IRRIGATION DATA FROM CASTRO AND PARMER COUNTIES, TEXAS, 1983-84

By Paul L. Rettman and Gene D. McAdoo

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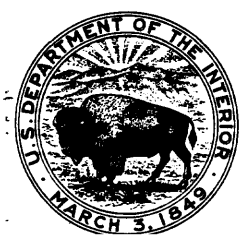

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UNITED STATES DEPARTMENT OF THE INTERIOR

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CONVERSION FACTORS

For those readers who may prefer to use the International System (SI) of units rather than inch-pound units, the conversion factors for the terms used in this report are given below:

From	Multiply by	To obtain
acre	0.4047	hectare
cubic foot (ft^3)	0.02832	cubic meter
foot (ft)	0.3048	meter
gallon (gal)	3.785	liter
gallon per minute (gal/min)	0.06308	liter per second
horsepower	745.7	joule per second
inch (in.)	25.40	millimeter
square mile (mi^2)	2.590	square kilometer

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ABSTRACT

Castro and and Parmer Counties, with an estimated 700,000 acres under irrigation, are two of the leading agricultural counties in Texas.

This report summarizes irrigation data collected by the U.S. Geological Survey at 64 randomly-selected sites as part of a study to better define the relationship between pumpage for irrigation and return flow to the High Plains aquifer from applied water (irrigation plus precipitation). The irrigation data include well yields, time of operation, fuel consumption, and water applied to individual crops for the 1983 and 1984 growing seasons. The average water application rate for corn was 35.1 inches in 1983 and 31.5 inches in 1984; the rate for cotton was 12.4 inches in 1983 and 13.7 inches in 1984; and the rate for wheat was 15.5 inches in 1984.

INTRODUCTION

The Dallas Morning News (1983) refers to Castro and Parmer Counties as being among the leading agricultural counties in the State with about 700,000 acres under irrigation. Precipitation alone (about 18 in.) is inadequate for the production of most crops; therefore, irrigation is required for substantial crop production. Irrigation water is provided by ground-water resources from the High Plains aquifer.

Corn, wheat, cotton, sugar beets, and milo (grain sorghum) are the most common irrigated crops, but soybeans, vegetables, sunflowers, and alfalfa are also grown in the area. Corn must be irrigated often as it does not produce abundantly when the soil moisture is low. Cotton can be produced with less soil moisture and is irrigated less often; some farmers produce cotton with only one application of water before planting.

The study area is located in the Southern High Plains of Texas and includes Castro and Parmer Counties (fig. 1). This 1,739-mi^2 area is part of the Great Plains physiographic province. In Texas and New Mexico, the High Plains aquifer consists solely of the Ogallala aquifer. A detailed description of the geology and hydrology of the Southern High Plains is contained in a report by Cronin (1961). The study area generally is flat and interrupted by many shallow, dish-shaped playa basins. Some small stream valleys drain from the northwest to the southeast and usually flow only after heavy rains.

The High Plains Underground Water Conservation District No. 1 reports the number of irrigation wells to be about 4,500 in Castro County and slightly greater than 5,000 in Parmer County. Almost without exception, irrigation wells in the study area have at least some underground conduit pipe to carry water away from the well for field application. Flood irrigation is the most common method of irrigation. Ground water is pumped to a gated aluminum pipe located at the end of the individual crop rows. Many of these flood-irrigation systems have water collection and return pumps located at the lower end of the irrigated fields, to salvage excess irrigation water. The use of center pivot irrigation systems is increasing.

Because of irrigation pumpage, ground-water levels in the High Plains aquifer have steadily declined (the maximum decline is about 100 ft) since the 1950's. These declines cause greater pumping costs and lower well yields.

Purpose and Scope

In 1978, the U.S. Geological Survey began a Regional Aquifer-System Analysis (RASA) study on the High Plains area. One of the findings of the regional study was that limited information exists on the volume of irrigation water that seeps back into the High Plains aquifer as return flow. This report documents the results of an investigation to quantify the average amount of water used to irrigate selected types of crops in Castro and Parmer Counties. The data collected for this investigation can be used to evaluate return flow.

