Evaluation of Effects on Rio Grande Streamflows Due to Proposed Transfer of Surface Water Rights in Val Verde, Socorro County, to Ground Water in Rio Rancho, Sandoval County, New Mexico

Declaration Numbers 04246 through 04255 into RG-57125 et. al.

by
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NEW MEXICO STATE ENGINEER OFFICE
HYDROLOGY BUREAU REPORT 97-4

Proposed transfer
Val Verde to Rio Rancho
04246-04255 into RG-57125 et al.
July 16, 1997

SUMMARY

Intel Corporation has applied for a transfer of 2,027.34 acre-feet of surface water rights (Declaration numbers 04246 through 04255 into RG-57125 et. al.) from previously irrigated lands for the purpose of offsetting depletions to the Rio Grande from wells RG-57125 et. al. The move-to wells are located in Rio Rancho, and the move-from lands are located in Val Verde, about 120 miles downstream. In 1994, the State Engineer approved permit RG-57125 el. al. for 3,248.6 ac-ft/yr, with the condition that "any depletion effects to the Rio Grande resulting from this application, which are not offset by return flow credit..., must be offset by retirement of existing water rights on the Rio Grande.." State Engineer's finding 25 in this permit further states that offsets should be made by **cessation** of surface water use **presently occurring** on the Rio Grande.

The purpose of this evaluation is to determine if this proposed transfer:

- would meet the conditions and finding of permit RG-57125;
- would prevent reduction of historical supply to senior water rights between Rio Rancho and Val Verde;
- and, whether it would prevent reduction of the historic flows to Elephant Butte Dam to meet Rio Grande Compact delivery obligations.

The water rights proposed for transfer **are not presently in use**, nor have they been in use since at least 1937. Consequently, granting the proposed transfer would not fulfill Finding 25 of permit RG-57125 et. al. All aerial photographs subsequent to 1937 show that these lands are not farmed. Since the late 1950's, Bureau of Reclamation easements occupy most of these lands that are now used for the new floodway of the Rio Grande, the levee, and the Tiffany Channel.

Granting this application will reduce historical supply to more than 25,000 acres of farmland between Rio Rancho and Val Verde that have earlier priority dates than Val Verde. It was found that the supply of the Rio Grande in the

reach between Rio Rancho and Val Verde is historically short. Evidence from flow duration analysis, MRGCD's requests for supplemental water, and historic supply and demand calculations provide confirmation of these shortages.

Finally, granting the application will reduce historical flow to Elephant Butte which may effect New Mexico's ability to meet Rio Grande Compact obligations. Under the proposed transfer, this water is not replaced at Val Verde. Val Verde lands are in the waterlogged floodplain and streambed of the Rio Grande and can not be "dried up", therefore upstream depletions are not offset.

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INTRODUCTION

On April 5, 1993, Intel Corporation (Intel) applied for a permit to appropriate ground water. On June 10, 1994, the State Engineer granted a conditioned permit to divert 3,248.6 acre-feet per year from 3 wells (RG-57125 et al.). Condition 8 of this permit requires that Intel offset depletion effects to the Rio Grande resulting from this permit. Finding 25 in this permit further states that offsets should be made by **cessation** of surface water use **presently occurring** on the Rio Grande. Under the terms of the permit, part of the depletion effect is offset with return-flow credit. To offset the balance, the applicant in 1996, applied to transfer 2,027.34 acre-feet per year of Val Verde surface water rights from Declaration numbers 04246 through 04255 into RG-57125 et. al. at Rio Rancho. These water rights are from 965.4 acres of previously irrigated lands located about 120 miles south of the reach effected by depletion. The applicant proposes to change the place and purpose of use from irrigation water rights at Val Verde (move-from area) to industrial ground water use in Rio Rancho (move-to). Figure 1 shows the location of the move-from and move-to areas.

State Engineer findings and conditions granting the RG-57125 et. al. permit require the applicant to offset depletion effects (less return flow credit) of about 1,624 acre-feet per year. The applicant has requested a transfer of 2,027 acre-feet per year in anticipation of increasing their water conservation efficiency and consequently reducing their return flows. A reduction in return flows would require the transfer of water rights above 1,624 acre-feet per year.

The purpose of this evaluation is to determine if this proposed transfer:

- would meet the conditions and finding of permit RG-57125;
- would prevent reduction of historical supply to senior water rights between Rio Rancho and Val Verde;
- and, whether it would prevent reduction of the historic flows to Elephant Butte Dam to meet Rio Grande Compact delivery requirements to Texas.

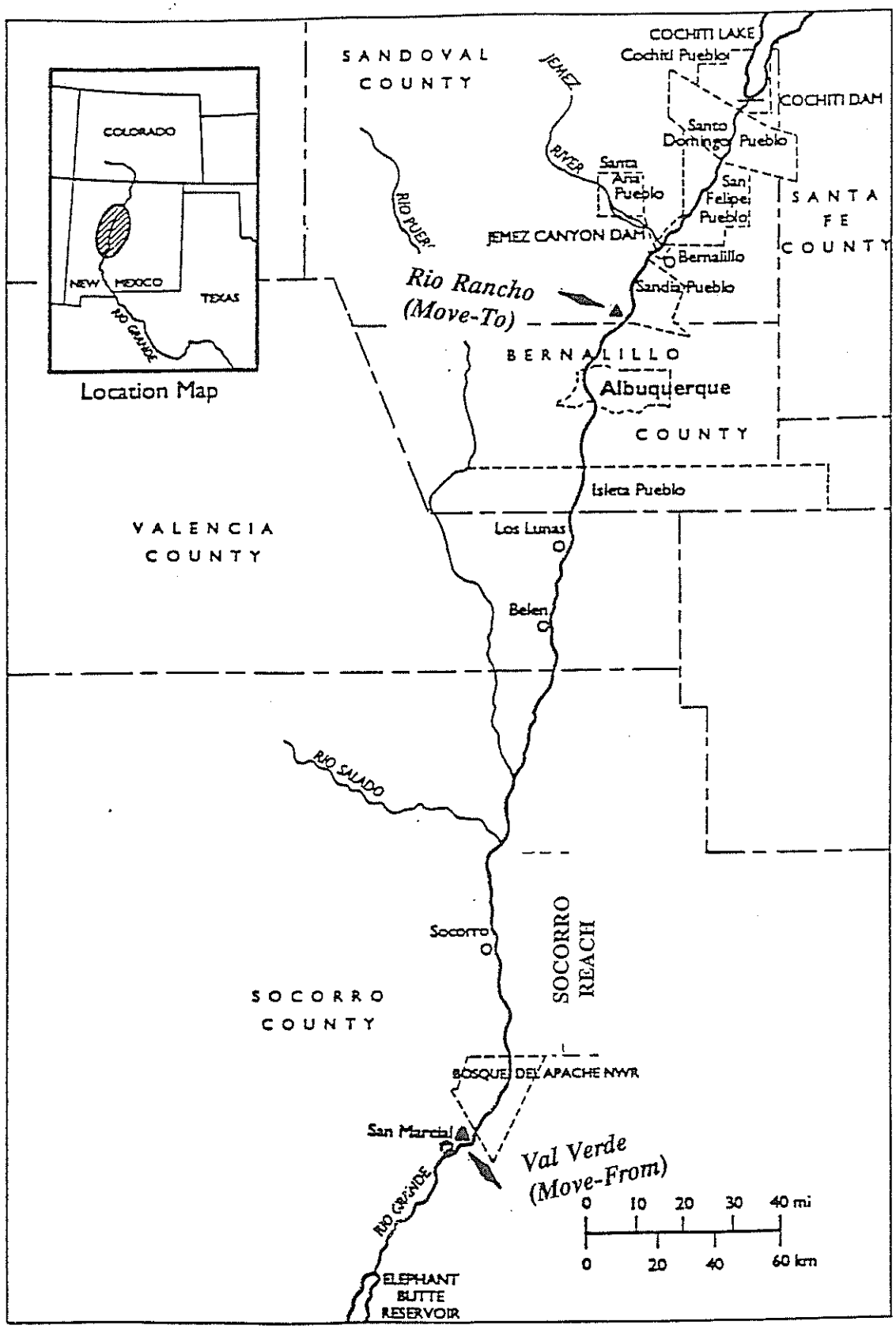


FIGURE 1: Location of proposed water-right transferVal Verde "Move-From" and Rio Rancho "Move-To" areas

ISSUES PERTAINING TO CONDITIONS OF PERMIT RG-57125

Finding 25 of permit RG-57125 requires that water rights used to offset depletion effects are presently in use and the current use ceases

Val Verde ditch was constructed in 1868 (Burkholder, 1928) and was in continuous use until the 1937 flood inundated farmlands, and destroyed ditches and headgates. Presently the Tiffany Channel and levee cross through the lands proposed for transfer, and the Rio Grande was moved by the Bureau of Reclamation from the west side of the valley to the east side effectively inundating the entire eastern portion of these lands. Large stands of salt cedar and other phreatophytes cover about 60% of the land in the floodplain (1992 aerial photo), the other 40% is mostly covered by the streambed of the Rio Grande, the Tiffany Channel, and levee. A field check of the area verified the salt cedar infestation. Salt cedars completely blocked the view within about 30 feet from the levee, thus requiring aerial photographs to evaluate the condition and extent of phreatophyte coverage of the proposed move-from lands.

The water rights proposed for transfer **are not presently in use**, nor have they been in use since at least 1937. Consequently, granting the proposed transfer would not fulfill Finding 25 of permit RG-57125 et. al.

IMPACT TO SURFACE WATER SUPPLY

Available evidence indicates that the surface water supply is periodically insufficient in the Rio Grande upstream of Val Verde and in the Val Verde area. There are three indications of short surface water supplies on the Rio Grande; flow duration curves showing long periods of record at San Marcial, a historical supply and demand analysis of the Socorro reach of the Rio Grande, and recent MRGCD requests for additional San Juan/Chama Project water.

Shortages at Val Verde are inferred from flow duration curves from the San Marcial gage, located about 1 mile downstream of the Val Verde ditch. Historical surface water flows at San Marcial indicate that the surface water

supply was not always adequate throughout the irrigation season at Val Verde (Figures A1 to A8, in Appendix A). These flow duration curves are a graphical presentation of a probability analysis that shows the percent of time actual flows equal or exceed a chosen cumulative flow rate in a given month. To estimate the minimum streamflow rate required at the Val Verde headgate to irrigate 909 acres (acreage from Neel, 1918), a range of values (13 to 40 cfs) is used. This range is based on the Interstate Stream Commission's rule-of-thumb, 1 cfs per 70 acres (13 cfs) and the reported ditch capacity of about 40 cfs (Yeo, 1910). Figure 2 shows the July flow duration curves for the San Marcial gage period of record (1899-1996). These curves indicate flows are historically low in July, the month with the highest water demand. For the years 1899 to 1935 flows were below the minimum required at the headgate at least 25% of the time in July and decreasing to 40% in September (Figure A6). Flow duration curves for the period of record indicate that streamflows in this reach were historically not reliable for irrigation requirements. It is the State Engineer's policy, that in an application to transfer a water right only the quantity of water beneficially used is transferrable. In this area there was less than a full supply therefore less than the full water right was beneficially used.

