HYDROLOGIC EVALUATION OF APPLICATIONS LRG-4793-S-2 AND LRG-4793-S-8 BY THE ANTHONY WATER AND SANITATION DISTRICT FOR PERMIT TO CHANGE LOCATION OF WELL IN THE LOWER RIO GRANDE UNDERGROUND WATER BASIN DOÑA ANA COUNTY, NEW MEXICO

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Summary

1. Well logs and water quality data indicate that replacement wells LRG-4793-S-2 and LRG-4793-S-8 are completed below the shallow zone in the intermediate freshwater zone of the basin-fill aquifer in the Mesilla Basin.

2. Well test data and estimates of available water columns indicate that the replacement wells are capable of reasonably obtaining the quantity of water sought. Minimum capacities of 826 gallons per minute per well would be required for the diversion of 800 acre-feet per year as requested on the applications, assuming production 60 percent of the time. Based on available information, the potential yield from wells LRG-4793-S-2 and LRG-4793-S-8 is about 1,200 gallons per minute each. Both wells are estimated to retain water columns of about 400 feet after 100 years of diverting 800 acre-feet per year.

3. A superposition version of a calibrated ground-water flow model of the Mesilla Basin (OSELRG), and the Theis equation were used to estimate hydrologic effects of granting the applications. Drawdowns after 100 years due to existing rights are estimated at 10 feet. Estimated drawdowns at the nearest wells of other ownership after 100 years resulting from existing rights and the proposed diversions are 20 feet or less. Simultaneous diversion of 800 acre-feet per year each at both replacement wells plus existing rights results in estimated drawdowns at the nearest wells of less than 25 feet. These drawdowns will not have a significant impact on the available water columns in these wells, and do not result in average annual rates of water-level decline exceeding the Mesilla Valley Administrative Area criterion of 1.0 foot per year. Any affected shallow wells could be deepened to regain supply.

4. Surface water depletions from increasing diversions to 800 acre-feet per year at the replacement wells would temporarily exceed those resulting from continued exercise of the right as it existed at the time it was permitted (baseline depletions). Depletions from LRG-4793-S-2 are estimated to be about 128 acre-feet per year greater than baseline in year one, and decrease after seven years to less than baseline. Estimated depletions from LRG-4793-S-8 are about 157 acre-feet per year greater than baseline in year one, and decrease to less than baseline after 10 years. Schedules could be developed which would allow increasing diversions to 800 acre-feet per year at the replacement wells while maintaining depletions at or below offset criteria for the Mesilla Valley Administrative Area.

5. Increasing diversions at the replacement wells to 800 acre-feet per year could potentially result in degradation of water quality in the basin-fill aquifer, by increasing drawdowns in the intermediate freshwater zone of the aquifer. Drawdowns in the intermediate zone near the wells estimated with the OSELRG model are about three to four feet greater than in the shallow aquifer zone, indicating the potential to induce downward flow of slightly saline water in the vicinity of the wells. These drawdowns represent averages over large areas; actual drawdowns in the intermediate zone near the wells could be greater than those calculated by the model. Quantification of water quality effects was beyond the scope of, and resources available for, this investigation.

Introduction

Applications to change location of wells LRG-4793-S-8 and LRG-4793-S-2 in the Lower Rio Grande Underground Water Basin were filed by the applicant Anthony Water and Sanitation District (AWSD) with the Office of the State Engineer (OSE) on December 1, 1998 and January 29, 1999, respectively. The applicant proposes to divert 800 acre-feet per year (ac-ft/yr) each from two replacement wells, as part of a total permitted diversion of 2,225.9 ac-ft/yr from wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8 for municipal, domestic, commercial, industrial and related uses within Townships 26 and 27 South, Range 3 East and Township 26 South, Range 4 East. The purpose of this evaluation is to determine whether the capacity of the wells is sufficient to reasonably obtain the quantity of water sought, and to estimate the hydrologic effects of granting applications LRG-4793-S-2 and LRG-4793-S-8.

The source of supply for the wells is the shallow water aquifer of the Mesilla Basin near Anthony in southern Doña Ana County, New Mexico (figure 1). Original well LRG-4793-S-8 was permitted in 1990 for a diversion of 100 ac-ft/yr; OSE has recognized a capacity of 290 ac-ft/yr based on the declaration for original well LRG-4793-S-2. The replacement wells have already been drilled within 100 feet of the original wells. Replacement well LRG-4793-S-2 was completed at a depth of 500 feet with 14-inch casing and screen in the NE¼, NW¼, SE¼ of Section 35, T26S, R3E. Well LRG-4793-S-8 was completed at a depth of 520 feet with 14-inch casing and screen in the SE¼, SW¼, NE¼ of Section 26, T26S, R3E. The applications were protested by the Elephant Butte Irrigation District (EBID) and the Desert Sands Mutual Domestic Water Consumers Association (MDWCA). Desert Sands MDWCA has two wells in the area (LRG-5037 and LRG-5037-S); the EBID has no wells in the area but is responsible for delivery of Rio Grande Project surface water supplies to users in New Mexico.

Existing water rights and wells

Information on 230 wells and over 200 associated water rights located in the vicinity of replacement wells LRG-4793-S-2 and LRG-4793-S-8 is presented in table 1. Information from OSE files and the WATERS database is summarized for wells in Sections 13-15, 22-27, and 34-36, T26S, R3E, as shown in figure 2. Well depths range from 30 feet to 1,300 feet, with depth to water ranging from less than 5 feet to 175 feet below land surface. Initial water columns in these wells range from 23 to 1,265 feet. Declared and permitted water uses include commercial, dairy, domestic, irrigation, school, subdivision and community water supply.

Geohydrologic setting

The regional geohydrologic setting in the vicinity of Anthony has been the subject of numerous previous studies including Wilson and others (1981), Hawley (1984), SSP&A (1987), Frenzel (1992), Frenzel and Kaehler (1992), Nickerson and Myers (1993), and LWA (1994). The following discussion of the geohydrology of the Mesilla Basin draws liberally from these sources.

The Mesilla Basin is a rift basin bounded by faults, volcanic rocks and uplifted blocks of Precambrian to Tertiary-age igneous, metamorphic and sedimentary rocks forming from north to south the Doña Ana, Organ and Franklin Mountains on the east, and the Robledo Mountains, Sleeping Lady and Aden Hills, and the East and West Potrillo Mountains on the west (figure 1). Up to 2,500 feet of sediments consisting of unconsolidated to consolidated clay, silt, sand and gravel comprising the Santa Fe Group fill the basin in New Mexico. Where saturated and permeable these basin-fill deposits form the principal aquifer in the Mesilla Basin. In the Mesilla Valley the alluvial deposits of the Rio Grande, which are about 80 feet thick, also form an important aquifer.

Mountain front recharge from the highland areas flanking the Mesilla Basin flows toward the central basin. The general direction of ground-water flow in the central basin is from northwest to southeast. Outflow occurs at the south end of the basin, and may occur to the Hueco Bolson to the east through Fillmore Pass. Recharge and discharge also occur as seepage to and from the Rio Grande and irrigation canals and drains in the Mesilla Valley. Ground-water withdrawals, principally for irrigation and for municipal uses by the cities of Las Cruces and El Paso have resulted in drawdowns of up to 50 feet near pumping centers. Elsewhere current drawdowns and projections of future water-level declines based on existing uses are not significant.

The basin-fill aquifer in the southern Mesilla Valley can be divided into three zones based on lithology and water quality (Wilson and others, 1981; LWA, 1994). The upper or shallow zone consists of relatively coarse-grained alluvium and the upper part of the Santa Fe Group, and contains slightly saline water (defined as water with a total dissolved solids [TDS] concentration between 1,000 and 3,000 milligrams per liter; [mg/L]), which has been affected by irrigation activities. This zone extends to a depth of about 200 feet below the water table. This is underlain by an intermediate zone consisting of interlayered sands, silts, clays and some gravel of the Santa Fe Group, which contains fresh water (TDS less than 1,000 mg/L) and is about 200 to 250 feet thick. The underlying deep zone contains saline water in most of the basin, except for the Cañutillo area south of Anthony where the City of El Paso produces drinking water from the deep zone at its Cañutillo well field (figure 1).

Site conditions

Wells LRG-4793 through LRG-4793-S-8 are located in the southern Mesilla Basin, east of the Mesilla Valley fault zone and about two to three miles west of the eastern edge of the basin. Hydrogeologic cross section K-K' of Hawley (1984; plate 12), which crosses the Mesilla Valley about five miles north of Anthony, indicates that the basin-fill deposits thin rapidly between the fault zone and the edge of the basin. The intermediate freshwater zone also thins rapidly eastward from the Rio Grande, pinching out somewhere east of Anthony (Wilson and others, 1981; plate 15).

Logs for replacement well LRG-4793-S-8 indicate a transition from predominantly silty clay to silty sand at a depth of 285 feet (JSAI, 1998), representing the transition from the upper zone to the intermediate zone. The intermediate zone is about 230 feet thick at this well, extending to a depth of 515 feet, where logs indicate a change in lithology to silty clay.

Molzen-Corbin (1993) reported that total dissolved solids (TDS) concentration of water produced by AWSD's wells ranged from 942 mg/L to 1,674 mg/L. Water chemistry data for the wells provided by the applicant indicates that TDS ranges from about 900 mg/L to almost 1,900 mg/L. Concentrations of TDS, sodium, sulfate and chloride are relatively high for drinking water. Water samples collected during drilling of replacement well LRG-4793-S-8 showed TDS of less than 1,000 mg/L for sample zones from 322 to 332 feet and 464 to 474 feet, and over 2,900 mg/L for a sample zone from 715 to 725 feet (JSAI, 1998). These data and the well logs indicate the replacement wells are screened in the intermediate zone. Based on total depths most of the other wells in the area (about 200 of 230 in table 1) appear to be completed in the shallow zone.

Analysis of data from pumping tests of replacement wells LRG-4793-S-2 and LRG-4793-S-8 (JSAI, 1998; 1999) yielded an aquifer transmissivity estimate of 40,000 gallons per day per foot (gpd/ft), or about 5,350 feet squared per day (ft^2/d). Over the 200-foot sections screened at both wells this yields bulk hydraulic conductivity values of about 27 feet per day (ft/d). These values are typical of the intermediate zone.

The AWSD wells are located near several important surface water features, including the Rio Grande and elements of the Rio Grande Project operated by the Elephant Butte Irrigation District (figure 2). The East Drain is approximately 1,800 feet west, and the Three Saints East Lateral is about one mile west of the nearest AWSD well (LRG-4793-S-2). The Rio Grande is located less than two miles west of well LRG-4793-S-2. Water levels in the Anthony area have not experienced recent significant declines.

Metered diversions from the AWSD wells available for the period 1990 through 2000 are summarized in table 3. Maximum diversion during that period was about 1,160 acre-feet in 1995. From 1994 to 1998 most of the production occurred from wells LRG-4793 (about 50 percent of total) and LRG-4793-S-3 (about 30 percent), with the remainder coming mostly from wells LRG-4793-S-7 and S-8. In 1999 and 2000 the pumping distribution has changed somewhat, although about 80 percent of the production is still coming from wells LRG-4793 and LRG-4793-S-3 (table 3). The applications under consideration propose that up to 36 percent of the total permitted diversion right of 2,225.9 ac-ft/yr be diverted from each of wells LRG-4793-S-2 and LRG-4793-S-8.

Capacity of wells and source of supply

An evaluation was conducted to determine whether replacement wells LRG-4793-S-2 and LRG-4793-S-8 might reasonably obtain the quantity of water sought. Assuming the wells pump 60 percent of the time, minimum capacities of 826 gpm per well would be required to obtain the requested 800 ac-ft/yr diversions. Both replacement wells are located in an area where Wilson and others (1981; plate 12) estimated potential yields of 1,000 gpm are possible for properly constructed wells. Estimated yields of 1,200 gpm were reported on the well records for both wells.

The wells have already been drilled and some pumping test data were available. Replacement well LRG-4793-S-2 was test pumped at an average discharge of 1,229 gpm for 24 hours, with approximately 105 feet of drawdown (JSAI, 1999). Performance of replacement well LRG-4793-S-8 was reported to be similar (JSAI, 1999). Based on this information, the replacement wells appear to have sufficient capacity to reasonably obtain the quantity of water sought. Effects of long-term pumping at the requested diversion rates on the water columns in wells LRG-4793-S-2 and LRG-4793-S-8 are addressed in the section titled “Hydrologic effects”.

Methods

A superposition version of a calibrated finite-difference numerical ground-water flow model of the Mesilla Basin (OSELRG) was used to estimate drawdowns and surface water depletions. The Theis analytical method was used to estimate drawdown at wells LRG-4793-S-2 and LRG-4793-S-8 resulting from the proposed diversions, and at the nearest wells of other ownership. Potential effects on water quality were evaluated qualitatively from the model drawdown calculations and published information.

Model description

The U. S. Geological Survey (USGS) developed a calibrated finite-difference numerical ground-water flow model of the Mesilla Basin in New Mexico and Texas (Frenzel, 1992). This model was later modified by Hamilton and Maddock (1993). Barroll (1998) used the Hamilton and Maddock (1993) model to develop OSELRG, a superposition version for administration of water rights in the Mesilla Valley Administrative Area (MVAA). Documentation of OSELRG is provided in Barroll and Johnson (2000). A brief description of the model is provided here; for more detail refer to Frenzel (1992), Hamilton and Maddock (1993), and Barroll and Johnson (2000).

