and 25 and then move the equipment to the next site (Alley Springs) next week, September 28 to October 2. The driller should be able to proceed on schedule for the entire job.

*The completed well will be grouted from the surface to 200 feet. The first grouting rose to about 17 1/2 feet but settled down to an unknown level after pumping or the grout stopped. The remaining grout seal will be poured from the top after test equipment is removed.

SIGNED
Donald C. Barrett

Cleared for Distribution:

(Sgd) William L. Bowen OCT 5 1970

Director, WSC (Date)

cc:
MW-WASO
Director, Midwest Region
Superintendent, Ozark

Other Supporting Information

10-02-1970: inventory of public water supplies: round spring

Form Approved
OMB No. 158-R0116

U.S. ENVIRONMENTAL PROTECTION AGENCY
WATER PROGRAM OPERATIONS (WH-450)
WASHINGTON, D.C. 20460

INVENTORY OF PUBLIC WATER SUPPLIES
(See instructions on the reverse)

KEY IDENTIFICATION NUMBER (1–14)

NAME OF WATER UTILITY (15–45): USMPS OZARK NATL SCENIC RIVERWAY

ADDRESS (47–76): PO BOX 448

CITY (77–101): VAN BUREN

COUNTY (102–126): SHANNON

STATE (127–128): MO

ZIP (129–133): 63965

PHONE AREA CODE (134–136): 314

TELEPHONE NUMBER (137–143): 3234236

UTILITY OWNER (Check one) (144)

- [ ] 1 MUNICIPALITY, DISTRICT, ETC.
- [ ] 2 INVESTOR
- [X] 3 FEDERAL
- [ ] 4 STATE
- [ ] 5 OTHER (Specify in remarks)

RETAIL POPULATION SERVED (145–153): 1500 *

NUMBER SERVICES (154–160): 25

NUMBER METERS (161–167): 1

NUMBER OF WHOLESALE CUSTOMERS (168–170): 0

PREDOMINENT CHARACTERISTIC(S) OF YOUR SERVICE AREA (171–189)

COMMUNITY	COMPANY TOWN	RECREATION AREA	MOBILE HOME PARK	INSTITUTION	SCHOOL OR COLLEGE	MOTEL	RESTAURANT	SERVICE STATION	CAMPGROUND	PICNIC AREA	LODGE	MARINA	SKI RESORT	BATHING AREA	VISITOR CENTER	HIGHWAY SAFETY REST AREA	AIRPORT	OTHER (Specify in remarks)
		X							X	X		X						

CAPACITIES

PRODUCTION, NORMAL OPERATION (Gal/Day) (190–199): 120000

EMERGENCY POWER ONLY (Gal/Day) (200–209): 0

DISTRIBUTION STORAGE, GRAVITY FLOW (Gallons) (210–219): 500000

PRODUCTION

AVERAGE DAY (Gal/Day) (220–229): 15000

MAXIMUM DAY (Gal/Day) (230–239): 25000

DATE FORM COMPLETED (YR MO) (240–243): 7509

NO.		SOURCE NAME	INTAKE LOCATION LATITUDE DEG	MIN	SEC	LONGITUDE DEG	MIN	SEC	MARK (One only): SURFACE	GROUND	PURCHASED	TREATMENT: AERATION	PRECHLORINATION	COAGULATION	SEDIMENTATION	FILTRATION	CORROSION CONTROL	SOFTENING	TASTE AND ODOR CONTROL	IRON REMOVAL	AMMONIATION	FLUORIDE ADJUSTMENT	DISINFECTION	LAB CONTROL: CHEMICAL	BACTERIAL	PHYSICAL
01	R	WELL	37	16	40					X													X	X	X	
	A 244		91	24	30																					290
02	R																									
	A 293																									339
03	R																									
	A 342																									388
04	R																									
	A 391																									437

REMARKS (Up to 50 characters) (783 – 832)

* INCLUDES AVERAGE DAILY SUMMER VISITATION

ROUND SPRING

EPA Form 7500-11 (9-74)

REPLACES EPA-18 (CIN) WHICH IS OBSOLETE.

