TECHNICAL REPORT

Evaluation of “Dry-Year Option” Water Transfers from Agricultural to Urban Use

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Executive Summary

This study investigated the economics of an Edwards Aquifer region "dry-year option" buyout directed toward decreasing agricultural water use in an effort to augment spring flow.

The research was separated into eleven tasks: (1) alternative irrigation strategies were developed and yields estimated for a number of deficit irrigation possibilities; (2) cost and return budgets were developed for the irrigation strategies; (3) an Edwards Aquifer regional level agricultural model was constructed; (4) three dry-year option definitions were developed - one involved a November announcement and interruption, the others involved June 1 interruptions: one without prior announcement and the other announced as a possibility in November with the interruption occurring in June 1 under low recharge; (5) a set of regression equations were developed predicting springflow consequences of interruption; (6) the springflow equations and the regional agricultural model was used to develop data on the consequences of alternative dry-year option prices; (7) a third party impact, input-output model was developed to look at the off-farm implications of the dry-year option; (8) potential compensation mechanisms to mitigate off-farm income losses were investigated; (9) the question of whether compensation was in order was examined as well as the identities of affected parties; (10) the model was delivered to the sponsors in disk form as was a workshop for sponsor employees; and (11) estimates were developed of the municipal and industrial demand for water exchanges over a range of prices.

The main findings during this research were:

1) There are alternatives that farmers selling water can use such as dryland farming or deficit irrigation if a June 1 cutoff is a possibility.

2) The springflow regressions revealed a dramatic difference in the implications of curtailed pumping in the eastern versus the western counties. Several times more springflow is generated in the current year when the pumping is curtailed east as opposed to west of the Knippa gap. This led us to examine separate dry-year options for eastern and western counties.

3) The November announcement of a dry-year option generated some water even at very low prices ($10 per acre). At an offer price of $90 per acre, most of the water in the region was sold. In the western region, considerably higher starting prices were required, but water use was again essentially curtailed at $90 per acre. However, when using western water the cost per unit springflow was much higher.

4) The cost of the water saved by the dry-year option is substantially greater when the option is exercised during the cropping season(June). Higher prices must be paid to get about half as much water as could be gotten under the November exercise. Also, an early announcement of the possibility of a mid-season option under low recharge allows land to enter the program more cheaply, but lowers the amount of water use reduction as farmers use crop mix and irrigation strategies which are not as dependent on late season water.

5) A dry-year option program based on local taxes exhibits greater regional income losses than one wherein compensation is funded externally. As many as 500 jobs are involved with a $5 to 36 million dollar range on loss of regional gross income. The secondary economic impacts fall most heavily on Uvalde and Medina counties.

6) History indicates that compensation to third parties affected by a specific economic change is rare. Classical economic theory indicates that regional losses are offset by secondary benefits elsewhere and does not recommend compensation. However, compensation to injured third parties may be a useful strategy for easing dry-year option policy implementation.

7) Compensation should not be paid to local government as revenues are not likely to be lost. Compensation may be in order to private businesses and individuals; farm labor; crop tenants; farm supply and service businesses; and speciality production and marketing systems.

8) Several assumptions were required to design and examine the dry-year option, some of which may not be absolutely in accord with the way the dry-year option is ever implemented. Thus, we developed a transportable regional economic model in which assumptions may be modified. However, we cannot deliver the input-output model.

9) We found the usage of municipal and industrial water fell from 336 thousand acre feet when water was not priced (a zero price was used) to 133 thousand acre feet when a $500/acre foot charge was used. Higher water usage occurred under the drier years and lower water usage in the wetter years.

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Brief description of study:

This study investigated the economics of an Edwards Aquifer region "dry-year option" buyout directed toward decreasing agricultural water use in an effort to augment springflow. The research involved several phases. First, we applied crop growth simulation models to quantify the expected yield of major crops by weather year for alternative irrigation strategies. Second, crop enterprise budgets were developed for these strategies for entry into a farm level simulation model. Third, equations were developed which predicted the monthly springflow implications of changes in agricultural water use. Fourth, a "dry-year" agricultural model which predicted the agricultural consequences of exercise of various forms of the dry-year option was developed. Fifth, a model and literature-based evaluation was undertaken to arrive at a definition of the term "dry-year option". Sixth, the agricultural model was used to determine willingness to sell water at alternative prices. Seventh, a regional input-output model was developed to allow estimates of regional impacts of the dry-year option. Eighth, the input-output model was used to estimate the effect of water transfers on local communities, by sector. Ninth, the proposal that there should be compensation to third parties was examined. Tenth, the LP model was put in a form for delivery to the sponsor and a training workshop was scheduled. Eleventh, data on the nonagricultural demand for water were developed.

Research background

To deal with drought, there is a need for an efficient and effective mechanism to transfer water from lower to higher valued uses. In the Western United States, water is marketed. However, marketing of water generally transfers the water rights in perpetuity with higher valued usages receiving water rights regardless of the quantity of water available. There is a need for short term transfers due to the magnitude of the fluctuation in water supplies. For example, Edwards Aquifer data contains historical variation in surface water induced recharge from 50,000 to over 2 million acre feet per year. In the face of such fluctuation, entities which require a relatively constant amount of water across all years may find themselves short on water in dry-years, but with an excess of water in wet years. Under such circumstances, it is an economically desirable strategy to transfer water from lower to higher valued users when water is scarce, but in periods of water abundance to have the water used by lower valued users (e.g., see the arguments in Colby; McCarl and Parandvash; Michelson and Young; McCarl et.al.; and Carter, Vaux and Scheuring).

California initiated such a program during the recent drought by using a water bank (Carter, Vaux, and Scheuring). The state purchases water from willing sellers, then pools the water and distributes it to meet the needs. This is an annual program that is implemented on an as needed basis. Colby reviews other cases. When pursuing such programs major questions arise regarding the appropriate buying and selling price of water as well as third party effects (Michelson and Young).

Many regions in Texas could support water transfers, but an especially relevant Texas location where dry-year water transfers could be considered is the Edwards Aquifer region. That region is one where demand has been growing steadily for many years, but the amount of aquifer recharge water has not grown. The region is also characterized by springflow which supports endangered species. Regional average annual usage does not now exceed average annual recharge; usage is now about 500,000 ac/ft/yr while average recharge is in the neighborhood of 630,000 ac/ft/yr and historical springflow averages 230,000 ac/ft/yr. However, usage exceeds recharge in many years and certainly long term prospects for springflow portend a much lower level than the historical average. Therefore, dry-years can be a problem both to the current level of usage and the level of springflow.

This situation has led to a number of societal actions. Various parties, including the Sierra Club and the Guadalupe-Blanco River Authority, have initiated legal actions to preserve water for springflow and base river flow. The most recent suit based on endangered species was upheld and resultant management actions are currently in the process of being implemented. There also has been a long history regarding the implementation of an aquifer management authority. Most recently this culminated in the passage and implementation of legislation where a new management authority was put into place. Important issues regarding dry-year water transfer options in the Edwards appear in both the court monitor's document for managing the Edwards and in some of the earlier regional aquifer management plans. In both cases, dry-year pumping limitations are suggested with triggers based on recharge, reference well elevation, pumping use, and/or springflow levels. Thus, the Edwards is a fruitful area for study of the dry-year water transfer option.

Another piece of the puzzle leading to this research involves the concern directed toward agricultural users and springflow quantity. It is almost certain that in the near future pumping will need to be curtailed with more water reserved for springflow. Recent legislation mandates pumping be reduced to 450,000 acre feet now and 400,000 acre feet by 2008 as opposed to the current level of about 500,000 acre feet. Court action has suggested water use restrictions to maintain springflow. The resultant water use reduction as well as the possibility of more severe curtailments in dry-years implies a need for a mechanism to reduce water use in lower valued usages so as to augment springflow. Often agricultural water is anecdotally referred to as being worth about $30 to $50 per acre foot, while water in urban usages, in terms of a tap prices, is valued somewhere in the neighborhood of $500 per acre foot. In the face of this differential, agricultural users are likely to respond to economic incentives to reduce use (Boggess, Lacewell and Zilberman). The questions then are: What is the economically efficient allocation of water? How could dry-year reductions in agricultural use be facilitated? At what cost are springflows augmented? These are particularly relevant issues as Texas has historically been under an appropriative system for surface water and a capture system for groundwater. Agricultural users have historically been using the water for a longer time period in most cases and are, in the Edwards, "upstream" with the rights of capture. Thus, transfers between low valued agriculture and springflow maybe in order, but will not happen without an explicit compensation effort or a new system of quotas.