The OSELRG model uses MODFLOW, the USGS modular three-dimensional finite-difference code (McDonald and Harbaugh, 1988). The finite-difference grid consists of 4 layers, 36 rows, and 64 columns (figure 3). Layer 1 of the model extends to a depth of about 200 feet below the 1990 water table, representing the upper part of the Santa Fe Group basin-fill deposits (and the Rio Grande alluvium in the Mesilla Valley), approximately corresponding to the upper (shallow) aquifer zone. Layers 2 through 4 are comprised of various thicknesses of the basin-fill deposits. Over most of the model area layer 2 is 400 feet thick and layer 3 is 600 feet thick. Layer 4 varies from 200 to 1,030 feet in thickness. All the layers are thinner near the edges of the model area.

Fillmore Pass and the northern and southern ends of the basin are simulated as constant-head boundaries (figure 3). Lower permeability rocks bounding the basin to the east and west, and underlying the basin-fill deposits at depth are modeled as no-flow boundaries. The complex interaction between the aquifer, the Rio Grande and the canals and drains of the Rio Grande Project in the Mesilla Valley has been greatly simplified in the model and is simulated using the MODFLOW River (RIV) module. Surface water depletions estimated by the model represent total depletions from all RIV cells.

Figure 4 shows the locations of wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8 in relation to the OSELRG model grid. Aquifer properties assigned to the model cells containing the wells are presented in table 4. These values compare reasonably well with aquifer properties determined from site-specific pumping tests (JSAI, 1998; 1999), and are within ranges presented as typical for zones in the basin-fill aquifer in the southern Mesilla Basin (LWA, 1994).

The OSELRG superposition version was developed from the calibrated Hamilton and Maddock (1993) model. For water rights administration in the MVAA individual applications are evaluated using the superposition version of the model in which background stresses (including evapotranspiration) are eliminated so that drawdowns and depletions predicted for each application are isolated. Barroll and Johnson (2000) discuss the superposition version and compare OSELRG with the original calibrated model.

Model simulations

Although the locations of the replacement wells are essentially the same as the original wells, increasing the diversions at wells LRG-4793-S-2 and LRG-4793-S-8 will result in a shift in the pumping center of the AWSD wells. Because the replacement wells are deeper than the original wells, approving the applications in full would also result in a vertical shift in the pumping center. To evaluate the effect of these shifts using the model, the layer(s) from which the wells are pumping must be determined. This determination requires information about 1) well construction (including total depth and screened interval of the well); 2) depth to the water table at or near the well; and 3) model layer thicknesses. This information is summarized for wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8 in tables 2 and 5, with model layer determinations presented in table 5.

With the exception of LRG-4793, which is screened about half in layer 1 and half in layer 2, all of the original AWSD wells pump entirely from model layer 1 (the shallow zone). As noted, the replacement wells have been screened entirely below the shallow zone in the intermediate zone, simulated in OSELRG by layer 2.

For each application two pumping scenarios were simulated, a baseline scenario and an application scenario. The baseline scenario was the same in both cases and estimates the effects of pumping the full permitted right (2,225.9 ac-ft/yr) at wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8, beginning in 1955 when the first wells were drilled. Well LRG-4793-S-2 was simulated as diverting 290 ac-ft/yr from layer 1 in model cell row 27, column 18 (R27C18) beginning in 1955, and well LRG-4793-S-8 was simulated as diverting 100 ac-ft/yr from layer 1 in cell R28C19 beginning in 1990. The other AWSD wells were simulated as a single well at the approximate pumping center of the field in model cell R28C18. Part of the remaining diversion right (290.4 ac-ft/yr or half the capacity of well LRG-4793) was simulated as being pumped from layer 2 at the pumping center. The remainder of the diversion right was simulated as being pumped from layer 1 (table 6).

The application scenarios simulate the effects of increasing diversions at each of the replacement wells to 800 ac-ft/yr. The replacement wells were simulated as pumping from the same model cells as the original wells, but entirely from layer 2. Applications were filed at the end of 1998 and beginning of 1999, and the wells were drilled and began pumping in 1999, so simulated diversions were increased to 800 ac-ft/yr at each location separately starting in 1999. Pumping of the remainder of the AWSD right was simulated in the same manner as baseline, with 290.4 ac-ft/yr pumped from layer 2 (tables 7-8).

All AWSD wells (figure 2) are located within the High Impact Area (HIA) of the Mesilla Valley Administrative Area (MVAA). The guidelines for review of water right applications in the MVAA (Turney, 1999; p. 7) state at section C.5 that for non-irrigation ground-water appropriations within the HIA the aquifer depletion is assumed to be equal to the diversion rate, until a return flow plan has been accepted by the state engineer. Because AWSD has no accepted return flow plan, the entire diversion amount (2,225.9 ac-ft/yr) was diverted without return flow in all scenarios.

Hydrologic effects

Drawdowns at replacement wells LRG-4793-S-2 and LRG-4793-S-8

Drawdowns in model cells containing the AWSD wells under the baseline and application scenarios calculated using the OSELRG model are summarized in tables 6-8. After 40 years of baseline diversions calculated drawdown in layer 1 at cell R28C18 is 15.8 feet, and drawdown in layer 2 is 5.3 feet. Baseline drawdowns in layer 1 at the cells containing wells S-2 (R27C18) and S-8 (R28C19) are 6.9 feet and 3.4 feet, respectively. Note that baseline drawdowns do not change from 40 to 100 years. These represent average drawdowns over the entire area of each cell.

Actual drawdowns at and near wells LRG-4793-S-2 and LRG-4793-S-8 would differ from the cell-wide averages calculated by the model. The Theis analytical method was used to better estimate drawdowns at and near the wells. The computer program TH94S developed by the OSE Hydrology Bureau was used to make the calculations. This program calculates drawdown at user specified coordinates in an infinite strip, non-leaky aquifer with user specified boundaries and one or more pumping wells with variable pumping schedules, using the Theis analytical equation.

A no-flow boundary was placed 13,200 feet (2.5 miles) northeast of well LRG-4793-S-2, simulating the faulted margin of the Mesilla Basin, and a constant head boundary was placed 8,400 feet southwest of this well, simulating the Rio Grande. Transmissivity determined from the pumping test at replacement well LRG-4793-S-2 (40,000 gpd/ft) and the model layer 2 storage coefficient of 0.0004 were used for the intermediate zone. Additional drawdown due to head losses in the wells was estimated based on an assumed well efficiency of 75 percent (Driscoll, 1986; p. 555).

The MVAA guidelines state that for the purpose of determining water-level decline due to existing rights, estimates in SSP&A (1987) may be used (Turney, 1999; p. 8). No projected drawdowns are reported for T26S, R3E in SSP&A (1987; table 8), but drawdowns reported for eight wells in T26S, R2E and T27S, R3E in the year 2100 range from 2 to 8 feet. Figure A-17 of SSP&A (1987) indicates less than 10 feet of drawdown in the Anthony area in the year 2100 from existing rights. Therefore 10 feet was added to all drawdowns as a conservative estimate of the effect of existing rights.

Estimated drawdowns are summarized in tables 9-11. After 100 years, estimated drawdowns due to diversions and well losses at LRG-4793-S-2 and LRG-4793-S-8 are 40 feet and 41 feet, respectively. Even with the addition of drawdowns due to existing rights (10 feet), and those resulting from combined diversions at both wells of 800 ac-ft/yr each, the replacement wells retain water columns of about 400 feet after 100 years (table 11).

<u>Effects on wells of other ownership</u>

Drawdowns at wells nearest LRG-4793-S-2 and LRG-4793-S-8 (figure 2) estimated using the Theis method are presented in tables 9-11. After 100 years drawdowns at the nearest wells resulting from existing rights and the proposed diversions are 20 feet or less (tables 9-10). Simultaneous diversion of 800 ac-ft/yr each at both of the replacement wells results in estimated drawdowns at the nearest wells of less than 25 feet (table 11). These drawdowns will not have a significant impact on the wells, with the possible exception of well LRG-3354, where an estimated 20 to 24 feet of drawdown could occur (tables 10-11). This well is only 63 feet deep and could be deepened to regain supply, which is the case in general for any shallow wells that may be affected by drawdown in the Anthony area. Given that estimated drawdowns at the nearest wells are less than 25 feet, the proposed diversions should not have significant effect on water columns in wells located farther from wells LRG-4793-S-2 and LRG-4793-S-8. None of the estimated drawdowns result in average annual rates of water-level decline exceeding the criterion in the MVAA guidelines of 1.0 foot per year (Turney, 1999; p. 2).

<u>Surface water depletions</u>

Surface water depletions under the baseline and application scenarios for both LRG-4793-S-2 and LRG-4793-S-8 estimated using the OSELRG model are summarized in table 12 and illustrated in figures 5-8. Depletion curves for both applications are similar, and include residual depletions from the original wells. Diverting 800 ac-ft/yr at either replacement well would temporarily increase depletions above baseline (figures 5 and 7). Depletions from LRG-4793-S-2 are estimated to be about 128 ac-ft/yr greater than baseline in year one, and decrease after seven years to less than baseline (figure 6). Estimated depletions from LRG-4793-S-8 are about 157 ac-ft/yr greater than baseline in year one, and decrease after 10 years to less than baseline (figure 8). Impacts at LRG-4793-S-8 are greater and persist for a longer period because the net increase in diversion (700 ac-ft/yr) is greater at this well. At both wells the baseline and application depletions eventually converge and approach the diversion rate of 2,225.9 ac-ft/yr. The sum of the net depletions represents the combined effects of both applications (table 12).

The MVAA guidelines (Turney, 1999; p. 5) state at C.1 that because of the uncertainty in hydrogeologic characteristics, offsets of surface water depletions will not be required when the proposed activity results in an increased calculated depletion of less than three percent of the total amount of water diverted and consumed. Increasing diversions to 800 ac-ft/yr at well LRG-4793-S-2 or well LRG-4793-S-8 will temporarily result in increased calculated depletions of almost six to seven percent, respectively, of the total permitted right of 2,225.9 ac-ft/yr. Schedules could be developed whereby diversion at each replacement well could be increased to 800 ac-ft/yr over time, while maintaining depletions at or below the MVAA offset criteria.

Effects on water quality

Mesilla Valley administrative objective 5 states that existing water quality for all beneficial uses may not be impaired (Turney, 1999; p. 3). Degradation of water quality in the basin-fill aquifer may occur as a result of increased pumping from replacement wells LRG-4793-S-2 and LRG-4793-S-8. Pumping from deeper zones could induce the movement of higher TDS water towards the pumping center. Referring to the City of Las Cruces well field, Wilson and others (1981; p. 47) noted that:

> Water quality may degrade slowly with time as pumpage continues to enlarge the cone of depression around the well field. Any deterioration in water quality that occurs will be due to the movement of slightly saline water laterally or downward into the cone of depression.

This is essentially a consequence of changes in the head distribution and the vertical and lateral hydraulic gradients in the aquifer as a result of pumping. It is possible that these same hydraulic mechanisms could lead to water quality degradation in the Anthony area as a result of pumping the new wells. Noting that such degradation has been observed in the City of El Paso's Cañutillo well field south of Anthony, LWA (1994; p. 7) stated:

> Wells pumping from the Santa Fe Group below the alluvial aquifer are likely to suffer long-term water quality degradation due to the downward movement of saline water into the producing interval of the wells…Downward intrusion of saline water is caused by water level declines in the Santa Fe Group.

The potential for water-quality degradation resulting from the proposed diversions was evaluated using drawdown calculations made with the OSELRG model. Drawdowns in layer 1 and layer 2 were compared to provide an estimate of the relative change in hydraulic heads between the shallow zone and the intermediate zone that could be induced by diverting 800 ac-ft/yr from each of the replacement wells.

Under the baseline scenario drawdowns in layer 1 model cells near the AWSD wells are greater than layer 2 drawdowns, because the bulk of the full diversion occurs in layer 1 (table 6). With the shift of 800 ac-ft/yr of diversion to the intermediate zone (layer 2) under the application scenarios drawdowns are lower in layer 1, and greater in some layer 2 model cells. Under the S-2 application scenario layer 2 drawdown in the model cell containing well S-2 is about 3.8 feet greater than baseline, while drawdown in neighboring cells increases by about one to two feet over baseline drawdowns (table 7). Under the S-8 application scenario layer 2 drawdown in the model cell containing well S-8 increases by about 4.3 feet (table 8). These drawdowns represent averages over the entire area of the model cell. As indicated by the Theis calculations, actual drawdowns in the intermediate zone (layer 2) at and near the wells would be greater than those calculated by the model, presumably resulting in greater potential for downward flow.

In both cases the layer 2 drawdowns in the cells containing the replacement wells are greater under the application scenarios than under the baseline scenario, indicating the potential to create or increase downward flow in the vicinity of the wells (tables 7-8). Near well S-2 drawdown is estimated to be 3 feet greater in layer 2 than in layer 1, and drawdown near well S-8 is estimated to be 4.3 feet greater in layer 2 than in layer 1.

Nickerson and Myers (1993) found downward vertical hydraulic gradients at their Cañutillo site about three miles south of Anthony. If downward flow exists between the shallow zone and the intermediate zone in the Anthony area then the estimated head changes would represent incremental increases in an existing gradient. Quantification of any water quality degradation (i.e., changes in TDS in the intermediate zone) would involve detailed investigation of the geochemistry, hydraulics, and existing vertical gradients in the aquifer in the Anthony area, and was beyond the scope of this study. The uncertainty regarding these factors renders determination of the magnitude of the potential water quality effects of applications LRG-4793-S-2 and LRG-4793-S-8 a matter of conjecture, given the resources available for this investigation.