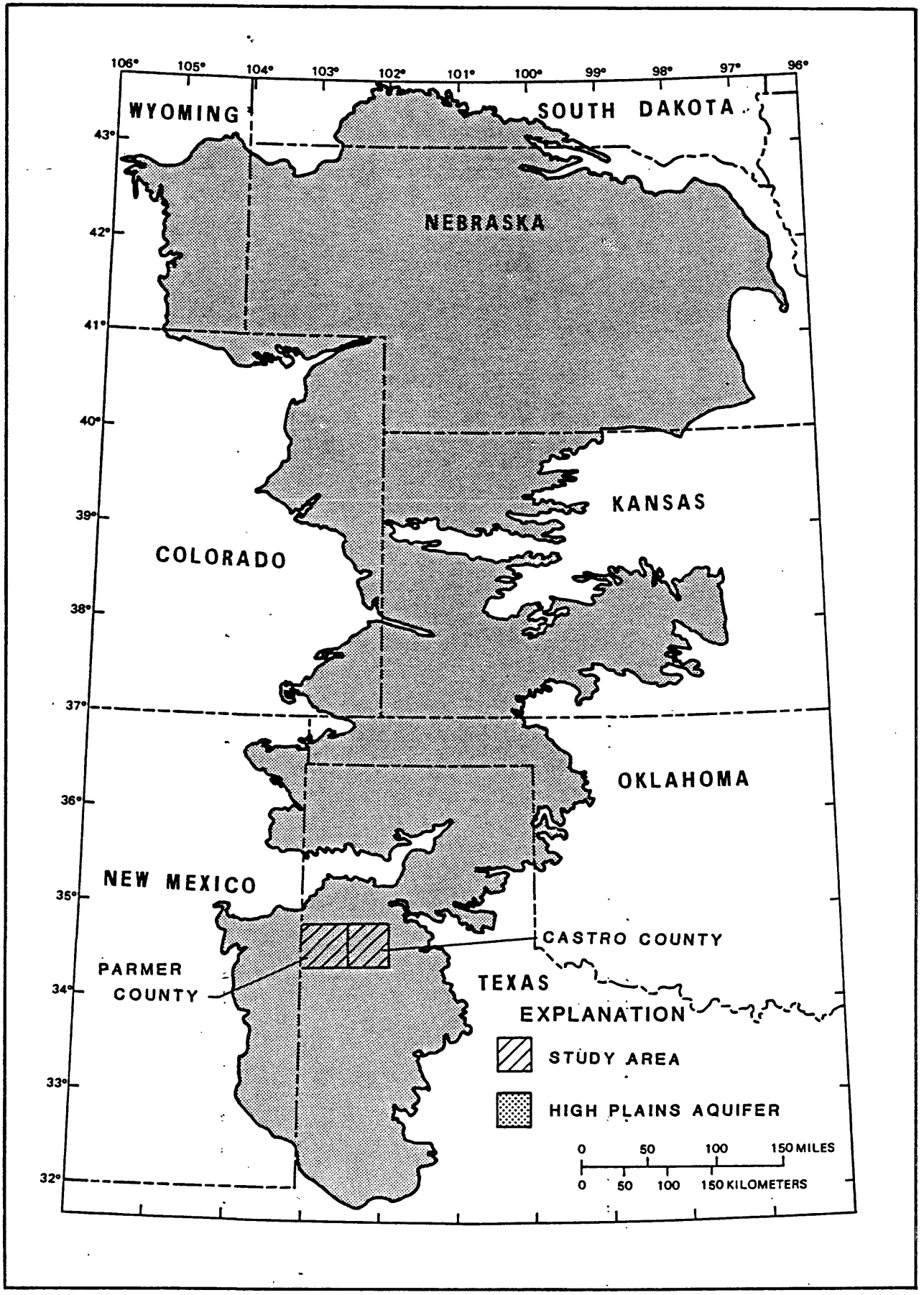

Figure 1.--Location of High Plains aquifer study area

Methods of Study

The methods of data collection used in this study are similar to those used in earlier studies in the High Plains (Heimes and Luckey, 1980; 1983). The data presented in this report were collected between September 1982 and September 1984. Sixty-four sites (fig. 2) were selected at random from well-log files. In the random selection process, a sequential number was assigned as wells were identified. Forty-nine of the sites were monitored in 1983 and all 64 sites were monitored in 1984. If the selected well was being used for irrigated agriculture and the farm operator would give permission, the site was made part of the sampling network. Adjustments occurred where a well was connected to other wells by an underground water-distribution system; therefore, it was necessary to add those wells as part of the site. The selected well is designated "A" in this report, while other wells at the site were designated "B" or another letter. When the system of connected wells totaled six or more, the site was rejected as being too complicated. Missing sequential site numbers represent wells that were rejected, usually because the wells had been abandoned or destroyed.

Well sites were visited prior to the irrigation season to obtain an initial reading on energy (natural gas or electric) meters and on inline flowmeters and engine-hour meters, if available. Vibration Time Totalizers (VTTs) were installed to provide additional information about operating times of the wells (Heimes and Luckey, 1980); these devices are electronic timers which record the total pumping time of a well. The sites were visited periodically during the irrigation season to obtain data on crop types, well discharge, energy consumption, time of operation, and water application. Well-discharge measurements were made using a portable transient-time flowmeter that uses a high-pitched sound to penetrate the pipe material and measure water flow (Luckey and others, 1980). On the rare occasions when it was not possible to use the transient-time meter, discharge measurements were made using other standard methods such as point velocity measurements in open ditches. When the irrigation system had an inline flowmeter, that measurement was compared to the result from the transient-time flowmeter.

Acknowledgments

The authors are indebted to the High Plains Underground Water Conservation District No. 1, Lubbock, Texas, for information from their well-log files and to the many landowners and irrigators who allowed us access to their land and equipment. Without their support, this study would not have been possible.

DESCRIPTION OF IRRIGATION DATA COLLECTED

In the High Plains, irrigation operators use ground water to supplement precipitation, but cannot always schedule and apply irrigation water to maintain ideal soil moisture conditions. The summer growing season can have extreme time and spatial variations of precipitation.

Table 1 shows the seasonal precipitation (averaged values for stations Dimmitt 6E and Clovis 13N), departure from normal, growing seasons, and the crops grown during these seasons from September 1982 to August 1984 (National

page 6 follows

Table 1.--Precipitation and crop-growing seasons

Growing season	Year	Seasonal precipitation (inches) 1/	Departure from normal (inches)	Crops irrigated
September October November December	1982 1983	2.65 4.29	-1.71 -.06	Wheat and vegetables.
January February March April	1983 1984	3.12 2.29	.77 -.06	Wheat, vegetables, alfalfa (may pre-water lands before planting later crops).
May June July August	1983 1984	4.65 14.74	-5.19 4.91	Wheat (irrigation usually ends in May), vegetables, corn, milo, cotton, soybeans, sugar beets, sunflowers, alfalfa.

1/ Averaged value for stations Dimmitt 6E and Clovis 13N, U.S. Department of Commerce (1982-84).

Oceanic and Atmospheric Administration, 1982-84). The averaged values for these stations show that precipitation during the 1983 summer growing season was significantly below normal (-5.19 in.), and the precipitation for the 1984 summer growing season was significantly above normal (+4.91 in.). Precipitation for the remainder of the 2 years was near normal.

Factors other than precipitation may cause variations in irrigation application rates. Some of these include soil type, crop type, method of water application, and management choices by the farmer (such as energy costs and farming habits).

Winter wheat is planted in September and harvested in May or June of the following year. A wheat crop may be followed by a summer crop, such as sunflowers or milo. Some varieties of vegetables can be grown throughout the year and two or three harvests of vegetables per year on the same land are common. The water requirement for vegetables depends in part on the number of crop rotations.

Table 2 (Supplemental Information) gives the site number and numerical well location (well identifier) for the network of selected wells. Well depths ranged from about 215 to 520 ft. Nearly all of the well diameters are 16 in. and, therefore, were not included in table 2. The depth to water below land surface ranged from about 170 to 350 ft. Natural gas is the most common energy source used to power the irrigation wells; electricity is the second most common energy source. Other energy sources, such as butane and diesel, are seldom used in the study area.

The data presented in table 3 (Supplemental Information) are the results of measurements obtained for two irrigation seasons. It was reported by farm operators that some well yields vary by as much as 50 percent in local areas. Well discharge measurements verified this report. Well yields can vary due to the throttle setting of combustion engines. However, the main cause of variations in well yields in the study area probably is due to a change in the pumping lift. Well yields usually vary more during the irrigation season than from one irrigation season to the next. A low-yield well may require the farm operator to drill more wells, to pump the well(s) more hours during the season, or to change the choice of crop or methods of farming.

Data concerning time of site observations and time of operation for the pumping wells are given in table 4 (Supplemental Information). Time of operation usually is recorded by more than one method. Occasionally, data represent more than one well, such as when a gas meter serves more than one well. In those cases, the assumption was made that each well was pumped for an equal amount of time.

The data presented in table 5 (Supplemental Information) are a summary of results for two irrigation seasons. The amount of water applied to a crop is given in inches for the crop seasons.

In order to insure that the water application data are as accurate as possible, considerable care was taken in collecting the well-yield and time-of-operation data. Personal interviews were conducted with some farm operators when additional information was needed. However, the water application figures

should be considered as estimates because well yields varied and operating hours were not always known with a great degree of confidence.

The most accurate data for well yields are obtained from a volumetric inline flowmeter after the meter has been checked and adjusted with a transient-time flowmeter. Most inline flowmeter data were adjusted to agree with the transient-time meter results when readings of the two meters differed by more than 10 percent. The most accurate estimates for time-of-operation in the study area probably were recorded by electric meters. Hour meters, gas meters, and vibration time totalizers are considered to give less reliable time estimates. The extraneous pumping noted in the remarks section in some of the tables usually reflects pumping that had occurred before the beginning of this study, and most of this pumping was for irrigating wheat.

Where one irrigation system supplied water to fields containing different crops, it was not possible to calculate the applied water for each of the separate crop types. The total water application for the combination of crop types is given in table 5. For vegetables, the number of months of irrigation in a given year is shown in remarks. Only a few values for water applied to wheat are listed in the 1983 season (September 1982 to June 1983) because the project was not started in time to obtain data for the fall of 1982. The 1983 figures given for wheat are only for those sites where the farm operator had good records of the time of irrigation prior to the beginning of site visits in early 1983. Site numbers 96 and above were added to the network after the 1983 season, and data for only the 1984 season are given for those sites.