INSTRUCTIONS

1. **IDENTIFICATION NUMBER** – This is a 14 digit code number that geographically identifies the location of the utility. It will be filled in by EPA personnel.

2. **NAME OF WATER UTILITY** – This is the complete, official name of the utility.

3. **ADDRESS** – This is the mailing address of the utility *(this may be but does not necessarily have to be the physical location of the treatment plant)*.

4. **CITY, COUNTY, STATE** – This is the city, county and state of the mailing address of the utility.

5. **ZIP CODE** – This is the zip code of the mailing address of the utility.

6. **IS THE UTILITY OWNED BY A MUNICIPALITY, DISTRICT, INVESTOR OWNER, STATE OR OTHER** *(specify in remarks)* – Place an **X** in the box that describes the type of ownership of the utility.

7. **RETAIL POPULATION SERVED - NUMBER SERVICES, METERS** – Fill in these boxes with the most current information available. Do Not include the population served by water utilities that purchase water from you wholesale.

8. **NUMBER OF WHOLESALE CUSTOMERS** – In cases where water is sold to wholesale customers *(customers who buy water from you for resale)* fill in the boxes with the number of this type of customer.

9. **WHAT IS THE CHARACTERISTIC(S) OF YOUR SERVICE AREA?** – Place an **X** in the boxes necessary to describe the predominent characteristic(s) of your service area.

10. **CAPACITIES** – Fill in these boxes with the most current information available. Report all storage that does not have to be pumped into the system, whether it is elevated or ground storage.

11. **PRODUCTION** – Fill in these boxes with the most current information available.

12. **DATE FORM COMPLETED** – Fill in the numeric designation of the month *(01 - 12)* and the last two digits of the year when the form was completed.

13. **REMARKS** – Additional information can be provided *(maximum of 50 Alpha and/or Numeric characters)*.

14. **SOURCE AND TREATMENT** – Write in the spaces below Name the name of the river, lake, other utility, well field, or other source from which the supply of water is taken. Circle "R" for regular source or "A" for auxiliary source. If more than one source is used, use separate lines for each source. If more than four sources are used, then list on a second form starting with 05. Place an **X** in the block(s) for the types of treatment rendered the raw water. Mark each source separately.

15. **INTAKE LOCATION** – Latitude and Longitude of intake.

16. **LABORATORY CONTROL** – Place an **X** in the box for the type of types of laboratory analyses made at the treatment facility. Leave these blocks blank if no laboratory analyses are performed.

☆U. S. GOVERNMENT PRINTING OFFICE: 1974–625-309/72 3-1

SUMMARY

We are including a summary of the drilling to date in the tabulation below. The wells are listed in the order of decreasing specific capacities.

Site	Formation penetrated	T.D.	Casing depth	Open Hole Dia.	Length	Yield	DD	Sp. Cap.
Big Spring	Potosi 190-520	520	370	8	150	230	20	11
Pulltite Spring	Potosi 240-310	308	205	6	103	118	26	4.5
Round Spring	Potosi 180-400	400	200	8	200	120	43	2.8
Austin House	Potosi 225-250	250	200	8	50	6	11	.55 *
Owls Bend	Potosi 75±303	303	202	6	101	50	112	.45
Alley Spring	Eminence 475-650	650	300	8	350	55	214	.26
Two Rivers	Potosi 160-350	350	100	8	250	11	110	.10

Some significance may become apparent from a comparison of the results in the tabulation, the graphs of the wells drilled, and the map showing their locations with respect to the igneous knobs in the area around Eminence. The wells at Big Spring, Pulltite Spring, Round Spring, Owls Bend and Two Rivers penetrated a substantial part of the Potosi section. The Austin House well penetrated a small part of the section. Big Spring well is located farthest from the center of the igneous knobs and had the highest specific capacity (11 gpm per foot of drawdown). Pulltite Spring well is a little closer in and has a good specific capacity (4.5 gpm per foot of drawdown). Austin House well, although it penetrated only a few feet of the Potosi, had a specific capacity that was much lower than those at Pulltite and Round Springs, but was higher than those obtained at Owls Bend and Two Rivers. Owls Bend well near the eastern flank of the knobs area had a rather low specific capacity for the thickness of Potosi penetrated but not as low as that of the Two Rivers well which probably penetrated most of the Potosi section. The Two Rivers well is essentially surrounded by igneous knobs. The well at Alley Spring did not penetrate the Potosi and for this reason is not included in the comparison.