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Figure 1. Hydrologic and administrative features in the vicinity of Anthony, New Mexico

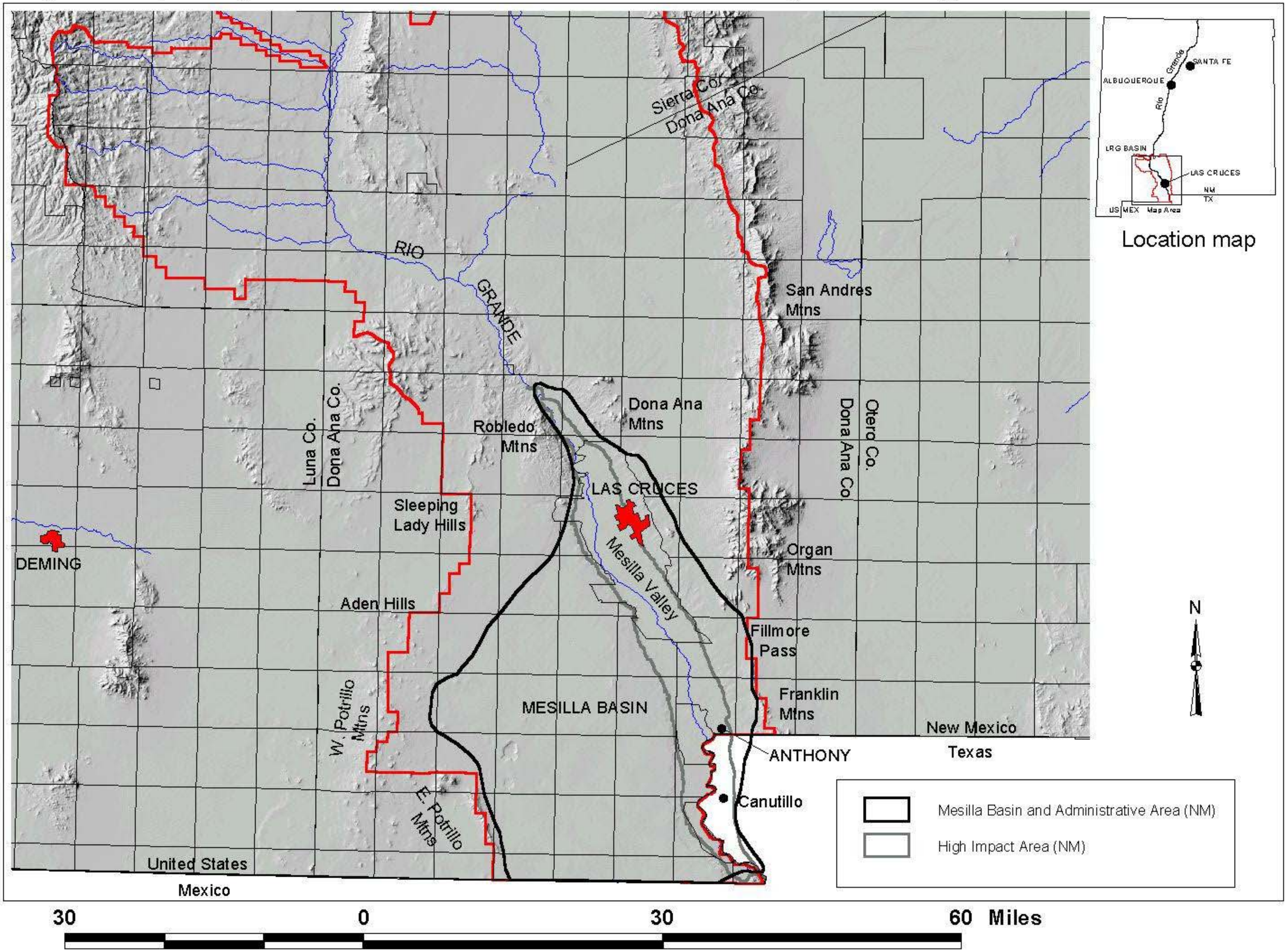


Figure 2. Locations of wells LRG-4793 et al. and nearby wells of other ownership

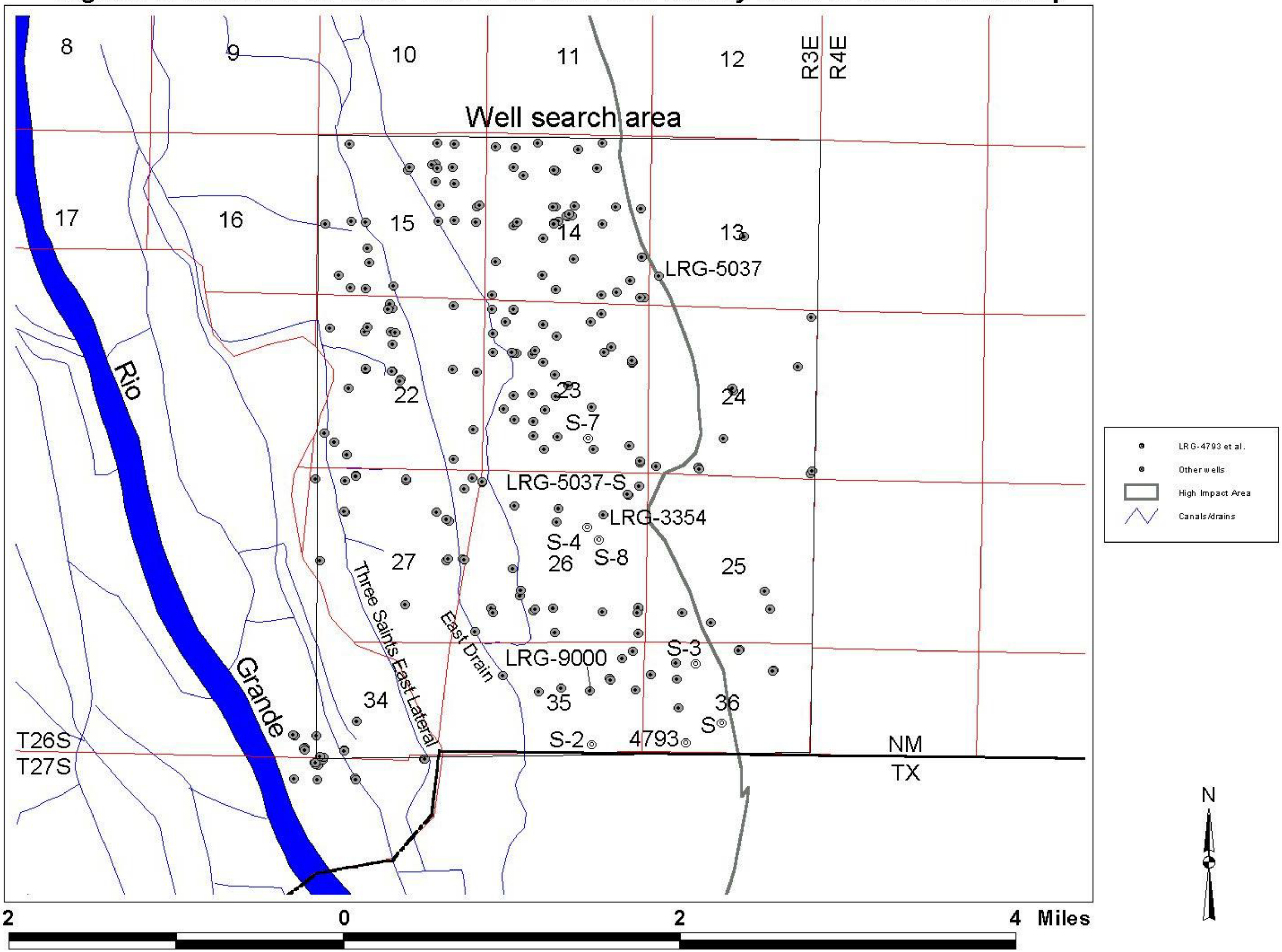


Figure 3. Finite-difference grid for the OSELRG model

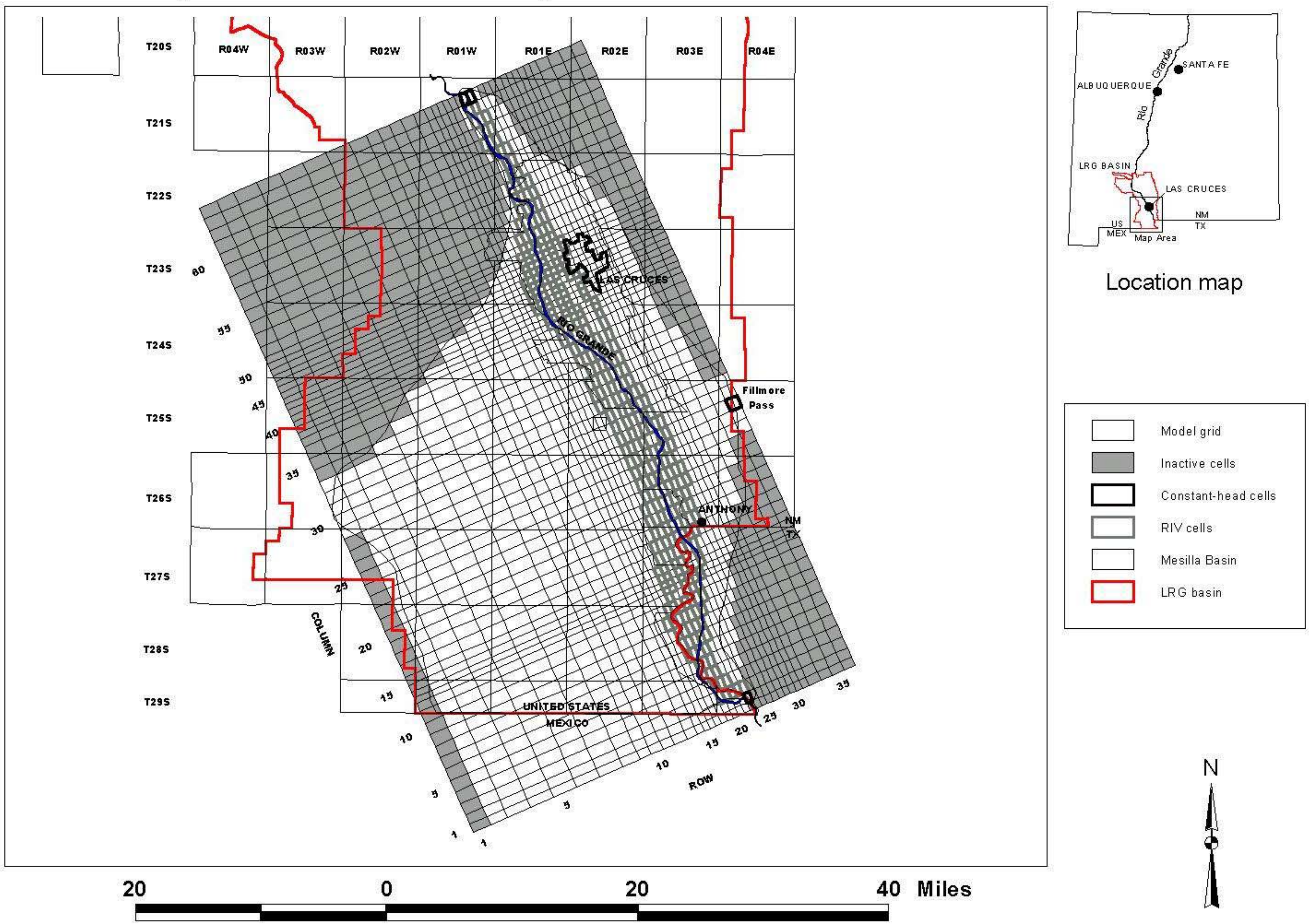


