University of Wisconsin-Extension

GEOLOGICAL AND NATURAL HISTORY SURVEY
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GEOLOGIC STRUCTURE IN THE YAHARA HILL GOLF COURSE AREA IN SOUTHEAST MADISON, WISCONSIN

by

P.G. Olcott

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University Extension

The University of Wisconsin
Geological and Natural History Survey

Preliminary report on geologic structure in the Yahara Hill Golf Course area in southeast Madison, Wisconsin

by Perry G. Olcott

Introduction

Purpose and Scope

Recent work relating to ground water supply by personnel of the Wisconsin Geological Survey has shown the presence of a relatively complex fault system in the bedrock of the southeast Madison area. Numerous faults also appear to be present elsewhere in the Madison area. Presently available geologic data are adequate only for a generalized interpretation of the geologic structure. A geophysical survey and/or drilling program is needed for an accurate description of the geology of the area.

It is the purpose of this paper to present an interpretation of the fault complex and its effects on hydrology in southeast Madison and point out locations of suspected faults in the remainder of the area. Interpretations were made from stratigraphic correlation of Wisconsin Geological and Natural History Survey well sample logs and bedrock outcrops supplemented by numerous drillers logs from the Department of Resource Development. This paper should form a basis for further exploration.

Geologic framework of the Madison area

The Madison area is underlain by 800-900 feet of sedimentary rocks of Cambrian and Ordovician ages that rest on crystalline rocks of precambrian age. The sedimentary rocks consist predominantly of sandstone but two thick dolomite units, The Platteville Formation, Decorah Formation, and Galena Dolomite (Sinnipee Group) and the Prairie du chien Group are present in the upper part of the section. Thin shale layers and lenses are present throughout much of the section and especially in the Eau Claire Sandstone.

The Madison area is located approximately on the axis of the Wisconsin arch, a broad southeasterly trending ridge on the Precambrian surface. In general, the Precambrian surface slopes away from Madison toward the southwest, south, and southeast. The latitude of the sedimentary rocks follows the slope of the Precambrian surface. The sedimentary rocks both dip and thicken toward the southwest, south, and southeast away from the Madison area.

The bedrock surface in the Madison area is cut by a deeply incised preglacial river drainage system that generally underlies the present Yahara River system. Contours on the bedrock surface were shown by Cline. The deep preglacial erosion of the bedrock surface has produced a rugged topography with maximum relief of about 600 feet that is similar to the topography of the driftless area west of Madison.

The preglacial river system, cut into the relatively flat lying sedimentary rocks, has produced a pattern on the bedrock surface of exposures of the oldest rock in the floor of the valley surrounded by exposures of successively younger rocks. The Sinnipee Group, the youngest rocks in the area, cap the highland areas. The pattern is disrupted, however, by the unconformable relationship of the St. Peter Sandstone and the underlying Prairie du Chien Dolomite. The two units together are about 150 feet thick but relief of the unconformity on the Prairie du Chien Dolomite is equal to or greater than the total thickness of the two units. Consequently, as one unit thickens the other thins and one unit may be present to the exclusion of the other.

The bedrock surface is mantled by glacial drift in the Madison area consisting largely of ground moraine with scattered kames and drumlins. Glacial drift fills the ancient bedrock river valley with up to 250 feet of unconsolidated material. The drift generally is much thinner in the highland areas where bedrock outcrops are common.

Geology of the Yahara Hills Golf Course Area

The Yahara Hills Golf course lies in sections 25 and 36 T. 7N., R. 10E. in Blooming Grove township. The area is about 3 miles east of the axis of the southeastward trending main channel of the buried bedrock valley that underlies the Madison area. Tributary valleys to the main channel trend northeasterly both to the north and south of the golf course. An interpretation of the bedrock geology of the Yahara Hills Golf Course area is shown in figure 2.

The golf course is largely underlain by dolomite of the Sinnipee Group and Prairie du Chien Group with some St. Peter sandstone (see fig. 2). Bedrock surrounding the golf course consists of sandstones of the St. Peter and Trempealeau formations. A prominent mound of Prairie du Chien Dolomite lies west of the golf course in sections 26 and 35 T. 7N., R. 10E. (see fig. 2) and dolomite of the Sinnipee Group caps the ridge tops east of the golf course.

Proposed fault locations are shown in figure 2 and stratigraphic relationships are illustrated by the cross section in figure 3. A graben or down dropped block between the two northeastward trending faults occupies the central part of the golf course. Stratigraphy of the down dropped block is shown by the sample log of Dn-929 (see fig. 4). Well samples, electric and gamma logs from this well appear normal and show a normal sequence of formations. The Platteville Galena dolomite is about 225 feet thick and is underlain by about a 150 foot thickness of Prairie du Chien dolomite. The St. Peter sandstone is missing. Adjacent to the southeast side of the graben is a tilt block also bounded by faults, the strike of the tilt block is N68°E and the dip is 18° measured at outcrop 04 (NE1/4, NE1/4, Sec. 36, T. 7N., R. 10E.). The southeast side of the tilt block has dropped in relation to adjacent rocks further southeast and the northwest side of the block is upraised in relation to the graben block. The tilt of the block has exposed the Platteville Galena unit at the bedrock surface in the southeast section and the Prairie du Chien dolomite in the northwestern section. The log of Dn-812 as determined by electric log shows about a 150 foot thickness of Prairie du Chien Dolomite underlain by a normal section down to the Galesville sandstone.

The geologic section southeast of the tilt block is shown by the sample log of Dn-932 (see figure 5). It has 120 feet of St. Peter Sandstone underlain by about 20 feet of Prairie du Chien Dolomite and shows a normal sequence of rock.

Northwest of the down dropped block, the Platteville-Galena Dolomite forms the bedrock surface but a maximum thickness of only 80 feet is present as shown in the sample log of Dn-945 (see figure 6). St. Peter Sandstone underlies the Platteville Galena unit which is underlain in turn by Prairie du Chien Dolomite (see figure 3). The log of Well Dn-945 is atypical in that it penetrated an unidentifiable sandy red clay zone about 200 feet in thickness and occurring between the Tunnel City Formation and a clean white sandstone assumed to be the Galesville Sandstone of the Wonowoc Formation (see figure 6). The Tunnel City Formation was less than normal thickness (see figure 6). A similar red clay material was reportedly hit in the bottom of Well Dn-928 but well samples are not available for conformation. This red clay may be a fault gauge material.

Structural relationships between wells Dn-928, 895, and 945 are not clear but it is assumed that formations dip in a northwesterly direction (see figure 3). *It is possible that another northeastward trending fault occurs between* Well Dn-945 and Wells Dn-928 and Dn-895. The logs of these three wells also do not correlate with well logs two to three miles north of the area and are down dropped in relation to an outcrop of Prairie du Chien Dolomite to the southwest in SW1/4, SW1/4, Sec. 26 and NW section 35. Hence the intervening northwest trending fault is proposed (see figure 2) and another fault probably occurs north of the area.

Ground Water Conditions

Ground water movement in the golf course area apparently is profoundly affected by the fault system. The faults were first discovered during an investigation as to why well yields were less than 300 gallons per minute (gpm) from an aquifer that normally yields 2000-3000 gpm to wells.

Wells Dn-917 and 945, owned by the golf course and well Dn-928, leased by the town of Blooming Grove are the only high capacity wells in the immediate area and all have specific capacities of close to 1.0 gpm/foot of drawdown. In contrast, the Village of McFarland well about 2 1/2 miles to the southwest had a specific capacity of about 45 gpm/foot of drawdown and several other wells in the tank farm area on terminal road have specific capacities from 20 to 25 gpm/foot of drawdown.