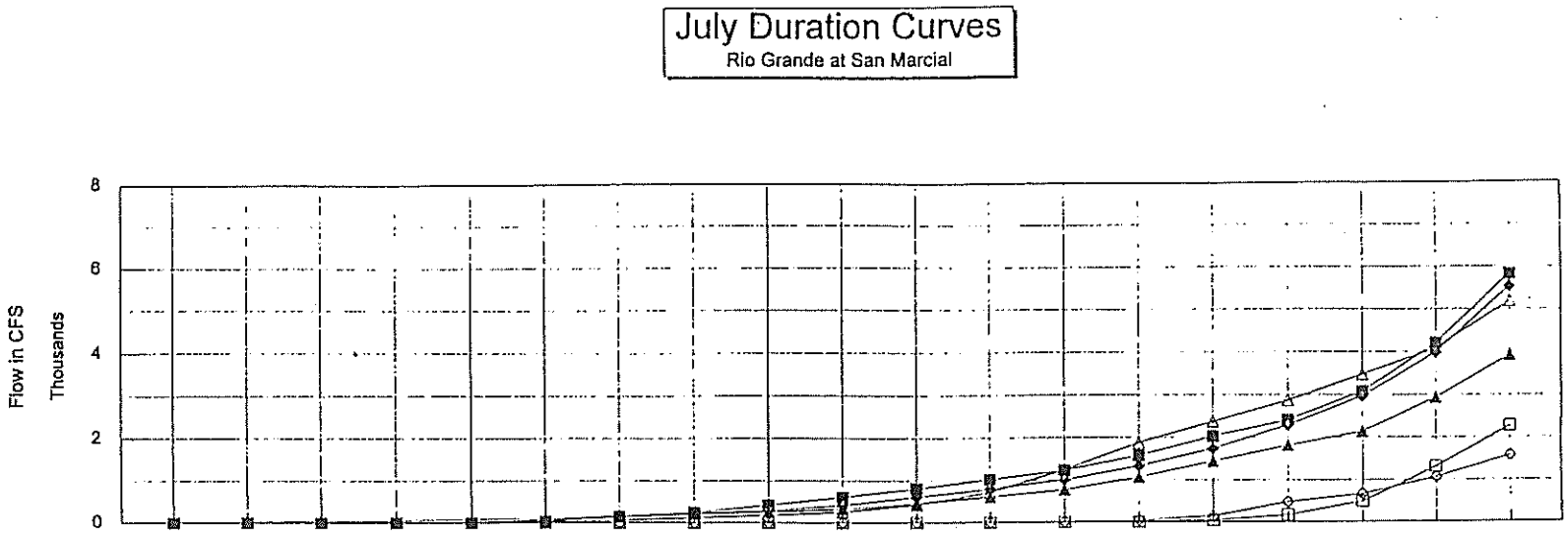
The Socorro reach (Figure 1) is analyzed to determine if supplies are historically short above Val Verde. If shortages occurred on the Socorro reach then supplies were likely to be short in Val Verde. This analysis suggests the magnitude of historic shortages in surface water supply, even though Val Verde ditch was not served by MRGCD. Irrigation demands and crop irrigation requirements for 1935 were selected for the baseline year for these calculations because in 1935 Val Verde was under irrigation, MRGCD's conveyance channels were not fully developed, and this was before imported water was introduced into native streamflows. Calculations were performed to show the estimated surface water supply and demand for the years 1936 to 1970 and compared to the base year 1935. These calculations show that estimated surface water supplies during the total irrigation season are 70% of demand from 1936 to 1970 (Table B1 in Appendix B). These calculations also indicate that for this historic period, shortfalls in July, the peak irrigation demand during the growing season, are as much as 50% below required supply. An explanation of calculation methods is in

Appendix B. Shortages in the Socorro reach indicate that additional diversions upstream will impact the MRGCD.

At the present, even after the introduction of imported San Juan/Chama Project water, there appear to be shortages of surface water supply. Flow durations curves for San Marcial (Figure 2) for the period from 1976 to 1996 show average July flows dropped below 13 cfs (the minimum estimated diversion requirement at Val Verde ditch) 30% of the time. In addition, MRGCD has had to supplement short supplies with Albuquerque's imported water to meet their delivery obligations to irrigators during years of low flows. This, in spite of the fact that the MRGCD has more than 20,000 acre-feet per year of its own San Juan/Chama Project water. These supplemental transfers began in 1973 and by 1986, after several wet years and partial paybacks, the MRGCD still owed Albuquerque about 58,019 acre-feet of water. Correspondence between the MRGCD, Albuquerque, and the U.S. Bureau of Reclamation documenting several supplemental transfers are in Appendix C.

Any short supplies in the MRGCD irrigation system are spread among all users. The consequence of pumping RG-57125 without offsetting depletions of 2,027 acre-feet will result in further reduction of surface water supply and increased shortages to irrigators below the point of depletion.

Since this proposed transfer may impact senior water users upstream of Val Verde, we next consider the relative priority of their water right. The Val Verde ditch standing in the priority system is shown in a survey conducted in 1894 by W.W. Follett (reported in Yeo, 1910, and Burkholder, 1928). Follett's survey shows that 25,179 irrigated acres between Corrales and Val Verde have earlier priority dates than the Val Verde ditch users. Table 1, based on Follett's survey shows ditch ages, number of ditches in that age group, and irrigated acreage associated with that ditch from Corrales to Contidero (near San Marcial). Therefore, it appears that this transfer will impact water availability to senior upstream water users.



Percent of Time Value Equalled or Exceeded	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
■ 1899-1915	0.94	1.88	2.82	3.77	4.71	35.6	152.9	246.4	423.1	608.1	815.1	1023.1	1229.3	1572.3	2024.1	2412.7	3090	4211	5836.1
◆ 1916-1935	0	0	0	0	0	78.4	136.3	210.7	292.9	410.9	603.4	793.5	1008.7	1328.7	1739.7	2287.6	2973.2	3998.7	5545
▲ 1936-1949	0.8	17.6	30.1	46.9	74.9	106.5	160.8	211.1	262.8	322.9	454.3	599.2	772.9	1066.4	1435.2	1811.3	2143.2	2946.4	3933.9
⊡ 1950-1964	0	0	0	0	0	0	0	0	0	0	0	0	0	7.53	36.1	166.3	480.1	1318.5	2278.5
◇ 1965-1975	0	0	0	0	0	0	0	0	0	0	0	0.55	2.5	41.7	139.4	476.1	665.6	1067.4	1578.3
△ 1976-1996	0	0	0	0	0.08	11.9	52.2	112.9	171.9	248.5	425	715.3	1248.7	1879.7	2375	2869.7	3481.1	4092.5	5193.1

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FIGURE 2: **July Duration Curves for San Marcial Gage from 1899 to 1996 (highest monthly Consumptive irrigation requirement)**

TABLE 1: Ditches and irrigated acres with earlier priority dates than Val Verde

DITCH AGE	NUMBER OF DITCHES	IRRIGATED ACRES	SOURCE
Pueblo, very old (pre 1700)	3	1,340	Follett, 1896
Very old (pre 1800)	1	600	Follett, 1896
Old (early 1800)	23	11,780	Follett, 1896
1706	2	680	Follett, 1896
Before 1800	12	6,520	Follett, 1896
Before 1850	5	2,709	Follett, 1896
1855	3	1,050	Follett, 1896
1863	1	200	Follett, 1896
1868	1	300	Follett, 1896
TOTAL:	51	25,179	
Val Verde Ditch Before 1869 (interpreted to mean December 31, 1868, SEO Legal)	1	200	Follett, 1896

The last point of this discussion is the effect of this application on interstate compact obligations. Under the terms of the Rio Grande Compact, New Mexico is obligated to deliver a scheduled quantity of water to Elephant Butte Dam based on the amount of Rio Grande water passing Otowi gage. New Mexico's scheduled delivery may be effected if new depletions are not offset. Retiring water rights at Val Verde will not replace surface water depletions due to RG-57125 et al.

CONCLUSIONS

The purpose of this evaluation was to determine if this proposed transfer:

- would meet the conditions and finding of permit RG-57125 that specify that a water right transfer to offset depletion effects of RG-57125 et. al. should be made by cessation of surface water use presently occurring on the Rio Grande;

  NO: The water rights proposed for transfer **are not presently in use**, nor have they been in use since at least 1937. Consequently, granting the proposed transfer would not fulfill Finding 25 of permit RG-57125 et. al. All aerial photographs subsequent to 1937 show that these lands are not farmed. Most of these lands proposed for transfer are within Bureau of Reclamation easements . Since 1958, these lands are used for the new course of the Rio Grande, the levee, and the Tiffany Channel.

- would prevent reduction of historical supply to senior water rights between Rio Rancho and Val Verde;

  NO: Granting this application will reduce historical supply to more than 25,000 acres of farmland between Rio Rancho and Val Verde that have earlier priority dates than Val Verde. Furthermore, it was found that the supply of the Rio Grande in the reach between Rio Rancho and Val Verde is historically short. Evidence from flow duration analysis, and the MRGCD's requests for supplemental water provide confirmation of these shortages. Historic supply and demand calculations show that surface water supplies are as much as, 50 percent short during the peak of the irrigation season.

- and, whether it would prevent reduction of the historic flows to Elephant Butte Dam to meet Rio Grande Compact delivery requirements to Texas.

  NO: Granting this application will result in a reduction of historic flows

to Elephant Butte. Reduced flows may effect New Mexico's ability to meet compact obligations. This water is not replaced at Val Verde because the lands can not be dried up.

The purpose of a water right transfer is to allow changes in the place and purpose of water use while protecting the river from increased depletions, thereby protecting the interest of historical surface water users and Rio Grande Compact obligations. To prevent new depletions on the river, lands associated with a water right transfer are "dried up" at one site (move-from site) so that water can be used at another site (move-to site) without increasing depletions on the river. Val Verde lands are in the waterlogged floodplain and streambed of the Rio Grande and can not be "dried up", therefore upstream depletions are not offset. Transferring water rights from Val Verde lands to Rio Rancho will result in a net loss to the river.

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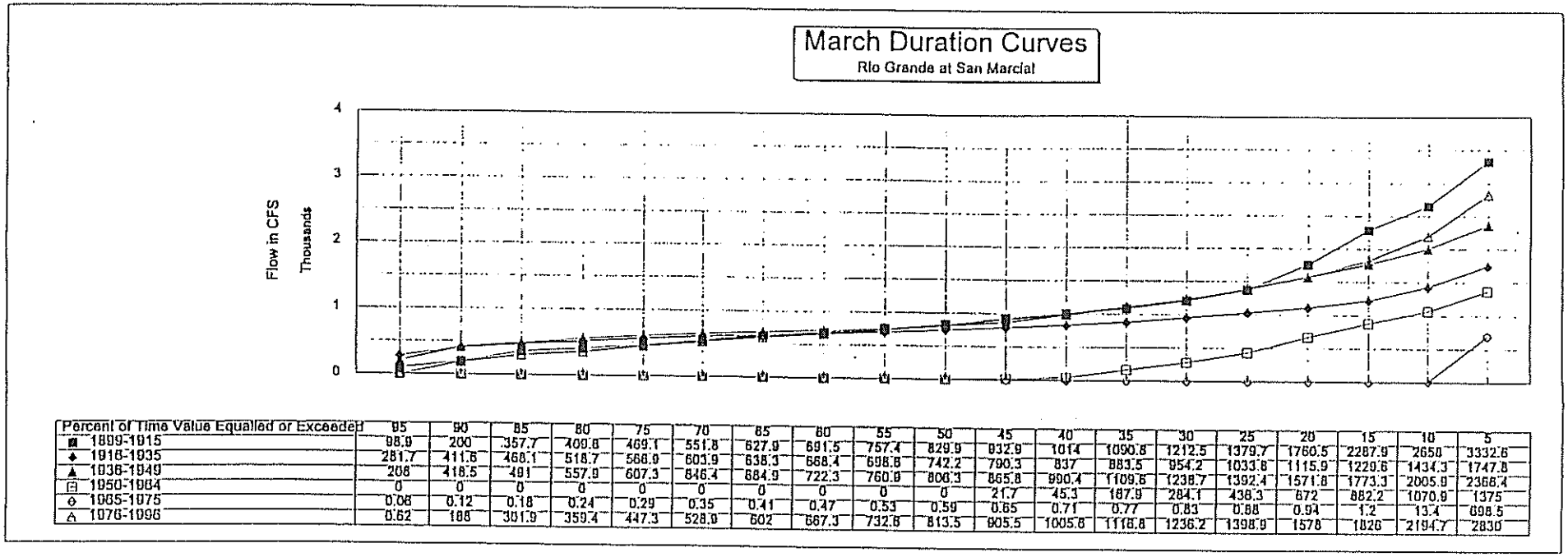
APPENDIX A