Figure 4. Locations of wells LRG-4793 et al. in relation to the model grid

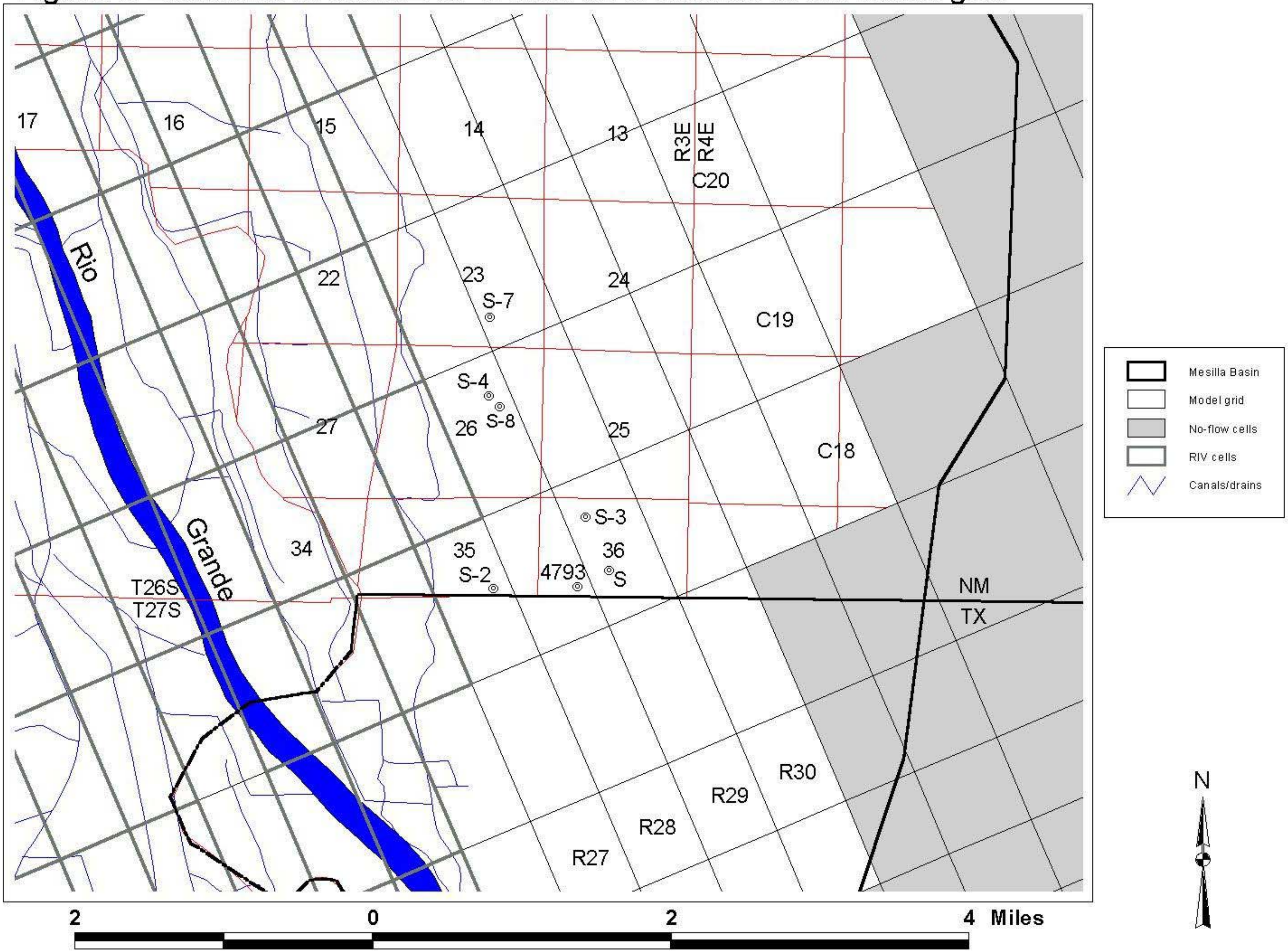


Figure 5. Depletions under baseline and LRG-4793-S-2 application scenarios

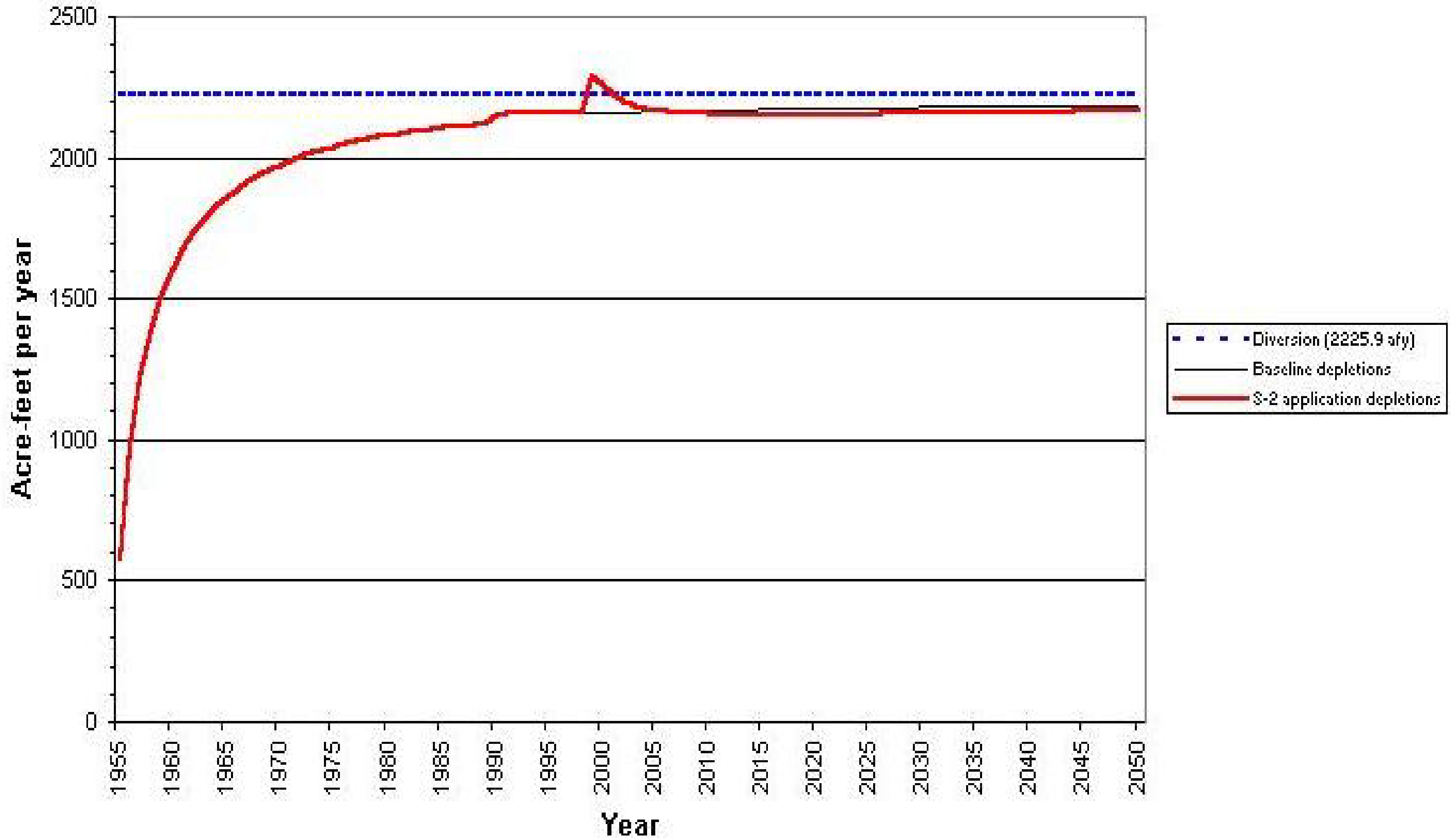
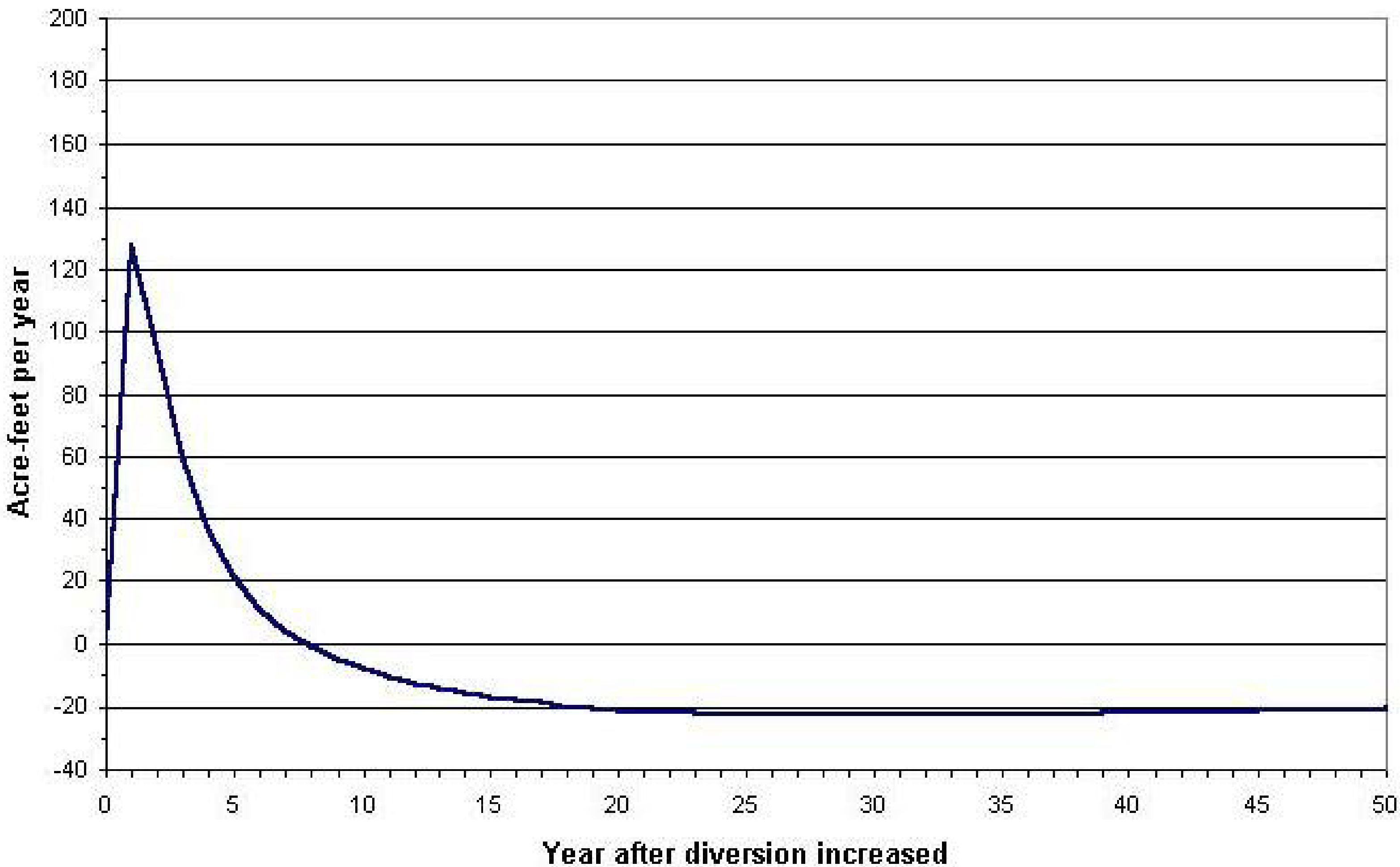


Figure 6. Net depletions from increasing diversion to 800 acre-feet per year under application LRG-4793-S-2



