THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 1 "THERE IS NO SUBSTITUTE FOR WATER" *January, 1970*

Board Reorganized

RESULTS OF THE JANUARY 1970 ELECTION

As provided by State law, the District held its annual election on the second Tuesday in January — January 13, 1970. The (1969) Board of Directors of the High Plains Underground Water Conservation District No. 1 met on January 19, to canvass the returns of this election.

After a thorough review of the results of this election, the Board declared: 1) that Mr. Ray Kitten of Slaton, Lubbock County, had been elected to succeed Mr. Russell Bean as the Director for Precinct 1; 2) that Selmer H. Schoenrock of Levelland, Hockley County, had been elected to succeed Mr. Weldon Newsom as the Director for Precinct 2; 3) and that Mr. Chester Mitchell of Lockney, Floyd County, had been re-elected the Director for Precinct 5; all of the newly elected Directors to serve from January 1970 to January 1972.

Board Members Elected

Mr. Russell Bean, former President of the Board of Directors, received a total of 280 votes in his bid for re-election. Mr. Ray Kitten received a total of 328 votes, and was declared as elected the Member to the Board from Precinct 1, replacing Mr. Bean. In this race, Mr. Kitten received 53.59 percent of the 612 votes cast for this office. There were four write-in votes cast for this office.

Mr. Weldon Newsom, former Secretary-Treasurer of the Board, did not seek re-election to the Precinct 2 post. There were four candidates in the race for this office. Messrs. S. H. Schoenrock, Levelland; Roy Hickman, Morton; W. B. Jones, Spade; and K. B. Parish, Earth; received 88, 68, 46 and 45 votes respectively. Mr. Schoenrock received only 35.6 percent of the votes cast for this office, however, his plurality was 20 votes greater than the candidate running second in this race.

Mr. Chester Mitchell was re-elected to a fourth term as the Director from Precinct 5. He received 81.61 percent of the 310 votes cast in this two-way race.

A total of 1,170 votes were cast in the Director's races for Precincts 1, 2 and 5. This represents approximately 2.3 times as many votes as were cast during the January 1968 election for these same offices. The voter turnout during the 1970 election represented only 1.7 percent of the approximately 68,500 eligible voters in

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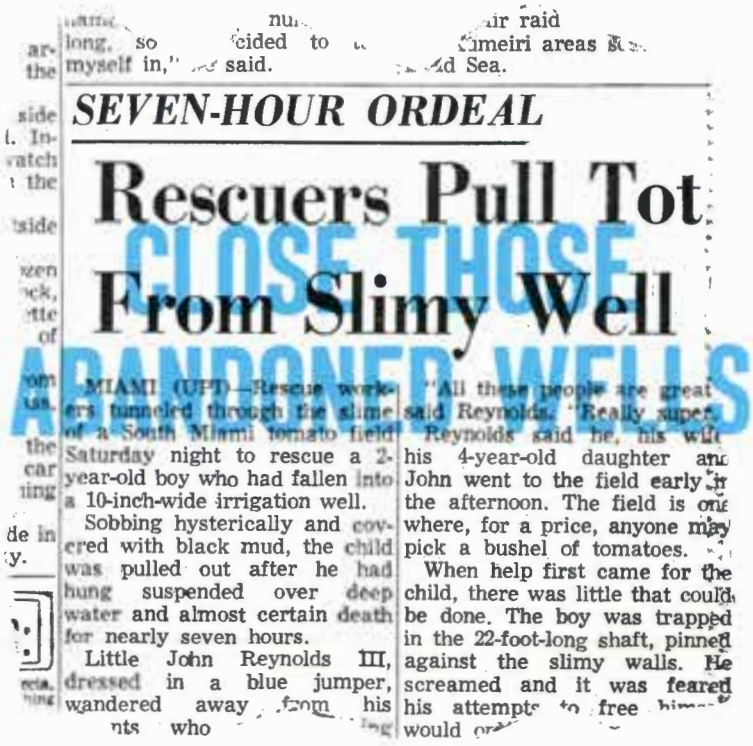
The 1970 Board of Directors, (left to right), John D. Pitman, Secretary-Treasurer, Hereford; Ray Kitten, Slaton; Ross Goodwin, Vice President, Muleshoe; Selmer H. Schoenrock, Levelland; and Chester W. Mitchell, President, Lockney.



SEVEN-HOUR ORDEAL

Rescuers Pull Tot From Slimy Well

CLOSE THOSE ABANDONED WELLS

MIAMI (UPI)—Rescue workers tunneled through the slime of a South Miami tomato field Saturday night to rescue a 2-year-old boy who had fallen into a 10-inch-wide irrigation well.

Sobbing hysterically and covered with black mud, the child was pulled out after he had hung suspended over deep water and almost certain death for nearly seven hours.

Little John Reynolds III, dressed in a blue jumper, wandered away from his

"All these people are great," said Reynolds. "Really super."

Reynolds said he, his wife, his 4-year-old daughter and John went to the field early in the afternoon. The field is one where, for a price, anyone may pick a bushel of tomatoes.

When help first came for the child, there was little that could be done. The boy was trapped in the 22-foot-long shaft, pinned against the slimy walls. He screamed and it was feared his attempts to free himself would

(Reprinted from Avalanche-Journal, January 25, 1970)

Eastland Court Hears Whitaker Case

Sun Oil Company's appeal of the decision handed down in favor of Ernest Whitaker, by Judge Ledbetter, Morton, Texas, was heard by the 11th Court of Civil Appeals on Tuesday, January 20, 1970. This Court, commonly referred to as the Eastland Court of Civil Appeals, was sitting in Amarillo on this date — Judges Grissom, Collings and Walter presiding. Judge Ledbetter's decision had enjoined Sun Oil Company from pumping groundwater from beneath Whitaker's land to be used in their water-flooding operations.

Old Lease at Issue

The issue at trial can be generally summed up as, what is the proper interpretation of a standard oil and gas lease executed in 1946, between L. D. Gann — then the owner of what is now the Whitaker property — and Sun Oil Company.

Sun Oil Company contends that the free use of wood, coal and water clause in the standard oil and gas lease included the right to establish a water-flood source well on the tract leased from Gann, even after this land

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The Board Of Directors A Historical Sketch

The governing body of the High Plains Underground Water Conservation District No. 1 consists of its elected executive officers — its five Member Board of Directors.

Since the District's creation in 1951, there have been 31 individuals to hold the office of Director on this governing Board.

The first five Directors were appointed by the Texas State Board of Water Engineers (now the Texas Water Rights Commission), when it created the District on August 9, 1951. On this date the Board of Water Engineers divided the newly created District — covering all or parts of 21 Southern High Plains Counties — into five precincts, and appointed E. C. Hatton of Lubbock; A. C. Chesher of Littlefield; J. M. Osborn of Muleshoe; Tom McFarland of Hereford; and Tom Bostic of Plainview the Directors for Precincts 1 through 5 respectively.

This newly appointed Board met on August 23, 1951, and ordered the confirmation election (as required by

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THE Cross SECTION

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FRANK RAYNER, Editor

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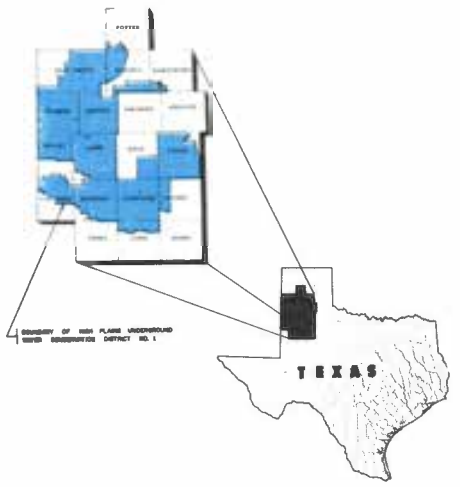

NOTICE: Information regarding times and places of the monthly County Committee meetings can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Armstrong and Potter Counties; in these counties contact Carrol Rogers and Vic Plunk, respectively.

Whitaker Case . . .

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had been purchased by Whitaker.

However, in his oral argument before the Eastland Court, Bill Browder, Sun's attorney, noted that Sun began "studying" water-flooding in this field (Levelland-Slaughter oil field) in 1963; some 17 years *after* executing the standard lease agreement with Gann.

Mr. Browder further stipulated that water-flooding was not practiced in this area before 1948; two years after the subject lease had been consummated.

Mr. George McCleskey, attorney for the appellee (Whitaker), stipulated Sun Oil Company had executed lease agreements with landowners in Duval County, in 1947, that contained a specific clause regarding Sun's rights to use fresh water for water-flooding purposes.

This, to the layman, would indicate that Sun contemplated water-flooding operations in other areas of the State several years before they admitted to first starting to "study" the possibility of water-flooding in this area. Therefore, it would reason that Sun should have seen fit to so change their oil and gas lease contracts that they were executing in this area, *if* they were indeed considering water-flooding in the Levelland-Slauhgter field at such an early date.

Sun has stipulated that their water-flooding operation on the Whitaker farm would require the use of 35 percent of all of Whitaker's fresh water. It has been unequivocally demonstrated that value of farmed property in the High Plains area is directly proportional to the amount of groundwater thereunder. This is particiularly true of the Whitaker farm; and when Whitaker purchased this property he was investing a considerable part of his capital in groundwater. Therefore, Sun Oil Company does, in fact, seek to freely appropriate 35 percent of this capital investment.

The wording of the court's decision in this case can be very crucial. If the court should find for Sun, as Sun is pleading, their decision could cloud the title of groundwater rights throughout Texas, and commence the wholesale (free) appropriation of groundwater by oil and other mineral developers.

1970 Election . . .

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the eight counties in these three precincts.

Board Reorganized

At the noon luncheon on January 19th, Judge Howard C. Davison, 99th Judicial District, administered the oath of office to Messrs. Kitten, Mitchell and Schoenrock, and declared them Directors of this District.

Reconvening after lunch, the newly designated (1970) Board elected officers. Mr. Chester Mitchell was elected President; Mr. Ross Goodwin of Muleshoe, Bailey County, was elected Vice-President; and Mr. John D. Pitman of Hereford, Deaf Smith County, was elected Secretary-Treasurer; all offices to run until January 1971.

The 1970 Board of Directors, their respective Precincts and the counties contained therein are shown in the listing of Directors on this page (columns 1 and 2). The county committeemen for each county for 1970 are also shown in these listings. The year (in January of same) in which the committeeman's term expires, and the committeeman's address are also shown.

Board History . . .

—continued from page 1

law), that was held on September 29, 1951. As a result of this election, all or parts of 13 counties elected to participate in the District. This election confirmed all of the Directors previously appointed to the Board, except Mr. Bostic. He was ineligible, because of his residing within a county (Hale) that had elected not to participate in the District. The confirmed members to the Board met on October 5, 1951 and appointed L. L. Jones of Floydada, the Director for Precinct 5.

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DRILLING STATISTICS FOR 1969

County	Permits Issued	New Wells Drilled	Replacement Wells Drilled	Reported Dry Hole
ARMSTRONG	0	0	0	0
BAILEY	73	57	4	3
CASTRO	116	95	4	8
COCHRAN	11	8	1	1
CROSBY	3	3	0	0
DEAF SMITH	158	110	5	6
FLOYD	80	56	7	1
HALE	13	15	0	0
HOCKLEY	73	45	2	4
LAMB	67	41	18	5
LUBBOCK	79	70	8	1
LYNN	12	10	0	2
PARMER	114	99	11	3
POTTER	6	8	0	0
RANDALL	43	33	1	3
TOTALS	848	650	61	37

JOIN WATER INCORPORATED

Board History . . .

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The names of these Directors, except that of J. M. Osborn, were again placed on the ballots of the January 1952 election. Two Directors were returned to office; E. C. Hatton of Lubbock, and Tom McFarland of Hereford. Mr. Willis A. Hawkins of Hart was elected to replace J. M. Osborn; and George Broome of Anton and C. J. Taylor of Lockney were elected to replace Chesher and Jones.

This Board then met on February 4, 1952, and drew lots for terms of office. Messrs. Broome and Taylor drew the two year terms, the other Directors were to serve for only one year.

This established the precedent of electing the Directors for Precincts 1, 3 and 4 on odd numbered years, and the Directors for Precincts 2 and 5 on even numbered years. This condition prevailed — as is illustrated by the photographs on this page — until 1965; when the election for Director for Precinct 1 was not held. As a result of this error, Mr. Russell Bean served a three year term, from January 1963 to January 1966, when he was again elected for another two year term. Directors for Precincts 1, 2 and 5 are now elected on even numbered years, and on odd numbered years for Precincts 3 and 4.

Group photographs of the Directors serving from August 1951 to January 1953 are not available. Group photographs for all of the Boards of Directors from 1953 through 1969 are, with great pride, included herein as a pictorial history of these public servants.

A 1956 photograph is not available. Therefore, a 1955 photograph of this same Board is shown.

1955 (Seated, L to R) W. O. Fortenberry (Deceosed), Pres., Lubbock; W. M. Sherley, V.P., Lazbuddie; (Stndg., L to R) V. E. Dodson, Hereford; M. Shurbet, S.-Tr., Petersburg; G. Parish, Springlake.

1960 (Seoted, L to R) T. L. Sparkman, Jr., Hereford; R. Hickman, Morton; (Stndg., L to R) J. Gommon, S.-Tr., Lazbuddie; J. R. Belt, Jr., V.P., Lockney; E. L. Blankenship, Pres., Wilson.

1965 (Seated, L to R) W. Newsom, S.-Tr., Morton; R. Beon, Pres., Lubbock; C. Mitchell, V.P., Lockney; (Stndg., L to R) A. Kershen, Hereford; R. Goodwin, Muleshoe.

1956 (Seated, L to R) W. O. Fortenberry (Deceased), S.-Tr., Lubbock; W. M. Sherley, V.P., Lazbuddie; (Stndg., L to R) V. E. Dodson, Hereford; M. Shurbet, Pres., Petersburg; G. Parish, Springloke.

1961 (Seated, L to R) J. Gammon, Pres., Lazbuddie; T. L. Sparkmon, Jr., V.P., Hereford; (Stndg., L to R) E. L. Blankenship, S.-Tr., Wilson; J. R. Belt, Jr., Lockney; R. Hickman, Morton.

1966 (Seated, L to R) C. Mitchell, V.P., Lockney; R. Bean,, Pres., Lubbock; R. Goodwin, Muleshoe; (Stndg., L to R) A. Kershen, Hereford; W. Newsom, S.-Tr., Morton.

1957 (Seated, L to R) G. Parish, Springlake; M. Shurbet, Pres., Petersburg; (Stndg., L to R) V. E. Dodson, S.-Tr., Hereford; A. H. Daricek, Maple; E. L. Blankenship, V.P., Wilson.

1962 (Seated, L to R) E. L. Blankenship, V.P., Wilson; T. L. Sparkman, Jr., Pres., Hereford; (Stndg., L to R) J. Gammon, Lazbuddie; H. J. Schmidly, Levelland; J. R. Belt, Jr., S.-Tr., Lockney.

1967 (Seated, L to R) A. Kershen, Hereford; R. Bean, Pres., Lubbock; W. Newsom, S.-Tr., Morton; (Stndg., L to R) C. Mitchell, V.P., Lockney; R. Goodwin, Muleshoe.

1953 (L to R) V. E. Dodson, Hereford; W. A. Hawkins, V.P., Hart; W. O. Fortenberry (Deceased), Pres., Lubbock; G. A. Broome, S.-Tr., Anton; C. J. Taylor (Deceased), Lockney.

1958 (Seated, L to R) V. E. Dodsan, Pres., Hereford; A. H. Daricek, S.-Tr., Maple; (Stndg., L to R) R. B. McQuatters, Sr., Littlefield; J. R. Belt, Jr., Lockney; E. L. Blankenship, V.P., Wilson.

1963 (Seated, L to R) J. R. Belt, Jr., Lockney; H. J. Schmidly, V.P., Levelland; (Stndg., L to R) R. Bean, S.-Tr., Lubbock; J. Gammon, Pres., Lazbuddie; E. Holt, Hereford.

1968 (Seated, L to R) R. Bean, Pres., Lubbock; C. Mitchell, V.P., Lockney; (Stndg., L to R) R. Goodwin, Muleshoe; A. Kershen, Hereford; W. Newsom, S.-Tr., Morton.

1954 (Seated, L to R) W. A. Hawkins, V.P., Hart; W. O. Fortenberry (Deceased), Pres., Lubbock; (Stndg., L to R) V. E. Dodson, Hereford; G. Parish, Springlake; M. Shurbet, S.-Tr., Petersburg.

1959 (Seated, L to R) R. B. McQuatters, Sr., V. P., Littlefield; E. L. Blankenship, Pres., Wilson; (Stndg., L to R) T. L. Sparkman, Jr., Hereford; J. R. Belt, Jr., S.-Tr., Lockney; J. Gammon, Lazbuddie.

1964 (Seated, L to R) J. Gammon, Pres., Lazbuddie; R. Bean, V.P., Lubbock; (Stndg., L to R) C. Mitchell, Lockney; W. Newsom, Morton; E. Holt, S.-Tr., Hereford.

1969 (Seated, L to R) C. Mitchell, V.P., Lockney; R. Bean, Pres., Lubbock; W. Newsom, S.-Tr., Morton; (Stndg., L to R) R. Goodwin, Muleshoe; J. D. Pitman, Hereford.

Directors Elected On January 13, 1970

CHESTER W. MITCHELL

On January 13, 1970, Mr. Chester W. Mitchell, a 56-year old Lockney farmer, was re-elected to a fourth term as the Member to the Board of Directors from Precinct 5 (Floyd and Hale Counties) of the High Plains Underground Water Conservation District No. 1.

Chester first moved to the Lockney area as the young son of Travis and Ethel Mitchell, from their Runnels County farm in 1919. The elder Mitchells, Chester and his brother R. C. — a well-known certified seed producer — still reside near Lockney.

After graduating from college, Chester served seven years as the county agent for Logan County, Oklahoma. He returned to Floyd County in 1946, and now farms 720 acres of cotton, maize, and wheat. He operates four irrigation wells. He has installed two playa water recovery systems, and an automatic tailwater return system.

Chester's formal education; his professional experience; his farm background and long years of irrigation farming; his six years experience as a County Committeeman, and six years service on the District's Board of Directors; his interests in groundwater conservation as practiced by both his unselfish service on several water interest projects, and by deed; are all self-evident of his impressive qualifications to serve as the President and Member to this Board. The support by the voters naming him to a fourth term is ample recognition of their endorsement of his past service in their behalf.

RAY KITTEN

On January 19, 1970, Mr. Ray Kitten took the oath of office to serve as the Member to the Board of Directors of the High Plains Underground Water Conservation District No. 1, from Precinct 1 (Crosby, Lubbock and Lynn Counties).

Ray's late father and mother, Henry and Kathrene Kitten, moved to the Slaton area from Nebraska in 1916. In all there were 12 children in the elder Kitten's family — eight boys and four girls.

Ray drilled his first irrigation well in 1945, and now operates two 8-inch wells, to irrigate cotton and maize. A third well on this farm is unused. This well is now equipped with an automatic water-level recorder (property of the Texas Water Development Board) and constitutes one of the more than 800 water-level observation wells within the District.

Now 58 years old, Mr. Kitten has the distinction of growing up with the development of groundwater irrigation in this area. His long experience of using and conserving groundwater will help guide him in formulating the policies and principles he will be responsible for helping to establish while a Member of the Board. The experience he has gained by his many years of unselfish service on many other private and public service boards, makes him eminently qualified to represent the interests of the residents of Precinct 1.

SELMER H. SCHOENROCK

Mr. Selmer H. Schoenrock, a 47-year old Hockley County farmer, took the oath of office as the Member to the Board of Directors of the High Plains Underground Water Conservation District No. 1, Precinct 2 (Cochran, Hockley and Lamb Counties), on January 19, 1970.

Selmer moved to the Levelland area in December 1934, the infant son of the five sons of Mr. and Mrs. Paul Schoenrock; formerly of Clifton, in Bosque County. The elder Schoenrocks, as well as four of their sons, Selmer included, still reside in Hockley County.

Selmer farms nearly 1,100 acres, about equally cropped with cotton and maize. In all, he operates four farms, two north of Levelland and two east of Whitharral. Selmer notes that as a result of the gradual decline of the water table throughout the High Plains area, his best well today pumps less than one-half as much water as did his original well.

At the height of the 50's drought, in 1956, he drilled his first irrigation well. There are now 16 wells on his farms.

Selmer has both observed and experienced the changes and hardships forced upon the irrigator by a waning groundwater supply. This experience, combined with his progressive interest in seeking solutions to our groundwater problems, makes him a fortunate choice to carry on the work of his seven predecessors to the Board from Precinct 2.

HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

SECOND CLASS PERMIT

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 2 "THERE IS NO SUBSTITUTE FOR WATER" *February, 1970*

OBSERVATION WELL RECORDS . . .

THE ANNUAL WATER STATEMENT, 1969-1970

During January and February 1970, personnel of the High Plains Underground Water Conservation District No. 1 and the Texas Water Development Board measured the depths to water in "observation" wells within the District. The 1969 and 1970 depths to water below land surface measurements made in observation wells in Castro, Floyd, Lubbock and Parmer Counties, and those wells in the District in Armstrong, Bailey, Cochran, Crosby, Deaf Smith, Hale, Hockley, Lamb, Lynn, Potter, and Randall Counties; and the change (Decline 1969-1970) in the water level during 1969; are presented in the tables on pages 2 through 7. The locations of the wells listed in the tables are shown on the accompanying maps.

The tables on pages 2 through 7 also show the average decline per year for each well. This average value represents the 1962 depth to water measurement subtracted from the 1970 depth to water measurement, and the difference divided by the number of intervening years (8). In the event a 1962 and/or 1970 measurement is not available, the average value represents the difference between the earliest (after 1962) and latest available measurement, divided by the number of intervening years. Plus signs (+) indicate a rise in the water level.

VALIDITY OF MEASUREMENTS

The depths to water, as listed in the tables, were taken directly from field measurement records. If the individual measuring a well did not note any circumstance or condition that would reflect upon the authenticity of the water-level measurement, the measurement was listed as reported. No attempt was made to screen (to disregard apparently erroneous water-level measurements) these data. However, it is apparent that a limited number of such measurements are not representative of the static water level in the well to which the measurement was accredited.

Dan Seale, measuring the depth to water in a typical observation well.

EVALUATING MEASUREMENTS

It is very difficult, even for an experienced hydrologist, to judge the validity of water-level measurements.

In the past, the District has employed a combination of several methods to judge the authenticity of water-level records. Most of these study routines employ the use of digital computers, however, the ultimate acceptance or rejection of a water-level record has always been a judgement decision. Such judgements are usually made in anticipation of the use of these data in a model, as a part of the District's cost-in-water-depletion, income-tax allowance program, or other anayltical uses.

In an effort to develop machine determinable, judgement criteria for the 1969 and 1970 depth to water measurments, the "standard deviation" has been calculated for each annual change in water level in each well from 1962 through 1970. These values are also listed in the tables on pages 2 through 7.

The standard deviation values represent the disagreement that was, on the average, common to every annual change in water level for each well, when compared to the average annual change in the depth to water in that well.

A large standard deviation indicates a very large randomness in the annual decline or rise of the water level in that well. In other words, the depth to water records for this well probably do not follow a given or definable pattern, which would be strong evidence of erroneous water-level data. A small standard deviation indicates that the depth to water in the subject well follows a definite (smooth) pattern; in most cases a steady decline of the water table.

EXAMPLE OF ANALYSIS

The following examples show how the standard devaition value can be used to determine the authenticity of the 1969-1970 change in water level.

Assuming a well wherein the 1969-1970 decline was 2.10 feet, while the average annual decline from 1962 through 1970 was 1.65 feet per year, and the standard deviation is 2.56; then the average decline plus the standard deviation (1.65 + 2.56) is 4.21, and the 1969-1970 decline of 2.10 feet is within this range, therefore this decline, and the 1969 and 1970 measurements, can probably be accepted as authentic and representative.

However, for a well wherein the 1969-1970 decline was 6.75 feet, while the average decline and standard deviation are 1.60 and 4.10 feet respectively (for a sum of 5.70); the 1969-1970 decline exceeds this range, and the 1969 and/or 1970 depth to water measurement should not be considered authentic, without further analysis.

It must be noted that the use of the standard deviation as presented is not a fool-proof method of judging water-level data. The final analysis must still be a judgment decision, which can only be made after consideration of numerous other controlling factors. The standard deviation values are included herein *only* as a guide to the users of these data.

SUMMARY OF RECORDS

The table, "Summary of Water-Level Measurements," shows the minimum and maximum depths to water

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Shurbet Appointed Chairman

Governor Preston Smith appointed Marvin Shurbet, Petersburg, Texas, Chairman of the five member Board of Directors of the Texas Water Development Board, on February 10, 1970.

Mr. Shurbet was elected the director for Precinct 5 of the High Plains Underground Water Conservation District's Board of Directors in January 1954. He was the President of the District's Board when he resigned to acept the appointment, by Governor Daniels, as one of the original Members of the Texas Water Development Board in 1957.

Marvin, and his wife Mildred, were the principal litigants of the now famous, Shurbet vs United States of

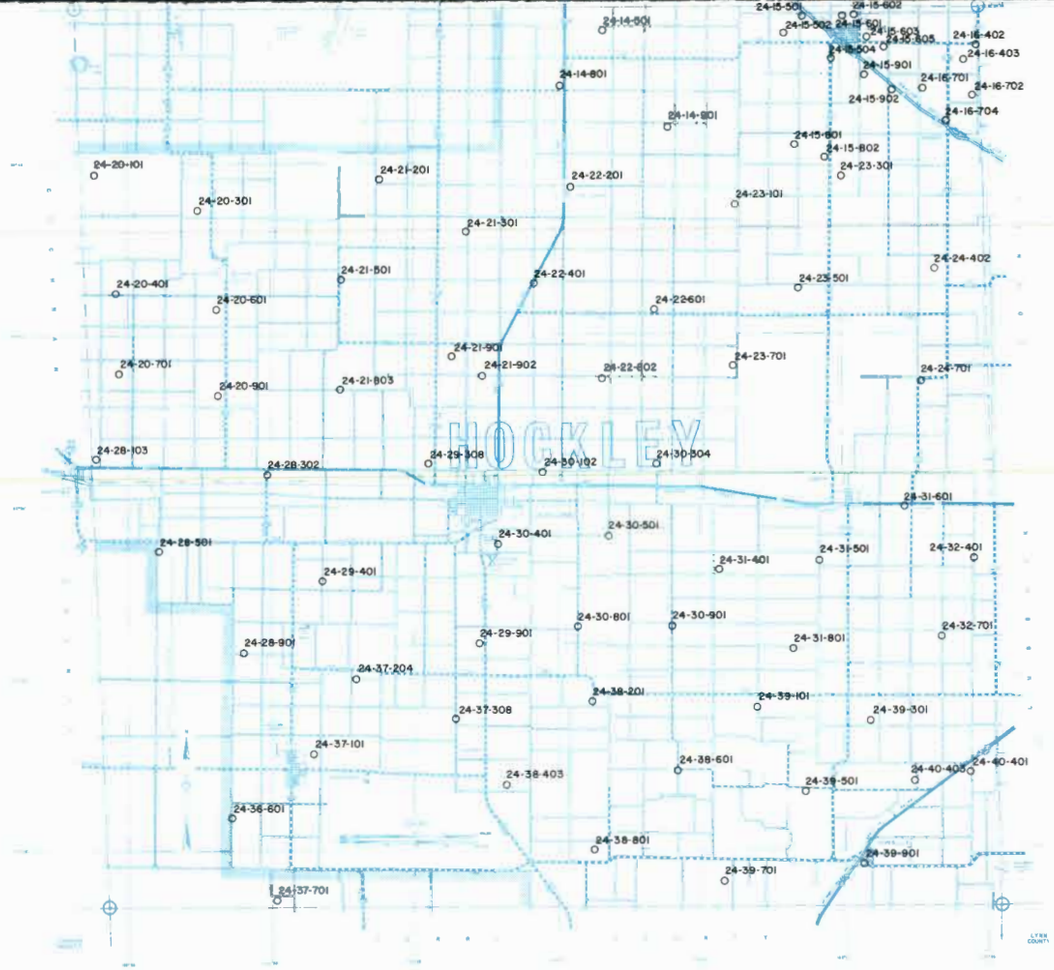
—continued on page 8

SUMMARY OF WATER LEVEL MEASUREMENTS

County	1962 No. of Wells Measured	1962 Depth to Water (Feet) Min.	1962 Depth to Water (Feet) Max.	1962 Depth to Water (Feet) Avg.	1970 No. of Wells Measured	1970 Depth to Water (Feet) Min.	1970 Depth to Water (Feet) Max.	1970 Depth to Water (Feet) Avg.
Armstrong	8	95.48	124.90	110.50	9	107.56	151.14	128.81
Bailey	41	25.11	142.72	67.22	61	19.51	143.34	82.39
Castro	45	52.64	224.41	143.71	61	110.55	266.52	173.84
Cochran	46	55.40	176.66	128.14	53	72.17	195.11	139.36
Crosby	10	116.48	179.34	151.60	15	128.05	208.46	183.91
Deaf Smith	61	52.25	286.40	137.66	71	58.50	310.99	170.36
Floyd	89	37.29	264.96	156.08	94	52.90	297.75	190.30
Hale	16	69.70	151.60	110.79	15	80.86	182.94	130.66
Hockley	36	34.64	178.60	109.68	75	37.98	195.88	125.36
Lamb	36	28.13	147.10	97.76	71	32.76	189.92	111.91
Lubbock	100	12.82	194.70	111.86	114	3.53	193.73	124.74
Lynn	29	25.89	133.73	81.97	28	27.10	147.13	89.02
Parmer	48	123.35	306.14	202.89	58	149.20	325.81	235.69
Potter	0	———	———	———	4	193.53	217.94	209.30
Randall	12	123.30	187.97	156.53	31	96.96	223.10	166.49

AVERAGE DECLINE OF WATER TABLE

County	Average Decline ft. 1969-1970	Average Decline (ft.) 1962-1970 or for Period of Record
Armstrong	3.25	2.17
Bailey	+ 3.88	1.40
Castro	2.62	3.36
Cochran	+0.48	1.12
Crosby	4.96	3.66
Deaf Smith	2.01	3.31
Floyd	2.77	3.46
Hale	+0.20	2.81
Hockley	0.17	1.29
Lamb	0.29	1.90
Lubbock	0.12	1.51
Lynn	+1.91	.80
Parmer	4.91	4.02
Potter	+0.52	2.56
Randall	+0.06	2.04



HOCKLEY COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
24-14-501	106.62	107.65	1.03	0.32	1.32
24-14-801	57.30	52.55	+4.75	0.28	2.89
24-14-901	99.12	99.61	0.49	0.53	3.21
24-15-501	74.19	73.43	+0.76	1.19	1.67
24-15-502	77.85	79.25	1.40	0.62	5.68
24-15-504	66.70	66.24	+0.46	0.54	1.52
24-15-601	108.50	105.25	+3.25	1.90	2.92
24-15-602	0.0	118.07	0.0	1.88	0.56
24-15-603	115.83	116.44	0.61	2.26	1.71
24-15-605	94.22	95.57	1.35	1.41	1.21
24-15-801	134.22	0.0	0.0	0.75	2.89
24-15-802	176.98	178.80	1.82	0.69	2.64
24-15-901	41.44	40.88	+0.56	+0.04	3.46
24-15-902	44.60	37.98	+6.62	0.42	5.19
24-16-402	128.94	127.98	+0.96	0.46	1.46
24-16-403	106.60	106.12	+0.48	1.57	3.11
24-16-701	64.50	63.89	+0.61	0.69	1.40
24-16-702	92.30	92.99	0.69	0.94	3.87
24-16-704	105.41	106.95	1.54	2.67	7.44
24-20-101	0.0	157.05	0.0	3.46	7.52
24-20-301	132.90	133.37	0.47	2.27	6.23
24-20-401	125.18	122.95	+2.23	1.48	2.65
24-20-601	151.38	150.00	+1.38	2.10	3.89
24-20-701	147.33	147.05	+0.28	0.63	1.34
24-20-901	140.41	141.98	1.57	2.66	2.42
24-21-201	44.18	45.01	0.83	0.92	1.45
24-21-301	91.03	92.07	1.04	1.27	1.15
24-21-501	156.15	154.09	+2.06	2.11	4.30
24-21-803	160.49	159.73	+0.67	2.35	2.79
24-21-901	157.11	157.26	0.15	1.94	1.41
24-21-902	168.90	171.08	2.18	2.57	3.00
24-22-201	78.30	77.52	+0.78	0.43	2.28
24-22-401	86.22	86.47	0.25	0.44	0.83
24-22-601	100.82	102.06	1.24	0.54	1.25
24-22-802	123.90	125.69	1.79	1.54	2.22
24-23-101	109.21	109.50	0.29	0.65	0.55
24-23-301	194.62	195.88	1,26	2.16	2.08
24-23-501	105.01	106.60	1.59	0.82	2.49
24-23-701	0.0	105.21	0.0	0.98	0.85
24-24-402	150.90	154.62	3.72	2.23	2,39
24-24-701	126.80	126.02	+0.78	0.26	0.77
24-28-103	149.11	147.39	+1.72	1.24	2.95
24-28-302	125.90	125.35	+0.55	+0.36	1.96
24-28-501	149.45	150.15	0.70	0.88	6.77
24-28-901	160.20	161.96	1.76	1.58	2.95
24-29-308	144.20	146.80	2.60	2.19	1.90
24-29-401	141.88	142.04	0.16	0.42	4.51
24-29-901	190.42	190.48	0.06	2.63	1.96
24-30-102	142.14	140.03	+2.11	2.20	2.61
24-30-304	104.50	106.30	1.80	1.46	1.06
24-30-401	132.24	131.47	+0.77	1.79	1.32
24-30-501	125.42	126.59	1.17	2.05	1.45
24-30-801	173.70	172.58	+1.12	1.41	1.79
24-30-901	155.92	155.93	0.01	1.55	3.17
24-31-401	129.21	131.23	2.02	1.96	1.41
24-31-501	80.80	80.55	+0.25	0.98	0.83
24-31-601	117.50	118.37	0.87	0.57	1.37
24-31-801	145.62	146.60	0.98	0.74	0.94
24-32-401	102.48	102.57	0.09	0.38	2.08
24-32-701	115.48	115.86	0.38	0.59	1.78
24-36-601	144.62	145.73	1.11	0.26	4.37
24-37-101	144.25	145.85	1.60	1.53	2.60
24-37-204	144.92	145.80	0.88	1.21	1.20
24-37-308	145.39	147.07	1.68	2.36	4.59
24-37-701	152.60	152.39	+0.21	0.17	0.83
24-38-201	170.23	172.62	2.39	2.59	1.10
24-38-403	160.55	161.52	0.97	1.39	1.12
24-38-601	133.14	133.10	+0.04	1.66	2.78
24-38-801	169.10	166.39	+2.71	1.64	2.32
24-39-101	154.58	155.14	0.56	1.26	1.80
24-39-301	151.76	150.90	+0.86	1.23	1.20
24-39-501	136.52	137.19	0.67	1.06	3.19
24-39-701	116.85	118.67	1.82	1.66	2.51
24-39-901	96.10	95.78	+0.32	0.64	0.53
24-40-401	142.00	143.17	1.17	1.46	1.32
24-40-403	148.55	147.37	+1.18	1.09	1.91

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Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
10-56-102	181.44	185.22	3.78	4.59	1.96
10-56-403	165.37	169.62	4.25	4.02	1.05

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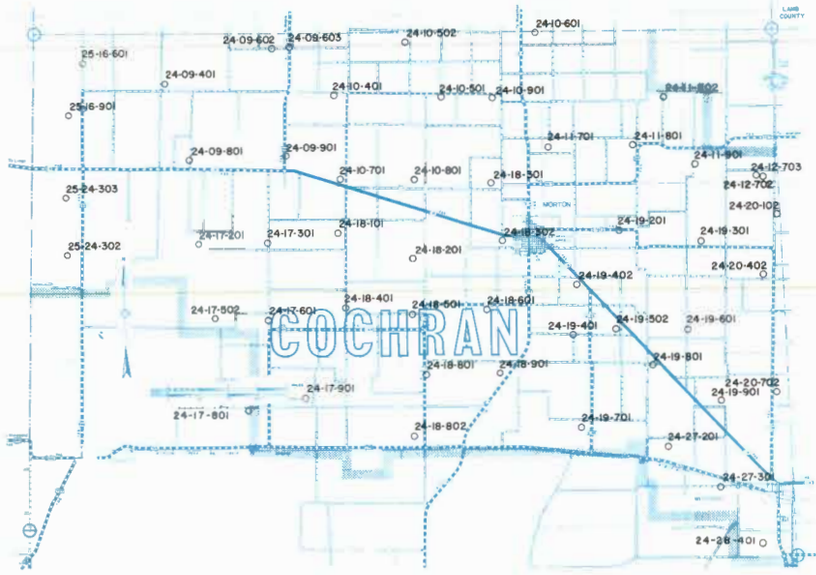

COCHRAN COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
24-09-401	86.46	86.76	0.30	+0.01	0.31
24-09-602	119.31	120.66	1.35	2.12	1.49
24-09-603	115.39	116.06	0.67	2.09	2.52
24-09-801	123.08	122.60	+0.48	0.23	0.80
24-09-901	102.57	100.87	+1.70	0.92	1.83
24-10-401	110.09	109.61	+0.48	0.41	1.24
24-10-501	95.03	93.91	+1.12	0.12	0.62
24-10-502	86.91	86.38	+0.53	+0.01	0.80
24-10-601	0.0	91.89	0.0	0.37	0.85
24-10-701	156.41	157.68	1.27	1.19	3.38
24-10-801	133.82	133.49	+0.33	1.19	1.78
24-10-901	93.80	93.02	+0.78	0.16	1.23
24-11-701	128.25	125.64	+2.61	0.43	1.40
24-11-801	106.77	105.77	+1.00	0.29	1.26
24-11-802	108.27	108.96	0.69	1.34	1.58
24-11-901	124.69	125.27	0.58	1.27	0.92
24-12-702	151.91	144.27	+7.64	3.02	4.13
24-12-703	137.47	138.82	1.35	2.70	4.08
24-17-201	144.61	143.15	+1.46	+2.13	0.67
24-17-301	140.14	139.99	+0.15	1.60	1.34
24-17-502	153.95	157.68	3.73	+1.05	4.78
24-17-601	148.96	147.86	+1.10	1.43	1.93
24-17-801	156.06	153.67	+2.39	+0.81	1.58
24-17-901	167.14	166.25	+0.88	0.81	4.53
24-18-101	149.83	150.25	0.42	0.87	0.61
24-18-201	175.07	174.49	+0.58	2.14	1.57
24-18-301	130.25	130.30	0.05	0.56	1.10
24-18-302	159.27	160.55	1.28	2.23	2.23
24-18-401	151.89	147.78	+4.11	1.22	2.82
24-18-501	194.78	195.11	0.33	1.39	1.12
24-18-601	168.66	169.02	0.36	1.57	3.08
24-18-801	183.87	188.15	4.28	1.77	8.93
24-18-802	172.37	168.17	+4.20	0.81	2.30
24-18-901	115.60	114.40	+1.20	+0.12	1.32
24-19-201	150.60	145.97	+4.63	1.48	2.65
24-19-301	166.14	165.07	+1.07	1.84	1.91
24-19-401	152.33	150.95	+1.38	1.30	1.96
24-19-402	146.10	145.11	+0.99	1.51	1.91
24-19-502	167.57	166.80	+0.77	1.83	4.11
24-19-601	154.41	154.97	0.56	1.30	1.31
24-19-701	0.0	168.05	0.0	3.00	4.44
24-19-801	162.07	162.20	0.13	2.23	2.31
24-19-901	126.59	127.20	0.61	0.28	0.42
24-20-102	143.61	144.26	0.65	3.03	4.52
24-20-402	149.37	148.47	+0.90	1.73	1.58
24-20-702	154.82	155.07	0.25	1.47	3.01
24-27-201	184.88	183.40	+1.48	1.84	2.07
24-27-301	180.62	181.20	0.58	0.57	0.53
24-28-401	184.56	185.92	1.36	0.81	0.55
25-16-601	70.81	72.17	1.36	2.10	0.57
25-16-901	90.02	90.39	0.37	+0.26	0.63
25-24-302	146.82	145.17	+1.65	+1.75	0.10
25-24-303	126.65	125.47	+1.18	+0.78	0.41

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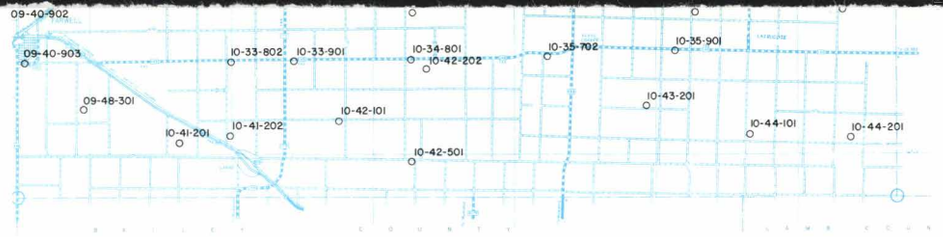
ARMSTRONG COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
11-12-401	115.03	115.40	0.37	0.99	0.44
11-12-601	106.22	109.17	2.95	1.05	1.47
11-12-701	129.91	139.26	9.35	3.33	3.51
11-12-702	145.04	151.14	6.10	3.99	2.83
11-12-801	139.74	139.92	0.18	1.89	3.94
11-12-802	142.71	149.50	6.79	3.08	3.85
11-12-803	121.90	123.38	1.48	1.81	1.38
11-12-901	122.15	123.92	1.77	1.86	0.92
11-13-701	107.26	107.56	0.30	1.51	2.45



PARMER COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
09-24-601	321.86	319.29	+2.57	4.15	5.58
09-32-901	231.62	231.05	+0.57	+2.58	5.30
09-40-901	251.55	259.67	8.12	4.13	9.77
09-40-902	224.97	229.22	4.25	3.84	1.26
09-40-903	229.60	241.21	11.61	4.35	11.93
09-48-301	210.45	223.08	12.63	3.94	10.57
10-17-301	191.81	191.82	0.01	0.14	7.87
10-17-401	273.19	266.64	+6.55	3.10	4.37
10-17-501	256.92	258.10	1.18	3.51	1.48
10-18-501	291.86	293.12	1.26	4.38	2.09
10-18-701	245.65	254.37	8.72	6.38	1.99
10-18-901	243.03	245.94	2.91	4.78	5.24
10-19-101	264.63	266.91	2.28	4.36	1.16
10-19-301	265.42	273.40	7.98	5.58	5.87
10-19-601	221.71	0.0	0.0	2.95	4.03
10-19-602	220.61	221.96	1.35	1.35	0.0
10-20-401	220.87	222.08	1.21	4.29	3.10
10-20-502	162.37	172.94	10.57	2.70	4.12
10-25-101	303.74	321.46	17.72	3.45	14.46
10-25-301	292.50	293.82	1.32	2.47	2.27
10-25-501	167.74	167.66	+0.08	0.69	1.48
10-25-701	244.42	251.62	7.20	4.87	4.48
10-26-101	0.0	314.90	0.0	3.21	6.65
10-26-301	0.0	304.87	0.0	4.06	3.40
10-26-601	272.55	275.52	2.97	3.77	1.03
10-26-701	197.89	205.44	7.55	3.00	2.74
10-26-801	218.25	227.51	9.26	4.91	10.26
10-27-102	254.90	0.0	0.0	4.06	1.56
10-27-301	291.67	295.80	4.13	5.46	2.65
10-27-501	324.28	325.81	1.53	4.14	4.17
10-27-901	239.29	240.80	1.51	4.10	1.64
10-28-201	263.58	267.10	3.52	3.55	6.88
10-28-501	274.86	277.09	2.23	5.10	0.51
10-33-101	273.01	271.77	+1.24	4.19	5.86
10-33-301	252.38	0.0	0.0	7.07	5.03
10-33-401	271.59	273.92	2.33	4.06	4.21
10-33-601	270.59	279.31	8.72	5.24	1.77
10-33-802	198.65	0.0	0.0	4.31	1.40
10-33-901	196.44	205.10	8.66	4.89	3.35
10-34-101	206.39	0.0	0.0	+6.01	11.93
10-34-102	205.89	208.19	2.30	2.30	0.0
10-34-301	205.61	213.08	7.47	3.28	7.81
10-34-401	266.85	276.12	9.27	5.16	6.94
10-34-801	202.05	204.22	2.17	3.59	8.42
10-34-802	227.04	232.21	5.17	3.90	4.12
10-35-304	199.67	202.92	3.25	3.53	0.99
10-35-401	230.05	246.17	16.12	5.25	5.40
10-35-501	220.23	231.27	11.04	4.60	4.57
10-35-601	198.88	199.85	0.97	3.78	1.67
10-35-702	217.35	223.25	5.90	4.92	0.99
10-35-901	233.96	242.60	8.64	5.22	6.06
10-35-902	229.69	239.76	10.07	5.42	5.21
10-36-101	196.79	210.13	13.34	5.54	3.38
10-36-601	189.50	190.33	0.83	4.35	12.19
10-36-801	182.00	187.79	5.79	3.87	9.28
10-41-201	164.77	165.72	0.95	3.55	6.73
10-41-202	0.0	151.91	0.0	3.57	0.31
10-42-101	160.52	168.92	8.40	3.84	11.69
10-42-202	194.32	196.82	2.50	4.13	2.09
10-42-501	147.70	149.20	1.50	3.12	1.40
10-43-201	193.59	196.17	2.58	4.04	7.64
10-44-101	0.0	175.84	0.0	3.87	4.20
10-44-201	0.0	187.06	0.0	3.42	0.81

