COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In the Matter of:

THE APPLICATION OF THE WEST DAVIESS COUNTY WATER DISTRICT FOR APPROVAL OF THE CONSTRUCTION AND METHOD OF FINANCING A WATERWORKS IMPROVEMENT PROJECT	)))))	CASE NO. 8723

ORDER

On February 15, 1983, a public hearing was held concerning the proposed application of West Daviess County Water District ("West Daviess") for a certificate of public convenience and necessity to construct additional facilities including a water storage tank. Although West Daviess proposed to finance most of the additions through internally generated funds, West Daviess requested authority to borrow $68,930 which was subsequently reduced to $50,000.

The Commission is concerned that the additional facilities, as proposed, will not be "used and useful" for sometime to come and that the application does not contain a comprehensive proposal to remedy current problems of low pressure which exist on the system as shown by the March 3, 1983 Engineering Report attached as Appendix A to this order.

It is the intent of the Commission to place the above-referenced report into the record in this proceeding since it provides useful and proper information for the Commission to

consider in making its decision in this proceeding. Accordingly, the Commission HEREBY ORDERS that the engineering report contained in Appendix A be and hereby is made a part of the record in this proceeding.

It is FURTHER ORDERED that West Daviess shall notify the Commission in writing within 14 days from the date of this order if it desires a hearing with respect to matters contained in the engineering report.

Done at Frankfort, Kentucky, this 28th day of March, 1983.

PUBLIC SERVICE COMMISSION

For the Commission

ATTEST:

Secretary

REPORT

TO: Claude G. Rhorer, Jr., Director
Division of Engineering and Services

THRU: Byrnes Fairchild, Chief
Water and Sewage Section

FROM: Eddie B. Smith
Public Service Engineer

RE: Investigation of the hydraulic capability of the West Daviess County Water District. Case No. 8723.

DATE: March 3, 1983

Brief

The purpose of this report is to present engineering data and hydraulic calculations concerning the ability of the West Daviess County Water District to effectively utilize their existing and proposed water storage tanks. On November 17, 1982, the Public Service Commission received an application from the West Daviess County Water District for approval of the construction of a 300,000 gallon steel storage tank. Engineering drawings and specifications were submitted with the original application but an engineering report was not included. In an attempt to determine if the proposed water storage tank would "be used and useful in rendering service to the public" additional engineering data was requested from the District by Order dated December 7, 1982. During this same period of time the District's Consulting engineer, James H. Gilliam, was made aware directly of the request for information. Mr. Gilliam stated that a formal engineering report had not been prepared for the particular project submitted to the Commission. Nevertheless, Mr. Gilliam did supply related reports, system maps, estimates of customer demands, and discussion

of system flow capabilities during the month of December. On February 7, 1983, Mr. Gilliam delivered a report entitled "West Daviess County Water District, Engineering Analysis of System" in answer to a direct written request from the staff of the Water and Sewage Section. Copies of Mr. Gilliam's report were filed for record on February 11, 1983. A formal hearing on the application by West Daviess County Water District was conducted on February 15, 1983.

Background Information

The West Daviess County Water District began operation in 1969 with approximately 1100 customers. The District presently serves 1936 customers in the western half of Daviess County (See Figure 1). The water distribution system is made up of 108 miles of pipeline, 3 storage tanks, and a duplex (2 equal pumps) pump station at Owensboro (See Figure 2). The 3 storage tanks include a 300,000 gallon standpipe in the vicinity of Ben Hawes State Park, a 150,000 gallon elevated tank at the West Louisville community, and a 200,000 standpipe near the community of Moseleyville. The three storage tanks are fed by a single pump station and connection to the City of Owensboro's Water System. The high water level overflow elevation for all three tanks is intended to be the same at 615 feet above sea level (ASL). The high water level in each of the two standpipes is regulated by altitude valves located in vaults at the base of the tanks. The elevated tank at West Louisville was originally designed to regulate the operation of the pump station via a telemetric control system set to monitor the water level in the elevated tank. The telemetric control system was abandoned soon after installation because of problems with the telephone lines according to the water system manager, Jan Kuegel. The operation of the pump station is currently controlled by a time clock manually set by District personnel. The District's pump station is

nominally rated at 650 gallons per minute. According to Mr. Kuegel, the pump station operates 15 to 16 hours a day during the winter months and 18 to 22 hours a day during the summer.

In 1981 the District reported average daily water purchases from the City of Owensboro of 685,887 gallons. The District's engineering consultant listed the 1982 average daily usage as 596,077 gallons. West Daviess resells water to Beech Grove Water System, Inc., and North McLean County Water District, both located in McLean County. The 1981 Annual Report showed average daily sales of 37,904 gallons and 73,814 gallons respectively. Mr. Gilliam, consulting engineer, gave the 1982 daily average sales as 26,000 gallons and 71,000 gallons for these same systems. The Beech Grove Water System's master meter is served by the elevated water tank at West Louisville. The North McLean County Water District has two master meters served by the standpipe at Moseleyville.

The District has been experiencing difficulty in maintaining the water level of the storage tank at Moseleyville. Approximately 12 customers supplied by the Moseleyville tank are located on the higher elevations south of the Utica community. These customers routinely experience low service pressures and occasional water outages. In addition, the Daviess County Fiscal Court has requested that the District improve its fire flow capability in the Utica area to 500-600 gallons per minute. West Daviess proposed to address all of these circumstances by construction of a 300,000 gallon steel storage tank on the high ridge south of Utica along with an 8-inch pipeline connection to the existing system.

Field Observations and Data Collection

Staff review of the information submitted by the West Daviess County Water District found it to be insufficient to allow an adequate engineering evaluation of the proposed water works improvements. In order to gather additional data on the water system's operational characteristics, Bob Arnett and Eddie Smith of the engineering staff made a field visit on Monday, February 7, 1983. During this visit the proposed water works improvements were discussed with Jan Kuegel, manager; James H. Gilliam, consulting engineer; and Robert M. Kirtley, Daviess County Attorney.

The primary purpose of the field visit was to set recording pressure gauges at various points throughout the West Daviess County Water District in order to monitor the system's operational characteristics. To this end, recorders were placed at the locations listed in the following table.

TABLE I. RECORDER LOCATIONS

Position Number	Location Description	Recorder Number	Approximate Elevation Above Sea Level (ASL)
1)	on the suction line of the pump station	74A-25693	395 ft.
2)	on the discharge line of the pump station	2G 531-14	395 ft.
3)	in the valve pit of the 300 M standpipe near Ben Hawes State Park	74A-25692	520 ft.
4)	in the valve pit of the 150 M elevated tank at West Louisville	74A-25691	474 ft.

TABLE I. RECORDER LOCATIONS (CONT.)

Position Number	Location Description	Recorder Number	Approximate Elevation Above Sea Level (ASL)
5)	in the valve pit of the 200 M standpipe near Moseleyville	801359	547 ft.
6)	in the master meter pit for North McLean County W.D. on Highway 81	801357	440 ft.
7)	at the meter of the Masonic Lodge Bldg. in Utica	801360	420 ft.
8)	at the garage entrance to the Allen residence on Locust Grove Rd., south of Utica	801361	550 ft.

The sea level elevations of the various recorder locations were determined from USGS topo maps of the area and from information furnished by Mr. James H. Gilliam for the pump station and tank sites. Mr. Jan Kuegel installed the recorder at the North McLean master meter on February 8, 1983, at the request of the PSC staff. Recorders numbered 801359, 801360, and 801361 were checked for calibration by Dennis Hildenbrand at the PSC meter laboratory prior to the trip to West Daviess County Water District.

Bob Arnett and Eddie Smith returned on February 10, 1983, to retrieve the recording gauges and their charts (copies attached). In addition a hydrant flow test was conducted at Utica on Highway 140 near the Masonic Lodge Building. The following data was obtained:

TABLE II. HYDRANT FLOW TEST

Date:	February 10, 1983
Time:	1:13 p.m. EST
Location:	Highway 140 in Utica
Elevation:	420 ft. ASL
Static Pressure:	75-80 PSI
Residual Pressure:	11-12 PSI
Estimated Flow:	550-580 gpm

During the February 10, 1983, visit the operation of the District's pump station was observed, and pumping rates were noted. The master meter for water purchased from Owensboro and one for water resold to North McLean were read and recorded. Mr. Jan Kuegel furnished readings on both meters taken on February 8, 1983. This information is tabulated below:

TABLE III. MASTER METER READINGS

Master Meter	Date	Time	Reading
West Daviess	February 8, 1983	11:00 a.m. EST	695106300 gal
	February 10, 1983	3:45 p.m. EST	696662500 gal
North McLean	February 8, 1983	11:30 a.m. EST	129028900 gal
	February 10, 1983	1:50 p.m. EST	129273800 gal

Mr. Kuegel furnished the daily recording flow rate charts from the pump station flow meter for the period February 7, 1983, through February 9, 1983, to the PSC staff. Copies of these flow rate charts are attached. Mr. Kuegel supplied a copy of the manufacturer's characteristic pump curve for the District's pumps. A copy of this capacity-head curve is also attached to this report.

Calculations and Data Reduction

The master meter readings indicate that West Daviess purchased 1,466,200 gallons of water from the City of Owensboro in the 52 3/4 hours from 11:00 a.m. Tuesday until 3:45 p.m. Thursday. The average purchases for a 24-hour period would amount to 667,086 gallons. The chart taken from the recorder placed on the discharge side of the pumps indicates that the pumps were in operation approximately 33 1/4 hours during the 52 3/4 hours between meter readings. This reduces to an average pumping rate of 735 gallons per minute and an average daily pump station operation of 15 1/8 hours. The flow rate charts supplied by the District show a pumping range of 710 gallons per minute to 805 gallons per minute for the same period.

An evaluation of the pressure charts from the suction and discharge points of the pump station and the flow charts furnished by West Daviess was made in order to develop a head/capacity curve for the pumps. The following data was taken from these charts and plotted on the pump curve supplied for the pump station by Mr. Kuegel.