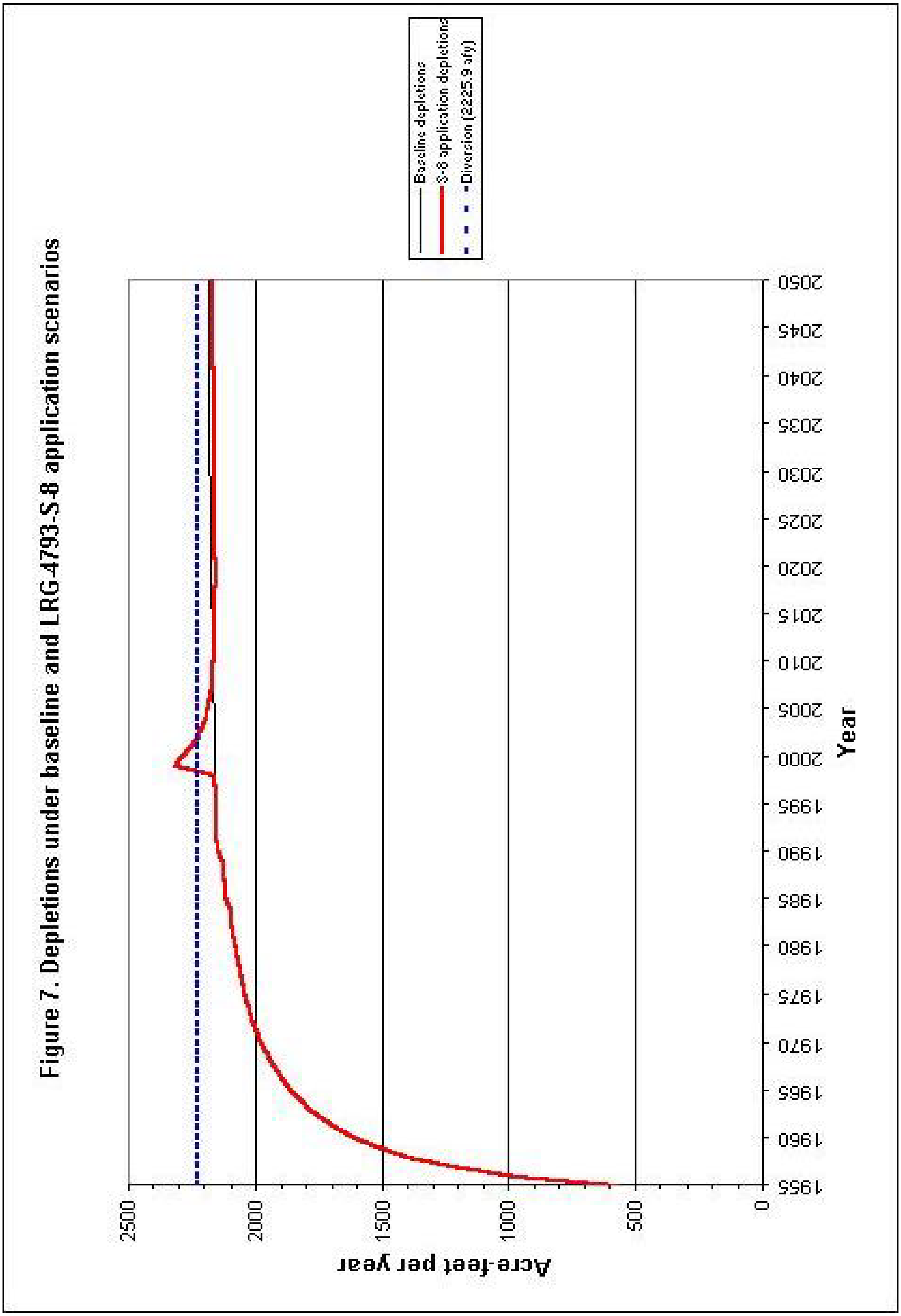
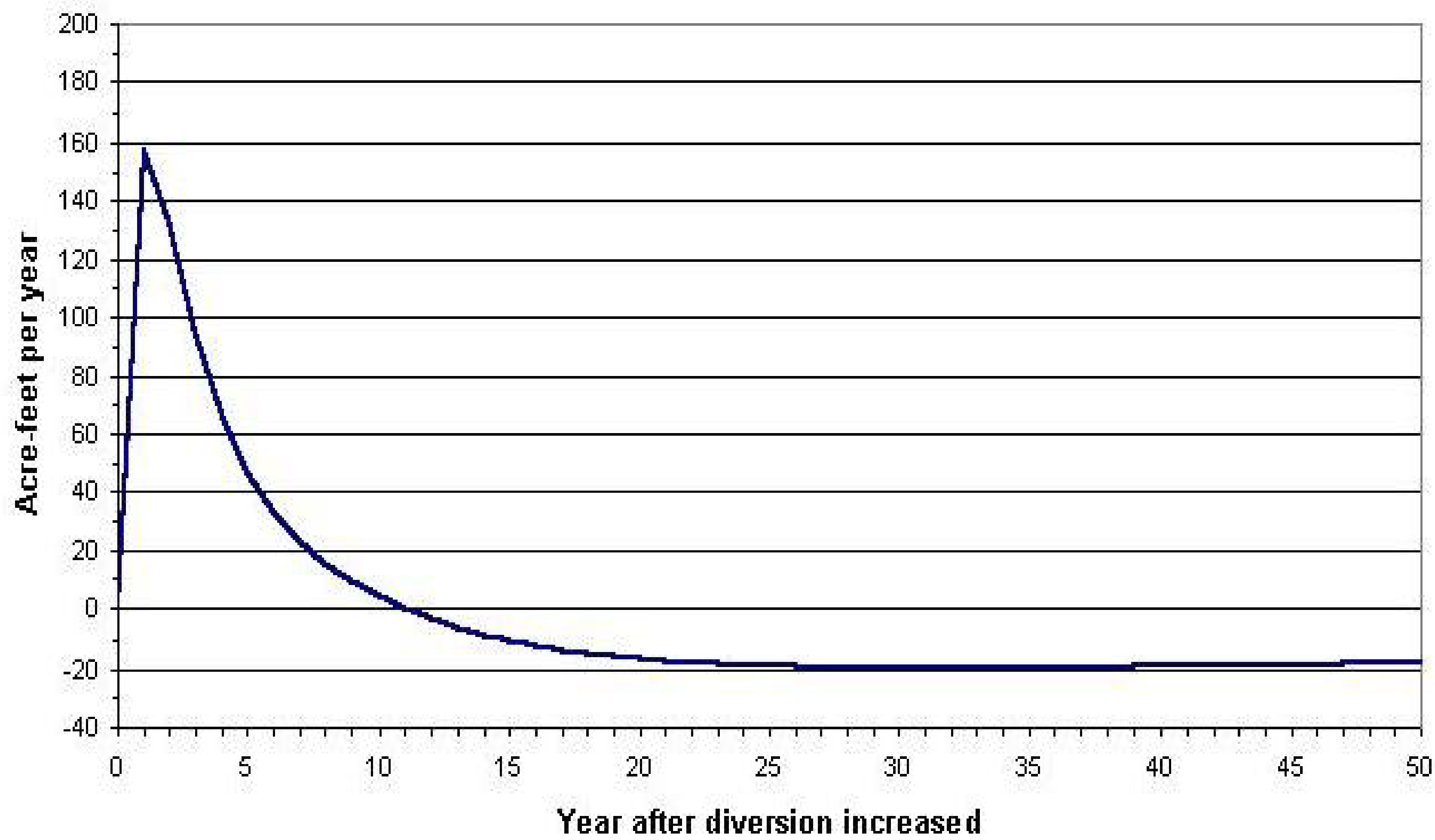


Figure 7. Depletions under baseline and LRG-4793-S-8 application scenarios

Figure 8. Net depletions from increasing diversion to 800 acre-feet per year under application LRG-4793-S-8



TABLES

New Mexico Office of the State Engineer
Technical Division Hydrology Report 01-1

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Table 1. Wells and water rights near wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8, Anthony Water and Sanitation District.
T26S, R03E, Sections 13-15, 22-27, 34-36

Notes at end of table.

File number	Use[a]	Diversion[b]	Owner	Status[c]	Well number	Tws	Rng	Sec	q	q	q	Date	Depth[d]	DTW[e]	WC[f]
LRG 00046	IRR	2002	JOHN B. COLQUITT		LRG 00046	26S	03E	35	1	4	1	10/31/65	900	44	856
					LRG 00046 S	26S	03E	34	4	2	3	10/31/81	1300	35	1265
LRG 00075	IRR	33	DELOS WAGNON	DEC	LRG 00075	26S	03E	14	4	4	3	10/31/71	200	85	115
LRG 00365	DOM	3	ABLERT HERRERA		LRG 00365	26S	03E	14	1			11/1/80	146	62	84
LRG 00551	IRR	46	CLIFFORD H. & W. E. LEIFESTE		LRG 00551	26S	03E	23	2	4		7/8/81	159	52	107
					LRG 00551 S	26S	03E	23	2	4		6/15/81	157	55	102
LRG 00551 B	IRR	42	ANTHONY F. CIESZKIEWICZ		LRG 00551	26S	03E	23	2	4		7/8/81	159	52	107
LRG 00589	DOM	3	BARBARA NEWMAN		LRG 00589	26S	03E	22	1	2	3	7/26/85	150	4	146
LRG 00667	IRR	82.75	ANTOINETTE HURLEY	DEC	LRG 00667	26S	03E	26	4	4	2	12/31/58	300		
LRG 00667 A	IRR	24.53	HUSTA A. OTH	DEC	LRG 00667	26S	03E	26	4	4	2	12/31/58	300		
LRG 00667 BA	COM	25	SIERRA VISTA WHOLESALE GROWER	DEC	LRG 00667	26S	03E	26	4	4	2	12/31/58	300		
LRG 00674	IRR	116.05	JAMES R. CRAVENS	DEC	LRG 00674	26S	03E	22	3	3	1	12/31/58	80	15	65
LRG 00705	IRR	806.4	JACK F. DARBYSHIRE	DEC	LRG 00705	26S	03E	27	1	2	1	12/31/50	120		
				DEC	LRG 00705 S	26S	03E	27	2	1	1	12/31/51	150		
				DEC	LRG 00705 S-2	26S	03E	27	2	1	1	12/31/62	95		
				DEC	LRG 00705 S-3	26S	03E	27	1	1	2	12/31/62	95		
				DEC	LRG 00705 S-4	26S	03E	27	1	2	1	4/30/78	1052		
LRG 00706	DOM	3	JACK F. DARBYSHIRE		LRG 00706	26S	03E	27	1			12/31/64	290		
LRG 00707	DOM	3	JACK F. DARBYSHIRE		LRG 00707	26S	03E	27	1			12/31/62	150		
LRG 00904	DOM	3	MAURICE & LOUISE MOULDER		LRG 00904	26S	03E	34	3	1	0	12/31/50	96		
LRG 00937	DOM	3	EDITH DONALDSON	DEC	LRG 00937	26S	03E	24				12/31/67			
LRG 00938	DOM	3	EDITH DONALDSON	DEC	LRG 00938	26S	03E	24				12/31/64			
LRG 00939	IRR	6	EDITH DONALDSON	DEC	LRG 00939	26S	03E	24	4	4	4	12/31/54	250		
LRG 01020	DOM	3	JUAN V. NAVARETTE		LRG 01020	26S	03E	27	4	2	1	12/31/72	290		
LRG 01021	IRR	377.1	JUAN V. NAVARETTE	DEC	LRG 01021	26S	03E	27	4	2	1	12/31/78	700		
LRG 01022	IRR	347.4	JUAN V. NAVARETTE	DEC	LRG 01022	26S	03E	15	1	1	2	12/31/78	280		
LRG 01195	IRR	546.75	LENMARK PARTNERSHIP	PMT	LRG 01195	26S	03E	22	3	1	2	9/27/95	102	5	97
LRG 01223	IRR	71.886	WILLIAM & BARBARA HARPER	DEC	LRG 01223	26S	03E	15	3	1	2	12/31/50	100		
LRG 01250	IRR	60	J. E. KNOTT	DEC	LRG 01250	26S	03E	23	1	4	1	10/12/72	209	42	167
LRG 01316	DOM	3	VALENTIN AVALOS		LRG 01316	26S	03E	24	2	4		12/31/76	114		
LRG 01357	DOM	3	LUIS M. GARCIA		LRG 01357	26S	03E	23	1	1	0	1/1/77	40		
LRG 01399	DOM	3	HELEN LAWSON		LRG 01399	26S	03E	22	3	3	0	1/1/52	120		
LRG 01404	DOM	3	ANTONIO MUNOZ		LRG 01404	26S	03E	22	0	0	0	1/1/61	147		
LRG 01421	DOM	3	JESUS RUEDAS		LRG 01421	26S	03E	15	3	3	0	2/1/71	60		
LRG 01434	DOM	3	SAMUEL W. WARTHEN		LRG 01434	26S	03E	14	0	0	0	3/19/70	180		
LRG 01451	IRR	24	JAMES & JEANETTE HARRIS	PMT	LRG 01451	26S	03E	23	3	4	1	5/10/94	260	42	218
LRG 01526	DOM	3	JAMES R. CRAVENS		LRG 01526	26S	03E	22	0	0	0	1/1/45	100		
LRG 01527	DOM	3	JACK GRACIE	PMT	LRG 01527	26S	03E	34	3	1	0	8/16/82	347	11	336

Table 1. Wells and water rights near wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8 (continued).

File number	Use[a]	Diversion[b]	Owner	Status[c]	Well number	Tws	Rng	Sec	q	q	q	Date	Depth[d]	DTW[e]	WC[f]
LRG 01542	IRR	950.34	LENMARK PARTNERSHIP	DEC	LRG 01542	26S	03E	22	1	4	4	12/31/59	100		
				DEC	LRG 01542 S	26S	03E	22	1	4	3	12/31/59	100		
LRG 01542 A	IRR	168.3	MARGARITA ONTIVEROS	DEC	LRG 01542	26S	03E	22	1	4	4	12/31/59	100		
				DEC	LRG 01542 S	26S	03E	22	1	4	3	12/31/59	100		
LRG 01568	DOM	3	JOSEPH W. ALEXANDER	PMT	LRG 01568	26S	03E	23	4	3		7/1/81	244	59	185
LRG 01635	IRR	0	COLQUITT COMPANY	PMT	LRG 00046 S	26S	03E	34	4	2	3	10/31/81	1300	35	1265
LRG 01648	DOM	3	LUIS F. MUNOZ	PMT	LRG 01648	26S	03E	36	2			5/12/81	220	165	55
LRG 01674	IRR	1170.18	MIKE DIPP, SR.	DEC	LRG 01674	26S	03E	27	3	1	1	12/31/59	400		
				PMT	LRG 01674 S	26S	03E	27	4	2	2	3/12/90	1050	37	1013
				DEC	LRG 01674 S-2	26S	03E	27	4	2	2	12/31/59	400		
LRG 01714	DOM	3	JOSE B. NEVAREZ	PMT	LRG 01714	26S	03E	36	2			5/22/81	220	165	55
LRG 01774	DOM	3	CLARENCE CAHOON	DEC	LRG 01774	26S	03E	15	3	4	3				
LRG 01775	IRR	166.89	CLARENCE CAHOON	DEC	LRG 01775	26S	03E	15	3	2	1	12/31/78	250		
					LRG 01775 S	26S	03E	15	3	2	3	12/31/58	200		
LRG 01794	DAI	39.01	DBA DE GRAAF FARMS		LRG 01794	26S	03E	25	4	3	2		501		
					LRG 01794 S	26S	03E	25	4	1	4	12/31/65	300		
					LRG 01794 S-2	26S	03E	25	3	4		7/30/82	501	125	376
LRG 01845	DOM	3	GISH FARMS	PMT	LRG 01845	26S	03E	22	4	4	3	12/31/59	100		
LRG 01846	DOM	6.5	GUILLERMO JACQUEZ	PMT	LRG 01846	26S	03E	36	1	3	1	1/19/85	147	47	100
LRG 01920	DOM	6	REFUGIO GIRON		LRG 01920	26S	03E	27	2	2			60		
LRG 01977	DOM	0	MIKE & MICHAEL G. WEATHERLY		LRG 01977	26S	03E	23				12/31/64	232		
LRG 01978	IRR	0	MIKE & MICHAEL G WEATHERLY	PMT	LRG 01978	26S	03E	23	2	3	2	6/30/78	203	55	148
LRG 02039	DOM	3	ANGEL S. MARTA	PMT	LRG 02039	26S	03E	14	4	4		9/5/81	200	91	109
LRG 03178	DOM	15	GUS F. BIGELOW		LRG 03178	26S	03E	36	2	1	1	12/31/67	187	119	68
LRG 03196	MUL	3	SYBIL BRADLEY		LRG 03196	26S	03E	34	3	3	1	6/30/40	84	8	76
LRG 03354	DOM	3	LAURO SANCHEZ	PMT	LRG 03354	26S	03E	26	2			3/23/82	63		
LRG 03466	DOM	3	CECIL E. BALLARD	PMT	LRG 03466	26S	03E	23	2	4		2/25/87	432	62	370
LRG 03466 S	DOM	3	CECIL E. BALLARD	PMT	LRG 03466 S	26S	03E	23	2	4	0	2/25/87	432	62	370
LRG 03499	DOM	3	ANTONIO DE LA O	PMT	LRG 03499	26S	03E	14	1	2	1	7/3/82	185	57	128
LRG 03501	DOM	3	I. C. ARCHIBEQUE	PMT	LRG 03501	26S	03E	34	3	1	4	3/18/86	294	15	279
LRG 03571	DOM	3	ROBERTO GOMEZ	PMT	LRG 03571	26S	03E	14				6/11/82	160	107	53
LRG 03601	DOM	3	MIGUEL GUILLEN	PMT	LRG 03601	26S	03E	36	2			8/11/82	148	61	87
LRG 03608	DOM	3	RAMON MENDOZA	PMT	LRG 03608	26S	03E	14	3	4		8/14/82	168	62	106
LRG 03618	DOM	3	HAROLD MORGAN	PMT	LRG 03618	26S	03E	34	3	1		9/21/82	294	15	279
LRG 03643	DOM	3	MARY THATCHER	PMT	LRG 03643	26S	03E	34				8/14/82	306	11	295
LRG 03650	DOM	3	RUBEN & BLANCA DOMINGUEZ	PMT	LRG 03650	26S	03E	14				7/27/83			
LRG 03700	DOM	3	WILLIAM N. RYE	PMT	LRG 03700	26S	03E	14	3	2		10/9/82	142	65	77
LRG 03702	DOM	3	STEVE F. AGUIRRE	PMT	LRG 03702	26S	03E	23	1	2		10/7/82	152	61	91
LRG 03852	DOM	3	SABINO HIDALGO	PMT	LRG 03852	26S	03E	23	2			12/7/82	150	67	83
LRG 03898	DOM	3	HECTOR MARQUEZ	PMT	LRG 03898	26S	03E	27	2			11/13/82	400	22	378

Table 1. Wells and water rights near wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8 (continued).