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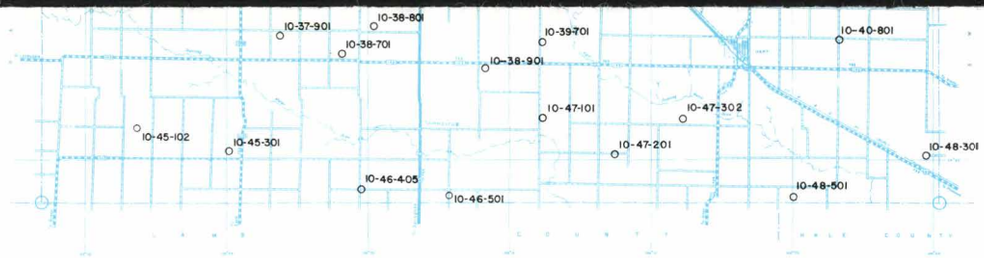

CASTRO COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
10-21-501	137.98	141.04	3.06	3.65	1.20
10-21-601	150.66	157.15	6.49	4.32	11.94
10-21-701	196.09	199.25	3.16	4.45	4.01
10-21-801	180.45	0.0	0.0	5.07	0.72
10-21-901	0.0	153.47	0.0	3.89	1.24
10-22-201	154.80	152.05	+2.75	1.01	2.90
10-22-301	0.0	115.98	0.0	1.14	0.56
10-22-401	132.28	133.60	1.32	3.38	2.26
10-22-501	130.20	133.35	3.15	2.86	3.83
10-22-601	118.13	117.86	+0.27	3.78	2.50
10-22-801	145.39	147.92	2.53	3.74	2.16
10-22-901	0.0	142.16	0.0	2.31	5.41
10-23-701	121.98	110.55	+11.43	0.74	9.64
10-23-801	148.87	150.38	1.51	0.23	0.49
10-24-202	0.0	175.21	0.0	0.50	0.0
10-24-401	187.86	187.75	+0.11	1.41	2.18
10-24-601	158.29	157.26	+1.03	+2.59	5.13
10-24-701	184.06	185.42	1.36	1.31	0.78
10-24-801	180.75	180.85	0.10	2.75	1.57
10-28-301	0.0	266.52	0.0	5.26	3.98
10-29-302	254.30	257.72	3.42	5.92	1.05
10-29-601	234.32	237.30	2.98	5.19	8.37
10-29-701	235.58	238.55	2.97	4.71	5.09
10-29-901	0.0	213.65	0.0	4.60	4.00
10-30-101	208.00	216.95	8.95	3.80	4.16
10-30-401	238.80	243.00	4.20	3.73	2.08
10-30-505	216.60	219.05	2.45	2.31	2.43
10-30-601	208.55	210.30	1.75	3.13	2.00
10-30-801	204.13	205.55	1.42	4.17	3.83
10-30-901	222.44	229.10	6.66	4.95	2.32
10-31-201	163.59	166.00	2.41	3.35	1.61
10-31-301	174.88	180.93	6.05	2.48	2.71
10-31-501	199.62	204.69	5.07	2.10	3.22
10-31-601	154.15	157.52	3.37	3.18	1.16
10-31-701	241.54	243.22	1.68	5.08	2.92
10-31-801	229.05	0.0	0.0	4.38	1.63
10-32-201	162.14	0.0	0.0	2.68	1.91
10-32-501	142.76	148.48	5.72	2.85	2.61
10-32-703	214.34	215.70	1.36	4.46	3.43
10-32-801	192.75	200.38	7.63	4.28	2.40
10-37-201	184.30	189.56	5.26	4.26	3.07
10-37-401	153.13	157.36	4.23	3.56	2.58
10-37-601	132.15	137.25	5.10	3.03	3.21
10-37-901	138.09	140.25	2.16	3.14	3.12
10-38-401	148.26	152.59	4.33	3.29	1.43
10-38-701	146.36	0.0	0.0	3.30	1.99
10-38-801	145.74	149.10	3.36	3.00	1.25
10-38-901	134.15	138.44	4.29	3.12	3.36
10-39-101	183.40	187.31	3.91	4.25	0.78
10-39-401	162.96	170.80	7.84	4.06	2.88
10-39-501	160.78	164.86	4.08	4.41	1.56
10-39-701	137.14	139.00	1.86	3.01	3.35
10-39-801	147.85	150.36	2.51	3.04	3.19
10-40-401	172.40	175.96	3.56	4.64	2.64
10-40-501	199.85	201.25	1.40	3.88	4.60
10-40-801	175.28	174.86	+0.42	3.49	3.56
10-45-102	155.32	158.00	2.68	2.68	0.0
10-45-301	163.82	163.42	+0.40	2.81	1.76
10-46-405	157.32	161.30	3.98	3.08	3.79
10-46-501	0.0	160.70	0.0	0.0	0.0
10-47-101	133.64	127.48	+6.16	2.70	4.22
10-47-201	160.94	166.00	5.06	3.86	2.20
10-47-302	145.25	148.85	3.60	3.39	0.89
10-48-301	147.45	146.80	+0.65	4.25	3.79
10-48-501	142.47	147.20	4.73	4.45	1.37

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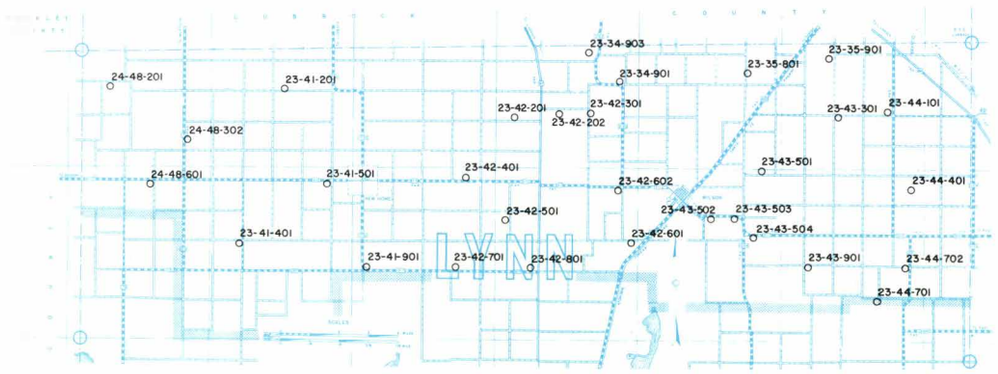

LYNN COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
23-34-901	137.80	138.67	0.87	2.38	1.68
23-34-903	145.52	147.13	1.61	1.67	7.18
23-35-801	86.61	86.32	+0.29	0.62	5.18
23-35-901	91.32	90.91	+0.41	0.53	3.22
23-41-201	106.62	101.46	+5.16	0.95	3.44
23-41-401	89.10	89.01	+0.09	0.67	1.31
23-41-501	74.25	73.80	+0.45	0.65	2.12
23-41-901	128.00	128.18	0.18	0.65	1.63
23-42-201	129.12	127.88	+1.24	0.02	1.68
23-42-202	131.76	123.95	+7.81	2.69	7.51
23-42-301	109.20	108.69	+0.51	0.75	3.19
23-42-401	121.70	115.62	+6.08	0.87	2.75
23-42-501	107.88	98.10	+9.78	0.91	4.74
23-42-601	51.11	46.30	+4.81	0.65	3.31
23-42-602	85.51	83.78	+1.73	0.58	5.30
23-42-701	103.26	104.02	0.76	0.98	3.66
23-42-801	67.95	68.81	0.86	0.50	3.79
23-43-301	31.66	27.10	+4.56	0.15	4.65
23-43-501	72.02	71.46	+0.56	0.19	2.72
23-43-502	78.18	78.81	0.63	0.58	4.44
23-43-503	84.41	0.0	0.0	0.35	1.05
23-43-504	78.02	78.39	0.37	0.34	0.91
23-43-901	63.45	62.87	+0.58	+0.23	2.35
23-44-101	66.80	66.05	+0.75	0.99	4.51
23-44-401	45.26	41.41	+3.85	+1.85	5.39
23-44-701	83.18	0.0	0.0	4.63	6.43
23-44-702	36.52	32.88	+3.64	+0.59	3.04
24-48-201	101.38	101.43	0.05	1.22	1.64
24-48-302	112.60	108.00	+4.60	1.12	3.32
24-48-601	93.32	91.41	+1.91	0.96	1.53

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HALE COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
11-59-401	162.90	0.0	0.0	5.02	2.07
11-59-402	83.30	85.60	2.30	1.99	3.60
11-59-501	81.60	80.86	+0.74	0.23	3.06
11-59-801	107.85	106.78	+1.07	0.94	1.70
11-60-401	90.40	91.38	0.98	1.66	0.41
11-60-702	92.86	95.29	2.43	2.22	2.23
23-02-302	117.20	116.39	+0.81	1.59	5.52
23-02-501	170.26	168.70	+1.56	4.35	6.16
23-03-301	99.00	100.10	1.10	1.70	2.33
23-03-502	120.01	120.14	0.13	2.37	14.15
23-03-802	169.00	165.40	+3.60	4.15	3.46
23-04-502	179.70	182.94	3.24	6.67	4.67
23-04-701	147.07	147.40	0.33	3.69	2.07
23-10-201	0.0	161.25	0.0	2.54	3.61
23-11-102	186.82	0.0	0.0	5.03	3.74
23-11-304	162.60	165.78	3.18	3.33	4.95
23-12-102	180.60	171.83	+8.77	2.94	5.61

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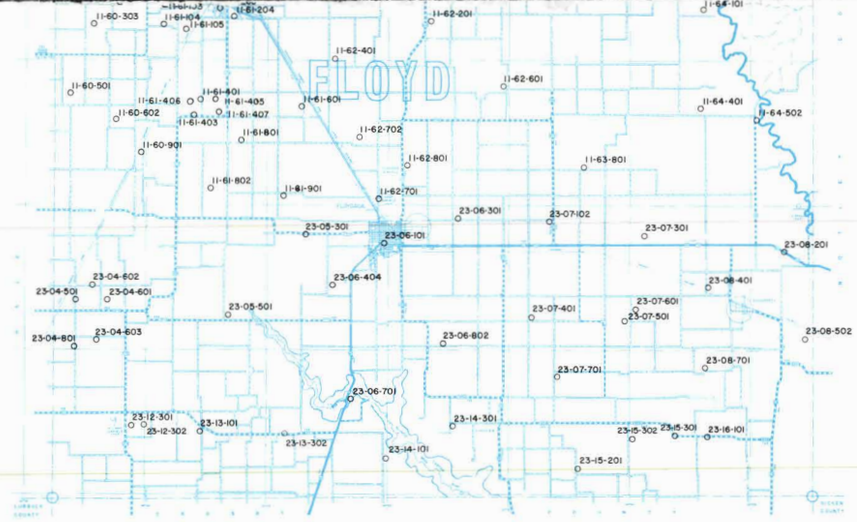

FLOYD COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
11-44-901	130.15	133.15	3.00	3.86	5.00
11-44-902	127.38	131.00	3.62	4.45	2.59
11-45-802	151.80	155.15	3.35	3.18	5.02
11-45-803	155.02	0.0	0.0	2.11	5.12
11-45-902	164.73	167.91	3.18	3.08	5.65
11-46-701	188.87	192.35	3.48	4.24	3.29
11-46-801	0.0	233.27	0.0	3.40	2.12
11-47-701	0.0	224.96	0.0	0.74	0.0
11-52-301	141.78	145.44	3.66	4.54	6.18
11-52-302	150.24	154.30	4.06	4.81	0.78
11-52-303	171.50	174.35	2.85	4.88	3.07
11-52-304	162.92	164.50	1.58	4.68	3.71
11-52-602	0.0	172.35	0.0	3.76	0.0
11-52-603	0.0	169.30	0.0	3.80	5.01
11-52-801	155.10	165.50	10.40	4.73	6.80
11-52-901	172.18	174.77	2.59	3.92	1.82
11-52-902	160.73	162.13	1.40	2.48	4.44
11-52-903	165.64	167.25	1.61	2.36	2.11
11-52-905	169.68	173.48	3.80	3.39	0.76
11-52-906	172.48	169.32	+3.16	3.01	3.82
11-53-201	148.89	152.18	3.29	3.23	1.16
11-53-202	149.52	0.0	0.0	3.22	4.41
11-53-203	144.87	146.55	1.68	1.98	1.95
11-53-204	149.52	150.38	0.86	+1.13	1.99
11-53-402	171.40	149.00	+22.40	0.65	9.93
11-53-501	188.47	195.00	6.53	4.41	2.38
11-53-701	166.14	169.30	3.16	2.90	3.88
11-53-702	158.84	162.28	3.44	3.49	2.25
11-53-703	161.80	163.65	1.85	2.41	6.48
11-54-401	174.30	175.48	1.18	1.27	0.81
11-54-901	218.81	218.98	0.17	1.67	1.13
11-55-701	229.60	230.67	1.07	2.00	4.31
11-55-901	276.29	277.48	1.19	1.57	6.00
11-60-301	159.40	164.55	5.15	3.95	1.71
11-60-302	164.45	168.65	2.40	3.74	0.96
11-60-303	162.60	168.40	5.80	4.00	1.65
11-60-501	158.44	164.46	6.02	5.29	3.46
11-60-602	160.38	164.89	4.51	3.77	5.10
11-60-901	151.42	156.35	4.93	4.37	3.85
11-61-101	170.80	175.50	4.70	3.45	3.72
11-61-103	0.0	172.45	0.0	3.67	0.88
11-61-104	172.09	177.75	5.66	4.77	1.24
11-61-105	0.0	182.46	0.0	4.84	2.11
11-61-110	172.73	176.79	4.06	4.06	0.0
11-61-203	0.0	195.30	0.0	4.45	2.18
11-61-204	183.13	188.40	5.27	4.75	1.55
11-61-401	185.82	190.02	4.20	5.52	2.73
11-61-403	181.25	184.63	3.38	5.81	3.12
11-61-405	192.08	195.60	3.52	4.08	0.56
11-61-406	180.66	185.40	4.74	4.47	0.27
11-61-407	186.88	0.0	0.0	6.16	1.87
11-61-601	52.38	52.90	0.52	1.03	1.10
11-61-801	196.60	200.55	3.95	5.89	6.02
11-61-802	194.09	197.73	3.64	7.11	11.34
11-61-901	183.72	192.00	8.28	5.71	3.92
11-62-201	141.72	142.25	0.53	1.23	3.96
11-62-401	60.59	60.30	+0.29	0.23	1.27
11-62-601	149.40	149.62	0.22	0.29	4.28
11-62-701	123.13	124.60	1.47	0.83	0.94
11-62-702	99.39	100.08	0.69	0.88	0.94
11-62-801	100.54	102.70	2.16	1.67	2.12
11-63-101	0.0	160.85	0.0	0.74	0.57
11-63-801	202.50	203.02	0.52	0.57	2.90
11-64-101	234.70	236.40	1.70	3.28	6.63
11-64-401	238.40	234.97	+3.43	+0.34	1.58
11-64-502	264.51	264.40	+0.11	0.10	4.62
23-04-501	182.39	186.50	4.11	5.47	1.46
23-04-601	173.30	176.90	3.60	4.76	2.50
23-04-602	182.00	185.84	3.84	4.62	1.76
23-04-603	186.43	184.44	+1.99	5.34	4.83
23-04-801	147.62	161.80	14.18	4.44	6.94
23-05-301	186.35	190.19	3.84	4.59	4.32
23-05-501	200.86	201.90	1.04	3.76	5.32
23-06-101	167.37	168.47	1.10	2.53	0.96
23-06-301	162.29	161.68	+0.61	0.78	4.08
23-06-404	203.73	211.00	7.27	6.19	4.97
23-06-701	0.0	214.70	0.0	4.36	7.66
23-06-802	220.88	223.36	2.48	4.99	3.59
23-07-102	246.45	246.56	0.11	0.11	0.0
23-07-301	227.80	225.26	+2.54	0.45	8.63
23-07-401	273.08	278.72	5.64	6.47	20.07
23-07-501	286.37	287.60	1.23	7.05	8.64
23-07-601	291.34	291.72	0.38	7.15	5.63
23-07-701	207.20	206.60	+0.60	+0.95	7.42
23-08-201	267.95	266.90	+1.05	0.65	2.29
23-08-401	279.00	294.35	15.35	4.12	9.63
23-08-502	266.20	272.03	5.83	3.66	3.07
23-08-701	274.88	277.51	2.63	2.33	1.96
23-12-301	187.44	186.09	+1.35	5.89	6.22
23-12-302	191.50	195.20	3.70	3.70	0.0
23-13-101	185.45	186.17	0.72	3.93	2.31
23-13-302	216.73	220.21	3.48	3.48	0.0
23-14-101	230.50	237.84	7.34	6.23	10.50
23-14-301	233.36	235.05	1.69	4.99	7.97
23-15-201	257.94	263.58	5.64	2.91	5.43
23-15-301	288.89	0.0	0.0	4.38	5.04
23-15-302	285.37	297.75	12.38	5.43	7.44
23-16-101	294.50	297.32	2.82	4.54	9.40

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POTTER COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
06-49-501	197.77	193.53	+4.24	2.42	3.64
07-56-401	216.82	215.94	+0.88	1.60	3.35
07-56-501	0.0	217.94	0.0	2.53	4.93
07-56-601	206.22	209.79	3.57	3.70	2.95

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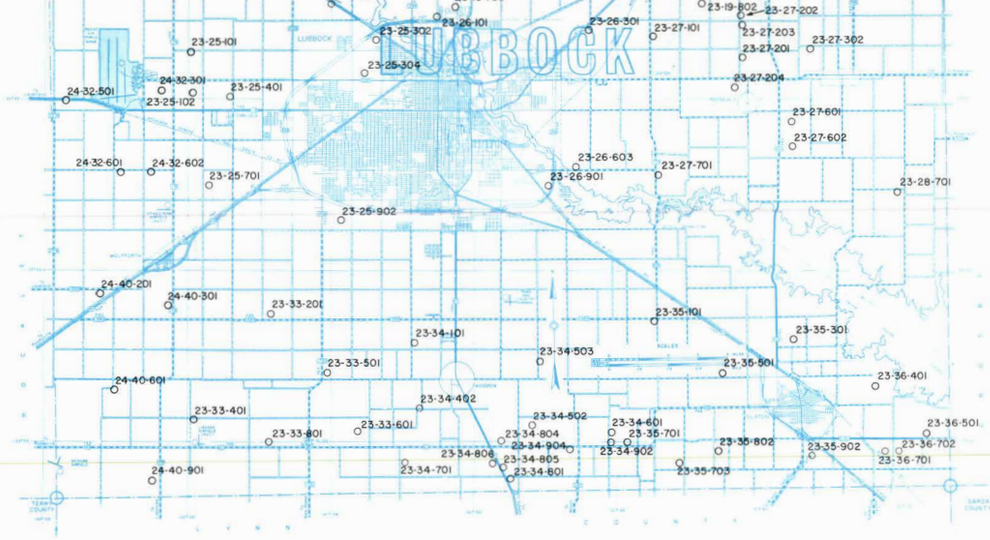

LUBBOCK COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
23-09-501	158.10	158.67	0.57	1.98	1.90
23-09-601	146.43	142.59	+3.84	2.44	3.00
23-09-701	152.66	154.81	2.15	2.83	1.48
23-09-901	194.10	193.73	+0.37	3.02	3.08
23-10-501	180.15	181.11	0.96	2.79	3.05
23-10-801	166.28	166.42	0.14	2.73	2.58
23-11-401	184.98	184.11	+0.87	3.40	4.33
23-11-601	161.61	163.71	2.10	2.23	1.95
23-11-701	178.50	181.99	3.49	4.38	2.59
23-11-702	168.80	169.27	0.47	3.29	1.89
23-11-901	156.05	157.29	1.24	3.77	2.14
23-11-902	159.12	159.72	0.60	2.22	1.52
23-11-903	161.40	164.16	2.76	4.44	2.08
23-12-401	175.20	171.78	+3.42	2.78	4.40
23-12-402	173.79	174.77	0.98	3.06	1.62
23-12-803	167.05	169.66	2.61	3.99	2.18
23-17-202	142.42	142.29	+0.13	1.60	1.44
23-17-501	122.80	124.20	1.40	1.51	2.56
23-17-502	72.36	71.00	+1.36	+1.36	0.0
23-17-701	110.52	109.67	+0.85	1.70	3.61
23-17-703	91.90	93.99	2.09	0.89	4.90
23-17-704	75.56	75.57	0.01	0.68	0.67
23-17-705	81.85	82.57	0.72	0.42	2.85
23-17-706	100.40	99.13	+1.27	1.99	3.94
23-17-801	85.38	87.65	2.27	1.57	0.96
23-17-802	70.05	70.98	0.93	2.08	7.19
23-17-901	79.30	77.74	+1.56	0.53	4.10
23-18-201	152.95	155.05	2.10	3.26	1.92
23-18-301	174.30	177.38	3.08	3.98	4.50
23-18-402	133.55	133.62	0.07	2.67	2.21
23-18-403	125.15	124.76	+0.39	1.45	1.77
23-18-404	140.97	139.80	+1.17	2.65	1.87
23-18-502	121.52	123.66	2.14	2.14	1.83
23-18-601	139.65	139.11	+0.54	2.54	2.23
23-18-701	86.38	83.81	+2.57	+2.57	0.0
23-18-703	85.40	85.30	+0.10	+0.61	3.64
23-18-704	84.55	84.18	+0.37	0.63	0.79
23-19-301	186.03	187.56	1.53	4.81	3.30
23-19-302	188.40	186.43	+1.97	4.95	4.65
23-19-402	154.89	154.30	+0.59	3.44	3.02
23-19-403	157.81	158.67	0.86	3.92	1.80
23-19-501	0.0	181.42	0.0	5.36	0.58
23-19-701	89.79	92.02	2.23	1.92	5.72
23-19-802	94.70	94.49	+0.21	1.43	2.05
23-19-804	93.05	92.67	+0.38	1.69	1.92
23-19-901	147.55	147.69	0.14	4.92	5.83
23-20-401	175.04	176.61	1.57	4.68	3.52
23-20-505	188.45	188.10	+0.35	+0.15	0.20
23-20-701	170.80	176.23	5.43	6.39	12.48
23-20-802	0.0	169.07	0.0	1.48	5.45
23-25-101	141.72	142.67	0.95	1.02	2.45
23-25-102	143.30	143.96	0.66	1.52	2.03
23-25-302	68.50	63.12	+5.38	+1.50	2.40
23-25-304	60.02	57.99	+2.03	+0.91	2.07
23-25-401	141.22	143.40	2.18	1.55	1.68
23-25-701	123.85	123.82	+0.03	1.67	3.06
23-25-902	107.45	104.50	+2.95	0.09	8.60
23-26-101	67.62	68.69	1.07	+0.45	1.44
23-26-301	94.98	94.78	+0.20	0.66	0.74
23-26-603	4.90	3.53	+1.37	+1.16	3.72
23-26-901	50.59	48.89	+1.70	+0.10	4.21
23-27-101	95.15	95.80	0.65	0.82	1.11
23-27-201	91.42	89.91	+1.51	0.70	3.55
23-27-202	85.40	90.48	5.08	2.09	3.96
23-27-203	86.74	87.48	0.74	1.51	1.95
23-27-204	91.08	0.0	0.0	1.32	2.70
23-27-302	78.40	78.50	0.10	1.47	1.82
23-27-601	84.87	85.54	0.67	1.36	1.39
23-27-602	90.08	91.59	1.51	0.56	3.47
23-27-701	83.72	83.58	+0.14	+2.23	2.61
23-28-701	65.52	62.22	+3.30	0.32	2.32
23-33-201	129.68	130.31	0.63	0.65	1.30
23-33-401	104.50	105.82	1.32	0.71	0.90
23-33-501	110.95	111.59	0.64	0.77	1.31
23-33-601	106.45	107.03	0.58	0.70	1.10
23-33-801	99.55	100.08	0.53	0.74	2.48
23-34-101	113.79	114.18	0.39	0.92	2.50
23-34-402	114.55	116.20	1.65	0.20	1.45
23-34-502	135.79	138.10	2.31	1.42	4.38
23-34-503	116.95	117.79	0.84	0.31	2.21
23-34-601	122.34	122.62	0.28	1.10	1.66
23-34-701	117.74	118.98	1.24	0.39	0.85
23-34-801	143.45	143.91	0.46	1.87	2.31
23-34-804	140.96	137.90	+3.06	1.61	3.79
23-34-805	138.02	138.41	0.39	0.39	0.0
23-34-806	0.0	134.97	0.0	0.0	0.0
23-34-902	130.55	131.11	0.56	1.15	1.19
23-34-904	128.42	126.23	+2.19	1.08	2.90
23-35-101	80.84	81.65	0.81	0.03	3.92
23-35-301	116.42	111.56	+4.86	+2.66	2.20
23-35-501	97.90	98.81	0.91	1.80	2.89
23-35-701	132.35	130.55	+1.80	1.96	4.27
23-35-703	130.50	131.14	0.64	1.81	2.06
23-35-802	114.56	115.23	0.67	1.30	1.11
23-35-902	146.65	148.41	1.76	+3.87	5.63
23-36-401	105.43	105.51	0.08	+0.24	0.44
23-36-501	193.72	177.18	+16.54	+2.19	0.96
23-36-701	117.16	117.92	0.76	+0.72	1.49
23-36-702	212.20	0.0	0.0	+2.47	0.0
24-16-501	117.23	119.11	1.88	1.36	1.33
24-16-601	128.10	128.25	0.15	0.76	3.19
24-16-901	168.00	168.10	0.10	0.72	2.58
24-16-902	161.41	159.27	+2.14	1.85	3.14
24-24-201	64.70	65.61	0.91	0.53	7.05
24-24-302	146.70	146.78	0.08	2.28	4.01
24-24-501	138.35	138.62	0.27	2.79	2.87
24-24-601	82.40	81.31	+1.09	1.28	1.98
24-24-901	159.60	158.67	+0.93	3.55	9.75
24-32-301	141.06	141.71	0.65	1.65	2.49
24-32-501	122.35	122.75	0.40	1.07	3.29
24-32-601	127.70	129.28	1.58	1.08	1.75
24-32-602	139.42	141.30	1.88	2.51	3.39
24-40-201	130.88	132.18	1.30	2.27	3.46
24-40-301	143.22	144.57	1.35	0.56	4.40
24-40-601	118.98	120.29	1.31	0.46	3.41
24-40-901	69.80	68.95	+0.85	0.36	0.84

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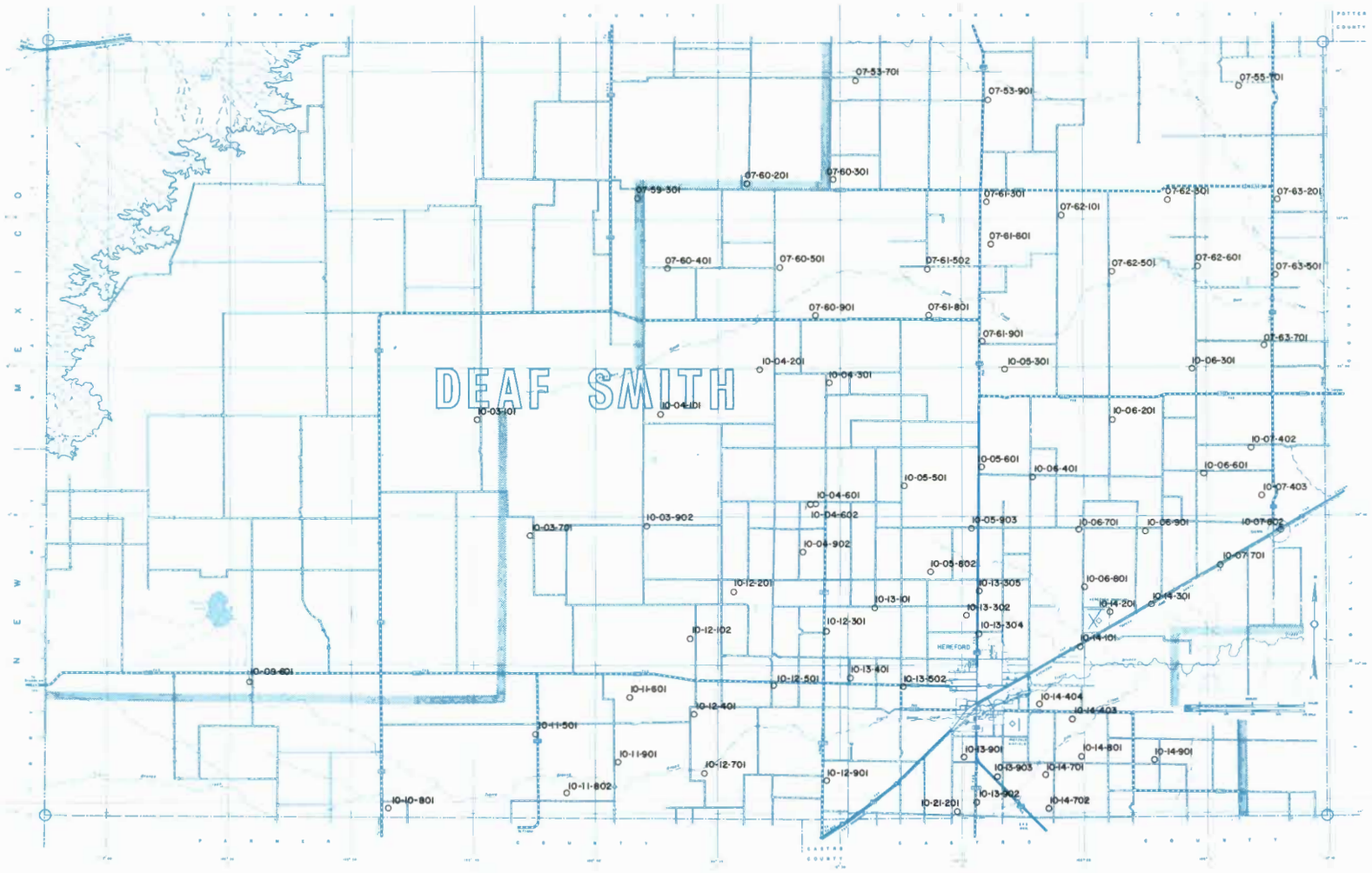
Water Level Measurements In Observation Wells In High Plains Water District



DEAF SMITH COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
07-53-701	224.17	226.30	2.13	2.72	1.03
07-53-901	222.62	221.50	+1.12	4.17	5.49
07-55-701	208.68	215.44	6.76	4.55	3.93
07-59-301	309.29	310.99	1.70	2.72	5.84
07-60-201	279.52	279.67	0.15	2.71	1.84
07-60-301	251.78	259.11	7.33	4.09	1.92
07-60-401	287.07	283.70	+3.37	0.39	13.88
07-60-501	241.88	243.20	1.32	4.06	2.66
07-60-901	204.22	205.82	1.60	1.58	1.66
07-61-301	206.41	212.43	6.02	3.45	3.45
07-61-502	0.0	185.02	0.0	0.0	0.0
07-61-601	181.52	182.55	1.03	3.18	0.98
07-61-801	178.96	183.05	4.09	2.72	1.78
07-61-901	158.53	162.78	4.25	2.97	0.91
07-62-101	196.45	200.10	3.65	4.88	4.30
07-62-301	181.10	176.30	+4.80	1.80	4.22
07-62-501	150.77	154.40	3.63	2.50	3.13
07-62-601	172.80	178.35	5.55	5.55	2.80
07-63-201	177.38	0.0	0.0	4.03	3.05
07-63-501	125.09	119.20	+5.89	1.15	4.75
07-63-701	148.36	147.68	+0.68	2.68	5.12
10-03-101	299.51	305.47	5.96	2.38	1.73
10-03-701	221.11	222.02	0.91	+0.60	2.59
10-03-902	238.59	241.40	2.81	3.67	0.82
10-04-101	300.62	0.0	0.0	3.65	1.34
10-04-201	0.0	268.60	0.0	4.75	0.0
10-04-301	262.41	265.74	3.33	4.94	1.82
10-04-601	229.48	0.0	0.0	5.63	1.40
10-04-602	0.0	233.80	0.0	0.0	0.0
10-04-902	170.52	174.40	3.88	2.43	4.16
10-05-301	153.18	155.44	2.26	2.57	5.99
10-05-501	186.32	180.98	+5.34	5.71	4.93
10-05-601	141.04	146.73	5.69	4.24	1.60
10-05-802	142.59	143.74	1.15	3.16	2.56
10-05-903	155.05	157.10	2.05	4.10	2.19
10-06-201	141.56	149.90	8.34	4.00	6.92
10-06-301	159.68	163.44	3.76	4.20	0.66
10-06-401	154.18	159.28	5.10	4.04	2.81
10-06-601	157.99	0.0	0.0	5.38	4.84
10-06-701	67.37	73.84	6.47	2.70	3.05
10-06-801	80.99	79.63	+1.36	1.69	3.69
10-06-901	128.30	132.05	3.75	3.50	1.52
10-07-402	139.21	141.20	1.99	3.90	2.22
10-07-403	128.16	129.52	1.36	4.10	2.08
10-07-701	128.05	124.49	+3.56	3.25	4.24
10-07-802	138.79	138.12	+0.67	2.01	19.56
10-09-601	57.11	58.50	1.39	+0.81	4.57
10-10-801	197.80	0.0	0.0	1.70	0.79
10-11-501	186.05	185.25	+0.80	1.66	3.56
10-11-601	169.28	0.0	0.0	2.60	5.25
10-11-802	192.38	196.59	4.21	4.28	1.46
10-11-901	163.29	165.17	1.88	+1.90	0.45
10-12-102	154.24	157.22	2.98	2.56	6.48
10-12-201	79.45	73.34	+6.11	0.71	3.06
10-12-301	157.12	159.60	2.48	3.80	6.20
10-12-401	182.46	192.45	9.99	5.78	4.05
10-12-501	202.56	193.88	+8.68	5.04	5.80
10-12-701	152.95	154.55	1.60	4.29	2.83
10-12-901	141.57	143.40	1.83	3.90	3.85
10-13-101	0.0	172.63	0.0	4.99	1.86
10-13-302	135.14	146.80	11.66	5.59	7.58
10-13-304	152.55	146.70	+5.85	3.96	5.88
10-13-305	127.17	139.27	12.10	5.26	5.42
10-13-401	145.95	149.70	3.75	4.07	1.54
10-13-502	165.40	0.0	0.0	4.38	3.56
10-13-901	140.97	143.75	2.78	2.71	1.64
10-13-902	150.63	153.16	2.53	3.51	0.88
10-13-903	156.94	158.95	2.01	4.04	2.72
10-14-101	75.18	74.90	+0.28	0.05	2.04
10-14-201	114.32	107.70	+6.62	4.60	7.16
10-14-301	76.19	78.82	2.63	1.20	5.90
10-14-403	115.61	120.00	4.39	3.29	1.22
10-14-404	121.73	122.80	1.07	4.09	3.06
10-14-701	168.20	167.15	+1.05	3.45	4.51
10-14-702	154.10	162.82	8.72	2.97	9.44
10-14-801	140.80	142.36	1.56	2.51	1.15
10-14-901	108.38	107.25	+1.13	0.67	1.15
10-21-201	182.63	186.72	4.09	4.76	3.63

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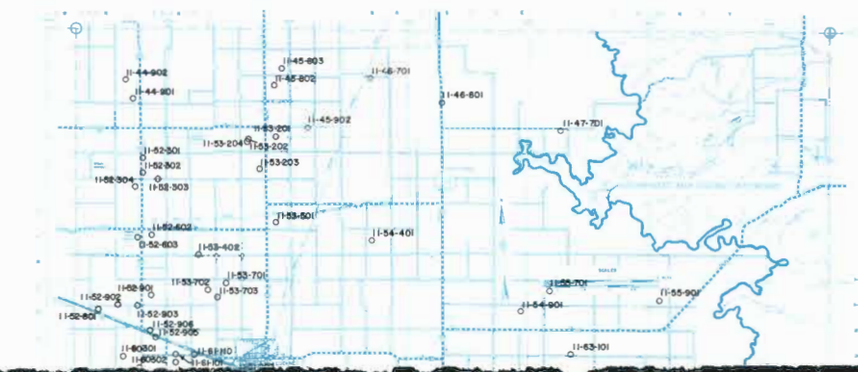

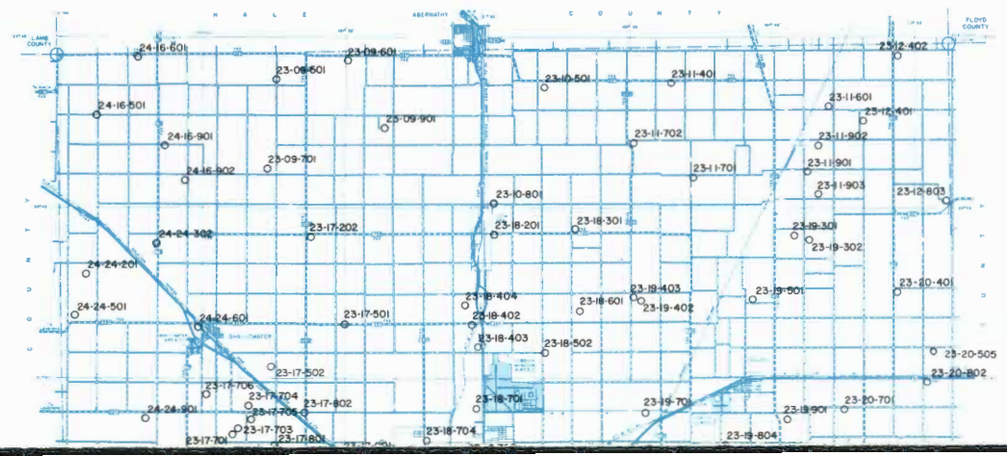

RANDALL COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
06-49-701	0.0	223.10	0.0	3.25	1.87
06-49-902	205.13	202.52	+2.61	0.88	1.50
06-57-202	188.71	189.26	0.55	2.25	1.72
06-57-401	170.82	168.48	+2.34	2.02	4.73
06-57-601	167.06	167.72	0.66	2.33	1.99
06-57-802	143.24	144.13	0.89	2.48	4.74
07-55-901	187.16	188.26	1.10	3.79	5.29
07-56-701	200.70	202.27	1.57	4.55	1.86
07-56-702	0.0	220.73	0.0	4.10	3.85
07-56-902	0.0	190.73	0.0	3.06	2.66
07-63-301	0.0	202.06	0.0	4.65	8.77
07-63-601	146.23	147.30	1.07	3.00	1.65
07-63-902	125.79	129.80	4.01	2.18	1.47
07-64-101	0.0	204.68	0.0	4.69	5.95
07-64-302	152.28	0.0	0.0	1.81	4.36
07-64-402	108.20	103.04	+5.16	0.42	2.56
07-64-501	135.40	0.0	0.0	0.51	1.23
07-64-903	155.80	148.12	+7.68	1.93	6.91
10-07-301	123.26	124.70	1.44	1.38	3.45
10-07-601	106.49	96.96	+9.53	0.94	5.75
10-08-102	138.86	138.00	+0.86	0.86	1.11
10-16-901	187.00	190.19	3.19	2.08	2.80
11-09-301	158.74	159.76	1.02	0.45	2.74
11-09-501	184.77	179.52	+5.25	0.96	4.55
11-09-601	193.68	194.02	0.34	0.86	2.40
11-09-801	188.09	188.06	+0.03	1.83	2.24
11-09-901	186.10	191.26	5.16	3.10	1.31
11-10-402	171.41	181.47	10.06	1.50	4.51
11-10-802	173.99	172.57	+1.42	1.69	3.60
11-10-901	0.0	124.33	0.0	0.0	0.0
11-11-502	160.58	160.63	0.05	0.42	4.19
11-11-801	109.51	110.62	1.11	1.93	0.95
11-11-901	115.90	116.83	0.93	2.12	3.11

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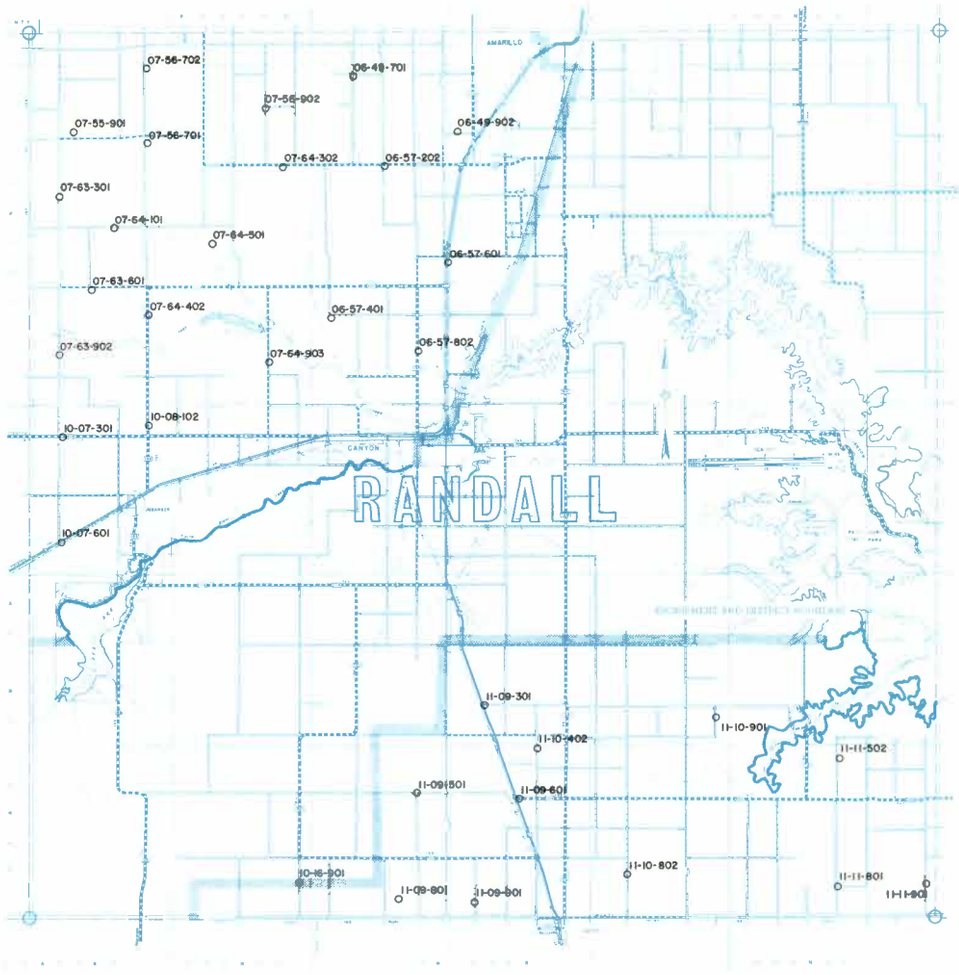

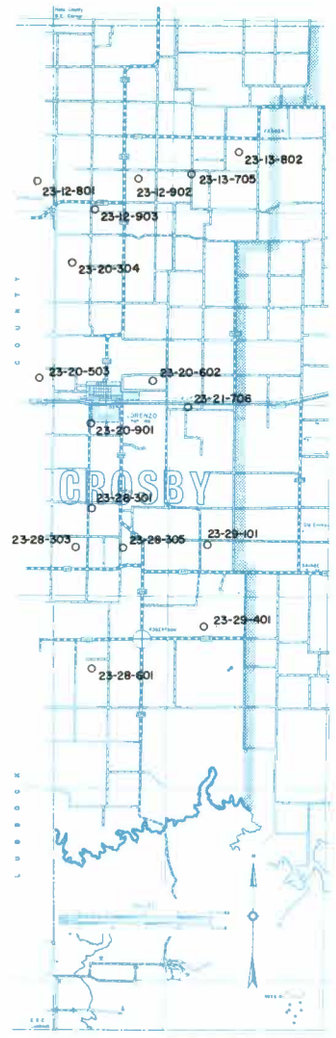

CROSBY COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
23-12-801	182.91	186.40	3.49	4.89	4.0
23-12-902	199.90	203.44	3.54	2.23	2.5
23-12-903	198.46	207.00	8.54	4.41	6.7
23-13-705	195.49	202.90	7.41	6.33	6.5
23-13-802	185.96	193.94	7.98	4.75	3.4
23-20-304	175.67	0.0	0.0	3.66	2
23-20-503	183.88	187.46	3.58	4.30	3
23-20-602	188.17	189.88	1.71	3.06	9
23-20-901	186.37	192.24	5.87	4.46	4
23-21-706	198.42	199.07	0.65	4.98	3
23-28-301	155.40	156.18	0.78	3.20	13
23-28-303	119.13	128.05	8.92	1.31	8
23-28-305	151.82	158.82	7.00	1.66	6
23-28-601	0.0	152.26	0.0	4.47	6
23-29-101	0.0	192.62	0.0	1.23	10
23-29-401	0.0	208.46	0.0	3.64	4