Flow Duration Curves
Rio Grande at San Marcial
March through October
1899 to 1996



Percent of Time Value Equalled or Exceeded	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1909-1915	98.9	200	357.7	409.8	469.1	551.8	627.9	691.5	757.4	829.9	932.9	1014	1090.8	1212.5	1379.7	1760.5	2287.9	2650	3332.6
1916-1935	281.7	411.6	468.1	518.7	566.9	603.9	638.3	668.4	698.8	742.2	790.3	837	883.5	954.2	1033.8	1115.9	1229.6	1434.3	1747.8
1936-1949	208	418.5	491	557.9	607.3	646.4	684.9	722.3	760.9	806.3	865.8	990.4	1109.6	1238.7	1392.4	1571.8	1773.3	2005.9	2368.4
1950-1964	0	0	0	0	0	0	0	0	0	0	21.7	45.3	187.9	284.1	436.3	872	882.2	1070.9	1375
1965-1975	0.06	0.12	0.18	0.24	0.29	0.35	0.41	0.47	0.53	0.59	0.65	0.71	0.77	0.83	0.88	0.94	1.2	13.4	698.5
1976-1996	0.62	188	381.9	359.4	447.3	528.9	602	667.3	732.8	813.5	905.5	1005.8	1116.8	1236.2	1398.9	1578	1826	2194.7	2830

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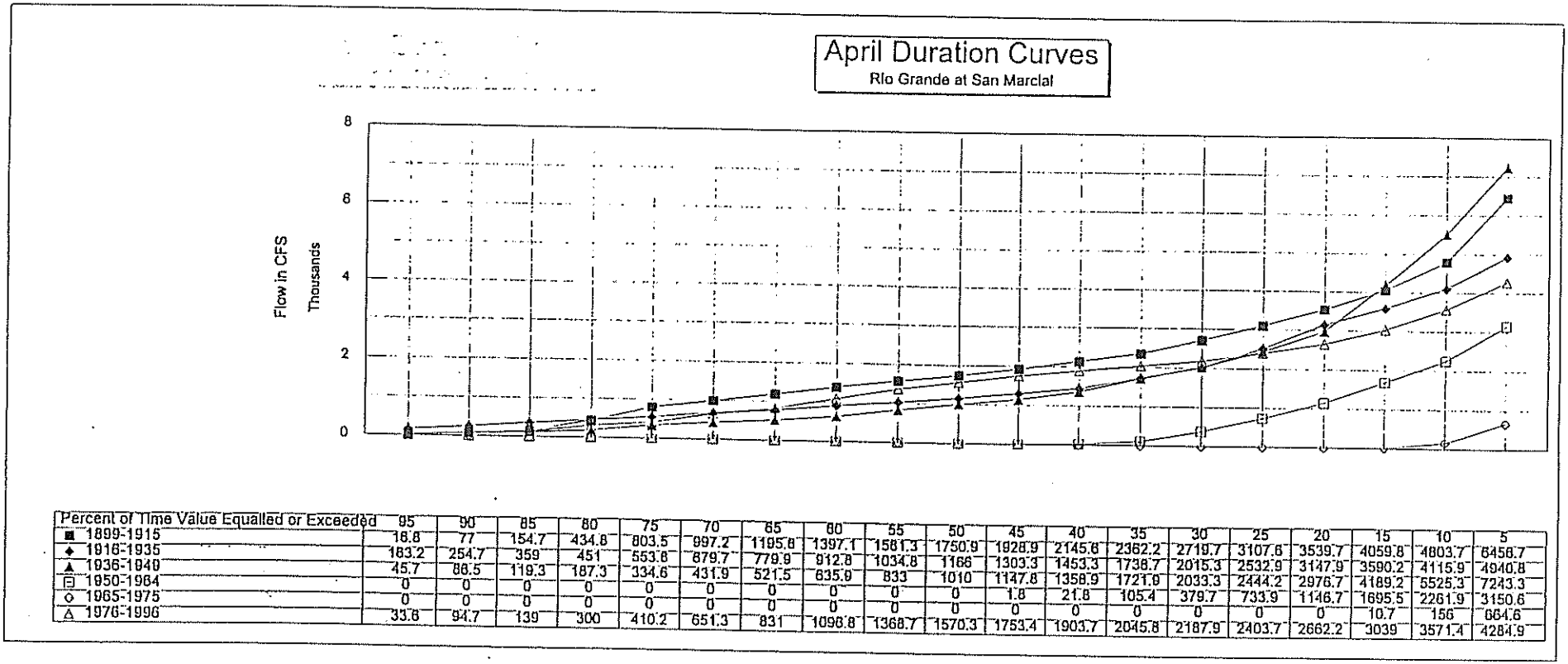
FIGURE A1: March Duration Curves for Rio Grande at San Marcial



Percent of Time Value Equalled or Exceeded	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1899-1915	16.8	77	154.7	434.8	803.5	997.2	1195.8	1397.1	1581.3	1750.9	1928.9	2145.6	2362.2	2719.7	3107.6	3539.7	4059.8	4803.7	6456.7
1916-1935	183.2	254.7	359	451	553.8	879.7	779.9	912.8	1034.8	1166	1303.3	1453.3	1738.7	2015.3	2532.9	3147.9	3590.2	4115.9	4940.8
1936-1949	45.7	86.5	119.3	187.3	334.6	431.9	521.5	635.9	833	1010	1147.8	1358.9	1721.9	2033.3	2444.2	2976.7	4189.2	5525.3	7243.3
1950-1964	0	0	0	0	0	0	0	0	0	0	1.8	21.8	105.4	379.7	733.9	1146.7	1695.5	2261.9	3150.6
1965-1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10.7	156	664.6
1976-1996	33.6	94.7	139	300	410.2	651.3	831	1096.8	1368.7	1570.3	1753.4	1903.7	2045.8	2187.9	2403.7	2662.2	3039	3571.4	4284.9

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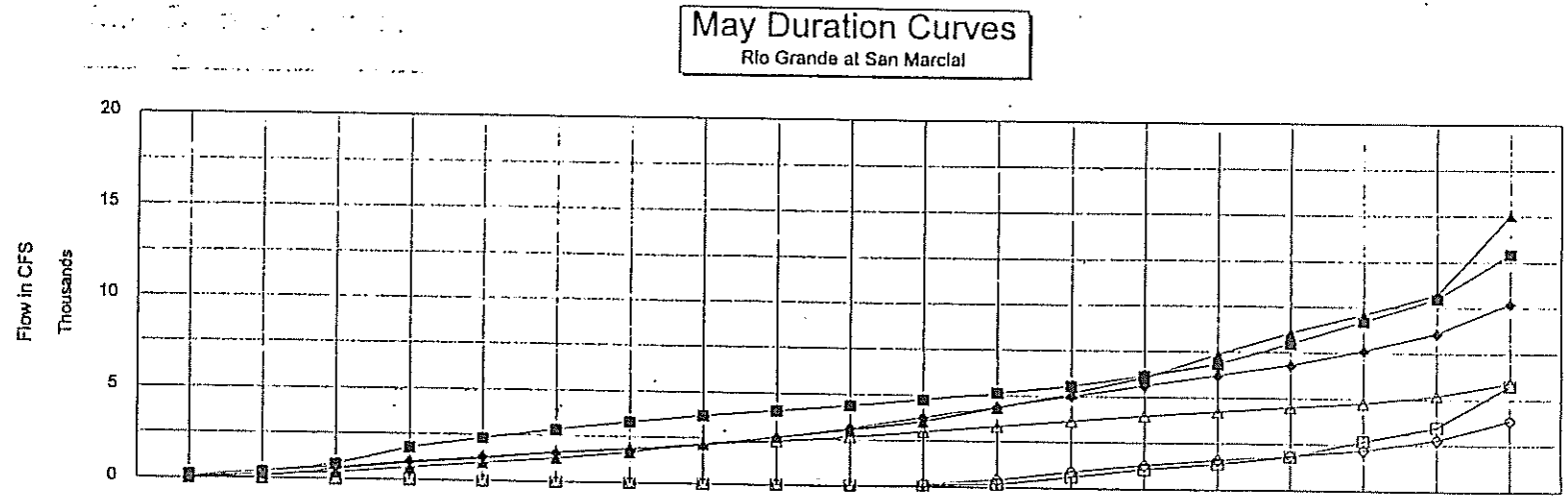
FIGURE A2: April Duration Curves for Rio Grande at San Marcial



Percent of Time Value Equalled or Exceeded	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1899-1915	223.6	381	838.5	1769.8	2315	2839.1	3317.3	3714.5	4058.3	4366.8	4763	5168	5569	6186.8	6843	7996.9	9214.8	10480.5	12964.4
1916-1935	131.3	400.5	667.7	1023.3	1324.4	1585	1817.5	2083.3	2574.2	3184.1	3779.9	4404.4	5029.6	5646.2	6240.8	6835.4	7650	8580	10243.2
1936-1949	88.1	227.8	363.8	674.2	972.9	1280.2	1653.6	2201.1	2804.1	3067.9	3553.3	4351.8	5201.3	6081.3	7393.1	8571	9599.7	10704.2	15082.5
1950-1964	0	0	0	0	0	0	0	0	11	55	100.7	172.9	619.8	1078	1401	1818	2694.2	3485	5803
1965-1975	0.19	0.39	0.58	0.78	0.97	1.17	1.36	1.56	1.75	1.95	169.7	433.8	908	1309.7	1608.1	1869.7	2187.6	2791.6	3880.4
1976-1996	17	71.5	563	928.5	1208	1610.2	1895.5	2135	2374.5	2684.5	2999.2	3333.9	3672.5	3982.4	4247.1	4511.7	4776.3	5222.5	5920

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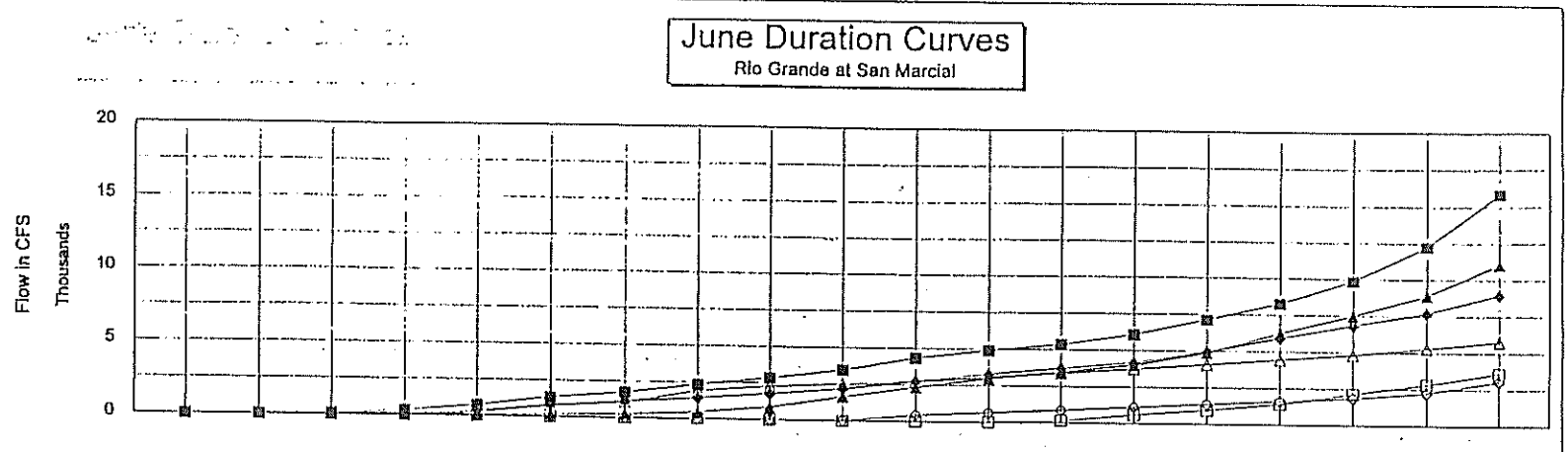
FIGURE A3: May Duration Curves for Rio Grande at San Marcial