File number	Use[a]	Diversion[b]	Owner	Status[c]	Well number	Tws	Rng	Sec	q	q	q	Date	Depth[d]	DTW[e]	WC[f]
LRG 03984	DOM	3	IVA WINEBRENNER	PMT	LRG 03984	26S	03E	34	3	1		2/8/83	305	12	293
LRG 04210	SAN	3	NM STATE HIGHWAY DEPT.	PMT	LRG 04210	26S	03E	14	2	4	3	11/3/83	600	96	504
LRG 04304	DOM	3	IVAN LIRA	PMT	LRG 04304	26S	03E	14	0	0	0	8/5/83	150	80	70
LRG 04323	MUL	3	LORENZO RAMOS	PMT	LRG 04323	26S	03E	23	2	1	0	8/16/83	180	48	132
LRG 04369	DOM	3	RUBEN & MARIA L. MARQUEZ	PMT	LRG 04369	26S	03E	23	2	1	2	10/3/83	162	48	114
LRG 04373	DOM	3	A. L. FOR HELEN LAUSON LAROCK	PMT	LRG 04373	26S	03E	22	3	3	4	9/1/83	125	10	115
LRG 04432	DOM	3	JESUS M. & JULIE CABRALES	PMT	LRG 04432	26S	03E	27	2	4	1	11/1/83	62		
LRG 04466	SUB	483	MINOT IV PRATT	DEC	LRG 04466	26S	03E	15	2	4	4	10/1/77	700		
LRG 04467	SUB	539	MINOT IV PRATT	DEC	LRG 04467	26S	03E	15	2	1	4				
				DEC	LRG 04467 S	26S	03E	15	2	1	3		200		
LRG 04468	DOM	3	MINOT IV PRATT	DEC	LRG 04468	26S	03E	15	2	1	3				
LRG 04582	DOM	3	WALTER R. DAVIS	PMT	LRG 04582	26S	03E	23	3	1	0	2/15/84	162	12	150
LRG 04781	MUL	3	MANUEL & YOLANDA SILVA TRUST	PMT	LRG 04781	26S	03E	34	3	3	1	5/17/84	105	8	97
LRG 04976	IRR	36	EDWIN R. ADAMS	DEC	LRG 04976	26S	03E	23	4	1		12/31/62	200	45	155
LRG 04978	IRR	120	EDWIN R. ADAMS	DEC	LRG 04978	26S	03E	23	3	2		12/31/75	224	40	184
LRG 05037	MDW	340	DESERT SANDS MDWC ASSN.	PMT	LRG 05037	26S	03E	13	3	3	1	11/4/97	750	62	688
				PMT	LRG 05037 S	26S	03E	26	2	2		11/20/84	432	77	355
LRG 05048	MUL	5	EDWIN R. ADAMS	DEC	LRG 05048	26S	03E	23	3	2	2	12/31/50	200		
LRG 05086	SAN	3	EDWIN R. ET AL ADAMS	PMT	LRG 05037 S	26S	03E	26	2	2		11/20/84	432	77	355
LRG 05262	DOM	3	HENRY MUSSMAN	DEC	LRG 05262	26S	03E	24	3	4	2	1/1/56	180		
				PMT	LRG 05262 S	26S	03E	24	3	4	3	3/22/85	278	165	113
LRG 05291	DOM	3	EMILIO & SUSIE PROVENCIO	DEC	LRG 05291	26S	03E	34	3	2	0	1/1/54	80		
LRG 05292	DOM	3	EMILIO & SUSIE PROVENCIO	DEC	LRG 05292	26S	03E	34	3	2	0	1/1/76	281		
LRG 05296	IRR	21.66	EMILIO PROVENCIO	DEC	LRG 05296	26S	03E	34	3	4	2	1/1/51	100		
				DEC	LRG 05296 S	26S	03E	34	3	4	2	2/28/58	270		
LRG 05343	IRR	540	JOHN A. CROSSETT	DEC	LRG 05343	26S	03E	26	1	4	2	12/31/52	240	38	202
				DEC	LRG 05343 S	26S	03E	26	3	4	2	12/31/58	144	22	122
LRG 05344	IRR	5	JOHN A. CROSSETT	DEC	LRG 05344	26S	03E	26	3	4	4	12/31/45	30		
LRG 05345	COM	38	JOHN AMIS CROSSETT	DEC	LRG 05345	26S	03E	26	3	2	3	1/1/51	22		
LRG 05371	IRR	33	JUAN H. VASQUEZ	PMT	LRG 05371	26S	03E	26	1	2	4	1/31/86	85	30	55
LRG 05375	DOM	3	RAYMUNDO D. LIMAS	PMT	LRG 05375	26S	03E	25	3	3	2	6/24/85	175	64	111
LRG 05383	COM	28	JOHN AMIS CROSSETT	DEC	LRG 05383	26S	03E	26	3	4	1	1/1/60			
LRG 05384	DOM	3	JOHN A. CROSSETT	DEC	LRG 05384	26S	03E	26	3	1	4	1/1/45			
LRG 05408	DOM	3	CRESENCIO JR. SALGADO	PMT	LRG 05408	26S	03E	23	3	1	2	6/14/85	160	12	148
LRG 05820	DAI	232.27	DEL ORO DAIRY	DEC	LRG 05820	26S	03E	23	4	4	4	1/1/78	200		
				DEC	LRG 05820 S	26S	03E	23	4	4	4	1/1/80	250		
				PMT	LRG 05820 S2	26S	03E	23	4	4		11/20/89	300	31	269
LRG 05985	DOM	3	GILBERTO OROZCO	PMT	LRG 05985	26S	03E	14	2	1	2	4/2/86	165	80	85
LRG 06027	DOM	3	JAVIER & NATALIA SALAZAR	PMT	LRG 06027	26S	03E	14	1	2	4	4/11/86	180	41	139
LRG 06028	COM	9	WALTER & KARI FRAN SOUKUP HUTC	DEC	LRG 06028	26S	03E	35	1	4	4	12/31/52	126		

Table 1. Wells and water rights near wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8 (continued).

File number	Use[a]	Diversion[b]	Owner	Status[c]	Well number	Tws	Rng	Sec	q	q	q	Date	Depth[d]	DTW[e]	WC[f]
LRG 06030	DOM	3	ABRAHAM ALVAREZ	PMT	LRG 06030	26S	03E	26	4	4	4	3/25/86	92	57	35
LRG 06234	DOM	3	RALPH SR. BOONE	PMT	LRG 06234	26S	03E	34	3	1	2	7/1/86	270	5	265
LRG 06361	DOM	3	ROY BLANKLEY	PMT	LRG 06361	26S	03E	34	3	1	1	11/20/86	141	6	135
LRG 06520	DOM	3	JAMES R. HARRIS	PMT	LRG 06520	26S	03E	23	3	4	2	11/1/87	129		
LRG 06558	DOM	3	ELBERT E. WHETTEN	PMT	LRG 06558	26S	03E	15	4	2	1	1/14/88	200	18	182
LRG 06561	SAN	3	DONA ANA COUNTY -	PMT	LRG 06561	26S	03E	24	3	3	3	1/5/89	453	77	376
LRG 06636	DOM	3	DAVID LIPPS	PMT	LRG 06636	26S	03E	23	3	4	0	6/12/87	206	40	166
LRG 06637	MUL	3	OSCAR LOPEZ	PMT	LRG 06637	26S	03E	34	3	1	4	5/15/87	138	5	133
LRG 06720	DOM	3	ROGER L. MONTGOMERY	PMT	LRG 06720	26S	03E	22	1	4	2	7/14/87	63	14	49
LRG 06777	DOM	3	NICHOLAS GORDON	PMT	LRG 06777	26S	03E	24	3	4	3	1/30/88	319	175	144
LRG 06802	DOM	3	ANGEL R. GUZMAN	PMT	LRG 06802	26S	03E	15	4	2	2	2/23/88	195	16	179
LRG 07005	DOM	3	GEORGE VEIGA	PMT	LRG 07005	26S	03E	15	2	4	4	7/13/88	212	38	174
LRG 07038	DOM	3	MANUEL QUESADA	DEC	LRG 07038	26S	03E	36	1	3	2	1/1/79	216		
LRG 07039	DOM	3	MANUEL QUESADA	DEC	LRG 07039	26S	03E	26	4	3	2	1/1/79	216		
LRG 07041	DOM	3	RAYMUNDO GOMEZ	DEC	LRG 07041	26S	03E	36	3	1	2	1/1/79	210		
LRG 07075	DOM	3	YOLANDA HERNANDEZ	PMT	LRG 07075	26S	03E	34	3	1	4	11/18/88	320	15	305
LRG 07242	DOM	3	CHRISTINA TORRES	PMT	LRG 07242	26S	03E	14	4	2	4	8/1/90	150	85	65
LRG 07260	DOM	3	MANNY JR. RIVERA	PMT	LRG 07260	26S	03E	22	4	4	2	5/30/91	60	12	48
LRG 07394	DOM	3	ALMA CHAVEZ FLEMING	PMT	LRG 07394	26S	03E	34	3	1	4	3/9/90	90	9	81
LRG 07399	DOM	3	GUADALUPE MORA	PMT	LRG 07399	26S	03E	15	2	1	4	2/26/90	92	15	77
LRG 07410	NOT	3	INC. JETON	PMT	LRG 07410	26S	03E	22	1	2	3	3/6/90	60	10	50
LRG 07414	DOM	3	JESUS HOLGUIN	PMT	LRG 07414	26S	03E	23	1	1	2	12/13/90	38		
LRG 07486	IRR	100	ANTHONY CEMETERY ASSOCIATION	DEC	LRG 07486	26S	03E	35	2	2	2	12/31/69			
				PMT	LRG 07486 S	26S	03E	35	2	2		12/6/90	452	45	407
LRG 07548	SCH	14.36	GADSDEN IND. SCHOOL DISTRICT	DEC	LRG 07548	26S	03E	34	3	2	3	12/1/94	630	17	613
LRG 07562	DOM	3	GURMAN HOLGUIN		LRG 07562	26S	03E	14	4	4	4				
LRG 07593	SCH	120.29	GADSDEN IND. SCHOOL DISTRICT	DEC	LRG 07593	26S	03E	35	2	4	4	12/31/61	180	48	132
				DEC	LRG 07593 S	26S	03E	35	2	4	1	12/31/73	300		
LRG 07604	PUB	13.36	GADSDEN IND. SCHOOL DISTRICT	PMT	LRG 07604	26S	03E	14	1	4	4	11/19/90	205	55	150
LRG 07614	IRR	70.96	GADSDEN IND. SCHOOL DISTRICT	Plugged	LRG 07614	26S	03E	34	3	3	2	1/1/56	250		
LRG 07749	DOM	3	BENITO TREVINO	PMT	LRG 07749	26S	03E	14	4	3	4	5/22/91	200	80	120
LRG 07924	DOM	3	RAMON & CONNIE GUADERRAMA	PMT	LRG 07924	26S	03E	24	4	4	4	2/12/92	130	40	90
LRG 07972	DOM	3	LAMBERT BONESTROO	PMT	LRG 07972	26S	03E	26	3	1	2	4/15/92	350	92	258
LRG 07976	DOM	3	PEDRO PORRAS	PMT	LRG 07976	26S	03E	13	4	1	1	1/26/93	120	54	66
LRG 08006	DOM	3	RAMON OR SANDRA MARTINEZ	PMT	LRG 08006	26S	03E	15	4	2	1	6/23/92	75	28	47
LRG 08018	IRR	2.5	MARGARITA MEDRANO		LRG 08018	26S	03E	23	1	3	2				
					LRG 80180	26S	03E	23	1	3	2	2/29/76	350		
LRG 08018 A	COM	3.5	DONA ANA MDCWA		LRG 08018	26S	03E	23	1	3	2				
LRG 08028	DOM	3	ROGER POOLE	PMT	LRG 08028	26S	03E	14	1	1	2	7/17/92	200	66	134
LRG 08091	DOM	3	CHARLES J. STEWART	PMT	LRG 08091	26S	03E	26	1	1	1	10/2/92	300	12	288

Table 1. Wells and water rights near wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8 (continued).