In the absence of a market driven mechanism for water allocation, government often assumes the allocation responsibility. Typically, government intervention does not provide efficient management, while political and legislative forces tend to make allocation decisions without consideration of value of water in alternative uses. There is a strong incentive to implement a market driven system (Boggess, Lacewell and Zilberman; Collinge et.al., McCarl et.al.).

Farmers, when faced with water restrictions or a potential to profitably sell water in any given year, can pursue several alternative courses of action. If the information comes in early enough, crop mixes can be changed to drought tolerant crops. If not, then crops can be abandoned or managed using deficit irrigation approaches. Furthermore, if a water transfer option is implemented, farmers may make long term changes in irrigation equipment, and farm capitalization. Thus, to study the farm welfare effects of the dry-year option, a comprehensive economic assessment needs to be made wherein factors such as timing of option, crop mix, deficit irrigation, dryland reversion and irrigation equipment capitalization are considered.

This research also considers the compensation question. Actually there are three parties directly involved in the dry-year option transaction. These include the farmer who loses income when water is limited (or must make capital expenditures to improve efficiency), municiple or springflow interests who gain when more water is made available, and third parties in the farming region who have their economic well being affected by alterations in farmer activities. The amount of compensation that will be paid is bounded below by the loss in farmer profits (or amortized investment to improve efficiency) and above by the amount of income gained by the nonagricultural water users. The transactions cost of bringing the parties together is also relevant.

Third party or secondary effects may also be relevant. Historically, compensation for the transfer of water or other natural resources to agricultural producers has included only the direct income loss to the owners of the resource. Examples include the USDA soil bank program of the 1950-60's and the more recent Conservation Reserve Program wherein crop farmers were paid a net return per acre equivalent to take land out of production. In those cases, farmers suffered no economic loss. However, communities economically dependent upon crop production suffered business income reductions, out migration of labor, declines in local property tax bases and other secondary or "third party" impacts. Less irrigation will be reflected in a reduction of goods and services used by production agriculture and less output which has an impact in local and regional economics. Compensation for such losses could be undertaken. Several public entities have provided mitigative compensation for impacts that policies have had on a local economy beyond the immediate impact on resource owners. For example, the Department of Defense considers mitigation payments to communities affected by military base closures. Also, the Department of Energy has offered mitigation payments to communities for radioactive waste disposal.

This research project investigated the question of compensation to third parties from several viewpoints. These include: 1) the normative and conceptual considerations involved in the issue of compensation for secondary impacts of water transfer in dry-years; 2) the analytical techniques needed for estimating the magnitude of secondary impacts under alternative dry-year option policies; 3) the procedures for implementing mitigation programs; and 4) the transactions costs and regional economic impact consequences of mitigation compensation.

Activities and findings

The research has been separated into eleven tasks. Here we report activities and results under each task.

Task 1 -- Development of deficit irrigation data

The estimation of the level of compensation to farmers to cause them to participate in "dry-year option" requires comparison of net returns among alternative irrigation and management strategies as well as dryland production. This requires information on crop yield and crop response to water for alternative irrigation strategies as well as crop yields for dryland production. EPIC (Erosion Productivity Impact Calculator), a biophysical simulation model, was used to simulate crop yield and irrigation water use for selected crops, vegetables, and hay under alternative irrigation strategies for the Edwards Aquifer region. EPIC is a process model that runs on a daily time step and simulate the interaction of soil erosion, plant growth, weather, hydrology, nutrient cycling, tillage, soil temperature, and economics. The crops and vegetables selected for simulations were corn, cotton, sorghum, oats, winter-wheat, peanut, cabbage, lettuce, spinach, carrot, cucumber, cantaloupe, and onions.

The simulations were conducted by using 17 years of actual weather data. From 1951 and 1987 and consist of dry, normal, and wet years. The data was obtained from the U.S. Dept. of Commerce, National Oceanic and Atmospheric Administration.

The automatic irrigation feature of EPIC was used to adjust irrigation water use to reflect weather-induced water availability. The automatic irrigation feature of EPIC was used where soil moisture tension triggers irrigation whenever the soil moisture tension is below a level specified by the user (Kilopascals, 33 to 1500, dependent on crop and strategy).

A large number of irrigation strategies were formulated for each major crop and vegetable. These strategies were based on alternative irrigation triggers, alternative irrigation ending dates (April 30, May 30, June 30 etc.), and alternative irrigation methods (furrow and sprinkler). For cotton, the irrigation ending dates were based on early bloom (EB), first bloom (FB), and first open boll (FOB) which correspond to irrigation ending dates of May 31, June 30, and July 31, respectively. Simulations for dryland production were also conducted.

For vegetables, simulations were performed for irrigation triggers and irrigation methods (furrow and sprinkler). Alternative irrigation ending dates were not used for vegetables since vegetables require full season irrigation.

Application amounts of 4.0 and 1.5 inches of water were used for furrow and sprinkler irrigation, respectively. Irrigation efficiency was assumed to be 70% and 95% for furrow and sprinkler irrigation, respectively, implying that for furrow irrigation, 30% of the water was lost through runoff, evaporation, and/or percolation, whereas only 5% was lost under sprinkler irrigation. To simulate crop yield, EPIC also requires other data on fertilizer and pesticide/herbicide use, tillage, as well as other site-specific information. These information were obtained from the Texas Crop Enterprise Budgets.

As hay is harvested many times throughout the year, simulations for hay were based on fraction of growing season. EPIC was allowed to schedule management operations according to the fraction of crop maturity rather than calendar date. Heat units (thermal time) were used to estimate the rate of crop development, and the fraction of crop maturity in a specific day is expressed as the number of heat units accumulated to that day divided by the number of heat units required for crop maturity.

The simulation results on crop yield and water use are incorporated in the data section of the GAMS code for the Edwards Aquifer economic model which readers can request from the authors.

Task 2 -- Budget development

Budgets giving per acre costs were obtained from the Texas Crop Enterprise Budgets largely from the Southwest Texas District, as produced by the Texas Agricultural Extension Service. Net returns by cropping system and weather year were developed based on the crop budgets, simulated crop yields, and crop price projections from several national policy studies. This provided baseline data for budgeting analysis and the necessary inputs for developing a regional economic model. Certain cost items were separated out from the budgets which were yield and/or irrigation water dependent. Their usage was changed as the irrigation strategies (and thereby yield and water application) were altered.

Task 3 -- Development of a regional level agricultural model

Numerous cropping pattern and irrigation strategies exist in the region that can be used to react to the dry-year option. The second task involved development of an agricultural, net income maximizing, linear programming model to simulate farmer decision making. This model includes the major field, hay and vegetable crops in the region grouped by county and includes crop mix decisions, deficit irrigation decisions, irrigation type decisions (sprinkler/furrow) and dryland use decisions for three pump lift zones. The model is designed to simulate short run, within season adjustments, to the dry-year water transfer option as well as medium term adjustments in crop mix and long term adjustments in crop mix and irrigation equipment.

Notable efforts involved in setting up this model included:

a) An earlier model of the Edwards Aquifer was adapted (McCarl et al.)
b) Lift zones were added
c) Numerous irrigation schedules based on the EPIC data were added
d) Sprinkler versus furrow irrigation features were added.

Task 4 -- Definition of the dry-year option

The project required a definition of a “dry-year option”. Two investigations were done to help develop an operational dry-year option definition. First, a related model which included industrial, municipal, and agricultural usage was used to develop data on potential frequency of interrupted water use by agriculture. This was done by looking at year 2000 demand under a 450,000 ac ft water limit, with agriculture operating unilaterally, maximizing profits and then later agriculture operating in conjunction with municipal and industrial interests in a cooperative fashion. In turn the difference observed between agricultural water use when it cooperated and when it did not was observed to determine the percentage of the years that agriculture might be cut back. The water use comparison is shown by the graph in Figure 1, and this revealed that 48% of the time agriculture used less than it would under a unilateral free capture setup. We used a 48% frequency in our study of midyear option exercises.