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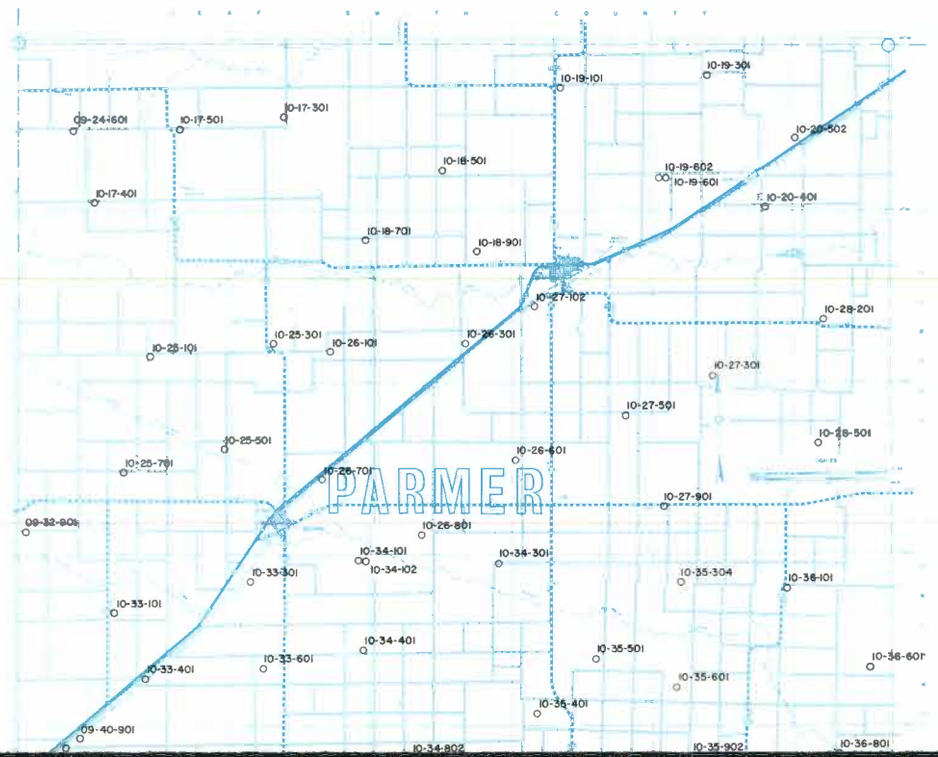

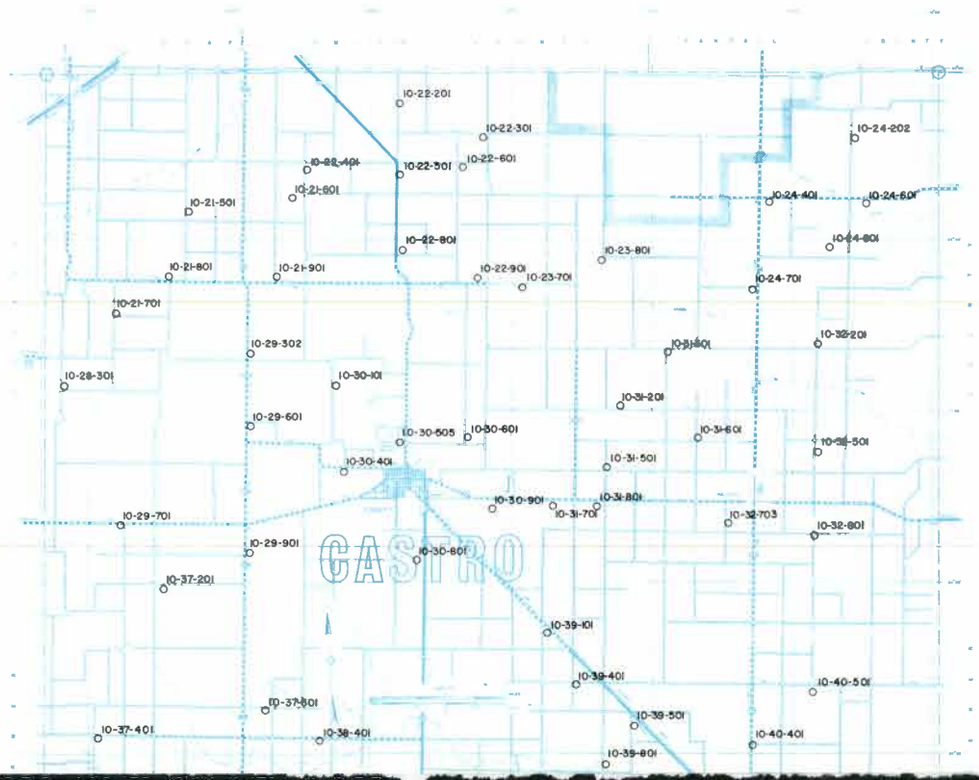

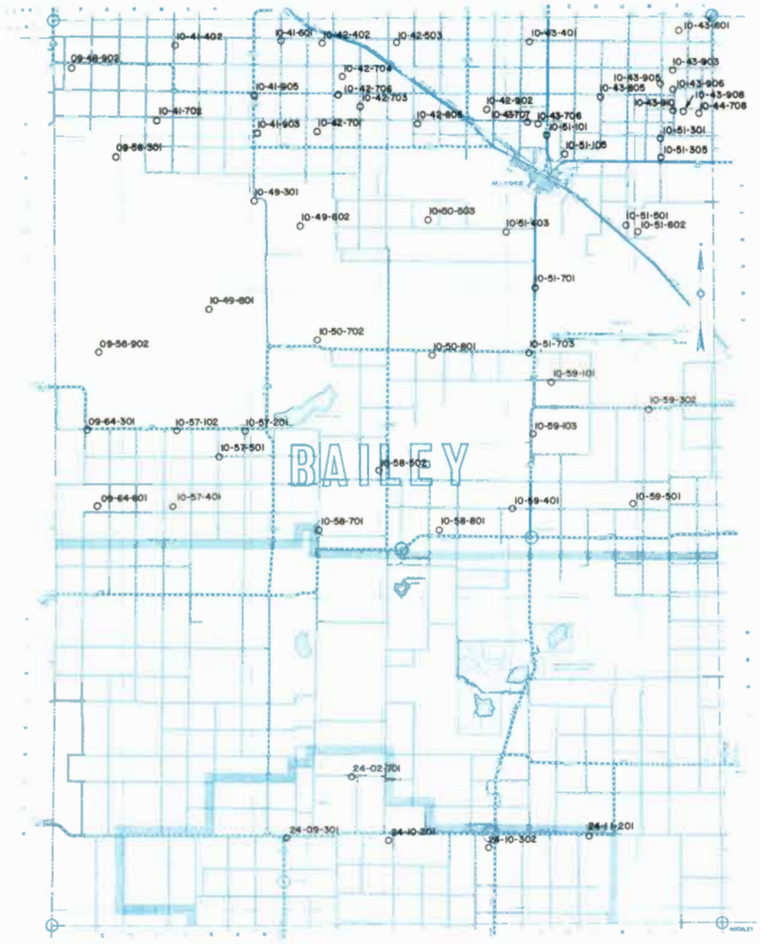

BAILEY COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
09-48-902	137.17	133.67	+3.50	2.75	3.17
09-56-301	83.22	70.60	+12.62	1.14	6.43
09-56-902	39.99	40.05	0.06	0.23	0.08
09-64-301	58.17	54.40	+3.77	0.50	2.62
09-64-601	129.10	133.24	4.14	1.02	4.26
10-41-402	163.42	143.34	+20.08	2.87	10.94
10-41-601	152.50	132.66	+19.84	2.97	9.90
10-41-702	101.67	88.45	+13.22	2.19	6.33
10-41-903	87.15	77.13	+10.02	2.10	6.34
10-41-905	106.48	104.14	+2.34	2.73	3.38
10-42-402	120.20	119.58	+0.62	2.40	1.62
10-42-503	118.43	112.95	+5.48	2.42	4.44
10-42-701	86.38	88.52	2.14	2.88	1.85
10-42-703	106.74	94.11	+12.63	2.00	7.18
10-42-704	111.96	106.04	+5.92	2.23	5.69
10-42-706	102.96	104.41	1.45	1.45	0.0
10-42-805	85.18	73.80	+11.38	2.13	6.91
10-42-902	87.55	79.38	+8.17	1.94	6.26
10-43-401	114.23	113.76	+0.47	3.22	3.07
10-43-601	117.07	119.96	2.89	3.16	1.23
10-43-706	78.30	80.26	1.96	1.56	2.18
10-43-707	0.0	80.79	0.0	1.48	2.71
10-43-805	81.26	85.98	4.72	2.79	1.88
10-43-903	109.89	98.95	+10.94	2.89	7.64
10-43-905	91.75	86.12	+5.63	2.58	5.05
10-43-906	0.0	86.25	0.0	2.69	0.0
10-43-908	79.24	80.52	1.28	2.12	1.63
10-43-910	96.98	81.40	+15.58	2.64	10.16
10-44-708	81.38	82.82	1.44	2.38	1.62
10-49-301	32.92	34.17	1.25	1.04	2.82
10-49-602	59.46	51.22	+8.24	1.24	4.31
10-49-801	75.90	76.00	0.10	0.26	0.25
10-50-503	58.83	56.10	+2.73	2.53	3.06
10-50-702	88.27	87.50	+0.77	0.76	0.95
10-50-801	72.37	70.62	+1.75	0.16	1.69
10-51-101	67.65	68.76	1.11	1.15	0.77
10-51-105	61.95	58.92	+3.03	2.05	3.87
10-51-301	61.81	62.34	0.53	1.74	3.52
10-51-305	53.89	55.51	1.62	1.27	2.30
10-51-403	37.43	36.59	+0.84	0.87	2.52
10-51-501	33.40	37.30	3.90	1.52	2.12
10-51-602	36.60	38.70	2.10	1.67	1.57
10-51-701	70.64	66.94	+3.70	0.83	5.89
10-51-703	94.96	88.96	+6.00	0.87	5.44
10-57-102	87.31	79.12	+8.19	0.21	4.87
10-57-201	28.97	27.11	+1.86	0.14	1.96
10-57-401	115.48	111.46	+4.02	0.13	3.06
10-57-501	38.05	32.40	+5.65	+0.59	3.14
10-58-502	73.98	72.82	+1.16	+0.30	1.29
10-58-701	49.12	46.87	+2.25	0.06	1.75
10-58-801	22.56	19.51	+3.05	0.05	3.31
10-59-101	115.32	112.57	+2.75	+0.52	4.69
10-59-103	95.38	104.61	9.23	1.47	4.55
10-59-302	119.16	109.89	+9.27	0.60	6.40
10-59-401	113.42	114.30	0.88	1.34	7.05
10-59-501	112.88	100.10	+12.78	+0.38	6.35
24-02-701	59.04	58.84	+0.20	+0.08	1.92
24-09-301	88.61	87.30	+1.31	+0.32	0.64
24-10-201	115.78	114.09	+1.69	1.82	7.31
24-10-302	97.36	88.81	+8.55	+0.28	7.39
24-11-201	121.28	103.39	+17.89	+0.63	10.77

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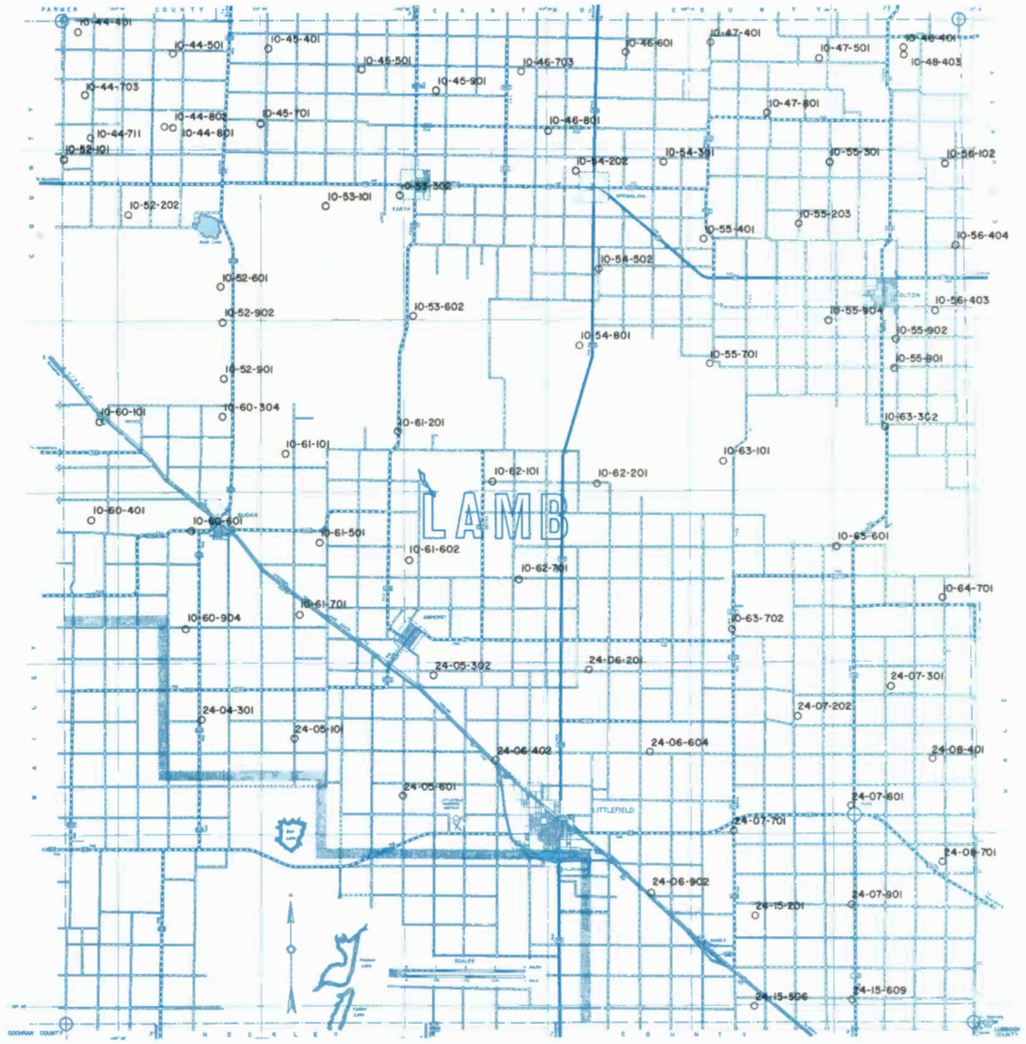

LAMB COUNTY

Well No.	Depth To Water 69	Depth To Water 70	Decline 1969-1970	Average Decline 1962-1970	Standard Deviation
10-44-401	135.94	131.09	+4.85	3.46	6.41
10-44-501	125.84	129.99	4.15	3.41	2.27
10-44-703	0.0	95.96	0.0	2.29	1.64
10-44-711	78.13	79.59	1.46	1.46	0.0
10-44-801	88.86	0.0	0.0	3.55	3.69
10-44-802	75.39	76.86	1.47	1.47	0.0
10-45-401	128.57	132.16	3.59	3.39	1.21
10-45-501	142.62	145.98	3.36	2.32	2.18
10-45-701	91.37	91.76	0.39	2.91	1.26
10-45-901	145.34	149.02	3.68	2.80	2.60
10-46-601	166.22	169.16	2.94	3.31	3.12
10-46-703	159.12	161.93	2.81	3.27	1.03
10-46-801	154.83	0.0	0.0	3.55	0.0
10-47-401	142.55	145.60	3.05	3.32	1.88
10-47-501	141.05	141.71	0.66	3.67	2.26
10-47-801	168.04	172.14	4.10	3.14	1.27
10-48-401	152.20	0.0	0.0	3.76	1.79
10-48-403	152.98	156.41	3.43	3.43	0.0
10-52-101	70.55	72.24	1.69	1.82	1.93
10-52-202	41.90	43.77	1.87	1.87	0.0
10-52-601	32.25	32.76	0.51	0.58	0.49
10-52-901	64.69	65.76	1.07	0.84	0.83
10-52-902	50.72	51.30	0.58	0.61	0.42
10-53-101	58.21	60.16	1.95	0.18	4.00
10-53-302	79.72	81.22	1.50	2.21	1.08
10-53-602	51.76	52.83	1.07	1.35	0.70
10-54-202	130.76	132.92	2.16	2.55	1.84
10-54-301	158.26	160.83	2.57	3.57	2.38
10-54-502	98.31	99.62	1.31	2.00	2.59
10-54-801	66.96	67.77	0.81	0.98	0.35
10-55-203	160.17	163.49	3.32	3.73	1.44
10-55-301	177.35	182.33	4.98	4.14	1.76
10-55-401	0.0	158.34	0.0	1.88	4.47
10-55-701	87.84	80.26	+7.58	1.27	5.12
10-55-901	116.68	119.61	2.93	2.95	1.11
10-55-902	141.56	142.27	0.71	3.40	1.48
10-55-904	133.24	136.46	3.22	3.23	1.60
10-56-404	193.61	189.92	+3.69	5.35	8.06
10-60-101	120.18	0.0	0.0	1.38	2.24
10-60-304	70.62	71.27	0.65	0.44	3.49
10-60-401	0.0	124.61	0.0	0.25	4.12
10-60-601	100.92	97.41	+3.51	+1.55	4.36
10-60-904	145.71	139.10	+6.61	0.18	4.63
10-61-101	69.54	71.19	1.65	1.04	3.18
10-61-201	58.64	56.17	+2.47	0.93	2.72
10-61-501	109.01	110.89	1.88	0.79	4.99
10-61-602	98.11	91.16	+6.95	0.16	3.49
10-61-701	114.27	118.19	3.92	1.99	2.12
10-62-101	51.52	52.67	1.15	0.91	0.81
10-62-201	100.70	99.59	+1.11	1.13	1.68
10-62-701	120.37	121.09	0.72	1.97	2.99
10-63-101	0.0	59.24	0.0	+0.90	12.73
10-63-302	99.29	99.65	0.36	0.36	0.0
10-63-601	101.28	103.87	2.59	0.41	4.50
10-63-702	134.55	137.67	3.12	2.20	1.66
10-64-701	113.39	115.39	2.00	1.60	2.45
24-04-301	59.16	54.00	+5.16	0.01	2.76
24-05-101	40.22	39.74	+0.48	0.38	0.77
24-05-302	0.0	105.34	0.0	1.23	1.74
24-05-601	100.20	83.93	+16.27	+0.98	7.01
24-06-201	135.72	127.21	+8.51	1.57	5.48
24-06-402	84.71	87.19	2.48	0.60	1.67
24-06-604	121.98	118.43	+3.55	1.53	4.93
24-06-902	97.16	95.71	+1.45	1.99	3.11
24-07-202	145.87	146.71	0.84	1.90	3.39
24-07-301	128.38	0.0	0.0	2.11	1.84
24-07-601	144.00	143.02	+0.98	1.56	1.62
24-07-701	135.13	137.54	2.41	1.81	2.54
24-07-901	109.59	110.75	1.16	1.35	4.57
24-08-401	0.0	147.17	0.0	1.61	3.34
24-08-701	127.13	127.05	+0.08	2.01	2.54
24-15-201	0.0	113.67	0.0	1.42	6.30
24-15-506	82.10	80.86	+1.24	1.62	2.02
24-15-609	137.64	130.38	+7.26	1.87	4.37

THE Cross SECTION

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FRANK RAYNER, Editor

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Water Statement . . .

—continued from page 1

as measured in 1962 and 1970. This table also lists the average depth to water in each respective county for these two years.

The table, "Average Decline of the Water Table", shows the average annual decline in the water levels in all wells measured in the respective counties for 1962 through 1970, as compared with the average decline for 1969-1970. This table shows the relatively "light" 1969-70 decline, as compared with the long-term average.

MINIMUM AND MAXIMUM

The maximum average decline for a single county during 1969 was the 4.91 feet for the 58 wells measured in Parmer County.

The minimum average decline (disregarding the counties wherein there was a net rise in water levels) for a single county during 1969 was 0.12 feet for the 114 wells measured in Lubbock County.

In six counties, Bailey, Cochran, Hale, Lynn, Potter and Randall, the 1969-1970 change was a net rise — ranging from 0.06 feet in Randall to 3.88 feet in Bailey. The abnormally large rise in water levels in Bailey county are believed to have resulted from the measurement of improper (not observation) wells.

For the individual counties the maximum, eight-year average annual decline was 4.02 feet per well in Parmer County; while the minimum eight-year average annual decline was the 0.80 feet per well in Lynn County.

DISTRICT AVERAGE

In 1962, the average of the depths to water below land surface as measured in all observation wells throughout the District was approxmately 128 feet, this average had increased to more than 148 feet in 1970.

District-wide, the average decline for 1969 was 0.94 feet per well. This is less than 37 percent of the average decline of 2.5 feet per well, per year, from 1962 to 1970.

STATUS OF PROGRAM

The table, "Observation Wells in the District", lists the total number of current observation wells within each county in the District, and the percentage of these wells that were measured in 1970. During January and February, 1970, nearly 90 percent of the observation wells within the District were measured.

OBSERVATION WELLS IN DISTRICT

County	Number of Current Wells	Percent Measured 1970
Armstrong	9	100.0
Bailey	63	96.8
Castro	74	82.4
Cochran	55	96.4
Crosby	16	93.8
Deaf Smith	85	83.5
Floyd	109	86.2
Hale	18	83.3
Hockley	76	98.7
Lamb	79	89.9
Lubbock	126	90.5
Lynn	30	93.3
Parmer	69	84.1
Potter	4	100.0
Randall	36	86.1

Shurbet . . .

—continued from page 1

America, cost-in-water-depletion, income-tax allowance case—an effort that has culminated in millions of dollars in tax allowances for groundwater owners in this area.

Mr. Shurbet brings a wealth of knowledge and practical experience to this most important position.

Governor Smith also appointed Searcy Bracewell, Houston, and John H. McCoy, New Boston, to this Board. Other members are W.E. Tinsley, Austin, and Milton T. Potts, Livingston.

ROBERT V. THURMOND

Robert V. Thurmond died of a heart attack on February 13. Bob, as he was affectionately known throughout Texas, was born in Quanah, Texas, in 1923.

After graduating from Texas A & M University in 1947, he began his water conservation and development career as the assistant county agent for Lamb County, Texas. He later became the first irrigation specialist for the Texas A & M University, Agricultural Extension Service, in charge of the entire High Plains of Texas. In this position, Bob pioneered the early efforts to promote the proper gravel packing of irrigation wells. He was also successful in establishing other improved and new irrigation practices.

After taking time out to earn a Masters Degree from Utah State University in 1951, Bob returned to Texas as the irrigation and drainage engineer for the Extension Service. He continued in the position until early in 1958, when he joined the State Board of Water Engineers (now Texas Water Development Board) as chief planning engineer.

In 1959, Bob joined the staff of Portland Cement Association in Austin. He was the senior water resources engineer for that organization at the time of his death.

During the early 1960's, Bob worked very closely with the District in investigating and developing the practices of artificially recharging the Ogallala formation. Throughout the years, his association and assistance to the District resulted in the development of other notable water conservation practices. The District, and the entire Texas water community, will miss the energetic public service and friendship of Bob.

CHARLES E. JACOB

On January 30th, Charles E. Jacob succumbed to a heart attack.

Mr. Jacob was born on September 3, 1914, in Mesa, Arizona. He received his Bachelor of Science degree in Civil Engineering from the University of Utah in 1935, and a Master of Science degree from Columbia University in 1936.

He commenced what was to become a world famous career in ground-water hydrology when he joined the staff of the Ground water division of the U.S. Geological Survey in 1936. He had been a member of the staff of the University of Utah, Brigham Young University, and the New Mexico Institute of Mining and Technology; as well as guest lecturer for several other colleges and universities.

In 1947, Mr. Jacob entered the then infant field of consulting groundwater hydrology. He was a consultant to several foreign governments, and to United States' interests abroad.

He authored numerous articles, published in several technical journals, and several of his works have been published in textbooks on groundwater hydrology, and hydraulics.

Mr. Jacob was a key witness for the District sponsored Shurbet vs. the United States of America—the cost-in-water depletion, income-tax allowance case. His testimony regarding the gross mathematical model that he developed for the Ogallala aquifer, and the digital computer routines for its solution, were very effective in helping the District to secure a favorable decision in this case.

His many works, that made practical the application of the science of ground-water hydrology, will continue as living memorials of his contributions to his chosen profession.

HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

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THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 3 "THERE IS NO SUBSTITUTE FOR WATER" *March, 1970*

Aquifer Model Research Reviewed

The sixth quarterly planning and review meeting of the participants in the aquifer model research project was held in the District's office on March 4, 1970.

Those in attendance were: Bill Claborn and Dr. Dan Wells, Texas Tech University; Dr. David Kleinecke and Charles Meyer, General Electric TEMPO, Santa Barbara, California; Dr. David K. Todd, University of California at Berkeley, California; Albert Sechrist and Frank Rayner of the District.

Model-Run

Mr. Claborn presented digital computer printouts of a test run of the aquifer management model being investigated. He noted the apparent "insensitivity" (not a critical or controlling factor) of the research model to subsurface inflow and outflow of groundwater into and out of the individual polygonal divisions (preselected segments of the aquifer) of the model.

The discussion that followed this disclosure indicated that in relatively thin, large (in areal extent) water table aquifers experiencing nearly uniform well development, the ratio of the subsurface inflow and outflow will remain essentially the same as that established prior to development. The results of the first model runs indicate that throughout a considerable part of the modeled area — except near boundaries — this appears to be the condition within the Ogallala aquifer. The model will be revised to print out underflow values, in order to determine their magnitude.

The possibility of using historical water-level data to determine net withdrawal—by running the model backwards—was considered, and will be investigated if major model revisions will not be necessitated.

Discussed at length were the possible approaches to modeling the aquifer as it progresses through successive stages of depletion and retreats into a series of buried channels. This problem will be the significant part of the next phase of this research.

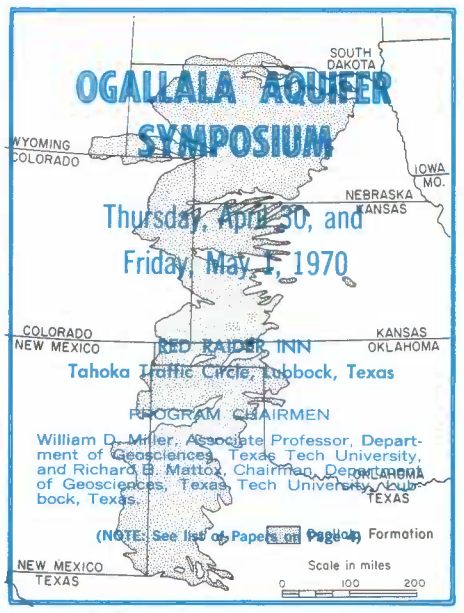
Pumpage Controlling Factor

The first model runs indicate that the primary controlling input information to the model is pumpage data.

Mr. Sechrist presented maps and computer printouts showing the magnitude of the task of determining pumpage employing energy routines; and the necessity for more reliance upon computers to perform some of these tasks.

This research is being funded by a grant to Texas Tech University and the District, and a complementary grant to General Electric TEMPO, from the Office of Water Resources Research, Department of the Interior, Washington, D. C.; Dr. H. Garland Hershey, Executive Director. The first phase of this research is scheduled to be completed by August 1, 1970.

Dr. Kleinecke (foreground), Meyer, Dr. Todd, Sechrist, and Dr. Wells review energy data to be used as model input.



AVERAGE WATER TABLE DECLINE

The average annual decline of the water-table in the Ogallala Formation, for each of the years from January 1962 to January 1970, is shown by the map on pages 2 and 3.

The table on page 2 is a complete analysis of the water-table conditions shown on this map.

HOW TO READ THE TABLE

Within Floyd County there are approximately 579,400 acres in the District. Under 189, 464 acres in this county, or 32.7 percent of the land surface, there was no decline of the water table. Beneath 73,005 acres, or 12.6 percent of the land surface in this county that is within the District, the water table declines, on an average, from 4 to 5 feet. Within this area, a net total of approximately 65,705 acre feet of water was extracted (pumped) from the aquifer. In an average year, a net total of 295,668 acre-feet of water is pumped from the Ogallala Formation in this county.

The pumpage values listed are net figures based upon the dewatering of the aquifer—somewhat more water is

—continued on page 4

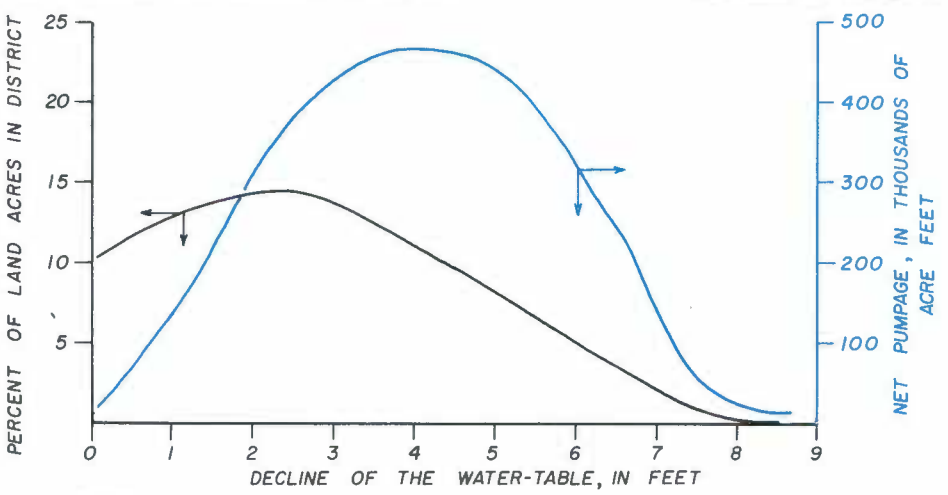


FIGURE 1—Average Annual Distribution of the Water-Table Decline and Net Pumpage.

MEETINGS

County Committees

The annual dinner meetings of the County Committeemen will be held between April 13 and 25.

This year, a joint meeting of all Committeemen in each Director's precinct will be held. This arrangement will provide for the attendance of a maximum number of the staff, and the Director from that precinct.

Arrangements for the time and place of each of the five meetings will be made through the respective Directors. County secretaries will be informed well in advance of such meetings. Any suggestions or recommendations regarding conflicts, or preferred dates, should be forwarded to the District's Lubbock office as soon as possible.

Reports regarding the condition and activities of the District will be made by the Manager and other members of the staff.

Committeemen will be asked to consider revision of the election procedures, as they apply to committeemen; and recommendations regarding the District's tailwater abatement program will be sought.

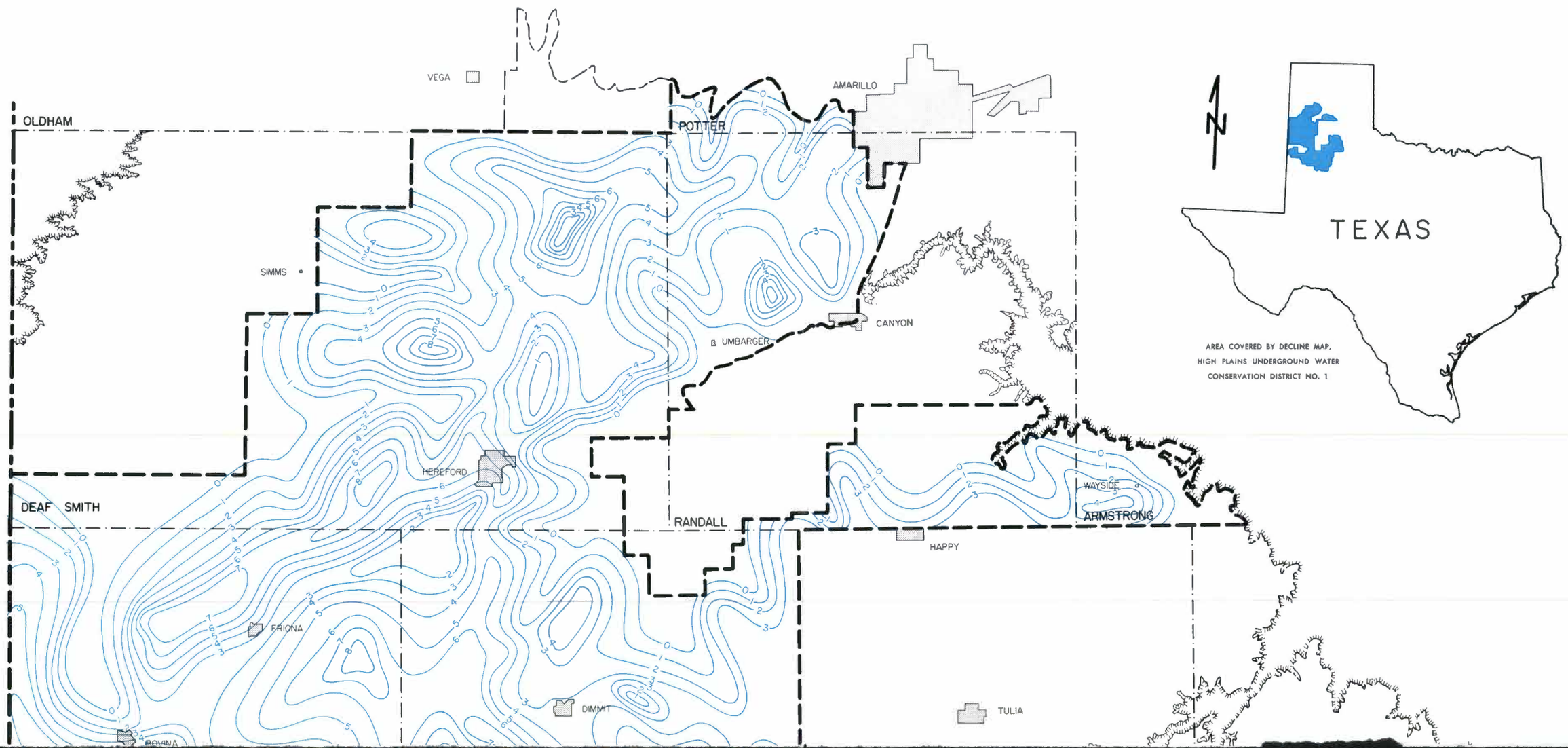
This is the one annual meeting that provides for the exchange of ideas regarding the *management of your District*. All of the 75 Committeemen, County secretaries, and their wives are urged to attend these most important meetings.

Average Annual Decline of the Water Table in the Ogallala Formation, High Plains Underground Water Conservation District No. 1

COUNTY	Acres In District	No Decline	0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	More Than 8
	ACRES WITHIN EACH WATER-TABLE DECLINE INTERVAL—FROM ZERO TO MORE THAN 8 FEET										
Armstrong	41,600	22,256	4,826	4,368	4,160	4,243	1,747				
Bailey	353,900	139,437	37,513	35,744	38,221	33,620	44,238	25,127			
Castro	539,700	14,032	23,207	74,479	94,447	127,909	90,670	78,796	32,382	3,778	
Cochran	219,000	101,178	49,056	42,048	21,681	3,723	1,314				
Crosby	88,800	7,992	6,749	16,428	18,914	15,718	13,675	5,950	3,374		
Deaf Smith	529,200	70,913	48,686	63,504	86,260	76,205	86,260	54,508	30,693	7,938	4,233
Floyd	579,400	189,464	37,661	46,931	49,828	71,266	73,005	53,305	44,614	9,850	3,476
Hale	156,100	30,908	15,454	20,137	24,352	30,127	18,264	13,424	3,434		
Hockley	577,800	216,097	126,538	106,315	71,069	50,269	7,512				
Lamb	550,200	116,092	97,385	125,446	110,590	56,671	27,510	9,903	6,603		
Lubbock	580,900	239,331	73,774	74,936	52,281	58,671	40,663	20,912	20,332		
Lynn	154,100	117,424	17,567	9,400	6,318	2,312	1,079				
Parmer	546,400	24,588	16,392	34,970	108,733	103,816	100,538	93,981	51,361	12,021	
Potter	18,500	3,922	5,106	5,495	3,977						
Randall	280,000	74,480	54,320	54,880	65,520	20,720	8,680	1,400			
TOTAL FOR DISTRICT	5,215,600	1,368,114	614,234	715,081	756,351	655,270	515,155	357,306	192,793	33,587	7,709

COUNTY	No. Decline	0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	More Than 8
	PERCENT OF THE TOTAL ACRES IN EACH COUNTY IN EACH DECLINE INTERVAL									
Armstrong	53.5	11.6	10.5	10.0	10.2	4.2				
Bailey	39.4	10.6	10.1	10.8	9.5	12.5	7.1			
Castro	2.6	4.3	13.8	17.5	23.7	16.8	14.6	6.0	0.7	
Cochran	46.2	22.4	19.2	9.9	1.7	0.6				
Crosby	9.0	7.6	18.5	21.3	17.7	15.4	6.7	3.8		
Deaf Smith	13.4	9.2	12.0	16.3	14.4	16.3	10.3	5.8	1.5	0.8
Floyd	32.7	6.5	8.1	8.6	12.3	12.6	9.2	7.7	1.7	0.6
Hale	19.8	9.9	12.9	15.6	19.3	11.7	8.6	2.2		
Hockley	37.4	21.9	18.4	12.3	8.7	1.3				
Lamb	21.1	17.7	22.8	20.1	10.3	5.0	1.8	1.2		
Lubbock	41.2	12.7	12.9	9.0	10.1	7.0	3.6	3.5		
Lynn	76.2	11.4	6.1	4.1	1.5	0.7				
Parmer	4.5	3.0	6.4	19.9	19.0	18.4	17.2	9.4	2.2	
Potter	21.2	27.6	29.7	21.5						
Randall	26.6	19.4	19.6	23.4	7.4	3.1	0.5			
TOTAL FOR DISTRICT	26.23	11.78	13.71	14.50	12.56	9.88	6.85	3.70	0.64	0.15

COUNTY	0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6	6 to 7	7 to 8	More Than 8	Total For County
	NET ACRE FEET OF WATER PUMPED FROM THE OGALLALA FORMATION WITHIN EACH DECLINE INTERVAL—ASSUMING A RECOVERY (STORAGE) FACTOR OF 20 PERCENT									
Armstrong	483	1,310	2,080	2,970	1,572					8,415
Bailey	3,751	10,723	19,110	23,534	39,814	27,640				124,573
Castro	2,321	22,344	47,224	89,536	81,603	86,676	42,097	5,667		377,466
Cochran	4,906	12,614	10,840	2,606	1,183					32,149
Crosby	675	4,928	9,457	11,003	12,308	6,545	4,386			49,302
Deaf Smith	4,869	19,051	43,130	53,344	77,634	59,959	39,901	11,907	7,196	316,991
Floyd	3,766	14,079	24,914	49,886	65,705	58,636	57,998	14,775	5,909	295,668
Hale	1,545	6,041	12,176	21,089	16,438	14,766	4,464			76,520
Hockley	12,654	31,894	35,534	35,188	6,761					122,032
Lamb	9,738	37,634	55,295	39,670	24,759	10,893	8,584			186,573
Lubbock	7,377	22,481	26,140	41,070	36,597	23,003	26,432			183,100
Lynn	1,757	2,820	3,159	1,618	971					10,325
Parmer	1,639	10,491	54,366	72,671	90,484	103,379	66,769	18,032		417,832
Potter	511	1,648	1,988							4,148
Randall	5,432	16,464	32,760	14,504	7,812	1,540				78,512
TOTAL FOR DISTRICT	61,423	214,524	378,176	458,689	463,641	393,037	250,631	50,381	13,105	2,283,605



NEW MEXICO
TEXAS
PARMER
CASTRO
SWISHER
BRISCOE
HALE
FLOYD
BAILEY
LAMB
HALE
LUBBOCK
LYNN
CROSBY
GARZA
COCHRAN
YOAKUM
HOCKLEY
TERRY
FARWELL
LAZBUDDIE
HART
KRESS
SILVERTON
MULESHOE
EARTH
SPRINGLAKE
OLTON
PLAINVIEW
SOUTH PLAINS
LOCKNEY
SUDAN
HALE CENTER
FLOYDADA
BAILEYBORO
LITTLEFIELD
PETERSBURG
ABERNATHY
MAPLE
ANTON
MORTON
SHALLOWATER
IDALOU
LORENZO
RALLS
CROSBYTON
BLEDSOE
WHITEFACE
LEVELLAND
LUBBOCK
SUNDOWN
SLATON
ROPESVILLE
MEADOW
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EXPLANATION

BOUNDARY OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

BOUNDARY OF SUBDIVISION NO. 1 OF THE UNDERGROUND WATER RESERVOIR IN THE OGALLALA FORMATION

SOUTHERN HIGH PLAINS ESCARPMENT

CONTOUR LINE SHOWING DECLINE OF THE WATER LEVEL IN THE OGALLALA FORMATION, CONTOUR INTERVAL ONE FOOT

THE Cross SECTION

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

1628 15th Street, Lubbock, Texas 79401

Telephone 762-0181

FRANK RAYNER, Editor

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District Office at Lubbock

Frank Rayner	Manager
Albert W. Sechrist	Agricultural Engineer
Mrs. Ann Bell	Geologist
Tony Schertz	Draftsman
Kenneth Seales	Field Representative
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Mrs. Dana Wacasey	Secretary-Bookkeeper
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TWDB Has Six Members

In the article, "Shurbet Appointed Chairman", that appeared in the February 1970 issue of *The Cross Section,* only five of the six members of the Texas Water Development Board were listed. The name omitted was that of Robert (Bob) Gilmore, P.E., of Dallas, Texas. Mr. Gilmore was appointed to the Board by Governor Connally in 1965.

Mr. Marvin Shurbet, Petersburg, is Chairman of the Board; Searcy Bracewell, Houston, is Vice-Chairman. Other Members are, John H. McCoy, New Boston; Milton T. Potts, Livingston; and W. E. Tinsley, Austin.

WTWI MEETS

The Board of Directors of the West Texas Water Institute met on the morning of February 6, 1970, immediately before the day-long, 8th Annual West Texas Water Conference.

The four new members elected to the Board of Directors, J. Wayland Bennett, Leon New, Joe B. Pate, Berwin Tilson, and Don Workman were installed during this meeting.

Dr. Grover E. Murray, President of Texas Tech University, reappointed Dr. Gerald W. Thomas and Dr. William D. Miller Co-Chairmen of the Institute for the ensuing year. Leon New was elected Vice-Chairman of Education; Dr. Bennett was elected Vice-Chairman of Research; and Frank Rayner was reelected Secretary of the Institute.

OGALLALA SYMPOSIUM

List Of Papers

Thursday, April 30, 1970

Session Chairman—(Mrs.) Jean Williams, Program Controller, Texas Water Development Board, Austin, Texas.

Significance of Ogallala Aquifer—F. B. Conselman, Dir. ICASALS, Texas Tech University, Lubbock

The Ogallala Formation—A Review—J. Frye, Chief, Illinois Geological Survey, Urbana, Illinois

Geology and Groundwater in the Ogallala Formation and Undifferentiated Pleistocene Deposits, Southwestern Kansas—H. E. McGovern, Sub. Dist. Chief, U.S.G.S., Garden City, Kansas

Hydrogeologic Information on the Glorieta Sandstone and the Ogallala Formation in Oklahoma Panhandle and Adjoining Areas as Related to Underground Waste Disposal—J. Irwin, Asst. Dist. Chief, and R. Martin, Hydrologist, U.S.G.S., Oklahoma City, Oklahoma

Correlation of Core Analysis with Geophysical Logs of Some Core Holes in the Ogallala Formation, Southern High Plains, Texas—R. F. Brown, Proj. Chief, U.S.G.S., Lubbock

Linear Features and Ground-Water Distribution in the Ogallala Formation of the Southern High Plains, Texas—W. I. Finch and J. C. Wright, U.S.G.S., Denver, Colorado

Session Chairman—Les McMillion, Head, Pollution Fate Section, R. S. Kerr Water Research Center, Ada, Oklahoma.

Drainage Pattern Analysis, Southern High Plains, Texas, and Eastern New Mexico—C. C. Reeves, Jr., Asst. Prof., Texas Tech University, Lubbock

Pliocene Drainage in Northwestern Kansas During Ogallala Time—R. H. Pearl, U.S.G.S., Cheyenne, Wyoming Digital Simulation of the Ogallala Aquifer in Sherman County, Northwestern Kansas—T. J. McClain, Kansas Geological Survey, and E. D. Jenkins, U.S.G.S., Colby, Kansas.

Numerical Model of Ogallala as a Management Tool—B. J. Claborn, Asso. Prof; T. A. Austin, Grad. Student, and D. M. Wells, Dir., Water Resources Center, Texas Tech University, Lubbock

Dynamic Model of the Ogallala Aquifer, Texas High Plains—F. A. Rayner, Manager, High Plains Underground Water Conservation Dist. No. 1, Lubbock.