TABLE IV. PUMP CURVE FIELD DATA

Date:	2/09/83	2/09/83	2/10/83	2/10/83
Time:	8:00 a.m. EST	10:00 a.m. EST	2:00 a.m. EST	7:00 a.m. EST
Discharge Pressure:	105 PSI	103 PSI	113 PSI	105 PSI
Suction Pressure:	57 PSI	54 PSI	55 PSI	55 PSI
Pressure Head:	48 PSI	49 PSI	58 PSI	50 PSI
Head in Feet:	111 ft.	113 ft.	134 ft.	115 ft.
Flow Rate:	805 G.P.M.	799 G.P.M.	710 G.P.M.	790 G.P.M.

From the information contained in Table IV an approximate pump curve was drawn on the head/capacity curve received from the District. The curve is a useful indication of the capability of the District's pump station.

Examination of the pressure charts indicates that the pump station can maintain the water levels in the three storage tanks during all but peak demand times of the day. However, at no time during the recorded period from Monday, February 7, until Thursday, February 10, were any of the tanks completely full. The 300M standpipe near Ben Hawes State Park ranged from a low water elevation of approximately 587 feet ASL to a high level of 605 feet ASL. Since the full or overflow elevation of all three tanks is 615 feet ASL, this corresponds to storage of 206,676 gallons and 266,667 gallons respectively. The 150M elevated tank at West Louisville ranged from a low water level of 601 feet ASL to a high level elevation of 610 feet ASL. This translates to a low of 75,000 gallons in storage to a high of 123,214 gallons. The water level of the 200M standpipe near Moseleyville was recorded to vary between a low of 584 feet ASL to a high of 595 feet ASL. These levels indicate a volume at low of approximately 103,125 gallons and a high of 137,500 gallons. The three tanks varied between their high and low levels on a daily basis. The fluctuations in water levels of the three tanks appear to be directly related to the daily operation cycles of the pump station itself. The tanks seem to fill when the pump station is on and to empty when the station is not pumping--a reasonable sequence of events!

An understanding of the West Daviess Couty Water District's hydraulic capabilities can be gleaned from reviewing the pressure charts in detail. It is possible to coordinate the charts through the use of pressure events created throughout the system by the operation of the pump station. One such obvious event occurred around 2:00 a.m. EST on Thursday morning February 10, 1983, when the pump station ceased pumping. Table V summarizes the conditions that existed immediately prior to the pump shut-off as indicated by the pressure charts.

TABLE V. SYSTEM CONDITIONS
February 10, 1983, 2:00 a.m. EST

Location	Pressure PSI	Hydraulic Gradient (Feet Above Sea Level)	Gallons Water In Tank	Estimated Flow Rate
Pump Suction	55	522		
Pump Discharge	113	656		710 GPM
Ben Hawes Tank	34	599	246,667	255 GPM
West Louisville Tank	59	610	123,214	190 GPM
Moseleyville Tank	21	595	127,500	265 GPM
North McLean	77	618		
Masonic Lodge	85	616		
Allen Residence	29	617		

The volume of water contained in each of the tanks was determined by a direct ratio of the indicated height of water and the nominal depth of the tank bowl times the stated capacity. The flow rate at the pump station was taken from the flow-rate charts provided by West Daviess. The flows assigned to each tank were distributed on the basis of friction head loss calculated by the Hazen-Williams formula. It was assumed that the pipe system had a friction factor of a C = 130 and that entrance losses for each of the two standpipes amounted to approximately 9 PSI and to approximately 5 PSI for the elevated tank.

It should be noted that the pump station stopped pumping water before any of the tanks were full. Since the 150M elevated tank does not have an altitude valve or any other method to prevent it from being overfilled, the pump station has to be shut off before the tank overflows. This is presently accomplished by setting the time clock to shut the pump station off when the elevated tank is expected to be near full. In view of the fact that the District was not able to fill any of the tanks during the period monitored by the pressure records, it must be asked if the tanks can indeed be filled.

In order to approximate the ability of the pump station to fill the storage tanks a mathematical simulation of system flow capabilities was performed. The same assumptions used in the previous flow rate calculations were retained. In addition it was assumed that the analysis was made for a period of no customer demands and no pipeline leakage. All flows were assigned to the storage tanks. The time period used for the calculations was the early morning hours of Thursday, February 10, 1983. The simulation presumed that the tanks were individually closed when full, and that the flow rates between calculations were constant. The results of the simulation are given in Table VI. This analysis indicates that with proper tank level controls the pump station could have filled the tanks before dawn and the beginning of customer demand. However, it would have required nearly 21 hours of pump operation out of the previous 24 hours to achieve full tanks.

TABLE VI. SIMULATION OF EXISTING FLOW CONDITIONS

Location	Hydraulic Gradient	Gallons Water In Tank	Estimated Flow Rate
@ 2:00 a.m. EST			
Pump Station	656		710 GPM
Ben Hawes Tank	599	246,667	255 GPM
W. Louisville Tank	610	123,214	190 GPM
Moseleyville Tank	595	137,500	265 GPM
@ 4:00 a.m. EST			
Pump Station	660		650 GPM
Ben Hawes Tank	608	277,267	230 GPM
W. Louisville Tank	614	146,014	190 GPM
Moseleyville Tank	605	169,300	230 GPM
@ 4:21 a.m. EST			
Pump Station	669		555 GPM
Ben Hawes Tank	610	282,097	280 GPM
W. Louisville Tank	615	150,000*	
Moseleyville Tank	607	174,130	275 GPM
@ 5:25 a.m. EST			
Pump Station	680		315 GPM
Ben Hawes Tank	615	300,000*	
W. Louisville Tank	615	150,000*	
Moseleyville Tank	612	191,730	315 GPM
@ 5:51 a.m. EST			
Pump Station			
Ben Hawes Tank	615	300,000*	
W. Louisville Tank	615	150,000*	
Moseleyville Tank	615	200,000*	

*Full

The question still remains as to whether or not the existing pump station and distribution system can support the proposed tank at Utica. To evaluate the capacity of the water system a mathematical simulation of the flow capabilities of the water system was performed with the proposed improvements in place and operating. The same assumptions used in the analysis previously conducted on the existing distribution system were also applied to this series of calculations. In addition the same time period was utilized in order to provide a direct comparison of the existing and proposed systems. The water level in the proposed tank at Utica was taken to be at the same elevation as the tank at Moseleyville. Such an assignment of water level corresponds to a half full condition and it is compatible with the measurements made on the existing system. It is expected that the analysis based on these conditions will generate reasonable approximations of the flows actually produced by the proposed water works improvements. The results of the simulation performed for the proposed system are listed in Table VII.

TABLE VII. SIMULATION OF PROPOSED FLOW CONDITIONS

Location	Hydraulic Gradient	Gallons Water In Tank	Estimated Flow Rate
@ 2:00 a.m. EST			
Pump Station	652		705 GPM
Ben Hawes Tank	599	246,667	245 GPM
W. Louisville Tank	610	123,214	180 GPM
Moseleyville Tank	595	137,500	185 GPM
Utica Tank	595	158,820	95 GPM

TABLE VII. SIMULATION OF PROPOSED FLOW CONDITIONS (CONT.)

Location	Hydraulic Gradient	Gallons Water In Tank	Estimated Flow Rate
@ 3:00 a.m. EST			
Pump Station	653		690 GPM
Ben Hawes Tank	603	261,367	235 GPM
W. Louisville Tank	612	134,014	175 GPM
Moseleyville Tank	599	148,600	180 GPM
Utica Tank	596	164,520	100 GPM
@ 4:00 a.m. EST			
Pump Station	654		680 GPM
Ben Hawes Tank	608	275,467	230 GPM
W. Louisville Tank	614	144,514	175 GPM
Moseleyville Tank	602	159,400	160 GPM
Utica Tank	597	170,520	115 GPM
@ 4:31 a.m. EST			
Pump Station	666		575 GPM
Ben Hawes Tank	610	282,666	260 GPM
W. Louisville Tank	615	150,000*	
Moseleyville Tank	604	164,408	185 GPM
Utica Tank	597	174,120	130 GPM
@ 5:38 a.m. EST			
Pump Station	679		355 GPM
Ben Hawes Tank	615	300,000*	
W. Louisville Tank	615	150,000*	
Moseleyville Tank	608	176,803	205 GPM
Utica Tank	598	182,830	150 GPM
@ 7:31 a.m. EST			
Pump Station	682		230 GPM
Ben Hawes Tank	615	300,000*	
W. Louisville Tank	615	150,000*	
Moseleyville Tank	615	200,000*	
Utica Tank	601	199,780	230 GPM

*Full

The situation presented in Table VII is considered to be within the mid-range of anticipated operating parameters.

It can be seen from the tabulation that the existing pump station was not capable of filling the tanks within the early morning (no demand) period. The 150M elevated tank was calculated to fill at about the same rate as was determined from the analysis of the existing system configuration. Again the 150M elevated tank would overflow if not controlled by either automatic or manual methods. The 300M standpipe near Ben Hawes State Park was calculated to fill at about the time that the customer demand is expected to begin. The existing 200M standpipe and the proposed 300M tank were unable to fill before the customers' daily demand period. Even if we assume that the tanks do not lose any water during the daily cycle of customer demands, it would still require approximately 3 days of continuous 24-hour a day pump station operation to fill all four tanks.

The hydrant flow test shown in Table II produced flows between 550 and 580 gallons per minute at Utica. The National Fire Protection Association and the Insurance Services Office require that fire flows be standardized at the flow available at 20 PSI residual pressure. Based on the Hazen-Williams formula, the flow test indicates that between 500 and 540 gallons per minute were available at 20 PSI residual at the time the test was conducted. The flow available at Utica is directly related to the amount of water in the tank at Moseleyville. Calculations indicate that the flow for the hydrant at Utica would range from approximately 425 to 580 gallons per minute depending upon whether the tank was near empty or full. The proposed storage tank would significantly improve the fire flow capability at Utica if the water level

could be maintained. Preliminary computations give a hydrant flow of 20 PSI from 1345 gallons per minute with the proposed and existing tanks near empty to around 1600 gallons per minute with both tanks full. These calculations assume that the water distribution system is intact and functioning properly and no large customer demands are being made on the system.