Percent of Time Value Equalled or Exceeded	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1899-1915	0.51	19	98.5	325.3	757.7	1347.7	1787.2	2348	2855.8	3462.1	4352.5	4923.3	5382.7	6098	7138.7	8301.5	9860.9	12264.7	15900
1916-1935	0	0	9.55	148	396.9	802.8	1155.4	1423	1773	2188.7	2788.7	3283.9	3733.4	4172.8	4985.4	5933.8	6827.8	7713.3	8985
1936-1949	0	3.8	25	50.8	94.7	165.5	263.1	469.3	883.7	1660	2382.4	2999.7	3497.9	3989.2	4879.2	6265.2	7500.2	8911.8	11073.5
1950-1964	0	0	0	0	0	0	0	0	0	0	1.9	15.2	151.6	614.3	965.1	1433.3	2160.7	2846.2	3635.6
1965-1975	0.11	0.22	0.33	0.45	0.58	0.67	0.78	0.89	1	30	458	670.2	885.5	1134.2	1376.9	1619	1863.9	2287.8	3105
1976-1996	0.28	0.56	0.84	5.4	260	767.5	1094.8	1910	2296.6	2524.1	2751.7	3058	3398	3741.5	4098.9	4458.4	4822.2	5305.6	5788.9

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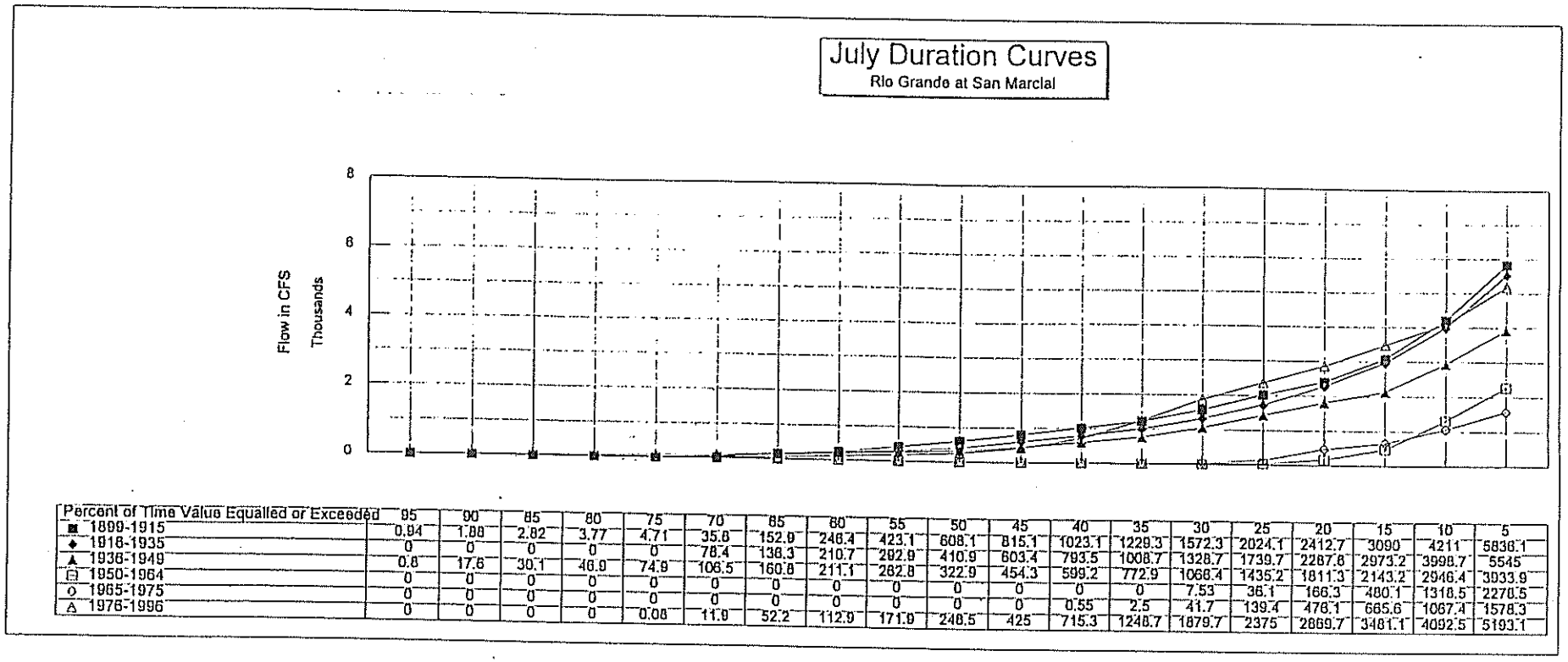
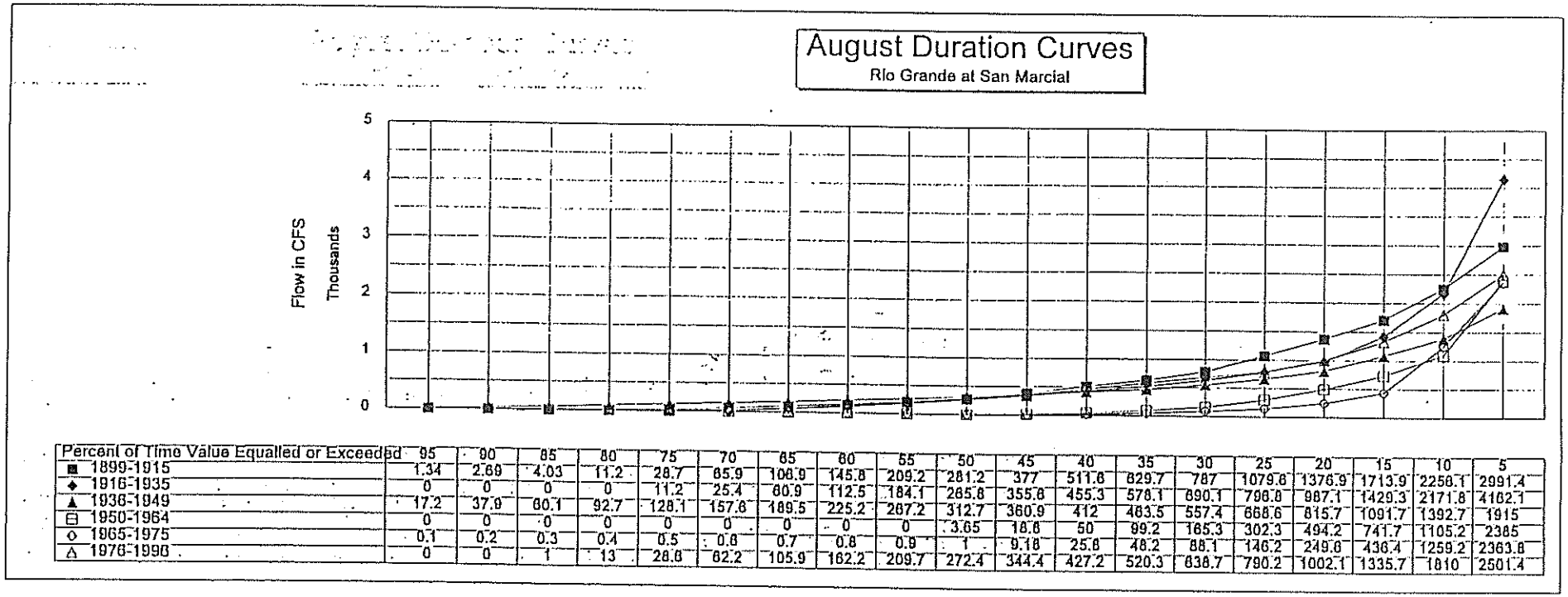
FIGURE A4: June Duration Curves for Rio Grande at San Marcial



Percent of Time Value Equalled or Exceeded	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1899-1915	0.94	1.88	2.82	3.77	4.71	35.8	152.9	246.4	423.1	608.1	815.1	1023.1	1229.3	1572.3	2024.1	2412.7	3090	4211	5838.1
1916-1935	0	0	0	0	0	78.4	136.3	210.7	282.9	410.9	603.4	793.5	1008.7	1328.7	1739.7	2287.8	2973.2	3998.7	5545
1936-1949	0.8	17.6	30.1	46.9	74.9	106.5	160.8	211.1	282.8	322.9	454.3	599.2	772.9	1068.4	1435.2	1811.3	2143.2	2946.4	3933.9
1950-1964	0	0	0	0	0	0	0	0	0	0	0	0	0	7.53	36.1	166.3	480.1	1318.5	2278.5
1965-1975	0	0	0	0	0	0	0	0	0	0	0	0.55	2.5	41.7	139.4	476.1	665.6	1067.4	1578.3
1976-1996	0	0	0	0	0.08	11.9	52.2	112.9	171.9	248.5	425	715.3	1248.7	1879.7	2375	2869.7	3481.1	4092.5	5193.1

sm-durat.wk4

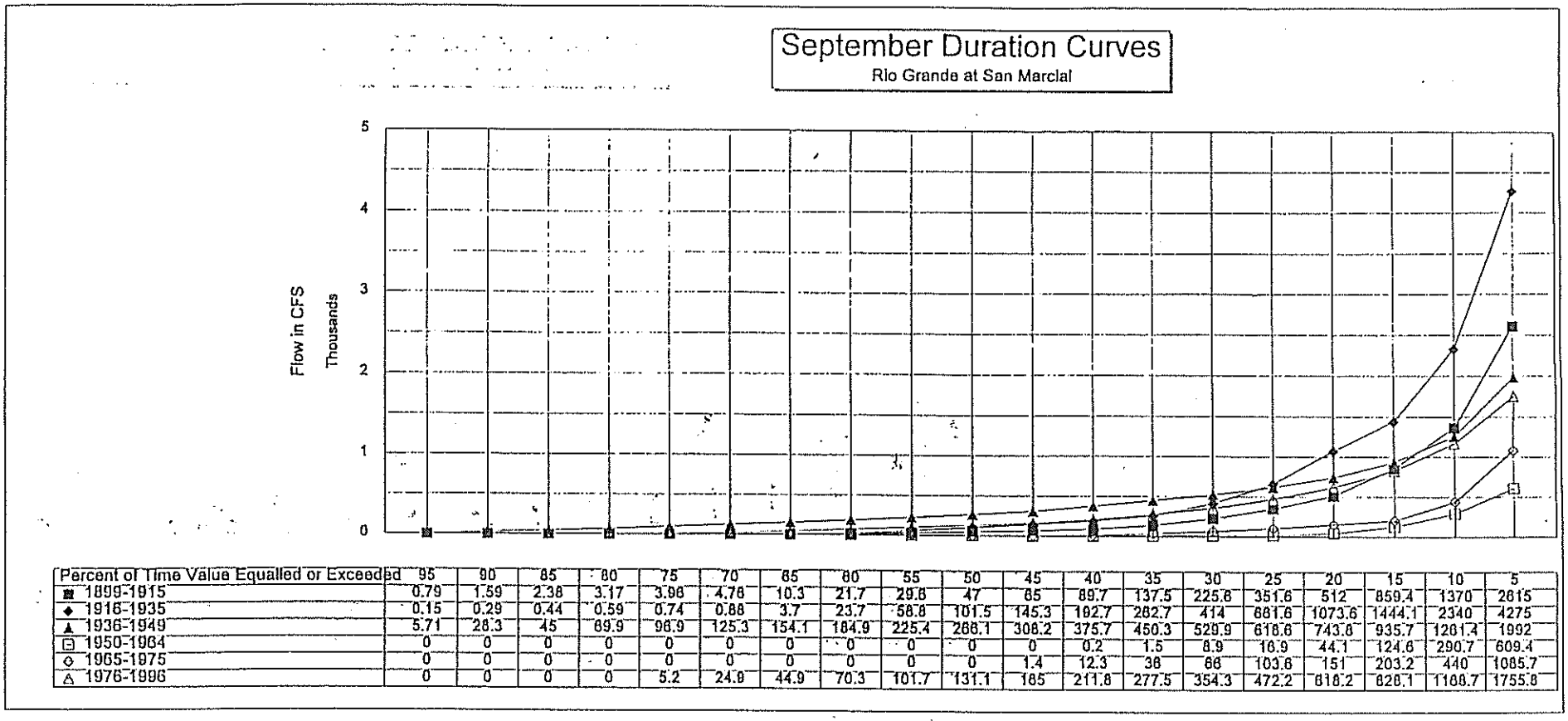
FIGURE A5: July Duration Curves for Rio Grande at San Marcial