A parallel project by Rothe developed a definition of the dry-year option in which water use was interrupted not based on how dry the year was, but based on the initial elevation of the aquifer at the beginning of the year. Rothe also assumed that water gained through the option would be dedicated to springflow. We then decided to examine of the dry-year option by first indicating that the water could be bought from agriculture, but that water would be dedicated to springflow and not put into non agricultural usages. Second, we considered beginning of year and mid-crop year timing for option exercise. The mid-crop year option, because of the availability of simulated data on irrigation strategies, will involve interruption of any ongoing agricultural usage of water beyond the 1st of June when the dry-year option is implemented. Further, this will occur either in all years or just in the 48% driest years, i.e., itis conceivable that the option might come into play when we had relatively low elevations at the beginning of the year and the year turned out to be dry.

Given Rothe’s definition that the water will not be transferred by the dry-year option, but will be allowed to go into springflow, we concentrated on the agricultural and springflow effects. See Task 11 for nonagricultural data.

Task 5 -- Development of a model of springflow impacts

If the water diverted is dedicated to springflow, it is desirable to examine how springflow responds to agricultural water use reductions. This was done using regression equations derived from repeatedly running the Texas Water Development Board’s GWBSIM IV model. Equations were estimated for monthly and annual flows at Comal and San Marcos springs as a function of water use; initial elevation both from east and west pools; and recharge. The annual regressions are given in Table 1. The monthly regressions which predict springflow are in the model code. A related paper by Keplinger and McCarl discusses the regression results at more length. Keplinger investigated the validity of the forecasts and shows that the signs and magnitudes of the coefficients derived from historic data are very close to those from the GWBSIM based regressions.

The GWBSIM IV and regression results influenced our study design. First, they showed a differential response based on pumping location. This led us to estimate the equations with respect to east and west pumping with east pumping occurring in Medina, Bexar, Hayes, and Comal counties and west occurring in Uvalde and Kinney counties. The regressions then revealed a dramatic difference in response based on whether the withdrawal was in the east or west. This led us to examine separate dry-year options for eastern and western counties. Our data examination also led us to focus on two measures of springflow — Annual and August quantity.

Task 6 -- Analysis of farm and springflow reactions to dry-year option

The dry-year farm based analysis examined what farmers would do at various offer prices, when prices are based on either an offer before the planting season, perhaps in late November, or an offer that arises to terminate irrigation. A similar program terminating water use June 1 was also examined. Finally, in the June 1 exercise context, we examined an offer announced in November which would only occur 48% of the time, i.e., when the annual recharge was less than 500,000 ac ft.

The model was applied assuming :

a) exercise of water transfer options before the crop year (allowing farmers to establish crop mixes knowing water availability)

b) implementation of a mid-year option with agricultural water use cessation June 1 and thereafter assuming the crop mix was implemented without assuming the dry-year option will be implemented. The interruption happens regardless of recharge.

c) implementation of the mid-year option with agricultural water use cessation June 1 and thereafter, assuming the crop mix has been implemented in January with knowledge that the option will occur under dry-years, and that water use is interrupted, for dry recharge years only (42% of the time based on the frequency of years with under 500,000 ac ft of recharge).

The analysis was run with the offer for compensation made to only eastern counties, basically Bexar and Medina or to western counties (Uvalde and Kinney), although the Uvalde portion was only considered for the November offer case. The analysis was done with the offer prices from $0-150 an acre.

Figures 2-5 show the basic results while tables 2-5 summarize them. When one announces a dry-year option in the eastern counties in November, low offer prices of around $10 /ac yield as much as 10,000 ac ft of water use reduction. On the other hand, when one does this in Uvalde, the offer price has to be somewhere around $60 /ac before any meaningful conversion occurs. Most of the buy out effectiveness occurs in both counties at an offer of $90/ac. The cost of the water saved by the buy out becomes substantially more expensive if one interrupts in the middle of the cropping season as prices somewhere around $90/ac need to be paid to get about half as much water as could be gotten under other circumstances. Other interpretations of the results appear in the paper by Keplinger et al. (and the thesis by Keplinger).

There are significant springflow implications depending on whether the water use reduction is in the east or the west counties as shown in Figures 4 and 5. For roughly the same amount of water taken out of production, you get several times the springflow if eastern water use is curtailed. Additional technical data surrounding these results appear in Tables 2-8.

<u>Task 7 -- Input-output model of counties</u>

In order to investigate the compensation questions, input-output models were developed for the counties that have significant agricultural acreage, namely Bexar, Medina, Uvalde and that part of Kinney which draws from the Edwards Aquifer. In addition, a regional input-output model was developed including all these counties. These models were set up so that the individual crops from the ASM model were aggregated into the appropriate IMPLAN sectors for cotton, feed grains, food grains, oilseeds, vegetables, and other agricultural crops. IMPLAN sectors are aggregations of US Department of Commerce Standard Industrial Classification codes.

Input-output analysis provides a method for estimating the secondary impacts on the county and regional economies that derive from adjustments made in irrigated acreage and other changes in agricultural sectors as a result of imposing the dry-year option. Input-output models have been used widely elsewhere to estimate the secondary or third party impacts of resource management changes (Hazen and Sawyer). While there are alternative input-output models available, this project used the proprietary IMPLAN software package program because of its timely data base and flexibility for developing regional models. The IMPLAN model is maintained and periodically updated by a commercial company, (Minnesota IMPLAN Group, Inc.). Software and data bases are available for purchase from this company.(Feldman and Gilbard)

IMPLAN was used to estimate input-output relationships for the individual counties and an aggregation of counties in the Edwards Aquifer region. Secondary impacts were estimated in terms of: (1) total industry output, (2) wage and salary income, (3) employment, (4) total income, (5) employment and (6) total value added.

Input-output multipliers for each of these variables for each county and the Edwards Aquifer region as a whole are presented in Appendix A. Results as to the estimated magnitude of secondary impacts arising from alternative, potential agricultural water management scenarios are presented in the following section.

Task 8 -- Investigate compensation mechanisms for secondary impacts

Results on gross revenue from selected irrigated and non-irrigated sectors were taken from the farm model solutions analyzing the November dry-year option. The differences in gross revenue by sector for each county with and without payments for the dry-year option at different compensation levels were analyzed. The values of production from each agricultural sector in the non-dry-year, free capture scenario were used as the baseline gross revenue estimates. Then, gross revenues were estimated under several dry-year option prices and gross revenue differences were estimated for each agricultural sector. These differences (reductions in revenues) were used to estimate the secondary impacts on the regional and county economies.

Estimated secondary impacts may be viewed as the levels of compensation required to offset the negative economic effects on third parties that result from imposing the dry-year option. No attempts were made to estimate any of the positive economic effects that may arise from the use of water saved in the aquifer by imposing the dry-year option and potentially utilized beneficially elsewhere.

8.1 Estimated magnitude of secondary compensation

Three assumptions were made relative to the source and disposition of compensation when the dry-year option is implemented.

1) Compensation when paid goes to agricultural producers in proportion to the value of their total output and this was drawn from local tax payers in the four county area.

2) Compensation goes to agricultural producers in proportion to their output, but that the compensation was drawn from outside the region, i.e., external sources such as federal government, the State of Texas and/or private parties who benefit from the water made available with the imposition of the dry-year option.

3) Compensation will be spent entirely outside the region having no effect on the local economy. (This scenario is analogous to achieving the same acreage reductions as in (1) and (2) without payment to farmers).

In addition, secondary impacts were estimated for two scenarios that rely on administrative rather than market approaches with a related model (McCarl et al). These were:

4) A maximum aquifer withdrawal limit of 450,000 ac ft per year, and

5) A minimum springflow of 150,000 ac ft per year.

Each of these assumptions was investigated for the different compensation levels assumed in the earlier sections of this report. Specifically reported in this section are compensation levels of $10, $60 and $90 per acre for a November implementation. Separate estimates were made for the three aquifer recharge levels during the growing season - wet, medium and dry rainfall conditions.