The West Daviess County Water District has close to a dozen customers located on the higher terrain south of Utica. One of these, Faye Lyn Allen, is located on the same ridge as the site for the proposed water tank. A pressure recorder was set at the Allen residence (See Table I) to observe their individual pressure situation. During the monitoring period the service pressure at the Allen residence ranged from a low of 4 PSI to a high of 29 PSI. (This does not include the short period of time when the hydrant flow test at Utica produced a zero pressure condition.) It is generally accepted that delivery pressures of 30 to 35 PSI are necessary to produce adequate domestic water service. In addition, the Commission's regulations require that "In no event . . . shall the pressure at the customer's service pipe under normal conditions fall below thirty (30) psig...." Since the proposed water tank will be constructed to the same overflow elevation as the existing tank, the pressure at the Allen residence will improve only to the extent that the proposed tank can be kept full. The maximum pressure available to the Allen residence would be only 28 PSI—the same as presently available. As long as the proposed tank contained any water whatsoever, the Allen's pressure should not fall below 9 PSI—only marginally better than the 4 PSI recorded by the gauge. The most important improvement as far as the Allens are concerned would be the decreased likelihood of a total water outage.

Conclusions and Recommendations

Based on the investigation, data review, and hydraulic computations conducted, the following conclusions are presented:

(1) There is a demonstrable need for additional water storage facilities in the West Daviess County Water District.

(2) The water system is not presently capable of supplying adequate service pressure to customers in the higher elevations located south of Utica.

(3) Efficient operation of the West Daviess County Water District requires the addition of an automatic control mechanism (such as an altitude valve) at the 150M elevated tank near West Louisville to prevent overflow.

(4) The existing pump station and water distribution system is only marginally capable of filling the existing water storage tanks.

(5) The existing pump station and water distribution system cannot reasonably be expected to fill and maintain the water level of the proposed water tank on a daily basis.

(6) The proposed water tank will not appreciably improve the low pressure conditions in the higher elevations south of Utica.

(7) The proposed water tank could increase the available fire flow in the Utica area.

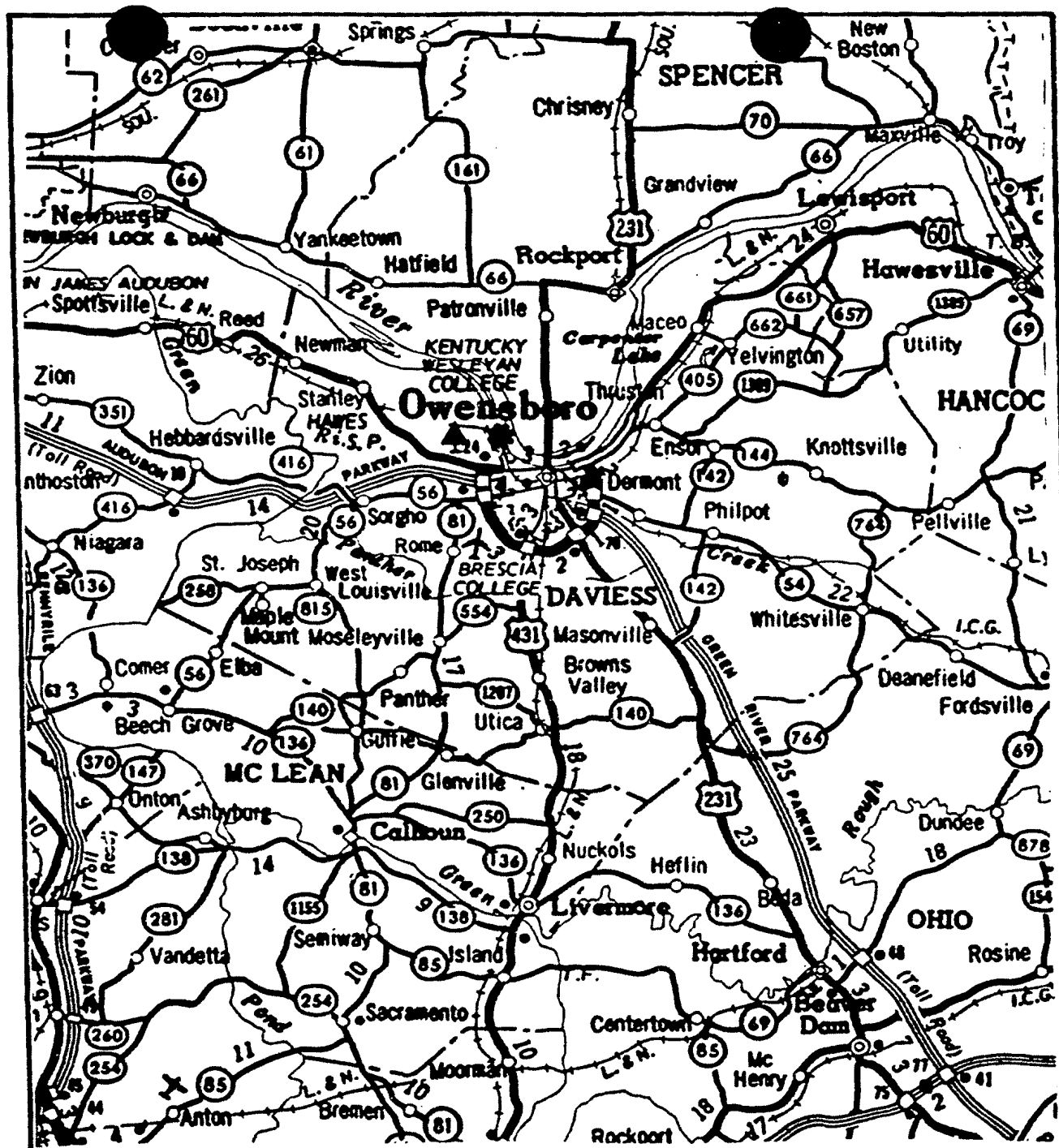
This report makes the following recommendations:

(1) The West Daviess County Water District's application for certificate of public convenience and necessity should be denied.

(2) The West Daviess County Water District should consider construction of an additional pump station and connection to the Owensboro Municipal Water System either prior to or in conjunction with any new storage facility at Utica.

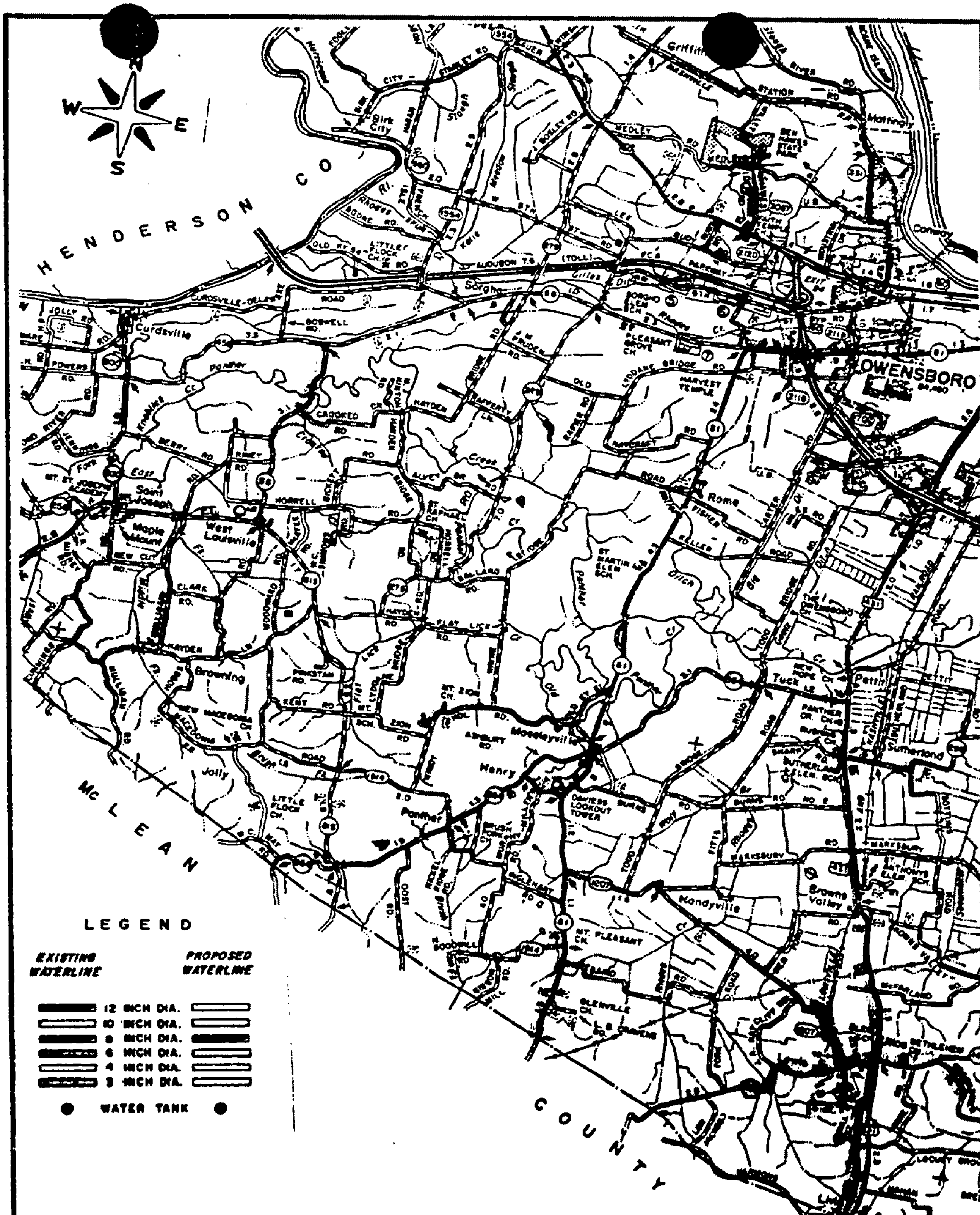
(3) The West Daviess County Water District should consider installing an automatic control device for the proper operation of the existing 150M elevated tank at West Louisville.