Comparison of Methods for Determining the Specific Yield of the Ogallala, Texas High Plains—O. R. Jones and A. D. Schneider, U.S.D.A., Southwestern Great Plains Research Center, Bushland, Texas

Method for Estimating Coefficient of Permeability Using Hydrologic Field Data (Colorado) — R. H. Pearl, U.S.G.S., Cheyenne, Wyoming

Water Transfer at Bedrock — Alluvium Contact—J. Waltz, Asst. Prof., Colorado State University, Fort Collins, Colorado

Friday, May 1, 1970

Session Chairman—Gerald Thomas, Dean, School of Agricultural Sciences, Texas Tech University

Problems of Artificially Recharging the Ogallala Formation in Colorado—C. T. Jenkins and W. Hofstra, U.S.G.S., Denver, Colorado

Mathematical Model for Determining Areal Distribution of Natural Recharge in Northern High Plains of Colorado—D. Reddell, Asst. Prof., Texas A&M University, College Station, Texas

Basin Recharging the Ogallala Aquifer through Pleistocene Sediments, Texas High Plains—V. S. Aronovici, A. D. Schneider and O. R. Jones, U.S.D.A., Southwestern Great Plains Research Center, Bushland, Texas

Application of Surface Pressure to Assist Water Recharge into the Ogallala Formation—P. Johnson, Prof., Texas Tech University, Lubbock

Recharging Ogallala Formation Using Shallow Holes, Texas High Plains—M. Dvoracek, Asst. Prof., Texas Tech University, Lubbock

Pollution Research in Recharging the Ogallala Aquifer through Wells, Texas High Plains—A. D. Schneider, O. R. Jones and A. F. Wiese, U.S.D.A., Southwestern Great Plains Research Center, Bushland, Texas

The Texas Water Development Board Cooperative Studies of the Ogallala Underground Reservoir—G. Brune, Texas Water Development Board, Austin

Field Trip, Ogallala Formation—C. C. Reeves, Trip Leader

Water Table . . .

—continued from page 1

actually pumped during an average year.

There are approximately 5,215,600 acres within the District. The water-table did not decline beneath 1,368,114 acres, or 26.23 percent of this land area.

Beneath 756,351 acres, or 14.50 percent of the land area in the District, the water table declines, on the average, from 2 to 3 feet annually. However, within this area only 378,176 acre feet of water was extracted, while 463,641 acre feet was extracted from beneath only 9.88 percent of the land surface. This condition is also illustrated by Figure 1 (page 1).

Figure 2 (page 4) shows the relative amounts of net pumpage in each county. The 417,832 acre feet pumped in Parmer County represents 18.3 percent of the total pumpage within the District. Four counties, Castro, Deaf Smith, Floyd and Parmer, account for approximately 62 percent of the total average annual net pumpage of 2,283,605 acre feet. It is presently estimated that actual pumpage will exceed this amount by 12 percent, for a total gross, average annual pumpage of approximately 2,557,600 acre feet.

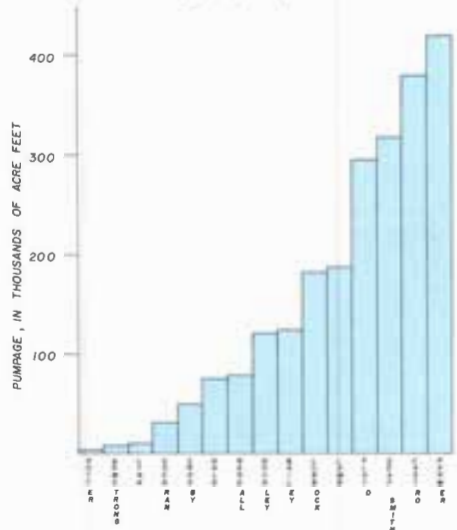


FIGURE 2—Average Annual Net Pumpage.

HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

SECOND CLASS PERMIT

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 4 "THERE IS NO SUBSTITUTE FOR WATER" *April, 1970*

Alex Daricek

Alex Henry Daricek passed away on April 3, 1970, at his Kingsland, Texas, home—he was 69 years old.

His gentle smile, a sort of grin, was the trademark he held throughout his life. He is survived by his wife, Cliffie, a son, a daughter, seven grandchildren, and 15 great grandchildren; and a multitude of friends and acquaintances.

Alex was the Member to the Board of Directors of the High Plains Underground Water Conservation District No. 1 for Precinct 3 (Bailey, Castro and Parmer Counties), in 1957 and 1958. He also served on the Bailey County Committee during 1956. He was a 32nd Degree Mason, a member of the Antelope Lodge.

He was born on August 10, 1901, the youngest son of a Chicago, Illinois family of four.

When he was 16, Alex and his mother moved to Weatherford, Texas, where he farmed with his stepfather. It was in Weatherford that he met and married 17 year old Cliffie Campbell —they celebrated their 50th wedding anniversary on September 18, 1969.

Soon after their marriage, the young couple moved to Corsicana, where Alex entered the automobile garage business. It was from Corsicana that they moved to a 160 acre rented farm, located three miles west of Maple, in 1930. They later purchased this farm and two additional 160 acre tracts.

It was this southern Bailey county farm that tested Alex's determination and ingenuity. Early in the 1940's, after having survived the drought of the 1930's, Alex told Cliffie that they must develop irrigation wells on their farm, or move to a more abundant rainfall area.

Although it was unknown to Alex,

—continued on page 4

RECOVERING AGRICULTURAL WATER—A LOCAL APPROACH*

The attention of the nation is increasingly being focused on man's environment, with particular emphasis on his development and use of natural resources. The two essential fluid elements—water and air—are receiving particular emphasis.

There are increasing demands for more federal and state legislation to legislate away the problems associated with the use of these two most vital fluids. However, there is no panacea in legislation, the solution of problems associated with man's use of air and water must come from the source of these problems—man, and man is both the local and logical approach.

OUR ENVIRONMENT

The element of our regional (local) interest is, of course, water—water from this area's primary supply, that stored underground in the Ogallala Formation. From the standpoint of our economy, the Ogallala aquifer is our environment; we live upon it, and we prosper because of it. Our local problem is the conservation of this environment—the conservation of water extracted from the Ogallala aquifer.

LOCAL APPROACH

In Texas, the local approach to water conservation is provided in the Underground Water Conservation District's enabling act (Article7880-3c, Vernon's Civil Statutes of Texas). This law provides for the creation of groundwater conservation districts. These districts are the only governmental agencies in Texas directed to enforce rules to prevent waste of groundwater pumped and used for irrigation. This law describes agricultural waste of water (tailwater) as:

> *"Willfully causing, suffering, or permitting underground water produced for irrigation or agricultural purposes to escape into any river, creek, or other natural watercourse, depression, or lake, reservoir, drain, or into any sewer, street, highway, road, road ditch, or upon the land of any other person than the owner of such well, or upon public land."*

DISTRICT'S APPROACH

State law provides that groundwater conservation districts will enforce their rules and regulations by, ". . . injunction, mandatory injunction or other appropriate remedy, in courts of competent jurisdiction . . ."

It is apparent that if the District can enforce its rules and regulations only through the expensive and time consuming injunctive process, then public understanding and acceptance of its rules and regulations is imperative. It is within this realization that the District has relied heavily upon its creed, "Dedicated To The Principle That Water Conservation Is Best Accomplished Through Public Education".

Within the confines of the specific charges as set forth by State law, the District began its "educational approach" to the tailwater abatement with the publication of a notice of the law prohibiting such waste in the July 1955 issue of The Cross Section. Since that time, a total of 48 issues have contained articles treating tailwater abatement.

One very effective educational demonstration has been incorporated with the method of measuring tailwater waste. A graduated stake and a sign have been placed in and near the v-notch weirs used to measure flow in roadside ditches. By observing the inches of water on the stake, and correlating this reading with the flow table on the accompanying sign, the gallons per minute passing through the weir can be determined. This type of demonstrational unit has proven to be very effective in abating waste—as long as the unit is in operation.

The most workable and economic means of preventing tailwater waste appears to be tailwater recirculation systems.

With the aid of the landowners, the

—continued on page 2

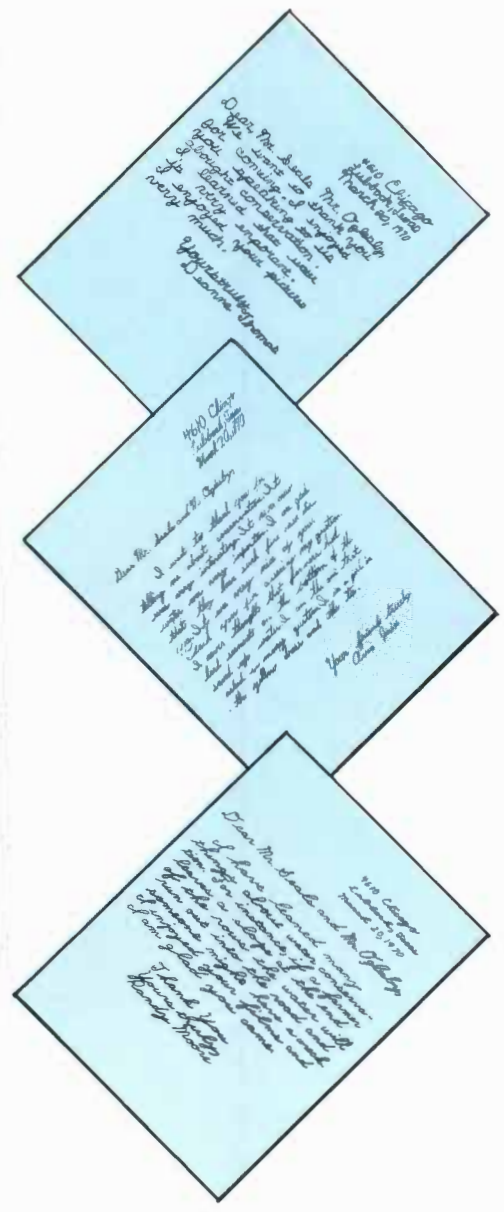
H. A. Beckwith (right) on the occassion of his 86th birthday, February 10, 1970; with friends Joe Carter (left) and Otha Dent (rear), Texas Water Rights Commissioners, and Mrs. Norma Garrett. (See story on page 4)

A NOTE FROM THE EDITOR

Hindsight is an easy thing, and we can all claim to be experts at it. Yet hindsight does have one great redeeming value, it forces us to look at the future.

Looking back to the time the District was first created, some 18 years ago, one can not help but to ponder as to what would now be the state of the art of groundwater conservation in this area, *if* the District had concentrated on the conservation education of the (then) children. A six year old child in 1951 could now be 25 years old—the second generation of adults (probably college educated); that are now ready to assume the role of using groundwater to make their livelihood. Once honestly and adequately taught, the respect for the principle of conservation is not easily forgotten or disregarded. In short, perhaps we should teach the children what we want the adult to know.

There are other rewards for teaching children conservation, as is attested to by the following letters that were received by Kenneth Seales and Burnie Goolsby, after speaking before a 4th grade class at Wester Elementary School, Lubbock, Texas.



THE Cross SECTION

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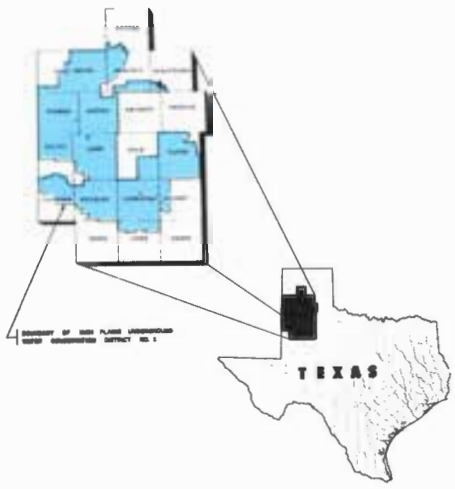

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Local Approach . . .

—continued from page 1

District has established numerous experimental tailwater recirculation systems on several private farms.

Once established, these demonstration units became the nuclei of the area wherein numerous other installations began to appear—the surrounding farmers having observed the increased efficiency of water management afforded by such systems, and their dollar making potential.

EFFECTIVENESS OF PROGRAM

The total effectiveness of the District's tailwater abatement and educational program cannot be accurately assessed, primarily because surveys of tailwater and playa recovery installations were not made in earlier years. However, a 1968 survey showed that there were about 1,000 tailwater and playa recirculation systems in the four counties—Castro, Deaf Smith, Floyd and Parmer — wherein conditions (large capacity wells and relatively "tight" soils) are most conducive to the creation of tailwater waste. In these counties, more than 86,000 acre feet of tailwater may be reclaimed in an average year.

The magnitude of tailwater waste, and the desirable effects of recirculation systems, can best be demonstrated by showing their effect on the depletion of the aquifer. This condition is shown by the curves below.

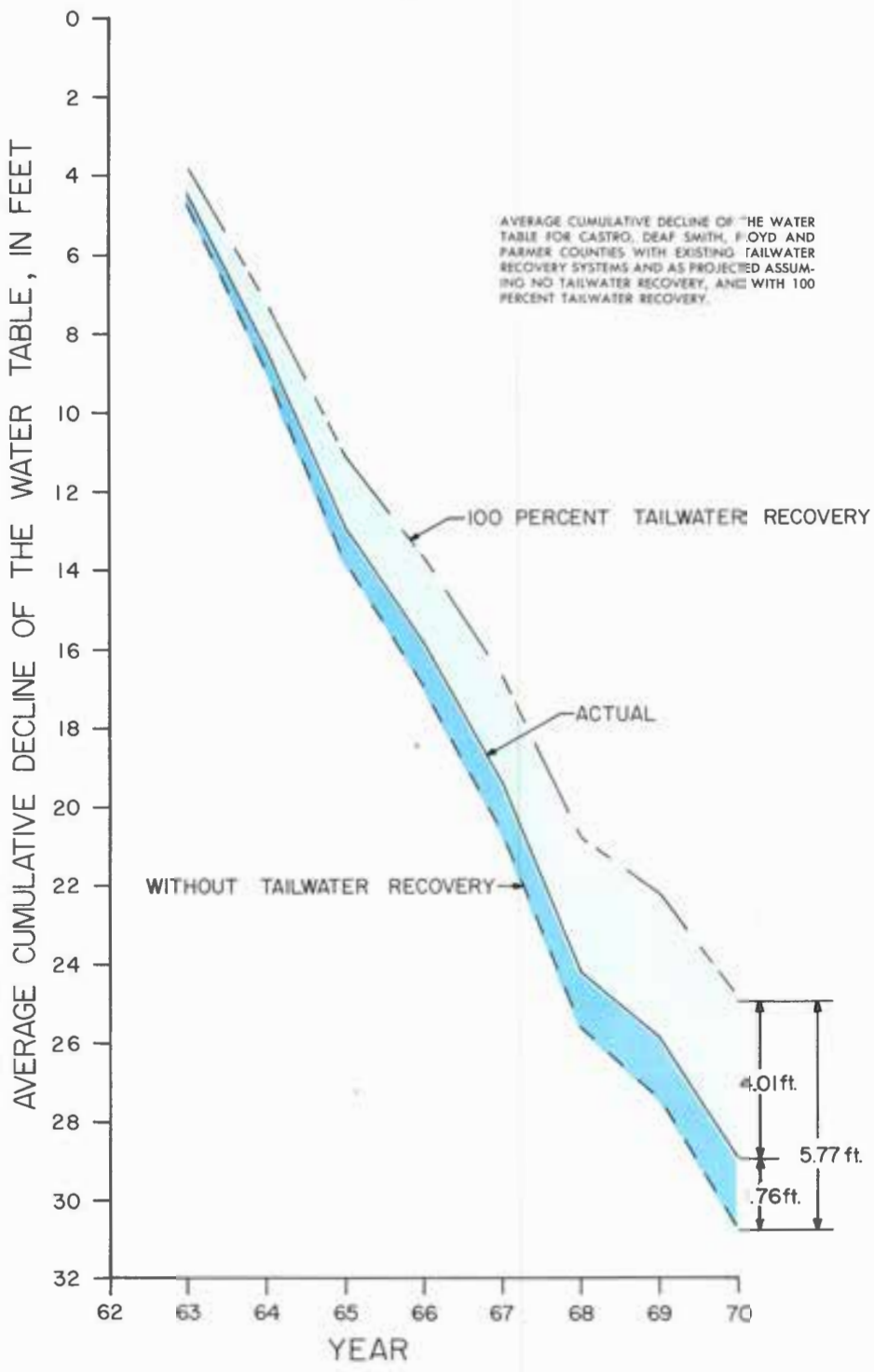
ANALYSIS OF CURVES

From January 1962 to January 1970 the average, cumulative decline of the water table for the four counties under consideration was 28.92 feet, or an average annual decline of 3.62 feet per year.

Without any tailwater recovery the total cumulative decline during this same period may have been 30.68 feet, or 1.76 feet more decline. This represents a reduction in the decline of the water table of nearly 6 percent.

However, if during the same period there had been 100 percent recovery of tailwater, the water table may have

—continued on page 4



AVERAGE CUMULATIVE DECLINE OF THE WATER TABLE FOR CASTRO, DEAF SMITH, FLOYD AND PARMER COUNTIES WITH EXISTING TAILWATER RECOVERY SYSTEMS AND AS PROJECTED ASSUMING NO TAILWATER RECOVERY, AND WITH 100 PERCENT TAILWATER RECOVERY.

ANNUAL COUNTY COMMITTEE MEETINGS

A meeting of County Committeemen and County Secretaries was held in each of the five Director's Precincts during April. The Precincts 4, 3, 2, 1 and 5 meetings were held on April 13, 14, 16, 21 and 23 respectively.

Several items of business were brought before the Committeemen.

A written report outlining the District's financial transactions during 1969 was presented to the Committeemen, and discussed by the Manager. This report showed the financial condition of the District at the end of 1969, as compared with that at the end of 1968.

Material regarding the 1970 election was presented to the Committeemen, and the Manager reported on election procedure changes now being considered by the Directors; that would provide for more representative elections while reducing the costs of same.

The Manager reported on the recent actions of the Board of Directors to commence revision of the well permit deposit procedures. A recent inventory revealed that there was nearly $5,000 in unremitted well permit deposits in these accounts—considering only those permit deposits made before January 1, 1969.

The Committeemen were polled for their opinions regarding the management, the indebtedness, and the programs of the District.

Alex Daricek . . .

—continued from page 1

or anyone else at the time, the aquifer in this part of Bailey County is confined primarily to ancient buried stream channels (now filled with sands and gravels) that traverse the area in a meandering fashion from northwest to southeast. Only within these channels can large capacity irrigation wells be developed. As chance would have it, Alex's first well did not intersect one of these channels, and it was considered a failure.

In order to reduce costs, Alex leased a drilling rig, taught himself how to drill wells, and began his exploration in earnest. Leasing also proved more costly than Alex was willing to accept for his continued failure to develop an irrigation well. Therefore, he approached his banker for a loan to purchase a drilling rig. With apparent disbelief in his proposal, but with equally apparent belief in Alex, the banker commented, as he was signing the check for the requested loan, "Alex, I would just as soon you were buying a battleship."

His indominable determination paid off—he ultimately developed a total of five irrigation wells. One of these wells was reportedly the largest (10-inch) well ever developed in this part of Bailey County.

In 1961, the Dariceks left their Bailey County farm to "retire" to the management of a lodge they purchased on Lake Granite Shoals (now L. B. J. Lake). Alex attacked retirement with the same gusto that he exhibited while farming, and it was only after selling the lodge that the Dariceks finally retired to their new lakeside home. It was here Alex passed away after being ill only a few hours, and nearby where he is buried in the red granite soils of the old Kingsland Cemetery.

Mitchell Undergoes Surgery

Chester Mitchell, President of the Board of Directors of the High Plains Underground Water Conservation District No. 1, entered St. Paul's Hospital, Dallas, on April 1, to undergo heart surgery. Veins removed from his legs were used to bypass blocked arteries adjacent to his heart. On April 18th, he returned to his home near Lockney. His recovery has been excellent.

HAL BECKWITH DIES—HIS RIVER FLOWS

"For so long as the Rio Grande shall continue to flow, the memory and contributions of the Honorable Hal A. Beckwith shall continue to serve and benefit generations of Texas, Mexican and American citizens." Hal A. Beckwith, 86 years old, passed peacefully from this world at 8:00 P.M. on Easter Sunday, March 29, 1970.

This tribute to Harry Abeel Beckwith, Hal, was part of Texas Senate Concurrent Resolution No. 71; naming the three pronged arm of Falcon International Reservoir the Beckwith Arm, on May 11, 1967.

This resolution was also introduced into the Congressional Record of the United States House of Representatives on September 21, 1967, by the Honorable Abraham Kazen, Laredo, Texas, who noted ". . . among the constituency which I am honored to represent in the Congress is an old and dear friend of mine, the Honorable Hal A. Beckwith of Eagle Pass, Texas."

HAL A. BECKWITH

Born on February 10, 1884, in Bell County, Texas, Hal earned his formal education by working on jobs ranging from hay baling, to surveying, to refrigeration plant design. He received a Bachelor of Science Degree in Civil Engineering from the Univeristy of Texas in 1911. On May 29, 1965, he was the recipient of the Distinguished Engineering Graduate Award; the highest award that the College of Engineering of the University of Texas can bestow upon an alumnus.

Arriving in the Rio Grande Valley in June 1911, Hal observed, "There were no railroads in the area where pumping plants were located, and equipment and material had to be hauled by wagon; no established sea level datum bench marks on which to base elevations, nor any established meridian for longitude control. Horizontal control was maintained by coordinating Polaris observations and old '1700' Spanish surveys."

As a result of his pioneering work in developing irrigation projects along the Rio Grande; the award, "In Appreciation For Unselfish Service", presented to Hal at the annual convention of the Texas Water Conservation Association, on March 28, 1966, in Corpus Christi, noted, "It has been said that he and the late Moss Hill (Lon E. Hill) dug the Rio Grande."

At the onset of World War I, Hal noted, "In the summer of 1917, I entered training camp, Leon Springs, and in August of that year entered one of the first aviation ground schools the United States ever operated." . . . "The engines were of the various types that were first used in airplanes, and the airplanes were the first types ever used in the Army."

After working on several irrigation projects in the Rio Grande Valley, in Nebraska and in the Republic of Haiti; Hal was employed on several national defense construction projects throughout World War II.

In April 1947 he was named by the late Governor Beauford H. Jester to the State Board of Water Engineers and served until December 1957. He was Chairman of the Board from November 1949 to September 1955. In December 1957 he was named Chief Topographic Engineer for the Board, in which capacity he served to November 1961, when he was again appointed a Member of the Texas Water Commission, successor to the Board of Water Engineers (now the Texas Water Rights Commission). He remained on the Commission until January 1965, at which time, he again became the Commission's Director of Topographic Mapping. He retired in January 1967.

Hal was a Registered Professional Engineer in Texas and a member of the Texas Society of Professional Engineers. He was an Associate Member of the American Society of Civil Engineers and the past President of the Association of Western State Engineers.

A resolution adopted by the Texas Water Rights Commission on April 2, 1970, noted that, ". . . the State lost one of its most distinguished citizens, a dedicated public servant and a recognized authority in the beneficial use and administration of public water and . . . Mr. Beckwith's life was characterized by splendid manhood and by his steadfastness to truth, honor and patriotic service in every position he occupied . . .".

His keen wit left us with the knowledge that a beautiful day was, "a powerful day", that the Big Bend country was, "fine for conversation but darned poor for prowlin"; and that a girl in a mini skirt, "would not get her skirt wet in a flood".

Two hours before he slipped into eternal rest he said, "As I look at the whole picture of my life, the plus's outnumber the minus's". There is no finer epitaph for an Engineer.

Local Approach . . .

—continued from page 2

only declined a total of 24.91 feet—4.01 feet less than the actual decline, or nearly 14 percent less decline of the water table.

There appears to be an average annual recovery of about 30 percent of the tailwater in these four counties.

During the last eight years, about one-half year's supply of irrigation water has been conserved; however, enough water was wasted during this same time to irrigate all the land in these same counties for more than one year.

IN THE FUTURE

It is apparent that the District's "educational" approach has made notable gains in abating tailwater waste, however, it is equally apparent that the job is less than one-half completed.

In these times of demands for instantaneous change through (supposedly) cure-all legislation, the new, city-bred cult of conservationists are showing less satisfaction for gradual and equitable change. Therefore, we advocates of home rule—the local approach — will be pressed for faster strides to attain the "ultimate" solution to tailwater and other water waste. We can meet this challenge by the individual's acceptance of his own responsibility—if you have the capacity to create waste you have the capacity to abate same.

**From a paper presented by F. A. Rayner at the Water Resources & Irrigation Symposium, Lubbock, Texas, March 31, 1970.*

HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

SECOND CLASS PERMIT

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 5 "THERE IS NO SUBSTITUTE FOR WATER" *May, 1970*

TORNADO - THE STORM OF MAY 11. 1970

A massive storm, with clouds towering over 55,000 feet, moved over Lubbock on Monday evening, May 11th, 1970. At about 9:30 p.m., this storm spewed a mammoth tornado, or tornados, that in a few short minutes swept away well over 1,000 buildings, and extensively damaged an estimated 8,000 others. Within hours, 20 dead were accounted for—eleven days later a total of 26 persons had died from injuries received in this storm. Three million dollars worth of automobiles and trucks (estimated to involve about 10,000 vehicles) were damaged or destroyed, as were over 100 airplanes. Property loss has been estimated to exceed 135 million dollars. All this damage wrought by winds measured at over 200 miles per hour, and estimated to have approached 300 miles per hour.

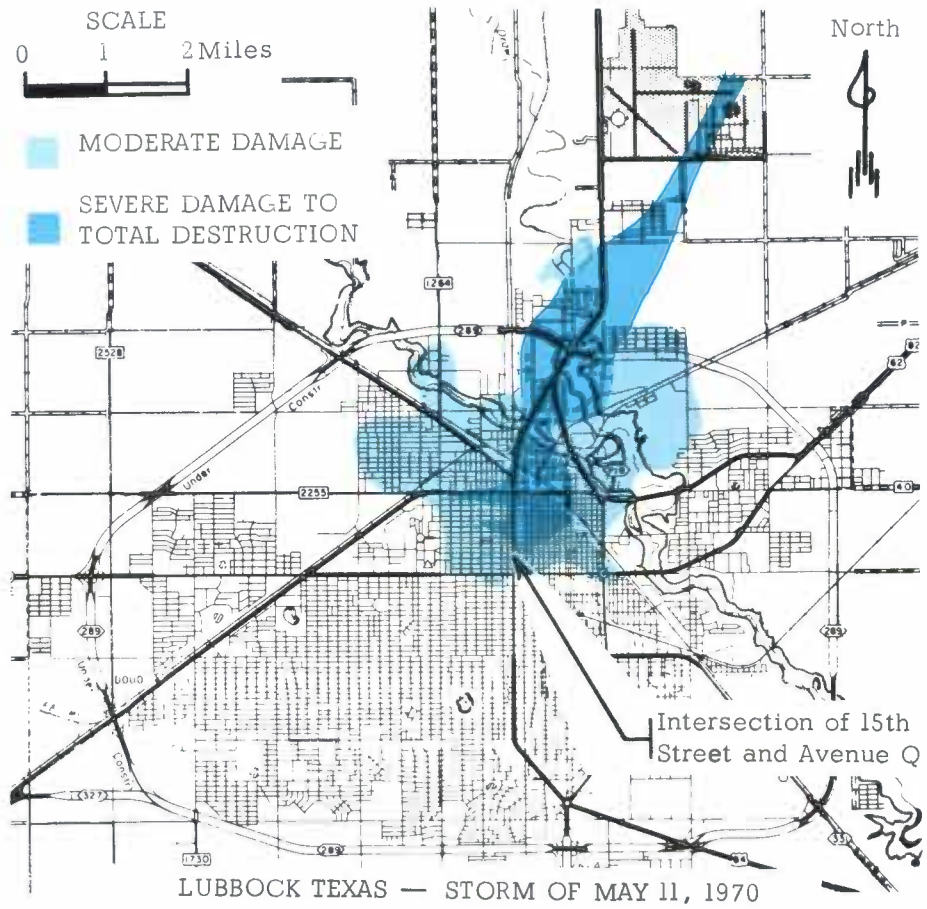
The map on this page shows the areas of moderate (approximately 5 square miles) and severe to total (approximately 4 square miles) destruction. Winds and hail spawned by this storm uprooted trees and caused other damage at numerous other places throughout the city (not shown on this map).

Office Survives

The tornado, or one of the tornados, reportedly touched down at the intersection of 15th Street and Avenue Q, 140 feet west of the District's office, causing heavy damage and demolishing one building (see accompanying photograph). However, the District's office sustained only very minor damage. No windows were broken and there was no damage to the building's interior, furnishings or records.

By Wednesday noon, the streets had been cleared enough to permit free access to the office, and the debris scattered around the building and its parking lot had been removed by District personnel. For the next five days, the District's Field Representatives, Messers Goolsby, Seale and Seales then assisted with the city-wide recovery operations, working through the United Fund, Red Cross, Salvation Army, and the Guadalupe Relief Center. They moved thousands of pounds of food, clothing, household furniture and appliances that were donated to these agencies.

We are pleased to report that except for the temporary shortage of electricity and telephone service, the District's Lubbock office continued to be fully operative. We are also very thankful to report that none of the District personnel or their families were injured by the storm.



LUBBOCK TEXAS — STORM OF MAY 11, 1970

Offices of the High Plains Underground Water Conservation District No. 1, at 1628 15th Street, Lubbock, Texas. Note building at left that was destroyed by the May 11th storm. This building faces Avenue Q at the 15th Street intersection.

★ ★ ★

IN A DISASTER

The Role Of Groundwater

The safety, convenience, purity and low cost of groundwater is too often not appreciated — except in an emergency. Such an emergency reared its ugly head after the disastrous storm that struck Lubbock, Texas, on the night of May 11th, 1970.

Although unable to drive through the litter strewn streets to assess the extent of damage, and without power for light to view the magnitude of the utter destruction wrought by the storm, it was immediately apparent to City Officials that a water shortage could soon develop. Kenneth May, reporting in the morning edition of the Lubbock Avalanche-Journal of May 12th wrote:

"Disaster officials were reviewing the situation in the emergency operating center at City Hall at 1:15 a.m. today.

Water is in critical shortage, City Manager Bill Blackwell told the group. *We have only about five million gallons in storage and we normally use about 35 million gallons per day at this time of year.*

Sam Wahl, city director of public works, said crews were on their way to the sand hills area near Muleshoe to start pumping water toward the city.

Our pumping station from which we get Canadian River water is without power and the equipment is too large to run off auxiliary power, Wahl said.

We should have water on the way here from the sand hills by mid-morning. It takes about eight hours for it to get here."

The storm had knocked out the City's two in-town generating stations

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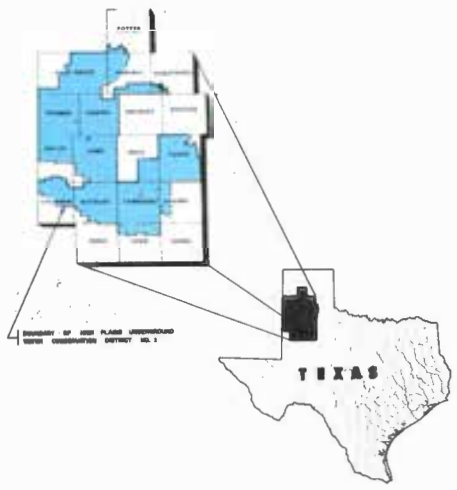

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The "old" diesel-electric powerplant, one of the two Lubbock power generating stations knocked out by the May 11th storm.

The Role Of Groundwater . . .

—continued from page 1

that supply power to the Canadian River water treatment plant—the system that was, at the time of the storm, furnishing all of the City's water supply.

Dual Water System

Until 1967, all of Lubbock's water supply came from the 77 wells in the sandhills well field, located about 60 miles northwest of Lubbock; the 17 wells in the Shallowater well field, located 10 miles northwest of the City; and from about 100 wells in and around the City proper. In 1965, the year of peak use, this system produced over 9 billion gallons of water.

In 1967, the City began to receive water from the Canadian River system. This surface water supply system consists of Stanford Dam and Lake Meredith on the Canadian River in Texas, and 322 miles of pipelines serving 11 Southern High Plains cities.

The Canadian River water supply system, which embodies several unique and improved engineering concepts of dam and pipeline construction, was designed and built by the Bureau of Reclamation, U. S. Department of the Interior. This system is now operated by the Canadian River Municipal Water Authority. (CRMWA).

The Canadian River pipeline system is an automatically controlled, full-flow pipeline. This is to say, flow through this pipeline system is regulated by electronically controlled valves, and the pipeline remains full of water at all times. This is a very modern and efficient system that will operate automatically unless power or communications between the flow regulating stations thereon are interrupted—the system will then shut down until overridden or otherwise operated by hand. This is what happened (the system shut down) at about 9:50 p.m., May 11th, when power to the Lubbock treatment plant was knocked out.

Treatment Plant

Water from Lake Meredith is delivered to the Lubbock treatment plant by the CRMWA. This water is then clarified and purified in this plant, which is owned and operated by the City of Lubbock. Treated water is then allowed to again flow back into the pipeline system operated by the CRMWA, and is transported by this Authority to six other cities to the south and west of Lubbock.

Without power, the Lubbock treatment plant went "off stream", and the water supply was soon cut off to seven cities, Lubbock included.

Reacting as though trained to meet such an emergency, CRMWA and City of Lubbock water officials converged on the treatment plant within minutes after the storm struck. Without power for light an assessment could not be made of the extent of damage to the treatment plant, and it was feared that the debris blown into the plant's settling basins would be injurious to this modern, fully automated plant, therefore it was decided to delay the "hand" operation of the plant until the daylight hours. The water officials knew that immediate restoration to service of the Canadian River system was not imperative, because all of the cities on the Canadian River system had another source of supply — groundwater.

Lubbock's Groundwater System

The storm had destroyed the microwave antennae tower at the City's Public Works Control Center, in downtown Lubbock. This center controls communications with the sandhills and Shallowater well fields, and the valve system on the pipeline to these well fields. Telephone service out of Lubbock had also been interrupted, therefore, it was necessary for Mr. Cordon Willis, Water Treatment Superintendent for the City of Lubbock, to drive to Shallowater in order to put the groundwater system into operation.

Power was available to the wells in the Shallowater well field, but the pumping station at this field was not operating, therefore, water pumped by the wells into the ground storage tank at this field could not be pumped into the pipeline to Lubbock.

—continued on page 4

OWNERS OF WATER WELLS QUITE WILLING TO SHARE

By GERRY BURTON
Lubbock Avalanche-Journal Staff

"Bring your buckets, barrels and jugs for all the water you need."

Words like these never fell on ears of pioneers who turned guns on friend and foe alike less than a century ago to claim and keep West Texas' most precious possession — water.

But they did come Tuesday to waterless Lubbock . . . words from a handful who sought to share their water wells with a waterless population that dwarfed all the cattle roaming the South Plains when water meant riches or ruin, plenty or poverty.

Tuesday it meant a drink for parched throats that had gone all night, dry at first from horror and despair, dry at last from dust and powdered debris that clung in nostrils and throats long without water. It meant, too, a drink of water for a small child who woke to his normal world in an undamaged section of the city.

Bottled water disappeared from grocery shelves with the first opening of doors and the promise of water coursing from pumps in city sandhill wells 70 miles away did not help the thirst that was now.

The offer of water had no limit—a person's necessity and conscience was the only guide to the amount he could carry away.

"If you need water, come . . ." the message said.

Many did come and the pitcher of charity continued to pour until the need was satisfied.

During the city water shortage that followed the May 11th storm, both rural and city well owners offered free water to anyone who wanted it. Lawson Farrar drinks from the hose from his well, southwest of Lubbock, that filled many water jugs. The wooden windmill tower in the background fell victim to a previous tornado. (Lubbock Avalanche-Journal Staff Photo)

Removing city debris blown onto farmland located northeast of Lubbock, Texas, by the May 11th storm.

Storm debris removed from farmland.

Dan Seale (in bed of pickup truck) aids in the disaster relief operations after the May 11th storm.

DRILLING STATISTICS FOR JANUARY, FEBRUARY, MARCH, & APRIL, 1970

County	Permits Issued	New Wells Drilled	Replacement Wells Drilled	Reported Dry Hole
ARMSTRONG	3	2	0	0
BAILEY	31	18	2	1
CASTRO	25	17	0	0
COCHRAN	10	3	0	0
CROSBY	1	1	0	0
DEAF SMITH	44	33	1	1
FLOYD	37	17	0	0
HALE	2	1	0	0
HOCKLEY	33	20	1	0
LAMB	21	9	2	0
LUBBOCK	52	31	0	1
LYNN	17	6	1	2
PARMER	44	26	2	0
POTTER	0	0	0	0
RANDALL	10	12	1	0
TOTALS	**330**	**196**	**10**	**5**

The Role Of Groundwater . . .

—continued from page 2

Mr. Willis then telephoned the operator of the sandhills well field, from Shallowater, and the operator turned on enough wells to start water at the rate of 20 MGD (million gallons per day) toward Lubbock by 2:00 a.m. on May 12th. Water from the sandhills well field began arriving in Lubbock by 10:00 a.m. on the same day. By midnight of May 12th, the City's overhead storage tanks were again filled to overflowing.

Unlike the Canadian River pipeline system, the pipeline from the sandhills and Shallowater well fields is not a full-flow pipeline. The valves on this pipeline allow it to drain when not in continuous use. Since this groundwater system had last been used in January (1970), the pipeline was empty; hence the eight-hour travel time for groundwater pumped from the sandhills well field to reach Lubbock.

Groundwater and Power

Power from the City's third and newest powerplant, the Holly Avenue station, located about four miles southeast of the City, was not interrupted by the storm. Water for this thermoelectric plant is supplied by 5 wells located in south Lubbock. The Holly Avenue plant, in turn, supplies power to these wells. The continued operation of this plant alleviated the emergency conditions that would have otherwise developed had this plant been dependent upon the surface water supply.

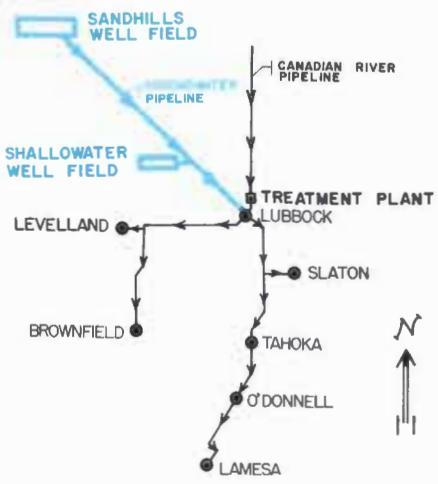
Pipeline Storage

At the time of the storm, water from the Lubbock treatment plant was being pumped back up the pipeline to the Shallowater field, and thence allowed to flow south to Reese Air Force Base (located about 10 miles west of Lubbock).

At power cut-off, the more than 5 million gallons of water in this pipeline began to flow back to Lubbock. This flow was directed to south and west Lubbock, where pumping plants, being supplied by power from the Holly Avenue plant, were able to pump it back into the distribution system. Although there was a considerable reduction in line pressure, some parts of the City were never totally without water.

No Other Water Shortages

Although the Canadian River water supply to Levelland, Brownfield, Slaton, Tahoka, O'Donnell and Lamesa was automatically cut off by the Lubbock storm, the residents of these cities did not even experience a drop in line pressure. Their water service—supplied by their own groundwater systems—continued uninterrupted.



Service Quickly Restored

With the coming of dawn on May 12th, it was determined that the Lubbock treatment plant could be put back in service by manual operation. Flow through the Canadian River pipeline system (from near Amarillo) and the Lubbock treatment plant is by gravity, except for the back flushing of the sand filters at the treatment plant. Therefore this system can be manually operated for considerable periods of time, by eliminating the chemical clarification treatment of the water. Since the water from Lake Meredith is relatively clear, the elimination of the chemical treatment for clarification did not overload the plant's sand filters.

This plant was put back into operation on the morning of the 12th, by manually adding HTH (a chlorinating disinfectant) to the water passing through the plant. By 4:00 p.m. of the same day, service had been restored to Slaton, Tahoka, O'Donnell, and Lamesa. Service to Levelland and Brownfield requires pumping. This service was not restored until a later time.

The exceptionally rapid restoration of the Canadian River water supply is a direct indication of the efficiency of the design and operation of this system.

Groundwater Meets Peaks

The Canadian River system supplies nearly 90 percent of all of Lubbock's water needs. However, Lubbock, like most of the other cities on this system, must pump groundwater during the peak demand months, June, July and August. Since there are no provisions for storing emergency supplies within the Canadian River system, the member cities of the CRMWA must rely on groundwater whenever the system is down for repairs.

Groundwater Supplies A Must

Most of the cities on the Canadian River system are wisely continuing to maintain their city-owned groundwater systems. Some of these cities have discontinued using leased wells, however, they are maintaining their city owned wells.

A Lesson Learned

There is no reason for the tragedy that struck Lubbock on May 11th, yet out of this tragedy there must come reason. It is apparent that some modification of the sandhills and/or Shallowater well fields pipeline system, should be considered if it is to be expected to function as an immediate source of water for the city in times of emergency. It is very fortunate that this storm was not followed by widespread fires. A modification of the valve system just to the Shallowater well field, and a dual power source for the pumping station at this field, would make about 4.5 MGD from this close-in supply readily available to Lubbock.

The recent emergency helped to clearly outline the advantages of the City's dual surface and ground water supply systems. The surface water supplied by Lake Meredith helps conserve the groundwater supplies, which, in turn, permits the wells to rest and recover to the point of being able to meet peak emergency needs.

Our groundwater supply system is completely enclosed, it does not require clarification or other treatment in ponds open to the atmosphere, therefore it is immune to airborne contaminants — even to radioactive fallout. It is an exceptionally safe water supply.

The groundwater that literally rose to the emergency after the May storm is always readily available, and in the abundance to meet every need; it is pure, requiring chlorination only to disinfect the distribution system carrying the same; it is one of the City's greatest assets.

REMINDER OF THE STORM PAST—MAY 11, 1970.

HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

SECOND CLASS PERMIT

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 6 "THERE IS NO SUBSTITUTE FOR WATER" *June, 1970*

AQUIFER MODELING RESEARCH MEETING

by A. W. SECHRIST

The seventh regularly scheduled quarterly meeting of the participants in the Tech-District aquifer-modeling research project was held in the District's Lubbock office on June 3, 1970. This was the last planning and work review meeting scheduled for this two year research project.

The object of this joint research project is to develop a mathematical management model of the Ogallala aquifer. It is anticipated that this model will be able to predict the behavior of the aquifer to both present and future rates of withdrawal of water; also to predict the aquifer behavior to any future recharge scheme.

The model when completed should be quite helpful to the District as well as to other agencies and individuals; especially those agencies who are developing plans for surface water importation to this area.

Dr. Dan Wells, Director of the Water Resources Center, Texas Tech University and Frank Rayner, Manager, High Plains Underground Water Conservation District No. 1, are co-directors of this research project.

Participating in this last planning meeting were Wells and Rayner, also Albert W. Sechrist, Water District Engineer; Bill Claborn and Floyd Urban, Assistant Professors of Civil Engineering at Tech; Dr. David K. Todd, Professor of Civil Engineering, University of California at Berkeley; Charles F. Meyer, Project Manager for Water Resources Research, General Electric TEMPO, Santa Barbara, California; and Dr. David Kleinecke, of General Electric TEMPO. General Electric TEMPO and their consultant, Dr. Todd, are consultants to the Tech-District research project.

The work accomplishment of the past quarter and of the past seven quarters in general was discussed at length and in particular the results of the work as presented in the paper "Numerical Model of the Ogallala as a Management Tool", which was presented at the Ogallala Symposium, was reviewed. This paper is a general progress report to date of the work on the research project and included the results of the output from a run of the model. Considerable discussion took place concerning the output of the model and of the analysis that can be made from the output. This paper also presented the results of a sample recharge problem run on the model.

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THE NITRATE DILEMMA

In most of the High Plains area, the nitrate problem appears to be only the problem of assuming that there is a nitrate problem. There is no evidence that nitrate, nitrite or any other element of the nitrogen cycle, are prevalent polluters of the groundwater, surface water or any other regimen of this area's environment. There is presently insufficient evidence to exonerate the nitrogen compounds of all threat to the quality of the area's groundwater — by the same token, there are also insufficient facts upon which to base the prevalent assumption that such compounds are a major polluter of our environment.

Water Quality Monitoring

The District, in cooperation with the Texas Water Development Board, has established a continuing program for monitoring the quality of the water in this area's aquifer system, the Ogallala aquifer.

The primary purposes of this program are to:

1) Appraise the landowner of the quality of the groundwater beneath his property and any changes in the quality of same. These data are important to soil analysis.

2) Establish a general quality of water base for the entire region. This type of information is very important to any prospective industry or other organization interested in locating in this area. These data will also be most important to the water importation studies and planning now in progress.

3) Establish a historical base of quality of water information. This type of data are necessary in order to appraise any change in the quality of the groundwater (contamination or pollution of same), and to protect the landowner's rights to compensation for any damage to the quality of his groundwater. These data are necessary to any appraisal of the causes for any change in the quality of the groundwater, and for appraising any remedial

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Tailwater Stories

Mr. Hoyt West, Managing Editor of the magazine, "Irrigation Age", has noted that two articles concerning tailwater return systems, in the March and April issues, have received the largest reader response of any stories yet carried by this magazine.

These articles, "Save That Water", (March), and "Returned Profits", (April) were compiled by Miss Patricia Patterson, a former staff writer for "Irrigation Age". The survey of reader response, conducted by "Irrigation Age", indicated a 66 percent response for the March story, and a 58 percent response for the April article.

Both of these well-illustrated articles attest to, and document the economic benefits of tailwater return systems. The unusual readers interest is an indication of the favorable conservation attitude of the irrigators in this area.

"Irrigation Age" was established by Mr. Palmer Norton, Hereford farmer and businessman. This excellent publication, devoted to practical irrigation, was first published in August 1966. The original circulation of about 15,000 has now grown to a circulation of 100,000.

Research Planning Group Meeting—left to right: Kleinecke, Urban, Meyer, Sechrist, Rayner, Claborn, not shown in picture are Wells and Todd.