The average application per season for irrigation on separate fields of selected crops are as follows:

Crop	Number of fields	Year	Average quantity of water applied (inches)
Corn	30	1983	35.1
	33	1984	31.5
Cotton	14	1983	12.4
	19	1984	13.7
Sugar beets	4	1983	34.1
	4	1984	26.6
Wheat	33	1984	15.5
Milo	9	1984	11.4

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SUPPLEMENTAL INFORMATION

Table 2.--Site and well information

Site: Random pick in sequence. See figure 2 for location.
Well identifier: A 15-digit number from latitude and longitude of well location in degrees, minutes, and seconds, with a 2-digit sequence code at the end to locate multiple wells within a 1-second area. This well identifier is used in the U.S. Geological Survey computer files.
Well depth: Depth of well in feet below land surface.
Water level: Approximate depth to water in feet below land surface, January 1984.
Number of wells at site: Total number of wells involved at site.
Irrigation system: Type of irrigation system. PV, center pivot; F, (flood) ditch or gated pipe; SPK, side roll sprinkler.
Power: Pump power source--E, electric motor; Ng, natural gas. Horsepower--rated pump motor horsepower from motor plate. Power consumption--fuel required to deliver 1,000 gallons of water to the crop, kilowatt hours for electric and cubic feet for natural gas.

Site	Well identifier	Well depth	Water level	Number of wells at site	Irrigation system	Power			Remarks
						Source	Horsepower	Consumption	
2	342552102390501	404	269	2	PV	Ng	200	17.6	--
3	342534102313601	381	230	3	F	Ng	--	--	--
6	343211102411701	447	330	1	F	Ng	--	--	--
9	343457102364501	490	342	2	PV	Ng	--	19.9	--
10	342923102361101	373	244	1	F	Ng	--	--	--
11	342110102101501	340	194	1	F	Ng	--	19.3	--
13	343605102500001	392	324	2	F	E	15	3.3	--
14	343145102415601	475	213	2	F	Ng	--	25.7	--
15	342628102265201	380	240	1	PV	E	100	1.6	--
19	342556102561601	520	327	2	F	Ng	--	38.2	--
20	343110102453501	433	179	3	F	Ng	--	23.3	--
22	342529102404001	420	275	2	F	Ng	--	23.9	--
24	343855102442801	344	258	5	F	E	--	3.1	--
26	342535102074701	395	226	3	PV,F	E	125	1.8	--
27	342128102470401	426	287	3	F	Ng	--	31.6	--
28	342750102470401	387	296	1	F	Ng	--	32.1	--
29	341946102452001	400	182	3	F	Ng	--	22.6	--
30	342923102054601	382	263	4	PV,F	E	50	5.9	--
31	342253102094101	410	177	3	F	Ng	--	27.7	--
35	342253102094101	410	200	1	F	E	100	3.0	--
38	341858102193001	316	202	1	F	Ng	--	16.8	--
39	342900102341001	385	240	1	F	E	100	2.3	--

Table 2.--Site and well information--Continued

Site	Well identifier	Well depth	Water level	Number of wells at site	Irri-gation system	Power			Remarks
						Source	Horsepower	Consumption	
41	342153102364201	390	244	2	F	Ng	--	24.4	--
42	342037102463501	433	222	1	PV	E	100	2.1	--
45	343006102475001	385	270	3	F	Ng	--	35.2	--
48	344220102280001	307	178	1	F	Ng	--	--	--
49	342217102284301	418	203	2	F	E	100	1.5	--
50	341856102224301	342	201	2	F	Ng	--	19.3	--
51	343857102531501	234	230	4	F	E	25	2.1	Site 125 is included.
53	341951102113501	351	208	2	F	E	100	1.3	--
54	343922102360001	368	248	2	F	Ng	--	32.0	--
55	343538102183801	361	254	3	F	Ng	--	26.0	--
56	342006102212001	338	196	1	PV	Ng	--	--	--
57	342827102400901	440	246	1	F	Ng	--	21.1	--
59	342709103001501	512	336	2	PV	E	150	2.7	--
60	342617102311601	369	236	1	F	Ng	--	27.2	--
64	342435102551301	400	290	1	F	E	100	2.6	--
65	343037102571301	380	278	3	F	E	40	3.0	--
66	343438102411301	505	384	2	F	Ng	--	36.7	--
69	344400102231301	290	208	1	F	Ng	--	22.3	--
77	342456102464801	414	288	1	F	Ng	--	14.3	--
78	344208102220201	326	178	3	F	Ng	--	--	--
82	343248102594001	420	308	3	PV	E	30	--	--
84	343035102480801	415	261	1	F	Ng	--	--	--
86	343355102093201	273	204	2	F	E	10	--	--
88	343650102524201	322	256	2	F	Ng	--	42.4	--
89	342609102080101	407	245	3	F	E	125	1.7	--
95	343540102365501	461	320	2	F,PV	Ng	--	--	--
96	342643102520501	431	318	3	F	Ng	--	--	--
97	343149102482401	433	350	3	F	Ng	--	29.2	--
99	342356102582301	413	282	1	PV	E	100	1.8	--
100	342300103020301	375	247	2	SPK	Ng	--	33.9	--
102	342224102350701	390	259	1	PV	Ng	--	31.5	--
104	343010102220601	420	300	1	F	Ng	--	--	--
105	342518102414501	442	273	2	F	Ng	--	15.4	Site 113 is included.
107	343906102062001	215	168	2	F	E	75	--	--

Table 2.--Site and well information--Continued

Site	Well identifier	Well depth	Water level	Number of wells at site	Irrigation system	Power			Remarks
						Source	Horsepower	Consumption	
108	342111102270201	326	206	1	PV	Ng	--	20.4	--
109	342802102135201	273	241	3	F,PV	E	125	1.7	--
114	343132102173601	465	277	3	F	Ng	--	27.2	--
115	343149102280601	462	316	4	F	Ng	--	28.3	--
116	343529102413001	450	334	1	F	Ng	--	25.5	--
123	342734102495601	448	311	2	F	Ng	--	24.6	--

Table 3.--Discharge data for irrigation wells in Castro and Parmer Counties

Site: Random pick in sequence. See figure 2 for location.
Number of wells at site: Total number of wells involved at site.
Date: Date when measurement was made.
Discharge: Measured discharge, in gallons per minute.
Transient-time meter: Portable flow meter used.
Inline: Flow meter installed in irrigation system.
Other: Other standard method of discharge measurement.

Site	Number of wells at site	Date	Discharge			Remarks
			Transient-time meter	Inline	Other	
2	2	07/06/83	436	--	--	Well B.
		07/06/83	782	908	--	Wells A and B.
3	3	06/29/83	--	--	610	Well A, pygmy meter.
		05/02/83	802	856	--	Well B.
		05/02/83	900	--	--	Well C.
6	1	05/04/83	558	--	--	--
9	2	09/14/83	685	--	--	Wells A and B.
10	1	05/03/83	504	--	--	--
		07/08/83	530	--	--	--
		08/03/83	--	--	495	Using propeller meter.
11	1	05/31/83	828	--	--	--
13	2	05/05/83	75	--	--	Well A.
		05/05/83	139	--	--	Well B.
14	2	05/05/83	--	--	689	Well A, with propeller meter.
		07/14/83	659	--	--	Well A.
		07/14/83	709	--	--	Well B.
15	1	06/29/83	827	816	--	--
19	2	06/30/83	794	--	--	Well B.
		07/07/83	807	--	--	Well A.