The faults apparently form hydrologic boundries or barriers to ground water movement. This may be caused by the presence of relatively impermeable gauge along the fault plane formed by grinding of rock material during movement along the fault. The red sandy clay penetrated by well Dn-945 (see figure 6) may be such a material.

The several faults in the area thus inhibit the movement of ground water toward pumping wells and seriously diminish the yield of the wells.

A continuous water level recorder was placed on well Dn-812, a 300 foot well in sandstones of Cambrian age, in an attempt to show effects of pumpage from golf course wells on ground water levels. The water level record and periods of pumping for the golf course wells are shown in figure 7.

The large amplitude fluctuations, such as the water level rise and decline during the period September 30 - October 3, appears to result from changes in barometric pressure.

Small amplitude water level changes, such as the several peaks shown during October 4 & 5, probably result from ground water pumpage. The hours of pumpage for Dn-917, the golf course well #1, are shown on figure 7. Well #2 (club house well) was pumped continuously during this period. There appears to be no direct correlation between well #1 pumpage and the small amplitude water level changes. Thus, the boundary fault on the southeast side of the graben may be causing a hydrologic boundary between the two wells. Additional information is needed to prove this conclusion.

The small amplitude water level changes may result from regional pumpage in the Madison area or may be the effect of a domestic well in the vicinity of Dn-812. A hydrograph of Dn-812 from August to December 1968, and daily precipitation at Truax Field is shown in figure 8. The hydrograph was constructed from daily low water level readings. The hydrograph indicates drawdown from pumpage that decreased in late October and increased again briefly in early December. Wells at the golf course were not pumped in December. Therefore, it is assumed that the hydrograph shows effects of regional pumpage.

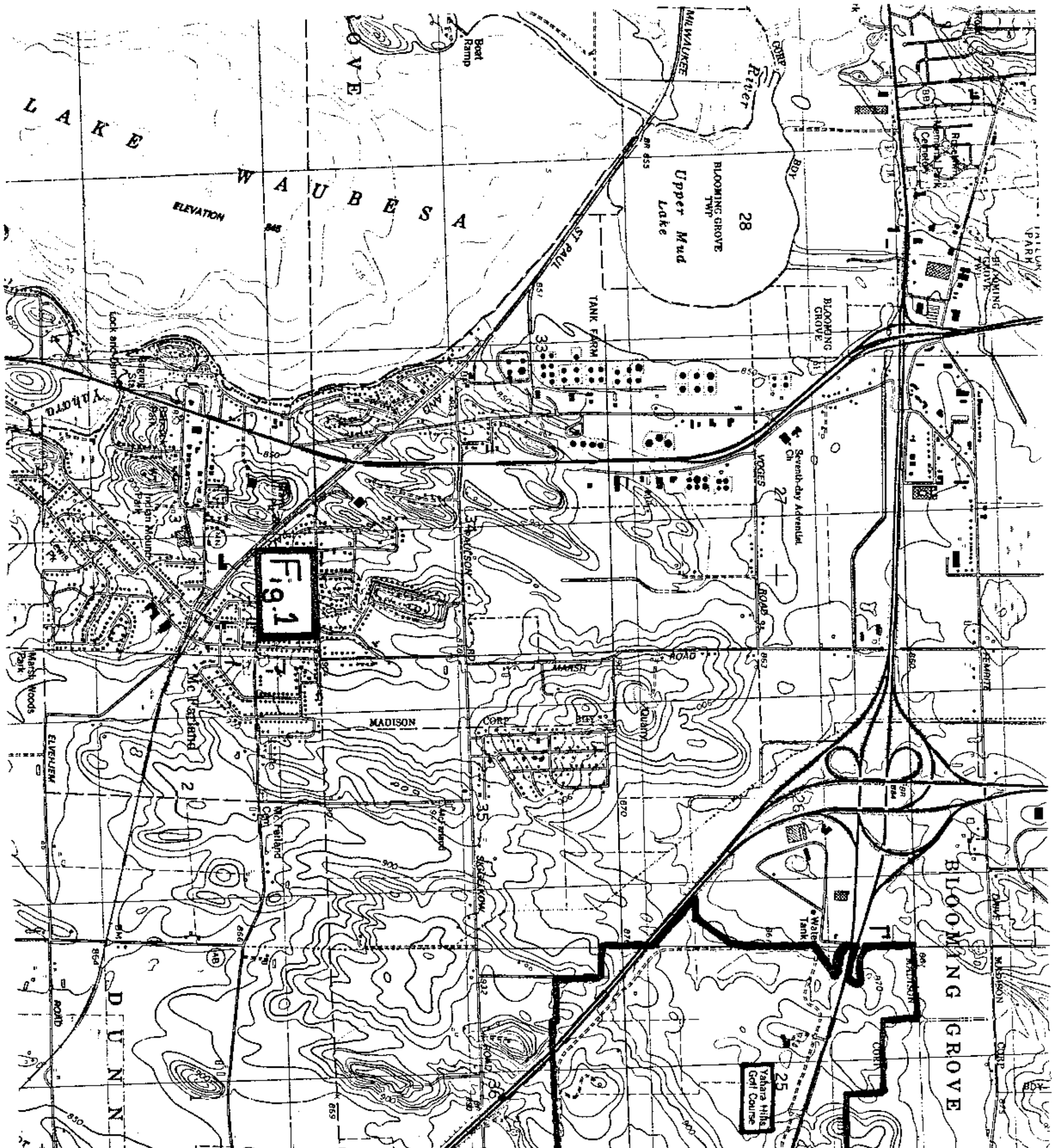
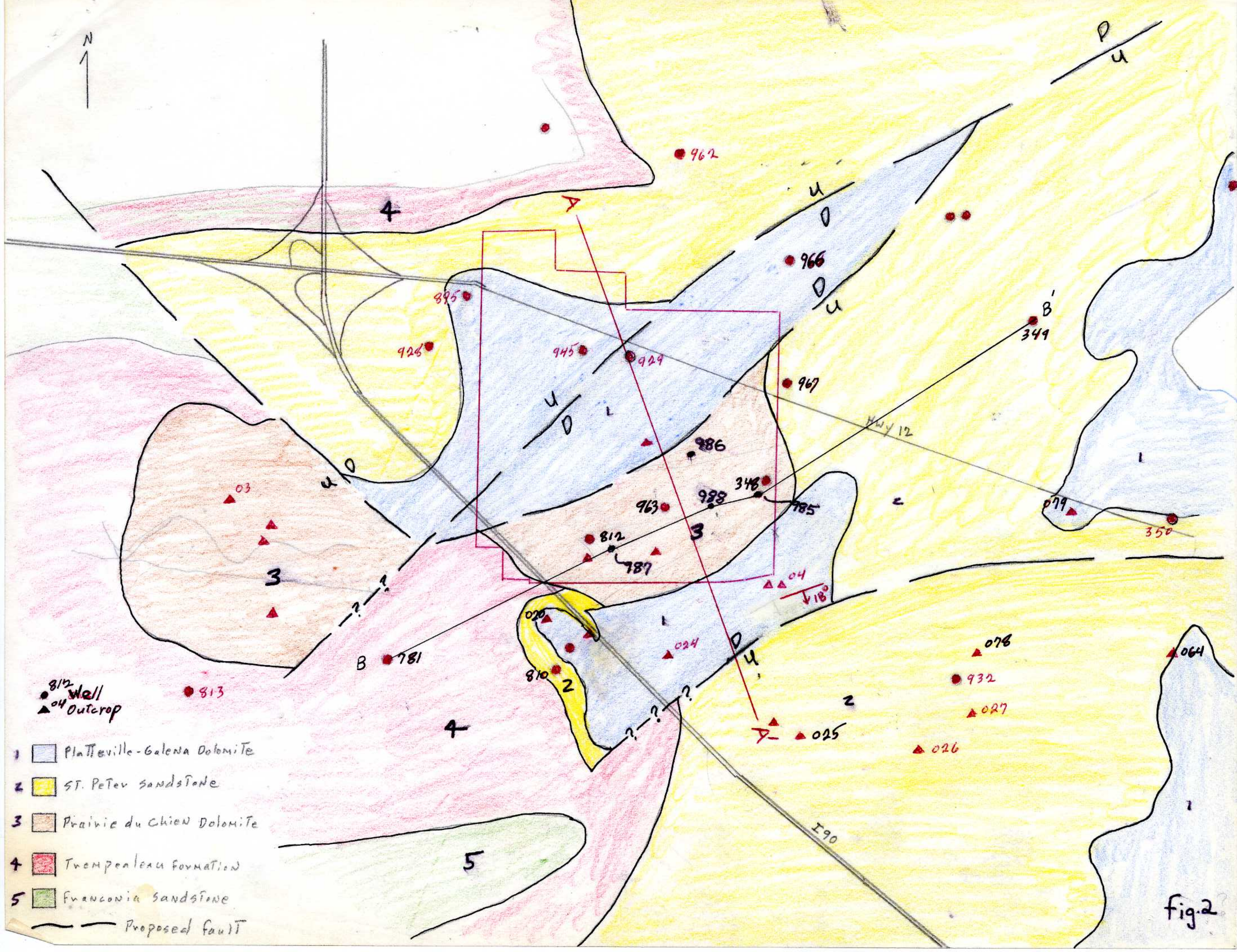