Summaries of the secondary (third party) impacts of these scenarios are presented in Tables 9 through 12 for the whole region, Uvalde, Medina and Bexar counties, respectively. Each table shows the secondary impacts of eleven scenarios of the dry-year option. The interpretation of individual estimates are identical among the tables presented. For example, scenario 1.2 in Table 9 shows the estimated impacts on the Edwards Aquifer Area of a $60 per acre payment to farmers for irrigated acreage reduction. In this scenario, it is estimated that regional shipments to final demand (consumers, exports from the region, etc.) would fall by $26.2 million, total industrial output by $32.54 million, employee income by $8.1 million, property income by $9.88 million, and total income by almost $18 million. Regional value added would fall by $19.6 million and total regional employment would fall by 487 jobs.

As expected, impacts from the local tax fund assumption are greater than those estimated under outside funds/local expenditures. Estimated regional impacts under local taxation are about the same as those under outside funds/outside expenditures, which assumes that farmers receive no payments for acreage reductions.

This result is not unexpected since payments to farmers from within the region would necessarily reduce government spending elsewhere within the economy or require tax increases. Secondary impacts from these alternatives are evidently about the same.

Estimates for the administrative alternatives (450,000 ac ft per year pumpage and 150,000 ac ft per year springflow) are also shown in Table 1. Comparisons between these scenarios and the market oriented scenarios (1 - 3) are not meaningful because reductions in irrigation and gross revenues from crops may not be comparable.

Estimated economic impacts for Uvalde, Medina and Bexar counties are shown in Tables 10-12. The values relating to each scenario and economic variable may be interpreted in the manner as those in Table 9 except that the impacts in each county table are limited to the economy of that county. Since leakages occur among counties in the region, the aggregation of individual county estimates for a given scenario and economic variable may give a larger value than that estimated for the region using the regional input-output model.

A comparison among counties shows that the secondary economic impacts fall greatest on Uvalde and Medina counties (Tables 10 and 11). Secondary impacts are much less in Bexar county and only exist at payment levels above $90. Estimated impacts were so small in Kinney county that they are not shown separately. Kinney county is included in the regional input-output model for the entire Edwards Aquifer area.

Value added is the most appropriate economic variable upon which to base a compensation program. Value added is an estimate of the returns to locally employed resources (land, labor, capital and management) throughout the regional or county economies. Under local taxation, value added losses to the region ranged from a low of $4.9 million for a payment level of $10 per acre to a high of $36.75 million for a payment level of $90 per acre (Table 9). Compensation in these amounts would approximately offset the losses to the regional economy because of the implementation of the dry-year option.

8.2 Alternative mechanisms of secondary impact compensation

Compensation methods or mechanisms may vary widely. A review of alternative cases is instructive in terms of outlining policy options. In the low level radioactive waste facility citing work in Texas in the 1980's, consideration was given to cash payments to county, school and city governments (Jones et al 1993). Similar approaches have been considered in terms of military base closings (Jones et al 1994). In the case of the Everglades restoration project, several potential secondary impact mitigation or compensation mechanisms were considered, including job retraining and placement for displaced workers (Hazen & Sawyer). In other cases that involve government actions to limit the commercial use of a natural resource, compensation has taken several forms. In 1978, the US Congress passed *The Redwood National Park Expansion Act.* This Act used the power of eminent domain to take a significant part the remaining merchantable inventory of old growth redwood timber in California.

This act affected directly industrial forest firms in the area. As compensation, the US Treasury paid just compensation that included the value of timber and severance damages for the loss of economic usefulness of mills, roads, etc. Further, secondary impacts were compensated by paying employees affected by the land acquisition. Employees totally or partially laid off because of the Act were entitled to all employment rights and benefits; pensions and welfare trust funds; layoff and vacation replacement benefits; and retraining at the expense of the US Government during a period of protection (Berck and Bentley).

In a more recent case involving the Northern Spotted Owl listing as an endangered species, the Bureau of Land Management developed a program to provide grants and benefit payments to communities and employees who were economically dependent on National Forest System lands and public lands administered by the BLM. The objectives of this program were: 1) to assist communities in achieving economic diversity and decreased dependency on forest products; 2) to supplement unemployment insurance benefits and extend income maintenance payments; 3) to provide short and long term retraining; 4) to provide base level health care insurance; and 5) to defray job search and relocation expenses (US Department of Interior).

Numerous other individual cases could be cited that used various mechanisms to provide compensation to third parties that result from public policy implementation that reduces the commercial use of a natural resource important to the regional economy. In general, compensation programs have focused on payments to communities and to employees that are displaced by the public policy. As is discussed in the following section, many of these compensation programs appear to have been put in place to reduce opposition to the policy and to ease the process of implementation.

A major difference exists between the dry-year option and the programs used as examples in this section. It is expected that the dry-year option will be an intermittent event and cause temporary displacements, whereas the cases cited above caused permanent displacements of economic activity. Implementation of the dry-year option would be expected to reduce irrigated acreage only in that year with a return to normal conditions in the following year in most cases. Hence, the need to provide compensation to third parties would be limited to losses only when they occur, usually one year.

Task 9 -- Compensation and the dry-year option

One other item meritorious of discussion regarding compensation relates to who should be compensated. Impact models are normally used to estimate secondary impacts of a policy change, economic structural shift, new industry location, or other events. Secondary impact estimates are typically used to anticipate and aid in planning for regional economic and social changes brought about by the event. Estimates of negative secondary impacts do not imply that compensation must be undertaken. Three aspects of the compensation question merit discussion: Is compensation in order?, What amount of compensation arises to third parties?, and, Who are the third parties? All these questions will be discussed below.

9.1 Is compensation in order?

There are three arguments on whether compensation to non-farm entities is in order.

First, history seems to indicate that compensation to third parties affected by a specific economic change is rare. We, as a society, have not chosen to compensate rural areas for public policy changes in most cases. Agriculture programs such as the Soil Bank of the 1960's and the Conservation Reserve Program of the 1990's had significant local economic impacts on food and fiber processing plants, input suppliers, communities and other sectors. While farmers were paid to participate in these programs and remove land from production, no compensation was offered to impacted third parties.

We have never required, as a public policy, private owners of assets to compensate a local area when a privately owned asset was closed or its economic use suspended. For example, over the last one hundred years, technological developments in the agricultural and industrial sectors have created mass migrations of people from rural areas to urban areas with no attempt made to compensate the rural areas. Furthermore, when businesses close they have not been required to compensate for the secondary benefits that are lost in the area. The economic argument against compensation has been that resources are mobile and, if displaced due to a policy or technological change, they will find employment elsewhere.

Second, classical economic theory indicates that estimating the appropriate level of compensation within the context of a particular event is difficult. The reason for this is that secondary benefits (costs), while potentially a valid welfare account, are likely offset by secondary costs (benefits) elsewhere. In the dry-year option case, benefit and costs would arise elsewhere by: a) more water being in the springs, b) more water flowing in the rivers downstream, c) sustained endangered species, d) more water available for urban uses, and e) production increases in other areas that replace crop production that ordinarily would have happened in the Edwards area, as well as other benefits. Generally, this compensation question has always been judged too difficult to handle in order to fully account and develop a rational basis for compensation.

Closely related to this problem is the question of the appropriate source of revenue for compensation. For example, let's assume that property taxes must be increased in the area to raise funds for compensation to farmers and third parties. Since increases in property taxes will reduce property values, *ceteris paribus,* are the owners of assets upon which the tax is imposed also due compensation? Of course, this question is not limited to property tax increases for compensation revenue. In fact, it could be asked of any revenue transfer program.

Third, consideration of an alternative view of compensation to injured third parties may be beneficial in analyzing the dry-year option. This view is based more on a strategy for policy implementation rather than on the traditional evaluation of whether or not third party compensation is justifiable from a social efficiency standpoint. In the past, in cases where the government action brings about an undesirable change in a region, or in some way injures third parties and consequently may be expected to face resistance, compensation has been judged appropriate. For example, in actions on the siting of a hazardous waste facility or closing of a military base, the federal government has engaged in payments and other forms of mitigation to the region to offset secondary economic losses. Moreover, the State of Texas has offered compensation to third parties in the case of the location of low level radioactive waste storage facilities (Jones, et al.). The purpose of these payments appears to be not an attempt to achieve efficiency or equity in policy actions, but rather an attempt to increase the acceptability of the action and reduce the transactions costs and time of implementation of the policy. In most cases, compensation has been made to certain governing bodies of the impacted region. No attempt has been made to make direct compensatory payments to owners of resources that become unemployed as a result of the action.