Percent of Time Value Equalled or Exceeded	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1899-1915	1.34	2.69	4.03	11.2	28.7	65.9	108.9	145.8	209.2	281.2	377	511.6	629.7	787	1079.6	1376.9	1713.9	2258.1	2991.4
1916-1935	0	0	0	0	11.2	25.4	60.9	112.5	184.1	265.8	355.6	455.3	578.1	690.1	796.8	987.1	1429.3	2171.8	4162.1
1936-1949	17.2	37.9	60.1	92.7	128.1	157.6	189.5	225.2	267.2	312.7	360.9	412	463.5	557.4	668.6	815.7	1091.7	1392.7	1915
1950-1964	0	0	0	0	0	0	0	0	0	3.65	18.8	50	99.2	165.3	302.3	494.2	741.7	1105.2	2385
1965-1975	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	9.18	25.6	48.2	88.1	146.2	249.6	436.4	1259.2	2363.6
1976-1998	0	0	1	13	28.8	62.2	105.9	162.2	209.7	272.4	344.4	427.2	520.3	638.7	790.2	1002.1	1335.7	1810	2501.4

sm-durat.wk4

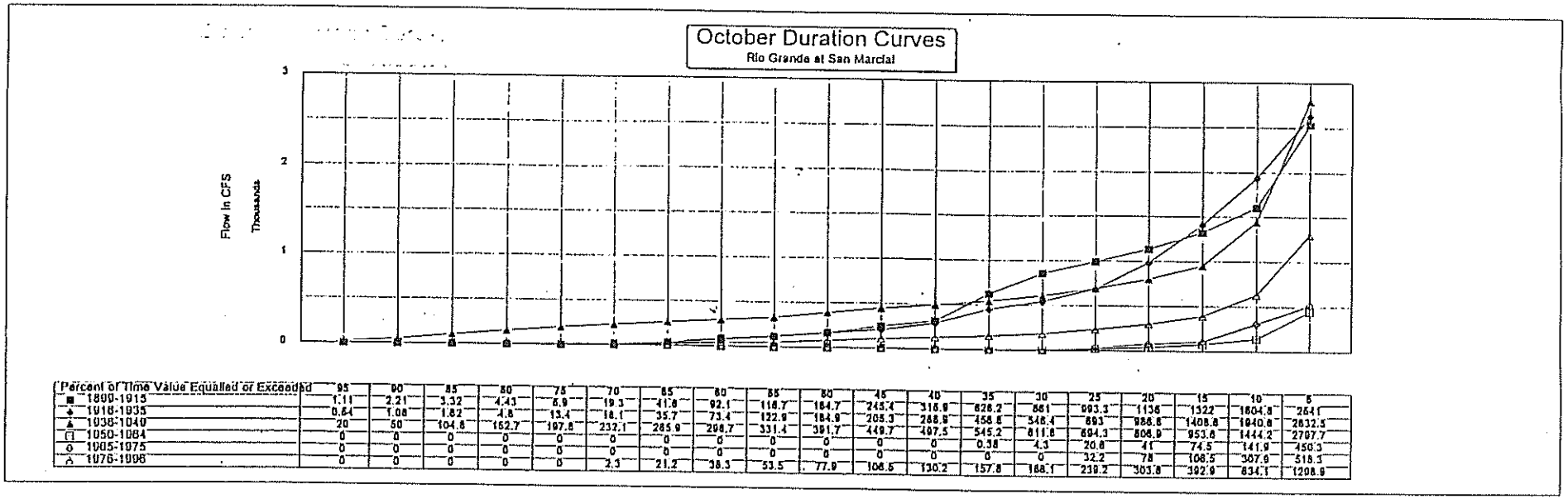
FIGURE A6: August Duration Curves for Rio Grande at San Marcial



Percent of Time Value Equalled or Exceeded	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1899-1915	0.79	1.59	2.38	3.17	3.96	4.76	10.3	21.7	29.8	47	85	89.7	137.5	225.8	351.6	512	859.4	1370	2615
1916-1935	0.15	0.29	0.44	0.59	0.74	0.88	3.7	23.7	58.8	101.5	145.3	192.7	262.7	414	681.6	1073.6	1444.1	2340	4275
1936-1949	5.71	28.3	45	69.9	98.9	125.3	154.1	184.9	225.4	268.1	308.2	375.7	450.3	529.9	618.6	743.8	935.7	1261.4	1992
1950-1964	0	0	0	0	0	0	0	0	0	0	0	0.2	1.5	8.9	16.9	44.1	124.6	290.7	609.4
1965-1975	0	0	0	0	0	0	0	0	0	0	1.4	12.3	38	86	103.6	151	203.2	440	1085.7
1976-1996	0	0	0	0	5.2	24.9	44.9	70.3	101.7	131.1	185	211.8	277.5	354.3	472.2	618.2	828.1	1168.7	1755.8

sm-durat.wk4

FIGURE A7: September Duration Curves for Rio Grande at San Marcial



Percent of Time Value Equalled or Exceeded	95	90	85	80	75	70	65	60	55	50	45	40	35	30	25	20	15	10	5
1890-1915	1.11	2.21	3.32	4.43	5.9	19.3	41.8	92.1	116.7	164.7	245.4	316.9	626.2	861	993.3	1136	1322	1604.8	2641
1916-1935	0.64	1.08	1.82	4.8	13.4	18.1	35.7	73.4	122.9	184.9	205.3	268.9	458.6	548.4	693	986.6	1408.8	1940.8	2632.5
1936-1949	20	50	104.8	152.7	197.8	232.1	285.9	298.7	331.4	391.7	449.7	497.5	545.2	811.8	894.3	806.9	953.6	1444.2	2707.7
1950-1964	0	0	0	0	0	0	0	0	0	0	0	0	0.38	4.3	20.8	41	74.5	141.9	450.3
1965-1975	0	0	0	0	0	0	0	0	0	0	0	0	0	0	32.2	78	108.5	307.9	518.3
1976-1996	0	0	0	0	0	2.3	21.2	38.3	53.5	77.9	108.5	130.2	157.8	188.1	239.2	303.8	392.9	834.1	1208.9

sm-durat.wk4

FIGURE A8: October Duration Curves for Rio Grande at San Marcial

Proposed transfer
Val Verde to Rio Rancho
04246-04255 into RG-57125 et al.
July 16, 1997

APPENDIX B

Surface Water Supply and Demand Calculations
and
Consumptive Irrigation Requirements
for
Socorro Reach and Val Verde