Fig. 1
LAKE WAUBESA
ELEVATION
Upper Mud Lake
28
BLOOMING GROVE TWP
TANK FARM
Seventh-day Adventist Ch
Yahara Hills Golf Course
BLOOMING GROVE
DUNN
MADISON
Golf Course
Door
Creek



N
1 Platteville-Galena Dolomite
2 St. Peter Sandstone
3 Prairie du Chien Dolomite
4 Trempealeau Formation
5 Franconia Sandstone
Proposed fault
812 Well
04 Outcrop
Hwy 12
I90
B
B'
A
A'

fig.2

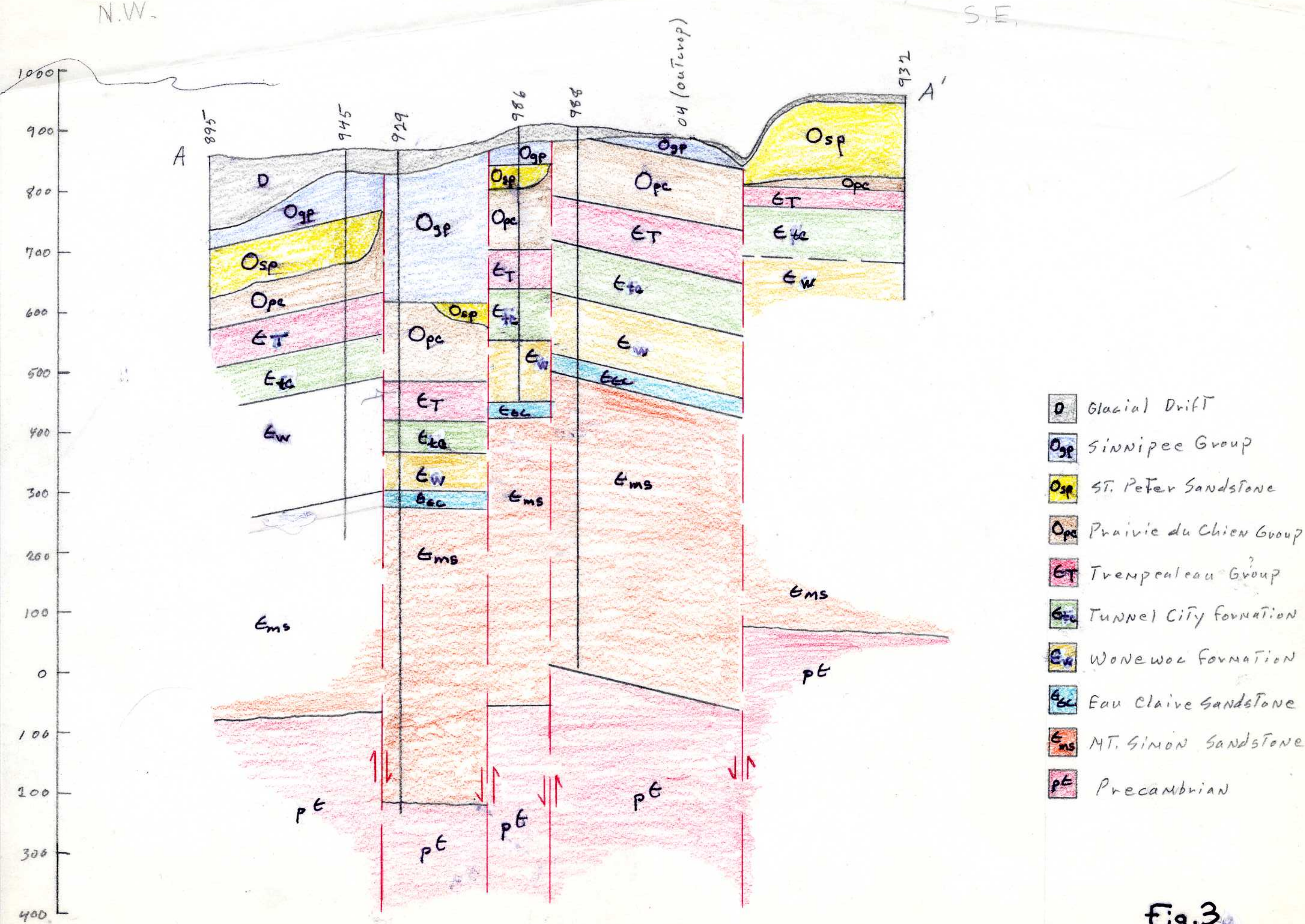

N.W.
S.E.
A
A'
895
945
929
986
988
04 (outcrop)
932
1000
900
800
700
600
500
400
300
200
100
0
100
200
300
400
Glacial Drift
Sinnipee Group
St. Peter Sandstone
Prairie du Chien Group
Trempealeau Group
Tunnel City formation
Wonewoc formation
Eau Claire Sandstone
Mt. Simon Sandstone
Precambrian

Fig.3

S. E. Madison Golf Course
Owner: City of Madison Park Commission
SE¼, NW¼, Sec. 25, T.7N., R.10E.

Egerer-Galloway Well Corporation - 12-13-65 - Mead & Hunt Engineering
Sample Nos. 257279-257499 Examined by J. Olmstead-10-12-65

865' ETM   +5'