Compensation to third parties is fraught with difficulties, including decisions as to who should be compensated and by how much. Nevertheless, setting aside the philosophical question of social efficiency, compensation to third parties may be viewed as a practical policy tool that may reduce local resistance and the transaction costs of implementing a public policy.

Numerous recent cases may be cited in which the question of third party impacts has dominated the debate over environmental policy to the extent that implementation has been significantly delayed and policies have been changed. Two of these will suffice. First, the program to protect the Spotted Owl in the northwestern United States became embroiled in extreme controversy because of its effect on logging, sawmills, rural communities, jobs and income to rural residents in the impact area. The second case involves the restoration of the Florida Everglades which would have an affect on sugarcane producers in South Florida, reduce the amount of land in production and spin-off secondary impacts in the communities where sugarcane production is the primary economic base for the region.

In both these cases, and in others similar, the delayed implementation, high cost of legal and consultant services and other costs significantly affected the overall transaction costs and effectiveness of the programs to address their intended purposes. The development of a program for third party payments may have been feasible in these and/or other public programs. If used as an implementation tool, then third party payments should be evaluated on a cost/benefit basis and used to the extent that the monetary value of the compensation is less than the expected transactions cost if no compensation is made.

In the case of the Edwards Aquifer, proposed programs for changing underground water allocation to anything but absolute capture have generally been met with resistance. Implementing the dry-year option will likely be no exception. Any policy to reallocate water may be expected to be viewed as an undesirable policy in the areas where water use is reduced. In this case, third party compensation may be feasible in terms of the cost of implementation.

9.2 What amount of compensation could be paid to third parties?

Beyond the question of whether or not third party payments should be made lies the question of how much should payments be. The dry-year option differs from the compensation experiences cited above in at least one significant feature. That is, the reallocation of water would be a periodic, annual event rather than a permanent change in water use. Hence, compensation would be due third parties only in the year in which the dry-year option is triggered and the amount of compensation would be limited only to annual, temporary losses to third parties.

One criterion for third party compensation could be to gauge the amount of compensation against the loss of regional benefits from the employment of local resources that results from the dry-year option. Specifically, an annual reallocation of water that reduces its use in agricultural irrigation would further reduce the employment of land, capital, labor and management resources where the reductions occur. The input-output model provides an estimate of this reduction under an aggregate title of Value Added. Value added losses due to the reallocation are estimated by county and sector of the economy and show the estimated loss in returns to land, capital, labor and management within the region. The estimate includes not only the losses from resource unemployment in irrigated agriculture, but also the secondary value added losses to input suppliers, processors, and other related, third party sectors in the economy.

9.3 Who are the third parties?

Typically, policy initiatives that consider third party compensation, focus on replacing potential lost revenue for taxing jurisdictions such as schools, county governments, municipalities and special taxing districts. Mechanisms called "payments in lieu of taxes" have been used to compensate public entities in cases where a public facility exists that is tax exempt by law but creates an increase in demand for public services, expenditures and revenue needs. Examples include military bases, public utility generating plants and other similar entities that use and cause an increase in demand for public services but cannot be taxed by local jurisdictions. This mechanism would seem to have limited applicability in the dry-year option program since no physical facilities would be put in place that would stimulate an increase the need for public spending. Moreover, underground water withdrawn from the aquifer for whatever reason is not taxed directly. Compensation would not, therefore, be in lieu of taxes.

9.3.1 Impacts on public jurisdictions

A program of payments to public jurisdictions (county, cities and schools) to replace lost taxes because of reduced agricultural production could be considered.

However, the temporary and intermittent nature of the dry-year option, combined with the tax laws relating to agricultural production, suggest that tax losses to jurisdictions in the Edwards area should be minimal if they exist at all.

Tax losses to local jurisdictions would occur only if the dry-year option program caused changes that reduced their most important tax bases. Counties and city governments and school districts depend primarily on property taxes for revenue. Counties and cities also depend to varying degrees on sales taxes. However, implementation of the dry-year option is expected to have little or no affect on either of these tax bases because of special treatment given to farmers and ranchers under Texas tax laws. First, both production inputs purchased and commodity sales made by farmers and ranchers are exempt from state and local sales taxes. Federal and state fuel taxes are also exempted. Hence, even if purchased inputs, such as seed, fertilizers, pesticides, irrigation equipment, etc. are reduced in the dry-year implementation period, there would be no loss in sales taxes since none are paid in the non-dry-years.

In the case of property taxes, farmers and ranchers again receive special treatment under Texas law. The Open Space land valuation law (see Article VIII, Sec. 1-d-1, TX. Const.) was incorporated into the Texas Constitution in 1980. This law allows qualifying land to be taxed on its agricultural productivity value rather than its market value as is other property. The taxable value of farm and ranch land is estimated using a capitalization formula that considers only the agricultural returns to land along with a capitalization rate that is also determined by law. The result of this law is that virtually all land used for agricultural production in Texas (over 95 percent) is qualified and taxed on productivity value rather than market value.

Productivity value is typically significantly less than market value. For example, the productivity values and market values of irrigated cropland in Uvalde and Medina counties are compared as follows (Turner):

	Uvalde	Medina
Market Value ($/acre)	713	1250
Productivity Value ($/acre)	308	413

Under Texas productivity valuation rules, the productivity value cannot exceed the market value. Hence, to have an affect on revenues of taxing jurisdictions the dry-year option program would have to cause market values of irrigated cropland to fall below the productivity value. Moreover, since landowners receive payments for participating in the program, these payments would be a consideration in any irrigated land sales so that the impact on market values should be minimal. Hence, farmers and ranchers would pay taxes based on productivity value in the dry-year just like any other year without any affect on the taxing jurisdictions.

In sum, there appears to be no reason to expect that the local taxing jurisdictions in the areas where farmers choose to participate in the dry-year option would be impacted. The participation payments should offset any losses from reduced irrigated acreage that might affect the market values of land. Further, even if market values were to decline, it is not likely that the decline would be sufficient to cause a shift in the farmland tax base from productivity value to market value.

9.3.2 Private businesses and individuals

Reducing irrigated acreage in the Edwards may affect a number of businesses and individuals either directly or indirectly related to irrigated crop production. Most directly impacted would be farm labor, businesses that supply productive inputs (mainly irrigation equipment and supplies), agricultural services, and possibly farmers who lease land from owners for irrigated crop production.

9.3.3 Farm labor

Irrigated crop production is more labor intensive than dryland crop or livestock production. Hence, it is expected that implementing the dry-year option would displace farm workers in the year in which irrigated acreage is reduced. Compensation may be in order for these farm workers since their income loss is directly related to the dry-year policy implementation. A program of temporary compensation would be consistent with that suggested by Berck and Hazen and Sawyer.

9.3.4 Cash and share leases

Some of the irrigated agricultural production in the Edwards region is carried out by farmers who do not own the land they farm. Leasing of farmland is a common practice. Typically, landowners (lessors) and farm operators (lessees) enter into agreements that state the terms of the lease which may be based on a cash payment per year or on a share to the production earned during the year.

In a cash lease, the landowner typically provides the land and irrigation well and pays property taxes. The lessee provides the variable inputs, farming equipment (capital), labor and management. The amount of cash lease going to the landowner reflects the return to land after all other inputs to production have been paid.

Obviously, a share lease, while variable in nature, is expected to yield about the same return to the landowner as the cash lease. There is a potential for losses of income by lessees depending upon the per acre amount of the offer made to landowners to temporarily take their irrigated land out of production. Landowners who lease out their land would be attracted by any offer that is greater than the amount of the cash lease offered by lessees or the expected amount of returns to land from a share lease. If these landowners enter the program, the lessee loses the opportunity for employment of the productive resources contributed by the lease. The amount of the lessee's loss in one year would be the expected returns to labor, capital and management.

Owner operators, those who farm their own land, would likely consider the unemployment consequences of resources other than land that they own. Consequently, they would require an offer to participate in the dry-year program that is sufficiently large to cover expected returns to land plus returns to fixed capital, operator and family labor and management (Michelson and Young).

