REPORT ON THE THIRD SAMPLING

OF THE JONESBORO PROTOTYPE

ARKANSAS PROTOTYPE MONITORING PROGRAM

Arkansas Department of Pollution Control & Ecology
November, 1995

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November, 1995

(revised 3/96; 5/96)

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INTRODUCTION

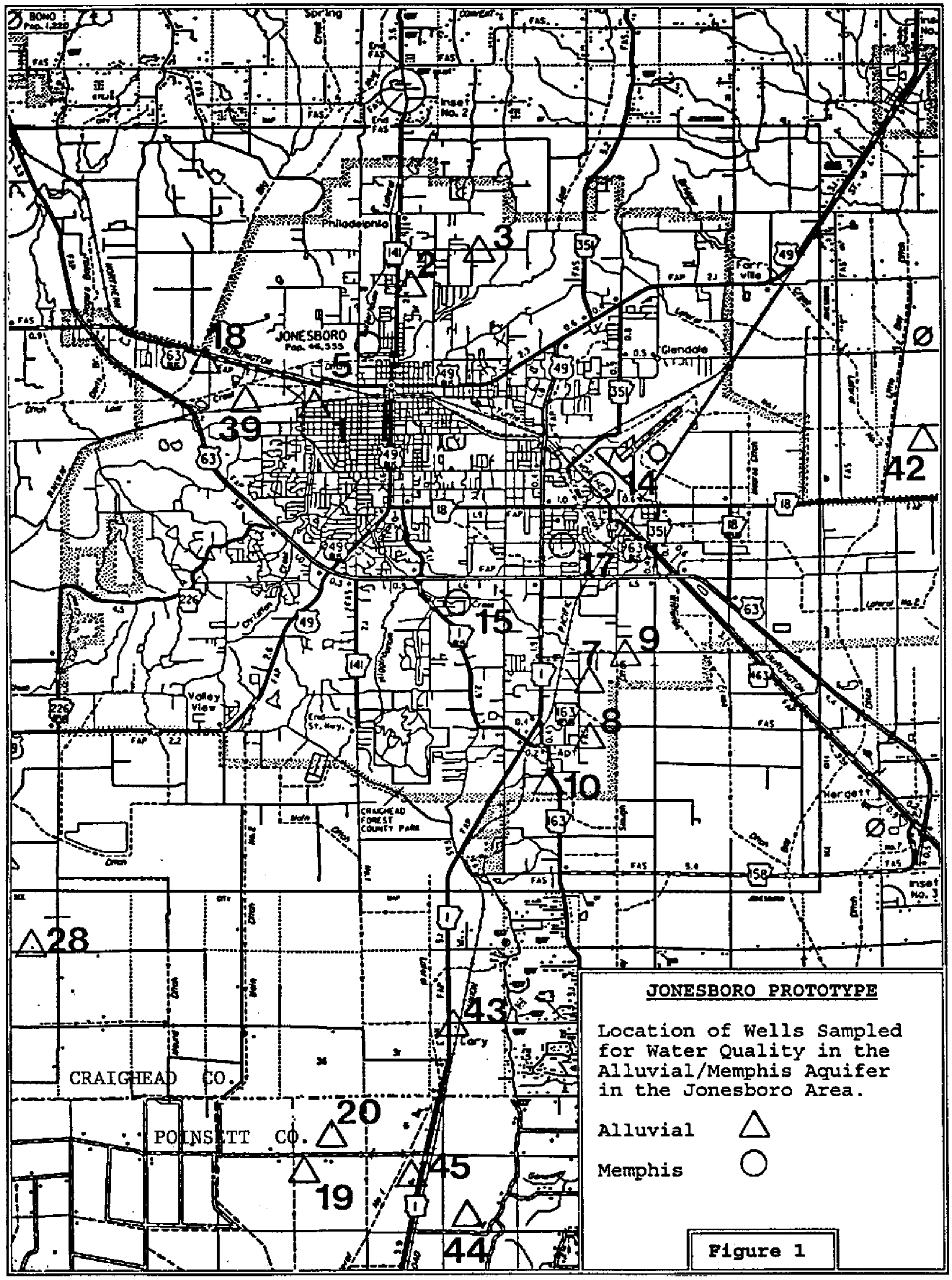
The third ground water quality sampling was completed during June, 1995, for the Jonesboro prototype. This prototype, sampled at three year intervals, was sampled for the first time in 1989 and again in 1992. It was recently expanded to include additional Mississippi River Valley alluvial wells within the immediate Jonesboro area and to the south in an area that has experienced increased water level declines over a five year period 1984-1989 (Westerfield and Gonthier, 1993). The prototype area, which lies within the Gulf Coast Physiographic Province, is in close proximity to the city of Jonesboro in south central Craighead County and extends into north central Poinsett County.

Ground water quality along with complete well descriptions will be placed in EPA's STORET data storage and retrieval system. This information will be available to all interested parties with access to STORET. Copies of the laboratory analyses have been sent to all interested well owners whether agricultural, domestic, industrial, or public. For the purposes of GIS data collection, all sample sites have been surveyed with the Magellan NAV 5000 PRO; a hand-held GPS C/A-code and carrier phase code receiver. This instrument generally has a horizontal accuracy of approximately 12 meters.

Please refer to the document entitled "Status Report For The Arkansas Prototype Monitoring Program" (April, 1994) for a review of the geology and methodology used in the statewide monitoring program. Location and description of wells and results of the first three sampling periods are listed in the tables at the back of this report. Other reports describing the geology and water quality of tne Mississippi River Valley alluvial aquifer include Boswell, Cushing, and Hosman (1968); Broom and Lyford (1982); Hines, Plebuch, and Lamonds (1972); Kilpatrick and Ludwig (1990); and Leidy and Morris (1990). The following is a brief summary for this prototype sampled during FY95. A list of public water supply wells (with correct PWS well numbers) is listed in the appendix.

FY95 MONITORING

Eighteen wells were sampled for ground water quality during June 12-14, 1995. Fourteen wells were sampled from the alluvial aquifer and four from the underlying Memphis aquifer. Figure 1 shows the location of wells sampled for ground water quality during the three sampling periods. Originally, nine wells were selected for the monitoring program. Two of the original wells were not sampled this time as they are no longer operative. As a result, eleven wells were sampled for the first time to bring the total number of wells to eighteen. The fourteen wells screened in the alluvial aquifer had depths ranging from 70 to 173 feet. The alluvial aquifer (Quaternary alluvium) near Crowley's Ridge ranges in thickness from about 35 to 185 feet, and averages 125 feet. The Memphis aquifer may be as thick as 750 feet (Hines, Plebuch, and Lamonds, 1972).