Formation	Depth (ft)	Thickness (ft)	Description
DRIFT	0-5	5	St, Bl, Si; P, Ltl Snd, Dol
	5-10	5	Snd, Mxd, M, Fn, Srnd, P, TrVFn, C, VC
	10-15	5	Snd, Mxd, M, C, Srnd, P, TrFn, VC, TrVFn, FnGvl
	15-20	5	Snd, Mxd, M, C, Srnd, P, TrFn, VC, TrVFn, FnGvl, MGvl
	20-40	20	Snd, Mxd, M, C, Srnd, P, TrFn, VC, TrVFn, FnGvl
50	40-50	10	Snd, Mxd, C, VC, Ang, P, TrFn, M, TrVFn, FnGvl
PLATTEVILLE-GALENA	50-55	5	Dol, lt gry, Vfn & fn, dns; ltl cvd snd
	55-65	10	Dol, lt gry mot lt yl, Vfn&fn, dns; tr snd
	65-120	55	Dol, lt gry mot lt yl, Vfn&fn, dns; ltl snd
	120-140	20	Dol, lt gry Vfn & fn, dns; ltl cvd snd
	140-160	20	Dol, LtYlBn, M, Fn, Dns
	160-180	20	Dol, LtYlGryBn, M, Fn, Dns, LtlPyr, Sh
	180-205	25	Dol, MYlRdGryBn, Fn, VDns, TrSh, Pyr
	205-210	5	Dol, MGry, Fn, VDns, LtlSh, TrPyr
	210-255	45	Dol, MGryYlBn, Fn, VDns, LtlSh, TrPyr
220'	255-270	15	Dol, LtYlBn, M, Fn, Dns, TrPyr, Sh
Pdu	270-285	15	Dol, LtYlBn, M, Fn, Dns, TrSs
	285-295	10	Dol, LtYlBn, M, Fn, Dns, TrSs, Sh
	295-300	5	Dol, LtYlBn, M, Fn, Dns, TrSs, Sh, Pyr
	300-315	15	Dol, LtYlBn, M, Fn, Dns, TrSs, Sh, Pyr
	315-320	5	Dol, LtYlGryBn, M, Fn, Dns, TrSh, Pyr
	320-335	15	Dol, LtYlBn, M, Fn, Dns
	335-345	10	Dol, LtYlRdBn, M, Fn, Dns

Well construction:
7' water level
24" hole
24" steel casing
cement grout
41'
42'
23" hole
20" steel casing
124'
19" hole

Fig. 4

S. E. Madison Golf Course
Sample Nos. 257279-257499

Formation	Thickness	Depth	Interval	Description
P du C		345-355	10	Dol,LtYlRdBn,M,Fn,Por,MchSs
		355-360	5	Dol,LtYlRdBn,M,Fn,Por,LtlSs,Ools
		360-370	10	Dol,LtYlRdBn,M,Fn,Por,LtlSs,Ools,TrPyr
		370-375	5	Ss,LtYlRdBn,M,C,Srnd,P,TrFn,LtlDol,Sh
	125'	375-395	20	Dol,LtYlBn,M,Fn,Dns,TrPor,LtlSs,TrOols,Sh
TREMP		395-400	5	No Sample
		400-410	10	Dol,LtRdBn,M,Fn,Dns,TrSs,TrSh
		410-415	5	Dol,LtRdBn,M,Fn,Dns,TrSh,Pyr,Glauc
		415-455	55	Dol,LtRdBn,M,Fn,Dns,TrSh,Glauc
		455-460	5	Dol,LtRdBn,M,Fn,Dns,TrSh,Glauc,Pyr
		460-465	5	Dol,LtRdBn,M,Fn,Dns,TrSh,Glauc,Pyr
	75	465-470	5	Dol,MRdBn,M,Fn,Dns,MchSs,Sh,TrGlauc
FRANCONIA		470-475	5	Ss,LtRdBn,M,Fn,Srnd,P,TrVFn,C,MchSh,Dol,TrGlauc
		475-480	5	Ss,Mxd,M,Fn,Srnd,P,TrVFn,C,MchSh,Dol,TrGlauc
		480-485	5	Ss,MRd,M,Fn,Srnd,P,TrVFn,C,TrSh,Glauc
		485-495	10	Ss,LtRd,M,Fn,Srnd,P,TrVFn,TrSh,Glauc
		495-500	5	Ss,LtRd,M,Fn,Srnd,P,TrGlauc,Sh
		500-505	5	Ss,LtRd,Fn,Srnd,P,TrM,VFn,TrSh
		505-510	5	Ss,LtRd,M,Fn,Srnd,P,TrVFn,TrSh
		510-515	5	Ss,VLtRd,M,C,Srnd,P,TrVFn,Fn,TrSh
		515-525	10	Ss,VLtRd,M,C,Srnd,P,TrFn,TrSh,Pyr
		525-530	5	Ss,VLtRd,M,C,Srnd,P,TrFn,TrSh,Pyr,Foss
		530-540	10	Ss,VLtRd,M,Fn,Srnd,P,TrVFn,C,TrSh,Pyr
	75	540-545	5	Ss,VLtRd,M,C,Srnd,P,TrVC,TrSh
GALS		545-550	5	Ss,VLtRd,M,C,Srnd,P,TrFn,TrSh,Pyr
		550-560	10	Ss,VLtRd,M,C,Srnd,P,TrFn,TrSh,Pyr
		560-565	5	Ss,VLtYlBn,M,C,Srnd,P,TrFn,TrSh,Pyr
		565-580	15	Ss,VLtYlBn,M,C,Srnd,P,TrFn,VFn,TrSh,Pyr
		580-590	10	Ss,VLtPnk,M,C,Srnd,P,TrFn,VFn,TrSh,Pyr
	50	590-595	5	Ss,LtRd,M,Fn,Srnd,P,TrC,VFn
EAU CLAIRE		595-600	5	Sh,DkRdMotLtGn,M,Fn,VPDolc:F
		600-605	5	Sh,DkRdMotLtGn,VPDolc:F,TrSs
		605-615	10	Ss,Mxd,M,Fn,Srnd,P,TrC,MchSh,TrPyr
		615-620	5	Ss,VLtRd,M,C,Srnd,P,TrFn,LtlSh,TrPyr
		620-645	25	Ss,VLtRd,M,Fn,Srnd,P,TrC,VFn,TrSh,Pyr
		645-650	5	Ss,VLtRd,M,C,Srnd,P,TrFnTrSh
		650-685	35	Ss,VLtRd,M,Fn,Srnd,P,TrC,VFn,TrSh,Pyr
		685-690	5	Ss,VLtRd,M,Fn,Srnd,P,TrC,VFn,TrSh,Foss
		690-700	10	Ss,VLtRd,M,Fn,Srnd,P.TrC

19" hole

Fig. 4 cont.