TABLE B1: **SOCORRO REACH - MONTHLY HISTORICAL SUPPLY AND DEMAND CALCULATIONS - (supply year 1935)**

CIR calculations in Tables B2 and B3

06/24/97

LATITUDE 341517 USGS STATION NUMBER 08354500 SOCORRO MAIN CANAL NORTH AT SAN ACACIA, NM
LONGITUDE 1065343
DATUM 4660.16

MONTHLY TOTALS IN ACRE FEET

	MARCH	Avg. Demand	Short	APRIL	Avg. Demand	Short	MAY	Avg. Demand	Short	JUNE	Avg. Demand	Short	JULY	Avg. Demand	Short	AUGUST	Avg. Demand	Short	SEPT.	Avg. Demand	Short	OCT.	Avg. Demand	Short	ANNUAL DEMAND	TOTAL ANNUAL SHORTAGE
1936	—	1256	0	3530	4108	578	8200	7016	0	8420	11238	2818	5320	13464	8144	8710	11780	3070	5450	7558	2108	5210	3880	0	60472	16718
1937	2150	1256	0	5200	4108	0	7680	7016	0	6410	11238	4828	9070	13464	4394	11340	11780	440	9100	7558	0	1800	3880	2080	60472	11742
1938	6100	1256	0	7690	4108	0	9220	7016	0	8190	11238	3048	6840	13464	6624	12260	11780	0	5090	7558	2468	5150	3880	0	60472	12140
1939	2870	1256	0	6850	4108	0	10180	7016	0	7580	11238	3658	6690	13464	6774	6350	11780	5430	3940	7558	3618	3940	3880	0	60472	19480
1940	3620	1256	0	7330	4108	0	7630	7016	0	7240	11238	3998	6700	13464	6764	7330	11780	4450	7370	7558	188	7870	3880	0	60472	15400
1941	3680	1256	0	7360	4108	0	2820	7016	4196	7820	11238	3418	8480	13464	4984	7860	11780	3920	5730	7558	1828	3890	3880	0	60472	18346
1942	6710	1256	0	6380	4108	0	6910	7016	106	7930	11238	3308	10220	13464	3244	9770	11780	2010	8300	7558	0	8600	3880	0	60472	8668
1943	8500	1256	0	10020	4108	0	11030	7016	0	10700	11238	538	10120	13464	3344	8850	11780	2930	9290	7558	0	8880	3880	0	60472	6812
1944	7030	1256	0	8990	4108	0	9350	7016	0	8640	11238	2598	8970	13464	4494	7430	11780	4350	8330	7558	0	7220	3880	0	60472	11442
1945	6920	1256	0	9520	4108	0	8410	7016	0	8730	11238	2508	10080	13464	3384	9380	11780	2400	8320	7558	0	8670	3880	0	60472	8292
1946	6420	1256	0	8110	4108	0	6280	7016	736	3640	11238	7598	5320	13464	8144	6670	11780	5110	4460	7558	3098	4920	3880	0	60472	24686
1947	8200	1256	0	8780	4108	0	8000	7016	0	8420	11238	2818	8120	13464	5344	4570	11780	7210	6100	7558	1458	4960	3880	0	60472	16830
1948	3250	1256	0	6080	4108	0	6680	7016	336	6560	11238	4678	8210	13464	5254	5660	11780	6100	3990	7558	3568	5850	3880	0	60472	19936
1949	5820	1256	0	7050	4108	0	7650	7016	0	8280	11238	2958	7400	13464	6064	8400	11780	3380	5330	7558	2228	5280	3880	0	60472	14630
1950	5310	1256	0	8140	4108	0	5040	7016	1976	4950	11238	6288	5360	13464	8104	3960	11780	7820	2950	7558	4608	2840	3880	1040	60472	29836
1951	5840	1256	0	4670	4108	0	4540	7016	2476	3600	11238	7638	2230	13464	11234	4330	11780	7450	1060	7558	6498	0	3880	3880	60472	39176
1952	4850	1256	0	6910	4108	0	7550	7016	0	8030	11238	5208	8820	13464	4644	8020	11780	3760	5010	7558	2548	3670	3880	210	60472	16370
1953	4520	1256	0	7750	4108	0	7640	7016	0	8090	11238	3148	4790	13464	8674	4020	11780	7760	655	7558	6903	311	3880	3569	60472	30054
1954	5660	1256	0	7410	4108	0	8900	7016	0	4140	11238	7098	2870	13464	10594	4400	11780	7380	1400	7558	6158	2210	3880	1670	60472	32900
1955	5800	1256	0	5150	4108	0	5530	7016	1486	5610	11238	5628	2990	13464	10474	5720	11780	6060	5230	7558	2328	5120	3880	0	60472	25976
1956	6660	1256	0	10860	4108	0	8120	7016	0	4800	11238	6438	579	13464	12885	2090	11780	9690	0	7558	7558	11	3880	3869	60472	40440
1957	6300	1256	0	7720	4108	0	9040	7016	0	9300	11238	1938	7790	13464	5674	7690	11780	4090	7010	7558	548	5250	3880	0	60472	12250
1958	6110	1256	0	8070	4108	0	7220	7016	0	10500	11238	738	6790	13464	6674	6470	11780	5310	4160	7558	3398	4610	3880	0	60472	16120
TOTALS 1936 to 1958		28888	0		94484	578		161368	11312		258474	92894		309672	155913		270940	110120		173834	61109		89240	16318	1390856	448244
		100.00 %			99.39 %			92.99 %			64.06 %			49.65 %			59.36 %			64.85 %			81.71 %		67.77 %	
1959	8730	1256	0	9090	4108	0	10090	7016	0	4670	11238	6568	1150	13464	12314	4860	11780	6920	797	7558	6761	5650	3880	0	60472	32563
1960	7130	1256	0	10850	4108	0	10590	7016	0	11400	11238	0	6370	13464	7094	1810	11780	9970	714	7558	6844	2250	3880	1630	60472	25538
1961	10670	1256	0	11180	4108	0	12460	7016	0	10300	11238	938	5980	13464	7484	5610	11780	6170	3790	7558	3768	7960	3880	0	60472	18360
1962	8450	1256	0	11830	4108	0	11780	7016	0	11450	11238	0	9060	13464	4404	3720	11780	8060	1840	7558	5718	5660	3880	0	60472	18182
1963	8160	1256	0	11040	4108	0	8230	7016	0	2000	11238	9238	540	13464	12924	4440	11780	7340	3210	7558	4348	1050	3880	2830	60472	36680
1964	9080	1256	0	9020	4108	0	11210	7016	0	6310	11238	4928	2690	13464	10774	3450	11780	8330	3410	7558	4148	2090	3880	1790	60472	29970
1965	9220	1256	0	11770	4108	0	11130	7016	0	11640	11238	0	12420	13464	1044	11220	11780	560	6590	7558	968	10680	3880	0	60472	2572
1966	9480	1256	0	11760	4108	0	13470	7016	0	10900	11238	338	6280	13464	7184	8480	11780	3300	5790	7558	1768	3420	3880	460	60472	13050
1967	9930	1256	0	7230	4108	0	8580	7016	0	10050	11238	1188	6120	13464	7344	6210	11780	5570	6100	7558	1458	8060	3880	0	60472	15560
1968	10180	1256	0	11610	4108	0	12260	7016	0	13840	11238	0	9130	13464	4334	4310	11780	7470	4510	7558	3048	5000	3880	0	60472	14852
1969	8360	1256	0	12170	4108	0	12050	7016	0	12890	11238	0	12530	13464	934	11040	11780	740	8110	7558	0	8100	3880	0	60472	1674
1970	9300	1256	0	12780	4108	0	13650	7016	0	12050	11238	0	8710	13464	4754	8320	11780	3460	6710	7558	848	8990	3880	0	60472	9062
TOTALS 1959 to 1970		15072	0		49296	0		84192	0		134856	23198		161568	80588		141360	67890		90696	39677		46560	8710	725664	218063
		100.00 %			100.00 %			100.00 %			82.80 %			50.12 %			51.97 %			56.25 %			85.59 %		69.95 %	

Year 1936-1958 are before the conveyance channel was constructed

Years 1959 - 1970 occasionally Socorro Main Canal received some drain water from the conveyance channel

TABLE B1: **SOCORRO REACH - MONTHLY HISTORICAL SUPPLY AND DEMAND CALCULATIONS - (supply year 1935)**

CIR calculations in Tables B2 and B3 — 05/24/97

LATITUDE 341517 — USGS STATION NUMBER 08354500 — SOCORRO MAIN CANAL NORTH AT SAN ACACIA, NM
LONGITUDE 1065343
DATUM 4650.18

MONTHLY TOTALS IN ACRE FEET

	MARCH	Avg. Demand	Short	APRIL	Avg. Demand	Short	MAY	Avg. Demand	Short	JUNE	Avg. Demand	Short	JULY	Avg. Demand	Short	AUGUST	Avg. Demand	Short	SEPT.	Avg. Demand	Short	OCT.	Avg. Demand	Short	ANNUAL DEMAND	TOTAL ANNUAL SHORTAGE
1936	—	1256	0	3530	4108	578	8200	7016	0	8420	11238	2818	5320	13464	8144	8710	11780	3070	5450	7558	2108	5210	3880	0	60472	16718
1937	2150	1256	0	5200	4108	0	7680	7016	0	6410	11238	4828	9870	13464	4394	11340	11780	440	9100	7558	0	1800	3880	2080	60472	11742
1938	6100	1256	0	7680	4108	0	9220	7016	0	8190	11238	3048	6840	13464	6624	12260	11780	0	5080	7558	2478	5150	3880	0	60472	12140
1939	2870	1256	0	6850	4108	0	10180	7016	0	7580	11238	3658	6690	13464	6774	8350	11780	5430	3940	7558	3618	3940	3880	0	60472	19460
1940	3820	1256	0	7330	4108	0	7630	7016	0	7245	11238	3993	6790	13464	6764	7330	11780	4450	7370	7558	189	7870	3880	0	60472	15400
1941	3580	1256	0	7360	4108	0	2920	7016	4186	7820	11238	3418	5480	13464	4984	7860	11780	3920	5730	7558	1828	3890	3880	0	60472	18345
1942	6710	1256	0	6380	4108	0	6910	7016	106	7939	11238	3308	10220	13464	3244	9770	11780	2010	9300	7558	0	6600	3880	0	60472	6668
1943	6500	1256	0	10020	4108	0	11030	7016	0	10700	11238	538	10120	13464	3344	6850	11780	2930	9290	7558	0	6680	3880	0	60472	6812
1944	7020	1256	0	9290	4108	0	9350	7016	0	8640	11238	2598	8970	13464	4494	7430	11780	4350	8330	7558	0	7220	3880	0	60472	11442
1945	6920	1256	0	9520	4108	0	8410	7016	0	8730	11238	2508	10090	13464	3364	9380	11780	2400	9380	7558	0	8670	3880	0	60472	8292
1946	6420	1256	0	8119	4108	0	6280	7016	736	3640	11238	7598	5320	13464	8144	6670	11780	5110	4460	7558	3098	4920	3880	0	60472	24685
1947	8290	1256	0	8780	4108	0	8060	7016	0	8420	11238	2818	8120	13464	5344	4570	11780	7210	6100	7558	1458	4960	3880	0	60472	16630
1948	3250	1256	0	6089	4108	0	6660	7016	336	6560	11238	4678	9210	13464	5254	5680	11780	6100	3990	7558	3568	5850	3880	0	60472	19935
1949	5820	1256	0	7059	4108	0	7650	7016	0	8266	11238	2958	7400	13464	6064	6400	11780	3380	5330	7558	2228	5280	3880	0	60472	14630
1950	5310	1256	0	8140	4108	0	5040	7016	1976	4950	11238	6288	5360	13464	8104	3060	11780	7920	2950	7558	4608	2840	3880	1040	60472	29835
1951	5940	1256	0	4670	4108	0	4540	7016	2476	3800	11238	7638	2230	13464	11234	4330	11780	7450	1060	7558	6498	0	3880	3880	60472	39175
1952	4850	1256	0	6910	4108	0	7550	7016	0	6030	11238	5208	6820	13464	4644	6020	11780	3760	5010	7558	2548	3670	3880	210	60472	16370
1953	4520	1256	0	7750	4108	0	7640	7016	0	8092	11238	3146	4790	13464	8674	4020	11780	7760	655	7558	6903	311	3880	3569	60472	30054
1954	5660	1256	0	7410	4108	0	8900	7016	0	4140	11238	7098	2670	13464	10794	4420	11780	7360	1400	7558	6158	2210	3880	1670	60472	32920
1955	5800	1256	0	5150	4108	0	5530	7016	1486	5610	11238	5628	2980	13464	10474	5720	11780	6080	5230	7558	2328	5120	3880	0	60472	25978
1956	5660	1256	0	10800	4108	0	8120	7016	0	4800	11238	6438	570	13464	12894	2090	11780	9590	0	7558	7558	11	3880	3869	60472	43449
1957	6300	1256	0	7720	4108	0	9040	7016	0	9300	11238	1938	7790	13464	5674	7690	11780	4060	7010	7558	548	5250	3880	0	60472	12250
1958	6110	1256	0	6070	4108	0	7220	7016	0	10500	11238	738	6790	13464	6674	6470	11780	5310	4160	7558	3398	4610	3880	0	60472	16120
TOTALS 1936 to 1958		29889	0		94484	578		161388	11312		258474	92834		305972	155913		270940	110120		173834	61109		89240	16318	1390856	446244
		100.00 %			99.39 %			92.99 %			64.06 %			49.65 %			59.36 %			64.85 %			81.71 %		67.77 %	
1959	6730	1256	0	9090	4108	0	10090	7016	0	4670	11238	6568	1150	13464	12314	4660	11780	6920	787	7558	6761	5650	3880	0	60472	32583
1960	7130	1256	0	10650	4108	0	10590	7016	0	11400	11238	0	6370	13464	7094	1810	11780	9970	714	7558	6844	2250	3880	1630	60472	25538
1961	10670	1256	0	11180	4108	0	12460	7016	0	10200	11238	938	5260	13464	7484	5610	11780	8170	3790	7558	3768	7260	3880	0	60472	18160
1962	8450	1256	0	11630	4108	0	11760	7016	0	11450	11238	0	9060	13464	4404	3720	11780	9260	1640	7558	5718	5660	3880	0	60472	18182
1963	6160	1256	0	11040	4108	0	8230	7016	0	2000	11238	9238	540	13464	12924	4440	11780	7340	3210	7558	4548	1050	3880	2830	60472	38680
1964	9090	1256	0	9020	4108	0	11210	7016	0	6310	11238	4928	2590	13464	10774	3450	11780	8330	3410	7558	4148	2090	3880	1790	60472	29970
1965	9220	1256	0	11770	4108	0	11130	7016	0	11640	11238	0	12420	13464	1044	11220	11780	550	6590	7558	958	10660	3880	0	60472	2572
1966	8482	1256	0	11769	4108	0	13470	7016	0	10900	11238	338	6280	13464	7164	8480	11780	3300	5790	7558	1768	5420	3880	450	60472	15050
1967	9930	1256	0	7220	4108	0	8580	7016	0	10050	11238	1188	6120	13464	7344	6210	11780	5570	6100	7558	1458	8600	3880	0	60472	15500
1968	10180	1256	0	11810	4108	0	12260	7016	0	13840	11238	0	9130	13464	4334	4310	11780	7470	4510	7558	3048	5000	3880	0	60472	14852
1969	8350	1256	0	12170	4108	0	12050	7016	0	12890	11238	0	12530	13464	934	11040	11780	740	8110	7558	0	8100	3880	0	60472	1674
1970	9300	1256	0	12780	4108	0	13850	7016	0	12050	11238	0	8710	13464	4754	6320	11780	3460	6710	7558	848	6990	3880	0	60472	9062
TOTALS 1959 to 1970		15072	0		49296	0		84192	0		134856	23198		161568	80588		141360	67890		90856	39577		46560	6710	725664	216093
		100.00 %			100.00 %			100.00 %			82.60 %			59.12 %			51.97 %			58.35 %			65.59 %		69.95 %	