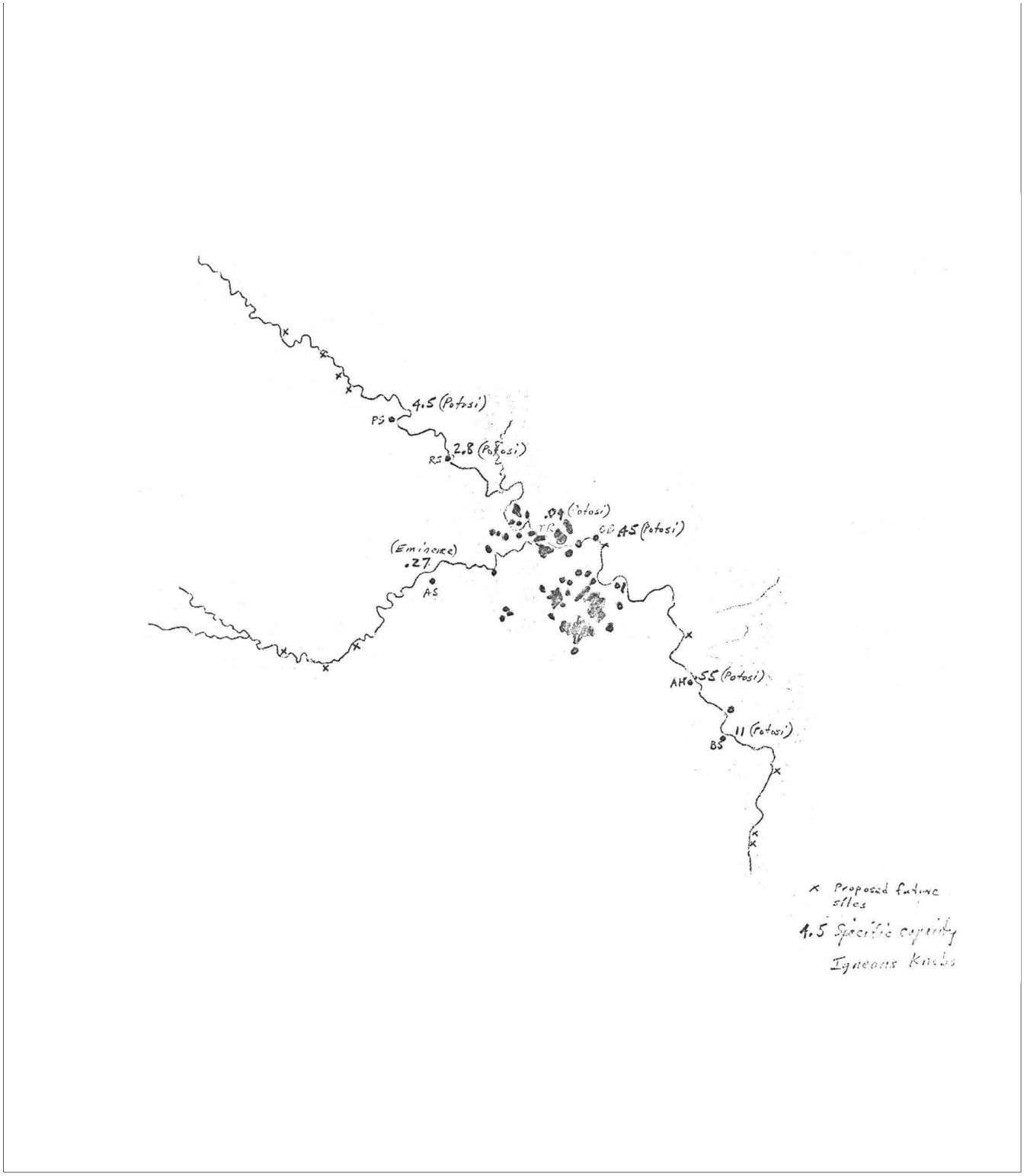
* Rounding of numbers I had done in the past accounts for some small differences in the two tables and the figures shown on the map.