Table 3.--Discharge data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date	Discharge			Remarks
			Transient-time meter	Inline	Other	
20	3	05/04/83	653	--	--	Well C.
		05/04/83	528	--	--	Well B.
		04/24/84	841	--	--	Well C.
22	2	06/29/83	590	--	--	Well B.
		08/02/83	733	--	--	Well A.
24	5	05/05/83	--	545	--	Well A, B, C, D, and E.
		05/05/83	169	--	--	Well C.
		05/05/83	--	417	--	Wells A, B, C, and D.
26	3	08/06/84	926	--	--	Well B.
		08/06/84	989	--	--	Well C.
27	3	07/06/83	741	--	--	Well A.
		07/06/83	--	--	1,122	Wells B and C, using bucket and stop watch.
28	1	06/30/83	725	--	--	--
29	3	06/30/83	580	--	--	Well A.
		06/30/83	612	--	--	Well C.
		08/07/84	571	--	--	Well B.
30	4	05/02/83	174	--	--	Well A.
		05/02/83	36	--	--	Well B.
		05/02/83	84	--	--	Well C.
		05/31/83	97	--	--	Well C.
		09/12/83	122	--	--	Well D.

Table 3.--Discharge data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date	Discharge			Remarks
			Transient-time meter	Inline	Other	
31	3	05/05/83	--	--	514	Well A, using propeller meter.
		05/05/83	355	--	--	Well B.
		05/05/83	522	--	--	Well C.
		07/07/83	--	--	450	Well B, using propeller meter.
		07/07/83	590	--	592	Well B, using pygmy meter.
		07/14/83	574	--	--	Well C.
35	1	07/05/83	895	946	--	--
		08/19/84	--	930	--	--
38	1	02/21/84	1,109	--	--	--
39	1	06/01/83	580	637	--	--
		07/08/83	591	638	--	--
		08/03/83	553	599	--	--
		08/20/83	--	584	--	--
		09/31/83	372	--	--	--
41	2	06/29/83	610	--	--	Well A.
		04/24/84	574	--	--	Well B.
42	1	08/17/83	879	--	--	--
45	3	05/03/83	911	--	--	Well C.
		07/13/83	478	--	--	Well B.
		07/13/83	544	--	--	Well B.
48	1	07/26/84	--	--	295	Using pygmy meter.
49	2	06/29/83	1,172	--	--	Well B.
		08/03/84	665	--	--	Well A.

Table 3.--Discharge data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date	Discharge			Remarks
			Transient-time meter	Inline	Other	
50	2	06/28/83	715	--	--	Well A.
		06/28/83	550	--	--	Well B.
51	4	02/24/84	427	--	--	Wells A, C, and D.
		03/15/84	61	--	--	Well B.
53	2	07/05/83	1,011	--	--	Well A.
		08/19/83	964	--	--	Well A.
		03/13/84	1,023	--	--	Well B.
54	2	05/04/83	500	--	--	Wells A and B.
		08/20/83	319	--	--	Wells A and B.
		04/06/84	507	--	--	Well B.
55	3	07/07/83	861	--	--	Wells A, B, and C.
		02/21/84	695	--	--	Wells B, and C.
		04/06/84	917	--	--	Wells A, B, and C.
56	1	03/13/84	802	725	--	--
57	1	06/29/83	--	--	956	Using propeller meter.
		08/19/83	--	--	990	Do.
59	2	06/30/83	1,091	--	--	Well B.
		07/07/83	818	--	--	Well A.
		08/17/83	1,052	--	--	Well B.
60	1	06/29/83	529	--	--	--
		08/19/83	379	--	--	--
		03/14/84	882	822	--	--
		04/11/84	--	699	--	--

Table 3.--Discharge data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date	Discharge			Remarks
			Transient-time meter	Inline	Other	
64	1	02/24/84	565	--	--	--
65	3	05/03/83	167	--	--	Well A.
		05/03/83	370	--	--	Well C.
		05/03/83	607	--	--	Wells A, B, and C.
66	2	05/04/83	559	--	--	Well A.
		07/07/83	1,006	--	--	Wells A and B.
69	1	04/24/84	507	544	--	--
		05/16/84	--	462	--	--
77	1	07/07/83	1,052	--	--	--
		04/04/84	802	--	842	Using propeller meter.
78	3	07/05/83	544	--	--	Well A.
		07/05/83	560	--	--	Well C.
		04/06/84	249	--	--	Well B.
		04/06/84	534	--	--	Well C.
		08/27/84	527	--	--	Well C.
82	3	07/06/83	698	706	--	Wells A, B, and C.
		08/18/83	--	723	--	Do.
		04/05/84	--	741	--	Do.
84	1	05/03/83	896	769	--	--
		07/06/83	1,014	844	--	--
86	2	05/14/83	--	296	--	Wells A and B.
		09/12/83	311	--	--	Well B.
		05/16/84	--	--	59	Well A, using trajectory method.

Table 3.--Discharge data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date	Discharge			Remarks
			Transient-time meter	Igline	Other	
88	2	05/03/83	330	--	--	Well A.
		05/03/83	141	--	153	Well B, using propeller meter.
		04/12/84	440	--	--	Well A.
		04/12/84	--	--	169	Well B, using propeller meter.
89	3	07/05/83	1,168	--	--	Well B.
		04/11/84	825	--	--	Well A.
		07/26/84	--	--	1,158	Well C, using pygmy meter.
95	2	07/07/83	--	--	759	Wells A and B, using propeller meter.
		08/20/83	--	--	940	Do.
96	3	04/04/84	659	--	--	Well A.
		04/04/84	457	--	--	Well B.
		04/04/84	388	--	--	Well C.
97	3	03/14/84	486	--	--	Well A.
		03/14/84	610	--	--	Well B.
		03/14/84	692	--	--	Well C.
99	1	03/13/84	707	--	--	--
100	2	04/05/84	451	--	--	Well A.
		04/05/84	--	--	550	Well B, using propeller meter.
102	1	03/14/84	650	--	--	--
104	1	--	--	--	--	Site not used in 1984.

Table 3.--Discharge data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date	Discharge			Remarks
			Transient-time meter	Inline	Other	
105	2	03/13/84	658	--	--	Well A.
		03/13/84	667	--	--	Well B.
107	2	--	--	--	--	Site not used in 1984.
108	1	03/13/84	661	--	--	--
109	3	03/14/84	1,125	--	--	Well A.
		08/02/84	1,090	--	--	Well A.
		08/02/84	450	462	--	Well C.
		08/03/84	582	--	--	Well B.
114	3	03/14/84	448	--	--	Well A.
		03/14/84	932	--	--	Wells B and C.
115	4	04/05/84	626	--	--	Well A.
		04/05/84	632	--	--	Well B.
		04/05/84	673	--	--	Well C.
		04/05/84	928	--	--	Well D.
116	1	04/12/84	690	--	--	--
123	2	02/23/84	684	--	--	Well A.
		02/23/84	643	--	--	Well B.

Table 4.--Time-of-operation data for irrigation wells in Castro and Parmer Counties

Site: Random pick in sequence. See figure 2 for location.
Number of wells at site: Total number of wells involved at site.
Date:
  Begin: Beginning date of time-of-operation measurement.
  End: Ending date of time-of-operation measurement.
Vibration time totalizer: Time of operation from VTT equipment, in hours.
Energy meter:
  Type: E, electric meter; Ng, natural-gas meter.
  Time: Time computed from energy meter, in hours.
Other:
  Source: Source of other time of operation data; Inl, inline flow meter; Hm, hour meter; R, all or part of time reported by operator.
  Time: Time computed from other source, in hours.