Year 1936-1958 are before the conveyance channel was constructed

Years 1959 - 1970 occasionally Socorro Main Canal received some drain water from the conveyance channel

TABLE B2: MONTHLY CONSUMPTIVE IRRIGATION REQUIREMNT FOR SOCORRO REACH ON THE RIO GRANDE

Monthly consumptive irrigation requirements (CIR) (Computed using SCS modified Blaney-Criddle method to determine monthly distribution of CIR)
Prepared by Brian C. Wilson, SEO, 6-20-97

	A	B	C	D	E	F	G	H	I	J	K	L
MONTH	CORN 0.076 (CIR)	SPRING GRAIN 0.018 (CIR)	WINTER GRAINS 0.034 (CIR)	COTTON 0.265 (CIR)	MISC FIELD 0..002 (CIR)	ALFALFA 0.441 (CIR)	PASTURE 0.089 (CIR)	SOYBEAN 0.049 (CIR)	ORCHARDS 0.007 (CIR)	VEGETABLES 0.019 (CIR)	CIR (weighted) (ac-in/ac)	RATIO TO ANNUAL TOTAL
January			0.000								0.000	0.000
February			0.011				0.009				0.020	0.001
March		0.005	0.096			0.379	0.131		0.002		0.613	0.021
April		0.054	0.143	0.074	0.001	1.442	0.246	0.001	0.014	0.009	1.984	0.068
May	0.083	0.114	0.096	0.233	0.004	2.342	0.388	0.053	0.030	0.043	3.386	0.116
June	0.318	0.051	0.000	0.623	0.009	3.418	0.556	0.284	0.046	0.090	5.395	0.185
July	0.538	0.002		1.264	0.011	3.453	0.568	0.459	0.046	0.104	6.445	0.221
August	0.492			1.561	0.010	2.867	0.487	0.149	0.034	0.092	5.692	0.195
September	0.255		0.013	1.102	0.006	1.883	0.326		0.014	0.056	3.655	0.125
October			0.074	0.506	0.002	1.072	0.181		0.003	0.020	1.858	0.064
November			0.037			0.018	0.046		0.001		0.102	0.003
December			0.000								0.000	0.000
TOTAL											29.150	1.000

NOTES: A to J = Monthly CIR for each crop type adjusted for average climatic conditions
K = Sum A to J
L = K/Sum K = Ratio of each crop type to total annual CIR
Annual weighted CIR (ac-in/ac)/12 = annual weighted CIR (ac-ft/ac)

(1) The cropping pattern used in this analysis was reported in Table 5, Henderson and Sorenson, 1968.
(2) The weather data is based on data recorded at the Socorro weather station for 1931 - 1960 period of record

TABLE B3: MONTHLY FARM DELIVERYREQUIREMENTS FOR THE SOCORRO REACH ON THE RIO GRANDE

Monthly consumptive irrigation requirements (CIR) (Computed using SCS modified Blaney-Criddle method)
Prepared by Brian C. Wilson, SEO, 6-20-97

	M	N	O	P	Q	R
MONTH	ACRES	CIRw (ac-ft/ac)	E(f)	FDR (ac-ft)	E(c)	PDR (ac-ft)
March	7131	0.044	0.50	628	0.50	1256
April	7131	0.144	0.50	2054	0.50	4108
May	7131	0.246	0.50	3508	0.50	7016
June	7131	0.394	0.50	5619	0.50	11238
July	7131	0.472	0.50	6732	0.50	13464
August	7131	0.413	0.50	5890	0.50	11780
September	7131	0.265	0.50	3779	0.50	7558
October	7131	0.136	0.50	1940	0.50	3880
November	7131	0.006	0.50	86	0.50	172
TOTAL		2.120		30235		60473

NOTES:
M = Number of acres irrigated IN 1935
N = L * 2.12 (2.12 = annual CIR from original Blaney-Criddle method)
O = E(f) = average on-farm irrigation efficiency
P =(M*N)/O = FDR is on-farm irrigation efficiency
Q = E(c) is the average off-farm conveyance efficiency
R = P/Q = PDR Project delivery requirement

(1) Irrigated acreage used in this analysis (7131 acres) reflects 1935 conditions, Middle Rio grande Biological Interagency Team, 1993
(2) 1935 irrigated acreage is in agreement with Natural Resources Committee report, 1938, showing 7237 acres irrigated.
(3) An on-farm irrigation efficency E(f) is assummed.
(4) An off-farm conveyance efficiency E(c) is assumed.
(5) A part of the Farm-delivery requirement may be met by Farm-runoff and seepage that is captured by drains and reused by downstream irrigators. However, no data is available to quantify these flows.

TABLE B4: MONTHLY CONSUMPTIVE IRRIGATION REQUIREMNT FOR SAN MARCIAL AND VAL VERDE IN SOCORRO COUNTY, NEW MEXICO

Monthly consumptive irrigation requirements (CIR) (Computed using SCS modified Blaney-Criddle method)
Prepared by Brian C. Wilson, SEO, 6-20-97

	A	B	C	D	E	F
MONTH	CORN 0.136 (CIR)	SPRING GRAIN 0.163 (CIR)	MISC FIELD 0.398 (CIR)	ALFALFA 0.303 (CIR)	CIR (weighted) (ac-in/ac)	RATIO TO ANNUAL TOTAL
March		0.045		0.260	0.305	0.012
April		0.492		0.991	1.483	0.058
May	0.148	1.036	0.434	1.609	3.227	0.127
June	0.568	0.464	1.664	2.348	5.044	0.198
July	0.963	0.014	2.818	2.372	6.167	0.242
August	0.881		2.579	1.969	5.429	0.213
September	0.457		1.337	1.293	3.087	0.121
October				0.736	0.736	0.029
November				0.012	0.012	0.000
TOTAL					25.490	1.000

NOTES: A to D = Monthly CIR for each crop type adjusted for average climatic conditions
E = Sum A to D
F = E/Sum E = Ratio of each crop type to total annual CIR

TABLE B5: MONTHLY FARM DELIVERY REQUIREMENT FOR SAN MARCIAL AND VAL VERDE IN SOCORRO COUNTY, NEW MEXICO

Prepared by Brian C. Wilson, SEO, 6-20-97

Monthly consumptive irrigation requirements (CIR) (SCS modified Blaney-Criddle method for monthly CIR percentages)
(Original Blaney-Cridle method for annual CIR = 1.78 ac-ft/ac)

	G	H	I	J	K	L
MONTH	ACRES	CIR (ac-ft/ac)	E(f)	FDR (ac-ft)	E(c)	PDR (ac-ft)
March	919	0.021	0.55	35.09	0.70	50.13
April	919	0.103	0.55	172.10	0.70	245.86
May	919	0.226	0.55	377.62	0.70	539.46
June	919	0.352	0.55	588.16	0.70	840.23
July	919	0.432	0.55	721.83	0.70	1031.18
August	919	0.379	0.55	633.27	0.70	904.67
September	919	0.215	0.55	359.24	0.70	513.20
October	919	0.052	0.55	86.89	0.70	124.13
TOTAL		1.780		2974.20		4248.86

NOTES: G = Number of acres irrigated
H = F * 1.78 (1.78 = annual CIR from original Blaney-Criddle method)
I = E(f) is on-farm irrigation efficiency
J =(G*H)/i = FDR is Farm Delivery Requirement
K = E(c) is the off-farm conveyance efficiency
L = J/K = PDR Project delivery requirement

Proposed transfer
Val Verde to Rio Rancho
04246-04255 into RG-57125 et al.
July 16, 1997

METHODS USED FOR SUPPLY AND DEMAND CALCULATIONS

Presently, no historical supply studies of the San Acacia to San Marcial reach of the Rio Grande exist in records of either the State Engineer Office (SEO) or the U.S. Bureau of Reclamation (personal communication, Carl Martin, June 25, 1997).

Historical supply studies at the SEO involve the comparison of actual flow in a surface water supply to the total irrigation demand for water from that source on an annual or month-by-month basis. Monthly water shortages are added up, and the total shortage is compared with the total demand. The total supply shortage is used to calculate the monthly percent historical supply. Yearly supply can never exceed 100%: it is the shortages of water supply, not the surpluses, that control water availability on a system. In this case, flow data is obtained from the Socorro Main Canal gage along the Rio Grande. All irrigation supply is assumed to come from the Main Canal, supplemental wells are not considered a factor. Irrigation demands are calculated from climatic and cropping data using Blaney-Criddle and modified Blaney-Criddle consumptive use calculations. These weighted irrigation demands are adjusted for conveyance efficiency and farm efficiency to determine the diversion demand on the surface water supply.

This historical supply and demand study contains some uncertainty. Specific data is not available for all key elements of the system, thereby requiring assumptions concerning these elements. In this case, sources of uncertainty come from the assumptions that all water for irrigation is from the gaged main canal (in the 1958 to 1970 period, some ungaged water was diverted from the conveyance channel into the Main Canal), return flow is not a factor, cropping patterns are consistent, total irrigated acreage is consistent, on-farm delivery efficiencies and off-farm conveyance efficiencies are constant throughout the reach.

For this analysis of historical supply, gaged flow data from the Socorro Main Canal at San Acacia is used to determine if there are short water supplies for downstream users below Rio Rancho. The Socorro Main Canal is the primary source of irrigation water in the Socorro reach. Flow data used for these calculations are for the irrigation months March through October and demands are based on 1935 cropping patterns and acreage.

Proposed transfer
Val Verde to Rio Rancho
04246-04255 into RG-57125 et al.
July 16, 1997

APPENDIX C

Correspondence For Transferring Additional San Juan/Chama Project Water From Albuquerque to MRGCD

City of Albuquerque

P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR KEN SCHULTZ

CHIEF ADMINISTRATIVE OFFICER GENE ROMO

DEPUTY CAO DEVELOPMENT & ENTERPRISE SERVICES LARRY LARRANAGA

DEPUTY CAO PUBLIC SERVICES DAN WEAKS

May 17, 1988

Mr. Clarence V. Lithgow
General Manager
MRGCD
P.O. Box 581
Albuquerque, NM 87103

Dear Mr. Lithgow:

This is to acknowledge City Chief Administrative Officer receipt of the notice of termination of the 1977 water storage agreement between the City and MRGCD sent by Mr. William F. Davis, attorney for the MRGCD, on March 28, 1988. As of the termination date, the end of calendar 1988, the City will retain rights described in paragraphs 7 and 12 of the agreement.

Paragraph 7 states that:

> "The District may elect to utilize, prior to 1986, all or any portion of City water stored under this agreement for its purposes in which case the amount of water used will be replaced in El Vado Reservoir by the District within a ten (10) year period measured from the year in which the water is used."

City records for the use of water by the MRGCD under this provision show a balance of 58,019 acre-feet owed the City, detailed as follows:

DATE	ACRE-FEET	
12/31/80	-38,508	Balance owed
4/81	- 1,721	Borrowed amount
5/81	- 1,264	" "
6/81	-25,926	" "
7/81	-11,635	" "
8/81	- 5,965	" "
12/82	+ 4,000	Payback amount
7/83	+10,000	Payment by City for North Valley licenses
12/83	+13,000	Payback amount
12/31/83	-58,019	Balance owed

Mr. Clarence V. Lithgow
General Manager
MRGCD
P.O. Box 581
Albuquerque, NM 87103

As has been indicated in previous discussions and negotiations with the District, the City would, in the context of a new long-term agreement for storage of City water in El Vado, like to postpone repayment of this debt until the water is needed by the City. The City remains willing to consider other ways of dealing with this debt as part of a new long-term agreement.