(4) The West Daviess County Water District should consider constructing a booster pumping station to directly serve its customers south of Utica with adequate pressure.



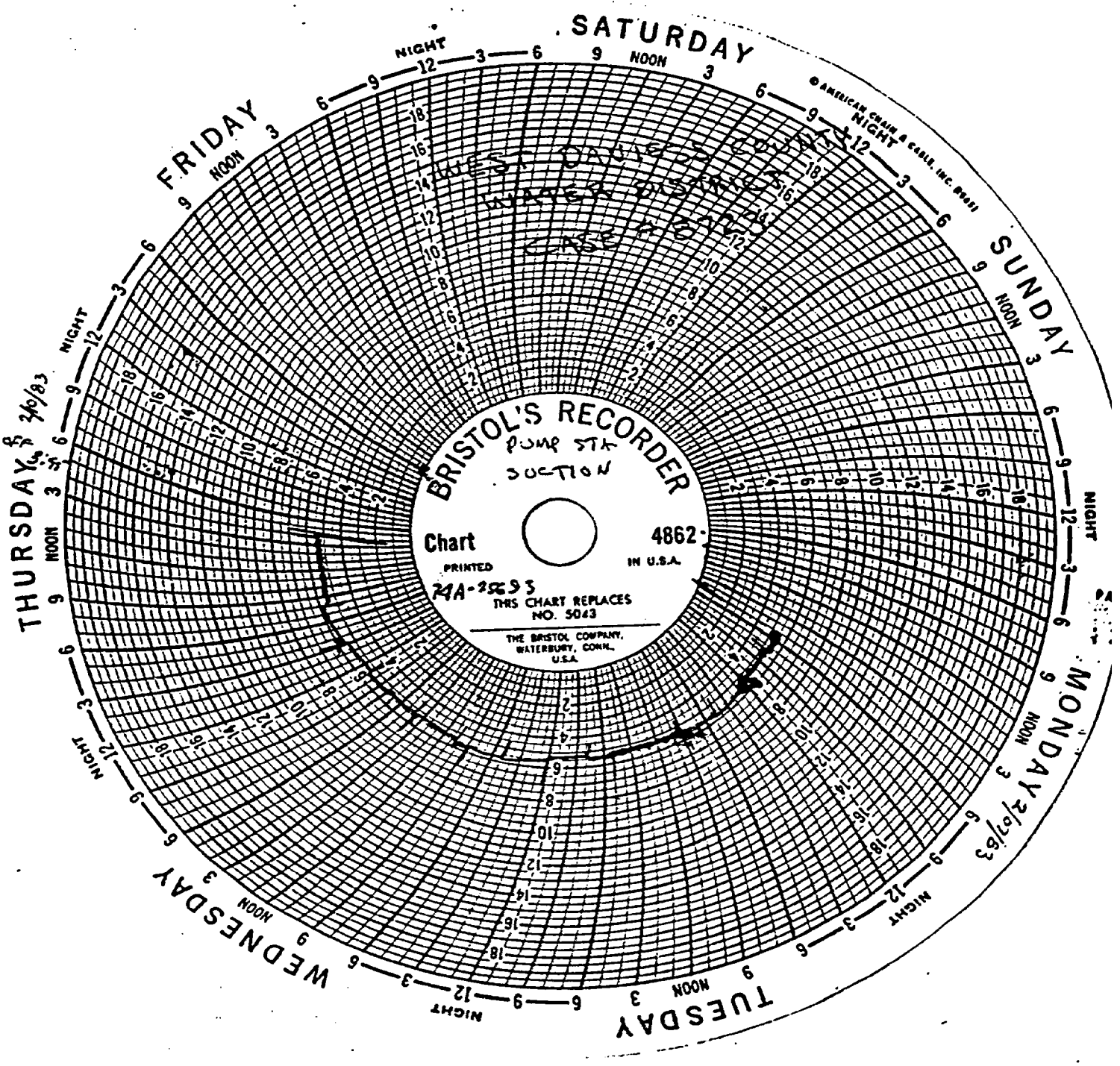
West Daviess County Water District

Figure 1



DISTRIBUTION SYSTEM

Figure 2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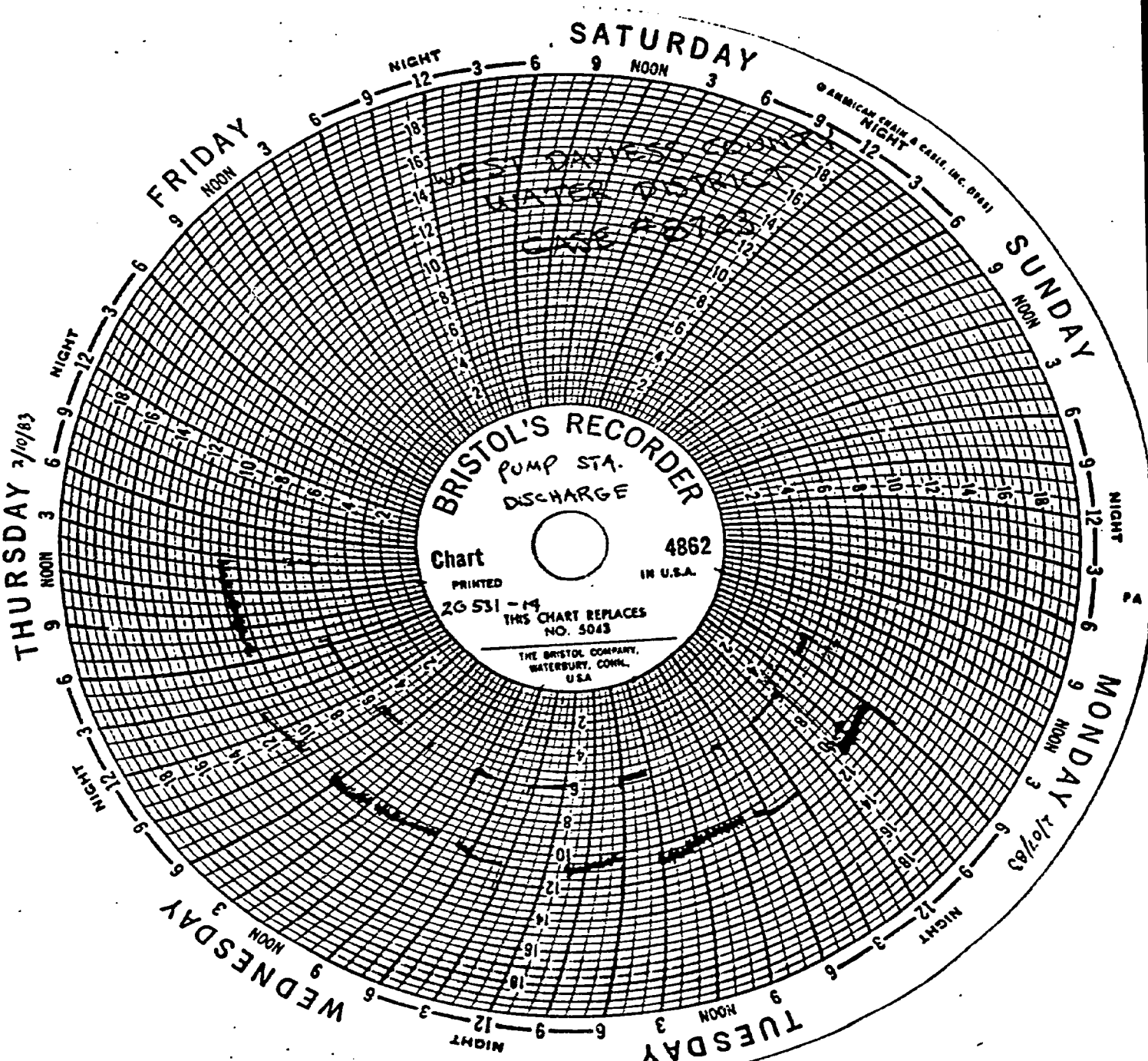
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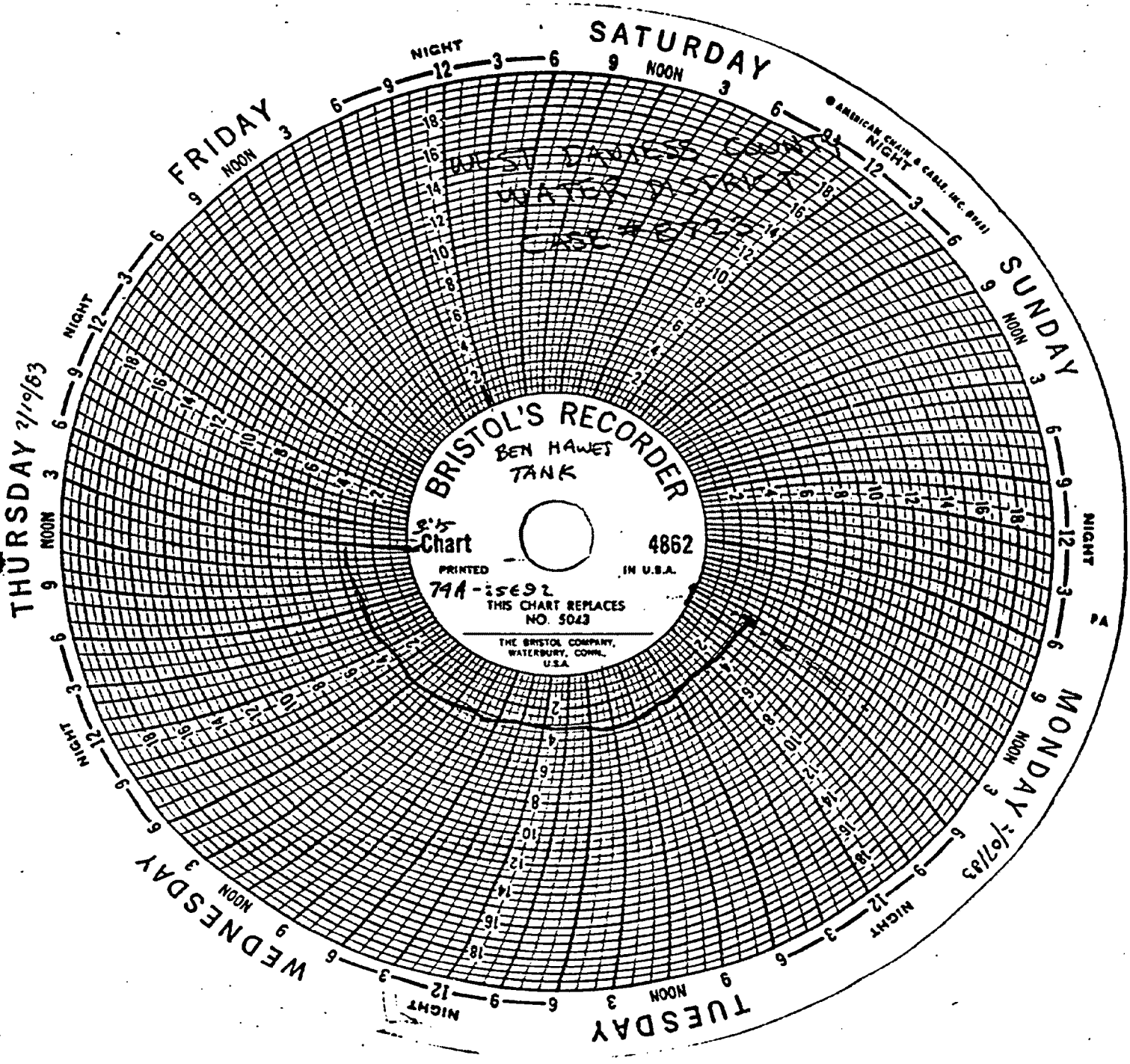
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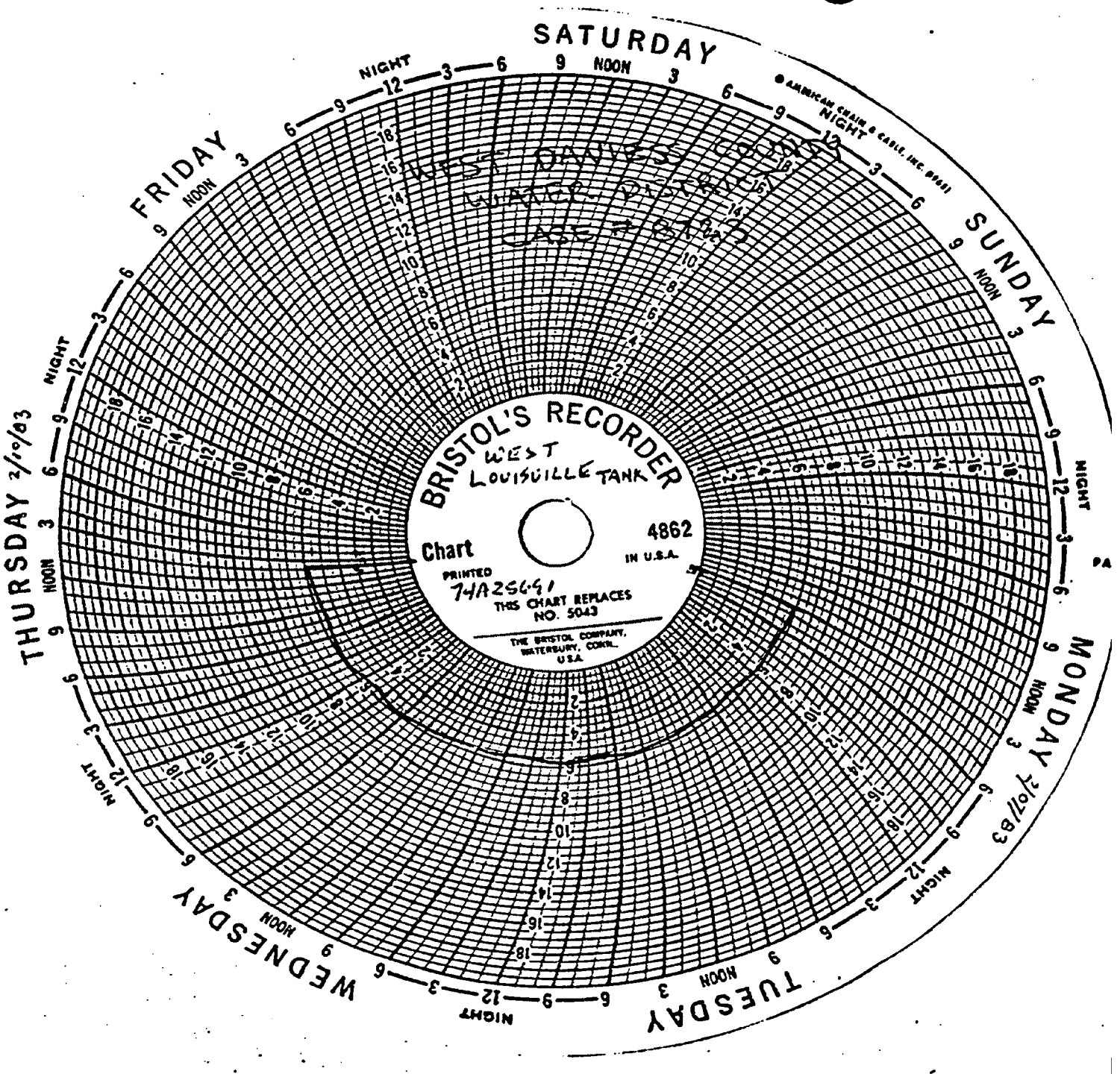
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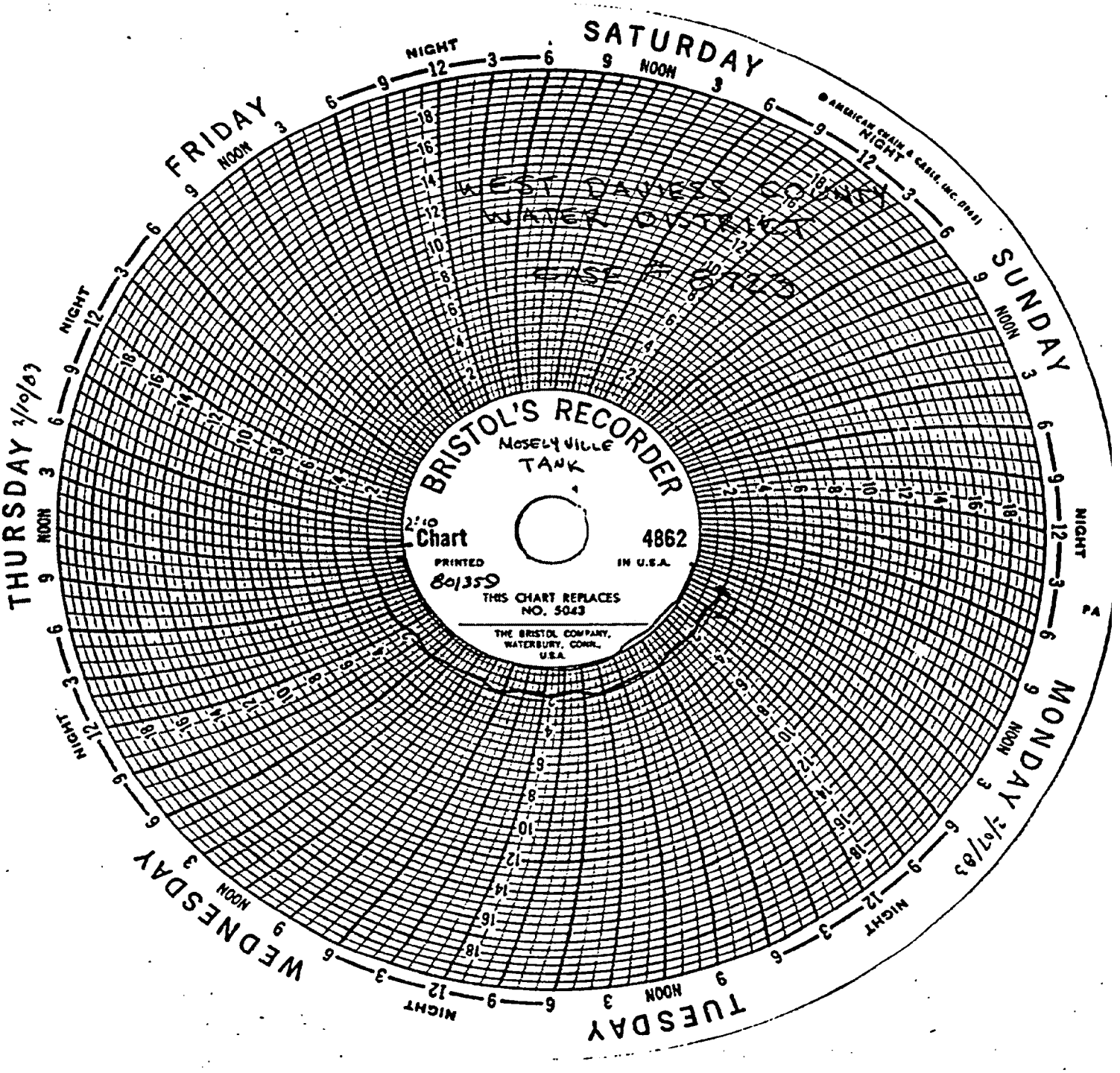