The comparison suggests that circulation of water in the Potosi is slower and retarded in the knobs area perhaps because of lack of fracture and bedding plane openings through which water might travel. Mineralization along fractures may have sealed openings to retard flow. Whatever the cause, lower yields might be expected in the knobs area and higher yields outside the knobs. Of course exceptions to this probably will be found as additional sites are developed.

Projected yields for various pumping levels

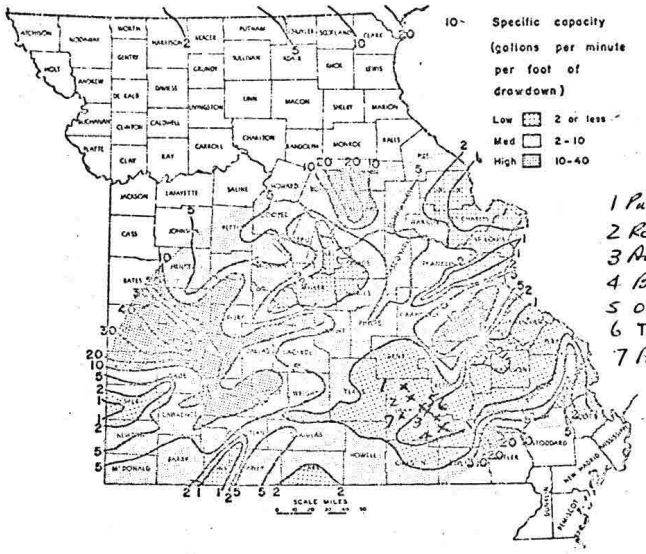
SWL (feet)	PWL (feet)	DD (feet)	Yield (gpm)	Sp. Cap. (gpm/ft)	
			BIG SPRING		
53	78	25	280	11	
	100	47	515		
	150	97	1,007		
	370	317	3,500		Bottom of casing
			PULLTITE SPRING		
32	58	26	118	4.5	
	100	68	306	4.5	
	150	118	530	4.5	
	200	168	760	4.5	Bottom of casing
			ROUND SPRING		
80	123	43	120	2.8	
	150	70	196	2.8	
	175	95	266	2.8	
	200	120	336		Bottom of casing
			AUSTIN HOUSE		
57	102	45	23	.51	
	150	93	47		
	200	143	73		Bottom of casing
			OWLS BEND		
45	155	110	50	.45	
	200	155	70		Bottom of casing
			ALLEY SPRING		
55	270	215	58	.27	
	300	245	66		Bottom of casing
			TWO RIVERS		
92	210	118	11	.09	This pumping level is 110 ft. below bottom of casing.

00-00-0000: map for proposed future sites



00-00-0000: mineral and water resources of missouri

conade Dolomite at an average depth of 500 to 600 feet. The wells that produce from this section are ideal for clubs, schools, small towns, and industries.



Sp. Cap.
1 Pulltite Spring 4.5
2 Round Spring 2.8
3 Austin House .15
4 Big Spring 11.0
5 Owls Bend .45
6 Two Rivers .09
7 Alley Spring .27

FIGURE 66.—Specific capacities of typical wells in the Ozarks.