JONESBORO PROTOTYPE
Location of Wells Sampled for Water Quality in the Alluvial/Memphis Aquifer in the Jonesboro Area.
Alluvial
Memphis
JONESBORO
Philadelphia
Glendale
Valley View
Cory
CRAIGHEAD CO.
POINSETT CO.
CRAIGHEAD FOREST COUNTY PARK
BONO
1
2
3
5
7
8
9
10
14
15
17
18
19
20
28
39
42
43
44
45
Figure 1

The four public water supply wells screened in the Memphis aquifer had depths ranging from 180 to 362 feet. Driller's logs were obtained, when possible, from the Arkansas Water Well Construction Commission or the Arkansas Geological Commission in order to verify the grout, depths, screened intervals, and well construction.

This prototype was originally selected because of the relatively large population utilizing ground water, and the lack of an extensive confining layer separating the alluvial aquifer from the underlying Memphis aquifer; thereby increasing the susceptibility of the deeper aquifer to contamination moving through the shallow aquifer. Communication between these two aquifers was suggested by Broom and Lyford (1982) as they noted that water-level decline in the Memphis aquifer was almost entirely in response to irrigation well discharge from the alluvial aquifer. The Memphis aquifer (Sparta equivalent) is the source for the four public water supply fields that supply Jonesboro with drinking water.

The chief sources of pollution in the area are pesticides and nitrates originating from agricultural practices, halogenated solvents from industrial or commercial enterprises, and various leachates derived from landfills. Septic systems may also be a source for high nitrate concentrations, particularly in shallow domestic wells. Extensive drawdown caused by widespread withdrawals in the alluvial aquifer may eventually create problems such as those associated with increased salinity as experienced elsewhere in the Gulf Coastal Plain of Arkansas.

GROUND WATER QUALITY

The location and description of wells sampled during the third sampling period are shown in Table 1 with the two wells not sampled during this period in Table 2. Results of all three sampling periods (1989, 1992, and 1995) are provided in Table 3 with the most recent sampling located at the bottom of each box following the format used in the Status Report (1994).

Ground water from the Quaternary alluvium and the Memphis aquifer in the Jonesboro area is of the calcium bicarbonate type with total dissolved solids as much as 437 mg/l (Hines et al, 1972). Total dissolved solids for the 1995 sampling period ranged from 123.0 to 703.0 mg/l for the alluvial aquifer and 97.0 to 489.0 mg/l for the Memphis aquifer (Table 3). Total hardness of ground water from the Memphis aquifer falls in the soft to moderately hard range (40.0-78.0 mg/l), whereas total hardness of ground water from the alluvial aquifer, which ranges from 55.0 to 562.0 mg/l, may be moderately hard to very hard with the latter being more prevalent (Table 3). pH measured in the field ranged from 6.5 to 6.8 for the Memphis aquifer and 6.1 to 7.2 for the alluvial aquifer.

Elevated nitrate concentrations in the alluvial aquifer were observed for the third consecutive time for well #3 (domestic). These values are 18.0, 12.5, and 11.3 mg/l for the three sampling events. The well owner has been notified of these high nitrate concentrations. Elevated nitrate concentrations were also observed in well #2 (2.7 and 1.9 mg/l) and in well #5 (2.0, and 1.69 mg/l). Well #2 (domestic) was screened in the Alluvial aquifer. The sample from well #5 (public water supply) was untreated water from the Memphis aquifer.

Iron and manganese concentrations from water sampled in the alluvial aquifer exceeded the secondary maximum contaminant level (SMCL) established by the EPA in several of the wells. One well, with a total dissolved solids concentration of 703 mg/l, exceeded the SMCL for TDS (500 mg/l), although several wells had TDS concentrations in excess of 450 mg/l (Table 3).

A pesticide scan for the more common pesticides used in rice and soybean production was run for all wells screened in the alluvial aquifer (Table 4). Two of the fourteen alluvial wells had traces of p-p'-DDE (a metabolite of DDT). The two wells (#8 and #44) had concentrations of .01730 and .00745 μg/l. Well #8 is approximately 155 feet in depth (personal communication with well owner), but had no driller's log available to verify the depth, producing interval, or grouted interval. Driller's logs from nearby wells indicate a clay surficial layer from surface to 30 feet. A thick surficial clay would appear to be sufficient to prevent the downward migration of contamination from the surface. The possible absence of grout in well #8 could provide an avenue for pesticide contamination migrating down the outside of the casing. The driller's log on well #44 showed a surficial clay 20 feet thick, but this well had no cement grout. The water producing interval for this well was from 70-170 feet. These two wells will be resampled in the spring. All alluvial wells were analyzed for VOCS as shown in Table 5. There were no detections of VOCS in any of the wells sampled.

GROUND WATER WITHDRAWAL - EFFECT ON WATER QUALITY

Ground water withdrawals for all uses in Craighead County (public, domestic, irrigation, etc.) increased from 204 MGD to 240 MGD between 1985 and 1990. Poinsett County ground water withdrawals increased from 302 MGD in 1985 to 406 MGD in 1990 (Holland, 1987; 1993). The vast majority of ground water withdrawals from the Quaternary alluvium is used for irrigation. Irrigation of crops accounted for 91.25 percent of total ground water withdrawals in Arkansas during 1990 (Holland, 1993). As a result of large-scale withdrawals, several areas in the Gulf Coastal Plain have been considered for designation as critical ground water areas. Critical ground water areas are those areas where the quantity of ground water is rapidly becoming depleted or the quality is being degraded. Lonoke, Prairie, Craighead, Poinsett, Drew, and Ashley Counties are considered as areas having the most serious ground water depletion problems (Figure 2). A critical ground water area is designated by the Arkansas Soil and Water Conservation Commission (AS&WCC) according to the following criteria:

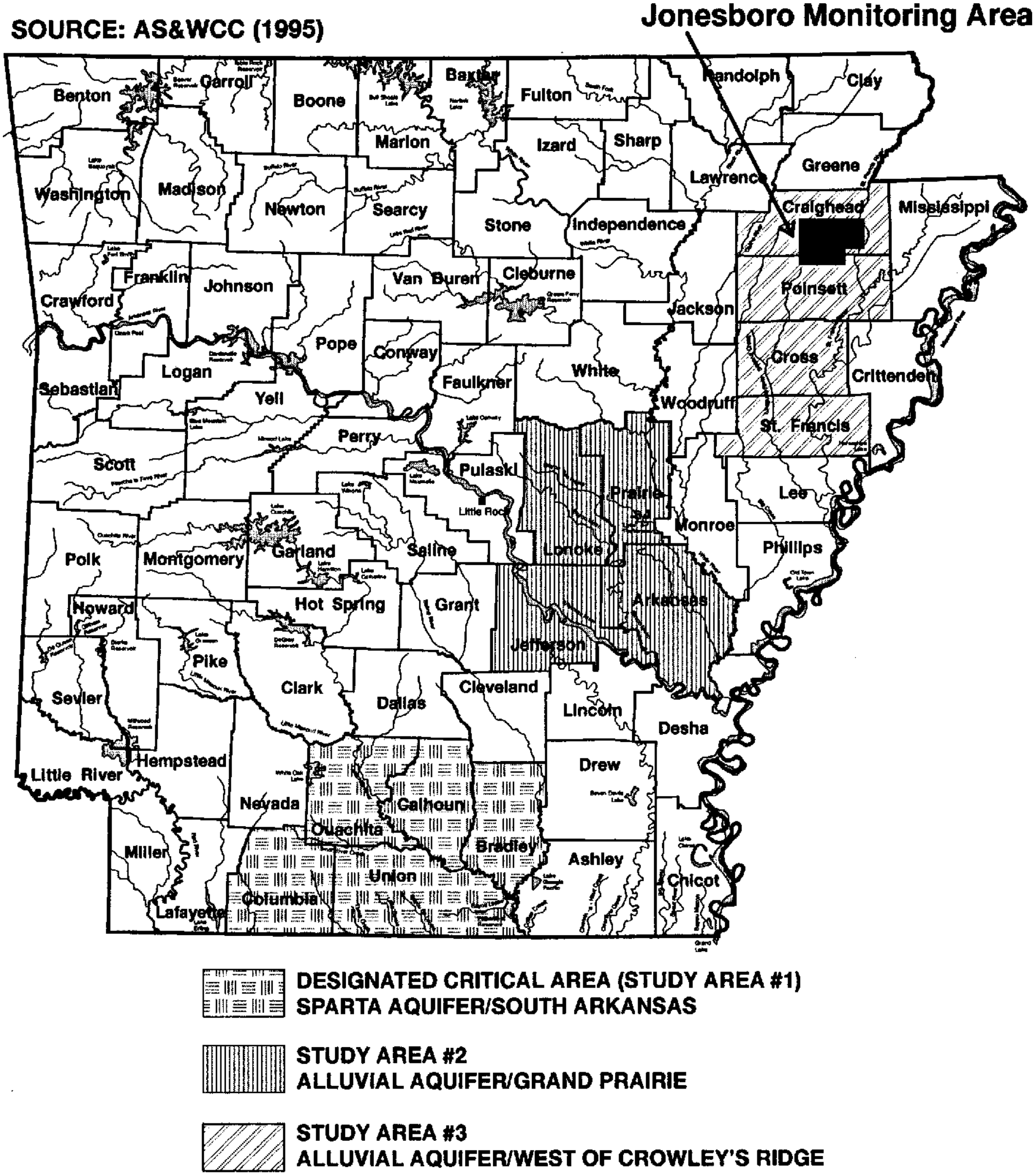


Figure 2. Jonesboro Monitoring Area

Location of the monitoring area in relation to areas that may potentially be designated as critical by the Arkansas Soil and Water Conservation Commission.

(1) For water table conditions:

(A) **Water levels have been reduced such that fifty percent or less of the thickness of the formation, is saturated and average declines of one foot or more have occurred for the preceding five years; or**

(B) **Ground water quality has been degraded or trends indicate probable future degradation that would render the water unusable as a drinking water source or for the primary use of the aquifer.**

(2) For artesian conditions:

(A) **Potentiometric surface has declined below the top of the formation and average annual declines of one foot or more have occurred for the preceding five years; or**

(B) **Ground water quality has been degraded or trends indicate probable future degradation that would render the water unusable as a drinking water source or for the primary use of the aquifer.**

The Jonesboro Prototype is located within an area that is being studied by the AS&WCC for possible designation as critical (Figure 2). Figure 3 shows the location of wells sampled with respect to areas of recent water level changes in the alluvial aquifer. This map was modified from a portion of the published document entitled "Water-Level Maps Of The Mississippi River Valley Alluvial Aquifer In Eastern Arkansas, 1989" by Westerfield and Gonthier, 1993. The green shaded area in Figure 3 is part of Crowley's Ridge as viewed by those authors; therefore, is not included as a part of their map. The present study utilizes the current geologic map of the State of Arkansas (Haley and others, 1993) to interpret the shaded area, which generally follows the trace of Lost Creek Ditch, as overlain by Quaternary terrace deposits. Use of the geologic map would place wells #1, #2, #3, #5, #18, and #39 as being screened in the Mississippi River Valley alluvial aquifer (with the exception of well #5 screened in the Memphis aquifer).

The report by Westerfield and Gonthier (1993) includes a map showing the change between the spring 1984 and the spring 1989 potentiometric surface in the alluvial aquifer. The largest declines were noted west of Crowley's Ridge in Craighead, Cross, and Poinsett Counties with another area extending from central Lonoke County into Prairie and White Counties. Several of the wells sampled during the third sampling period were located in an area of high water level declines for the period 1984-1989 (wells #19, #20, #28, #43, #44, and #45).

The descriptive statistics for selected parameters in the fourteen alluvial wells are listed in Table 6. The shaded cells represent water quality parameters exceeding median values. In general, wells exceeding the median values for water quality parameters such as Ba, Fe, Mn, SO4, and TDS were those located near areas of high water level declines (> 5 foot decline) (Figure 3). In wells #20 and #43, both located in or near an area where the water level decline is in excess of ten feet, the concentrations for all the selected water quality