This potential third party loss may be avoided in at least two ways. These are: (1) setting the participation bid price sufficiently high to cover the returns to all resources employed in irrigation production; and (2) requiring that both lessors and lessees participate in the benefits of the participation offers. This approach should be equally attractive to owner-operators, landowners and farmers who rent land for irrigated production.

9.3.5 Farm supply and service businesses

A variety of businesses in the Edwards Aquifer area are established and operate to serve the needs of farmers and ranchers. These include farm implement and equipment companies, irrigation equipment suppliers, input supply companies, and custom service operations to name a few. The dry-year option could impact these businesses as farmers reduce their use of purchased inputs, use less services, and delay investments in machinery and equipment. For most purchases that farmers make, the local businesses earn a wholesale and/or retail margin from the sale of inputs, machinery and equipment that is manufactured outside the region. In dry-years, businessmen who supply farmers would be expected to make reductions in orders of materials, equipment and other items purchased for resale during the production year. In this case, the loss to local businesses is limited to the reduced wholesale and retail margins foregone because of reduced sales to farmers who participate in the program. Also, these businesses may cut back on employees. This would reduce personal income in the locale and have subsequent impacts on retail sales, business and personal service businesses, banks and other businesses that depend primarily upon the local markets for sales of their goods and services. This impact may also affect local and state sales tax revenues.

9.3.6 Speciality production and marketing systems

Within the Edwards Aquifer region, there exist a variety of speciality agricultural production and marketing systems that are integrated or coordinated by use of contracts from production to final consumer. These systems focus primarily on vegetable production and corn for human consumption.

These systems typically serve "niche" or speciality markets, unlike major field crops that sell commodities into a national market. An important ingredient in a coordinated, speciality system is the dependability of supply for specific consumer markets such as restaurants and brand name products. Should the irrigated acreage serving these systems be reduced within the area, adjustments would need to be made elsewhere to sustain the supply of products and efficient alternatives may be limited.

9.4 Compension - concluding comments

The dry-year option program presents questions relative to third party payments that are quite different from previous public programs adopted to manage natural resources. At this time, it is expected that implementation of the dry-year option will be a temporary, annual event which should serve to minimize the impacts on private third parties and on public service providers. The magnitude of these intermittent impacts will depend upon the amount of irrigated land that enters the dry-year option program and leaves production in a given year.

Of course, the loss of one year's business can be a severe impact for some businesses, but not as severe as the permanent removal of land or other resources as is the case in most previous natural resource management programs.

Task 10 -- Delivery of models

Several assumptions were made in order to examine consequences of the dry-year option, some of which may not be absolutely in accord with the way the dry-year option is eventually set up and/or there may be alternative ways that the agricultural producers might respond. Thus, we have developed a transportable version of the farm economic model in which assumptions may be modified.

We are prepared to deliver a disk copy of the model including all related files to those interested for a nominal fee. However, we cannot deliver the input-output model, just the multipliers as we are contractually obligated by the IMPLAN developers to not redistribute the software. We certainly can make available the procedures for the aggregation and analysis to those who own IMPLAN.

Task 11 -- Municipal and industrial demand

Water released by the dry-year option can conceivably be used to allow greater usage by nonagricultural users. We generated a municipal and industry-only model to determine how much water municipal and industrial interests would buy using the same pumping lifts as in the agricultural model. The water price was varied above pumping costs from $0-500. This yielded observations for each recharge year as well as average results. Table 13 gives the amount of recharge and the probability of each of the recharge years, while Table 14 gives the usage in an average year and the usage in each of the recharge years. As can be seen from the table, water use varied from 336,482 acre feet when water was not priced (a zero price was used) to 132,508 ac/ft when a $500 charge was used. Also note higher water usage occurred under the drier years and lower water usage in the wetter years.

Figure 1. Difference between irrigated acreage in free capture versus cooperative context

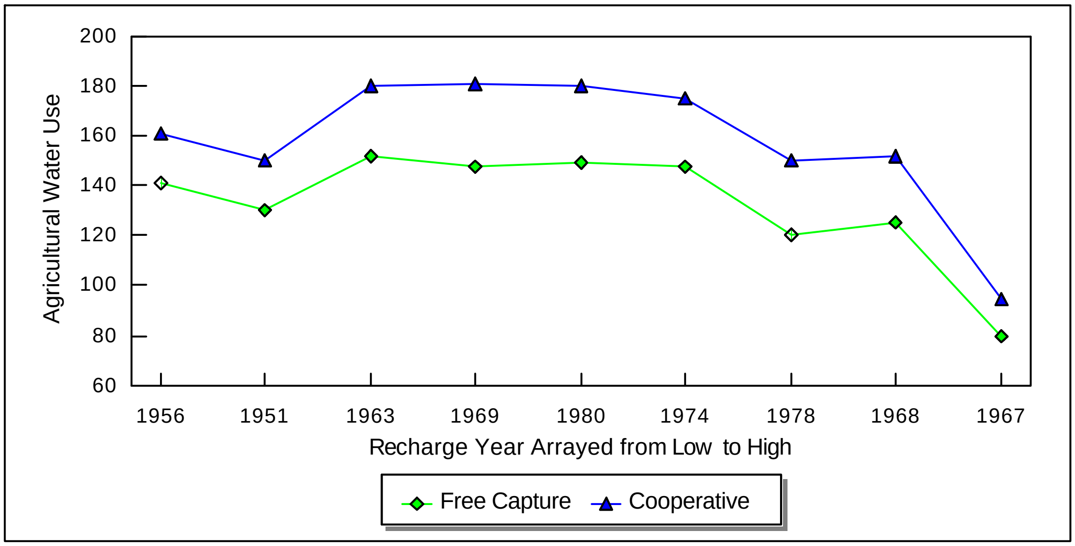

Table 1. Regression coefficients for current year Comal and San Marcos springflow, and J17 and Sabinal index well ending elevations.

	Comal Springflow (acre feet)	San Marcos Springflow (acre feet)	J17 Ending Elevation (feet above sea level)	Sabinal Ending Elevation (feet above sea level)
J17 Starting Elevation (feet above sea level)	2,651	412	0.54	0.35
Sabinal Starting Elevation (feet above sea level)	551	0.0	0.16	0.58
Annual Recharge (acre feet)	0.080	0.024	0.000019	0.000024
Western Pumping (acre feet)	-0.04	-0.0005	-0.000028	-0.000091
Eastern Pumping (acre feet)	-0.28	-0.025	-0.000136	-0.000059
Intercept	-1924677	-203976	210	102
R-Square	0.93	0.77	0.95	0.96