Paragraph 12 states that:

> "The termination of this Agreement pursuant to paragraph 11 hereof shall terminate all rights and obligations of the City to store any further or additional water in El Vado Reservoir but shall not terminate this Agreement insofar as that water which is at that time stored in El Vado Reservoir for which payment has been made by the City and as to such water this Agreement remains in full force and effect".

The "Agreement remains in full force and effect" for 33,795 acre-feet, less evaporation losses to December 31, 1987, of the 66,056 acre-feet of City water in El Vado as of April 30, 1988. The other 32,261 acre-feet is of course available for use by the District pursuant to the letter agreements of the last two years.

The City wants to continue its mutually beneficial relationship with the MRGCD through storage of City water in El Vado and making the water available water for use by District farmers by loan or other equitable arrangement until the water is needed by the City. In return, the City would have storage for some of its water and, in addition, would seek some mechanism for future repayment of City water used by the District.

Sincerely,

George A. Selvia
Director
Public Works Department

Reviewed by:

Edward R. Pearson
Assistant City Attorney

MIDDLE RIO GRANDE CONSERVANCY DISTRICT
POST OFFICE BOX 581
1931 SECOND ST., S.W. PHONE 243-6796
ALBUQUERQUE, NEW MEXICO 87103

December 12, 1986

City of Albuquerque
Attn: Chief Administrative Officer
P. O. Box 1293
Albuquerque, NM 87103

Gentlemen:

At the present time, the Middle Rio Grande Conservancy District owes to the City of Albuquerque approximately 58,019 acre feet of the San Juan Chama water which accrued under an agreement of 1977. After the 1986 irrigation season the District has available 45,000 acre feet of San Juan Chama water, which it can return to you prior to December 31, 1986.

The Middle Rio Grande Conservancy District by this letter hereby tenders to the City of Albuquerque 45,000 acre feet of San Juan Chama water to discharge a portion of the existing debt owed by the District to the City of Albuquerque.

Please advise us immediately what you wish done with this water.

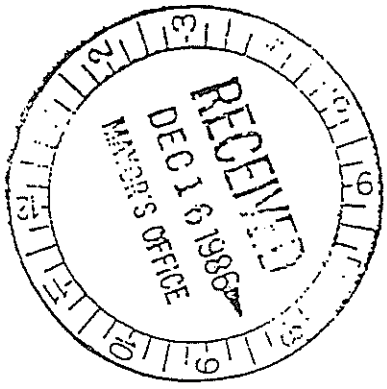
Sincerely,

Ray Shollenbarger
Attorney

RS:apg

cc: Jim L. Gill, Director
Public Works Department

Gary Daves
Water Resources Department



MIDDLE RIO GRANDE CONSERVANCY DISTRICT
POST OFFICE BOX 581
1930 SECOND ST., S.W. PHONE 243-6796
ALBUQUERQUE, NEW MEXICO 87103

August 28, 1981

RECEIVED
AUG
WATER RESOURCES

Mr. Jim Gill
Water Resources Division
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Dear Mr. Gill:

The District has been most appreciative and very fortunate in being able to utilize the City of Albuquerque's water that has been stored in El Vado Reservoir plus 17,600 ac. ft. of your 1981 San Juan water supply. Without this water many farmers in the Middle Rio Grande Valley would have suffered severe crop losses.

The irrigation season is not over. Rains have been of tremendous benefit to our irrigation needs. However, weather conditions could change drastically and the need for irrigation water could again become critical.

In order to provide what cushion may be possible, the District would like to negotiate with the City for San Juan water the City currently has stored in Abiquiu. We would hope we would not need it, but one can never be certain.

Please let me know what would be required of the District to arrange for delivery of this water to meet our late season irrigation needs, should it be required.

Sincerely,

Robert S. Nanninga
General Manager

RSN:cj

MIDDLE RIO GRANDE CONSERVANCY DISTRICT
POST OFFICE BOX 581
1930 SECOND ST., S.W. PHONE 243-6796
ALBUQUERQUE, NEW MEXICO 87103

April 14, 1981

RECEIVED
APR 17 1981
WATER RESOURCES

Mr. Paul Noland
City Water Resources Dept.
500 Marquette NW
Albuquerque, NM 87102

ATTN: Jim Gill

Dear Mr. Gill:

The District anticipates a very serious irrigation water shortage this year because of the absence of any appreciable amount of snow on our Rio Grande Watershed.

We are going to need to exercise our agreement covering the use of City water stored in El Vado.

The District also sees a definite need to negotiate with the City to see what can be done to make available to the District the water the City currently has stored in the Abiquiu Reservoir.

Please advise what steps you feel should be taken to determine whether or not an agreement might be reached.

Thank you.

Sincerely,

Robert S. Nanninga
General Manager

RSN:cj

United States Department of the Interior
WATER AND POWER RESOURCES SERVICE
UPPER RIO GRANDE BASIN PROJECTS OFFICE
P.O. BOX 252
ALBUQUERQUE, NEW MEXICO 87103

IN REPLY
REFER TO:
411.

25 FEB 1981

RECEIVED
SEP 24 1981
WATER RESOURCES

Mr. Paul D. Noland, Director
Water Resources Department
City of Albuquerque
P.O. Box 1293
Albuquerque, New Mexico 87103

Attention: Jim Gill

Gentlemen:

Our records show, as of December 31, 1979, that of the 40,184 acre-feet used by the District, 37,182 acre-feet has been replaced, leaving a balance of 3,002 acre-feet.

As of October 10, 1980, the District borrowed an additional 35,506 acre-feet, for a total of 38,508 acre-feet at the end of calendar year 1980.

Sincerely yours,

R. E. Schembera

Projects Superintendent

cc: Mr. Ray Shollenbarger, Jr.
Attorney for MRGCD

SW-400

I 10484

7.K

United States Department of the Interior

BUREAU OF RECLAMATION
UPPER RIO GRANDE BASIN PROJECTS OFFICE
P.O. BOX 252
ALBUQUERQUE, NEW MEXICO 87103

IN REPLY
REFER TO:
511.

NOV 07 1977

Mr. Ernest G. Sanchez
General Manager
Middle Rio Grande Conservancy
District
P. O. Box 581
Albuquerque, New Mexico 87103

Dear Ernie:

During 1977, City of Albuquerque water was released for use by the District as provided by agreements dated May 23, 1977, and September 26, 1977. Based upon provisional water records, the water released amounts to 40,048 acre-feet. We will inform you immediately of any changes that may result due to revisions in water records.

The following tabulation presents the pertinent information regarding the releases.

Location of Storage	Date of Original Storage	Amount Released (acre-feet)
El Vado Reservoir	1976	13,718
Heron Reservoir	1977	17,100
El Vado Reservoir	1973	6,000
Abiquiu Reservoir	1974-75	3,230
	TOTAL	40,048

If any question arises, feel free to contact us for a detailed explanation of our operations during 1977.

Sincerely yours,

J. E. Sanchez

Projects Superintendent

cc: City of Albuquerque, Attn: Chief Administrative Officer
P. O. Box 1293, Albuquerque, N. M. 87103

Regional Director, Amarillo, Texas
Attention: 5M-430

El Vado Reservoir Operation
Storage-Beginning of Year
(Unit-acre-feet)

Year	San Juan-Chama					Rio Grande			Total Reservoir
	Albq.	P.S.Co.	ERDA	MRGCD	Total	M.R.G.C.D.	Compact	Total	
1972	0	0		0	0	0	1,130	1,130	1,130
1973	14,700[1/]	2,929		0	17,629	4,081	0	4,081	21,710
1974	14,700	5,716		35,174	55,590	33,480	37,200	70,680	126,270
1975	14,197[2/]	8,057		22,094	44,348	41,976	0	41,976	86,324
1976	13,760	9,956		42,298	66,014	60,356	0	60,356	126,370
1977	27,316	11,569	500	61,779	101,164	8,442	0	8,442	109,606

1/Transferred from City of Albuquerque to M.R.G.C.D, 9/5/73
2/Additional 14,290 acre-feet in Abiquiu Reservoir

MIDDLE RIO GRANDE CONSERVANCY DISTRICT
POST OFFICE BOX 581
ALBUQUERQUE, NEW MEXICO 87103
1930 SECOND ST., S.W. PHONE 243-6796

July 5, 1977

Mr. Paul Noland
City of Albuquerque
Post Office Box 1293
Albuquerque, New Mexico 87103

Dear Mr. Noland:

In a letter dated June 8, 1977, the District advised the City that it appeared it would be necessary for the continued irrigation of the middle valley lands that the District would need to acquire the City's San Juan/Chama water stored in El Vado Reservoir.

It is the District's understanding the water in storage is for calendar years 1975 and 1976. The District would propose that we be charged with whatever the release is from storage each day until the District no longer needs to release water or until the full 1975 and 1976 volume has been expended. The amount of water charged to the District for settlement with the City would then be identified by the releasing authority, the Bureau of Reclamation

If there are any documents required other than the contract between the City of Albuquerque and the District, please advise.

Although it is a little early to make final determination of further needs the District may have for water, the District does advise the City that if necessary to meet the needs of the irrigated crops of the middle valley, the District would so notify the City and begin using 1977 San Juan/Chama water assigned to the City.

If for any reason the above arrangements are not satisfactory, the District would appreciate knowing of them as soon as possible.

Sincerely yours,

Robert S. Nanninga
General Manager
MIDDLE RIO GRANDE CONSERVANCY DISTRICT

RSN/mr

cc: Bureau of Reclamation

RECEIVED
JUL 8 19..
WATER RESOURCES

MIDDLE O GRANDE CONSERVANCY STRICT
POST OFFICE BOX 581
1930 SECOND ST., S.W. PHONE 243-6796
ALBUQUERQUE, NEW MEXICO 87103

July 27, 1977

Mr. Paul Noland
City of Albuquerque
Post Office Box 1293
Albuquerque, New Mexico 87103

Dear Mr. Noland:

As per our agreement with the City of Albuquerque for the storage of water in El Vado Reservoir, the District anticipates needing the City's share of the 1977 San Juan/Chama water of approximately 17,700 acre feet. Since this water is in storage at Heron Reservoir and since no evaporation losses are charged to any contractor so long as the water is in Heron Reservoir, it is the desire of the District to call for this water as its use demands. It is conceivable that the District may not use all of this water if adequate rains supplement the current flows of the river.

The Board of Directors of the Middle Rio Grande Conservancy District has authorized me to make the needs of the District known to the City and in turn has agreed that whatever the City's share of the 1977 San Juan/Chama water is not used by the District that it may be stored in El Vado Reservoir at no charge to the City.

Sincerely yours,

Robert S. Nanninga
General Manager
MIDDLE RIO GRANDE CONSERVANCY DISTRICT

RSN/mr

cc: Bureau of Reclamation

RECEIVED
1 1977
WATER RESOURCES

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

MAYOR
Harry E. Kinney

CHIEF
ADMINISTRATIVE OFFICER
Frank A. Kleinnenz

September 27, 1977

Mr. Robert Schembera
Project Superintendent
Upper Rio Grande Basins
U. S. Bureau of Reclamation
P. O. Box 252
Albuquerque, New Mexico 87103

Dear Mr. Schembera:

In response to a request from the Middle Rio Grande Conservancy District, the city of Albuquerque has contracted with the District to allow use of 12,000 acre feet of our San Juan/Chama water. The conditions of the agreement are that the initial 6,000 acre feet be released from Abiquiu Reservoir and the remainder from El Vado Reservoir and all releases must be made prior to December 31, 1977.

The Bureau of Reclamation is hereby authorized to release from storage in El Vado Reservoir, 6,000 acre feet of Albuquerque water at the request of the District. The intended use of the water is for irrigation purposes and must be accomplished before December 31, 1977, and after releases from Abiquiu Reservoir. The releases from Abiquiu will be coordinated with the Corps of Engineers.

Thank you for your assistance.

Sincerely,

Frank A. Kleinhenz
Chief Administrative Officer

FAK:JG:rm

cc: State Engineer Office
George W. Hannett