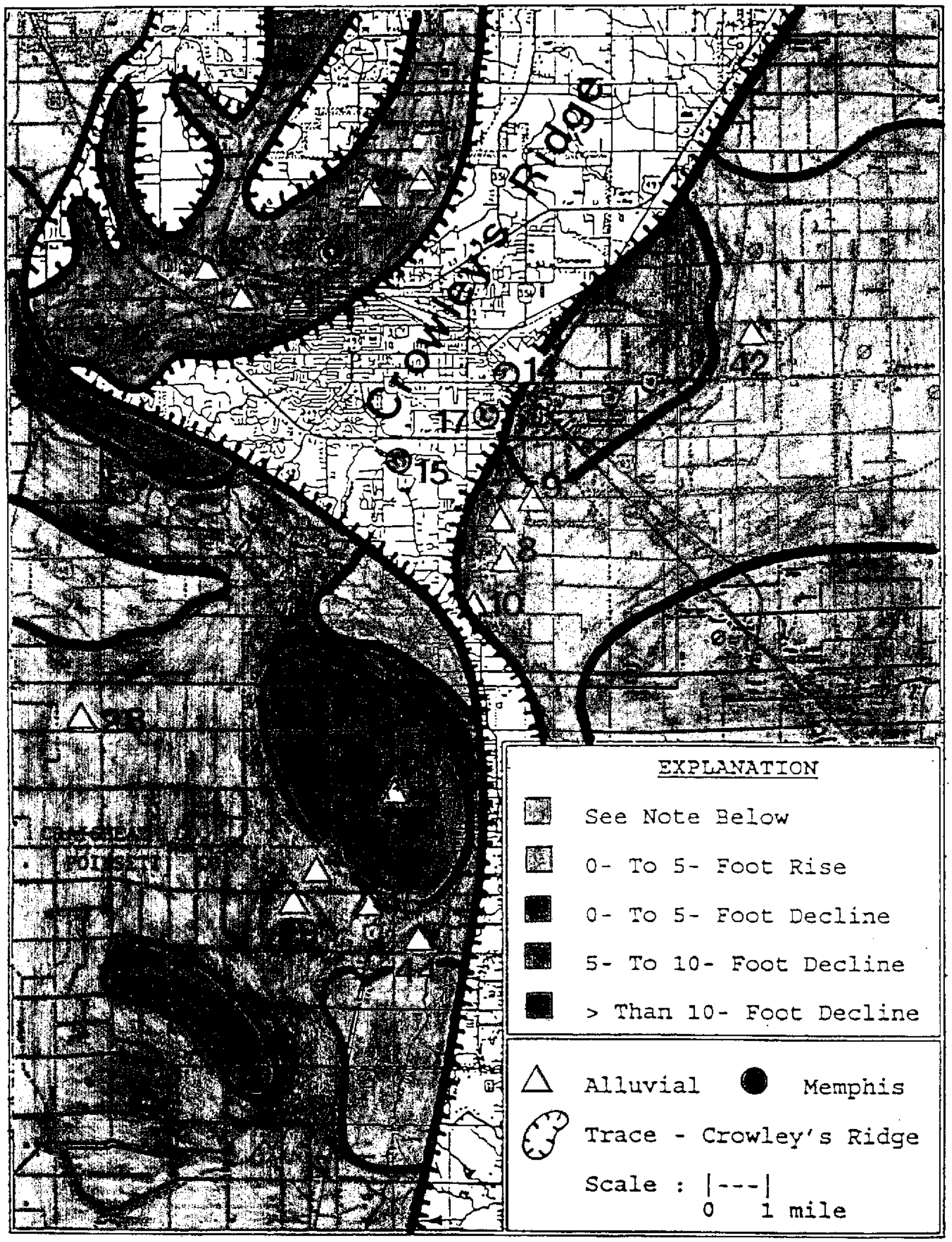


Figure 3. Location of wells sampled with respect to areas of recent water level changes in the Alluvial aquifer (modified from Westerfield and Gonthier, 1993; Note: area shaded in green was not included in that report). Wells # 20 and #43 exceeded median values for all selected water quality parameters.

parameters were higher than the median values. Despite the apparent changes in water quality in areas of notable water level declines, there is no evidence of saltwater contamination in the alluvial aquifer. The sodium concentrations in the fourteen wells ranged from 10.4 to 45.8 mg/l with a median concentration of 15.0 mg/l. The chloride concentrations ranged from 5.9 to 47.0 mg/l with a median concentration of 14.4 mg/l.

A possible reason for the higher mineral concentrations in an area of high pumpage is provided in a report by Broom and Lyford (1982). They concluded that ground water in the alluvial aquifer tended to increase in mineralization in the direction of flow. They further suggested that as water moved eastward from the Cache River and westward from the St. Francis River toward the area of extensive pumping in Poinsett and Cross Counties (west of Crowley's Ridge), dissolved solids increased from 200 to 500 mg/l.

This reasoning appears to be substantiated by the present study which shows higher dissolved solids near the more localized areas of high water level declines. The present study suggests a need for additional wells to be sampled over a larger area (including those completely outside of designated critical ground water areas) to verify significant ground water quality degradation in areas of high water level declines.

The chemical quality of the water from the alluvial aquifer near Jonesboro and Lonoke was compared because both communities depend heavily upon ground water for irrigation purposes and they are located within critical ground water areas as designated by the AS&WCC (Figure 2). The Arkansas Department of Pollution Control and Ecology (ADPC&E), in a cooperative effort with the U.S. Geological Survey, monitored ground water quality in the alluvial aquifer near Lonoke, Arkansas in Lonoke County during 1988. The main emphasis was monitoring for pesticide contamination in an agricultural area with heavy pesticide and fertilizer use. Ground water from twenty-one wells in the alluvial aquifer was analyzed for physical properties, major inorganic constituents, nutrients, trace inorganic constituents, total organic carbon, and selected pesticides (Leidy and Morris, 1990). This monitoring program was also the basis for the Lonoke Prototype. Please refer to the document entitled "Report on the Third Sampling of the El Dorado, Pine Bluff, and Lonoke Prototypes" (October, 1994) for the latest update on the Lonoke prototype.

Table 7 compares selected water quality parameters for the alluvial aquifer from wells sampled in the Jonesboro and Lonoke areas. Median values for calcium and magnesium for ground water from the alluvial aquifer near Jonesboro generally were higher (59.15 and 16.0 mg/l, respectively) compared to ground water near Lonoke (29.0 and 4.9 mg/l, respectively). Total hardness of ground water near Jonesboro, which ranges from 55.0 to 562.0 mg/l, may be moderately hard to very hard. Total hardness of ground water near Lonoke ranges from 10.0 to 380.0 mg/l and may be considered soft to very hard. Median values for SO4 (30.5 mg/l) near Jonesboro is considerably higher than those from wells near Lonoke (6.0 mg/l). This was also true for total dissolved solids (348.0 and 195.0 mg/l, respectively). Although there were minor differences, overall ground water quality for both areas is comparable with no obvious saltwater or other contamination evident in the wells. Contamination of wells by pesticides or nitrates is considered localized and not indicative of regional ground water quality.

SUMMARY AND CONCLUSIONS

The Jonesboro prototype was expanded to give it a more "ambient" nature with regard to the Mississippi River Valley alluvial aquifer. Additional wells were sampled in areas of high water level declines over a five year period (1984-1989) to determine if there was noticeable water quality degradation. The overall quality of the ground water was good with the exception of some wells with high concentrations of iron and manganese making the water unsuitable for human consumption without treatment. Elevated nitrate concentrations were noted in three wells - one in the Memphis aquifer, and two in the very shallow alluvial aquifer. Two irrigation wells had detections of p-p'-DDE (a metabolite of DDT).

The Jonesboro prototype is located within an area that is being studied by the AS&WCC for possible designation as critical. Selected water quality parameters exceeded median concentrations for wells located in areas of high water level declines (> five feet over a five year period). There was no evidence of saltwater contamination in the Memphis or the alluvial aquifer. A comparison of water quality for the alluvial aquifer in the Jonesboro and Lonoke areas indicate similar water quality with median values for calcium, magnesium, sulfate, and total dissolved solids somewhat higher for the Jonesboro area. Future monitoring should include additional wells over a larger area to more fully evaluate water quality in areas of significant water level decline in comparison to areas where there has been little, if any, decline.