Site	Number of wells at site	Date		Vibration time totalizer (total hours)	Energy meter		Other		Remarks
		Begin	End		Type	Time (total hours)	Source	Time (total hours)	
2	2	03/03/83	09/13/83	1,059	--	--	--	--	Well A.
				1,333	--	--	--	--	Well B.
					Ng	956	Inl	1,019	Wells A and B.
		09/13/83	08/29/84	1,622	--	--	--	--	Well A.
				1,624	--	--	--	--	Well B.
					Ng	1,551	Inl	1,382	Wells A and B.
3	3	03/04/83	09/21/83	1,704	--	--	--	--	Well A.
				--	--	--	Inl	1,315	Well B.
				1,686	--	--	--	--	Well C.
		09/21/83	09/06/84	2,166	--	--	--	--	Well A.
				1,325	--	--	--	--	Well B.
				1,050	--	--	--	--	Well C.
6	1	03/02/83	09/14/83	151	--	--	--	--	--
		09/14/83	08/27/84	1,562	--	--	--	--	--
9	2	03/09/83	09/14/83	344	Ng	284	R	424	Wells A and B.
		09/14/83	08/28/84	--	Ng	1,508	--	--	Wells A and B.
10	1	03/03/83	09/13/83	--	--	--	R	2,028	--
		09/13/83	09/06/84	2,142	--	--	--	--	--
11	1	02/16/83	09/12/83	839	Ng	861	--	--	--
		09/12/83	09/06/84	1,285	--	--	--	--	--
13	2	03/10/83	09/13/83	2,930	E	2,920	--	--	Well A.
				2,389	E	2,751	--	--	Well B.
		09/13/83	08/28/84	--	E	1,998	--	--	Well A.
				--	E	1,885	--	--	Well B.

Table 4.--Time-of-operation data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date		Vibration time totalizer (total hours)	Energy meter		Other		Remarks
		Begin	End		Type	Time (total hours)	Source	Time (total hours)	
14	2	03/02/83	09/13/83	989	Ng	1,007	--	--	Well A.
				--	Ng	857	--	--	Well B.
		09/13/83	08/27/84	881	Ng	776	--	--	Well A.
				1,084	Ng	1,053	--	--	Well B.
15	1	02/16/83	09/13/83	1,549	E	1,457	Inl	1,402	--
		09/13/83	09/06/84	817	E	833	Inl	815	--
19	2	02/29/83	09/13/83	1,227	Ng	915	--	--	--
				1,206	Ng	1,506	--	--	Well B.
				1,876	Ng	1,336	--	--	Well A.
		09/13/83	08/28/84	--	Ng	2,581	--	--	Well B.
20	3	03/04/83	09/21/83	--	--	--	--	--	Operator added one more well--site not useful, 1983.
		09/02/83	09/06/84	2,475	Ng	2,345	--	--	Well A.
				1,417	Ng	1,548	--	--	Well B.
				1,919	Ng	2,452	--	--	Well C.
22	2	03/04/83	09/13/83	--	Ng	721	--	--	Well A.
				--	Ng	707	--	--	Well B.
		09/13/83	08/29/84	2,348	Ng	2,343	--	--	Well A.
				1,571	--	1,764	--	--	Well B.
24	5	03/08/83	09/13/83	1,810	E	2,311	--	--	Well A.
				1,719	E	2,203	--	--	Well B.
				1,625	--	--	--	--	Wells C and D.
				1,503	--	--	--	--	Well E.
		09/13/83	08/28/84	--	E	2,707	--	--	Well A.
				--	E	1,887	--	--	Well B.
				--	E	2,806	--	--	Wells C and D.
				2,226	--	--	--	--	Well E.
26	3	03/02/83	09/12/83	--	--	--	--	--	Site unused, 1983.
		09/12/83	08/27/84	--	E	0	--	--	Well A.
				--	E	409	--	--	Well B.
				--	E	1,542	--	--	Well C.

Table 4.--Time-of-operation data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date		Vibration time totalizer (total hours)	Energy meter		Other		Remarks
		Begin	End		Type	Time (total hours)	Source	Time (total hours)	
27	3	02/25/83	09/13/83	--	Ng	923	--	--	Well A.
				--	Ng	1,058	--	--	Well B.
				--	Ng	1,015	--	--	Well C.
		09/13/83	08/27/84	1,697	Ng	1,489	--	--	Well A.
				2,024	Ng	1,951	--	--	Well B.
				--	Ng	2,122	--	--	Well C.
28	1	02/16/83	09/21/83	--	Ng	1,437	--	--	--
		09/21/83	08/27/84	--	Ng	2,407	--	--	--
29	3	03/09/83	09/13/83	1,319	Ng	1,590	--	--	Well A.
				1,399	Ng	1,749	--	--	Well C.
		09/13/83	03/28/84	1,829	Ng	1,314	--	--	Well A.
				--	E	309	--	--	Well B.
				1,796	Ng	2,446	--	--	Well C.
30	4	02/16/83	09/21/83	3,210	E	2,926	--	--	Wells A and B.
				3,134	E	3,025	--	--	Well C.
				--	E	1,367	--	--	Well D.
		09/21/83	08/27/84	3,112	E	2,686	--	--	Wells A and B.
				--	E	2,580	--	--	Well C.
				--	E	2,795	--	--	Well D.
31	3	03/10/83	09/12/83	1,185	Ng	1,135	--	--	Wells A and B.
				621	E	594	--	--	Well C.
		09/12/83	08/27/84	0	--	--	R	0	Well A.
				439	--	--	--	--	Well B.
				527	E	518	--	--	Well C.
35	1	02/16/83	09/12/83	716	E	893	Inl	822	--
		09/12/83	08/27/84	1,565	E	1,657	Inl	1,579	--
38	1	02/16/83	08/17/83	1,041	Ng	781	--	--	--
		08/17/83	08/02/84	976	--	--	--	--	--
39	1	02/16/83	09/21/83	2,345	E	2,331	--	--	--
		09/21/83	09/06/84	2,229	E	2,552	Inl	2,465	--

Table 4.--Time-of-operation data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date		Vibration time totalizer (total hours)	Energy meter		Other		Remarks
		Begin	End		Type	Time (total hours)	Source	Time (total hours)	
41	2	03/03/83	9/13/83	939	Ng	951	--	--	Well A.
				0	Ng	0	--	--	Well B.
		09/13/83	09/06/84	1,308	--	--	--	--	Well A.
				1,541	--	--	--	--	Well B.
42	1	02/24/83	09/13/83	--	E	586	--	--	--
		09/13/83	09/06/84	--	E	1,920	--	--	--
45	3	03/04/83	09/14/83	745	--	--	Hm	715	Well A.
				710	--	--	--	--	Well B.
				1,608	--	--	Hm	1,144	Well C.
		09/14/83	08/28/84	--	Ng	1,355	--	--	Well A.
				1,028	Ng	1,242	--	--	Well B.
				1,722	Ng	1,668	Hm	1,832	Well C.
48	1	02/15/83	09/14/83	--	--	--	--	--	Crop plowed.
		09/14/83	06/07/84	394	--	--	--	--	--
49	2	03/03/83	09/13/84	664	E	662	--	--	Well A.
				1,507	E	1,497	--	--	Well B.
		09/13/83	08/28/84	1,105	E	1,131	--	--	Well A.
				1,908	E	1,908	--	--	Well B.
50	2	02/16/83	09/12/83	1,017	Ng	1,203	Hm	1,037	Well A.
				433	Ng	892	Hm	1,016	Well B.
		09/12/83	08/27/84	804	Ng	1,475	Hm	1,201	Well A.
				2,060	--	--	Hm	2,377	Well B.
51	4	02/13/83	09/13/83	--	--	--	--	--	Site unused, 1983.
		12/09/83	08/28/84	--	E	2,202	R	2,207	Well A.
					--	--	R	2,207	Well B.
					E	2,353	R	2,207	Well C.
					D	1,918	--	2,207	Well D.
53	2	03/03/83	09/12/83	1,123	E	1,104	--	--	Well A.
				551	E	497	--	--	Well B.
		09/12/83	08/27/84	2,027	E	1,920	--	--	Well A.
				--	E	--	R	1,204	Well B.