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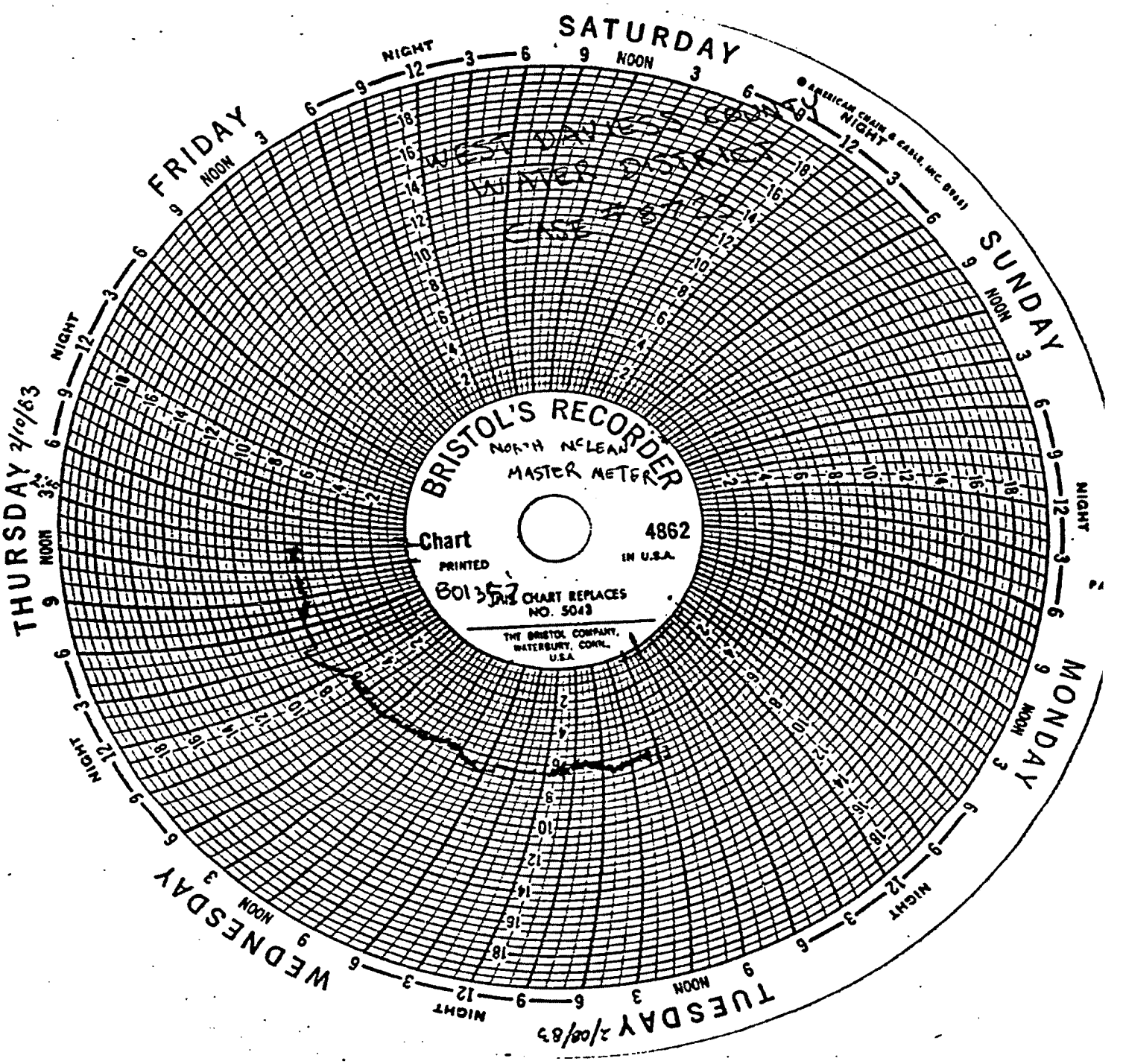
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NO. 5043
THE BRISTOL COMPANY,
WATERBURY, CONN.,
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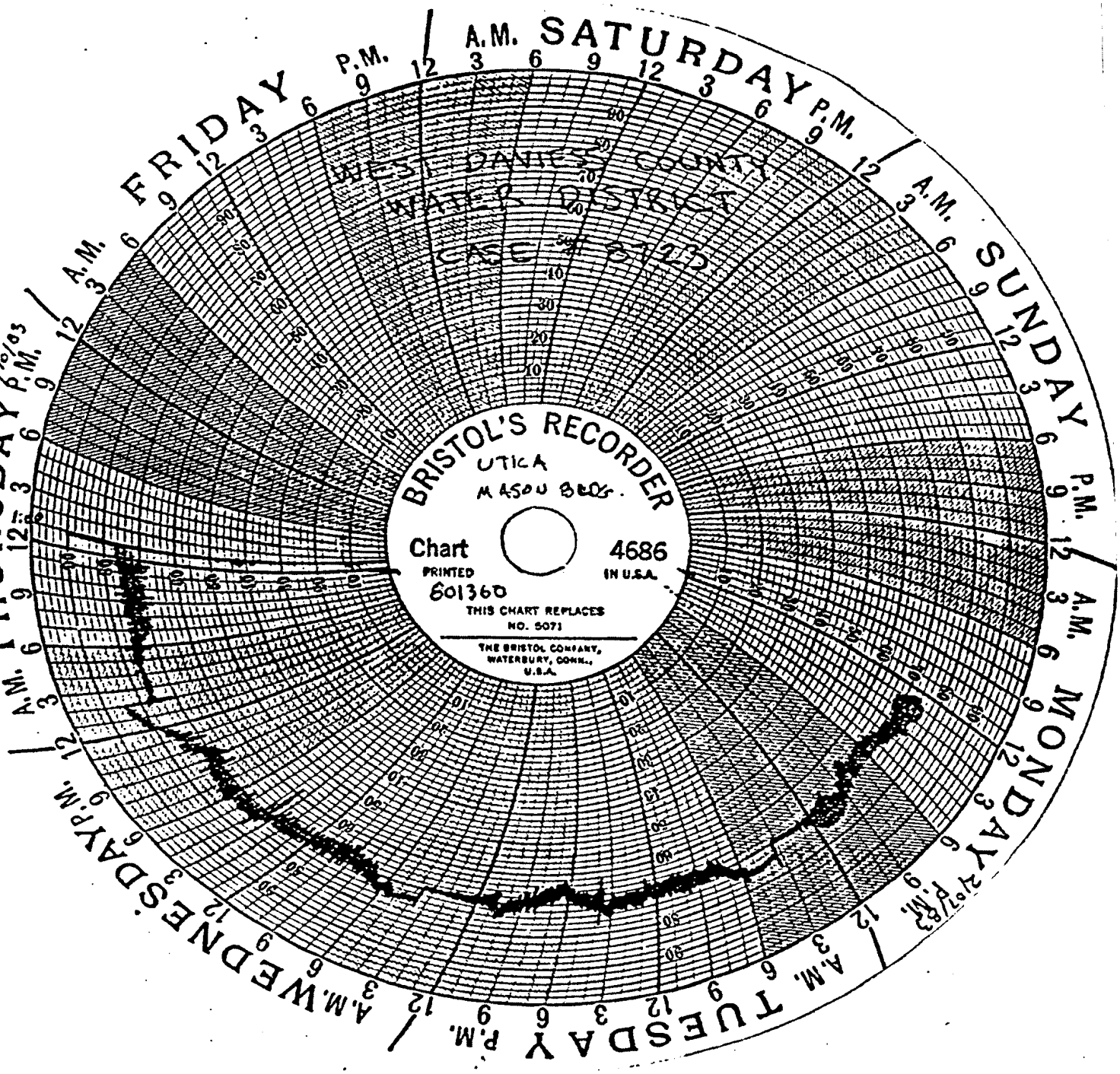
SATURDAY
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
FRIDAY
A.M.
P.M.
WEST DANIELS COUNTY
WATER DISTRICT
CASE 8123
BRISTOL'S RECORDER
UTICA
MASON BROS.
Chart
4686
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601360
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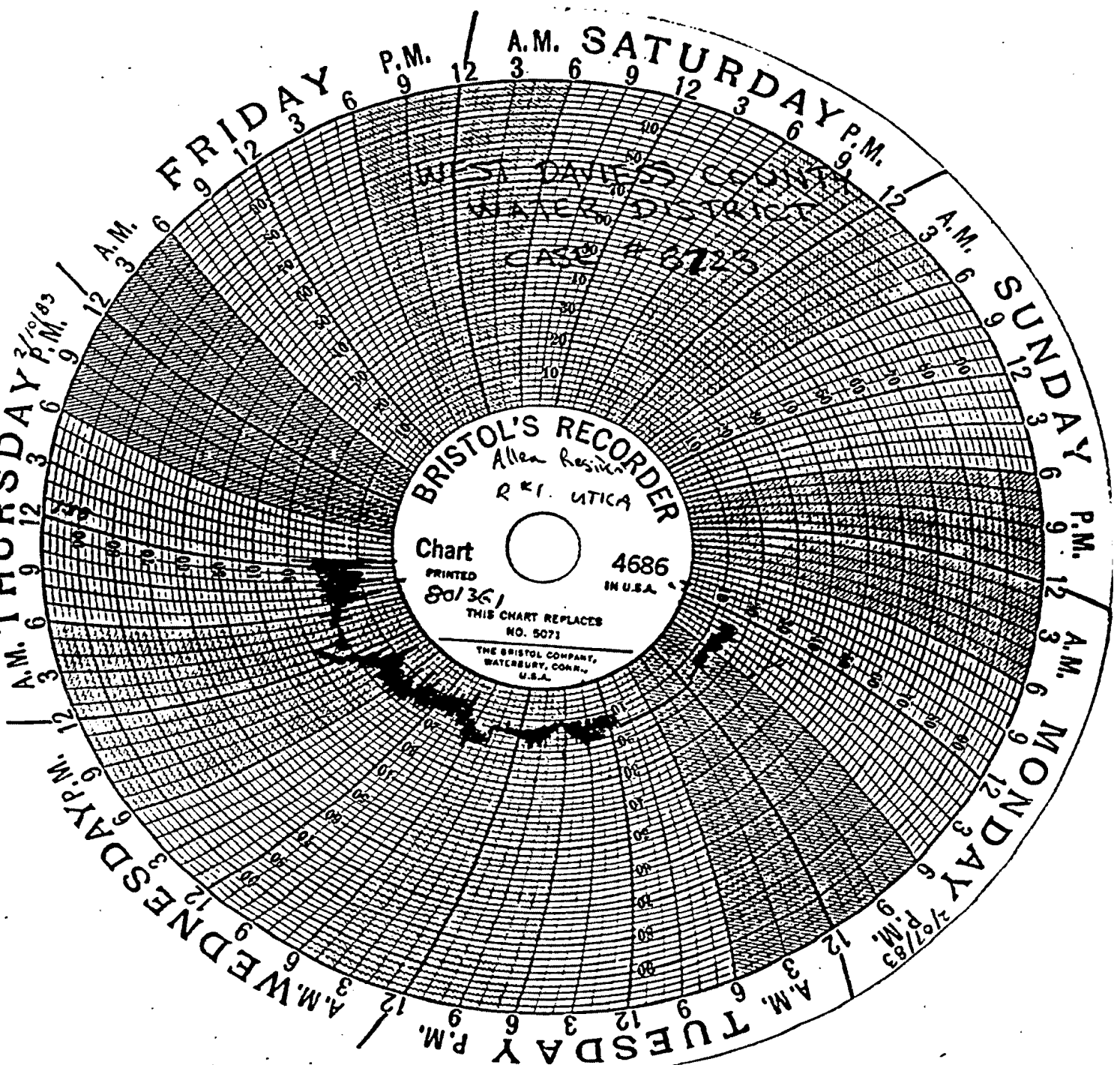
NO. 5071
THE BRISTOL COMPANY,
WATERBURY, CONN.,
U.S.A.