Farmer And Consumer Relations Should Be Strong

by W. E. BLACK*

The consumer's best friend is the farmer. He has supplied them with an abundance of high quality food and in great variety and at bargain prices. Consumers pay less for food because their farmer friends are producing 20 percent more on 6 percent fewer acres than they did in the period from 1957-59. Each of the nation's farm workers is now supplying the food and fiber for 45 persons compared with 23 in 1957-59, and his output per man-hour has increased 83 percent over the past decade. During the last decade, food prices rose less than three-fourths as much as other consumer goods due primarily to farmer efficiency.

Consumer income increases exceeded food expenditure rises, leaving families extra money to buy other things. The average family in 1969 spent less than $1 out of each $6 to feed the family.

It is true that expenditures for food per person in the U.S. have increased from $306 in 1947-49 to $511 per person in 1969, but disposable incomes have increased even faster — from $1,244 per person in 1947-49 to $3,098 in 1969. The percent of income spent for food by the average American thus has dropped from 24.6 percent in 1947-49 to only 16.5 percent in 1969. No other country approaches this record. Rising incomes enabled consumers to buy more food services even though services increased the food bill.

Prices for food away from home have increased much more than food served at home. In the last decade prices of restaurant meals climbed 50 percent.

Rising incomes also let us indulge our tastes for preferred foods, and our good friend, the farmer, has shifted his production patterns to keep up with them. We are greater consumers of poultry, beef, vegetable oils, processed vegetables and fruits, and sugar than 10 years ago.

Less labor is needed to pay for our food today than even a few years ago. *In fact, Americans work less time to purchase most food items than people in any other country in the world.* We are particularly favored on high-quality food items such as meat, poultry, and dairy products.

Farmers received an average of 41 cents out of each $1 spent for U. S. farm produced food in 1969. This was about 2 cents more than in 1957-

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THE Cross SECTION

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

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Telephone 762-0181

FRANK RAYNER, P.E., Editor

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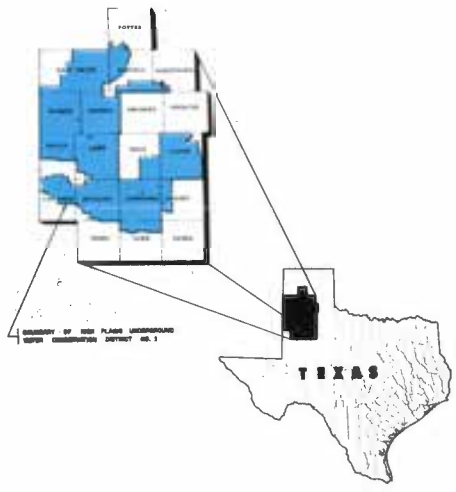

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NOTICE: Information regarding times and places of the monthly County Committee meetings can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Armstrong and Potter Counties; in these counties contact Carrol Rogers and Vic Plunk, respectively.

COUNTY COMMITTEEMEN

DANIEL

William Bryan Daniel, a Hockley County farmer, died of a heart attack on June 22, 1970. Mr. Daniel, age 56, was a member of the District's Hockley County Committee. He had served in this capacity from 1961 to 1967, and was re-elected to the Committee in January 1969—to replace Mr. Selmer Schoenrock; now a member to the District's Board of Directors for Precinct 2. He was also a member of the First United Methodist Church of Levelland, a Mason, an assistant scout master, a member of the Farmers Union and a director of the Farmers Co-Op gin in Levelland, and the Farmers Co-Op oil mill in Lubbock.

COLLARD

Felix Brundy Collard, age 52, passed away as a result of a heart attack on March 22, 1970, in Amarillo, Texas.

Mr. Collard was elected to the Potter County Committee in January 1970.

At the time of his death, Mr. Collard was manager of the W. H. Bush Trust Properties, Amarillo; owner of the Collard Cattle Company; and a partner in the Tecovis Cattle Company. A well known breeder of registered Hereford cattle, he was the Vice-President of the Panhandle Hereford Breeders Association, and a former director of the Texas Hereford Breeders Association.

After graduating from Texas A & M University in 1942, Mr. Collard served as a Major in the U.S. Army during World War II. After the war he re-entered A & M and received a Masters Degree in agronomy. He then joined the staff of the University's Agronomy Department.

Mr. Collard was active in civic affairs, a director of the YMCA and Kids Incorporated. He founded the Panhandle Junior Hereford Breeders Association.

Aquifer Modeling . . .

—continued from page 1

This example recharge problem was discussed regarding its accuracy and the model's potential for predicting the aquifer response to artificial recharge schemes.

The methodology being used by the District in attempting to determine more nearly precise pumpage figures was presented by Albert W. Sechrist.

Also discussed was the remaining effort to conclude the research project. The model will be revised to consider possible improvements as suggested during the meeting and to include revised and additional data. Other work necessary to complete the research project includes preparation of an annual report by July 1 and the final project report by August 1.

The Tech-District Aquifer-model research project is funded by a $98,578.00 grant from the Office of Water Resources Research (OWRR), United States Department of Interior, to Texas Tech and the District.

Dr. H. Garland Hershey is the Director of OWRR. Dr. Edward Altouney, OWRR Water Research Scientist is coordinating the Tech-District research within OWRR.

Crosby Office Closed

On June 17, at the request of the District Manager, the Board of Directors voted to close the District's Crosby County office in Lorenzo. Permits for wells in Precinct 3, Crosby County, will now be issued at the District's Lubbock office. Mr. Cliff Thompson will now serve as the Crosby County Secretary.

The Crosby County office was opened in June 1969. Since that time, five well permits have been issued at a total cost to the District of over $300.00 per permit.

Closing this office establishes the same relationship between the Lubbock office and Precinct 3 that has always existed between the Lubbock office and the northern one-third of Lynn County—Lynn County has never had a District office. Mr. Thompson also serves as the Lynn and Lubbock County's Secretary.

There will be no change in the Crosby County Committee. These committeemen are to be commended for their unselfish efforts in behalf of the people in Precinct 3. Through their efforts and support, the Crosby County taxpayers have received from the District: (1) the guidelines (8 maps and tables) for claiming the cost-in-water depletion, income-tax allowance; (2) an expansion of the water-level observation well program; (3) a chemical quality of water monitoring program; (4) all wells were located on maps, in order to recognize their existence at the time Precinct 3 joined the District; (5) the economic and physical protection provided by equitable well spacing; (6) an official body speaking and working for the preservation of the principles of private ownership of groundwater; (7) and other services.

Farmer and Consumer . . .

—continued from page 1

59, but 9 cents less than in 1947-49. The farmers' share of the consumer's dollar varies widely among products. It is smaller for a highly serviced product, such as bread, than for an unprocessed product such as eggs. When $1 was spent in 1969 at the grocery store, 41 cents went for products and 59 cents for marketing services.

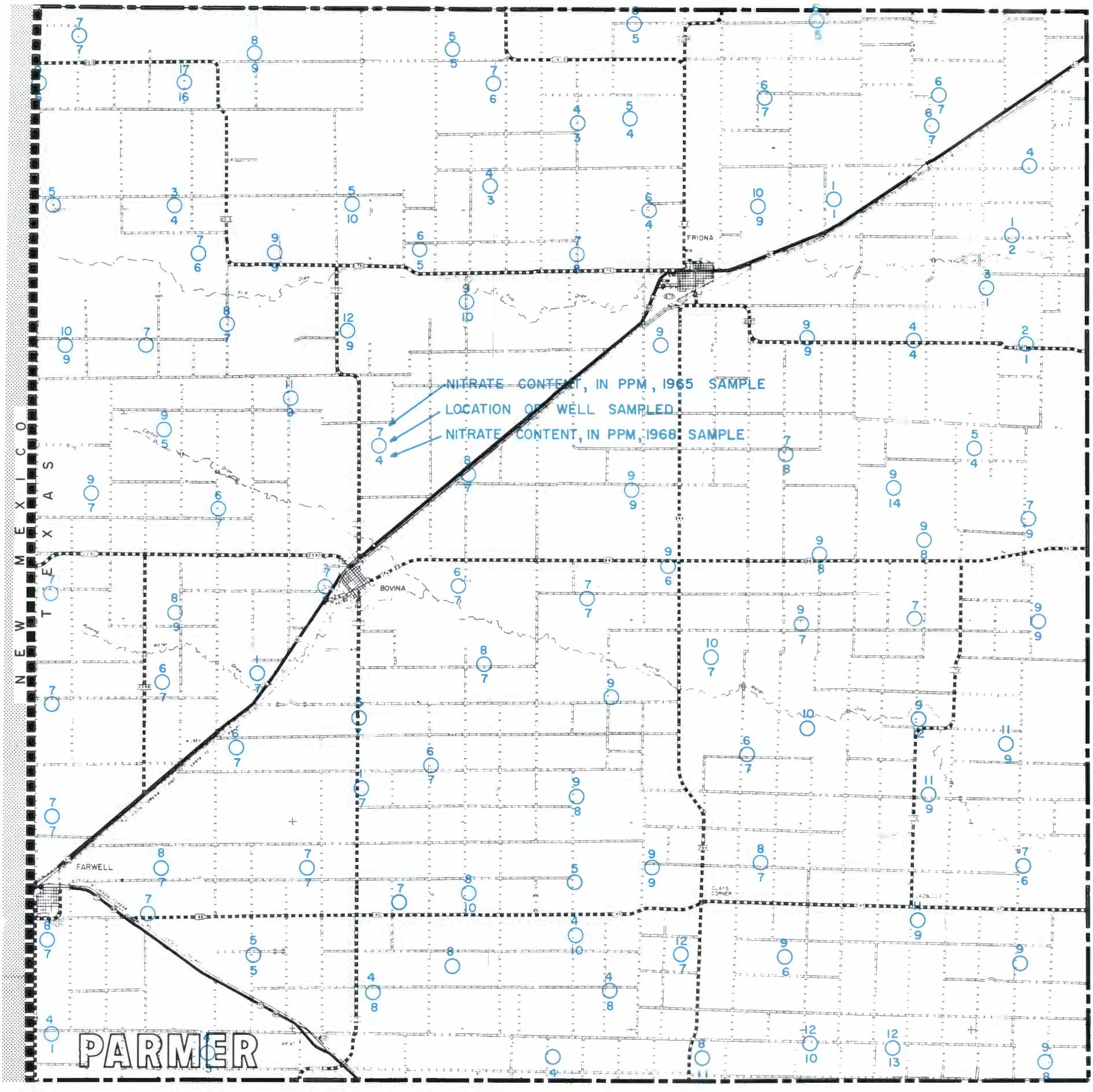
Higher marketing costs were part of the increase in food expenditures. Part was due to increases in the price of goods and services farmers use to produce the product. Sharpest cost increases are in taxes, wage rates, and interest.

From 1957 to early 1970, the index of prices farmers pay for commodities, interest, taxes, and wage rates increased 31 percent. Taxes were up to 129 percent, hired wage rates 81 percent, motor vehicles 35 percent, fertilizer 7 percent, and feed 6 percent, to name a few. Thus, the cost-price squeeze continues to keep their earnings below those in other industries.

Though it gets little attention from the average American, consumers also gain from the farmers' role as an exporter. *Foreign trade in agricultural products is an important source of national income and most important in our balance of trade situation.*

**Economist; Marketing and Policy Section, Texas A & M University Agricultural Extension Service.*

Location of Wells Sampled During the 1965 and 1968 Surveys



The Nitrate Dilemma . . .

—continued from page 1

efforts undertaken to abate such causes. Accurate quality of water data will also help to prevent unreasonable quality of water laws, rules and regulations that could be based upon supposition, in lieu of available data.

Parmer County Study

As part of a 1965 groundwater survey, water samples were collected from 99 widely spaced wells in Parmer County. Water samples were again collected from 85 of these same wells in 1968. The locations of these wells, and the nitrate content of both the 1965 and 1968 water samples collected therefrom are shown by the map on this page.

The average nitrate content of the 99 water samples collected in 1965 was 7.1 ppm (parts per million); while the average nitrate content of the 86 water samples collected in 1968 was 6.8 ppm.

There was an average increase of 2.23 ppm nitrate in the water sampled from 27 wells, and an average decrease of 1.8 ppm nitrate in 44 wells. Fourteen wells showed no change in the nitrate content of the water produced therefrom. The average change in the nitrate content of the 85 comparable samples was a decrease of .23 ppm.

The changes in the nitrate content of all of the comparable samples collected were within the expected range of error of analysis, and the expected differences that could result from the methods of collection.

It can be concluded from this survey, that the groundwater beneath Parmer County is relatively low in nitrates, and does not appear to have been affected by high density farming; and the resultant high fertilizer and water application rates that have been

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The Nitrate Dilemma . . .

—continued from page 3

practiced in this county for well over a decade.

Fertilizer Use

Caught in the price squeeze, the farmer-irrigator in this area has found it necessary to try for greater yield goals—through more fertilizer and water. In attempting to reach these goals, he has considered it necessary to apply larger and larger amounts of nitrogen fertilizer. The old adage, "if a little is good, a lot will be much better", has, apparently, become an accepted fact.

Nitrogen Balance

Studies by agricultural researchers have concluded that plants can generally only assimilate a maximum of about 70 percent of the fertilizer applied. Little is known about what is happening to the other 30 percent of these nitrogen rich compounds.

Nitrogen balance studies are increasingly drawing the attention of the agricultural scientist. Although there is some suggestion that the nitrogen fertilizer compounds may even be broken down and assimilated by (anaerobic) bacteria in the soil zone; there is, as yet, no accurate accounting for the excess nitrogen applied to the soils. There is a prevalent speculation that it is carried deep into the subsurface by percolating water.

Holly Sugar Studies

This speculation — that large concentrations of nitrates are percolating deep into the subsurface — may have been partly dispelled by a recent soil analysis survey conducted by the Holly Sugar Corporation of Hereford, Texas.

Searching for an explanation for the abnormally low sugar content of the area's 1969 sugar beet crop, Holly collected, and analyzed for nitrate content, 581 soil samples from 1, 2, 3 and 4 foot depths. These samples were collected in Castro, Deaf Smith, Parmer and Randall Counties in Texas, and Curry County, New Mexico, during February of 1970. Samples were collected from land that had been cropped (in 1969) in sugar beets (239 samples); grains (wheat, corn, milo, etc., 135 samples); vegetables (lettuce, carrots, etc., 24 samples); cotton (48 samples); summer fallow and long term fallow land (130 samples); and 5 samples from new (uncultivated) land.

These samples, analyzed for their nitrate (NO_3) content, but reported in equivalents of nitrogen (approximately 20 percent of the total nitrate content), ranged from about 10 to 580 pounds per acre foot of soil. The total equivalent nitrogen in the entire 4-foot profile ranged from 36 to over 1,100 pounds per acre. A considerable number of these samples showed that some fields contained sufficient nitrogen for an additional crop year, without further fertilization.

The average equivalent nitrogen in the samples taken from the different croplands is shown by the table below.

1969 Crop	Pounds of Equivalent Nitrogen Per Acre-Foot of Soil			
	0-1 Ft.	1-2 Ft.	2-3 Ft.	3-4 Ft.
Sugar Beets	69	50	35	38
Grains	72	72	63	63
Vegetables	191	100	81	53
Cotton	96	83	60	52
Grassland	28	72	38	20
Fallow	128	98	72	53
Overall Average	92	70	53	49

Research Needed

It is apparent that there is considerable residual nitrogen remaining (as compounds) in the near-surface soil profile after the crops are harvested annually. However, the ultimate fate of this surplus nitrogen is not known. The Holly survey indicates that the majority of this surplus nitrogen is being retained in the near surface zone.

Projecting the near straight line part of the curve shown on Figure 1, indicates that at less than 6 feet below land surface, the nitrate content of the soil should be zero. However, the single soil sample taken during the Holly survey from a depth of 4 feet on new land (not previously cultivated) contained 20 pounds of equivalent nitrogen per acre foot of soil — this represents 16 ppm nitrate. If this represents "native" conditions, then the average nitrate content at the four foot level beneath cropped lands, in the Holly survey area, has increased about 2.5 times.

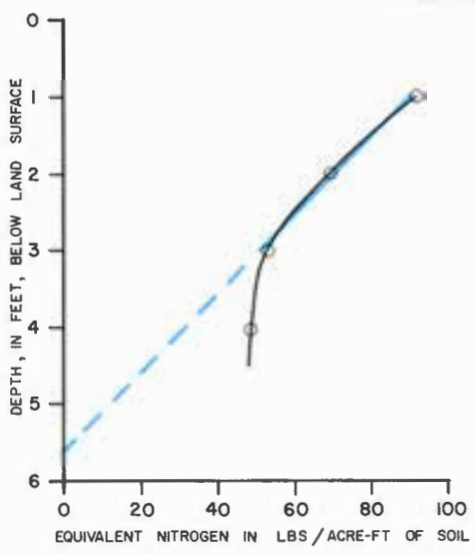

FIGURE 1—Distribution of Nitrogen in the Soil.

This photograph shows the 6-foot root system of sugar beets. This deep root system removes the nitrogen from the deep soil profile. This condition is verified by the relatively low residual nitrate content of the soil samples taken from beet fields. (Photograph supplied by Holly Sugar Corp.)

Since the average depth to the water table in Parmer County is nearly 236 feet (The Cross Section, February 1970), it is apparent that the present water and fertilizer application practices should not constitute a threat to the quality of the water in the aquifer beneath this county.

However, if imported surface water is delivered to this area in unlined canals, and if over irrigation becomes a widespread practice, the downward leaching of the annually-available, excess nitrogen could become a serious groundwater contamination problem. Closed conveyance systems, and subsurface storage and retrieval through wells of surface water imported to this area would avoid this potential hazard.

The many disciplines of research have not adequately delved into the complexities of the nitrogen cycle. Herein lies a frontier for the researcher interested in problem solution with a practical application.

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SECOND CLASS PERMIT

THE Cross SECTION

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Volume 16—No. 7 "THERE IS NO SUBSTITUTE FOR WATER" *July, 1970*

EASTLAND COURT RULES FOR WHITAKER

On June 26, 1970, the 11th Court of Civil Appeals (the Eastland Court) handed down their decision in the Sun Oil Company (appellant) vs Earnest Whitaker (appellee) case, finding for Whitaker the Court concluded, *"We have considered all of the points presented by appellant and find them to be without merit. The judgment is affirmed"*.

This judgment affirmed the findings of Judge M. C. Ledbetter (the 121st Judicial District Court of Cochran County), denying the petition of Sun Oil Company seeking the free use of water from a well drilled (over the protests of Mr. Whitaker) by Sun on Whitaker's land.

History of Case

This represents the fifth court decision in this case.

Sun Oil Company first filed suit for an injunction in the District Court of Hockley County (Judge Ledbetter presiding), early in 1966, to prevent Mr. Whitaker from interfering with the drilling of a water well on his property.

The Hockley County District Court denied Sun's pleading. Sun then appealed this decision to the 7th Court of Civil Appeals (the Amarillo Court). This Court further affirmed the lower court's decision—Sun then appealed to the Texas Supreme Court.

The Trial Court's decision in the earlier appeal was affirmed by the Texas Supreme Court, *but* in that appeal the Texas Supreme Court did not decide the question of whether or not the parties to the oil and gas lease involved in this suit intended that Sun should have free use of water from the Ogallala Formation for water flood, pressure maintenance purposes. Therefore, the Texas Supreme Court returned the case to the Trial Court for retrial on its merits—hence the recent decision of the Eastland Court, as outlined above.

Mr. George McCleskey, of Nelson, McCleskey, Harriger & Brazill, a Lubbock law firm, represented Whitaker in his appeal before the Eastland Court.

The Eastland Court's decision represents a thorough analysis of the complexities of the issues of this case; and, because of the importance of this decision, it has been reproduced in its entirety on page four of this issue of the Cross Section.

District Joins Water, Inc.

The District's Board of Directors, at its June 17th meeting, resolved to have the District assume a Sustaining Membership in Water, Inc.

The Manager, and the Members that were serving on the District's Board of Directors at the time Water, Inc. was organized, also hold Charter Memberships in Water, Inc.

BOSWELL RETIRES

HOWARD BOSWELL

At their regular monthly meeting, on July 23rd, the Members of the Texas Water Development Board accepted Mr. Howard Boswell's notice of intent to retire on October 1, 1970. Mr. Boswell was appointed the Board's Executive Director on February 1, 1968; after serving for six years as its Executive Secretary, and later as its Water Development Fund Manager.

Mr. Marvin Shurbet, Chairman of the Board, appointed a committee composed of three other members to the Board, Messrs. Searcy Bracewell, John H. McCoy and W. E. Tinsley, to select a successor to Mr. Boswell.

Although Howard will be turning over the reigns of Texas' water agency to someone else, the District hopes that he does not intend to completely withdraw his much needed, quiet but persuasive leadership from the water community.

Youth Committee Tours High Plains

In March 1970, Governor Preston Smith designated a 4-H Citizenship Project group from Smith County to act as "The Governor's Youth Committee on the Texas Water Plan". This Youth Committee from Tyler, composed of 12 high school and college students, is conducting an informational study of the Texas Water Plan. Specifically, they are studying water in its relationship to East Texas and to the West Texas Plains area.

Six of these students and the adult advisors (see accompanying photograph) toured parts of the Southern High Plains of Texas for two days—July 13th and 14th. Water, Inc., arranged the itinerary for their High Plains tour. The High Plains Underground Water Conservation District No. 1 assisted Water, Inc. in providing transportation and guides — Messrs. Seales and Sechrist toured with the students. Mr. Homer Garrison, First National Bank of Hereford, hosted the group's luncheon in Hereford.

While in West Texas, the youths were shown the use of groundwater and its conservation, products produced and marketed thereby, as well as being briefed as to the economic benefits derived from groundwater.

To complete their study, the Committee is compiling their findings into a brief report. The report will be published and distributed to citizens wishing to be appraised as to this group's findings regarding the Texas Water Plan as it relates to East Texas, the High Plains, and the people of Texas.

On the afternoon of June 14th, the group attended a question and answer meeting in the offices of Water, Inc. Attending this meeting were Bill Clayton, Executive Director of Water, Inc.; and Gerald Ivey, Duncan Ellison and Tom Williams, all of Water, Inc. Also in attendance was Frank Rayner and Albert Sechrist, and Dr. Dan Wells, Texas Tech University.

Frank Rayner (far right) explains the functions of the District to the Youth Committee. Also shown is Dr. Wells (middle) and Mr. Fugger.

Sponsors of the Youth Committee include Reader's Digest Foundation, D. K. Caldwell Foundation of Tyler, Ed and Mary Heath Foundation of Tyler, and Texas Power and Light Company.

The Governor's Youth Committee on the Texas Water Plan shown during their West Texas Tour. Standing, left to right: Larry Osborne, Chairman; Donna Barron; Kathy Borchers, Assistant Home Demonstration Agent; Jennifer Wilson; Paula Cobb; David Payne; and Penny Rodgers. Seated is Edward Fugger, Smith County Associate County Agricultural Agent who is in charge of the Committee. Not shown is Wilson Hale of Texas Power and Light who serves as adult advisor to the Committee.

THE Cross SECTION

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

1628 15th Street, Lubbock, Texas 79401

Telephone 762-0181

FRANK RAYNER, P.E., Editor

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District Office at Lubbock

Frank Rayner ..... Manager
Albert W. Sechrist ..... Graduate Engineer
Mrs. Ann Bell ..... Geologist
Tony Schertz ..... Draftsman
Kenneth Seales ..... Field Representative
Obbie Goolsby ..... Field Representative
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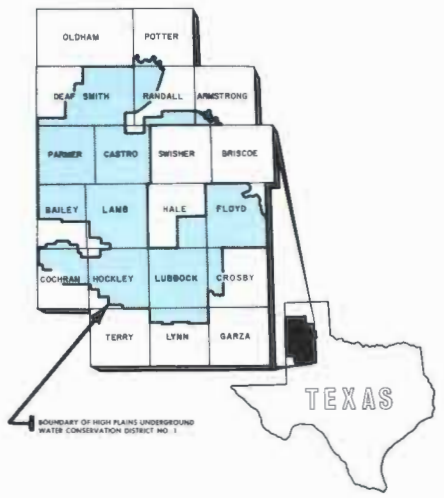

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NOTICE: Information regarding times and places of the monthly County Committee meetings can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Armstrong and Potter Counties; in these counties contact Carrol Rogers and Vic Plunk, respectively.

YEMENITE VISITS DISTRICT

Mohammed N. Ghaleb, an exchange student from Yemen, and a recent graduate of Texas University, visited the District on July the 6th and 7th.

Mohammed's two-day visit to the District was part of a tour, arranged by Lew Seward, Assistant Chief Engineer, Texas Water Development Board, and Professor Carl Morgan, Texas University, that was to include visits with several water agencies in Texas, New Mexico and Arizona.

The eldest child of a family of 13 children, Mohammed will soon be returning to his homeland, to enter the civil service of the Yemenite Government. He was very impressed with the agricultural practices he observed in the High Plains area—noting that we feed cattle the same grains (grain sorghum) that are consumed by his people. In Yemen, they pull the leaves from the grain sorghum plant for feeding to cattle, mill and prepare a bread from the grain, and use the stalks as firewood.

$H_2 O_2$

In recent years, there has developed an increasing public awareness of the vitality of fresh water to the maintenance of a quality environment. In regard to water quality, the ranks of the layman are fastly being absorbed into the camps of the pollutionist, conservationist, preservationist, or just plain protestationist.

Nearly everyone, be they informed, misinformed, or uninformed has a definite opinion regarding all real, apparent, or pseudo water quality issues. This new brand of "awareness" has cast some doubt as to the usability of the classic formula for pure water, $H_2 O$ —two parts hydrogen and one part oxygen. Perhaps it is now time to drop the reference to pure water, and start to refer to $H_2 O_2$—two parts hydrogen, one part oxygen, and one part OPINION.

Mohammed Ghaleb inspects the elaborate tailwater return system on the Charles Schlabs farm south of Hereford, Deaf Smith County.

Kenneth Seales explains the design and function of an underground water distribution system, using gated pipe for row irrigation, to Ghaleb.

Over the protests of Earnest Whitaker, Sun Oil Company completed this water supply well (in freeze-protecting box in near background) on Whitaker's Hockley County farm.

DISTRICT PRESENTS STATEMENT BEFORE THE TEXAS WATER RESOURCES STUDY COMMITTEE

Reproduced below is the text of the District's statement presented before the Texas Water Resources Study Committee, on June 19th, in Abilene.

This Committee, established by House Concurrent Resolution 12 of the 61st Legislature, is holding public hearings throughout Texas to receive testimony on several water issues; particularly testimony regarding the Texas Water Plan and the financing of same.

Committee members are: Representative John Allen, Chairman, Longview; Senator Tom Creighton, Vice-Chairman, Mineral Wells; Senator Jim Bates, Edinburg; Senator Criss Cole, Houston; Representative Rex Braun, Houston; Representative Bill Clayton, Springlake; Mr. M. P. Anderson, Houston; Mr. George T. Brabham, Daingerfield; and Mr. R. M. Dixon, Austin.

The High Plains Underground Water Conservation District No. 1 is an agency of the State of Texas created pursuant to the Underground Water Districts enabling act, codified as Article 7880-3c (Vernon Civil Statutes of Texas). This is the first district created in compliance with the provisions of this act, and it is the largest Underground Water Conservation District in Texas and the Nation. The District contains 5,315,600 acres, over 8,000 square miles. The District extends nearly 140 miles south from Amarillo, to near Tahoka, and from the New Mexico-Texas State line over 100 miles east through Floyd County. The District contains all or parts of 15 Southern High Plains Counties in Texas.

The District is governed by a five-member Board of Directors, elected for two year terms. The District has also established 75 other elective offices; consisting of five county committeemen for each of the fifteen counties within the District. The eighty elected officials of this District makes it the most democratically controlled water regulatory agency in the State of Texas.

Since this is the very first time it has been my pleasure to testify before this Committee, or any other similar committee, I would like to present a brief resume of my background, in order to help the Committee in judging the qualification of my statement.

I graduated from Texas A&M University in 1958, with a Bachelor of Science degree in Geological Engineering. I was immediately employed by the then Texas State Board of Water Engineers, in the "planning group"—established as the result of the acts of the Texas Legislature, in 1957. From 1959 to 1964, I served as the Engineer in charge of the Texas Water Development Board's Lubbock office. In 1964, I returned to Austin to become the Assistant Director of the Ground Water Division, in charge of the Board's Surface Casing and Subsurface Waste Disposal sections. In 1966, I resigned to become the District's Chief Engineer, and then its Manager in 1969. I am a Registered Professional Engineer in Texas, and a member of the Texas Society of Professional Engineers.

With this short resume of my background, I hope that the Committee will be kind enough to consider me an expert in some facets of my statement today; and to otherwise do me the courtesy of listening to my remarks on subjects which I can not honestly claim expertise.

I have arranged my statement to speak only on, and in the order of, the subjects outlined in the agenda for this hearing that was attached to Chairman Allen's letter of June 10, 1970.

I—AREA WATER REQUIREMENTS

I was employed by the Texas Water Development Board during the time the Texas Water Plan was being conceived, studied and developed. Although I did very little work on the plan, it was my pleasure to observe the dedication, enthusiasm and competence of the many Texas Water Development Board employees who did make the work on this plan the major part of their lives for over two years.

Do not believe that with these State employees the day started at 8:00 a.m., or ended any where near 5:00 p.m.—it was twelve-hour days, few holidays or vacations, and only Sunday revered.

Knowing these things makes me less than tactful in my judgment of those guilty of attacking the Texas Water Plan like a mountain—just because it is there.

The State's function in water resource development and implementation must necessarily be that of the directing role, since this is a Statewide function. The integration of the functions of Federal agencies and their participation in the Texas Water Plan are provided in the Plan; particularly as an integral role for meeting water requirements that can not be met with In-State supplies. This integration of the Federal Government into the Plan is a classic example of its flexibility.

In respect to flexibility, it is our opinion that the democratic procedures that were originally provided for financing the implementation of this Plan made it both flexible and defendable, from the standpoint of equality to all of the State's citizens.

I fear that the word "flexibility" is getting to be more and more used, but less and less understood; such as is the word "freedom." Any engineer can tell you that a steel ball is more "elastic" than a rubber one, however, try to tell that to a person that has just been hit by a steel ball.

There is nothing flexible about a dam, but there is flexibility in a dam planned for and integrated in a planned system of water development. If the staff of the Texas Water Development Board did not develop an adequate, equitable or flexible water plan, then an adequate, equitable, or flexible plan can not be developed by any others so qualified.

II—STATE WATER LAW

Although State law is specific as to the priority of surface water use, there does not appear to be any conflict in the present priorities that would restrict the implementation of the Texas Water Plan. It is possible that the old State law specifying water priorities should now be expanded to include other beneficial uses. However, it appears that it is still functional within the framework of the Texas Water Plan.

There is no priority of use established for groundwater within Texas. In this State, groundwater is the private property of the landowner. The landower can develop groundwater for any benefical purpose, the only restriction being that groundwater is not to be wasted. This freedom of selection of groundwater use priorities is responsible for the unprecedented, economic and equitable development of such water supplies within Texas.

Although there is no statutory priority for groundwater use, there is one priority while being exercised that assumes the role of priority of use—that being the powers of eminent domain, as practiced by municipalities and certain other local divisions of government. Through the powers of eminent domain, the priority for municipal use, and in some cases industrial use, has been exercised over groundwater.

It is in the opinion of the District, that the present private ownership of groundwater in Texas, as provided by the Texas Constitution, is the most workable, the most equitable, and the most economically benefical method for the assignment of priority of groundwater use that can be developed. One has only to observe the differences in economic development of groundwater in Texas' sister States, to appreciate this principle of private ownership.

Artificial recharging of aquifers is indeed, from the standpoint of an engineer, a beneficial use. The subsurface reservoirs are natural storage areas for excess surface water supplies. I believe it can be safely predicted that subsurface storage and retrieval of surface water will eventually become a primary facet of most water supply systems.

Groundwater reservoir systems have also been used by several cities in the western part of Texas to store groundwater that is pumped from other parts of the aquifer, and stored near the cities of use, in order that the pipe-line systems serving such cities can meet peak water needs during the summer months. This beneficial use (subsurface storage) of groundwater has been well established, and there is no reason that such practices should not be included as a beneficial use of surface water.

Recreation is becoming an increasingly powerful and beneficial water use. Since recreational use of water is nonconsumptive, it is illogical not to place considerable emphasis on this benefit.

The development of a recreational use priority is inevitable for any water impoundment project in Texas. The public will develop this priority regardless of any planning for same. The human need for recreation is compounded with the accelerating trend to urbanization. The general public are increasingly inclined to consider the recreational use of surface water impoundments as an inherent right. Recreation will assume a high priority use in the future. If it is an inevitable use, it should be considered for its repayment value.

The District does not recognize the necessity for restrictions on the beneficial use of potable water. If water is being put to beneficial use, such use should not be restricted. This position is tempered only by the realization that in some cases brackish or saline water could best be used to conserve potable water in short supply. Such uses could include waterflooding or pressure maintenance of oil reservoirs, cooling water, and other limited uses.

The economics of the use, and the availability of fresh water, should dictate to the user the conditions for restricting the use of potable water.

The recodification of water laws of Texas should, if accomplished **without substantive changes**, make these laws more understandable and administerable. There are probably some overlapping and duplication of charges within the water laws of Texas, that may require further study by this Committee, and possible substantive change to clarify and apply same. However, substantive changes in established law are the prerogative of only the Texas Legislature; and they should be accomplished only through and by the consent of the Legislature.

III—RESEARCH RELATED TO WATER RESOURCES

The universities in Texas have, through the Water Resource Research Centers, developed some very capable and useful water resource research capabilities. Unfortunately, in Texas, there is no provision for the State funding of the amount of water resource research that is needed. The vast resources of knowledge available through these universities is not now being beneficially utilized to seek solutions to specific problems of water resource development in Texas. Therefore, the District would recommend to this Committee that the Texas Legislature explore the possibility of the State funding water related research through the universites, and other organizations capable of performing such research.

There are numerous artificial recharge studies now in progress. The District took the lead in this field of study as early as 1954; today there are nearly 10 universities and other governmental agencies involved in this type of work in the High Plains area. However, there is one facet lacking in this artificial recharge research activity—that being the research into the economics of such practices. All of the organizations involved with artificial recharge are concerned only with the physical aspects of such practices; they have not made adequate surveys of the economics of their methods. This field, the field of artificial recharge research, is wide open and it will become one of the primary areas of research interest; because the subsurface storage of surface water supplies shall become an unavoidable necessity. In this respect, I would urge this Committee to take whatever action it can to further this type of research.

There is probably some need for environmental, ecological and land management studies for some water development projects. Until recently it has fallen upon management, the engineer or geologist, to make these appraisals for water development projects. The engineers and geologists have functioned for years as environmentalist, conservationist and ecologist without realizing that this was one of their primary functions; while their interest has been the economic and equitable development of surface and groundwater supplies.

Ecologic, environmental and other related studies should not be directed toward the hindrance of needed water development, but should look for answers and alternative methods for satisfying water needs with a minimal undesirable influence on the ecosystem.

IV—FINANCING

Interim financing of practically all water resource development projects is a necessity. Income from water sales can not be realized until the financing of the projects that provide for the development of such projects is forthcoming. However, interim financing should be just that, and the water resource development projects should rely primarily upon repayment through water sales.

Bond financing appears to be the most feasible method of obtaining interim financing for water projects. The 4-percent constitutional bond interest ceiling is not realistic in the present day, or under changing, bond market conditions. Therefore, it is the recommendation of the District that this Committee work to remove constitutional ceilings on bond interest; while providing some type of legislative flexibility for monitoring of future interest limits.

There should not be any users fee for groundwater, it is private property. However, for water development projects that are funded through public monies, it would not be unreasonable to require water users fees in order to retire part, or, in some cases, all of the costs of such projects.

V—WATER QUALITY PROBLEMS

In the High Plains of Texas, the sands and gravels of the Ogallala Formation provide an unprecedented degree of protection of the quality of the water stored therein.

There are no known instances of widespread pollution problems related to the use of agricultural chemicals within the High Plains area. Studies by the District, Texas Tech University, and the United States Agricultural Research Service have not shown any reason for alarm in regard to the use of agricultural chemicals in this area. This includes the widespread and heavy use of nitrogen fertilizers.

Research conducted by the District, Texas Tech University, the Agricultural Research Service and the Federal Water Pollution Control Administration, indicates that the filtering quality of the sands and gravels of the Ogallala Formation will tend to abate the introduction of organic pollutants into this aquifer.

Municipal sewage effluent is not a problem in the High Plains area. Such effluent, in this water short area, is considered an asset, and it is put to immediate beneficial use.

Recently there has developed a hysteria concerning the potential water pollution problems associated with the area's mammoth cattle feeding operations. I must emphasize that this concern is now completely based upon the supposition that feedyards are a water quality hazard—there is no established evidence that this is a major problem. The District would urge this Committee to allow the completion of the presently ongoing research being conducted on these feedyards, before judging their actual effect on the quality of groundwater, and/or the entire ecosystem.

While employed by the Texas Water Development Board, it was my privilege to be in overall charge of the surface casing section of this agency. This function, within the Texas Water Development Board, was to recommend to the Texas Railroad Commission, and to the oil operators, the amount of surface casing necessary to protect the fresh water strata. However, there are no provisions for a follow-up check to see if adequate surface casing and/or cementing programs were employed to protect subsurface water supplies.

After the oil fields cease to produce oil in economic quantities, and are abandoned, the protection of the fresh water aquifers will then be dependent upon the adequacy of the surface casing and cementing programs of the oil wells in such fields. It is my opinion that as old oil fields are abandoned, and the wells sealed, the oil reservoir system will again start to repressurize, and attempt to attain the equilibrium pressure existing before such reservoirs were developed. In a lot of cases, this will mean that the fluid level in such abandoned wells will be opposite that of the fresh water strata. In those cases of inadequate or improper surface casing and cementing programs, there is a tremendous potential for pollution of fresh water supplies. Such pollution is almost impossible to detect, until it has progressed to widespread proportions. It is these possibilities that behooves the District to recommend to this Committee that they develop legislative programs that will provide for the monitoring of the surface casing programs, and of the abandonment and plugging procedures of all oil and gas wells, and test wells in Texas. The District would also recommend the maintenance of a record of the **absolute** location of all oil and gas wells drilled in the State.

The District recommends that pressure recorders or gauges be installed to record the annular (between the surface casing and the long string, or production tubing) pressure in all producing wells in oil fields under waterflooding or pressure maintenance programs, and that pressure records be kept thereof.

The District also recommends that no wells be used for fluid injection purposes, that do not possess pressure monitored annular space between the surface casing and the injection tubing, or other casing in the well.

The District further recommends that selected wells be maintained in abandoned oil and gas fields, wherein the pressure(s) in the abandoned zone(s) can be monitored.

VI—WILLINGNESS TO PAY PROJECT COST

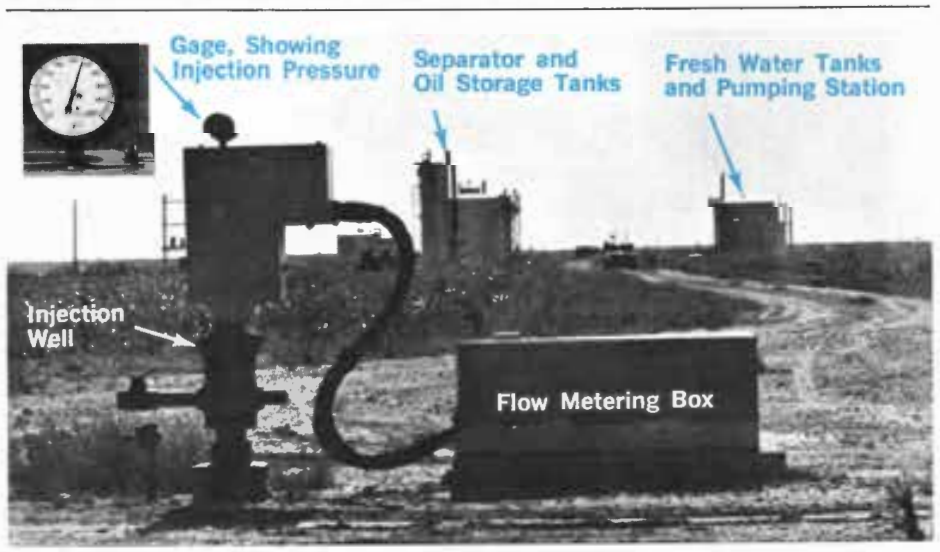
The willingness of the municipal water user to pay for surface water development projects has been demonstrated time and again throughout Texas. A classic example of this willingness to pay is exemplified by the City of Lubbock. Nearly five years before the receipt of the first surface water from the Canadian River aqueduct, the citizens of Lubbock voted upon themselves an increase in their groundwater use fees, to provide for the interim financing of a surface water treatment plant. This modern water treatment plant at Lubbock, treating water for a total of 7 cities on the Canadian River System, was nearly paid for before the first surface water was ever delivered to same. This is a classic example of the municipal water users willingness to pay their share of water development costs.

The industrial water users capacity to pay for water development is almost always dependent upon a cost to profit ratio that must be determined for each industry. In some cases the municipalities deriving other benefits from the industry are capable of assuming some of the industry's water costs, in order to derive the benefits of the industry's location in their area. This is a mutual and fair adjustment in their water use capability to pay, and there is no reason to restrict or limit such adjustments in water users rates where they are applicable or beneficial.

Agricultural water, because of the magnitude of the volumes required, provides some obstacles to the irrigator's capacity for repayment. However, in the High Plains of Texas, the area's economy is almost totally dependent upon agricultural development. Therefore, it is not unreasonable to expect that the people in the area will recognize this dependence, and provide their fair share of the cost of water development for such agricultural use—this is the same as the municipality aiding the industry.

The willingness of this area's irrigators to pay the principal share of such projects can be amply demonstrated by looking at their record for assuming their rightful responsibilities for water development and conservation. Only within the High Plains of Texas are there underground water conservation districts organized under Article 7880-3c. In this area, the irrigators voted upon themselves a tax-supported, regulatory agency—with such broad powers as to prorate the production of water from the landowner's wells—in order to provide for the protection and water conservation services of such districts. Nowhere else in the State of Texas have the groundwater owners with similar problems assumed their own responsibilities as have the irrigators in the High Plains of Texas. We believe this is documentary evidence of this area's irrigators willingness to assume their responsibility for repayment of the costs of surface water delivered to this area.

It has been a distinct pleasure to address this honorable Committee. The District and I stand ready to assist this Committee in any way that they should request of us. Thank you gentlemen, for your courtesy in listening to my statement. I hope you will consider some of it with some expertise, and all of it in the honestly, truthfully felt opinions, and sincerity with which it has been presented.



Water Flood Injection Well—One of two on the Whitaker farm.

SUN vs WHITAKER—

THE OPINION OF THE EASTLAND COURT

Sun Oil Company, Appellant
Vs. No. 4363
Earnest Whitaker, Appellee

Appealed from the 121st Judicial District Court of Cochran County.

Sun Oil Company brought this suit seeking a permanent injunction against Earnest Whitaker and his tenant son-in-law, Doyle Henderson, enjoining them from interfering with plaintiff's production of not more than 100,000 gallons of fresh water per day from Whitaker's 267.7 acres of land to use in waterflooding plaintiff's oil and gas lease thereon. Sun contends that the lease gave it this right as a matter of law. Whitaker filed an answer and cross action seeking to enjoin Sun from producing fresh water from his land for waterflood purposes. He contends that the parties to the lease did not intend to grant Sun the right to use amounts of water which would materially affect the supply of water available for irrigation farming. He sought to recover actual and exemplary damages. The case was tried before a jury and based upon the verdict, judgment was rendered denying Sun its requested injunction against Whitaker and Henderson. The court also granted Whitaker a permanent injunction, enjoining Sun from producing fresh subterranean water from the land in question and decreed that Whitaker recover from Sun actual and exemplary damages in the sum of $12,598.03 for fresh water already produced therefrom with six percent interest from the date of the judgment. Sun Oil Company has appealed.

This case is sequel to an earlier appeal in which Sun was denied a temporary injunction. See 412 SW 2d 680, (Amarillo CCA, 1967, affirmed 424 SW 2d 216.)

The record shows that Whitaker is the owner of the surface of the land by virtue of a deed to him from L. D. Gann in 1948. The conveyance to Whitaker was by its terms subject to a 1946 oil, gas and mineral lease from Gann to Sun Oil Company. Appellant contends that the rights of the parties hereto are determined by the provisions of the above mentioned deed and oil and gas lease, and in support of its contention particularly relies upon the following language in the 1946 oil and gas lease:

"Lessee shall have free use of oil, gas, coal, wood, and water from said land except water from Lessor's wells for all operations hereunder, and the royalty on oil, gas and coal shall be computed after deducting any so used."

In 1966, Sun drilled a water well into the Ogallala water formation on appellee's land and, after obtaining approval of the Railroad Commission of Texas, began injecting water produced therefrom into the underlying San Andres oil formation to increase production of oil from such land. The evidence indicates that the water is produced from the only available source of water on the land and that such water is used exclusively for the benefit of the leased premises, the so-called Gann-Whitaker tract. The waterflood operation results in the production of additional oil. Sun contends that it has the right under its lease to use as much of the surface estate, including fresh water, as is reasonably necessary for the conduct of all operations authorized by the lease. The evidence shows that the Sun water supply well is equipped so that it cannot produce in excess of 100,000 gallons of water per day and that 966,703 barrels of water have been produced from the well. It has been stipulated by the parties that the secondary recovery of oil by the waterflood process is a reasonable and proper operation for the production of oil from the San Andres reservoir under the land in question; that it is a reasonable and proper operation by Sun to use Ogallala water as the extraneous or makeup water for injection into the San Andres reservoir under the land in conducting secondary recovery of oil by waterflood process, and that the location of the injection wells and the rates of water injection as conducted by Sun Oil Company on the land constitute reasonable and proper operations for the production of oil.