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JONESBORO PROTOTYPE

TABLES

Table 1. JONESBORO PROTOTYPE - LOCATION AND DESCRIPTION OF WELLS - THIRD SAMPLING PERIOD

SAMPLE DATE	LOCAL NUMBER	SAMPLE LOCATION NO.	LATITUDE-LONGITUDE	DEPTH	AQFR	USE
6-12-95	14N04E07CDC2	#5	35 51 08.3 90 42 29.4	180’	Memphis	P
6-12-95	14N04E22CBD1	#14	35 49 29.4 90 39 21.8	350’	Memphis	P
6-12-95	14N04E28DAB1	#17	35 48 49.2 90 39 47.6	362’	Memphis	P
6-12-95	14N04E32BCA1	#15	35 48 10.7 90 41 29.9	342’	Memphis	P
6-12-95	14N05E20ABA1	#42	35 50 04.6 90 34 30.1	167’	Alvm	I
6-12-95	14N04E05DBB1	#3	35 52 19.0 90 40 58.7	80’	Alvm	D
6-13-95	13N03E20DCD1	#28	35 44 06.6 90 47 33.1	@120’	Alvm	I
6-13-95	13N04E03ABB1	#9	35 47 31.0 90 39 05.4	90’	Alvm	I

Uses: P = Public; I = Irrigation; D = Domestic
AQFR = Aquifer; Alvm = Alluvium

Table 1. JONESBORO PROTOTYPE - LOCATION AND DESCRIPTION OF WELLS - THIRD SAMPLING PERIOD

SAMPLE DATE	LOCAL NUMBER	SAMPLE LOCATION NO.	LATITUDE-LONGITUDE	DEPTH	AQFR	USE
6-13-95	14N03E10DDD1	#18	35 51 02.6 90 44 56.6	@80'	Alvm	I
6-13-95	14N03E14CAA1	#39	35 50 30.1 90 44 23.4	173'	Alvm	I
6-13-95	14N04E07ABA1	#2	35 51 50.8 90 42 00.3	70'	Alvm	D
6-14-95	13N04E32BDB1	#43	35 42 57.4 90 41 33.4	142'	Alvm	I
6-14-95	13N04E10BBB1	#8	35 46 35.9 90 39 37.9	@155'	Alvm	I
6-14-95	12N04E08CDB1	#44	35 40 51.7 90 41 25.0	170'	Alvm	I
6-14-95	12N04E07ACD1	#45	35 41 12.7 90 41 59.7	156'	Alvm	I
6-14-95	12N03E01DCB1	#20	35 41 47.1 90 43 12.9	@160'	Alvm	I

Uses: I = Irrigation; D = Domestic

Table 1. JONESBORO PROTOTYPE - LOCATION AND DESCRIPTION OF WELLS - THIRD SAMPLING PERIOD

SAMPLE DATE	LOCAL NUMBER	SAMPLE LOCATION NO.	LATITUDE-LONGITUDE	DEPTH	AQFR	USE
6-14-95	12N03E12BBC1	#19	35 41 25.3 90 43 46.7	160'	Alvm	I
6-14-95	13N04E09DCD1	#10	35 45 51.8 90 39 59.3	105'	Alvm	A

Table 2. JONESBORO PROTOTYPE - LOCATION AND DESCRIPTION OF WELLS NOT SAMPLED DURING THIRD SAMPLING PERIOD

LAST SAMPLED	LOCAL NUMBER	SAMPLE LOCATION NO.	LATITUDE-LONGITUDE	DEPTH	AQFR	USE
1st	14N03E13CAB1	#1	35 50 30.0 90 43 27.5	140'	Alvm	C
2nd	13N04E03BCC1	#7	35 47 12.6 90 39 37.0	100'	Alvm	I

Uses: I = Irrigation; A = Aquaculture; C = Commercial

Table 3. JONESBORO PROTOTYPE

Results of the first three sampling periods initiated 6/89, 6/92, and 6/95. "K" indicates actual value is known to be less than value given. T. Rec. = Total Recoverable.

WELL NO.	#5	#14	#17	#15	#42	#3	#28	#9	#18	#39
AQFR.	Mphs	Mphs	Mphs	Mphs	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm
DEPTH	180'	350'	362'	342'	167'	80'	@120'	90'	@80'	173'
Alk. Total mg/l	63.0 - -	53.0 - -	57.0 - -	85.0 - -	- - -	153.0 - -	- - -	149.0 - -	- - -	- - -
Al µg/l T. Rec.	- - 31.6	- - 17.3	- - 16K	- - 17.4	- - 29.7	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K
As µg/l T. Rec.	- - 5K	- - 5K	5K - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5.8	- - 5K
B µg/l T. Rec.	- - 3.4K	- - 3.4K	- - 3.4K	- - 3.4K	- - 4.0	- - 3.4K	- - 8.1	- - 4.0	- - 18.1	- - 3.4K
Ba µg/l T. Rec.	- - 22.1	- - 33.7	- - 29.1	- - 20.7	- - 292.5	- - 72.7	- - 135.7	- - 32.3	- - 71.2	- - 30.6
Be µg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K
Ca mg/l T. Rec.	- - 18.3	- - 11.3	- - 13.8	- - 9.5	- - 98.3	- - 45.9	- - 155.0	- - 41.9	- - 34.8	- - 26.2
Carbon Org. Total mg/l	1.6 - 1.7	2.5 - 1.4	1.2 - 1.5	3.7 - 1.5	- - 2.3	3.9 - 1.8	- - 2.1	5.1 - 1.7	- - 2.0	- - 2.2
Cd µg/l T. Rec.	- - .5K	- - .5K	.5K - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K
Cl mg/l Total	10.0 - 8.8	9.0 - 10.4	12.0 - 10.5	16.0 - 7.5	- - 13.9	62.0 45.0 43.7	- - 16.8	7.0 - 7.6	- - 17.5	- - 9.8
Co µg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K
Cr µg/l T. Rec.	- - 1K	- - 1K	1K - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1.5

AQFR = Aquifer; Mphs = Memphis aquifer; Alvm = Alluvium (Alluvial aquifer)