FRIDAY
SATURDAY
SUNDAY
MONDAY
TUESDAY
WEDNESDAY
THURSDAY
A.M.
P.M.
WISA DAVIES COUNTY
WATER DISTRICT
CASE # 8723
BRISTOL'S RECORDER
Allen Residence
R # 1. UTICA
Chart
4686
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80/36
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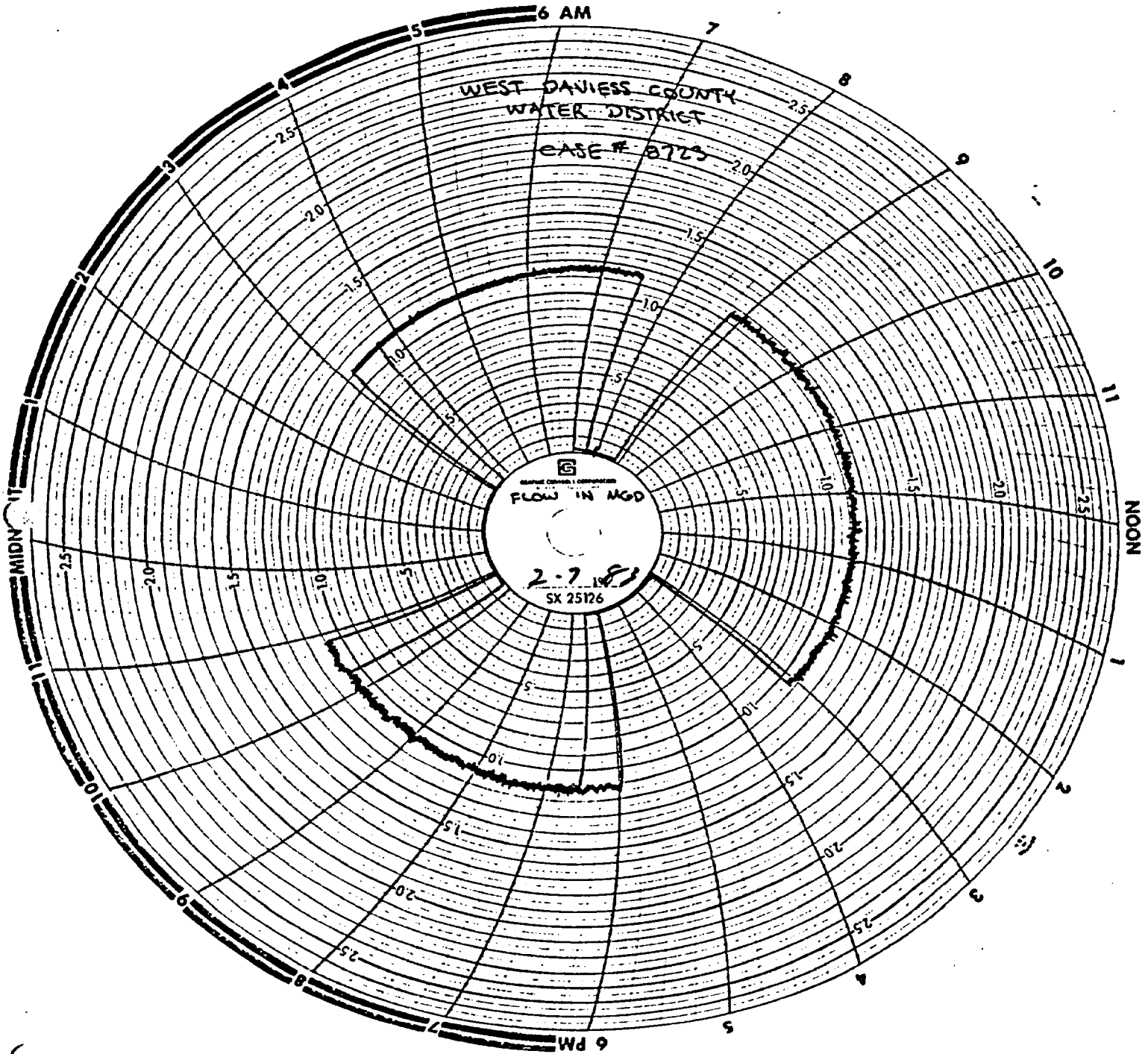
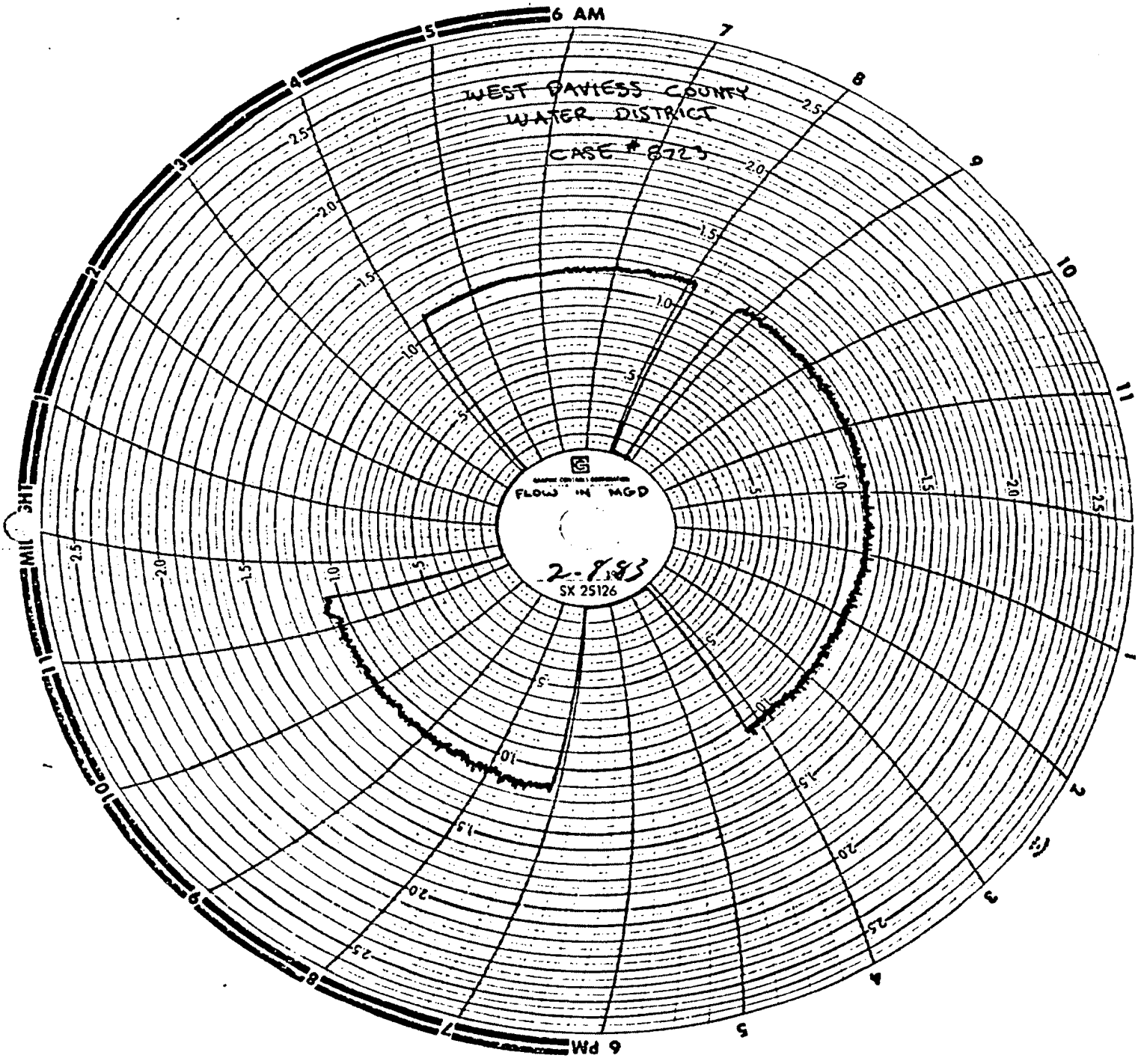
THIS CHART REPLACES
NO. 5071
THE BRISTOL COMPANY,
WATERBURY, CONN.,
U.S.A.