Table 4.--Time-of-operation data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date		Vibration time totalizer (total hours)	Energy meter		Other		Remarks
		Begin	End		Type	Time (total hours)	Source	Time (total hours)	
54	2	02/25/83	09/14/83	3,946	Ng	3,961	--	--	Wells A and B.
		09/14/83	09/06/84	4,772	Ng	4,035	--	--	Wells A and B.
55	3	03/01/83	09/12/83	1,012	Ng	771	Hm	765	Well A.
				891	Ng	766	Hm	720	Well B.
				775	Ng	766	Hm	809	Well C.
		09/12/83	09/07/84	1,706	Ng	1,730	Hm	1,496	Well A.
				1,249	Ng	1,695	Hm	1,517	Well B.
				1,544	Ng	1,695	Hm	1,508	Well C.
56	1	03/10/83	09/12/83	--	--	--	--	--	Crop plowed.
		09/12/83	09/06/84	2,641	--	--	Inl	2,540	--
57	1	02/16/83	09/13/83	676	Ng	972	--	--	--
		09/13/83	08/29/84	--	Ng	1,746	--	--	--
59	2	02/24/83	09/21/83	972	E	986	--	--	Well A.
				1,262	E	1,686	--	--	Well B.
		09/21/83	08/28/84	277	E	173	--	--	Well A.
				1,467	E	1,363	--	--	Well B.
60	1	02/16/83	09/21/83	1,055	Ng	2,356	--	--	--
		09/21/83	09/06/84	--	Ng	3,246	--	--	--
64	1	03/10/83	09/12/83	--	--	--	--	--	Crop plowed.
		10/23/83	05/17/84	--	E	630	--	--	--
65	3	02/17/83	09/22/83	--	E	1,559	--	--	Well A.
				--	E	1,279	--	--	Well B.
				2,276	--	--	Inl	1,858	Well C.
		09/22/83	08/28/84	--	E	1,494	--	--	Well A.
				--	--	1,692	--	--	Well B.
				1,879	--	--	--	--	Well C.
66	2	03/03/83	09/13/83	--	Ng	1,692	--	--	Wells A and B.
		09/13/83	09/06/84	2,074	Ng	2,073	--	--	Wells A and B.
69	1	03/04/83	09/12/83	433	Ng	449	Inl	403	32 hours extraneous pumping, 1983.
		09/12/83	09/07/84	1,095	Ng	1,043	Inl	1,036	--

Table 4.--Time-of-operation data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date		Vibration time totalizer (total hours)	Energy meter		Source	Time (total hours)	Remarks
		Begin	End		Type	Time (total hours)			
77	1	02/16/83	09/13/84	1,132	--	--	--	--	--
		09/13/83	08/27/84	1,629	Ng	1,640	--	--	--
78	3	03/08/83	09/14/83	1,200	--	--	--	--	Well A.
				969	--	--	--	--	Well B.
				1,809	--	--	--	--	Well C.
		09/14/83	08/27/84	109	--	--	--	--	Well A.
				1,589	--	--	--	--	Well B.
				1,716	--	--	--	--	Well C.
82	3	02/17/83	09/14/82	666	E	661	Inl	875	Well A.
				955	--	--	--	--	Well B.
				894	--	--	--	--	Well C.
				--	--	--	Inl	875	Wells A, B., a 282 hours ext pumping.
		09/14/83	08/28/84	1,005	E	977	--	--	Well A.
				1,025	--	--	--	--	Well B.
				--	--	--	--	--	Well C.
				--	--	--	Inl	1,065	Wells A, B, a
84	1	03/09/83	09/13/83	--	--	--	Inl	1,226	--
		09/13/83	08/29/84	1,278	--	--	Inl	1,269	--
86	2	03/03/83	09/21/83	--	E	1,284	--	--	Well A.
				--	--	--	R	1,765	Well B.
		09/21/83	08/27/84	--	E	2,053	--	--	Well A.
				--	Ng	2,303	--	--	Well B.
88	2	02/17/83	09/13/83	634	Ng	560	--	--	Well A.
				--	Ng	373	--	--	Well B.
		09/13/83	08/28/84	489	Ng	487	--	--	Well A.
				--	--	--	R	487	Well B.
89	3	03/02/83	09/12/83	592	E	568	--	--	Well A.
				1,719	E	1,698	--	--	Well B.
				--	--	--	R	0	Well C.
		09/12/83	08/27/84	--	E	418	--	--	Well A.
				1,638	E	1,661	--	--	Well B.
				1,325	E	1,713	--	--	Well C.

Table 4.--Time-of-operation data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date		Vibration time totalizer (total hours)	Energy meter		Other		Remarks
		Begin	End		Type	Time (total hours)	Source	Time (total hours)	
95	2	03/09/83	09/22/83	1,817	--	--	R	1,877	Wells A and B.
		09/22/83	08/28/84	1,790	--	--	--	--	Wells A and B.
96	3	02/16/84	08/29/84	1,272	--	--	--	--	Well A.
				1,925	--	--	--	--	Well B.
				1,275	--	--	--	--	Well C.
97	3	12/10/83	08/28/84	1,671	Ng	1,456	--	--	Well A.
				1,491	Ng	2,084	--	--	Well B.
				1,295	Ng	1,326	--	--	Well C.
99	1	02/14/84	08/27/84	--	E	1,367	--	--	--
100	2	02/16/845	10/03/84	363	Ng	770	--	--	--
				1,467	Ng	1,671	--	--	--
102	1	02/15/84	08/29/84	1,167	Ng	1,143	--	--	--
104	1	02/22/84	08/29/84	0	--	--	--	--	Site not used in 1984.
105	2	02/22/84	08/27/84	2,130	--	--	--	--	Well A.
				2,079	--	--	--	--	Well B.
				--	Ng	1,938	--	--	Wells A and B.
107	2	01/04/84	08/06/84	--	E	0	--	--	Site not used in 1984.
108	1	02/15/84	08/28/84	1,528	Ng	1,876	R	882	994 hours extraneous pumping.
109	3	01/04/84	08/27/84	--	E	562	--	--	Well A.
				--	--	752	--	--	Well B.
				--	--	540	Inl	532	Well C.
114	3	02/23/84	09/07/84	1,905	--	--	--	--	Well A.
				1,931	--	--	--	--	Well B.
				--	Ng	1,864	--	--	Wells A and B.
				1,293	Ng	1,598	--	--	Well C; 912 hours extraneous pumping.
115	4	02/15/84	09/06/84	2,246	--	--	--	--	Well A.
				2,077	--	--	--	--	Well B.
				2,362	--	--	--	--	Well C.
				--	--	--	--	--	Well D.
				--	Ng	2,093	--	--	Wells A, B, C, and D; 254 hours extraneous pumping.