Special issue number 1 which inquired of the jury whether the use of water by Sun Oil Company for secondary recovery purposes was taking water from existing wells of appellee Whitaker, was not answered. The answers to special issues upon which the judgment was based were: (2) that the parties to the Gann-Sun Oil Company lease did not mutually intend for the lessee to use such quantities of water as would materially affect the supply which the surface owner could produce by wells, (3) that the use of fresh water by Sun for secondary recovery purposes from the wells which it had drilled on said tract would materially affect the supply which the surface owner could produce by wells, (4) that it was not reasonably necessary for Sun to use water from the Ogallala formation underlying the Whitaker farm to waterflood the Gann lease, (5) that at the time the lease in question was executed there existed a custom in Hockley County for oil companies to use fresh water only in substantially smaller amounts than those needed for waterflood purposes (6) that both parties to the lease knew of such custom prior to the time the lease was executed, (7) that the proposed use of fresh water by Sun for waterflood purposes will substantially reduce the value of the farm owned by Whitaker, (8) that the installation of waterflood facilities on the land by Sun destroyed a portion of Whitaker's growing crops, (9) that the reasonable cash market value of Whitaker's crops so destroyed was $431.00, (10) that the reasonable cash market value in Hockley County of the fresh water that Sun has produced from the Whitaker farm for waterflood purposes from the beginning of such waterflood to the date of trial was $9,667.03, (11) that Sun acted willfully and maliciously in producing fresh water from the Whitaker farm and using it for waterflood purposes and (12) that $2,500.00 was the amount of exemplary damages which should be adjudged against Sun.

Appellant presents numerous points contending that under the undisputed facts the Court erred as a matter of law in submitting any issue to the jury; erred in rendering judgment against it and in favor of appellee Whitaker; erred in admitting into evidence and considering for any purpose extrensic evidence to vary, contradict or explain the intention of the lessor Gann and the lessee Sun as expressed in the language of their 1946 oil and gas lease and particularly erred in admitting into evidence testimony concerning the custom in regard to the amount of water used in oil operations in and prior to 1946; erred in admitting evidence which tended to show that Sun's use of water from its supply wells on the leased premises "will materially affect" the amount of water which Whitaker could produce from his wells, evidence that Sun could obtain water for its waterflooding operations from some source beyond the boundaries of the leased premises, or testimony concerning the value of the Whitaker farm either before or after the commencement of Sun's waterflooding operation on the premises. Appellant further urged that there was no evidence or in the alternative insufficient evidence, to support the submission of any of the issues presented to the jury.

The principal question presented is whether the provision of the lease granting Sun the right to "free use of oil, gas, coal, wood and water from said lease except water from lessor's wells for all operations hereunder" includes the right to use such water for waterflood purposes. Both parties to this appeal agree that in construing an oil and gas lease the intention of the parties is controlling. The general rule of law is that a court in construing a contract will ascertain the intention of the parties from the language contained in the contract. 13 Tex. Jur. 2d, page 288. Sun contends that the language of the lease is not ambiguous and grants to the lessee the right to use as much of the water as is reasonably necessary to produce oil and gas, and that the only limitation to lessee's right to use the water is stated in the lease as follows: "except water from lessor's well". As contended by Sun the record is conclusive that it has drilled and equipped its own water well and has not and does not propose to use any water from appellee Whitaker's wells. Appellant cites in support of its contention Carroll v. Roger Lacy, Inc., 402 SW 2d 307, (CCA 1966, Ref. nre); Guffey v. Stroud, 16 SW 2d 527, (Com. 1929) and Brown v. Lundell, 162 Texas 84, 344 SW 2d 863, (Sup. Ct. 1961), in which the Supreme Court reaffirmed the holding in the Guffey case and stated that:

" 'The grant of the oil carried with it a grant of the way, surface, soil, water, gas and the like essential to the enjoyment of the actual grant of the oil.' Thus, says the lessee, his right of user extends to the subsurface water. We do not question that proposition but the right to use does not imply the right to damage negligently or unnecessarily."

None of the cases cited by appellant involve the right of an oil and gas lessee under a lease similar to the one here under consideration to use water from the leased land for waterflood purposes. Appellant admits that the specific question has not been passed upon in Texas.

Appellee contends that the meaning of the language of the free wood and water clause as used in the lease and as applied to the facts and circumstances in this case are uncertain and doubtful and that the court properly admitted evidence concerning the circumstances, conditions and customs existing at the time the lease was executed to determine the intention of the parties. We agree with appellee's contention. Appellant's points to the contrary are overruled. Murphy v. Dilworth, 151 SW 2d 1004, (Sup. Ct. 1941); Ryan v. Kent, 36 SW 2d 1007, (Com. 1931); Dauray v. Gaylord, 402 SW 2d 948, (CCA 1966 Ref. nre); King v. City of Dallas, 374 SW 2d 707, (CCA 1964 Ref. nre). In Murphy v. Dilworth, supra, Justice Alexander speaking for the Supreme Court stated as follows:

"It is true that, even though a written contract be unambiguous on its face, parol evidence is admissible for the purpose of applying the contract to the subject with which it deals; and if by reason of some collateral matter an ambiguity then appears, proof of the facts and circumstances under which the agreement was made is admissable, in order that the language used in the contract may be read in the light thereof for the purpose of ascertaining the true intention of the parties as expressed in the agreement. In other words, if the meaning of the language used in a written contract becomes uncertain when an attempt is made to apply it to the subject matter of the contract, though not otherwise uncertain, parol evidence is permissible to aid in making the application."

On the former appeal of this case the Amarillo Court of Civil Appeals, 412 SW 2d at pages 682, 683, in passing upon this question stated as follows:

"The phrase 'all operations hereunder' is not ambiguous on its face. However the meaning of that language when applied to the rights of the parties hereto become uncertain and doubtful. We do not think it can be said such language is not subject to more than one reasonable meaning. Contrary to Sun's contention 'all operations hereunder' has not been given a settled, legal construction. It does not have an exact meaning. The lease does not specifically grant the lessee the right to engage in secondary recovery by the process of waterflooding. To hold the phrase under consideration is not subject to more than one reasonable interpretation, we would be compelled to hold as a matter of law that the lessee is entitled to free water for waterflooding as an operation under its lease rights. We think such a holding would be untenable. We therefore conclude the trial court correctly admitted evidence pertaining to the conditions and circumstances under which the oil and gas lease was executed."

The evidence concerning the circumstances, conditions and customs which existed at the time of execution of the oil and gas lease in 1946 containing the "free wood and water clause" was, in effect: that such clause was usual and customary in oil and gas leases executed at that time and had been used by Sun in all its leases as early as 1926; that the only uses which oil companies were or had been making of water at that time and in that portion of the state under the wood and water clause were for drilling operations, supply operations for water boilers and reworking operations and that none of these operations used a large amount of water; that at the time of the execution of the lease waterflooding was unknown to landowners, farmers, bankers and attorneys in that part of the state and that at that time neither party to the lease knew of the existence of the underground water deposits here involved. Although Sun Oil Company personnel knew of the waterflooding practice for several years prior to the date of this lease it made no effort to specifically provide for the right to use water for that purpose. The evidence indicated that the consideration for the lease was commensurate with the consideration paid for any lease on a farm with insufficient water for waterflooding or irrigation. The evidence indicated that waterflooding was not practiced in the west Texas area in 1946 although prior to that date waterflooding had been practiced in some parts of Texas, but that knowledgeable people in the Hockley County area became aware of secondary recovery by waterflooding several years after the date of the lease here under consideration. As above indicated, at the time the lease was executed in 1946 all operators in Hockley County and in surrounding territory had used fresh water only for drilling operations and other activities which did not require appreciable or substantial amounts of fresh water; that the amount of water needed for drilling eight oil wells is three acre feet and that Sun Oil Company proposes to use 451 acre feet for its waterflood project.

The Ogallala formation is a closed isolated underground reservoir in that there is no replenishment of such water except from moisture which penetrates down into it after falling on the surface. The fresh underground water with which Whitaker irrigates his crops and secures his domestic water and that which Sun proposes to use comes from the Ogallala formation which is the only source of water in the area of Whitaker's farm. There was evidence to the effect that a water well drilled into the Ogallala formation in close proximity with other wells in the same formation will take part of the water from those wells; each well depends upon its supply from an area spread out from the well, and the longer a well is pumped the broader this sphere of influence spreads. The evidence indicates that hydrological records show that the water level in the vicinity of the Whitaker farm has declined over a period of years, and there was expert testimony to the effect that this water level will continue to decline and that Sun's proposed use will considerably shorten the useful life of Whitaker's water supply; that this is true even if Sun uses only one well and Whitaker drills no more irrigation wells. The evidence indicated that Sun's waterflooding project would ultimately consume 4,200,000 barrels of Ogallala water and although there is some evidence to the contrary that if Sun uses such amount of water without drilling other supply wells Whitaker's water supply will disappear at least eight years more quickly than it would in the absence of Sun's activities. The evidence also indicated that if the development of water on the land surrounding Whitaker occurs, Sun's activities would cause the effective life of Whitaker's water to be reduced from 18 years to 10 years.

In answer to special issues numbers 2, 3, and 7, the jury found that the parties to the lease did not mutually intend for the lessee to use such quantities of water as would materially affect the supply which the surface owner could produce by wells; that the use of fresh water by Sun for waterflood purposes would materially affect the supply which the surface owner could produce by wells; that at the time the lease was executed there existed a custom in Hockley County for oil companies to use fresh water in their operations only in substantially smaller amounts than that needed for waterflood purposes; that both parties to the lease knew of such custom prior to the time the lease was executed; and that the proposed use of fresh water by Sun for waterflood purposes will substantially devalue the farm owned by Whitaker.

In numerous points appellant contends that there was no evidence to support the submission of such special issues and that there was insufficient evidence to support the answers of the jury thereto and that such answers are against the great weight and preponderance of the evidence. These points are overruled. As shown by the facts and circumstances in evidence, as heretofore summarized, there was evidence supporting the submission of each of the issues, and although there was some evidence to the contrary, the evidence considered as a whole was sufficient to support the findings of the jury in answer thereto and such answers are not against the great weight and preponderance of the evidence.

In answer to special issue number 4 the jury found that it was not reasonably necessary for Sun to use water from the Ogallala formation underlying the Whitaker farm to waterflood the Gann lease. Appellee urges points contending that the court erred in admitting any evidence tending to show that Sun could afford to purchase water for its lease waterflood operation from some source beyond the boundaries of the Whitaker land, that there is no evidence or insufficient evidence to support the submission of special issue number 4 to the jury and that the answer to such issue is contrary to the great weight and preponderance of the evidence. These points are overruled. Appellant's argument contending that the court erred in admitting evidence tending to show that it could purchase such water from some source beyond the boundaries of the lease is based upon the assumption that Sun had the right under the lease to use fresh water from that land for waterflood purposes. We have already held that contention untenable. It is true as contended by Sun that it is reasonably necessary for Sun to use Ogallala water to waterflood the Gann lease but there is ample evidence showing that Ogallala water could be purchased and used by Sun from other sources than the water from Whitaker's land.

In appellant's 21st point it is contended that the court erred in entering judgment against Sun for exemplary damages. It is true as contended by appellant that exemplary damages will not be granted merely because of the commission of an unlawful act. Ware v. Paxton, 359 SW 2d 897. However the record in this case shows that Sun drilled a water well on Whitaker's property over strenuous objections and has since unlawfully produced almost 1,000,000 barrels of water of a total value of $9,667.03 which it has used in its waterflooding operations. At the time such well was drilled this lawsuit was pending and the trial court had denied Sun's request for a temporary injunction. The drilling of the well by Sun was not only unlawful but was done intentionally and willfully and with full knowledge that the District Court had made a judicial determination that Sun had no legal right to use Whitaker's water for waterflood purposes. It is held that a defendant may be compelled to respond in exemplary damages if the act causing actual damages is a wrongful act done intentionally in violation of the rights of the plaintiff. Tennessee Gas Transmission Company v. Moorhead, 405 SW 2d 81, (CCA 1966, Ref. nre).

We have considered all of the points presented by appellant and find them to be without merit. The judgment is affirmed.

CECIL C. COLLINGS
ASSOCIATE JUSTICE

June 26, 1970.

EARNEST WHITAKER
The Man In The Middle

HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

SECOND CLASS PERMIT

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 8 "THERE IS NO SUBSTITUTE FOR WATER" *August, 1970*

Pictured, left to right, in the Washington offices of Congressman George Mahon are: Ross Goodwin, Vice-President of the District's Board of Directors; Congressman Bob Poage (Waco); Ray Kitten, Member of the District's Board of Directors; Congressman George Mahon (Lubbock); and Frank Rayner.

Mahon Announces Grant

Congressman George Mahon, 36 year Congressional veteran from the 17th Congressional District, and Chairman of the House of Representatives Appropriations Committee, has announced the award of a $100,263.00 grant, from the Office of Water Resources Research (OWRR), U.S. Department of the Interior, to Texas Tech University and the District, to continue modeling research on the Ogallala aquifer.

A $98,578.00 grant from OWRR, in August 1968, provided the funding for the first two years of this research. The District and Texas Tech University will also contribute a total of $38,213.00 to this 4-year research effort.

The objective of this research is to develop mathematical modeling techniques, amenable to high speed digital computer analysis, for developing a predictive model for the Ogallala and similar aquifers. It is hoped that the model developed by this research will be readily adaptable as an aquifer management tool. It will aid water importation studies now underway by both the Federal and State agencies.

An explanation of the scope and objectives of this research are presented in the article, "Dynamic Model Of The Ogallala Aquifer," on page 3.

Comments on the 1970 Census

STANLEY A. ARBINGAST*

The preliminary 1970 Census count indicates that on April 1 Texas had 10,981,447 people. This number is somewhat below the projection of 11,187,000 for July 1, 1969, and of 11,399,000 for July 1, 1970, published previously by the Bureau of the Census, and it is approximately one million below the projection of 12 million for December 1970 made by the Bureau of Business Research in the mid-1960's (The Bureau did not assume a decline in the birth rate or shortages of water). Preliminary figures for many communities in the state were far below local expectations; in fact, several cities of substantial size lost population. Final revisions, after a thorough recheck by Census personnel, will probably bring these disappointing figures to a total in excess of 11 million.

In contrast to some local forecasts, the annual estimates made by the Population Research Center and published each spring in the *Texas Business Review* appear to have been remarkably accurate, in view of the Census counts. Fortunately for the staff of the Center, they have confined their activity to estimating current population and have stayed away from the precarious business of forecasting.

A number of reasons explain why forecasters at state and local levels were too high in their predictions. First and foremost, the decline in the birth rate had a greater effect than was anticipated. Second, the assumption in general use by forecasters that a utility meter connnection serves an average of from 3.0 to 3.5 persons clearly appears too high. Obviously, many more dwellings are occupied by only one or two persons than was the case when the 1960 Census was taken. Third, *automation of agriculture,* of mineral production and exploration, and of manufacturing has proved to be more of a loss factor than was assumed generally. Most counties in which the economy is more dependent on agriculture and mineral production than on other activities show population declines. *People leave the farm as agricultural procedures are further mechanized.* Farms become larger. A loss occurred even in Hale County, for many years one of the leading counties in agricultural income in the nation. Declines in mining activity and automation of production facilities in place were the

—continued on page 2

POPULATION TO WATER ABOUNDS

The excellent article by Mr. S. A. Arbingast, "Comments On The 1970 Census," (appearing in this issue of the *Cross Section)* prompted these further comments on the interdependence of population density on available water supplies.

Although Mr. Arbingast's paper may be of primary interest to the professional users of demographic data; his analysis of the census data pungently stresses the agricultural, mineral and water interests of the entire State. The overwhelming inference is upon the limiting influence of available water on population growth.

Earlier censuses established the trend of continued population growth of the western part of Texas. However, the 1970 census revealed the end, and possible reversal, of this trend.

It takes very little study to perceive the primary reason for this demographic reversal — the western population continued to grow vigorously until reaching nearly full utilization of the area's limited water supply. Without additional water supplies, the vast climatic, land, mineral, and human resources of western Texas will waste to nonuse.

The accelerating trend to urbanization has resulted in the concentration of approximately 50 percent of the State's entire population in only four metropolitan areas; Dallas-Fort Worth (Dallas, Denton and Tarrant Counties); Houston (Brazoria, Harris and Galveston Counties); Austin (Travis County); and San Antonio (Bexar County). This means that half of the State's 11 million (+) population is concentrated on only 3.5 percent of its nearly 276,600 square miles of land area.

The relative voting enormity of this population concentration is further nurtured by the type of urban migration that may be taking place. The official 1970 census data will probably reveal that the younger (below 30 years of age) generations are flocking to the cities. If the newly enacted Federal laws giving full voting priviledges to 18-year olds is upheld by the courts; the foundations of our stable, rurally founded form of governmental rule and reason is subject to severe scrutiny; and to possible eventual overhaul at the whim of the metropolitan voter. The age old realization that, "as goes agriculture, so goes the economy," is subject to further decay with

—continued on page 2

THE Cross SECTION

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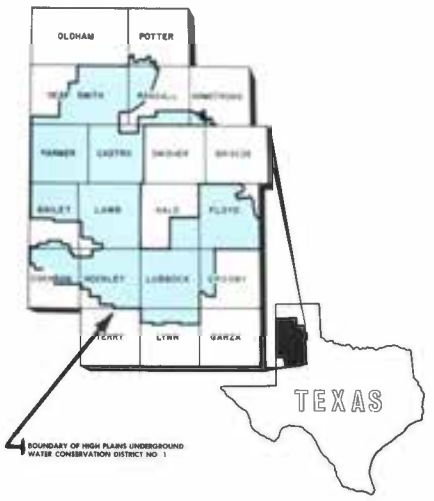

NOTICE: Information regarding times and places of the monthly County Committee meetings can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Armstrong and Potter Counties; in these counties contact Carrol Rogers and Vic Plunk, respectively.

The 1970 Census . . .

—continued from page 1

major causes for declines in counties such as Andrews, Crane, Ector, Scurry, and Midland, all of which gained population rapidly in the forties and fifties. *Unlike the pine trees of East Texas, minerals are not a renewable resource.* Most astonishing, however, was the decline of almost 3,000 in Jefferson County, where the huge Beaumont-Port Arthur chemical and refining complex is located and where impressive amounts of new capital were invested in manufacturing facilities during the decade of the sixties.

Forecasters, particularly those working at local levels, have been too optimistic for other reasons. In some instances they failed to consider the effects of demolitions of dwellings to make way for expressways, parking lots, new commercial structures, and convention and civic centers. In other cases the predictors were overly impressed by the substantial rises in the number of employed persons in a community, neglecting to correlate growth in jobs to the expansion in the number of families in which the husband and wife are both wage earners. New jobs mean that more money circulates within a community but do not always imply proportional immigration into the area. Importantly, some forecasters failed to take into consideration that, although most Texans claim to abhor commuting to work, many in fact do commute. Some agricultural counties lost fewer people than might have been anticipated, or they gained slightly, because their residents prefer to commute to work rather than move to the job site in a nearby county.

Several significant population-distribution trends in Texas worth studying during the seventies can be identified on the map on page 4. They include:

1. Far more counties served by Interstate Highways 35 (Dallas-Fort Worth to San Antonio) and 45 (Houston to Dallas) gained than lost. This development tends to confirm the forecast that the Dallas and Fort Worth-San Antonio-Houston triangle is where a high proportion of the economic growth in the state will take place during the next few decades.

2. More coastal counties gained than lost. The coastal area is attractive not only to investors in industrial activities but also to the investors in recreational facilities. These counties will continue to grow rapidly during the seventies.

3. *Construction of new reservoirs and development of residential, resort, and recreational facilities along shorelines of inland lakes is contributing to growth in several areas,* particularly in the Hill Country west of Austin and San Antonio, where all counties except Blanco increased in population.

4. *Deficiencies in water would seem to be affecting the growth potential of West Texas adversely.* The area to the east of Fort Worth and San Antonio contains most of the counties which gained residents; this is the portion of the state which has the most rainfall and the most dependable water supply.

5. Texans are continuing to crowd into the state's major urban centers—Houston, Dallas, San Antonio, Fort Worth, El Paso, and Austin—at the expense of other parts of the state. Among these six urban areas Austin had the largest percentage gain—32.3 percent. Three standard metropolitan statistical areas (SMSA)—Houston, Dallas, and Fort Worth—account for almost 40 percent of the population. If the population of the San Antonio SMSA is added to that of these three, the total approaches 50 percent. Some suburban communities, such as Pasadena in the Houston SMSA, Irving and Garland in the Dallas SMSA, and Arlington in the Fort Worth SMSA, are now larger than the central cities of some SMSA's—for example, Odessa, Laredo, San Angelo, Midland, and Tyler. Forecasters for the four largest cities didn't realize that the rate of growth of their suburbs is outstripping the growth rate of the central city. By 1980 or 1990 population in the largest of the central cities may even decline.

It is clear that by 1980 the statistically larger standard metropolitan areas will have much stronger influence on politics, on decision making relative to social problems, and on the economy than they have had in the past.

**Director of Texas University's Bureau of Business Research.*

Population to Water . . .

—continued from page 1

each succeeding generation of city dwellers.

Unlike other governmental spending, all large scale water development projects must undergo one or more elections requiring voter approval by the general public. This requirement for voter endorsement has placed in the hands of the metropolitan voter further agricultural controls; because, as is both the urban and rural economy tied to agriculture, so is agriculture tied to water development.

If the trend to urbanization that is reflected by the 1970 census is to continue in the future, efforts will have to be taken to appraise the urbanite with an understanding and appreciation for the metropolitan dependence upon the rural economy. A complete overhaul of the Texas educational system's approach to the teaching of the conservation and development of natural resources could be a first step toward the realization of this most necessary appreciation.

Mr. Arbingast's predictions, ". . . that by 1980 the statistically larger standard metropolitan areas will have much stronger influence on politics, on decision making relative to social problems, and on the economy than they have had in the past," appears to have been preempted by history, with the defeat of the Constitutional Amendment No. 2 proposition on August 5, 1969. During this election the (primarily) metropolitan voter exercised the, "much stronger influence . . . on decision making . . . and on the economy . . ."; by rejecting the adoption of an amendment to the Texas Constitution that would have empowered the Texas Legislature to authorize the Texas Water Development Board to sell bonds to finance the water projects set forth in the Texas Water Plan *(The Cross Section,* August 1969).

Dynamic Model of the Ogallala Aquifer*

The dynamism of an aquifer model is a measure of its applicability to simulate real and changing aquifer conditions.

The Ogallala aquifer in Texas is a relatively thin aquifer, of considerable areal extent. The top of the aquifer is the water table in the Ogallala formation, the base of the aquifer is formed by the eroded surface of older rocks. It is the configuration of this old erosional surface — incised and meandering stream channels, mesas, cuestas, hills and valleys — that controls, for the most part, the configuration of the Ogallala aquifer.

The magnitude of the economic dependence upon this aquifer has established a trend to its depletion, and as the water table draws closer to the base of the aquifer, the configuration of the aquifer is undergoing change. Therefore, to economically model this aquifer, to near depleted conditions, is going to require a model that can effect its own internal adjustment to compensate for the changes in aquifer configuration — a dynamic model.

Models

The present generation of aquifer models may be much too rigid in their configuration to be readily adaptable as a management tool for the Ogallala aquifer.

The analog model has finitely established nodes and fixed analogies. Aside from a host of other inflexible characteristics, storage depletion cannot be readily simulated by this type of model — a condition of paramount importance for modeling the Ogaliala aquifer.

Mathematical models are presently the most flexible method of simulating aquifers, and they can readily model storage depletion. When fed into large high speed computers, they are the least expensive of all procedures for modeling large areas. However, they presently have one inherent inflexibility that may limit their application to modeling the Ogallala aquifer — this inflexibility is in the manner in which the model is partitioned for analysis.

Polygons

To mathematically model an aquifer, it is necessary to divide it into segments (polygons) of known geometric configuration. It is the mathematical simulation of the balancing of the flow of water into and out of these polygons that constitutes the model.

In the Ogallala formation, the top of the polygon is the water table, and the bottom is some preselected elevation chosen to represent the base of the aquifer — both surfaces are assumed to be flat. A model of this type is now being constructed by Texas Tech University, in cooperation with the District, on the area within the District in Bailey, Castro, Lamb, and Parmer Counties.[1]

This model is an adaptation of the California Department of Water Resources, Chino Basin model—the work of Ernest Weber, Mel Schrecongost, Kiyoshi Mido, and others.

Bill Claborn's (Texas Tech University) adaption of this model to the four county research area has produced some surprisingly accurate first run results. However, this modeling has been confined to predicting water levels through a known historical range, which only applies to the top few feet of a relatively thick blanket-like aquifer; a condition where the assumption of a flat base of the aquifer, in polygons covering large areas, is not a critical factor. This condition is illustrated by Figure 1.

In the interest of simplicity, only the total configuration (all sides, bottom and top) of polygon A is shown on Figure 1. This drawing is further simplified by assuming a common water table elevation for all of the polygons (A, B, C and D) — a condition that would not exist in a real model.

The base of polygon A (simulated base of the aquifer in this polygon) is partly below the base of the aquifer. This, or a base above the bottom of the aquifer, may be a common condition for large polygons in the Ogallala aquifer; because of the slope of the base of the aquifer, its unevenness, and the assumption of an average elevation for same.

The base of polygon B would probably be above, and below, parts of the actual base of the aquifer; due to the averaging of the elevations associated with the buried mesa therein.

If the model was to be run to near depletion of the aquifer, a condition illustrated by Figure 2, the model predictions could be expected to contain inherently large errors, since the uneven base of the aquifer would then become a critical factor.

However, if a model of the Ogallala aquifer could be developed that had the ability to automatically adjust its polygonal configuration through successive stages of depletion of the aquifer; the assumption of a flat bottom for the polygons would become less critical, and the predictions for the polygons more accurate. A model to provide this dynamism is the object of a research proposal now before the Office of Water Resources Research, from Tech and the District.

Tech's modeling expert, Bill Claborn, has developed a computer program, coupled with a Cal Comp Plotter, that plots polygons based upon the Thiessen method of polygon construction. This routine provides a quick way to construct polygons, when the nodal and boundary data are provided as input. This is a rather involved routine that requires considerable machine space and time. Perhaps square or rectangular polygons will have to be employed in the dynamic model, in order to simplify the automatic machine routines for constructing same. The projections provided by a square patterned model would also be better adapted to field conditions.

Data Codified

It is hoped that the sought-after dynamic model will have the capacity to assimilate raw well data, and from such data determine the correct polygon configuration to represent changing geohydrologic conditions.

The District has established procedures[2] for the card punching of these data; to date, all of the locations, and about one-half of the other geohydrologic data for the 14,000 wells in the 4-county research area have been codified and card punched.

Groundwater Basin Management

The "cast in concrete" polygon is the primary physical inflexibility to modeling the Ogallala aquifer. However, there is one other limitation to model simulation by high speed computers, and that is the type of model output usually generated by such machines—a mammoth series of lists of numbers. This type of output is not readily adaptable to the framework for groundwater basin management in this area.

In Texas, groundwater basin management is provided through local districts that are established over aquifers, or subdivisions thereof. These districts are governed by a 5-member board of directors, who are *elected* for two year terms. Although a board member may serve any number of terms, he, nevertheless, must stand for re-election every two years. Groundwater basin management, as it is practiced by these districts, is principally through controls on well development. This means that such management is directly involved with one of the irrigator's primary instruments for creating income, therefore, decisions made by water district directors are directly linked with the economic well-being of an individual, and/or the general public. Within this realization, it is apparent that the model output must be of such a character to be convincingly usable to these board members. It should also be pointed out that the board members are experts in their own fields; be it farming, cattle feeding, or other agricultural or general business—they are not engineers, hydrologists, geologists, or computer experts—therefore, the computer output must be tailored to their needs.

The computer programmers' comments regarding pictorial computer output is that the machines were not designed to do artwork; however true this may be, if their output is not readily understandable by those responsible for groundwater basin management, the model output will not receive the acceptance needed to make it worth the efforts of developing same.

If a physically flexible model can be built, making it speak in the language of management does not appear to be an insurmountable inflexibility.

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[1]This work is being financed by a grant to Texas Tech University and the District from the Office of Water Resources Research, U.S. Department of the Interior. A complimentary grant, also from the Office of Water Resources Research, provides funds to General Electric TEMPO, and their consultant Dr. David K. Todd, to consult on the Tech-District project.

[2]Procedures for Codification of Ground-Water Data, High Plains Underground Water Conservation District No. 1, by F. A. Rayner and A. W. Sechrist, 1969.

**Paper presented by Frank Rayner at the first Ogallala Aquifer Symposium, Lubbock, Texas, April 30, 1970.*

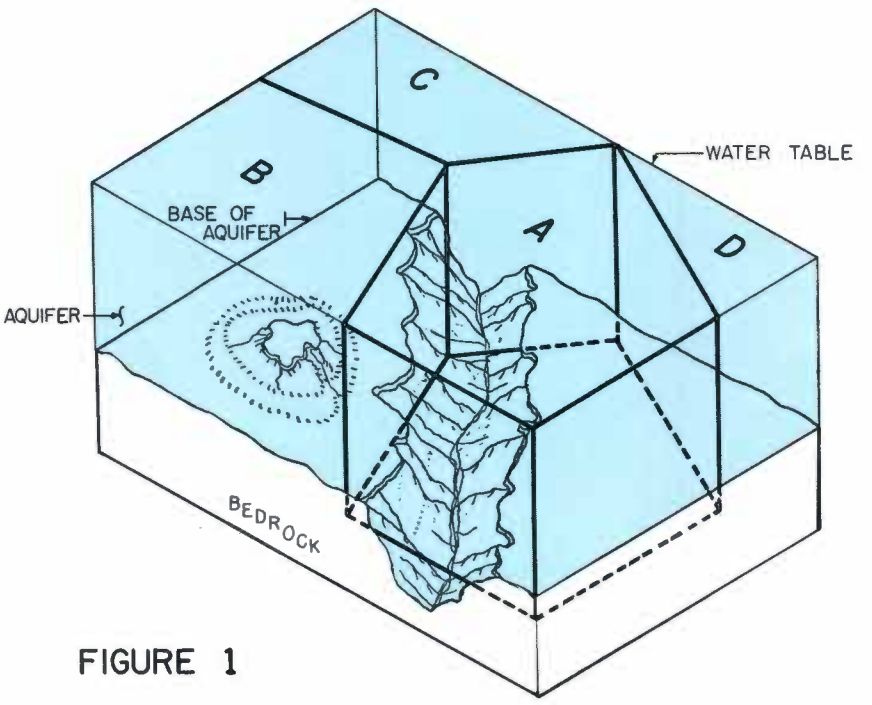


FIGURE 1

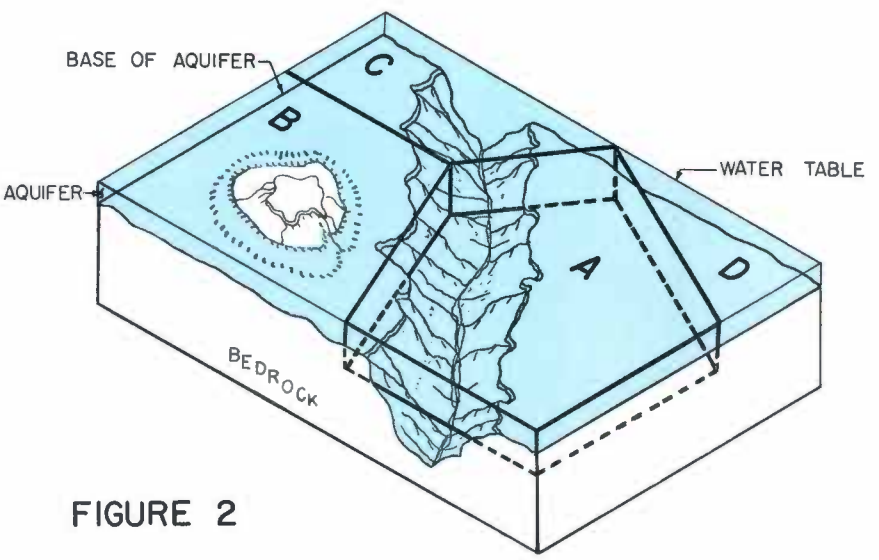
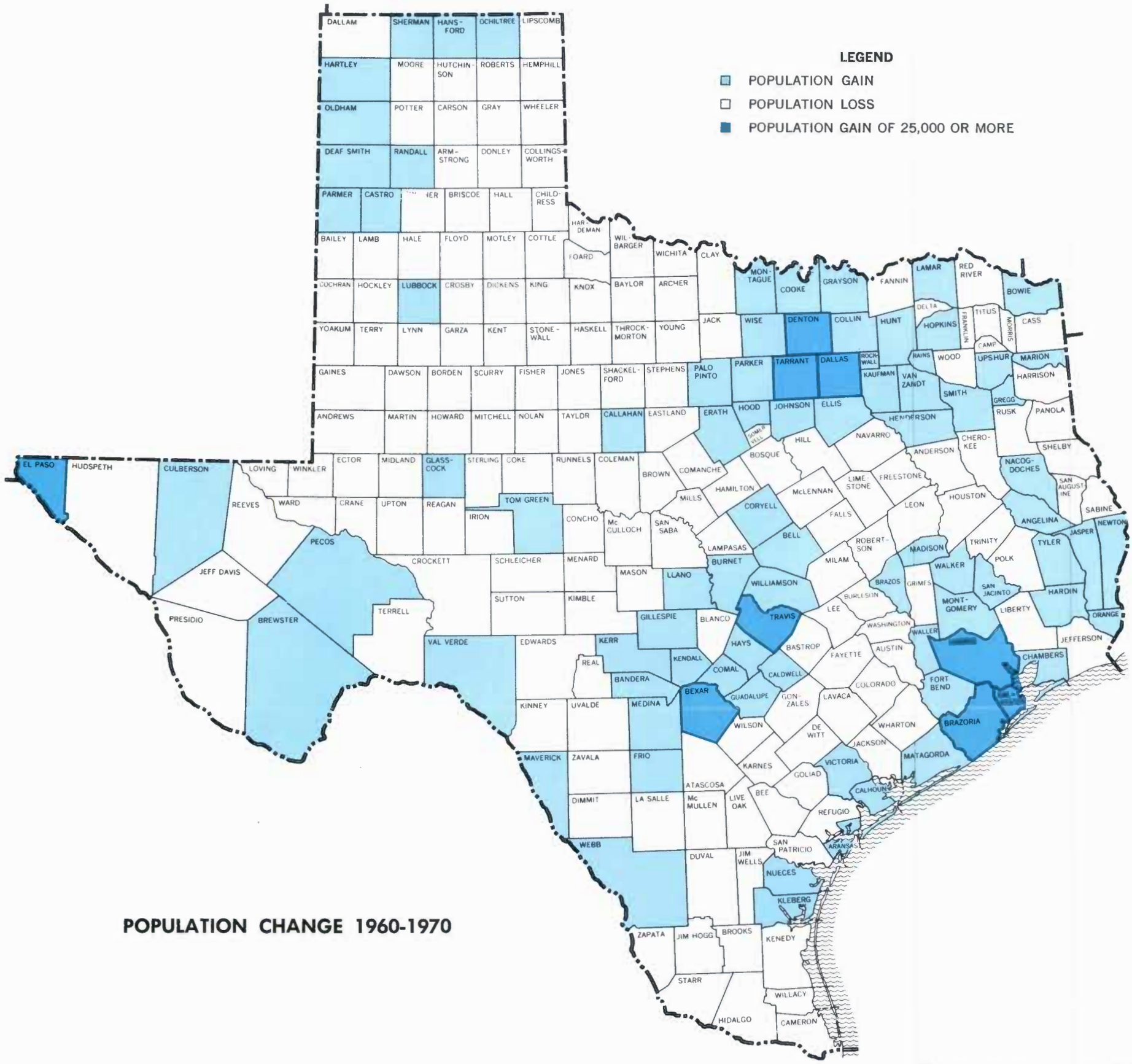


FIGURE 2



POPULATION CHANGE 1960-1970

The Cross Section, August, 1970

HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

SECOND CLASS PERMIT

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 9 "THERE IS NO SUBSTITUTE FOR WATER" *September, 1970*

Shown after recent ceremonies admitting new lawyers to the Texas Bar are, Richard B. Amandes, Dean of the Texas Tech University Law School; Joe Greenhill, Associate Justice of the Texas Supreme Court, and John Seymour.

Attorney Joins District

John L. Seymour has recently joined the staff of the High Plains Underground Water Conservation District No. 1 as an attorney.

Seymour recently graduated from Texas Tech University School of Law receiving a Juris Doctor degree as a member of the school's first graduating class. He passed the Texas State Bar Examination, which was given last June, and was admitted to practice law in Texas on September 18, 1970. The admission ceremonies for Texas' 499 fledgling lawyers was conducted by the Supreme Court of Texas with Chief Justice Robert W. Calvert presiding. The Supreme Court's Associate Justices include Clyde E. Smith, Ruel C. Walker, Joe Greenhill, Robert W. Hamilton, Zollie Steakley, Jack Pope, Tom Reavley and Sears McGee. Judge James Denton of Amarillo will become (pending the November elections) an Associate Justice on the Texas Supreme Court in January, 1971, replacing Justice Hamilton.

The first graduating class from Tech's new Law School distinguished itself on this year's bar exam by having the highest bar exam grade average of any of the eight law schools in the State, as well as having the students making the top five grades out of the more than 600 who took the examination. The Dean of the Law School, Richard B. Amandes, and his faculty can take pride in this achievement.

The Tech Law School has, from its opening, offered courses in Water Law. These courses have been taught by Professor Justin C. Smith who is the School's Associate Dean. Professor Smith has seen the need to have as many of the school's graduates as possible take courses in Water Law, especially those who intend to stay in the High Plains area, where the economy is so directly tied to groundwater.

The legal profession is becoming more and more cognizant of the importance that groundwater plays in our society. Supreme Court Associate Justice, Joe Greenhill has stated "Ground water is assuming an increasingly significant role in our economy; questions involving its ownership and control have become extremely important." 33 *Texas Law Review* 621.

Majoring in government, Seymour received a B.A. from Texas Tech University in January, 1964, before entering the U. S. Army with the rank of Lieutenant. He spent the majority of his two years active duty stationed in Korea, on the Demilitarized Zone, as a member of the First Cavalry Division. After his active duty he was a member of the reserves, and for a time he was the Company Commander of Co. B 980th Engr. Bn. located in Lubbock.

While in law school, Seymour developed a keen interest in natural resources law, particularly the area of water law. He has attended several national water conferences. Being concerned with the modern environmental problems, John has shown an interest in the laws dealing with the control of waste of groundwater, while encouraging its full and complete development for beneficial purposes. He is currently taking courses in geology and groundwater at Tech, in order to increase his knowledge of the physical problems concerning underground water.

Water Conservation And Farm Leases

Until recently it has been a common practice for the farm landowner and his tenant to orally agree on the terms under which the landowner's farm was to be managed by the tenant. Written leases were, and are, for the most part, still not commonly executed between the farm lessee and the landowner (lessor). Usually only "gentlemen" are involved, and a smile and handshake have sufficed remarkably well throughout the years. In addition, the landowner and his tenant were usually neighbors.

However, the increasing complexities of the interrelationships of the landowner and governmental (local, state and federal) laws, rules and regulations have placed additional burdens on such gentlemen's agreements.

Now the landowner and his tenant are seldom neighbors—absentee ownership, estates and other types of farm corporations are becoming quite common. The "cooperative" partnership between the High Plains tenant and the absentee owners, who often live in New York or California, is also being strained by the squeeze on farm profits; while at the same time the landowner finds that he must depend more and more upon the tenant to satisfy the landowner's governmental obligations.

It is these complexities that have made it advisable for the landowner to depend upon a written lease instrument; prepared by competent counsel. The benefits of the tenant also being represented by counsel can not be overlooked.

Cash Leasing

In recent years the practice of cash leasing of land—mostly in the form of cash in advance—has gained in prominence. In this situation the tenant has already "spent his money," and he must then recover same by producing what he hopes to be a bumper crop. If all goes well with him—if the weather cooperates—the tenant may take it upon himself to also look out for his landlord's inter-

—continued on page 2 . . . WATER

GOVERNOR'S YOUTH COMMITTEE REPORT

The Governor's Youth Committee on the Texas Water Plan *(The Cross Section,* July, 1970), has released their report, "A 2020 Vision", of their impressions and opinions of the interrelationship of East and West Texas through the Texas Water Plan.

The Committee's report, authored by Larry Osborne, Donna Barron, Paula Cobb, Ronald Newland, David Payne, Penny Rodgers, Jennifer Wilson, and Danny Wyatt, all of Tyler—with advice from Edward F. Fugger, Smith County Associate Agricultural Agent, Kathy Borchers, Smith County Assistant Home Demonstration Agent, and Wilson Hail, Texas Power and Light Company—follows the format of presenting the Committee's finding of their answer to the most common questions asked about the Texas Water Plan, and the means of financing same.

Like most of today's youth, the Committee's answers are as factually and bluntly stated as are the questions asked. Although some of their answers and opinions may not be professionally correct or factually founded, they, nevertheless, contain the honesty of youthful curiosity and youthful expertise.

If their answers are not all correct, it is through no fault of their own. The complexities of the interrelationship of the many disciplines of the water development field are not easily understood. The problem may partly be what is now popularly described as the lack of communication between the establishment and youth.

The 26-page report is much too detailed to present in its entirety in *The Cross Section.* However, some excerpts are presented herein. Copies of the complete report can be secured by contacting Mr. Fugger at the Texas Agricultural Extension Service, 404 Courthouse, Tyler, Texas 75701.

In the report's "Introduction", the Committee notes:

The citizens of Texas are facing a

—continued on page 4 . . . YOUTH

MAHON

The article, "Mahon Announces Grant", that appeared in the August 1970 issue of *The Cross Section,* erred in reporting that Congressman Mahon serves from the 17th District. Congressman Mahon represents the 19th Texas Congressional District in the U.S. Congress.

THE Cross SECTION

A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

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FRANK RAYNER, P.E., Editor

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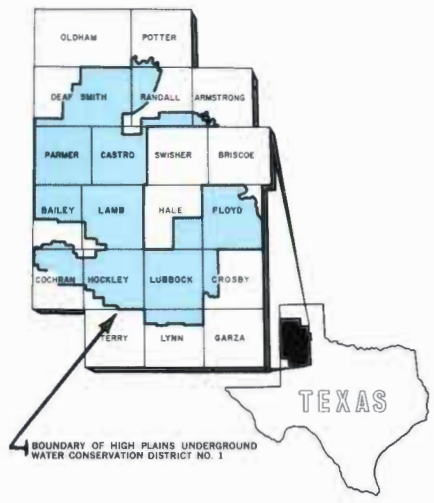


NOTICE: Information regarding times and places of the monthly County Committee meetings can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Armstrong and Potter Counties; in these counties contact Carrol Rogers and Vic Plunk, respectively.

Water . . .

—continued from page 1

ests. However, in the case of a short lease (one year), and when he runs afoul of the weather or some governmental rule, he will naturally fend for himself and neglect the landowner's interests.

In the High Plains area, it is recognized that nearly 70 percent of the value of the farmland is in the groundwater thereunder. This is, of course, the property of the landowner. However, the tenant is also the custodian of this property, since he must use same to create income (by irrigating crops). If the tenant is not a good custodian of this property—if he wastes groundwater—the landowner's interests are being adversely effected; and both the landowner and the tenant are subject to injunctive intervention by the District.

Groundwater Conservation

Mr. George McCleskey, a partner in the Lubbock law firm of Nelson, McCleskey, Harriger and Brazill, presented an excellent paper on farm leases at the Farm and Ranch Law Institute, Texas Tech University School of Law, on September 26, 1970. In his paper Mr. McCleskey noted:

"In an area where the ground water is being mined, such as that on the Southern High Plains, it becomes ever more important for waste to be avoided and to insist upon efficient use of the water. The waste of 'never to be replaced' ground water is foolhardy and expensive. Allowing the water to run onto public roads or onto other land may possibly result in claims for damages. If the land is located within a Water District, such activity may constitute a violation of the Water District's rules. For all of these, and other reasons, it would be well to have some definite understanding between the parties concerning efficient use of water. Since the farmer is usually the man who actually controls the water, this matter might be dealt with in the lease by making the farmer directly responsible to the landlord in this respect. One suggested provision would be in the following language:

Lessee shall have the right to use so much of the ground water for irrigation purposes as is proper in efficient and farmerlike production of agricultural products; but, Lessee shall not waste irrigation water nor allow any of it to move or be used in such a manner as to violate the statutes of the State of Texas or the rules and regulations of any underground water district or other governmental agency in which said land is located. The Lessee agrees to save harmless and indemnify the Lessor against claims for damages, penalties, fines, and other claims resulting from or arising out of or in connection with any breach of this obligation or the improper use of or management of or failure to control said water."