S. E. Madison Golf Co/urse
Sample Nos. 257279-257499

EAU CL	700-720	20		Ss,VLtRd,M,C,Srnd,P,TrFn,TrSh,Pyr	
EAU CL	720-730	10		Ss,VLtRd,M,C,Srnd,P,TrFn,VFn,TrSh,Pyr	19" hole
EAU CL	730-740	10		Ss,VLtRd,M,Fn,Srnd,P,TrC,VFn,TrSh,Pyr	
EAU CL	740-755	15		Ss,VLtRd,M,Fn,Srnd,P,TrC,TrSh,Pyr	
EAU CL	755-760	5		Ss,VLtRd,M,Fn,Srnd,P,TrC,TrSh,Pyr,Foss	
EAU CL	760-765	5		Ss,VLtRd,M,Fn,Srnd,P,TrC,TrSh,Pyr	
EAU CL 775	765-770	5		Ss,VLtRd,M,Fn,Srnd,P,TrFn,TrSh	
MT SIMON	770-795	25		Ss,VLtPnkGry,M,C,Srnd,P,TrFn,LtlSh,TrPyr	
MT SIMON	795-810	15		Ss,VLtPnkGry,M,C,Srnd,P,TrFn,TrSh,TrPyr,Foss	
MT SIMON	810-835	225		Ss,VLtRd,M,C,Srnd,P,TrFn,VFn,TrSh,TrPyr,Foss	
MT SIMON	835-850	15		Ss,VLtRd,M,Fn,Srnd,P,TrC,VFn,TrSh,Pyr	
MT SIMON	850-855	5		Ss,VLtYl,M,C,Srnd,P,TrFn	
MT SIMON	855-875	20		Ss,VLtYlPnk,M,C,Srnd,P,TrFn	
MT SIMON	875-880	5		Ss,VLtYlBn,M,C,Srnd,P,TrFn	
MT SIMON	880-900	20		Ss,VLtYlRd,M,C,Srnd,P,TrFn,TrSh,Foss	
MT SIMON	900-905	5		Ss,VLtYlRd,M,C,Srnd,P,TrFn,TrSh,Foss	
MT SIMON	905-910	5		Ss,LtRd,M,C,Srnd,P,TrFn	
MT SIMON	910-915	5		SsLtRd,M,C,Srnd,P,TrFn,VC	
MT SIMON	915-925	10		Ss,MRd,M,C,Srnd,P,TrFn,VC	
MT SIMON	925-930	5		Ss,VLtRd,M,C,Srnd,P,TrFn,TrSh	
MT SIMON	930-940	10		Ss,VLtRd,M,C,Srnd,P,TrFn,VFn,TrPyr	
MT SIMON	940-945	5		Ss,VLtYlPnk,M,Fn,Srnd,P,TrC	
MT SIMON	945-950	5		Ss,VLtYlPnk,M,Fn,Srnd,P,TrC,VFn	
MT SIMON	950-960	10		Ss,VLtYlPnk,M,Fn,Srnd,P,TrC	
MT SIMON	960-965	5		Ss,VLtYlPnk,M,C,Srnd,P,TrFn	
MT SIMON	965-970	5		Ss,LtRd,M,Fn,Srnd,P,TrC,VFn	
MT SIMON	970-975	5		Ss,LtRd,M,Fn,Srnd,P,TrC,VC,VFn	
MT SIMON	975-980	5		Ss,LtRd,Fn,VC,SrndVP,TrC,M	
MT SIMON	980-985	5		Ss,LtRd,M,Fn,Srnd,P,TrC,VC	
MT SIMON	985-990	5		Ss,LtRd,M,Fn,Srnd,P,TrC,VC,LtlSh	
MT SIMON	990-1000	10		Ss,VLtYl,M,C,Sang,P,TrVC,Fn	
MT SIMON	1000-1010	10		Ss,VLtRd,M,C,Sang,P,TrVC,Fn	
MT SIMON	1010-1015	5		Ss,VLTRd,M,Fn,Sang,P,TrVFn	
MT SIMON	1015-1020	5		Ss,VLtRd,M,Fn,Sang,P,TrVFn,C	
MT SIMON	1020-1025	5		Ss,LtYl,C,VC,Srnd,P,TrM,Fn	
MT SIMON	1025-1035	10		Ss,VLtYlRd,M,C,Srnd,P,TrFn,VFn	
MT SIMON	1035-1040	5		Ss,VLtYlRd,M,C,Sang,P,TrVC,Fn,TrMxdColors	
MT SIMON	1040-1045	5		Ss,VLtYlRd,C,VC,Sang,P,TrM,Fn	

fig. 4 cont.

S. E. Madison Golf Course
Sample Nos. 257279-257499

M		1045-1055	10		Ss, VLtY1Rd, M, C, Sang, P, TrVC, Fn, TrMxdColors, TrVFnGvl	
T		1055-1060	5		Ss, VLtY1Rd, M, C, Sang, P, TrVC, Fn, TrMxdColors	
		1060-1065	5		Ss, DkRd, M, C, Sang, P, TrVC, Fn, TrMxdColors	19" hole
S		1065-1070	5		Ss, DkRd, M, C, Sang, P, TrVC, Fn.	
I		1070-1080	10		Ss, LtRdBn, M, Fn, Sang, P, TrVC, C, TrSts, Sh	
M	315	1080-1085	5		Ss, LtRdBn, C, VC, Sang, P, TrM, TrVFnGvl	
P		1085-1090	5		Gran, MOr.	
-		1090-1095	5		Gran, MOr	
C	20'	1095-1105	10		Gran, LtOrRd	1105'

Formations: Drift, Platteville-Galena, Prairie du Chien, Trempeleau, Franconia, Galesville, Eau Claire, Mt. Simon, Precambrian penetrated 20'.

Well tested for 6 hours at 200 gpm with 183' of drawdown.
Specific capacity = 1.1 gpm per foot of drawdown.

UNIVERSITY OF WISCONSIN GEOLOGICAL & NATURAL HISTORY SURVEY
1815 University Avenue, Madison, Wisconsin 53706

Log No. Dn-932
Issued: Nov., 1967

County: Dane

Well name Thomas W. Jones
Town of Cottage Grove, Wis.
Owner..... Tom W. Jones
Address.. R.R.#1, Siggelkow Rd.
McFarland, Wisconsin
Driller.. Guy W. Peterson
Engineer.

Completed....10/18/65
Field check.
Altitude....
Use......... Residen
Static w. l.= 104'
Spec. cap...= undeterminable

R. 11E.
T. 7 N.
Sec. 31

Quad. Cottage Grove 7½'.

Drill Hole						Casing & Liner Pipe or Curbing							
Dia.	from	to	Dia.	from	to	Dia.	Wgt.& Kind	from	to	Dia.	Wgt.& Kind	from	to
10"	0	44'				6"	D&R steel 19.45	+8"	44'				
6"	44'	280'											
5"	280'	340'				4"	D&R steel	109'	285'				

Grout: Kind	from	to
Cement	0	44'

Samples from 0 to 340' Date received: 12/14/65
Sample Nos. 259218 to 259278 Examined by: J. Warren Date: 5/25/66
Formations: Surface, St. Peter, Prairie du Chien, Trempealeau, Franconia, Ironton, Galesville.

Remarks:Well tested for 24 hours at 25 gpm with 0 feet of drawdown.

LOG OF WELL:

Formation	Thickness	Depth	Feet	Description
SUR	20'	0-20	20	Snd, rd,M & fn,rnd/Srnd,P srtg,ltl C & VC,tr Vfn;mch cl,tr cht,gvl
ST PETER		20-30	10	Ss, yl or,M & fn,rnd/Srnd,F srtg,ltlC&VC,trVfn;ltl dol,tr cht,gvl
		30-60	30	Ss,yl or,M & fn,rnd/Srnd,F srtg,tr Si-cem,ltl C & VC,tr Vfn;tr cht
		60-95	35	Ss,Vpl bn pnk,M&fn,rnd/Srnd,F srtg,ltlC,trVfn;ltl rd or Fe stn, r
		95-100	5	Ss,dk rd bn,M&fn,rnd/Srnd,F srtg,VP lim-cem,ltlC,trVfn;ltl Fe stn
		100-105	5	Ss,dk rd bn,dk yl or,M&fn,F si-cemP lim-cem,mchC&Vfn;mchFe stn&sndy dk rd bn dol
		105-110	5	Ss,dk rd bn&wh,C,Sang,F Si-cem,P lim-cem,mchM&VC,tr fn&Vfn;
		110-115	5	Ss,dk yl or,dk rd bn&wh,C,F Si-cemP lim-cem,mchM&VC,trfn&Vfn;dol&cht
		115-120	5	Ss,dk rd bn&wh,C,VP lim-cem,ltlM;mch rd bn&wh sndy sh,mch cht
		120-125	5	Ss,dk rd bn&wh,fn&Vfn,Srnd,ltlM,mch rd bn&wh sndy sh,mch cht
		125-135	10	Ss,pl rd,M,anf/Srnd,F lim-&Si-cem,mch C;ltl rd vn&wh sndy sh,ltl cht, mch Fe stn,
	125'	135-145	10	Ss,gry pnk,C,VP lim-cem,mchM;ltlVC;ltl cht, tr Fe stn
PdC		145-150	5	Ss,pl rd bn,M&fn,VP Si-cem,mchFe stn,ltl rd bn sndy glaucic sh
	20'	150-165	15	Dol,pnk&gry yl,Vfn,sft;tr cht,C/fn snd,glauc&rd bn& wh glaucic sh
TREM		165-170	5	Ss,gry rd,Vfn,ang/Sang,VP lim-cem,trM/VC;ltl glaucic sh&dol,ltlglauc
		170-175	5	Ss,gry rd,fn&Vfn,VP lim-cem,trM/VC;ltl glaucic sh&dol,ltl glauc
		175-190	15	Dol,gry rd,Vfn,VP lim-cem,sft;mch fn&Vfn Ss&snd,trM/VC,mch rd bn&yl or sndy glaucic sh