Table 3. JONESBORO PROTOTYPE- continued

WELL NO.	#5	#14	#17	#15	#42	#3	#28	#9	#18	#39
AQFR.	Mphs	Mphs	Mphs	Mphs	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm
DEPTH	180'	350'	362'	342'	167'	80'	@120'	90'	@80'	173'
Cu µg/l T. Rec.	- - 3.7	- - 24.5	15K - 7.1	- - 5.9	- - 4.2	- - 9.3	- - 2K	- - 2K	- - 4.5	- - 2K
Fe µg/l T. Rec.	.400 - 15.5	- - 245.0	.300 - 11.8	- - 66.0	- - 8060.0	- - 33.7	- - 3060.0	- - 24.4	- - 4470.0	- - 32.9
F mg/l Total	- - .10K	- - .10K	- - .10K	- - .10K	- - .110	- - .120	- - .10K	- - .140	- - .150	- - .130
Hard. Total mg/l	78.0 - 78.0	46.0 - 46.0	52.0 - 58.0	88.0 - 40.0	- - 304.0	224.0 - 206.0	- - 562.0	132.0 - 153.0	- - 122.0	- - 109.0
Hg µg/l Total	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K
K mg/l T. Rec.	- - .500	- - .620	- - .640	- - .500	- - 1.3	- - .460	- - .880	- - .690	- - .860	- - .490
Mg mg/l T. Rec.	- - 7.9	- - 4.3	- - 5.7	- - 3.9	- - 14.2	- - 22.3	- - 42.5	- - 11.8	- - 8.5	- - 10.7
Mn µg/l T. Rec.	- - 2K	- - 8.2	- - 5.1	- - 3.1	- - 275.0	- - 2K	- - 777.0	- - 250.0	- - 523.0	- - 2K
Na mg/l T. Rec.	- - 13.7	- - 10.9	16.0 - 13.3	- - 9.1	- - 37.4	- - 45.8	- - 14.7	- - 14.8	- - 23.2	- - 12.9
Ni µg/l T. Rec.	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K
NH3-N mg/l Total	.020 - .116	.060 - .076	.020 - .072	.050 - .071	- - .178	.030 .05K .062	- - .05K	.01K - .055	- - .293	- - .054
NO3-N mg/l Total	2.0 - 1.69	.610 - .678	.570 - .341	.010 - .399	- - .02K	18.0 12.5 11.3	- - .02K	.070 - .020	- - .02K	- - .359

Table 3. JONESBORO PROTOTYPE- continued

WELL NO.	#5	#14	#17	#15	#42	#3	#28	#9	#18	#39
AQFR.	Mphs	Mphs	Mphs	Mphs	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm
DEPTH	180'	350'	362'	342'	167'	80'	@120'	90'	@80'	173'
Phos.-T Ortho mg/l	.020 - .03K	.030 - .03K	.030 - .03K	.040 - .03K	- - .03K	.100 .080 .03K	- - .03K	.100 - .034	- - .189	- - .041
Phos.- Total mg/l	- - .046	- - .03K	- - .03K	- - .03K	- - .211	- .060 .250	- - .104	- - .075	- - .492	- - .095
Pb µg/l T. Rec.	- - 2K	- - 2K	4.0 - 2K	- - 2K	- - 2K	- - 6.0	- - 2K	- - 2K	- - 2K	- - 2K
Se µg/l T. Rec.	- - 10K	- - 10K	5K - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K
SO4 mg/l Total	29.0 - 23.8	5.0 - 3.9	5.0 - 7.5	16.0 - 3.9	- - 45.4	12.0 20.0 32.7	- - 152.0	7.0 - 14.0	- - 7.5	- - 5.2
TDS mg/l	- - 144.0	- - 97.0	- - 116.0	- - 489.0	- - 452.0	- - 370.0	- - 703.0	- - 209.0	- - 209.0	- - 153.0
TSS mg/l	- - 1K	- - 1K	- - 1K	- - 1K	- - 12.5	- - 1K	- - 5.0	- - 1K	- - 1K	- - 1K
V µg/l T. Rec.	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K
Zn µg/l T. Rec.	- - 12.9	- - 43.5	- - 4.0	- - 3.5	- - 6.5	- - 5.24	- - 2K	- - 2K	- - 2K	- - 2K
COND. µS/cm	- - 262.0	- - 174.0	- - 212.0	- - 150.0	- - 765.0	- - 664.0	- - 1075.0	- - 357.0	- - 448.0	- - 306.0
pH	- - 6.8	- - 6.7	- - 6.7	- - 6.6	- - 7.0	- - 6.8	- - 6.8	- - 7.1	- - 6.7	- - 7.0

COND. = Conductivity in µS/cm, measured in the field

Table 3. JONESBORO PROTOTYPE- continued

WELL NO.	#2	#43	#8	#44	#45	#20	#19	#10	#1	#7
AQFR.	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm
DEPTH	70'	142'	@155'	170'	156'	@160'	160'	105'	140'	100'
Alk. Total mg/l	49.0 - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -	84.0 - -	101.0 - -
Al μg/l T. Rec.	- - 16.4	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K	- - 16K	- - 17.2	- - -	- - -
As μg/l T. Rec.	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - 5K	- - -	- - -
B μg/l T. Rec.	- - 3.4K	- - 5.7	- - 3.4K	- - 4.2	- - 3.4K	- - 3.4K	- - 4.5	- - 3.4K	- - -	- - -
Ba μg/l T. Rec.	- - 32.1	- - 93.8	- - 33.6	- - 124.5	- - 153.4	- - 187.4	- - 236.8	- - 52.8	- - -	- - -
Be μg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - -	- - -
Ca mg/l T. Rec.	- - 13.5	- - 84.2	- - 18.4	- - 72.4	- - 95.0	- - 111.0	- - 113.0	- - 23.9	- - -	- - -
Carbon Org. Total mg/l	3.0 - 1.7	- - 2.3	- - 2.0	- - 2.3	- - 2.2	- - 2.8	- - 2.3	- - 2.3	2.7 - -	2.3 - -
Cd μg/l T. Rec.	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - .5K	- - -	- - -
Cl mg/l Total	32.0 - 19.6	- - 14.9	- - 10.0	- - 9.3	- - 5.9	- - 47.0	- - 25.3	- - 10.8	16.0 - -	11.0 9.0 -
Co μg/l T. Rec.	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - 3K	- - -	- - -
Cr μg/l T. Rec.	- - 3.8	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1K	- - 1.8	- - -	- - -

Table 3. <u>JONESBORO PROTOTYPE</u>- continued

WELL NO.	#2	#43	#8	#44	#45	#20	#19	#10	#1	#7
AQFR.	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm
DEPTH	70'	142'	@155'	170'	156'	@160'	160'	105'	140'	100'
Cu µg/l T. Rec.	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - -	- - -
Fe µg/l T. Rec.	- - 8.4	- - 1460	- - 39.8	- - 2670	- - 2630	- - 2760	- - 3110	- - 30.3	- - -	- - -
F mg/l Total	- - .10K	- - .120	- - .110	- - .160	- - .150	- - .110	- - .120	- - .130	- - -	- - -
Hard. Total mg/l	70.0 - 55.0	- - 308.0	- - 75.0	- - 254.0	- - 318.0	- - 376.0	- - 396.0	- - 98.0	88.0 - -	72.0 - -
Hg µg/l Total	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - -	- - -
K mg/l T. Rec.	- - .520	- - 1.1	- - .590	- - .520	- - .750	- - .960	- - .790	- - .830	- - -	- - -
Mg mg/l T. Rec.	- - 5.3	- - 23.7	- - 7.0	- - 17.8	- - 19.7	- - 24.1	- - 27.6	- - 9.2	- - -	- - -
Mn µg/l T. Rec.	- - 2K	- - 764.0	- - 8.7	- - 218.0	- - 306.0	- - 329.0	- - 249.0	- - 2.49	- - -	- - -
Na mg/l T. Rec.	- - 14.0	- - 20.3	- - 10.4	- - 14.4	- - 15.2	- - 16.6	- - 14.7	- - 21.0	- - -	- - -
Ni µg/l T. Rec.	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - 6K	- - -	- - -
NH3-N mg/l Total	.010 - .057	- - .051	- - .059	- - .127	- - .078	- - .056	- - .066	- - .054	.040 - -	.150 .05K -
NO3-N mg/l Total	2.7 - 1.9	- - .02K	- - .02K	- - .02K	- - .02K	- - .02K	- - .02K	- - .182	.010 - -	.030 .110 -