Figure 2. Agricultural irrigated land use reduction by dry-year option scenario

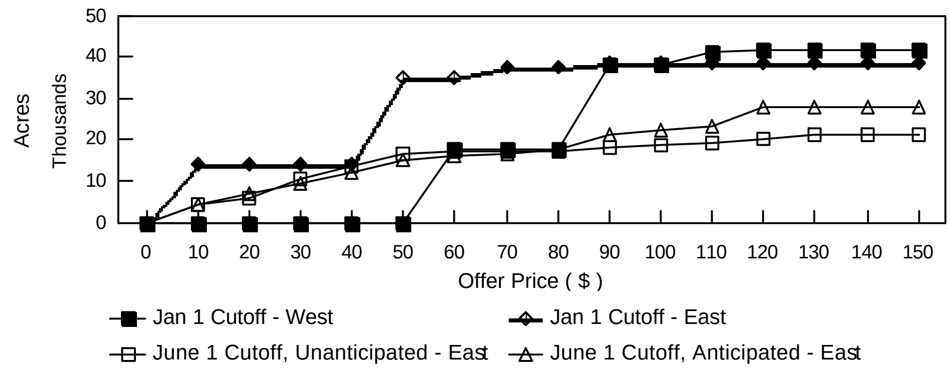

Figure 3. Agricultural water use reduction by dry-year option scenario

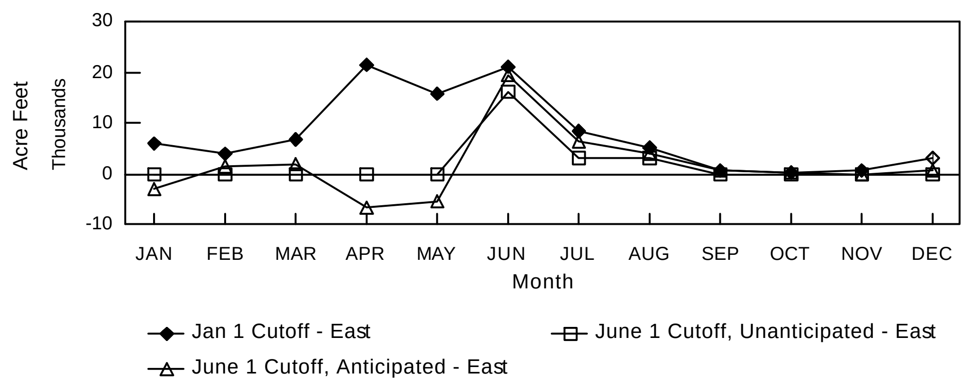

Figure 4. Comal springflow increase by dry-year option scenario

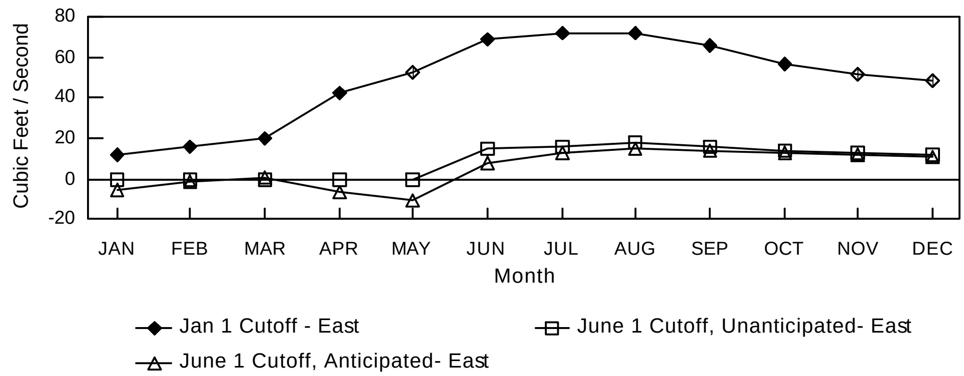

Figure 5. Water use reduction and springflow increase

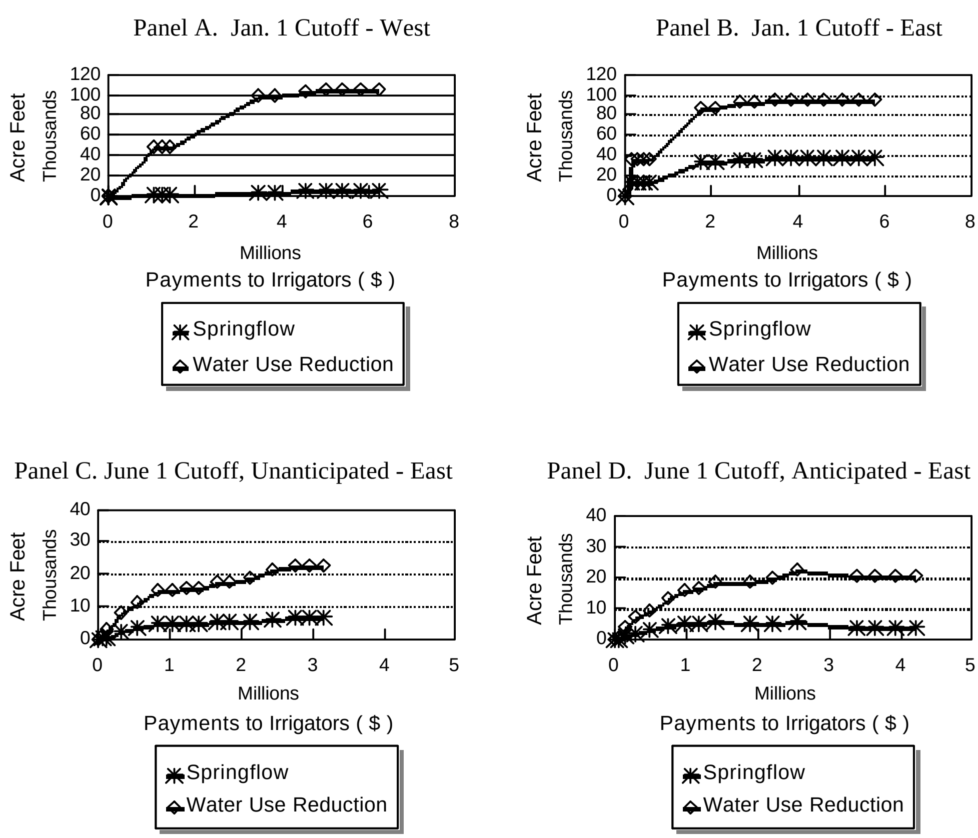

Table 2. Response to offer price of implementing a dry-year option: January 1st cutoff - Uvalde and Kinney counties.

Offer		Type of Land Use			Irrigation Water		Springflow Response		Agricultural Income			Cost of Program			
		Irrigated				Amount of	Total	Comal		From		Cost of Water			Cost of Springflow
Price	Total	Furrow	Sprinkler	Dryland	Applied	Reduction	Current Yr.	August	Total	Operation	Total	Average	Marginal	Marginal	Average
($)	(Acres)	(Acres)	(Acres)	(Acres)	(AF)	(AF)	(AF)	(CFS)	($)	($)	($)	($/AF)	($/AF)	($/AF)	($/AF)
0	41,560	28,357	13,203	0	104,516	0	0	0.00	2,813,701	2,813,701	0	0	inf.	inf.	0
10	41,560	28,357	13,203	0	104,551	0	0	0.00	2,813,707	2,813,707	0	0	inf.	inf.	0
20	41,560	28,357	13,203	0	104,551	0	0	0.00	2,813,707	2,813,707	0	0	inf.	inf.	0
30	41,560	28,357	13,203	0	104,551	0	0	0.00	2,813,707	2,813,707	0	0	inf.	inf.	0
40	41,560	28,357	13,203	0	104,551	0	0	0.00	2,813,707	2,813,707	0	0	inf.	inf.	0
50	41,560	28,357	13,203	0	104,551	0	0	0.00	2,813,707	2,813,707	0	0	inf.	inf.	0
60	23,941	10,738	13,203	17,618	54,895	49,621	2,789	5.55	3,168,235	2,111,155	1,057,080	93	93	379	379
70	23,941	10,738	13,203	17,618	54,895	49,621	2,789	5.55	3,344,415	2,111,155	1,233,260	109	inf.	inf.	442
80	23,941	10,738	13,203	17,618	54,895	49,621	2,789	5.55	3,520,595	2,111,155	1,409,440	124	inf.	inf.	505
90	3,265	0	3,265	38,294	6,092	98,424	5,507	10.93	4,550,983	1,104,523	3,446,460	153	214	879	626
100	3,265	0	3,265	38,294	6,092	98,424	5,507	10.93	4,933,923	1,104,523	3,829,400	170	inf.	inf.	695
110	234	0	234	41,326	448	104,068	5,812	11.53	5,483,934	938,074	4,545,860	191	851	3,610	782
120	0	0	0	41,560	0	104,516	5,836	11.58	5,908,681	921,481	4,987,200	208	4,304	18,194	855
130	0	0	0	41,560	0	104,516	5,836	11.58	6,324,281	921,481	5,402,800	226	inf.	inf.	926
140	0	0	0	41,560	0	104,516	5,836	11.58	6,739,881	921,481	5,818,400	243	inf.	inf.	997
150	0	0	0	41,560	0	104,516	5,836	11.58	7,155,481	921,481	6,234,000	260	inf.	inf.	1,068

Table 3. Response to offer price of implementing a dry-year option : January 1st cutoff - Medina and Bexar counties