6 AM
NOON
MIDN
6 PM
WEST DAVIESS COUNTY
WATER DISTRICT
CASE # 8729
FLOW IN MGD
2-7
SX 25126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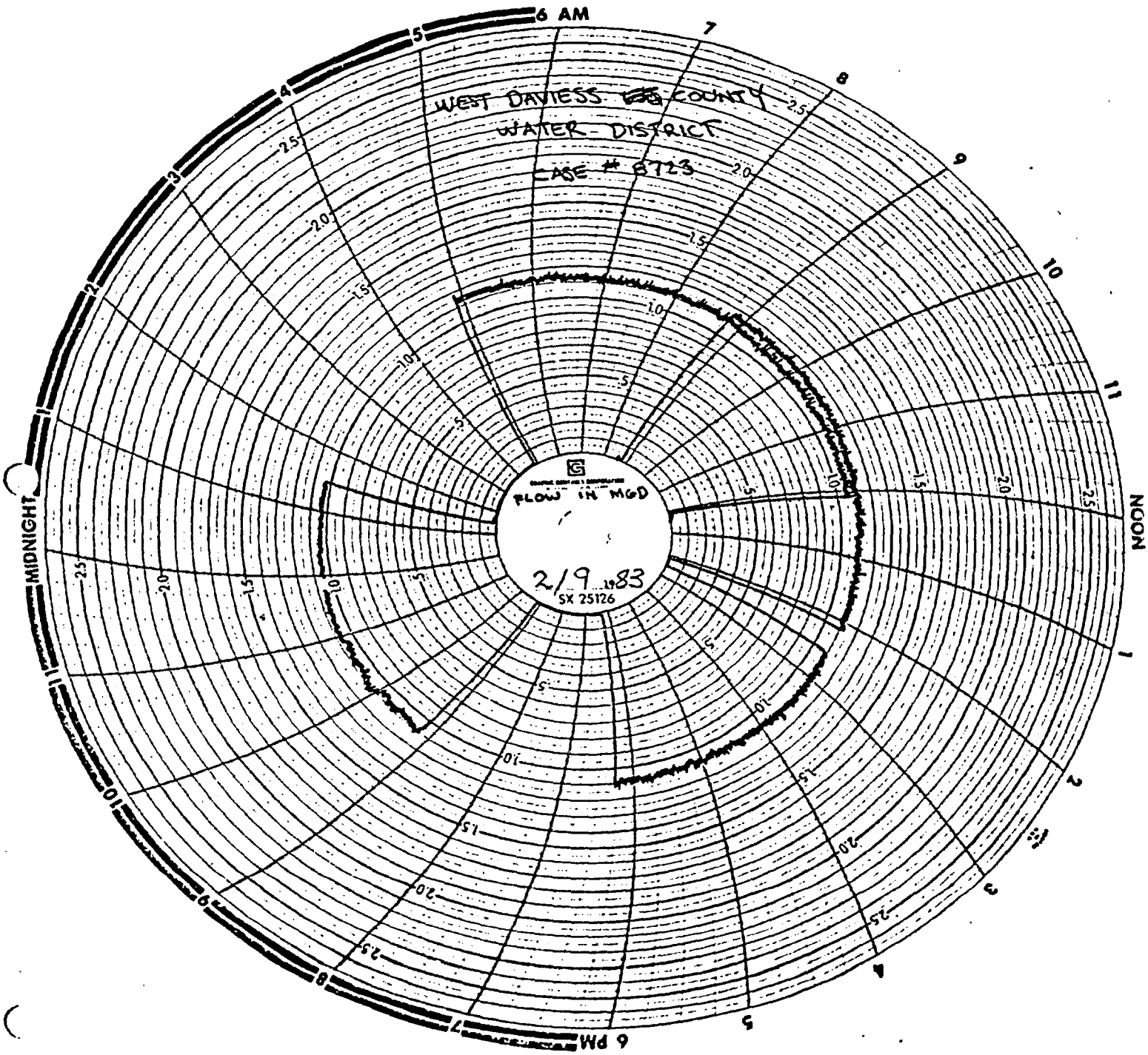
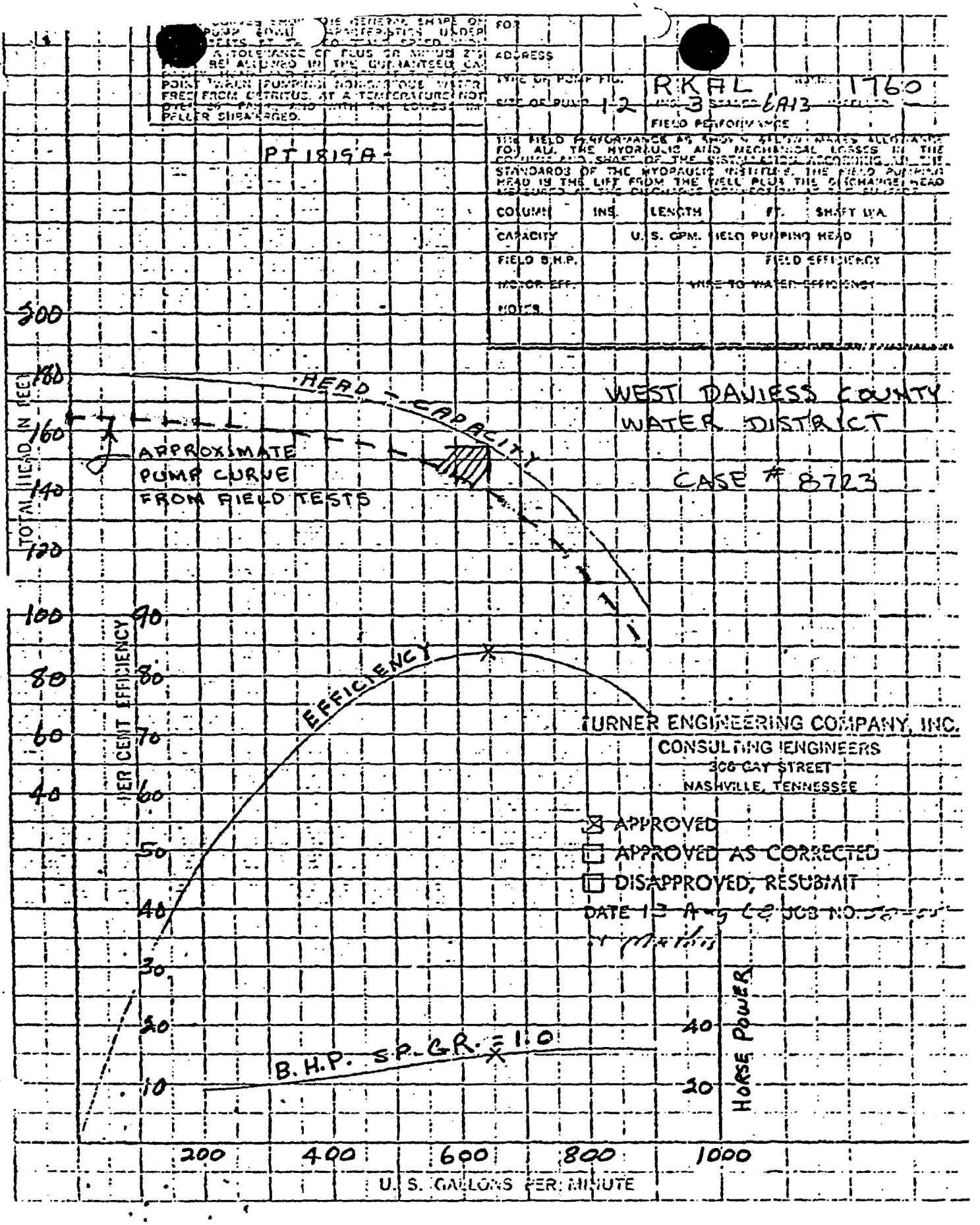
WEST DAVIESS COUNTY
WATER DISTRICT
CASE # 8723
FLOW IN MGD
2-8 83
SX 25126