Applications to the District for permits to drill and operate wells are usually executed by the tenant, acting as the landowner's agent. Although the landowner pays for the drilling and casing of the well, the tenant usually oversees its drilling and completion. However, if the application for a well permit is ruled invalid as a result of erroneous information supplied thereon, or if the well is not completed in accordance with the information on the permit, the well can be closed by the District, and the landowner would lose his investment therein. In this regard, it is particularly important that both the landowner's and tenant's responsibilities are specified by a written agreement.

A written lease would also benefit the landowner, and aid in water conservation, by providing for his tenant's cooperation with governmental units providing groundwater services. As an example, if one or more of the landowner's wells are being used by the Texas Water Development Board or the District to measure the depth to the water table in the aquifer, provision should be made in the lease agreement to protect this use, since such measurements are used by the District to prepare the maps that the landowner uses to claim his income tax allowance on the depletion of his groundwater.

In respect to his groundwater, the landowner is also subject to the fines, penalties and/or liabilities provided in the laws administered by the Texas State Department of Health, Texas Water Quality Board, Texas Railroad Commission, Texas Water Development Board and the Texas Water Well Drillers Board, in addition to the rules and regulations of the District.

The quality of our environment—and in the High Plains area, the Ogallala Formation and aquifer is the mainstay of our (economic) environment—is being closely scrutinized by the regulatory agencies charged with its protection. If a landowner's tenant should, through neglect, carelessness, or intent, pollute the aquifer, the landowner is, in most cases, subject to the punishments provided for such acts.

It is apparent that a properly written and executed land-lease agreement protects the landowner's investment in his groundwater, and the tenant's economic use of same. If such agreements become common practice, groundwater conservation is inevitable.

GROUNDWATER CONSERVATION IS YOUR JOB

IT'S YOUR WATER

THE TALLEST WINDMILL

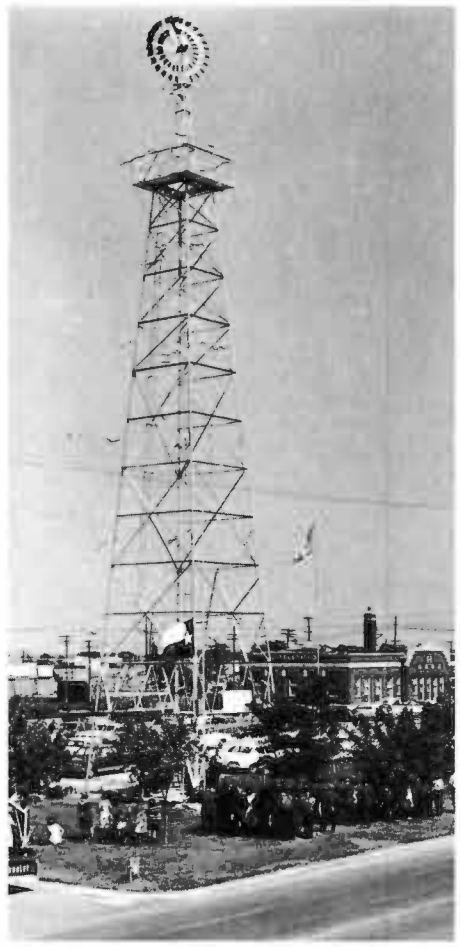
It is not very often that one gets to attend the dedication of a windmill. Even less frequent are windmills dedicated that can not pump water, and, in this case, did not even have a well beneath it. But such was the happy occasion when on August 28, 1970, a replica of what has been claimed as the world's tallest windmill was dedicated as a part of the City of Littlefield's (Lamb County) Second Annual Festivities Days.

The original 132 foot, wooden tower, windmill to which the new steel structure (114 foot) was dedicated, originally stood on the XIT's Yellow House Ranch, about 10 miles southwest of Littlefield.

There were two such exceptionally tall windmills erected at this same site—so located to tap the source of the spring issuing from the eastward facing escarpment of the Yellow House canyon in the vicinity of the Yellow House Lakes. Their tremendous heights were necessitated to permit their rosette wheels to project above the nearby escarpment; below which they would be protected from the gentle prairie breezes.

The same feat could have been accomplished by a much shorter towered windmill, if the well had been located upon the escarpment. However, in those days it was not the practice to search for the subsurface source of the water; the pioneers developed the sources (springs) where they found them.

The second tall windmill at the Yellow House site was reportedly responsible for the demise of the first. It has been reported that the winds that toppled the second windmill caused it to fall upon the wires guying the first, resulting in the destruction of both. Whatever the reasons for their passing into history, we have been left with the enjoyable heritage of being able to marvel at their having ever existed.



Dedicating Littlefield's replica of the World's Tallest Windmill, August 28, 1970. Photograph courtesy of the Lamb County Leader-News, Bill Turner Editor.

The paper, "Windmills, Plains and People", presented by David B. Gracy at the dedication of the World's Tallest Windmill, gives an interesting insight into these sentinels of the Plains.

WINDMILLS, PLAINS, AND PEOPLE

by

DAVID B. GRACY II—Archivist, Texas Tech University

The common windmill probably appears to a tourist crossing the hot, sunswept plains in his comfortable, air-conditioned car as just a part of the landscape. Appearances can be deceptive; for truly the windmill was once, and to many still is a member of the West Texas family.

Many West Texans got to where they could not go to sleep without the steady, reassuring whirr and clank, whirr and clank of their mill. Some even claim that before sun up, they could tell from the creaking and groaning of the mill what the weather that day would be like.

Early-day cowboys had mixed emotions about the spider-web-like affair. Certainly the cooling, life-giving water which the windmill afforded was duly appreciated. But the chore of greasing the contraption once a week was almost more despised than walking. And in another vein, the thing only added to the strangeness of this unusual—dry, flat, windblown—country. This feeling was best summed up by a hand on the Slaughter outfit in Hockley County whose first chores after he had hired on fresh from East Texas were to grub mesquite roots for the cook fire, then to grease the windmill and carry water to the chuck wagon. "This is a strange country," he muttered, "you dig for wood and climb for water." Even so, he was willing to carry the pure water from the marvelous underground reservoir because he knew that surface gyp water was worse. Why, navy beans simmered in this brackish stuff just got harder and harder and harder the longer they cooked.

Of course, neither the windmill nor the search for water on the Great Plains are new. By the time ranchers and farmers were prepared to move onto the western plains, after the Civil War, the windmill was ready, even down to the rosette wheel still common today.

Actually, ranchers were at first hesitant to employ the new device. It was rather expensive to set up—the average mill cost $1000 to $2000 installed, and the price tag on the initial well on a range might be much higher. For the first well in Eastern New Mexico—in the Ranger Lake region—the rancher had to stand the added expense of freighting the drilling equipment and timber 100 miles from Midland and the water used in drilling about 50 miles from Monument Spring. Then, the all-wooden wheels and gearboxes had a life expectancy of only a decade; a crew as highly specialized as the cook or the broncbuster was necessary on larger spreads just to keep the thing in repair. And most importantly, on the open range, who wanted to pay the cost of putting in a watering place just anybody could use. The simultaneous introduction of barbed wire solved the problem. Barbed wire also permitted fencing of ranches into pastures, which required in turn more, and more dependable watering places than the high plains could even begin to provide naturally. At this point, the windmill came into its own.

The first windmills on the Texas plains—a country then known as "the Great American Desert"—were put in shortly after 1880. Soon they were a common sight, and actually more common on the High Plains than anywhere else. On the XIT Ranch, between 1886 and 1900, 335 of them were installed. By the 1890's, the old saw was in vogue that, "on the plains, the wind draws the water and the cows cut the wood."

The windmill at once became the faithful and unmistakable sign of human habitation. And with water on the land, settled agriculture at last was possible on the plains. Though most men dry-farmed in the early years, the only crop they could be sure of was, ironically, the one they watered from the windmill. And in a dry season, the dependable windmill made the difference between bankruptcy and starvation.

But why sound so pessimistic. The windmill did much more than this. For one thing, it promoted peace and harmony between rancher and settler. Thanks to the windmill, fighting to control precious natural water sources was unnecessary. At Littlefield, for example, there were no hostile feelings. Why should there be. Title to the land was secure, water was secure. Furthermore, the ranch provided a good market for agricultural produce, especially surplus garden crops which had been raised under windmill irrigation. The rancher and the settler here worked hand-in-hand to develop the country to mutual benefit. For another thing, the windmill truly brought luxury into the plains home. A city visitor to the Yellow House Ranch in the summer of 1916 marveled that, "A telephone, electric lights, and a water system through the house are the comforts made possible by windmills. Keeping house on a western ranch," she continued, "has lost much of its former disadvantages."

Mrs. Jewell Pritchard and the World's Tallest Windmill, that, as a young woman, she climbed on a dare—one of the "Sunday afternoon thrills" of that time.

The windmill is considerably less common now than it was then, for the advent of the rural electric cooperative during the 1930's eliminated the need for wind-powered generating plants to run telephones and lighting systems. But it is no less important. Indeed, it has just returned to its traditional role of pumping liquid life to the surface.

And the venerable windmill is now passing into a well-deserved chapter in our western folklore. Take the World's Tallest Windmill for example. It was put up over a half century ago to do a specific job, and as long as it did that, no one thought much about it. But once the structure was blown down, stories and anecdotes began to circulate. One relates that greasing this windmill was a cowboy's first job; if he did it, the ranch foreman knew he was loyal and could be trusted to follow orders. Another tells how the hands had to alternate at the chore and that, "it was no uncommon occurence for a cowboy to find it convenient to quit just before his turn came to climb the swaying tower." A third says that being tapped to grease the thing was a way of telling a hand that his final pay was ready.

Of course, in reality the Yellow House Ranch had windmillers the same as any other big outfit. But the anecdotes will continue to flourish, and should, for the windmill is a permanent fixture on the West Texas scene and must always occupy a central place in any story of life in this region.

The original World's Tallest Windmill near the Yellow House Ranch Headquarters is shown by this early 1900s photograph. This photograph was supplied by Mrs. Jewell Staggers Pritchard, now of San Jose, California.

Youth . . .

—continued from page 1

serious problem. Texas is running out of water. A July 13, 1953 issue of LIFE magazine points out that "Texas simply does not have enough water in the right places to support its fast growing population, industry and agriculture." Although this statement was made seventeen years ago, it applies even more acutely today. Throughout our studies of Texas and the current Water Plan, it was emphasized that in order to meet these water demands, full development and conservation of all Texas water reservoirs is essential.

The Texas Water Plan is in itself a long range, comprehensive project designed to meet the future water needs for all portions of the state. The Plan, expected to be totally complete by the year 2020, protects and provides for each individual portion—the basin of origin as well as the water's destination.

In the Texas Water Plan, 33 new East Texas reservoirs are to be constructed. These reservoirs will catch and store the surplus water in Texas that currently escapes to the sea. In a year, the Sabine River alone loses on the average enough water to sustain 25 cities the size of New York for the same period of time. East Texas will store millions of acre-feet of water, some of which is capable of being used in other portions of the state.

The Plan then provides for this surplus East Texas water, plus a supplementary 12.5 million acre-feet from the lower reaches of the Mississippi River, to be transported through a Trans-Texas canal in northern Texas to West Texas and a coastal canal in the southern part of the state to the Rio Grande area. Most of this transported water will be used for irrigation although some must necessarily go for industrial and municipal purposes.

The Texas Water Plan as it stands now is the greatest project of its type in history. The cost is staggering, $11.5 billion Federal money and $3.5 billion Texas bonds (according to the Texas Water Plan Publication), and yet nothing less will supply Texas water needs for any length of time. The cost, naturally, will be greater with each year of delay. The Plan is not immediate, but is, like the full development of the Plan, a long-term contract. Each portion of the State will pay for, under the Water Plan, only that part of the Plan which affects them. West Texas will pay for transportation and use of this water while East Texas will pay for the development of the reservoirs.

At this time, studies are being conducted by the Texas government and the U. S. government concerning the results if some type of a Texas Water Plan is not put into action. These studies are to be released in 1973, but seem to show at the present time, that the consequences to the state and possibly the nation will be drastic if West Texas runs completely out of water and cannot support its current population which is in excess of 2 million people or produce the vast amounts of wheat, sorghum, sugar beets, and vegetables, not to mention the cotton or cattle marketing.

In summation, Texas is facing a crucial period in history and Texans must realize that the responsibility of investigating and deciding about this crisis remains up to them. That is what this report is all about.

In discussing the East Texas position the Committee observed:

East Texas plays perhaps the most important part in the overall Texas Water Plan. Three-fourths of the amount of rainfall that falls in Texas every year lands on East Texas soil, but due to poor conservation facilities, much of this water is lost to the sea. In one year, the Sabine River alone caused $50 million damage to East Texas property through flooding. The Plan provides for 4 main benefits to East Texas: (1) building reservoirs to store East Texas water that would otherwise be lost, (2) maintaining control over East Texas floods, (3) creating new and more inviting recreation spots to attract tourists, and (4) allowing surplus water to be shipped to other parts of the state.

The need for water in East Texas is growing, as are the needs in other portions of the state, but the Plan ideally protects and provides for the basin of origin. Under the current Texas Water Plan the basin of origin has recapture powers as well as a provision requiring a surplus amount of water to remain in East Texas—that is, enough water to meet the 50 year needs of East Texans.

As to West Texas, the Committee found:

The High Plains area of West Texas is one of the most productive sections of the state. The Plains, including several counties in New Mexico and Oklahoma, produces more vegetables than 44 other states. One-eighth of the nation's cotton is grown on the Plains and approximately 2.5 million head of cattle are fed annually in Texas alone.

People that live on the Plains, however, recognize the value of their limited supply of water, and as in no other part of Texas, have enforced strict water laws upon themselves. Wells must be spaced and the amount of water taken from each piece of land is strictly regulated. Constant evaluation of water conservation helps reduce the vast amounts of water wasted each year, but still the underground water supply, the Ogallala Aquifer, diminshed 60 feet during the last 20 years in Hale County alone. This water supply will continue to drop because there is no water to replace that which is lost. Within 15 years, by 1985, the High Plains will be dependent mainly on dry land farming. Both state and federal governments are studying the effect this economic loss will have on the state and possibly the nation. Many things that are taken for granted will be greatly reduced or perhaps lost. People of the High Plains base their way of life on machinery that is manufactured in the East and this will be lost. Directly, in Texas, the cattle and cotton markets will suffer drastically as will all facets of work based on these markets both in South Texas and East Texas. These are but two examples of the impending results if something is not done.

The Committee concluded:

The Texas Water Plan is indeed one of the most complicated water projects in history. When the vote for the bond to finance this overwhelming project was brought before Texas citizens in 1969, it was voted down for several reasons. First, Texas citizens were shocked by the size of the bill which they anticipated would come from their taxes. Secondly, most voting Texans neither understood nor had any desire to study the Plan to find its faults or values. Thirdly, the Plan was presented to the public as an immediate contract. And lastly, most citizens were worried about federal intervention in the Plan, afraid that this would give the federal government more control over the state. Therefore, in spite of the fact that the Plan had the support of three former Governors and many Congressmen and Representatives, it was voted down.

The bonds for the Plan will come to vote again in 1973, but in the meantime, Texans everywhere are beginning to recognize that Texas, as a state, is coming to a crossroads and that each Texan must decide whether he wants Texas to turn right or left.

The purpose of this report was not necessarily to help any person make up his mind about the Plan. It is our sincere hope that this report will only create the desire in each individual to investigate further and more completely the facts concerning the Texas Water Plan.

Only the generalized part of the report, "A 2020 Vision", have herein been cited. The report's nearly 12 pages of questions and answers contain the really pertinent concepts of the Youth Committee—we would recommend it for reading, particularly to the leaders in the water community.

Shown standing near the State Historical Marker at the replica of the World's Tallest Windmill are: Arthur P. Duggan Jr., whose late father, Senator Arthur P. Duggan has been called the "Father of Littlefield"; Otha F. Dent, Chairman of the Texas Water Rights Commission, and former Lamb County Judge; Mrs. Arthur P. Duggan; and David B. Gracy II.

HIGH PLAINS UNDERGROUND WATER
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SECOND CLASS PERMIT

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 10 "THERE IS NO SUBSTITUTE FOR WATER" *October, 1970*

Pictured at the recent NWWA Convention in Columbus, Ohio, on October 6, 1970 are: L. G. McMillion, Head of the Groundwater Pollution Fate Section, Federal Water Quality Administration, Ada, Oklahoma; Frank Clarke, Assistant Director, U.S. Geological Survey, Washington, D.C.; Frank Rayner; Dr. Jay H. Lehr, Executive Director, NWWA, Columbus, Ohio; and James H. McDermott, Director, Bureau of Water Hygiene, Department of Health, Education and Welfare, Washington, D.C. (phtograph by Georges Lareau, Urbana, Ill., for the NWWA)

NWWA DISASTER COMMITTEE

The availability, safety and economy of groundwater supplies are readily understood by those concerned with developing groundwater supplies; yet these same assets most often go unappreciated by the general public *until* disaster strikes. When an emergency need for a replacement for water supplies knocked out by some natural (or man-made) catastrophe arises, the attention most often turns to groundwater. However, even after being recognized as a potential solution to a water shortage crisis, the knowledge and machinery necessary to facilitate the development of groundwater supplies is often more clumsy to set in motion than are the many other types of disaster relief operations.

Considerable knowledge and experience regarding the governmental framework needed for a coordinated, efficient and swift response to a disaster has been gained in recent national disasters—to wit, the Detroit and Los Angeles riots; hurricanes Camille and Celia; and the Lubbock tornado (see the May 1970 issue of *The Cross Section).*

The primary knowledge that has been gained from these and many other national disasters is an overview of the slowness of response of most governmental agencies to a disaster, and the duplication and overlapping of the services performed by both governmental and private relief agencies.

NWWA Committee

Recognizing the need for the coordinated services that could be rendered by the water-well industry during a national disaster, the National Water Well Association has organized and funded a Disaster Committee.

The exact functions of the Committee have not yet been set down, however, they may include: 1) Committee mobilization after any state of emergency declared by any Governor or the President; 2) On-site inspection of the disaster area by Committee members and other groundwater experts; 3) Provide a clearinghouse for the types of state and Federal emergency resources management plans and the funding of same; 4) Coordinate the services of consulting engineers and geologists, and the mobilization of water well drillers and water well equipment suppliers; 5) Contact and offer such services to the American Red Cross, Corps of Engineers, Bureau of Reclamation, U. S. Health Department (and local health departments), the Office of Civil Defense, the Small Business Administration, the Governor's Emergency Planning Councils, and other governmental and private disaster relief agencies.

Although it was still in the formulative stages, the Committee, under the chairmanship of Robert Peters, Norfolk, Virginia, was quick to volunteer its services to the Corps of Engineers after the recent Corpus Christi hurricane (Celia).

It is doubtful that the Disaster Committee, like nearly all other committees, will ever be able to fulfill all of its ambitions; however, it has already made one major contribution to our safety and welfare—it has brought some public attention to the assets of, and priorities for developing groundwater supplies.

Apollo 9 Eyes Water Management

At 10:30 A.M. central standard time, on March 12, 1969, the crew of Apollo 9 snapped photograph number AS9-26A-3807A. This was just another of the many continuous sequence photographs taken by the Apollo 9 crew, that have since held the interest of thousands of scientists and laymen throughout the world.

Although photograph number AS9-26A-3807A was in fact a much less impressive and spectacular aerial view than most of the Apollo 9 photography; its interest lies in its revelation of the pronounced difference in agricultural development on either side of the Texas-New Mexico State line. This photograph, as shown on page 3, taken from an altitude of 137 miles, covers nearly 10,000 square miles, and is centered around latitude 34 degrees 42 minutes and longitude 103 degrees 1 minute (a point located 5 miles north of Bledsoe, Cochran County, Texas).

On this photograph the cultivated areas are exemplified by the square or rectangular patches; with those being irrigated (primarily preplant irrigation), or with a cover crop (wheat, rye, or other winter grains) showing up as black or dark gray patches. The bland areas, (devoid of the square patches), light to dark gray in color, represent uncultivated (primarily grassland) areas.

In comparison to Texas, the uncultivated and sparcely irrigated areas predominate in the New Mexico part (west ½) of the photograph; while the cultivated, and for the most part irrigated, lands are located in Texas (east ½ of the photograph). This difference pinpoints the Texas-New Mexico State line, bisecting this photograph from north to south. A more detailed in-

—continued on page 3 . . . APOLLO

WATER FOR TEXAS CONFERENCE

The 15th annual Water For Texas Conference will be held at Texas A&M University, College Station, Texas, on November 23 and 24, 1970.

The theme of this year's conference is, "Water Development and the Quality of the Environment". On the first day (23rd), eight scholars will speak to the effects of water development on the ecosystem. On the following day, four speakers will expound the need for, and benefits of, water development projects.

THE Cross SECTION

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1628 15th Street, Lubbock, Texas 79401

Telephone 762-0181

FRANK RAYNER, P.E., Editor

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COUNTY COMITTEEMEN

Armstrong County

Clifford Stevens, 1971	Rt. 1, Happy
Guy Watson, 1971	Wayside
Carroll Rogers, 1972	Wayside
George Denny, 1973	Rt. 1, Happy
Jack McGehee, 1973	Wayside

Bailey County

Mrs. Darlene Henry, Secretary
Henry Ins. Agency
217 East Ave. B, Muleshoe

R. L. Davis, 1971	Box 61, Maple
Lloyd Throckmorton, 1971	Box 115, Muleshoe
Jessie Ray Carter, 1972	Rt. 5, Muleshoe
Ernest Ramm, 1973	Rt. 2, Muleshoe
Adolph Wittner, 1973	Star Route, Baileyboro

Castro County

E. B. Noble, Secretary
City Hall, 120 Jones St., Dimmitt

Morgan Dennis, 1971	Star Rt., Hereford
Donald Wright, 1971	Box 65, Dimmitt
John Gilbreath, 1972	Rt. 2, Hart
Bob Anthony, 1973	Rt. 4, Dimmitt
Dale Maxwell, 1973	Hiway 385, Dimmitt

Cochran County

W. M. Butler, Jr., Secretary
Western Abstract Co., 108 N. Main Ave., Morton

Ronald Coleman, 1971	Rt. 1, Morton
Dan Keith, 1971	Rt. 1, Morton
Keith Kennedy, 1972	Star Rt. 2, Morton
Jessie Clayton, 1973	706 S. Main Ave., Morton
Hugh Hansen, 1973	Rt. 2, Morton

Crosby County

Clifford Thompson, Secretary
1628 15th Street, Lubbock

W. O. Cherry, 1971	Lorenzo
M. T. Darden, 1971	Lorenzo
E. B. Fullingim, 1971	Lorenzo
Jack Bowman, 1973	Lorenzo
Kenneth Gray, 1973	Lorenzo

Deaf Smith County

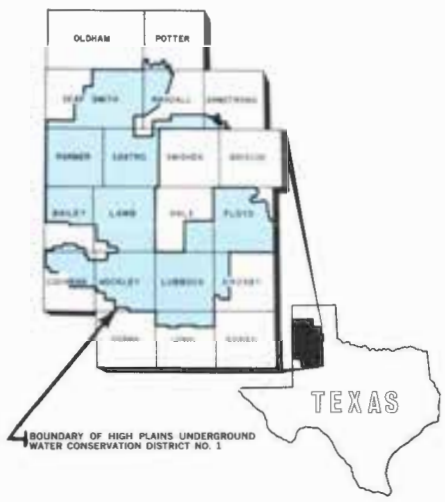
B. F. Cain, Secretary
County Court House, 2nd Floor, Hereford

Harry Fuqua, 1971	Rt. 1, Hereford
Billy Wayne Sisson, 1971	Rt. 5, Hereford
W. L. Davis, Jr., 1972	Hereford
L. B. Worthan, 1973	Rt. 3, Hereford
Frank Zinser, Jr., 1973	Rt. 5, Hereford

Floyd County

Gayle Baucum, Secretary
Farm Bureau, 101 S. Wall Street, Floydada

M. M. Julian, 1971	Box 55, South Plains
M. J. McNeill, 1971	833 W. Tenn., Floydada
Malvin Jarboe, 1972	Rt. 4, Floydada
Fred Cardinal, 1973	Rt. 4, Floydada
Pat Frizzell, 1973	Box 1046, Lockney



Hale County

J. B. Mayo, Secretary
Mayo Ins., 1617 Main, Petersburg

J. C. Alford, 1971	Box 28, Petersburg
Harold D. Rhodes, 1971	Box 100, Petersburg
W. D. Scarborough, Jr., 1972	Petersburg
Don Hegi, 1973	Box 160-A, Petersburg
Henry Kveton, 1973	Rt. 2, Petersburg

Hockley County

Ronnie Wallace, Secretary
208 College, Levelland

Ewel Exum, 1971	Rt. 1, Ropesville
H. R. Phillips, 1971	Rt. 4, Levelland
Douglas Kauffman	200 Mike St., Levelland
E. E. Pair, 1973	Rt. 2, Levelland
Jimmy Price, 1973	Rt. 3, Levelland

Lamb County

Calvin Price, Secretary
620 Hall Avenue, Littlefield

Ardis Barton, 1971	Hiway 70, Earth
Gene Templeton, 1971	Star Rt. 1, Earth
W. W. Thompson, 1972	Star Rt. 2, Littlefield
Lee Roy Fisher, 1973	Box 344, Sudan
Jack Thomas, 1973	Box 13, Olton

Lubbock County

Clifford Thompson, Secretary
1628 15th Street, Lubbock

Glenn Blackmon, 1971	Rt. 1, Shallowater
Andrew (Buddy) Turnbow, 1971	Rt. 5, Lubbock
Alex Bednarz, 1972	Rt. 1, Slaton
R. F. (Bob) Cook, 1973	804 6th St., Idalou
Dan Young, 1973	4607 W. 14th, Lubbock

Lynn County

Clifford Thompson, Secretary
1628 15th Street, Lubbock

O. R. Phifer, Jr., 1971	New Home
Reuben Sander, 1971	Rt. 1, Slaton
Dale Zant, 1972	Rt. 1, Wilson
Roger Blakney, 1973	Rt. 1, Wilson
Orville Maeker, 1973	Rt. 1, Wilson

Parmer County

Aubrey Brock, Secretary
Wilson & Brock Insurance Co., Bovina

Guy Latta, 1971	Friona
Edwin Lide, 1971	Rt. D, Bovina
Webb Gober, 1972	RFD, Farwell
Jim Ray Daniel, 1973	Friona
Joe Moore, 1973	Box J, Lazbuddie

Potter County

Jim Line, 1971	Bushland
Temple Rogers, 1971	Rt. 1, Amarillo
Henry W. Gerber	Rt. 1, Amarillo
Fritz Menke, 1973	Rt. 1, Box 538, Amarillo
Vic Plunk, 1973	Rt. 1, Amarillo

Randall County

Louise Knox, Secretary
Farm Bureau, 1714 Fifth Ave., Canyon

R. B. Gist, Jr., 1971	Rt. 2, Box 43, Canyon
Carl Hartman, Jr., 1971	Rt. 1, Canyon
Leonard Batenhorst, 1972	Rt. 1, Canyon
Richard Friemel, 1973	Rt. 1, Canyon
Marshall Rockwell, 1973	Canyon

NOTICE: Information regarding times and places of the monthly County Committee meetings can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Armstrong and Potter Counties; in these counties contact Carrol Rogers and Vic Plunk, respectively.

Attending the October 16th model briefing session for Dr. Giuliano are: Albert Sechrist; Dr. Dan Wells, Director of the Water Resources Center, Texas Tech University; Professor Bill Claborn, Texas Tech University; Dr. Giuliano; and Frank Rayner.

ITALIAN SCIENTIST VISITS DISTRICT

Dr. Giuseppe Giuliano, representing the Institute on Water Research of the National Research Council of the Government of Italy, Rome, Italy, visited Texas Tech University and the District on October 16, 1970.

The purpose of Dr. Giuliano's visit was to review the model work completed by Texas Tech University and the District as a part of the aquifer model research work that is being funded by the Office of Water Resources Research, U. S. Department of the Interior *(The Cross Section,* September 1970). Dr. Giuliano's visit to the United States was funded by a grant from NATO (North Atlantic Treaty Organization). His visit to Tech and the District was arranged by the Office of Water Resources Research through Dr. J. R. Runkels, Director of the Water Resources Center, Texas A&M University.

Groundwater in Italy, like that in Texas, is the private property of the landowner, and very few records of wells and the amount of water pumped therefrom are available. This condition, observed Dr. Giuliano, makes aquifer model building very difficult in his country. Dr. Giuliano also noted that practically all of Italy's surface water supplies have been developed, therefore, there is an increasing interest in large-scale groundwater development to meet the demands for municipal water supplies.

WATER WELL DRILLING STATISTICS

FOR MAY, JUNE, JULY AND AUGUST 1970

County	Permits Issued	New Wells Completed	Replacement Wells Drilled	Dry Holes	Wells Completed In 1970 (Thru August)	Wells Completed 1953 thru August 1970
ARMSTRONG	0	0	0	0	2	119
BAILEY	17	20	1	0	41	1809
CASTRO	30	29	2	0	48	2737
COCHRAN	2	3	0	0	6	1042
CROSBY	1	1	0	0	2	5
DEAF SMITH	32	24	2	0	60	2933
FLOYD	18	31	2	1	50	2662
HALE	6	1	1	0	3	53
HOCKLEY	19	23	1	1	45	3771
LAMB	22	19	6	0	36	2975
LUBBOCK	16	16	2	2	49	5110
LYNN	3	10	0	1	17	1712
PARMER	36	39	1	0	68	3394
POTTER	1	1	0	0	1	47
RANDALL	21	9	0	1	22	1066
TOTALS	**224**	**226**	**18**	**6**	**450**	**29,435**

Apollo . . .

—continued from page 1

terpretation of this photograph is presented on page 4.

Since the soils are similar, if not identical, in the area immediately adjacent to the State line; since the Ogallala Formation and the Ogallala aquifer—which, for the most part, covers the entire area of this photograph—does not recognize a man-made line established hundreds of thousands of years after their deposition; since there is no sharp change in the climatic conditions at the State line; since the same type of enterprising farmer could have settled in New Mexico as easily as in Texas; since the State line is, for the most part, not physically evident on the land surface (not a road or a fenceline); then what could account for the difference between New Mexico and Texas as revealed by the Apollo 9 photograph? The answer, the one thing that does change across a state line—the form of government—and, in this case, the form of government concerned with groundwater basin management.

In Texas, the landowner is also the owner of the groundwater tarrying beneath his property, and he can use his groundwater for any beneficial purpose; as long as he does not abuse this privilege by wasting same. In New Mexico, the groundwater is the property of the State and the landowner (in declared basins) can only develop such water (for other than domestic or stock purposes) by securing a permit to do so from the New Mexico State Engineer.

This difference in the types of groundwater basin management is our interpretation as the primary reason for the distinct appearance of the Texas-New Mexico State line on this photograph; there are other reasons—most of which I will hear about from *The Cross Section's* New Mexico readers.

There can be no argument to the contrary that the Apollo 9 photograph of March 12, 1969, exhibited a startling difference in the affluence and the resultant economic impact of agriculture, particularly of irrigated agriculture, in Texas as compared to that of New Mexico. However, the proponents of the New Mexico form of groundwater basin management (delayed development?) will undoubtedly pose the question; what will be the argument created by a possible Apollo photograph of the same area taken in the year 2020—this conjecture I leave to be answered by the possible readers of *The Cross Section* of 2020.

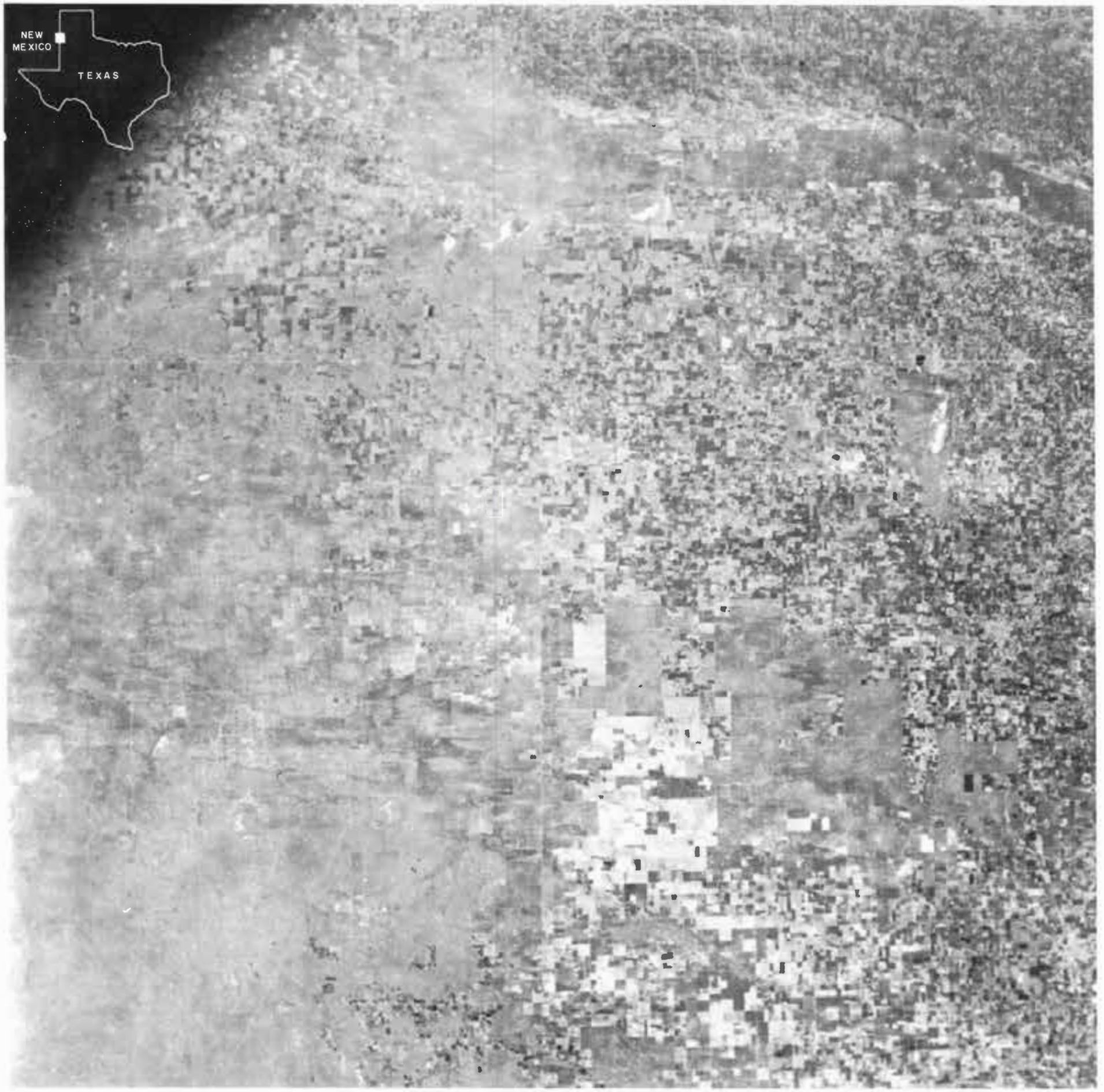
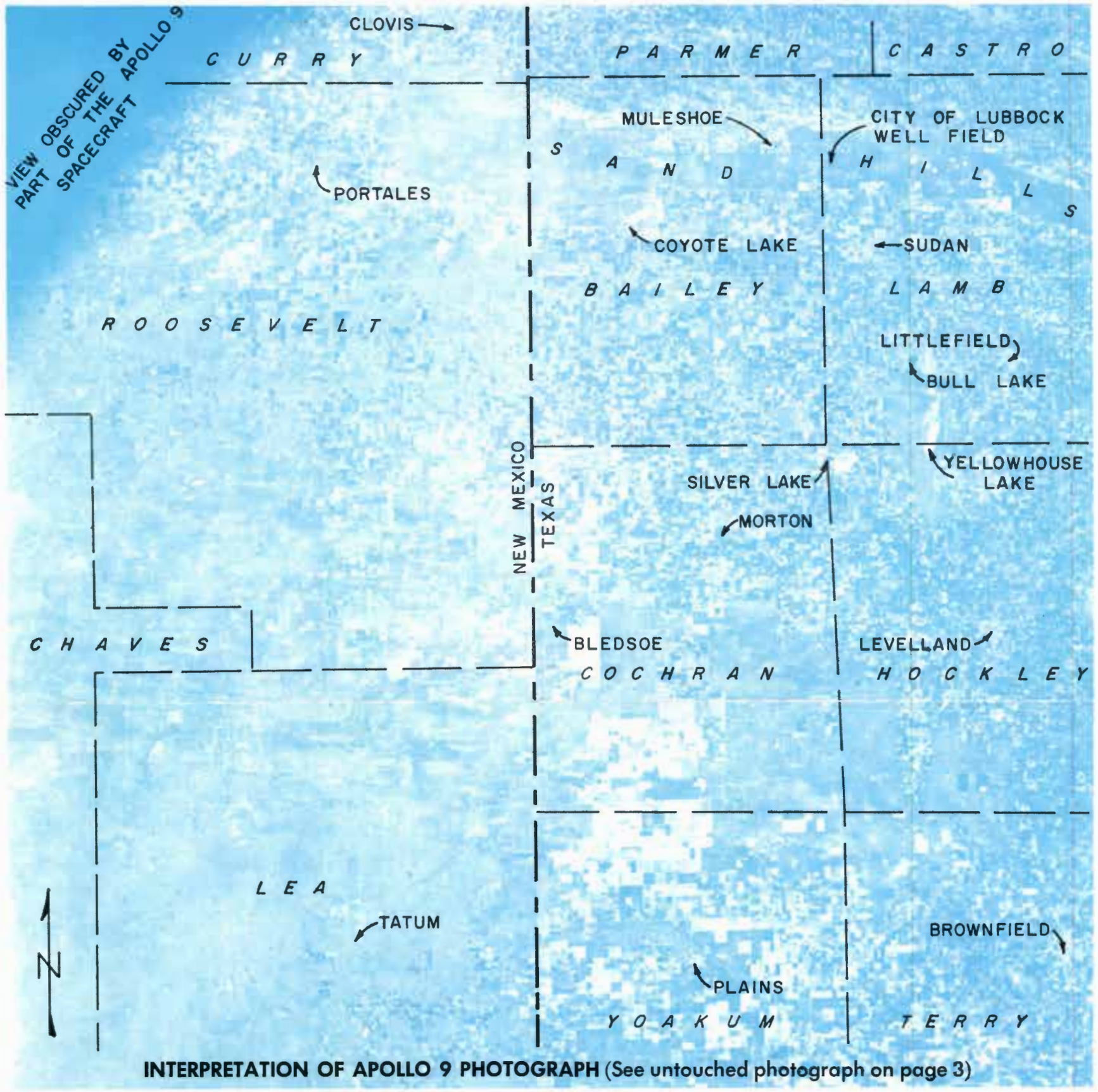


PHOTO COURTESY OF NASA, MANNED SPACECRAFT CENTER, HOUSTON, TEXAS



INTERPRETATION OF APOLLO 9 PHOTOGRAPH (See untouched photograph on page 3)

HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

SECOND CLASS PERMIT

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 11 "THERE IS NO SUBSTITUTE FOR WATER" *November, 1970*

Dr. Edward Altouney, Research Scientist with the Office of Water Resources Research, Washington, D.C.; Mrs. Ann Bell, Geologist and Albert Sechrist, Graduate Engineer, both of the District Staff.

OWRR Official Visits District

Dr. Edward Altouney traveled to Lubbock on November 3rd to meet with the research principals at Texas Tech University and the District to review the research projects being funded by the Office of Water Resources Research (OWRR), U. S. Department of Interior. Dr. Altouney, a Water Research Scientist, is the coordinator of a five southwestern states region for all OWRR funded research. His visit to Lubbock was a part of a larger tour of several water research centers.

The District in cooperation with the Texas Tech University Water Resources Center received a $98,578.00 grant from OWRR in 1968 to perform aquifer modeling research. A similar grant of $100,263.00 was awarded to Tech and the District in 1970 to continue with the second phase of this research.

Ann Bell and Dr. Altouney discuss the interpretation of dual, machine plotted hydrographs, and the significance of detailed data collected for irrigation pumpage research.

COUNTY COMMITTEEMEN RULE AMENDED

Elections are fundamental to our way of life as a free self governing people. There are numerous elections held throughout the year which affect the residents of the High Plains area. Just to name a few, there are general elections, city elections, bond elections, and local governmental elections (school boards, local water districts, etc.). The local elections often have a more fundamental and direct effect on us than elections at the State or National level. Soon, the annual election for officials of the High Plains Underground Water Conservation District No. 1 will once again be upon us. As specified by State law, the District's election is scheduled for Tuesday, January 12, 1971. This year there will be some new, improved, and streamlined procedures in the District's election. Not only will these provisions permit the election to be conducted with more efficiency, care, and competence; but they will also save the District's taxpayers approximately $2,000.00 per year in election costs.

On September 23, 1970, the Board of Directors passed a resolution designed to change the rules concerning the election of County Committeemen. The primary object of the rule change was to provide for a more effective and efficient method of electing the County Committeemen. Economy of operation was also a factor considered. The new rule change will effect only County Committeemen and not the election of Directors, since the election procedures for Directors are prescribed by State law and can not be altered by a change in the District's rules.

After due public notice, as specified by State law, the District's Rule 4 governing the election of County Committeemen became effective on November 7, 1970. The following is the text of the amended rule:

RULE 4—The County Committees

(a) Each County in the District shall have a County Committee composed of five Committeemen. Each commissioner's precinct within the District or partly within the District, shall at all times have at least one member on the County Committee unless the District Board waives the requirement in writing. If the County shall have four commissioner's precincts within or partly within the District, one Committeeman shall be elected from each commissioner's precinct and one Committeeman elected at

—continued on page 2 . . . RULE

Important I.R.S. Determination

B. C. Selden, Chief Engineer for the Dallas Regional Office of the Internal Revenue Service, has informed officials of the High Plains Underground Water Conservation District No. 1 that recent interpretations of a 1959 Internal Revenue Service ruling (number 59-220) could be very important to some property owners in the Southern High Plains area.

Basically the determination deals with the "holding period" that the I.R.S. recognizes as applying to the estates of the survivors of the decedent.

The following example illustrates the importance of this interpretation to those inheriting real property in this area. The I.R.S. holds that land acquired before 1948 did not involve a cost in the groundwater. Therefore, a man and his wife who acquired property before 1948 could not claim an income-tax allowance for the depletion of the water beneath their land, that resulted from their using such water to

—continued on page 2 . . . I.R.S.

GUIDELINE MAPS

The District is attempting to computerize the entire cost-in-water depletion, income-tax allowance program (see *The Cross Section,* December 1969). In order to accomplish this, it is necessary to first locate all of the individual parcels of land for which this allowance is being claimed.

Those persons, or their agents (accountants) who have claimed or who anticipate claiming such an income-tax allowance are urged to contact the District's Lubbock office immediately; or to supply to the District the information requested in the letter that accompanied all of the 1969 water-table-decline maps, and/or as outlined in the article, "Program Streamlined—Tax Guideline Maps Released", that appeared in the December 1969 issue of *The Cross Section.*

The 1970 water-table decline maps, and cost-in-water tables, will be sent to only those persons supplying the requested information as set forth above.

The 1970 maps are expected to be available by January 1, 1971.

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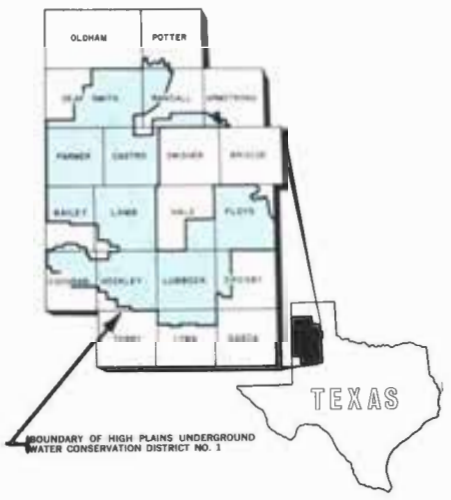

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The High Plains farmer is continually seeking to expand his knowledge of new and more efficient irrigation practices. Pictured above is Ross Goodwin, Vice President of the District's Board of Directors, listening to an explanation of the function of a center-pivot automatic irrigation system. (Picture taken at the annual field day at the High Plains Research Foundation, Halfway, Texas, September 10, 1970)

I.R.S. . . .

—continued from page 1

create income. In the past, land that was acquired before 1948, and belonging both to a husband and wife as community property, was granted a new holding period for the one-half of the estate that passed from the decedent to the surviving spouse. However, that half of the community property already belonging to the surviving spouse was not granted a new holding period, but retained the date of the original purchase.

The new determination provides: "For the purpose of determining the holding period, the surviving spouse's share of the community property would date from the date of the decedent's death." This simply means that if a husband dies and the widow inherits the deceased's share of the community estate, that the date of the death will be considered as the new "holding period" for *all* of the land. Where land was bought before 1948, and a husband and wife have not been able to claim an income-tax depletion allowance on groundwater, then upon the death of either the husband or the wife, the surviving spouse can begin to claim the depletion allowance as of the date of the spouse's death. This same new holding period interpretation would also apply to community property now benefitting from the cost-in-water depletion, income-tax allowance program. This is to say that a new cost in water would be assumed for the property at the date of death of either spouse.

This new interpretation is particularly beneficial to the surviving spouse, since he or she would be eligible to claim the depletion allowance on the entire property while paying inheritance taxes on only the decedent's ½ of the estate.