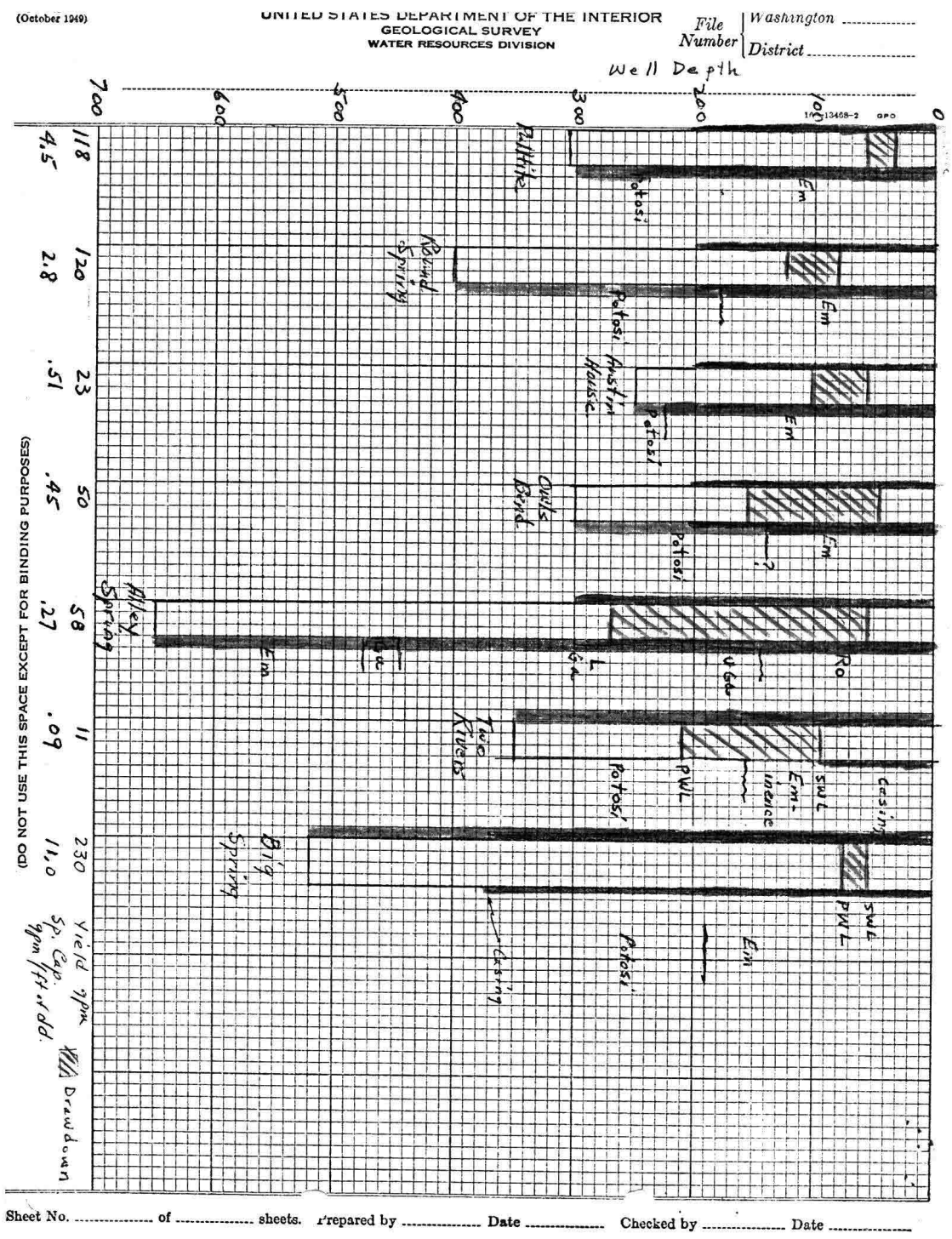
Throughout the area numerous municipal and industrial wells yield 500 to 1,000 gallons per minute. These wells vary in depth. Wells that produce 300 to 500 gallons per minute average 1,000 to 1,500 feet in depth. Wells at Springfield in Greene County, for example, average 1,400 to 1,700 feet in depth and produce 500 to 1,000 gallons per minute. Wells at Rolla in Phelps County and Sullivan in Franklin County are 1,000 to 1,200 feet in depth and produce 400 to 600 gallons per minute.

Throughout the area requirements of 15 to 25 gallons per minute can normally be met by drilling to a depth of 300 to 350 feet through the Roubidoux Formation. This is usually an ideal depth for farm wells. Private wells for farms and dwellings in the central Ozarks average 300 feet in depth, whereas in the southwest part of the State the average depth to the Roubidoux is 800 feet.

Descriptions of aquifers

Lamotte Sandstone.—The Lamotte Sandstone is geologically the oldest aquifer in the State and is the basal unit of the Cambrian Sys-

00-00-0000: graph for well depth



Docket Information

Number of Documents in Docket 25

Documents Dated from 8/19/1970 to 1/20/1971

Docket Compiled: 6/7/2011