UNIVERSITY OF WISCONSIN GEOLOGICAL & NATURAL HISTORY SURVEY
1815 University Avenue, Madison, Wisconsin 53706

Log No. Dn-932

Well name Thomas W. Jones, Town of Cottage Grove, Wis.
Sample Nos. 259218 to 259278

Formation	Thickness	Depth	Interval	Lithology	Description
T	30'	190-195	5		Dol,gry rd,Vfn,VP lim-cem,sft;mch lt gn,pl yl,dk rd sndy glaucic sh mch fn & Vfn snd,
FRANCONIA		195-200	5		Ss,gry rd,fnand&Sang,F srtg,trM&C;mch sndy glaucic dol&sh,tr cht
		200-210	10		Ss,gry rd, fn, VP lim-cem,trM,C&VC;mch sndy glaucic dol& sh,tr cht
		210-215	5	G	Ss,pl rd,fn,mch M;ltl glauc,mch glaucic dol,ltl glaucic sndy sh& Fe stn
		215-225	10	G	Ss,pl rd,fn&M,mchM;ltl glauc,mch glaucic dol,ltl glaucic sndy sh& stn
		225-230	5	G	Ss,lt bn,fn&M,P lim-cem,mchM;ltl glauc,mch glaucic dol, etc.
		230-240	10	G	Ss,lt bn,fn&M,mchM;ltl glauc,mch yl glaucic dol,ltl pnk,ltl rd bn& wh glaucic sh
		240-245	5	G	Ss,pnk bn,fn&M,VP lim-cem,mchM;ltl glauc,mch yl glaucic dol
		245-250	5	G	Ss,pnk bn,fn&M,mchM;ltl glauc,mch yl glaucic dol,ltl pnk,ltl rd sh
		250-255	5	G	Ss,pnk bn,M&fn,;ltl glauc,mch yl glaucic dol,tr pnk,rd bn&wh glaucic sh
		255-265	10	G	Ss,pnk bn,M&fn; ltl glauc& yl glaucic dol,tr pnk,rd bn & wh glaucic sh, tr Fe stn
	80'	265-275	10	G	Ss,pl yl rd,M&fn,Sang,F srtg, trC;tr glauc,ltl rd bn yl & wh dol, tr gn sh & Fe stn
IRONTON		275-280	5		Ss,gry pnk,M&C,Srnd,P srtg,mch fn;ltl rd bn gn&wh sndy sh,tr yl dol
		280-285	5		Ss,gry pnk,M&C,VP lim-cem,mch fn; tr rd bn & lt gn sh, tr Fe stn
		285-295	10	G	Ss,gry pnk,M&C,Srnd,P srtg,ltl fn;ltl rd bn&lt gn sh,tr Fe stn
	60'	295-310	15	G	Ss,gry pnk,M&C,ltl fn,trVC;ltl rd bn&lt gn sh,tr Fe stn,& glauc
GVIL		310-315	5		Ss,gry or pnk,M&C,P limcem,ltl fn;tr py yl gn sndy sh,ltl Fe stn& lt yl dol
		315-325	10		Ss,gry or pnk,M&C,ltl fn;tr pl yl gn sndy sh,ltlFe stn&pl or dol
		325-330	5		Ss,gry pnk& gry rd,M&C,ltl fn;ltl pl gn& rd bn sh, tr dol
		330-335	5		Ss,Vpl gry or,M&C,Srnd,P srtg; tr rd bn sh
	30'	335-340	5	G	Ss,Vpl gry or&gry rd,M&C,Srnd,P srtg,tr fn;ltl rd bn&lt gn sh,tr glauc

END OF WELL

Fig. 5 cont.

UNIVERSITY OF WISCONSIN GEOLOGICAL & NATURAL HISTORY SURVEY — Log No. Dn-945

1815 University Avenue, Madison, Wisconsin 53706 — Sample Nos. 268688 - 268819

County: Dane

Well name: Madison S.E. Golf Course, Well #4, Club House, Yahara Hills
Owner....: City of Madison, Board of Park
Address..: Commissioners, City-County Bldg. Madison, Wisconsin
Driller..: Miller Well & Pump Co.
Engineer.: Mead & Hunt, Inc.

Completed... 7/26/66
Field check. P.G.O., & M.E.O.,
Altitude.... 875' ETM W.G.S. 7
Use......... Clubhouse facilities
Static w. l. -- 12
Spec. cap... -- 0.9

R. 10E. N. Sec. 25

Quad. Madison E. 7½'

Drill Hole						Casing & Liner Pipe or Curbing							
Dia.	from	to	Dia.	from	to	Dia.	Wgt.& Kind	from	to	Dia.	Wgt.& Kind	from	to
16"	0	40'6"	10"	50'	515'	16"	Blk.stl.62½# prime	0	40'6"	8"	Blk stl.28# prime	350'	515'
15¾"	40'6"	50'	8"	515'	660'	10"	Blk stl.40½# prime	+12"	51'6"				

Grout: Kind	from	to
Neat cement	0	51'6"

Samples from 0 to 660' — Date received: 7/21/66 — Examined by: J. M. Warren — Issued: July, 1968 — Date: 7/22/66

Formations: Drift, Platteville-Galena, St. Peter, Prairie du Chien, Trempealeau, Franconia, Fault material?, Galesville

Remarks: Well tested for 26 hours at 100 to 175 gpm with 43 to 189 feet of drawdown. Specific capacity figured on maximum rate and levels. The section between 395' and 590' may be fault material or repetition of the section.

LOG OF WELL:

Formation	Depth	Interval	Thickness	Description
DRIFT		0-5	5	St, dk yl bn, C, F srtg,;tr M & fn snd, cl & org mat
		5-25	20	Snd, lt or bn, M, rnd&Srnd, P srtg, mch C & fn;mch st, ltl cl, dol & gvl
		25-30	5	Snd, lt or bn, M, rnd&Srnd, P srtg, mch C&fn, ltl V fn;mch st&cl, ltl dol
	40'	30-40	10	Snd, pl yl or bn, M, mch C & fn, ltl VC&V fn;mch pl yl or cl, dol&gvl
PLATTE.GAL		40-45	5	Dol, gry yl, fn, slgt por, ltl M & fn; tr cvd snd
		45-55	10	Dol, gry yl, fn, slgt por, ltl M & fn;ltl cvd snd, tr cht
		55-60	5	Dol, gry yl, fn, slgt por, ltl M & fn; ltl cvd snd, tr cht
		60-65	5	Dol, pl yl or, fn, dns, ltl-mch sft, ltl V fn;tr wh cht
		65-80	15	Dol, pl yl or, fn & V fn, dns, ltl-mch sft;tr wh cht
		80-85	5	Dol, pl gry or, fn & V fn, mst sft; tr wh cht
		85-90	5	Dol, yl gry or, fn & V fn, mst sft, ltl dns, tr M; tr wh cht
		90-95	5	Dol, yl gry or, fn & V fn, mst dns, ltl sft, tr M;tr discem pyr&cht
		95-100	5	Dol, lt ol gry, M & fn, slgt por;tr foss frags, cht, pyr&ol gry sh
		100-105	5	Dol, gry, fn, slgt por, ltl mot lt gry & wh;mch gry sh, tr pyr
		105-110	5	Dol, lt ol gry, M&fn, slgt por, ltl mot lt&dk gry&yl bn;ltl foss frags
		110-115	5	Dol, pl gry or mot gry, fn&V fn, dns, tr M, tr mot dk gry;tr discem pyr
		115-120	5	Dol, pl gry or mot gry, V fn, dns, ltl fn, tr mot dk gry;tr discem pyr
	85'	120-125	5	Dol, V pl yl bn, fn&V fn, dns, ltl mot yl bn&dk gry; tr foss frags
ST PETER		125-130	5	Ss, lt ol gry, M&fn, rnd&Srnd, VP dol-cem, ltl V fn;mch gry sh, ltl dol
		130-135	5	Ss, lt ol gry, M&fn, VP dol-cem, ltl V fn;mch gry sh, ltl dol&dol-cem
		135-140	5	Ss, lt ol gry, M, rnd, VP dol-cem, mch fn, ltl C&V fn, tr VC;mch st,
		140-145	5	Ss, lt ol gry, C/fn, rnd, P srtg, ltl V fn;mch gry sh, tr wh dol
		145-160	15	Ss, lt ol gry, M, Srnd, mch fn, ltl C&V fn;mch st, tr pyr-&P dol-cem
		160-165	5	Ss, V lt ol gry, M, Srnd, mch fn, ltl C&V fn;mch st, tr cl, lim&xln dol
		165-170	5	Ss, pl ol gry, C/fn, ltl V fn;mch V pl gry sh, tr dol, pyr & st
		170-175	5	Ss, rd bn, C/fn, rnd&Srnd, P srtg, ltl V fn;mch rd sh&sh pellets, tr st
		175-180	5	Sh, rd bn mot wh, sft;ltl fn/VC snd, tr cht & pyr, ltl xln dol
		180-185	5	Ss, pnk, M, Srnd, mch fn, V fn&C, ltl VC;ltl st & dol, tr cht, cl, lim, py
		185-190	5	Ss, gry or pnk, M, mch fn&V fn, ltl C, tr VC;ltl st, ltl cht, tr gn sh

Fig. 6

UNIVERSITY OF WISCONSIN GEOLOGICAL & NATURAL HISTORY SURVEY
1815 University Avenue, Madison, Wisconsin 53706

Log No. Dn-945

Well name Madison S.E.Golf Course, Well #4 Club House
Sample Nos. 268688 to 268819

Formation	Thickness	Depth	Interval	Description
SP		190-195	5	Ss, pl rd,M,mch fn&V fn,ltl C,tr VC;mch st,pl gry gn&pl or dol,ltl sh
	75'	195-200	5	Ss, pl or pnk,M,mch fn& V fn,ltl C;mch st&pl or dol,tr rd sh
PDUC		200-210	10	Dol, pl or pnk,fn,dns;mch V fn/M snd,ltl C,tr rd sh,st & cl
		210-215	5	Dol, pl or pnk,fn,snd;mch V fn/M snd,tr dk rd sh,st, cl & cht
		215-235	20	Dol, gry or pnk,fn,dns;mch V fn/M snd,tr C,mch cl,tr cht& dk rd sh
		235-245	10	Ss, gry or pnk,M,F dol-cem,mch fn,V fn&C;mch dol-cem&sft dol,ltl st & cl
	55'	245-255	10	Dol,gry or pnk,fn&V fn,dns,ltl sft,mch sndy;ltl oolic cht,ltl st&cl
TREMP		255-260	5	Ss, V pl or mot lt gry,M,F-P dol-cem,mch fn,V fn&C,ltl VC;mch sft dol
		260-275	15	Ss, V pl or mot lt gry,fn, Sang, P srtg, F-P dol-cem, mch M, V fn & C;mch sft dol-cem,ltl cl,tr cht
		275-285	10	Ss, V pl or, fn,S ang, P srtg, P dol-cem, mch M & V fn,ltl C; mch st,ltl sft dol-cem,tr rd & gn sh
		285-295	10	Ss, V pl or,fn,P dol-cem, mch M&V fn,ltl C,mchst, ltl sft dol-cem
		295-300	5	Ss, V pl or,fn,P dol-cem,mch M & V fn, ltl C,tr VC;mch st
		300-305	5	Ss, gry or pnk,dn,F-G dol-cem,mch M & V fn, ltl C tr VC;ltl dol
		305-310	5	Dol,gry or pnk,mot wh,pl or&pl yl bn,fn,dns;mch V fn/M snd,ltl C
	70'	310-325	15	Dol,gry or pnk mot wh,pl or & pl yl bn,fn,dns,ltl V fn;mch fn snd
FRANCONIA		325-335	10	Ss, pl rd bn,fn&V fn,P dol-cem,ltl M,tr C;mch xln dol
		335-340	5	Ss, lt ol gry,M&fn,P dol-cem,mch V fn,ltl C;ltl sft dol-cem,st&cl
		340-345	5	Ss, yl gry,M,VP dol-cem,mch fn&C,ltl V fn & VC;ltl st,cl&sft dol-cem
		345-355	10	Ss, yl gry,M,VP dol-cem,mch fn&C,ltl V fn,tr VC;ltl st,cl
		355-365	10	Ss, yl gry,M&fn,VP dol-cem,mch V fn,ltl C;ltl cl,mch sft dol-cem
		365-375	10	Ss, pl gry or,M&fn,Srnd,P srtg,mch V fn, ltl C;mch st & cl
	70'	375-395	20	Ss, yl gry,M,mch C&fn,ltl V fn,tr VC;mch st & cl,tr dk ol sh
IDENTITY UNCERTAIN *		395-405	10	Sh, rd bn,P srtg,;mch st&fn/C snd,ltl V fn,trVC,xln dol,tr sh
		405-410	5	Sh, rd bn,tr mot wh;ltl st,fn&V fn snd,tr M&C,ltl wh cht,tr sh
		410-425	15	Sh, rd bn,tr mot wh;ltl st,mch V fn/M snd,ltl C,ltl wh cht
		425-430	5	Sh, rd bn,slgt dolic,tr mot wh;mch st,fn&V fn snd,tr M,mch dk gry
		430-440	10	Sh, rd bn,P srtg,dolic,tr mot wh;mch st,fn& V fn snd,mch dk gry sh
		440-455	15	Sh, rd bn,dolic,tr mot wh;mch st, fn & V fn snd,ltl dk rd gry sh
		455-480	25	Sh, rd bn, slgt dolic,tr mot wh;mch st, fn & V fn snd,ltl sh,cht
		480-500	20	Sh, rd bn,ltl mot wh;mchst& V fn, fn/C snd,ltl dk rd gry sh,tr cht
		500-530	30	Ss, rd, M & fn,ltl C&V fn;mch rd sh,ltl gry,gn&wh sh,ltl cht&mic
		530-535	5	Ss, pl rd,M&C,mch fn,ltl V fn;ltl rd sh,tr cht,vari-clr sh,dol&st
		535-540	5	Ss, pl rd, C ,mch M&fn,tr V fn;tr vari-clr sh, cht,dol & st
		540-550	10	Ss, pl rd,M&fn,Srnd,P srtg,ltl C,tr V fn;ltl sh,tr dol
		550-555	5	Ss, pl rd,M&fn,ltl C&V fn;mch dolic pl rd cl&sft dol,ltl vari-clr sh&cht
		555-560	5	Ss, pl rd, fn,Srnd,P srtg, ltl M, C & V fn; mch dolic cl&sft dol

Fig. 6 cont.