Table 3. JONESBORO PROTOTYPE- continued

WELL NO.	#2	#43	#8	#44	#45	#20	#19	#10	#1	#7
AQFR.	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm	Alvm
DEPTH	70'	142'	@155'	170'	156'	@160'	160'	105'	140'	100'
Phos.-T Ortho mg/l	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .03K	- - .052	.030 - -	.140 .100 -
Phos.- Total mg/l	- - .046	- - .085	- - .046	- - .182	- - .143	- - .104	- - .133	- - .085	- - -	- .090 -
Pb µg/l T. Rec.	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - -	- - -
Se µg/l T. Rec.	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - 10K	- - -	- - -
SO4 mg/l Total	8.0 - 3.9	- - 63.3	- - 6.4	- - 28.3	- - 52.9	- - 58.9	- - 95.0	- - 21.0	11.0 - -	3.0 2.0 -
TDS mg/l	- - 123.0	- - 397.0	- - 129.0	- - 326.0	- - 388.0	- - 469.0	- - 498.0	- - 179.0	- - -	- - -
TSS mg/l	- - 1K	- - 1.5	- - 1K	- - 3.0	- - 4.5	- - 4.0	- - 4.0	- - 1K	- - -	- - -
V µg/l T. Rec.	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - 5.3K	- - -	- - -
Zn µg/l T. Rec.	- - 30.0	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - 2K	- - -	- - -
COND. µS/cm	- - 235.0	- - 691.0	- - 223.0	- - 642.0	- - 766.0	- - 910.0	- - 917.0	- - 340.0	- - -	- - -
pH	- - 6.1	- - 7.2	- - 6.7	- - 7.2	- - 7.2	- - 7.2	- - 7.2	- - 6.7	- - -	- - -

COND. = Conductivity in µS/cm, measured in the field

Table 4. JONESBORO PROTOTYPE PESTICIDE ANALYSES

Analyses for pesticides shown below indicated all wells sampled were below detection limits with the exception of trace amounts of p-p'-DDE (*) found in wells #8 and #44 (.01730 μg/l and .00745 μg/l, respectively).

Parameter	Detection Limit **	Parameter	Detection Limit **
Molinate	<.00459 μg/l	Prometryn	<.00273 μg/l
Propachlor	<.00650 μg/l	Heptachlor	<.00355 μg/l
Trifluralin	<.00153 μg/l	Terbutryn	<.00283 μg/l
Alpha-BHC	<.00603 μg/l	Metolachlor	<.00273 μg/l
Atraton	<.00684 μg/l	Malathion	<.01137 μg/l
Prometron	<.01011 μg/l	Dipropetryn	<.00456 μg/l
Simazine	<.01146 μg/l	Chlorpyrifos	<.00511 μg/l
Atrazine	<.00253 μg/l	Cyanazine	<.00494 μg/l
Propazine	<.00246 μg/l	Aldrin	<.01150 μg/l
Beta-BHC	<.00797 μg/l	Pendimethalin	<.00653 μg/l
Gamma-BHC	<.00571 μg/l	Heptachlor-Epoxide	<.00444 μg/l
Terbuthylazine	<.01386 μg/l	Endosulfan-I	<.09421 μg/l
Diazinon	<.00737 μg/l	p-p'-DDE (*)	<.00150 μg/l
Fluchloralin	<.00310 μg/l	Dieldrin	<.01385 μg/l
Fonofos	<.00597 μg/l	Endrin	<.01692 μg/l
Delta-BHC	<.00760 μg/l	Endosulfan-II	<.02990 μg/l
Cyprazine	<.00287 μg/l	p-p'-DDD	<.00131 μg/l
Metribuzin	<.00439 μg/l	Endosulfan-Sulfate	<.00784 μg/l
Methyl-Parathion	<.00938 μg/l	p-p'-DDT	<.00194 μg/l
Alachlor	<.00343 μg/l	Hexazinone	<.00800 μg/l
Ametryn	<.00188 μg/l	Methoxychlor	<.00154 μg/l

** Detection Limits may vary somewhat for each analyte from one well sample to another.

Table 5. JONESBORO PROTOTYPE VOCS ANALYSES

Analyses for the VOCS shown below for all wells indicated no detections.

Parameter	Concentration	Units	Detection Limit
Chloromethane	<2	µg/l	2.0
1,1-Dichloroethane	<1	µg/l	1.0
Chlorobenzene	<1	µg/l	1.0
Bromoform	<1	µg/l	1.0
1,1,2,2-Tetrachloroethane	<1	µg/l	1.0
Vinyl_Chloride	<2	µg/l	2.0
Bromomethane	<2	µg/l	2.0
Chloroethane	<2	µg/l	2.0
Trichloroflouromethane	<1	µg/l	1.0
1,1-Dichloroethene	<1	µg/l	1.0
Methylene_Chloride	<1	µg/l	1.0
Trans-1,2-Dichloroethene	<1	µg/l	1.0
Cis-1,2-Dichloroethene	<1	µg/l	1.0
2,2-Dichloropropane	<1	µg/l	1.0
Bromochloromethane	<1	µg/l	1.0
Chloroform	<1	µg/l	1.0
1,1,1-Trichloroethane	<1	µg/l	1.0
1,2-Dichloroethane	<1	µg/l	1.0
1,1-Dichloropropene	<1	µg/l	1.0
Benzene	<1	µg/l	1.0
Carbon_Tetrachloride	<1	µg/l	1.0
1,2-Dichloropropane	<1	µg/l	1.0
Trichloroethene	<1	µg/l	1.0
Dibromomethane	<1	µg/l	1.0
Bromodichloromethane	<1	µg/l	1.0
Cis-1,3-Dichloropropene	<1	µg/l	1.0
Toluene	<1	µg/l	1.0
Trans-1,3-Dichloropropene	<1	µg/l	1.0
1,1,2-Trichloroethane	<1	µg/l	1.0