6 AM
NOON
MIDNIGHT
6 PM
WEST DAVIESS COUNTY
WATER DISTRICT
CASE # 8723
FLOW IN MGD
2/9 1983
SX 25126


FOR
ADDRESS
TYPE OF PUMP FIG. RKAL 1760
SIZE OF PUMP 12 NO. 3 STAGE CAI3
FIELD PERFORMANCE
PT 1819 A
COLUMN INS. LENGTH FT. SHAFT DIA.
CAPACITY U. S. GPM. FIELD PUMPING HEAD
FIELD B.H.P. FIELD EFFICIENCY
MOTOR EFF. WIRE TO WATER EFFICIENCY
NOTES
WEST DAVIESS COUNTY
WATER DISTRICT
CASE # 8723
HEAD - CAPACITY
APPROXIMATE
PUMP CURVE
FROM FIELD TESTS
EFFICIENCY
B.H.P. S.P.GR. = 1.0
TURNER ENGINEERING COMPANY, INC.
CONSULTING ENGINEERS
306 CAY STREET
NASHVILLE, TENNESSEE
APPROVED
APPROVED AS CORRECTED
DISAPPROVED, RESUBMIT
DATE 12 Aug 60 JOB NO.
TOTAL HEAD IN FEET
PER CENT EFFICIENCY
HORSE POWER
U. S. GALLONS PER MINUTE
200
160
140
120
100
80
60
40
90
80
70
60
50
40
30
20
10
40
20
200
400
600
800
1000