File number	Use[a]	Diversion[b]	Owner	Status[c]	Well number	Tws	Rng	Sec	q	q	q	Date	Depth[d]	DTW[e]	WC[f]
LRG 08115	DOM	3	PRIMITIVO REYNOSO	PMT	LRG 08115	26S	03E	23	3	2	1	2/20/93	150	35	115
LRG 08118	DOM	3	JUAN M MURILLO	PMT	LRG 08118	26S	03E	14	3	1	2	4/6/93	200	50	150
LRG 08148	DOM	3	GEORGE D & ARVELL BOHN	PMT	LRG 08148	26S	03E	22	1	2	4	2/3/93	50	7	43
LRG 08183	DOM	3	LORENZO HERNANDEZ	PMT	LRG 08183	26S	03E	14	3	3	1	3/6/93	150	31	119
LRG 08193	DOM	3	JESUS FRANCO	PMT	LRG 08193	26S	03E	35	2	4	1				
LRG 08237	DOM	3	ANTONIO HERNANDEZ	PMT	LRG 08237	26S	03E	24	2	2	2	4/8/93	140	52	88
LRG 08298	DOM	3	MARIANO MOLINA	PMT	LRG 08298	26S	03E	26	2	2	2	10/17/94	120		
LRG 08363	DOM	3	EUSEBIO SANCHEZ	PMT	LRG 08363	26S	03E	26	1	1	1	8/20/93	145	32	113
LRG 08537	DOM	3	ALFREDO R FIERRO	PMT	LRG 08537	26S	03E	22	1	2	4	4/5/94	50	8	42
LRG 08608	DOM	3	IGNACIO 7 BLANCA VILLALOBOS	PMT	LRG 08608	26S	03E	23	3	2	3	7/8/94	78		
LRG 08668	DOM	3	JOSEPH & EDITH FANDEY	PMT	LRG 08668	26S	03E	26	3	4	1	8/30/94	485	47	438
LRG 08688	DOM	3	SALVADOR CASTILLO	PMT	LRG 08688	26S	03E	15	2	2	1	6/29/94	63	18	45
LRG 08691	DOM	3	FAUSTINO K AGUILERA	PMT	LRG 08691	26S	03E	15	2	3	2	12/1/89	45		
LRG 08693	DOM	3	RAMON LOPEZ	PMT	LRG 08693	26S	03E	15	2	4	1	3/20/92	60	28	32
LRG 08701	DOM	3	RUBEN SAENZ	PMT	LRG 08701	26S	03E	15	2	1	4	1/1/91	47	20	27
LRG 08710	DOM	3	ELIAS PAVAZ	PMT	LRG 08710	26S	03E	14	1	1	1	9/30/94	200	48	152
LRG 08794	DOM	3	MARIA D MONTOYA	PMT	LRG 08794	26S	03E	14	2	4	4	1/21/95	150	80	70
LRG 08801	DOM	3	JUDY PENA	PMT	LRG 08801	26S	03E	23	1	4	1	6/19/95	60	25	35
LRG 08810	DOM	3	JUAN JOSE LAGUNA	PMT	LRG 08810	26S	03E	14	4	1	2	2/11/95	250	20	230
LRG 08824	DOM	3	JESUS REYNA	PMT	LRG 08824	26S	03E	14	2	1	4	3/8/95	155	85	70
LRG 08825	DOM	3	MIGUEL CERVANTES	PMT	LRG 08825	26S	03E	14	3	4	4	3/14/95	175	80	95
LRG 08826	DOM	3	ENRIQUE HERNANDEZ	PMT	LRG 08826	26S	03E	14	2	1	1	3/10/95	160	80	80
LRG 08857	DOM	3	JOSE S. BARAJAS	PMT	LRG 08857	26S	03E	14	3	1	2	3/30/95	250	38	212
LRG 08866	DOM	3	TONY CIESZKIEWIEZ	PMT	LRG 08866	26S	03E	14	4	4	4	4/5/95	160	98	62
LRG 08868	DOM	3	PANFILO CALDERON	PMT	LRG 08868	26S	03E	14	3	2	2	4/8/95	250	38	212
LRG 08923	DOM	3	MARIA ALBIDRES	PMT	LRG 08923	26S	03E	14	3	2	2	5/29/95	135	63	72
LRG 08943	DOM	3	RITA M WAGNER	PMT	LRG 08943	26S	03E	34	3	2	3	6/26/95	305	14	291
LRG 08952	MUL	3	ARMANDO SOTO	PMT	LRG 08952	26S	03E	23	1	1	2	6/26/95	80	24	56
LRG 09000	DOM	3	MANUEL PEREZ	PMT	LRG 09000	26S	03E	35	2	3	4	6/5/96	80	21	59
LRG 09020	DOM	3	WILLIAM R URISTA	PMT	LRG 09020	26S	03E	22	2	4	4	8/1/96	53	8	45
LRG 09022	DOM	3	JAVIER MORENO	PMT	LRG 09022	26S	03E	15	2	3	4	3/20/96	40	12	28
LRG 09033	DOM	3	RODOLFO B RIVERA	PMT	LRG 09033	26S	03E	22	1	2	2	9/27/95	78	7	71
LRG 09052	DOM	3	JESUS MACIAS	PMT	LRG 09052	26S	03E	27	2	4	1	12/9/95	345	15	330
LRG 09070	DOM	3	BLANCA TORRES	PMT	LRG 09070	26S	03E	15	2	1	4	11/29/95	40	16	24
LRG 09098	DOM	3	EDWARDO M AGUIRRE	PMT	LRG 09098	26S	03E	22	1	2	2	1/10/96	100	8	92
LRG 09155	DOM	3	MANUEL ALVIDREZ	PMT	LRG 09155	26S	03E	14	3	2	2	2/28/96	130	60	70
LRG 09176	DOM	3	MANUEL GARCIA	PMT	LRG 09176	26S	03E	23	1	2	4	3/5/96	200	20	180
LRG 09201	DOM	3	MANUEL B OLIVAS	PMT	LRG 09201	26S	03E	14	4	3	1	3/19/96	180	80	100
LRG 09204	DOM	3	MARIA DELGADO	PMT	LRG 09204	26S	03E	36	1	4	1	4/25/96	156	65	91
LRG 09215	MUL	3	RAQUEL & ENRIQUE CASTILLO	PMT	LRG 09215	26S	03E	14	2	3	3	4/16/96	200	72	128

Table 1. Wells and water rights near wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8 (concluded).

File number	Use[a]	Diversion[b]	Owner	Status[c]	Well number	Tws	Rng	Sec	q	q	q	Date	Depth[d]	DTW[e]	WC[f]
LRG 09224	DOM	3	ARTURO GASCA	PMT	LRG 09224	26S	03E	23	1	4	4	4/3/96	60	28	32
LRG 09252	DOM	3	BONIFACIO TORREZ	PMT	LRG 09252	26S	03E	15	2	2	3	5/17/96	80	40	40
LRG 09309	DOM	3	ROGELIO HOLGUIN	PMT	LRG 09309	26S	03E	14	3	3	3	5/24/96	152	68	84
LRG 09331	DOM	3	STEVE HERNANDEZ	PMT	LRG 09331	26S	03E	15	3	3	4	6/3/96	120	7	113
LRG 09383	DOM	3	CRESENCIO & CARMEN SALGADO	PMT	LRG 09383	26S	03E	23	3	1	4	3/5/97	110	5	105
LRG 09411	DOM	3	GERALD J SMITH	PMT	LRG 09411	26S	03E	27	1	1	1	8/7/97	80	8	72
LRG 09442	DOM	3	EUSEBIO SANCHEZ	PMT	LRG 09442	26S	03E	34	3	1	1	8/13/96	105	6	99
LRG 09503	DOM	3	DAVID & ANGELICA ULLOA	PMT	LRG 09503	26S	03E	23	1	1	3	1/1/84			
LRG 09504	MUL	3	GERARDO VILLALOBOS	PMT	LRG 09504	26S	03E	23	1	3	1	1/1/88	50		
LRG 09521	DOM	3	MANUEL R CASTILLO	PMT	LRG 09521	26S	03E	14	1	2	4	9/30/96	166	73	93
LRG 09606	IRR	504.48	ERNESTINA & VICTOR ACOSTA	DEC	LRG 09606	26S	03E	15	4	1	2				
LRG 09625	DOM	3	RAYMUNDO JR LASCANO	PMT	LRG 09625	26S	03E	15	2	1	2	1/24/97	80	22	58
LRG 09670	MUL	3	JOSE M ANTUNEZ	PMT	LRG 09670	26S	03E	27	2	2	2	2/27/97	80	10	70
LRG 09749	DOM	3	SUSAN D PROVENCIO	PMT	LRG 09749	26S	03E	34	3	2	3	5/7/97	500	14	486
LRG 09754	DOM	3	LUZ MARIA HERNANDEZ	PMT	LRG 09754	26S	03E	23	1	1	1	1/1/90	45		
LRG 09757	DOM	3	GERALD M TOUCHTON	PMT	LRG 09757	26S	03E	15	3	4	4	5/8/97	80	12	68
LRG 09798	MUL	3	LUCY YANEZ	PMT	LRG 09798	26S	03E	14	1	4	4	6/27/97	170	58	112
LRG 09820	DOM	3	WILLIAM AND EVA STONER	PMT	LRG 09820	26S	03E	27	4	3	1			7	
LRG 09912	DOM	3	RICHARD PASTRAN	PMT	LRG 09912	26S	03E	23	1	4		11/7/97	74	26	48
LRG 09945	MUL	9	EZEQUIEL & YOLANDA RIOS	DEC	LRG 09945	26S	03E	36	2	1	1				
LRG 10088	DOM	3	SOCORRO FERNANDEZ	PMT	LRG 10088	26S	03E	22	1	2	2	5/14/98	103	14	89
LRG 10116	DOM	3	JOSE G. & ANDREA ORTIZ	PMT	LRG 10116	26S	03E	26	1	1	4	6/1/95	140	50	90
LRG 10148	DOM	3	HERMAN HARPER	PMT	LRG 10148	26S	03E	15	3	4	1	7/13/98	80	6	74
LRG 10362	DOM	3	RAMONA CAMPA	PMT	LRG 10362	26S	03E	26	3	3	1	2/27/99	63	5	58
				PMT	LRG 10362 S	26S	03E	26	3	3	1	2/27/99	63	5	58
LRG 10514	DOM	3	DALE A. MCCLEARY	PMT	LRG 10514	26S	03E	22	2	4	3	7/16/99	80	8	72
LRG 10546	DOM	3	RUBEN OR EVA ALVIDREZ	PMT	LRG 10546	26S	03E	35	2	3	3	7/27/99	120	23	97
LRG 10609	DOM	3	RICK FUENTES	PMT	LRG 10609	26S	03E	14	1	1	4	9/30/99	92		
LRG 10658	MUL	7	RAMON G. & NORMA A. ALVAREZ	DEC	LRG 10658	26S	03E	22	1	1	3	12/31/50	80		
LRG 10708	DOM	3	BERNARDINO & CONCEPCION RAYOS	PMT	LRG 10708	26S	03E	22	1	2	4	5/31/98	43	20	23
LRG 10727	DOM	3	ELENA CORTEZ	DEC	LRG 10727	26S	03E	22	2	2	1	12/31/24	75		
LRG 10870	DOM	3	ALBERTO GARCIA	PMT	LRG 10870	26S	03E	15	1	1	3		200		
LRG 10903	DOM	3	JOE C. HERNANDEZ	PMT	LRG 10903	26S	03E	26	3	3	3	6/16/00	120	7	113

[a]Use: COM=commercial; DOM=domestic; DAI=dairy; IRR=irrigation; MDW=mutual domestic; MUL=multi-domestic; PUB=public works; SAN=drinking and sanitary; SCH=school; SUB=subdivision.

[b]Diversion: declared or permitted diversion, in acre-feet per year.

[c]Status: status of water right; DCL=declared; PMT=permitted.

[d]Depth: drilled depth of well, in feet.

[e]DTW: depth to water in well, in feet.

[f]WC: water column in well, in feet.

Table 2. Information about wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8, Anthony Water and Sanitation District.

Well number (LRG)	Location	Year	TD[b] (ft)	Screen interval (ft)	DTW (ft)[c]	Date	WC[d] (ft)	CD[e] (in)	Yield[f]	
									gpm	afy
4793	26S.03E.36.321	1970	400	200-400	86.1	4/9/73	314	12.00	600	580.8
4793-S	26S.03E.36.233	1955	300	208-240	114	4/59	186	8.00	300	290.4
4793-S-2	26S.03E.35.412	1955	300	198-230	--	--	--	8.00	300	290.4
4793-S-2R[a]	26S.03E.35.412	1999	500	280-480	51.78	12/30/99	448	14.00	1200	1,162
4793-S-3	26S.03E.36.123	1955	250	--	63.4	6/12/75	187	16.00	1000	968
4793-S-4	26S.03E.26.41	1969	249	--	--	--	--	4.00	100	96.8
4793-S-7	26S.03E.23.43	1981	244	--	59	7/1/81?	185	12.00	--	--
4793-S-8	26S.03E.26.243		250	--	--	--	--	8.00	100	96.8
4793-S-8R[a]	26S.03E.26.243	1999	520	300-500	53	1999	467	14.00	1200	1,162

[a]R = replacement well.
[b]Total depth of well in feet (ft).
[c]Depth to water in feet (ft).
[d]Water column in well, in feet (ft).
[e]Casing diameter in inches (in).
[f]Reasonable yield of well in gallons per minute (gpm), and in acre-feet per year (afy) assuming 60 percent production time.