Table 4.--Time-of-operation data for irrigation wells in Castro and Parmer Counties--Continued

Site	Number of wells at site	Date		Vibration time totalizer (total hours)	Energy meter		Other		Remarks
		Begin	End		Type	Time (total hours)	Source	Time (total hours)	
116	1	02/15/84	08/28/84	--	Ng	1,924	--	--	--
123	2	11/28/83	08/27/84	--	Ng	3,171	--	--	Wells A and B.

Table 5.--Summary of water applied to crops in Castro and Parmer Counties

Site: Random pick in sequence. See figure 2 for locations.

Number of wells at site: Total number of wells involved at site.

Year: Harvest year of pumping season.

Weighted average discharge per well (gal/min): Total volume production considering number of wells and running time (gallons per minute)

Season well yields determined: P, previous; S, same; F, following.

Site	Number of wells	Year	Weighted average discharge per well (gal/min)	Season of yield measurement	Average pumping hours per well	Total volume pumped (acre-feet)	Crop type	Crop acres	Water application (inches)	Remarks
2	2	1983	391	S	1,019	146.7	corn	62	28.4	--
		1984	391	P	1,382	199	wheat	64	10.4	--
							corn	64	18.4	--
							soybeans	64	8.5	--
3	3	1983	772	S	1,568	668.7	vegtables	246	32.6	In eight crop months.
		1984	733	P	1,514	613.0	vegtables	147	41.1	In 12 crop months.
							wheat	109	12.1	--
6	1	1983	558	S	151	15.5	cotton	13	14.3	--
		1984	558	P	1,562	160.5	corn, cotton	76	18.1	38 acres each crop, cannot separate application.
							wheat	40	13.8	--
9	2	1983	343	S	424	53.5	wheat	85	7.5	--
		1984	343	P	1,508	190.5	wheat	128	8.3	--
							milo	128	9.5	--
10	1	1983	510	S	2,028	190.5	sugar beets	25	53.0	--
							corn	14	68.6	--
		1984	510	P	2,142	201.2	wheat	43	15.5	--
							corn	37	44.0	--
							sunflowers	31	3.9	--
11	1	1983	828	S	839	127.9	corn	32	48.0	--
		1984	828	P	2,385	363.6	wheat	47	18.8	--
							corn	100	34.8	--
13	2	1983	106	S	2,836	110.7	corn	32	20.8	--
							cotton	16	8.3	--
							sugar beets	32	16.6	--
		1984	106	P	4,143	161.7	wheat	48	16.7	--
							corn, sugar beets	64	18.0	Cannot separate application.

Table 5.--Summary of water applied to crops in Castro and Parmer Counties--Continued

Site	Number of wells	Year	Weighted average discharge per well (gal/min)	Season of yield measurement	Average pumping hours per well	Total volume pumped (acre-feet)	Crop type	Crop acres	Water application (inches)	Remarks
14	2	1983	690	S	932	236.9	corn, sugar beets	78	36.5	Cannot separate application.
		1984	688	P	915	231.8	corn	128	21.7	--
15	1	1983	816	S	1,402	210.7	cotton	43	13.8	--
							corn	85	22.7	--
		1984	816	P	815	122.5	cotton	101	6.1	--
							corn	34	25.0	--
19	2	1983	801	S	1,217	359.0	corn	64	67.3	--
		1974	799	P	2,109	620.6	wheat	32	31.8	--
							corn	131	49.1	--
20	3	1983	--	--	--	--	--	--	--	Operator added one more well site, not useful, 1983.
		1984	695	P, S	2,115	812.2	corn	147	49.7	--
							sugar beets	32	38.1	--
							cotton	64	19.0	--
22	2	1983	662	S	714	174.1	corn	64	24.5	--
							cotton	32	16.3	--
		1984	672	P	2,054	508.3	corn	104	46.9	--
							cotton	64	19.1	--
24	5	1983	109	S	1,664	166.2	corn, sugar beets	118	17.0	Cannot separate application.
		1984	109	P	2,406	241.5	corn, sugar beets	118	15.5	--
							wheat	40	26.8	--
26	3	1983	--	--	--	--	--	--	--	Site unused, 1983.
		1984	976	S	976	350.6	corn	160	26.3	Only wells B and C used, 1984.
27	3	1983	616	S	999	340.1	corn	144	28.3	--
		1984	609	P	1,854	624.0	wheat	32	11.5	--
							corn	266	26.8	--

Table 5.--Summary of water applied to crops in Castro and Parmer Counties--Continued

Site	Number of wells	Year	Weighted average discharge per well (gal/min)	Season of yield measurement	Average pumping hours per well	Total volume pumped (acre-feet)	Crop type	Crop acres	Water application (inches)	Remarks
28	1	1983	725	S	1,437	191.8	cotton	32	10.8	--
							corn	32	16.3	--
		1984	725	P	2,407	321.3	wheat	32	18.0	--
							cotton	32	12.6	--
							Corn	51	56.4	--
29	3	1983	596	S	1,359	298.5	corn, soybeans, cotton	251	14.3	Only wells A and C used; cannot separate application.
		1984	599	S, P	1,356	448.5	milo	64	9.3	--
							cotton	77	19.4	--
							corn	83	39.6	--
30	4	1983	147	S	2,561	277.7	wheat	128	7.7	--
							milo	118	19.9	--
		1984	106	P	2,687	209.7	sugar beets, milo	128	14.0	Each crop, 64 acres; cannot separate application.
							wheat	51	14.2	--
31	3	1983	482	S	1,135	100.7	corn	40	30.2	Three separate corn crops and wells, 1983.
			473	--	1,135	98.9	corn	48	24.7	--
			548	--	597	59.9	corn	32	22.5	--
		1984	590	P	439	47.7	milo	88	6.5	Only wells B and C used, 1984.
			574	--	518	54.8	wheat	61	10.8	--
35	1	1983	946	S	822	141.9	corn	67	25.4	--
		1984	895	S	1,657	273.1	corn	109	25.7	--
							cotton	49	9.7	--
38	1	1983	1,109	F	781	159.5	wheat	155	12.4	--
		1984	1,109	S	976	199.3	wheat	155	15.4	--
39	1	1983	557	S	2,331	239.1	cotton	34	12.7	--
							corn	63	38.7	--

Table 5.--Summary of water applied to crops in Castro and Parmer Counties--Continued

Site	Number of wells	Year	Weighted average discharge per well (gal/min)	Season of yield measurement	Average pumping hours per well	Total volume pumped (acre-feet)	Crop type	Crop acres	Water application (inches)	Remarks
41	2	1983	610	S	951	106.8	cotton	48	7.5	Only well A used, 1983.
							corn	32	28.8	--
		1984	591	S, P	1,425	310.1	corn	128	25.9	--
							cotton	80	5.1	--
42	1	1983	879	S	586	94.9	cotton, soybeans	80	14.2	Cannot separate application.
		1984	879	P	1,920	310.8	wheat	48	20.2	--
							corn	80	30.3	--
							sunflowers	48	7.0	--
45	3	1983	689	S	1,238	326.0	corn	136	28.8	--
		1984	667	P	1,422	523.5	corn	208	27.9	--
							wheat	32	14.7	--
48	1	1983	--	--	--	--	--	--	--	Crop plowed, 1983.
		1984	295	S	394	21.4	wheat	48	5.4	--
49	2	1983	1,017	S, F	1,080	404.1	cotton	64	15.2	--
							corn	32	54.5	--
							sugar beets	48	44.4	--
		1984	983	P, S	1,520	550.2	cotton	176	13.8	--
							wheat	55	11.3	--
							corn	138	25.7	--
50	2	1983	633	S	1,027	239.4	cotton	32	24.9	--
							corn	48	43.2	--
		1984	638	P	1,376	323.5	cotton	40	16.8	--
							corn	80	40.1	--
51	4	1983	--	--	--	--	--	--	--	Site unused, 1983.
		1984	122	S	2,207	198.3	wheat	77	10.1	--
							cotton	144	11.1	--
53	2	1983	999	S, F	801	294.5	corn	86	41.1	--
		1984	979	P, S	1,562	563.2	wheat	48	31.6	--
							corn	112	46.7	--