If anyone believes that they may be affected by this new determination, then it would be advisable to contact their accountant or attorney to clarify any questions concerning this matter —it could mean many thousands of dollars in tax savings.

Rule . . .

—continued from page 1

large. If only three commissioner's precincts are within or partly within the District, one Committeeman shall be elected from each precinct and two Committeemen elected at large. If only two commissioner's precincts are within or partly within the District, two Committeemen shall be elected from each such precinct and one Committeeman elected at large. If only one commissioner's precinct is within or partly within the District, all Committeemen shall be elected from such precinct.

The term of the Committeemen shall be for four years. The terms shall be staggered and overlapping.

Each County shall elect County Committeemen only in years when District Directors are chosen for the District Director's precinct in which the County lies. Counties which are in District Director's Precinct 3 and District Director's Precinct 4 will elect County Committeemen in odd-numbered years beginning with 1971, and Counties which are in District Director's Precinct 1, District Director's Precinct 2, and District Director's Precinct 5 will elect County Committeemen in even-numbered years beginning with 1972. The County Committeemen shall be elected on the same day as are the District Directors for the corresponding District Director's precincts. Each County shall alternately elect two and three County Committeemen each time there is an election for County Committeemen.

Those County Committeemen now serving whose terms end in years when District Directors are not being chosen in their District Director's precincts will continue to serve in their capacity as County Committeemen until the next scheduled election in that County

—continued on page 3 . . . RULE

Rule . . .

—continued from page 2

wherein District Directors will be elected.

Any qualified resident voter within any commissioner's precinct may have his name placed on the ballot for the office of County Committeeman by being nominated by the County Committee or by petition signed by not less than five qualified voters of the respective commissioner's precinct or by any five qualified voters of the county for the office of County Committeeman at large, which petition shall be filed with the District Board at least thirty (30) days prior to the date of such election.

No Committeeman may serve more than two successive terms without a period of inactive status of at least two years.

Rule Summarized

In summary, the change in Rule 4 provides for: 1) the changing of the terms of the County Committeemen from three to four years; 2) arranging for the election of three County Committeemen one year, and the election of the other two County Committeemen two years later in lieu of the former method of electing two County Committeemen one year, two the next year, and one the third year; 3) to hold elections for the offices of County Committeemen only in those counties wherein an election is being held for the position on the District's Board of Directors; 4) and to extend the terms of the County Committeemen in the District Director's precincts wherein an election will not be held in January 1971, 1972, or 1973.

Types Of Precincts

The county commissioner's precincts have been adopted by the District as the basis for partitioning of the counties within the District for the purposes of selecting the representation on the District's County Committees. A County Committeeman or Committeemen, as specified by Rule 4, are elected from each of the commissioner's precincts. Commissioner's precincts govern only the selection of County Committeemen. The District's Board of Directors are elected as one Member from each of the five "District Director's Precincts". The partitioning of the District into five District Director's precincts was accomplished soon after its creation, as provided by State law. The area covered by each of the five District Director's precincts is shown by the map on page 3 (Figure 1).

In January 1971, elections will be held for the offices of the Members to the Board of Directors in District Director's Precincts 3 and 4. Two County Committeemen will also be elected for each of the seven counties in these two District Director's precincts. No elections will be held in District Director's Precincts 1, 2 and 5 in January 1971. In January 1972, elections for the offices of District Directors, and County Committeemen will be held in District Director's Precincts 1, 2 and 5—no elections will be held in District Director's Precincts 3 and 4 in 1972.

This change provides that elections will be held only within the seven counties in District Director's Precincts 3 and 4 on odd-numbered years (1971, 73, 75, etc.); while elections in the eight counties in District Director's Precincts 1, 2 and 5 will be held only on even-numbered years (1972, 74, 76, etc.). The counties within the five District Director's precincts and the Member to the District's Board of Directors from each of these precincts are listed in column 1, page 2, of each issue of *The Cross Section*.

Committeemen Polled

All of the 40 County Committeemen whose terms had to be extended in order to facilitate this change in Rule 4 have agreed to a one-year extension of their terms of office. The new expiration dates (in January of the year shown) of the terms of all County Committeemen (including the extended terms) are listed in column 1 and 2, page 2, of this issue of *The Cross Section*.

Summary Of 1970 Elections

The voting results of the January 13, 1970, election are shown by the map on page 3 (Figure 2). The blue circles show the location of each voting box and the accompanying number represents the total number of votes cast at each respective polling place.

A total of 1,323 votes were cast at the 34 polling places within the District during the 1970 election. This represents only 1.5 percent of the nearly 89,000 people who were eligible to vote during this election.

During the 1970 election, a total of 1,170 votes were cast in the Director's races for District Director's Precincts 1, 2 and 5. This represents approximately 2.3 times as many votes as were cast during the January 1968 election for these same offices.

The total direct cost (printing of election supplies, pay to election judges and clerks, outside legal advice, and the publishing of legal notices—but not including salaries and travel expenses of the District's staff) of the 1970 election was $3,620.62. This represents a cost to the District from a high of $26.57 per vote in Potter County to a low of $0.81 per vote in Lubbock County. The average direct cost per vote was $2.74.

The 1971 Election

A detailed summary of the 1971 election procedures will be presented in next month's *Cross Section* (December 1970).

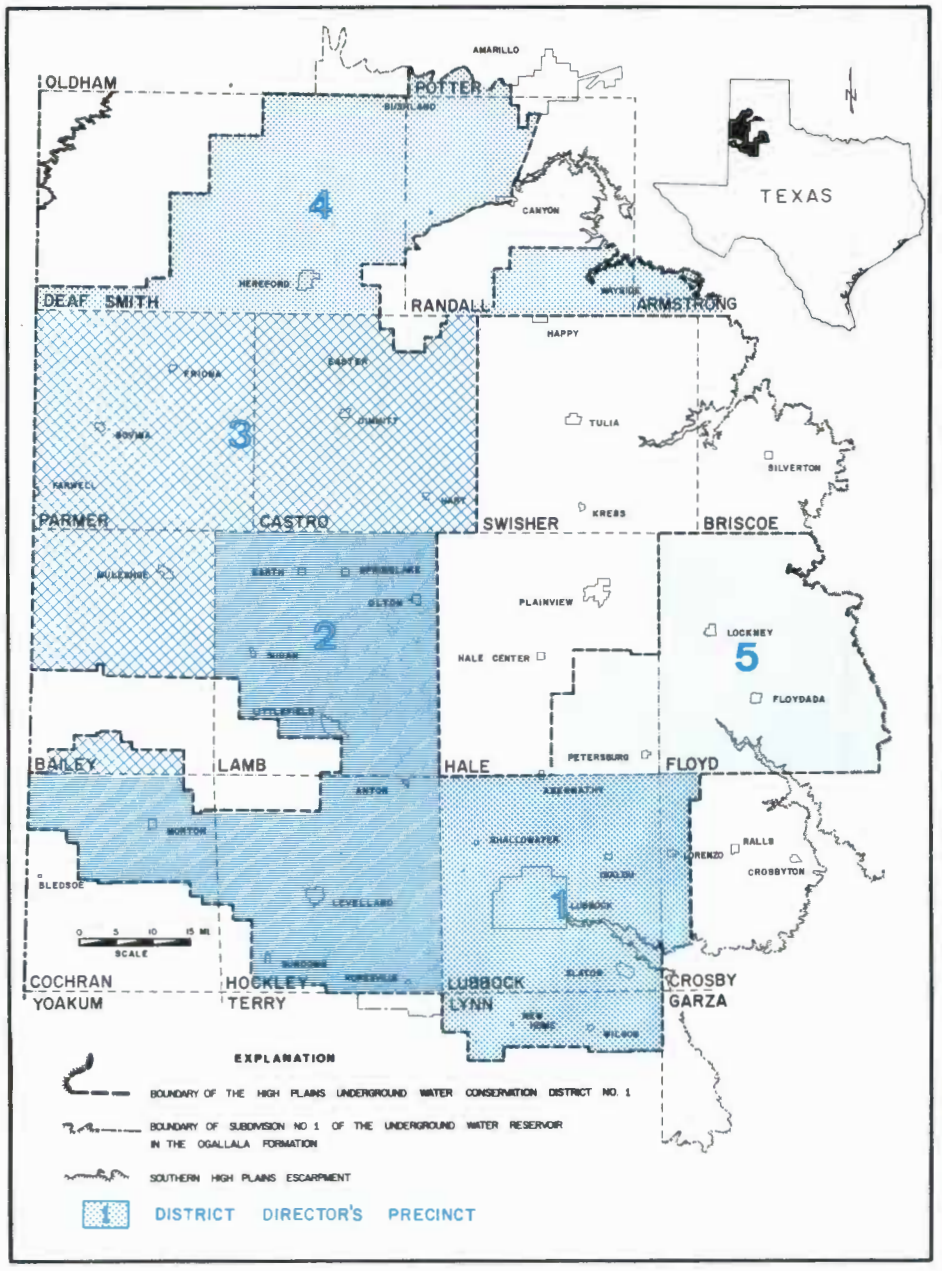


FIGURE 1 The District Director's Precincts, High Plains Underground Water Conservation District No. 1.

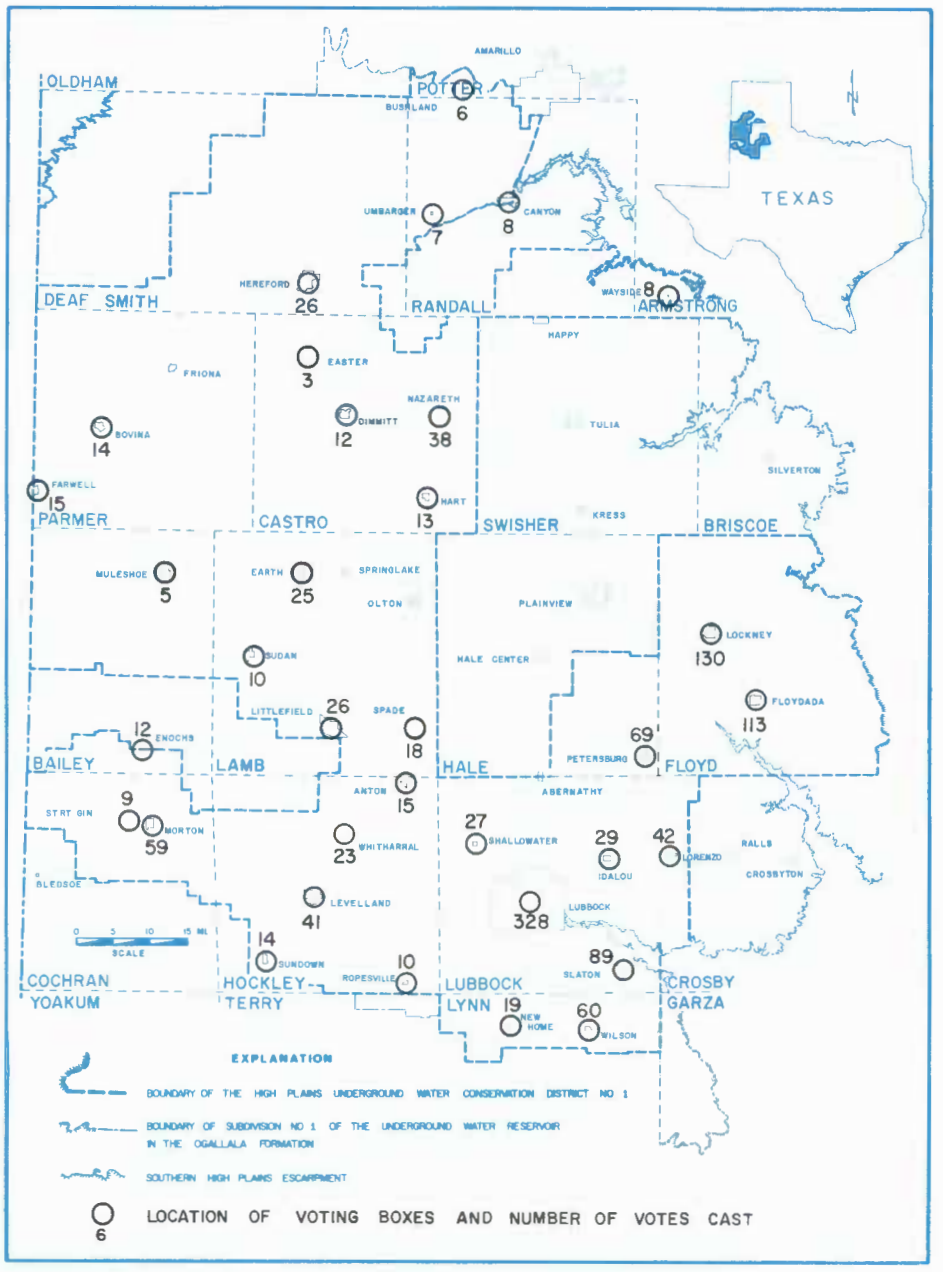
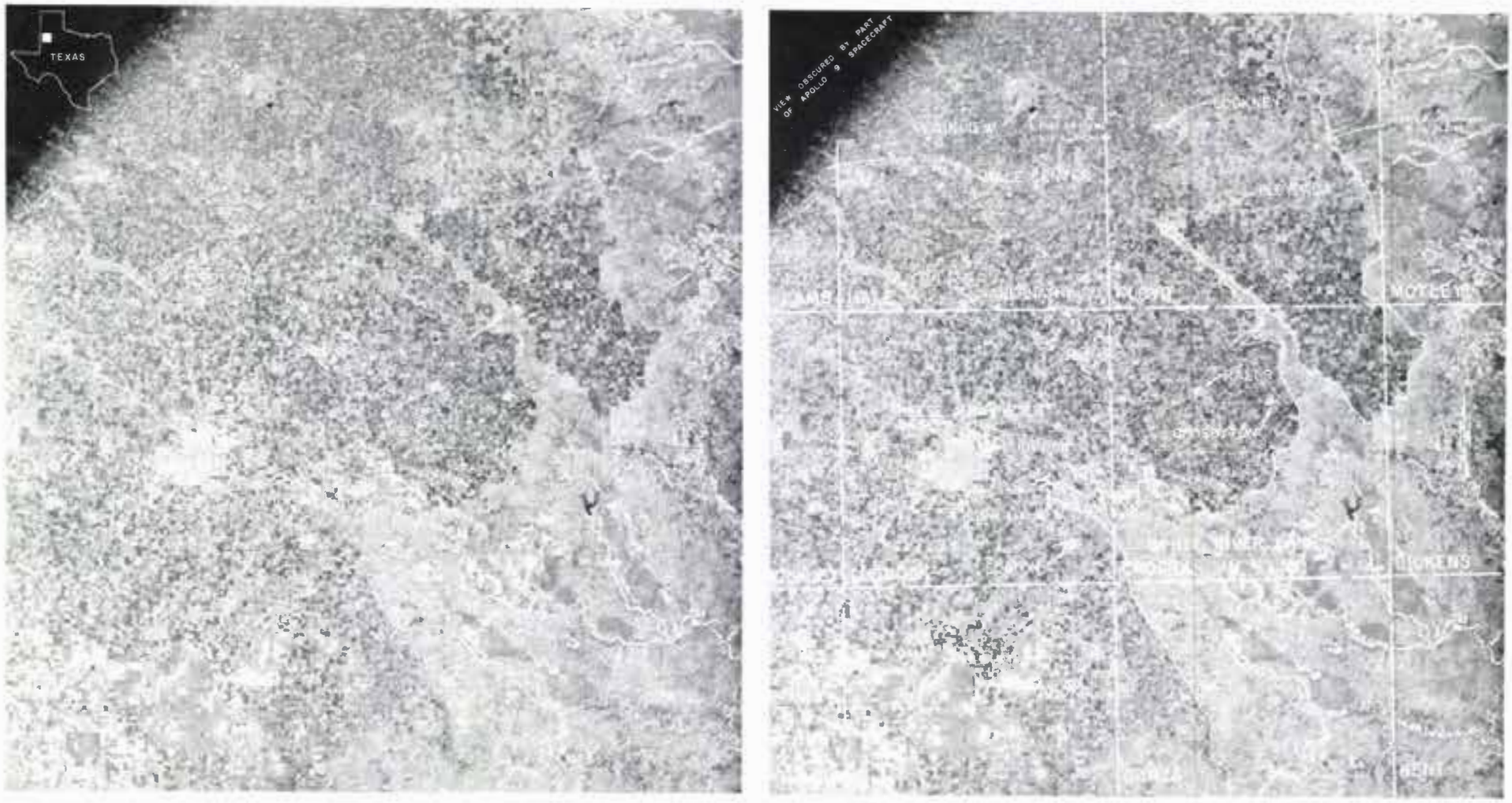


FIGURE 2 Location of polling places and number of votes cast during the January 1970 election.



Apollo 9 Photograph, Courtesy of NASA Manned Spacecraft Center, Houston, Texas

Apollo 9 Eyes Agriculture

The Apollo 9 photograph and article, "Apollo 9 Eyes Groundwater Management", that appeared in the October 1970 issue of *The Cross Section,* invoked an unusually large amount of interest, comment and reader response.

The comprehensive and interesting sequence of photographs taken by the Apollo 9 crew on March 12, 1969, has permitted the layman to literally step back out of the world and take an overall look at the part of his planet that invokes his particular interest. The photograph above is the next Apollo 9 photograph (AS9-26A-3808A) in the sequence with photograph AS9-26A-3807A, that was published in the October 1970 issue of *The Cross Section,* as the spacecraft moved from west to east over New Mexico and Texas. This photograph was also taken from an altitude of about 137 miles, and covers approximately 10,000 square miles of the land surface.

This photograph reveals the abrupt termination of the High Plains agricultural complex at the Plain's eastern escarpment. This escarpment also marks the termination of the Ogallala Formation, and the resultant abrupt termination of the topographic, and the geohydrologic conditions conducive to concentrated agricultural development. It should be noted that the termination of the high density agriculture shown on this photograph follows the irregular lines dictated by geohydrologic conditions, and not by the straight line revealed by the photograph (number AS9-26A-3807A) published in last month's *Cross Section.*

A disquieting comparison between this area's groundwater and surface water supplies is also revealed by photograph number AS9-26A-3808A. Soon after its completion, White River Lake (see callout on interpreted photograph), became a very popular recreational area. To the High Plains resident who visits this lake, it may appear to contain an extremely large amount of water. This *is* a relatively large lake for the West Texas area, even though it contains only 38,850 acre feet of water. However, when compared to the magnitude of the Ogallala aquifer — the water supply that literally provides the foundation for the mammoth agricultural development shown in this photograph — this lake would only irrigate about 26,000 acres of grain sorghum (one of the major crops in this area). This represents only 0.4 percent of the area shown by this photograph. In other words, the area that could be irrigated by completely draining this lake would appear on this photograph as a square with 5/16-inch sides.

PUMP WHAT YOU NEED
BUT USE WHAT YOU PUMP

PREVENT TAILWATER WASTE

HIGH PLAINS UNDERGROUND WATER
CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

SECOND CLASS PERMIT

THE Cross SECTION

A Monthly Publication of the High Plains Underground Water Conservation District No. 1

Volume 16—No. 12 "THERE IS NO SUBSTITUTE FOR WATER" *December, 1970*

SEASON'S GREETINGS From the Directors and Staff of the High Plains Underground Water Conservation District No. 1. Left to right: Kenneth Seales, John Seymour, Albert Sechrist, Norma Fite, Selmer Schoenrock, Ann Bell, Frank Rayner, Dana Wacasey, Ross Goodwin, Chester Mitchell, Obbie Goolsby, Dan Seale, Ray Kitten, Tony Schertz, and Clifford Thompson.

THE PRESIDENT'S 1970 REPORT

It is my pleasure as President of the Board of Directors of the High Plains Underground Water Conservation District No. 1, to submit to the District's residents and taxpayers, this brief report regarding the status of your District.

First, let me wish all of you the most joyous of season's greetings, on behalf of both the Board of Directors and the District's Staff.

Second, let me commend to you the District's Staff. In the seven years that I have served on the District's Board of Directors, I have come to know them very well. With this knowledge, I can relate to you their most commendable dedication in service to the District, as has been exemplified by the quality and volume of their achievements.

Seventeen months ago, the District embarked upon a program to alleviate its chronic and accelerating indebtedness. I am most happy to report that the goals of this program have been achieved in less than half the time initially projected for their solution. The District will enter the new year (1971) free of debt — for the first time in ten years. This was realized without a change in the District's tax rate.

At the end of 1969, the District's Staff consisted of a manager, an engineer, a geologist, a director of public relations, a secretary-bookkeeper, a draftsman, a clerk, and three field representatives. The Staff now consists of a manager, an engineer, a geologist, an attorney, a draftsman, a secretary-bookkeeper, a secretary, a clerk, and the same three field representatives. These eleven people are primarily responsible for the remarkable improvement in the District's financial position. They assumed an additional workload, while exercising a frugal attitude towards all but the most necessary spending. In spite of financial restrictions, they have continued to efficiently perform all ongoing services, while undertaking new responsibilities as needed.

The table accompanying this report summarizes the District's financial condition at the end of the years listed. Annual audits itemizing the expenditures of the District during these same years have been filed for public record.

In 1971, I pledge to the District's residents the continued management of the District within its financial capabilities, and in conformance with the laws governing its operations.

Respectfully submitted,

Chester Mitchell

CHESTER MITCHELL, President
Board of Directors

(See table on page 4)

WATER DEPLETION TAX ALLOWANCE MAPS

The 1970 cost-in-water depletion, income-tax guideline maps, for all of the counties within the District, will be released on January 11, 1971.

The Internal Revenue Service has authorized the same cost-in-water values used for land purchased in 1969 to be used for land purchased in 1970. The 1970 cost-in-water tables can be secured without cost, by contacting the District's Lubbock office.

The District is working toward the complete automation (machine processing) of the cost-in-water depletion, income-tax-allowance program. In order to implement these procedures, it will be necessary for each claimant, or his agent (accountants), to supply the District with the legal description of each parcel of land for which an

—continued on page 3 . . . MAPS

THE Cross SECTION

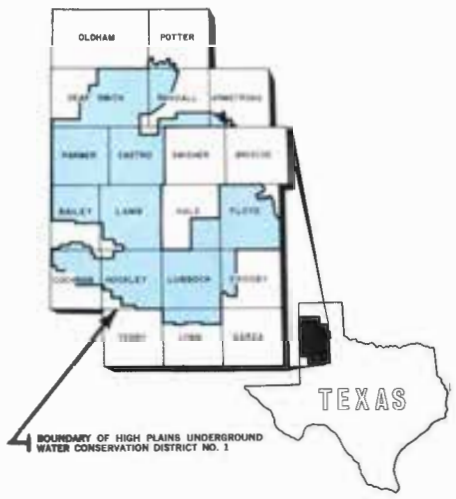
A MONTHLY PUBLICATION OF THE HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1

1628 15th Street, Lubbock, Texas 79401

Telephone 762-0181

FRANK RAYNER, Editor

Second Class Postage Paid at Lubbock, Texas



NOTICE: Information regarding times and places of the monthly County Committee meetings can be secured from the respective County Secretaries.

Applications for well permits can be secured at the address shown below the respective County Secretary's name, except for Armstrong and Potter Counties; in these counties contact Carrol Rogers and Vic Plunk, respectively.

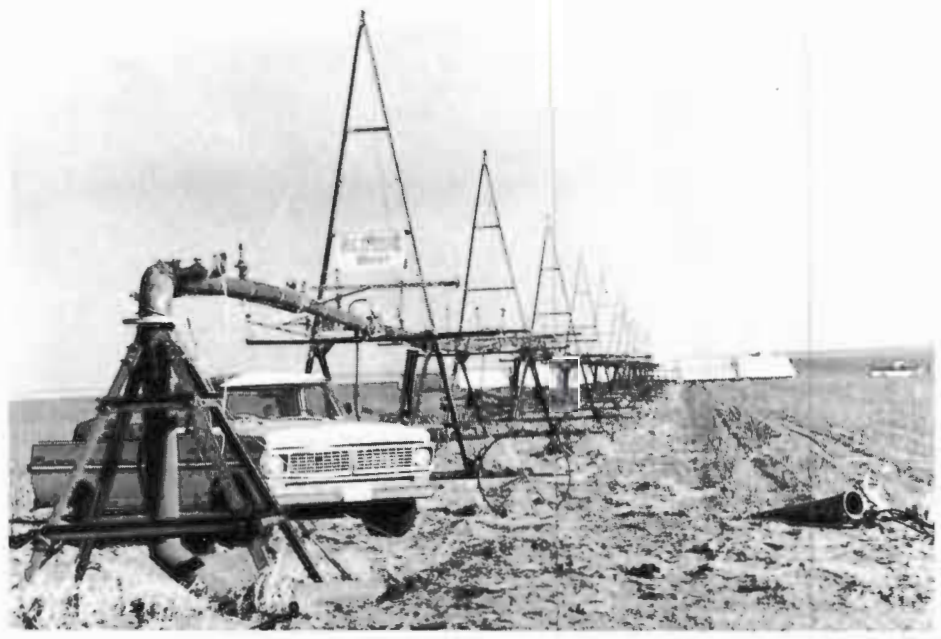
OIL PUMPS STOP AUTOMATIC SPRINKLER

The Court of Civil Appeals of Texas, San Antonio recently handed down a decision (dated July 22, 1970) dealing with a conflict of uses for the air space immediately above some farm land. The suit which is styled *Jones vs. Getty Oil Company* (458 S.W. 2d 93) concerns a land owner and farmer who was seeking an injunction to prohibit an oil company from maintaining oil pumping units which interfered with a "Valley" irrigation sprinkler system. After the farmer had installed a Valley sprinkler irrigation system, the mineral lessee, Getty Oil Company, drilled two wells and installed pumping units which were taller than the maximum which the Valley sprinkler could pass over. This type of sprinkler system has a maximum clearance of seven feet. In other words, most obstructions in a field that are less than seven feet in height will not prevent the Valley system from proceeding with the irrigation. One of the Getty pumping units was 17 feet above the ground at the top of its upstroke, while the other pumping unit extended approximately 34 feet above the ground. These units made the Valley system useless to Jones.

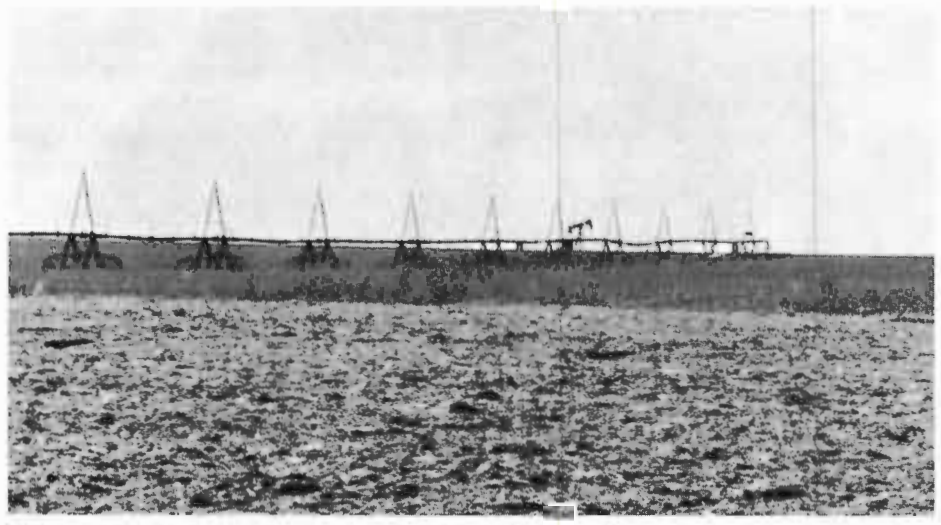
When the case was originally heard, in District Court, Gaines County, the question was whether the mineral lessee found it reasonably necessary to install pumping units to a height that would interfere with Jones' automatic sprinkler system. The Gaines County jury found that it was *not* reasonably necessary for the oil company to place pumping units over their wells which would interfere with the use of the already in place, self propelled sprinkler system. However, the Judge entered a "non obstante veredicto" (notwithstanding the verdict) decision. In other words, the jury found in favor of Jones, however, the Judge overruled the jury's verdict and found for Getty Oil Company. Judgments notwithstanding the verdict are generally entered where the judge does not feel that either the law or the facts will uphold the verdict at which the jury arrived.

Jones' attorneys (Clayton, Gresham and Fulbright, Lamesa, Texas) appealed the Judge's decision; and subsequently, the San Antonio Court of Civil Appeals overruled the Judge's finding, stating that, "it is a fundamental rule that in considering whether a judgment non obstante veredicto was properly granted we must consider the evidence in the light most favorable to the jury finding, giving credit to all evidence supporting such finding and indulging every reasonable presumption in support of the verdict while disregarding all evidence and inferences to the contrary." In other words, the appeals court stated that there seems to be sufficient evidence for the jury to have arrived at its decision,

—continued on page 3 . . . OIL



A typical Valley Sprinkler on the Jones farm.



One of the Valley Sprinklers on the Jones farm, and the long-stroke Getty Oil Company pump.

Oil . . .

—continued from page 2

consequently, the trial Judge's decision notwithstanding the verdict was erroneously granted in that the evidence supporting the jury's verdict was competent.

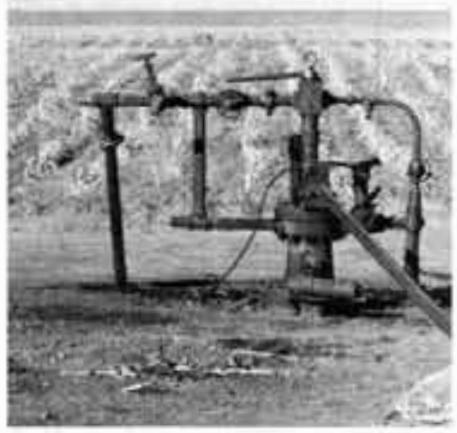
There was no question that the standard oil and gas leases provide for the use of Jones' land as was "reasonably necessary" in order to produce oil and/or gas. The question which was decided was whether or not it was reasonably necessary for Getty to install pumps in a manner as to prevent Jones from using his Valley system. Another oil company's wells on the Jones land were placed in concrete cellars (pits), which had been constructed so that the top of the pumping unit extended less than seven feet above the ground, thus permitting Jones to continue to use his Valley system. Still another oil company equipped their wells on Jones' farm with hydraulic pumping units whose height does not interfere with the rotating irrigation system.

One judge of the Appeals Court dissented from the judgment entered by that court. He stated, "I have found no case where the lessees use of the vertical space over the well site has been limited or restricted, or any case where a lessee has been liable for damages for excessive use of such air space." He stated that Getty's operations were legitimate operations due to the fact that Getty held the dominant estate in the land.

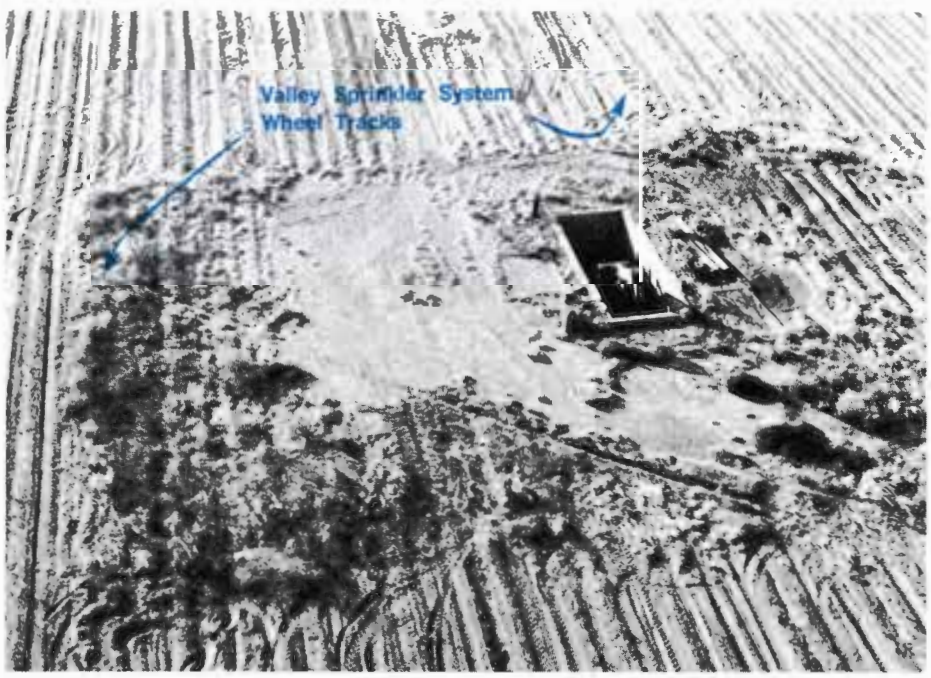
After the decision by the Court of Civil Appeals, Getty applied for a writ of error to the Texas Supreme Court, for a hearing by that Court. The Texas Supreme Court has granted the writ and has set January 13, 1971, as the date that it will hear oral arguments in this case.

There are many farming areas where sprinkler irrigation is the most efficient and effective method of irrigating crops. The efficiency of automatic sprinkler irrigation makes it an extremely important water conservation practice. Every means of conserving groundwater, by affording its most efficient use, should be the goal of every prudent farmer. Where conservation methods such as sprinkler irrigation can be used to prevent waste of groundwater, these practices should be applauded, and should certainly not be hindered. Therefore, in the interest of water conservation, the High Plains Underground Water Conservation District No. 1 is preparing an amicus curiae (friend of the court) brief in support of Jones to be submitted to the Texas Supreme Court.

Long-stroke Getty Oil Company pumping unit on the Jones farm.



A hydraulic oil-pumping unit on the Jones farm.



Oil-pumping unit set in cellar, allowing use of the Valley Sprinkler system.

Maps . . .

—continued from page 1

allowance is claimed. This can be done by:

1) Providing the District with a copy of the reverse side of I.R.S. Form 665, noting on same the total acres in each parcel;
2) returning to the District the 1969 decline map with the parcel(s) shown thereon (the District will, in turn, return the map to the party providing same);
3) providing the District with a list of the legal descriptions of the parcels claimed. Forms for this purpose can be obtained from the District.

The 1970 maps, will be sent to only those persons supplying the requested information as set forth above. If the District's efforts to automate this program are successful, then parcels of land that have not been submitted for machine processing could lose a year's allowance, while they are being processed for machine programming.

THE 1971 DISTRICT ELECTION

by JOHN SEYMOUR

The High Plains Underground Water Conservation District No. 1 will hold an election on Tuesday, January 12, 1971, in which two District Directors and fourteen County Committeemen will be elected. At this election there will be races only in seven of the District's counties. Those counties in which elections will be held include Armstrong, Potter, Randall, Deaf Smith, Parmer, Castro and Bailey. Those counties comprise District Director's Precincts Three and Four. There will be no elections on January 12, 1971, in District Director's Precincts One, Two and Five. Those individuals needing to vote absentee may do so at their County Clerk's office. Absentee voting will extend from December 23, 1970, until January 8, 1971.

Two District Directors will be chosen at the upcoming election. One each from Director's Precincts Three and Four. Each county in which an election is to be held this time will elect two County Committeemen.

The two Director's positions are presently held by Ross Goodwin and John D. Pitman (Director's Precincts Three and Four respectively). Mr. Pitman has decided that he will not be able to continue to serve at this time as a member of the Board of Directors for the District, and he will not be running this year. Billy Wayne Sisson is running for the Director's position which represents Deaf Smith, Potter, Randall, and Armstrong Counties. In Director's Precinct Three the incumbent Ross Goodwin will be opposed in the upcoming election by John Gunter of Muleshoe, Texas. The winner of that race will represent Parmer, Castro, and Bailey Counties on the Board of Directors. The members of the Board of Directors are the District's executive officers and are responsible for governing the High Plains Underground Water Conservation District No. 1.

The County Committeemen to be elected in January will become members of each county's five-man county committee, which is responsible for recommending approval of well drilling permits, together with other recommendations concerning District matters at the county level. These recommendations by the county committees are given to the District's Board of Directors for their action.

Any qualified voter (one who has a valid voter registration certificate for 1970) may vote for District Directors as long as the voter is a resident of the county within the District Director's Precinct in which there will be a Director chosen at this election. Qualified voters must reside within the County Commissioner's Precinct for which a County Committeeman is to be elected. In other words, if a County Committeeman is to be elected from Commissioner's Precinct Three of a county, then only those residents within Commissioner's Precinct Three may vote in that race. Where there is a County Committeeman running "at large" then voters anywhere within that county may vote in that race.

The candidates for District Directors and County Committeemen were nominated by the respective County Committees in accordance with the rules of the District. There will be blank spaces provided on each ballot so that voters may write in the name of anyone else they might prefer in any given race. Listed below are the nominees for District Director, the nominees for County Committeemen, and the polling places and officers for the election.

NOMINEES FOR DISTRICT DIRECTOR:

Director's Precinct No. Three—Territory within the District which is situated in each of the following counties: Bailey, Castro, and Parmer.

Ross Goodwin, 1829 W. Ave. D, Muleshoe, Texas
John Gunter, Route 2, Box 721, Muleshoe, Texas

Director's Precinct No. Four—Territory within the District which is situated in each of the following counties: Armstrong, Deaf Smith, Potter, and Randall.

Billy Wayne Sisson, 114 Liveoak, Hereford, Texas

NOMINEES FOR COUNTY COMMITTEEMEN:

ARMSTRONG COUNTY

Residents vote for two Committeemen-at-large.

Charles Kennedy, Rt. 1, Happy, Texas
Cordell Mahler, Wayside, Texas
James Stockett, Rt. 1, Happy Texas
Ron Hamblen, Wayside, Texas

BAILEY COUNTY

Residents of Commissioner's Precinct No. 1 vote for one.

Lloyd D. Throckmorton, Route 1, Box 115, Muleshoe, Texas

Residents of Commissioner's Precinct No. 4 vote for one.

W. R. "Bill" Welch, Maple, Texas

—continued on page 4 . . . ELECTION

Election . . .

—continued from page 3

CASTRO COUNTY
Residents of Commissioner's Precinct No. 3 vote for one.
Joe Nelson, Box 73, Dimmitt, Texas
David Cole, Route 5, Dimmitt, Texas
Residents of Commissioner's Precinct No. 4 vote for one.
Anthony Acker, Route D, Nazareth, Texas
Don Schilling, Route 5, Dimmitt, Texas

DEAF SMITH COUNTY
Residents of Commissioner's Precinct No. 3 vote for one.
George Ritter, Westway, Hereford, Texas
Residents of Commissioner's Precinct No. 4 vote for one.
Harry Fuqua, Route 1, Hereford, Texas

PARMER COUNTY
Residents of Commissioner's Precinct cinct No. 1 vote for one.
Guy Latta, 1006 West 5th, Friona, Texas
Dalton Caffey, 15th Street, Friona, Texas
Residents of Commissioner's Precinct No. 2 vote for one.
Edwin Lide, Route 1, Bovina, Texas
Eddie G. Steelman, Route 1, Bovina, Texas

POTTER COUNTY
Residents vote for two committeemen-at-large.
F. G. Collard, III, Route 1, Box 101, Amarillo, Texas
W. J. Hill, Bushland, Texas

RANDALL COUNTY
Residents vote for one Committeeman-at-large
John F. Robinson, 1002 7th Street, Canyon, Texas
Melvin Schaeffer, Route 1, Happy, Texas
Residents of Commissioner's Precinct No. 3 vote for one.
Jack Brandt, Route 1, Canyon, Texas
Fred Begert, 1422 Hillcrest, Canyon, Texas

POLLING PLACES AND OFFICERS FOR THE ELECTION:

ARMSTRONG COUNTY
Polling Place No. 1:
Schoolhouse, Wayside, Texas
Presiding Judge:
Bernice Hamblin, Wayside, Texas

BAILEY COUNTY
Polling Place No. 1:
Enochs Gin Office, Enochs, Texas
Presiding Judge:
W. R. Adams, Route 2, Morton, Texas
Polling Place No. 2:
Bailey County Courthouse, Muleshoe, Texas
Presiding Judge:
B. H. Black, Route 2, Box 48, Muleshoe, Texas

CASTRO COUNTY
Polling Place No. 1:
Brockman Hardware Co., Nazareth, Texas
Presiding Judge:
Mrs. Blanche Birkenfeld, Nazareth, Texas
Polling Place No. 2:
County Couthouse, Dimmitt, Texas
Presiding Judge:
Floyd Copeland, Dimmitt, Texas
Polling Place No. 3:
City Hall, Hart, Texas
Presiding Judge:
Percy Hart, Hart, Texas

DEAF SMITH COUNTY
Polling Place No. 1:
County Courthouse, Hereford, Texas
Presiding Judge:
Mrs. Clinton Jackson, N 385, Hereford, Texas

PARMER COUNTY
Polling Place No. 1:
County Courthouse, Farwell, Texas
Presiding Judge:
Mrs. Albert H. Smith, Farwell, Texas
Polling Place No. 2:
Wilson & Brock Ins., Bovina, Texas
Presiding Judge:
Carl Rea, Box 106, Bovina, Texas
Polling Place No. 3:
City Hall, Friona, Texas
Presiding Judge:
J. L. Witten, 1602 W. 7th, Friona, Texas

POTTER COUNTY
Polling Place No. 1:
Schoolhouse in Bushland, Texas
Presiding Judge:
Mrs. James Walton, Box 76, Bushland, Texas

RANDALL COUNTY
Polling Place No. 1:
Schoolhouse, Umbarger, Texas
Presiding Judge:
Emil Olson, Route 1, Canyon, Texas

SUMMARY OF THE DISTRICT'S FINANCIAL STANDING 1961-1970*

Year[1]	Net Tax Receipts	Other Income[2]	Bank Notes	Grant[3]	Total Income	Cash On Hand	Accounts Payable	Net Indebtedness[4]
1961	152,451.15	709.20			153,160.35	26,119.73	28,829.40	— 2,709.67
1962	163,344.33	985.00	25,000.00		189,329.33	18,088.96	87,771.99	— 69,683.03
1963	174,730.02	186.00	56,000.00		230,916.02	21,134.26	89,348.93	— 68,214.67
1964	181,384.93	705.00	75,000.00		257,089.93	19,179.90	112,377.65	— 93,197.75
1965	191,004.64	1,771.00	90,000.00		282,775.64	23,281.93	135,854.21	—112,572.28
1966	202,877.72	8,292.46	75,000.00		286,170.18	14,400.02	144,251.63	—129,851.61
1967	212,858.05	5,427.55	128,500.00		346,785.60	20,083.31	164,361.52	—144,278.21
1968	223,151.89	6,086.87	128,000.00	4,391.11	361,629.87	25,595.51	179,071.88	—153,476.37
1969	230,405.74	3,842.65	105,000.00	37,209.52	376,457.91	35,692.96	123,115.77	— 87,422.81
1970	238,500.	7,900.	25,000.	18,200.	289,500.	30,400.	1,200.	+ 29,200.

*All values are in dollars and cents as taken from the respective year's official audit report; except for the 1970 values which were compiled from the District's books through November, and estimated through December 31, 1970.

1. Each year ending December 31st.
2. Includes: Map sales, permit deposit forfeits, equipment sales, well validation certificates, insurance refunds, etc.
3. Received from the Office of Water Resources Research, U. S. Department of the Interior.
4. A minus (—) sign indicates the net indebtedness. A plus (+) sign indicates uncommitted cash on hand.

TEXAS SUPREME COURT TO HEAR WHITAKER CASE

The Texas Supreme Court has set Wednesday, February 17, 1971 as the date it will hear oral arguments in the *Sun Oil Company vs. Whitaker* case. That court recently granted Sun Oil Company's application for Writ of Error, which was filed with it after the 11th Court of Civil Appeals (Eastland) held for Whitaker last June. The Supreme Court will decide whether to affirm or reverse the decision made by the 121st Judicial District Court of Cochran County, which was subsequently affirmed by the Eastland Court.

The High Plains Underground Water Conservation District No. 1, which has had a continuing interest in the Whitaker case, plans to file an amicus curiae (friend of the court) brief with the Supreme Court.

The case was initiated when Sun Oil Company filed suit for an injunction to prevent Mr. Whitaker from interfering with Sun's drilling of a water well on Whitaker's property. The Supreme Court will determine whether or not Sun Oil Company has the right to free use of water from the Ogallala Formation beneath Whitaker's property for water flooding.

WATER LEVELS TO BE MEASURED IN JANUARY

Personnel of the High Plains Underground Water Conservation District No. 1 and the Texas Water Development Board will be measuring the depth to water in over 800 observation wells within the boundaries of the District during January 1971.

The 442 observation wells in Bailey, Cochran, Hockley, Lamb, Lubbock and Lynn Counties will be measured by Kenneth Seales, Obbie Goolsby and Dan Seale, all District personnel.

Within the District, the 409 wells in Armstrong, Castro, Crosby, Floyd, Hale, Parmer, Potter and Randall Counties will be measured by Charles Cornelius, David Cunningham, Hershell Davidson, Charles Ferguson and Steve Moore, all TWDB personnel.

A blue, 4 by 2½-inch, stick-on tag will be affixed to the well-head of every observation well measured by District personnel. A white tag will be affixed to the well-head equipment of wells measured by TWDB personnel.

BE SURE AND VOTE ON JANUARY 12, 1971!

HIGH PLAINS UNDERGROUND WATER CONSERVATION DISTRICT NO. 1
1628 FIFTEENTH STREET
LUBBOCK, TEXAS 79401

SECOND CLASS PERMIT