Table 3. Metered diversions at wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8, in acre-feet and as percent (%) of total pumping.

LRG no. (name)	4793 (James)		4793-S (Wood Tank)		4793-S-2 (McKinley)		4793-S-3 (Van Buren)		4793-S-7 (O'Hara)		4793-S-8 (Gillett)		Total[b]
Year	acre-feet[a]	%	acre-feet[a]	%	acre-feet[a]	%	acre-feet[a]	%	acre-feet[a]	%	acre-feet[a]	%	
1990	--	--	--	--	--	--	--	--	--	--	--	--	35.57
1991	--	--	--	--	--	--	--	--	--	--	--	--	180.84
1992	275.6	34.1	50.4	6.2	14.2	1.8	189.1	23.4	23.4	2.9	71.6	8.9	613.08
1993	--	--	--	--	--	--	--	--	--	--	--	--	833.59
1994	433.3	46.6	8.7	0.9	3.3	0.4	298.4	32.1	137.6	14.8	48.1	5.2	929.85
1995	598.8	51.3	3.5	0.3	5.6	0.5	348.3	29.8	147.9	12.7	63.4	5.4	1160.55
1996	557.3	52.4	3.0	0.3	3.1	0.3	288.6	27.1	124.7	11.7	86.6	8.1	1062.25
1997	495.5	48.8	0.6	0.1	0.6	0.1	341.4	33.6	95.1	9.4	82.8	8.2	1019.94
1998	461.9	44.1	0.2	0.0	0.2	0.0	473.5	45.2	72.0	6.9	39.5	3.8	1050.53
94-98 average	509.4	48.8	3.2	0.3	2.6	0.3	350.0	33.5	115.5	11.0	64.1	6.1	1044.62
1999	184.2	20	0	0	106.4	11	522.6	55	0	0	137.0	14	952.35
2000	366.9	39	0	0	139.4	15	410.9	43	0	0	29.0	3	946.15

[a]Sum of monthly totals reported by AWSD in gallons, converted to acre-feet (acre-feet = gallons/325,851).
[b]Total diversion for year recorded in OSE meter file; may not match sum of individual well totals due to unit conversions. Partial year totals for 1990 (August through December) and 2000 (January through November).

Table 4. Aquifer properties at model cells containing wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8.

Well number	OSELRG model cell			Layer 1 K (ft/d)[b]	Layer 1 b (feet)[c]	Layer 1 T=Kxb (ft^2/d)[d]	Layer 2 b (feet)[c]	Layer 2 T (ft^2/d)[d]	Layer 2 S[e]
	R	C	L						
LRG-4793	28	18	1	20.0	209	4,180	400	7,300	0.00040
LRG-4793-S	29	18	1	20.5	210	4,305	250	4,300	0.00025
LRG-4793-S-2	27	18	1	20.0	208	4,160	400	7,440	0.00040
LRG-4793-S-2R[a]	27	18	2	20.0	208	4,160	400	7,440	0.00040
LRG-4793-S-3	29	18	1	20.5	210	4,305	250	4,300	0.00025
LRG-4793-S-4	28	19	1	20.0	213	4,260	400	8,000	0.00040
LRG-4793-S-7	29	20	1	20.0	198	3,960	400	8,000	0.00040
LRG-4793-S-8	28	19	1	20.0	213	4,260	400	8,000	0.00040
LRG-4793-S-8R[a]	28	19	2	20.0	213	4,260	400	8,000	0.00040

[a]Replacement well (R).
[b]Hydraulic conductivity (K) assigned to cell in layer 1, in feet per day (ft/d).
[c]Saturated thickness (b) of layer assigned at cell, in feet.
[d]Transmissivity (T) at cell, in feet squared per day (ft^2/d). Effective transmissivity calculated as hydraulic conductivity (K) multiplied by saturated thickness (b) for layer 1; transmissivity value assigned for layer 2.
[e]Storage coefficient (dimensionless)

Table 5. Information for determination of model cells and layers stressed, wells LRG-4793 through LRG-4793-S-4, LRG-4793-S-7 and LRG-4793-S-8.

Well number	OSELRG model cell		Depth to water (feet below land surface)	Layer 1 bottom (feet below water table)	Layer 1 bottom (feet below land surface)	Screen interval (feet below land surface)	Model layer(s) stressed
	R	C					
LRG-4793	28	18	86	209	295	200-400	1 and 2
LRG-4793-S	29	18	114	210	324	208-240	1
LRG-4793-S-2	27	18	52[b]	208	260	198-240	1
LRG-4793-S-2R[a]	27	18	52	208	260	280-480	2
LRG-4793-S-3	29	18	63	210	273	≤ 250	1
LRG-4793-S-4	28	19	45[c]	213	258	≤ 249	1
LRG-4793-S-7	29	20	59	198	257	≤ 244	1
LRG-4793-S-8	28	19	53[b]	213	266	≤ 250	1
LRG-4793-S-8R[a]	28	19	53	213	266	300-500	2

[a]R = replacement well.
[b]Depth to water at replacement well, located ≤ 100 feet from original.
[c]Water level at well in same qqq section and at same elevation as well LRG-4793-S-4.

Table 6. Simulated diversion rates in acre-feet per year and cubic feet per second (cfs), and model estimated drawdowns in feet at 40 and 100 years (yrs) under the baseline scenario for the full right under LRG-4793.

Simulated well locations (LRG wells)	Model cell			Diversion			Drawdown	
	R	C	L	Start year	acre-feet/yr	cfs	40 yrs	100 yrs
4793 (upper ½), S, S-3, S-4, and S-7	28	18	1	1955 1990	1645.1 1545.1	2.2723 2.1342	15.9	15.8
4793 (lower ½)	28	18	2	1955	290.4	0.4011	5.3	5.3
4793-S-2	27	18	1	1955	290.4	0.4011	6.9	6.9
4793-S-8	28	19	1	1990	100.0	0.1381	3.4	3.4
TOTALS					2225.9	3.0745		
Replacement well locations								
4793-S-2R	27	18	2				3.5	3.5
4793-S-8R	28	19	2				2.6	2.6

Table 7. Simulated diversion rates in acre-feet per year (ac-ft/yr), total and incremental (Incr.) drawdowns, and differences in drawdowns between model layers in feet at 100 years due to application LRG-4793-S-2.

Well(s) simulated (LRG)	Model cell			Diversion (ac-ft/yr)	Layer 1 drawdown		Layer 2 drawdown		Layer 2 – Layer 1 drawdown
	R	C	L		Total	Incr.	Total	Incr.	
4793 (upper ½), S, S-3, S-4, and S-7	28	18	1	1035.5	11.2	-4.6	7.1	1.8	-4.1
4793 (lower ½)	28	18	2	290.4	11.2	-4.6	7.1	1.8	-4.1
4793-S-2R	27	18	2	800.0	4.3	-2.6	7.3	3.8	3.0
4793-S-8	28	19	1	100.0	2.9	-0.5	3.4	0.8	0.5
TOTALS				2225.9					

Table 8. Simulated diversion rates in acre-feet per year (ac-ft/yr), total and incremental (Incr.) drawdowns, and differences in drawdowns between model layers in feet at 100 years due to application LRG-4793-S-8.

Well(s) simulated (LRG)	Model cell			Diversion (ac-ft/yr)	Layer 1 drawdown		Layer 2 drawdown		Layer 2 – Layer 1 drawdown
	R	C	L		Total	Incr.	Total	Incr.	
4793 (upper ½), S, S-3, S-4, and S-7	28	18	1	845.1	10.0	-5.8	5.8	0.5	-4.2
4793 (lower ½)	28	18	2	290.4	10.0	-5.8	5.8	0.5	-4.2
4793-S-2	27	18	1	290.4	5.1	-1.8	4.0	0.5	-1.1
LRG-4793-S-8R	28	19	2	800.0	2.6	-0.8	6.9	4.3	4.3
TOTALS				2225.9					

Table 9. Estimated 100-year drawdowns and impacts to water columns due to diversion of 800 acre-feet per year at replacement (R) well LRG-4793-S-2, and at other nearby wells.

Well number	Estimated distance from pumping well LRG-4793-S-2 (feet)	Estimated drawdown (feet)			Initial water column (feet)	Estimated water column remaining (feet)
		Due to existing rights	Due to S-2 at 800 afy[a]	Total		
LRG-4793-S-2R	0	10	40	50	448	398
LRG-9000	1,620	10	7	17	59	42
LRG-10564	2,000	10	6	16	97	81

[a]Drawdown estimated using Theis equation, plus additional drawdown at pumping well (LRG-4793-S-2R) due to head losses in the well assuming 75 percent efficiency.

Table 10. Estimated 100-year drawdowns and impacts to water columns due to diversion of 800 acre-feet per year at replacement (R) well LRG-4793-S-8, and at other nearby wells.

Well number	Estimated distance from pumping well LRG-4793-S-8 (feet)	Estimated drawdown (feet)			Initial water column (feet)	Estimated water column remaining (feet)
		Due to existing rights	Due to S-8 at 800 afy[a]	Total		
LRG-4793-S-8R	0	10	41	51	467	416
LRG-3354	780	10	10	20	--	--
LRG-5037-S	1,680	10	8	18	355	337

[a]Drawdown estimated using Theis equation, plus additional drawdown at pumping well (LRG-4793-S-8R) due to head losses in the well assuming 75 percent efficiency.

Table 11. Estimated 100-year drawdowns and impacts to water columns due to combined diversion of 800 acre-feet per year each at replacement (R) wells LRG-4793-S-2 and LRG-4793-S-8, and at nearby wells of other ownership.

Well number	Estimated distance from LRG-4793-S-2 (feet)	Estimated drawdown (feet)			Initial water column (feet)	Estimated water column remaining (feet)
		Due to existing rights	Due to S-2 and S-8 at 800 afy[a]	Total		
LRG-4793-S-2R	0	10	45	55	448	393
LRG-4793-S-8R	6,400	10	47	57	467	410
LRG-9000	1,640	10	12	22	59	37
LRG-10564	2,000	10	11	21	97	76
LRG-3354	7,200	10	14	24	--	--
LRG-5037-S	7,900	10	12	22	355	333

[a]Drawdown estimated using Theis equation, plus additional drawdown at pumping wells (LRG-4793-S-2R and LRG-4793-S-8R) due to head losses in the wells assuming 75 percent efficiency.

Table 12. Estimated surface water depletions, in acre-feet per year (afy) and as a percentage of the total diversion (% div.) of 2,225.9 afy under the baseline and application scenarios at replacement wells LRG-4793-S-2 and LRG-4793-S-8, calculated using the OSELRG model.

End of year	Years after diversion increased	Baseline depletions		Depletions under S-2 application		Net depletions due to S-2 at 800 afy		Depletions under S-8 application		Net depletions due to S-8 at 800 afy		Net depletions due to both S-2 and S-8 at 800 afy	
		afy	% div.	afy	% div.	afy	% div.	afy	% div.	afy	% div.	afy	% div.
1999	1	2157	97	2285	103	128	5.8	2314	104	157	7.0	285	12.8
2000	2	2158	97	2254	101	96	4.3	2291	103	133	6.0	229	10.3
2001	3	2159	97	2219	100	60	2.7	2254	101	95	4.3	155	7.0
2002	4	2159	97	2196	99	37	1.7	2226	100	67	3.0	104	4.7
2003	5	2160	97	2181	98	21	0.9	2207	99	47	2.1	68	3.0
2004	6	2161	97	2172	98	11	0.5	2194	99	33	1.5	44	2.0
2005	7	2162	97	2166	97	4	0.2	2185	98	23	1.0	27	1.2
2006	8	2163	97	2162	97	-1	--	2179	98	16	0.7	16	0.7
2007	9	2164	97	2159	97	-5	--	2173	98	9	0.4	9	0.4
2008	10	2165	97	2157	97	-8	--	2169	97	4	0.2	4	0.2
2009	11	2165	97	2154	97	-11	--	2165	97	0	0.0	--	--
2010	12	2166	97	2153	97	-13	--	2163	97	-3	--	--	--
2011	13	2167	97	2152	97	-15	--	2161	97	-6	--	--	--
2012	14	2168	97	2152	97	-16	--	2160	97	-8	--	--	--
2013	15	2168	97	2151	97	-17	--	2158	97	-10	--	--	--
2014	16	2169	97	2151	97	-18	--	2157	97	-12	--	--	--
2015	17	2170	97	2151	97	-19	--	2157	97	-13	--	--	--
2016	18	2170	97	2150	97	-20	--	2155	97	-15	--	--	--
2017	19	2171	98	2151	97	-20	--	2155	97	-16	--	--	--
2018	20	2172	98	2151	97	-21	--	2156	97	-16	--	--	--
2023	25	2174	98	2152	97	-22	--	2155	97	-19	--	--	--
2028	30	2177	98	2154	97	-23	--	2158	97	-19	--	--	--
2033	35	2178	98	2156	97	-22	--	2159	97	-19	--	--	--
2038	40	2180	98	2158	97	-22	--	2161	97	-19	--	--	--
2043	45	2182	98	2161	97	-21	--	2164	97	-18	--	--	--
2048	50	2184	98	2164	97	-20	--	2166	97	-18	--	--	--