Table 5.--Summary of water applied to crops in Castro and Parmer Counties--Continued

Site	Number of wells	Year	Weighted average discharge per well (gal/min)	Season of yield measurement	Average pumping hours per well	Total volume pumped (acre-feet)	Crop type	Crop acres	Water application (inches)	Remarks
54	2	1983	205	S	3,961	299.0	vegtables	52	24.4	In six crop months.
							corn	51	45.4	--
		1984	205	P	4,035	304.6	milo, cotton, sugar beets	240	10.9	Cannot separate application.
							wheat	86	12.0	--
55	3	1983	287	S	765	121.3	corn	29	14.8	--
							cotton, milo	58	17.7	Cannot separate application.
		1984	296	P, S	1,507	246.7	wheat	64	12.3	--
							cotton, milo	148	6.1	Cannot separate application.
							corn	43	29.4	--
56	1	1983	--	--	--	--	--	--	--	Crop plowed, 1983.
		1984	817	S	2,540	382.3	wheat	64	32.0	--
							corn	64	39.7	--
57	1	1983	973	S	972	174.2	corn	54	38.7	--
		1984	956	P	1,746	307.4	wheat	30	10.1	--
							soybeans	101	11.8	--
							corn	30	30.0	--
59	2	1983	1,072	S	1,686	332.8	corn	128	31.2	Well B; well A not used, 1983.
		1984	1,036	P	768	291.9	wheat	150	10.7	--
							milo	150	12.6	--
60	1	1983	454	S	2,356	197.0	corn, sugar beets	78	30.4	Cannot separate application.
		1984	568	S	3,246	397.5	corn, sugar beets	96	27.5	Cannot separate application.
								80	17.9	--
64	1	1983	--	--	--	--	--	--	--	Crop plowed, 1983.
		1984	565	S	630	65.5	wheat	45	17.5	--

Table 5.--Summary of water applied to crops in Castro and Parmer Counties--Continued

Site	Number of wells	Year	Weighted average discharge per well (gal/min)	Season of yield measurement	Average pumping hours per well	Total volume pumped (acre-feet)	Crop type	Crop acres	Water application (inches)	Remarks
65	3	1983	221	S	1,565	191.0	corn	56	28.7	--
							soybeans	65	10.6	--
		1984	210	P	1,688	195.8	wheat	49	9.5	--
							corn	102	15.6	--
							cotton	59	5.0	--
66	2	1983	503	S	1,692	313.4	corn	144	26.1	--
		1984	503	P	2,073	384.0	wheat	112	19.9	--
							milo	192	12.4	--
69	1	1983	544	F	371	37.1	milo	58	7.7	--
		1984	462	S	1,037	88.2	corn	42	11.6	--
							wheat	52	8.4	--
							milo	32	4.2	--
77	1	1983	1,052	S	1,132	219.3	corn	64	35.7	--
							cotton	32	10.9	--
		1984	802	S	1,640	242.2	cotton	63	12.2	--
							corn	96	22.3	--
78	3	1983	479	S, F	1,326	351.2	corn	64	56.6	--
							cotton	32	7.3	--
							sugar beets	16	22.4	--
		1984	405	S, P	1,138	254.5	cotton, soybeans, sugar beets	234	13.0	Cannot separate application.
82	3	1983	238	S	593	78.0	corn	39	24.0	--
		1984	244	S, P	1,065	143.5	wheat	56	11.1	--
							corn	71	15.5	--
84	1	1983	944	S	1,226	213.1	corn	96	26.6	--
		1984	928	P	1,269	217.1	sugar beets	68	20.3	--
							milo	96	12.8	--

Table 5.--Summary of water applied to crops in Castro and Parmer Counties--Continued

Site	Number of wells	Year	Weighted average discharge per well (gal/min)	Season of yield measure-ment	Average pumping hours per well	Total volume pumped (acre-feet)	Crop type	Crop acres	Water appli-cation (inches)	Remarks
86	2	1983	175	S, F	1,525	98.5	vegtables	32	7.3	In four crop months.
							cotton	19	12.7	--
							milo	32	22.1	--
		1984	192	S, P	2,178	154.3	milo, corn, wheat, sugar beets	115	16.1	Cannot separate application.
88	2	1983	254	S	467	43.7	cotton	80	6.6	--
		1984	305	S	487	54.7	cotton	120	5.5	--
89	3	1983	825	F	568	86.3	soybeans	64	16.2	Well A.
			1,168	S	1,698	365.2	corn	96	45.7	Well B; well C unused, 1983
		1984	825	S	418	63.5	cotton	64	11.9	Well A.
			1,163	S, F	1,588	679.8	wheat	80	15.8	Wells B and C.
							corn, vegtables	226	30.5	Cannot separate application.
95	2	1983	425	S	1,877	293.2	wheat	110	15.4	--
							milo	64	28.5	--
		1984	425	P	1,790	280.2	wheat	62	17.2	--
							milo	64	14.1	--
							sugar beets	64	21.8	--
96	3	1984	495	S	1,491	407.7	corn, vegtables, cotton	352	13.9	Cannot separate application.
97	3	1984	595	S	1,622	533.3	corn, cotton, vegtables	518	12.4	Cannot separate application.
99	1	1984	707	S	1,367	178.0	corn	64	33.4	--
100	2	1984	520	S	1,221	233.8	Alfalfa	155	18.1	--
102	1	1984	650	S	1,143	136.8	corn	128	12.8	--
104	1	1984	--	--	--	--	--	--	--	Site unused, 1984.
105	2	1984	663	S	2,114	515.6	cotton	128	12.1	--
							sugar beets	32	26.3	--
							corn	112	33.9	--

Table 5.--Summary of water applied to crops in Castro and Parmer Counties--Continued

Site	Number of wells	Year	Weighted average discharge per well (gal/min)	Season of yield measurement	Average pumping hours per well	Total volume pumped (acre-feet)	Crop type	Crop acres	Water application (inches)	Remarks
107	2	1984	--	--	--	--	--	--	--	Site unused, 1984.
108	1	1984	661	S	882	107.4	cotton	85	15.2	--
109	3	1984	807	S	657	195.1	corn	128	18.3	Wells A and B.
			462	S	532	45.3	cotton	46	11.8	Well C.
114	3	1984	460	S	1,471	373.8	cotton	96	10.5	--
							milo	32	20.8	--
							corn	77	36.6	--
115	4	1984	715	S	1,839	968.0	corn	352	33.0	--
116	1	1984	690	S	1,924	244.5	corn	121	24.2	--
123	2	1984	663	S	3,171	774.3	wheat	80	16.9	--
							corn	202	37.2	--
							cotton	38	11.2	--