Table 5. JONESBORO PROTOTYPE VOCS ANALYSES- CONTINUED

Parameter	Concentration	Units	Detection Limit
1,3-Dichloropropane	<1	μg/l	1.0
Dibromochloromethane	<1	μg/l	1.0
1,2-Dibromoethane	<1	μg/l	1.0
Tetrachloroethene	<1	μg/l	1.0
1,1,1,2-Tetrachloroethane	<1	μg/l	1.0
Ethyl_Benzene	<1	μg/l	1.0
Styrene	<1	μg/l	1.0
Ortho_Xylene	<1	μg/l	1.0
1,2,3-Trichloropropane	<1	μg/l	1.0
Isopropylbenzene	<1	μg/l	1.0
Bromobenzene	<1	μg/l	1.0
2-Chlorotoluene	<1	μg/l	1.0
N-Propyl_Benzene	<1	μg/l	1.0
4-Chlorotoluene	<1	μg/l	1.0
1,3,5,-Trimethylbenzene	<1	μg/l	1.0
Tert-Butyl_Benzene	<1	μg/l	1.0
1,2,4-Trimethylbenzene	<1	μg/l	1.0
1,3-Dichlorobenzene	<1	μg/l	1.0
Sec-Butyl_Benzene	<1	μg/l	1.0
1,4-Dichlorobenzene	<1	μg/l	1.0
P-Isopropyl_Toluene	<1	μg/l	1.0
1,2-Dichlorobenzene	<1	μg/l	1.0
N-Butyl-Benzene	<1	μg/l	1.0
1,2-Dibromo-3-Chloropropane	<1	μg/l	1.0
1,2,4-Trichlorobenzene	<1	μg/l	1.0
Naphthalene	<1	μg/l	1.0
1,2,3-Trichlorobenzene	<1	μg/l	1.0
Hexachlorobutadiene	<1	μg/l	1.0
Para_Xylene	<1	μg/l	1.0
Meta_Xylene	<1	μg/l	1.0

Table 6. DESCRIPTIVE STATISTICS - SELECTED WATER QUALITY PARAMETERS - 14 ALLUVIAL WELLS - JONESBORO, ARKANSAS

WELL NO.	Na Total Rec. (mg/l)	Ca Total Rec. (mg/l)	K Total Rec. (mg/l)	Mg Total Rec. (mg/l)	Cl Total (mg/l)	Ba Total Rec. (µg/l)	Total Hard. (mg/l)	Fe Total Rec. µg/l	Mn Total Rec. (µg/l)	SO4 Total (mg/l)	TDS (mg/l)
42	37.40	98.30	1.30	14.20	13.90	292.50	304.00	8060.00	275.00	45.40	452.00
3	45.81	45.90	.46	22.30	43.70	72.70	206.00	33.70	2K	32.70	370.00
28	14.72	155.00	.88	42.50	16.80	135.7	562.00	3060.00	777.00	152.00	703.00
9	14.82	41.90	.69	11.80	7.60	32.30	153.00	24.40	250.00	14.00	209.00
18	23.18	34.80	.86	8.50	17.50	71.20	122.00	4470.00	523.00	7.50	209.00
39	12.95	26.20	.49	10.70	9.80	30.60	109.00	32.90	2K	5.20	153.00
2	14.02	13.50	.52	5.30	19.60	32.10	55.00	8.40	2K	3.90	123.00
43	20.34	84.20	1.10	23.70	14.90	93.80	308.00	1460.00	764.00	63.30	397.00
8	10.42	18.40	.59	7.00	10.00	33.60	75.00	39.80	8.70	6.40	129.00
44	14.38	72.40	.52	17.80	9.30	124.50	254.00	2670.00	218.00	28.30	326.00
45	15.19	95.00	.75	19.70	5.90	153.40	318.00	2630.00	306.00	52.90	388.00
20	16.57	111.00	.96	24.10	47.00	187.40	376.00	2760.00	329.00	58.90	469.00
19	14.73	113.00	.79	27.60	25.30	236.80	396.00	3110.00	249.00	95.00	498.00
10	20.96	23.90	.83	9.20	10.30	52.80	98.00	30.30	2.49	21.00	179.00
Total Wells	14	14	14	14	14	14	14	14	14	14	14
Mean	19.68	66.68	.77	17.46	17.97	110.67	238.29	2027.82	264.66	41.89	328.93
Median	15.00	59.15	.77	16.00	14.40	83.25	230.00	2045.00	249.50	30.50	348.00
Std. Dev.	9.65	42.04	.24	9.77	12.27	79.64	142.15	2239.45	257.73	40.13	164.25
Range	10.40-45.81	13.50-155.00	.46-1.30	5.30-42.50	5.90-47.0	30.60-292.50	55.00-562.00	8.40-8060.00	2K-777.00	3.90-152.00	123.00-703.00

Note: Shaded cells indicate water quality parameters exceeding median values.

Table 7. DESCRIPTIVE STATISTICS - SELECTED WATER QUALITY PARAMETERS ALLUVIAL AQUIFER - LONOKE AND JONESBORO AREAS

Jonesboro	Na Tot. Rec. mg/l	Ca Tot. Rec. mg/l	K Tot. Rec. mg/l	Mg Tot. Rec. mg/l	Cl Total mg/l	Ba Tot. Rec. µg/l	Total Hard. mg/l	Fe Tot. Rec. µg/l	Mn Tot. Rec. µg/l	SO4 Total mg/l	TDS mg/l
Total Wells	14	14	14	14	14	14	14	14	14	14	14
Mean	19.68	66.68	.77	17.46	17.97	110.67	238.29	2027.82	264.66	41.89	328.93
Median	15.00	59.15	.77	16.00	14.40	83.25	230.00	2045.00	249.50	30.50	348.00
Standard Deviation	9.65	42.04	.24	9.77	12.20	79.64	142.15	2239.45	257.73	40.13	164.25
Range	10.4-45.81	13.5-155.00	.46-1.30	5.3-42.50	5.9-47.00	30.6-292.50	55.0-562.00	8.4-8060.00	2K-777.00	3.9-152.00	123.0-703.00

Lonoke	Na Tot. Rec. mg/l	Ca Tot. Rec. mg/l	K Tot. Rec. mg/l	Mg Diss. mg/l	Cl Diss. mg/l	Ba Tot. Rec. µg/l	Total Hard. mg/l	Fe Tot. Rec. µg/l	Mn Tot. Rec. µg/l	SO4 Total mg/l	TDS mg/l
Total Wells	14	14	14	10	21	1	13	19	14	19	21
Mean	19.00	41.21	3.30	5.76	13.81	82.00	106.88	3121.05	560.71	25.91	249.58
Median	15.50	29.00	2.50	4.90	10.00	82.00	93.00	2000.00	545.00	6.00	195.00
Standard Deviation	8.36	31.67	2.38	2.97	13.81	0.00	106.88	4469.38	400.51	50.93	141.84
Range	11.0-43.00	3.0-91.00	.3-8.00	1.1-11.00	.5-48.00	-	10.0-380.00	0.0-20000.00	100K-1480.00	1.0-190.00	88.0-536.00

K: Indicates actual value is known to be less than value given; Tot. Rec.: Total Recoverable; Diss.: Dissolved

APPENDIX

List Of Public Water Supply Wells

Jonesboro Water System

Well #5	**- Johnson Street Plant Well #4**
Well #14	**- Airport Plant Well #1**
Well #15	**- Medallion Plant Well #1**
Well #17	**- Race Street Plant Well #1**