Well name Madison S.E. Golf Course, Well #4
Sample Nos. 268688 to 268819

Formation	Thickness	Depth	Ft.	Description
I.U		560-575	15	Ss, pl rd, M&fn,Srnd,P srtg, ltl C & V fn;mch dolic pl rd cl&sft dc
		575-585	10	Ss, pl rd, M&fn,ltl C&V fn;mch cl & sft dol,ltl st,tr gn&gry sh
	195'	585-590	5	Ss, lt rd, V fn,ltl M;mch dolic sh& sft dol,tr gn & gry sh&glauc
GALESVILLE		590-600	10	Ss, or pnk,M,mch C&fn,ltl V fn;ltl st&cl,tr dk rd&gn sh
		600-635	35	Ss, pnk&gry pnk,M,rnd,P srtg,mch C&fn,ltl V fn;tr glauc,cht,sh&st
		635-645	10	Ss, pnk or, M,mch C&fn,tr V fn;ltl pnk cl,tr pnk&wh dol,tr rd&gn sh
	70'	645-660	15	Ss, pnk or,M,mch C&fn,tr V fn;tr dol,ltl pnk cl,tr rd & wh sh

END OF WELL

Fig. 6 cont.

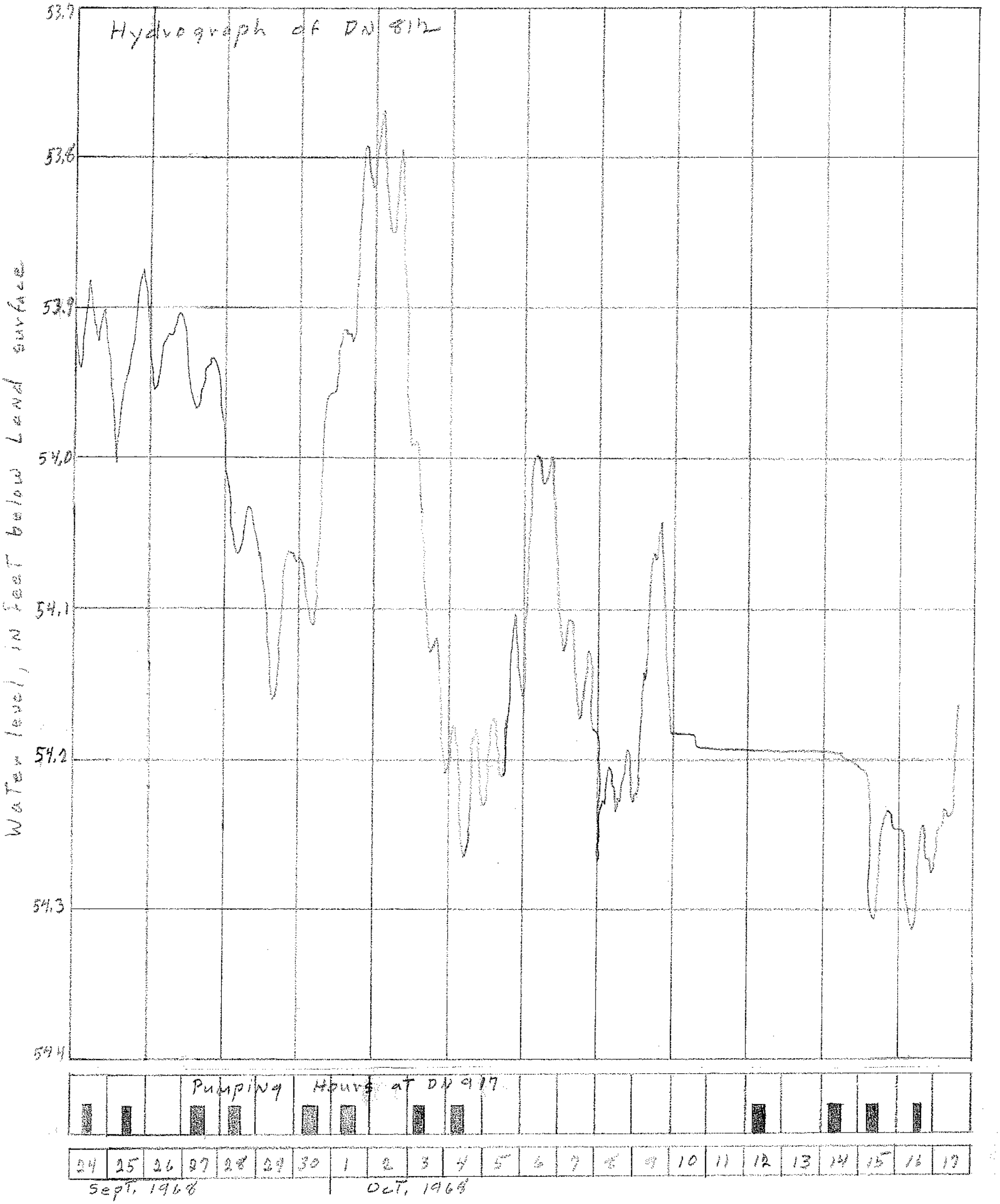
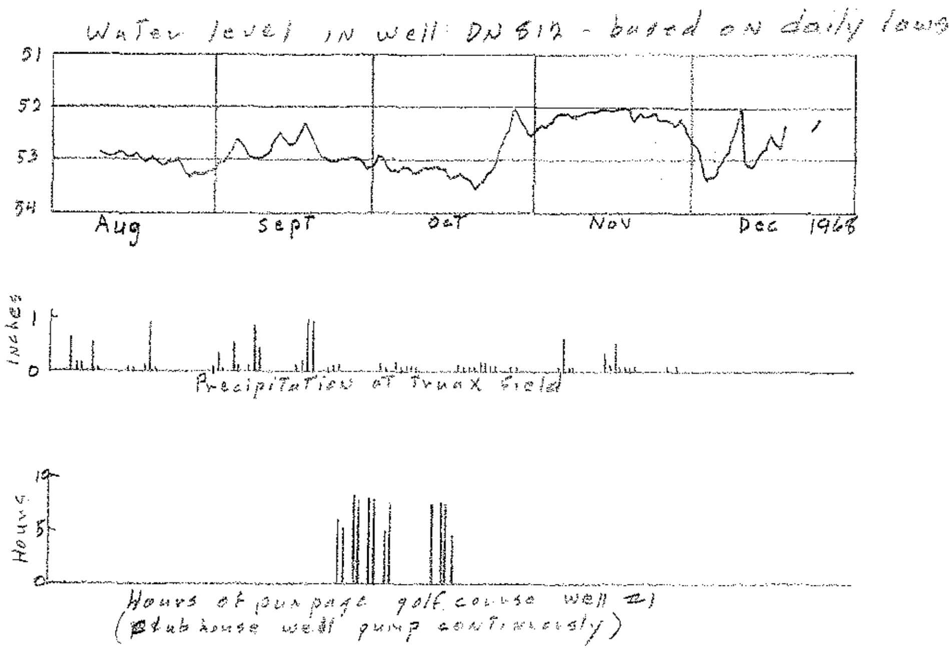

Hydrograph of DN 8112
Water level, in feet below land surface
53.7
53.8
53.9
54.0
54.1
54.2
54.3
54.4
Pumping Hours at DN 917
24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Sept. 1968
Oct. 1968

Fig. 7



Water level in well DN 812 - based on daily lows
51
52
53
54
Aug
Sept
Oct
Nov
Dec 1968
Inches
1
0
Precipitation at Truax Field
Hours
10
5
0
Hours of pumpage golf course well #1
(Club house well pump continuously)

Fig. 8