		Type of Land Use			Irrigation Water		Springflow Response		Agricultural Income			Cost of Program			
Offer		Irrigated				Amount of	Total	Comal		From		Cost of Water			Cost of Springflow
Price	Total	Furrow	Sprinkler	Dryland	Applied	Reduction	Current Yr.	August	Total	Operation	Total	Average	Marginal	Marginal	Average
($)	(Acres)	(Acres)	(Acres)	(Acres)	(AF)	(AF)	(AF)	(CFS)	($)	($)	($)	($/AF)	($/AF)	($/AF)	($/AF)
0	38,332	26,982	11,350	0	94,397	0	0	0.00	1,374,515	1,374,515	0	0	inf.	inf.	0
10	24,447	13,097	11,350	13,885	57,385	37,011	15,034	28.25	1,602,128	1,463,278	138,850	4	4	9	9
20	24,447	13,097	11,350	13,885	57,385	37,011	15,034	28.25	1,740,978	1,463,278	277,700	8	inf.	inf.	18
30	24,447	13,097	11,350	13,885	57,385	37,011	15,034	28.25	1,879,828	1,463,278	416,550	11	inf.	inf.	28
40	24,447	13,097	11,350	13,885	57,385	37,011	15,034	28.25	2,018,678	1,463,278	555,400	15	inf.	inf.	37
50	3,531	0	3,531	34,801	6,737	87,660	35,491	66.86	2,899,836	1,159,786	1,740,050	20	32	78	49
60	3,531	0	3,531	34,801	6,737	87,660	35,491	66.86	3,247,846	1,159,786	2,088,060	24	inf.	inf.	59
70	950	0	950	37,382	1,858	92,538	37,403	70.45	3,736,095	1,119,355	2,616,740	28	180	458	70
80	950	0	950	37,382	1,858	92,538	37,403	70.45	4,109,915	1,119,355	2,990,560	32	inf.	inf.	80
90	0	0	0	38,332	0	94,397	38,132	71.81	4,530,525	1,080,645	3,449,880	37	448	1,143	90
100	0	0	0	38,332	0	94,397	38,132	71.81	4,913,845	1,080,645	3,833,200	41	inf.	inf.	101
110	0	0	0	38,332	0	94,397	38,132	71.81	5,297,165	1,080,645	4,216,520	45	inf.	inf.	111
120	0	0	0	38,332	0	94,397	38,132	71.81	5,680,485	1,080,645	4,599,840	49	inf.	inf.	121
130	0	0	0	38,332	0	94,397	38,132	71.81	6,063,805	1,080,645	4,983,160	53	inf.	inf.	131
140	0	0	0	38,332	0	94,397	38,132	71.81	6,447,125	1,080,645	5,366,480	57	inf.	inf.	141
150	0	0	0	38,332	0	94,397	38,132	71.81	6,830,445	1,080,645	5,749,800	61	inf.	inf.	151

Table 4. Response to offer price of implementing a dry-year option: June 1 cutoff, unanticipated, Medina and Bexar counties.

		Type of Land Use			Irrigation Water		Springflow Response		Agricultural Income			Cost of Program			
Offer		Irrigated				Amount of	Total	Comal		From		Cost of Water			Cost of Springflow
Price	Total	Furrow	Sprinkler	Dryland	Applied	Reduction	Current Yr.	August	Total	Operation	Total	Average	Marginal	Marginal	Average
($)	(Acres)	(Acres)	(Acres)	(Acres)	(AF)	(AF)	(AF)	(CFS)	($)	($)	($)	($/AF)	($/AF)	($/AF)	($/AF)
0	38,332	26,982	11,350	0	94,397	0	0	0.00	1,374,515	1,374,515	0	0	0	0	0
10	33,845	23,762	10,083	4,487	92,972	1,425	470	1.15	1,403,547	1,358,675	44,872	31	31	96	96
20	32,437	22,748	9,689	5,895	91,441	2,955	960	2.38	1,453,702	1,335,804	117,898	40	48	149	123
30	27,743	18,993	8,749	10,589	86,051	8,346	2,665	6.73	1,538,065	1,220,385	317,680	38	37	117	119
40	24,749	17,736	7,013	13,583	83,241	11,156	3,556	8.99	1,651,353	1,108,036	543,317	49	80	253	153
50	21,587	14,825	6,763	16,745	79,304	15,092	4,829	12.17	1,813,155	975,916	837,239	55	75	231	173
60	21,126	14,748	6,378	17,206	78,968	15,429	4,939	12.44	1,984,319	951,981	1,032,338	67	580	1,760	209
70	20,937	14,668	6,269	17,395	78,837	15,560	4,983	12.54	2,158,018	940,368	1,217,650	78	1,413	4,288	244
80	20,937	14,668	6,269	17,395	78,837	15,560	4,983	12.54	2,331,968	940,368	1,391,600	89	inf.	inf.	279
90	19,956	13,687	6,269	18,376	76,810	17,586	5,509	14.18	2,509,058	855,261	1,653,797	94	215	828	300
100	19,886	13,617	6,269	18,446	76,677	17,720	5,545	14.28	2,693,329	848,773	1,844,556	104	1,428	5,273	333
110	19,046	12,777	6,269	19,286	75,248	19,148	5,943	15.44	2,883,393	761,933	2,121,460	111	194	696	357
120	18,055	11,786	6,269	20,277	73,211	21,186	6,474	17.08	3,082,071	648,817	2,433,253	115	153	588	376
130	17,262	10,993	6,269	21,070	71,863	22,533	6,850	18.16	3,288,346	549,246	2,739,100	122	227	815	400
140	17,262	10,993	6,269	21,070	71,863	22,533	6,850	18.16	3,499,046	549,246	2,949,800	131	inf.	inf.	431
150	17,262	10,993	6,269	21,070	71,863	22,533	6,850	18.16	3,709,746	549,246	3,160,500	140	inf.	inf.	461

Table 5. Response to offer price of implementing a dry-year option: June 1 cutoff, anticipated with 48% probability, Medina and Bexar counties

		Type of Land Use			Irrigation Water		Springflow Response		Agricultural Income			Cost of Program			
Offer		Irrigated				Amount of	Total	Comal		From		Cost of Water			Cost of Springflow
Price	Total	Furrow	Sprinkler	Dryland	Applied	Reduction	Current Yr.	August	Total	Operation	Total	Average	Marginal	Marginal	Average
($)	(Acres)	(Acres)	(Acres)	(Acres)	(AF)	(AF)	(AF)	(CFS)	($)	($)	($)	($/AF)	($/AF)	($/AF)	($/AF)
0	38,332	26,982	11,350	0	94,397	0	0	0.00	1,374,515	1,374,515	0	0	0	0	0
10	33,787	23,704	10,083	4,545	93,766	631	122	0.51	1,412,152	1,366,699	45,453	72	72	373	373
20	31,373	21,684	9,689	6,959	90,165	4,232	1,367	3.41	1,468,960	1,329,782	139,178	33	26	75	102
30	28,738	19,955	8,783	9,594	87,181	7,216	2,337	5.82	1,554,415	1,266,589	287,826	40	50	153	123
40	26,215	19,203	7,013	12,117	84,868	9,528	3,087	7.68	1,656,287	1,171,618	484,670	51	85	262	157
50	23,456	16,694	6,763	14,876	80,681	13,716	4,529	11.06	1,802,857	1,059,068	743,789	54	62	180	164
60	22,365	15,987	6,378	15,967	78,577	15,820	5,196	12.75	1,958,205	1,000,187	958,018	61	102	321	184
70	21,755	15,486	6,269	16,577	77,373	17,023	5,562	13.72	2,121,298	960,939	1,160,359	68	168	553	209
80	20,773	14,646	6,127	17,559	75,352	19,045	6,196	15.32	2,297,403	892,683	1,404,720	74	121	385	227
90	17,280	11,211	6,069	21,052	75,555	18,842	5,092	14.63	2,669,370	774,690	1,894,680	101	inf.	inf.	372
100	16,182	10,657	5,525	22,150	74,088	20,308	5,396	15.68	2,919,469	704,425	2,215,044	109	641	6,275	410
110	15,239	9,714	5,525	23,093	71,808	22,588	6,128	17.51	3,146,362	606,132	2,540,230	112	143	445	415
120	10,255	6,376	3,879	28,077	73,383	21,014	4,038	15.34	3,804,981	435,741	3,369,240	160	inf.	inf.	834
130	10,255	6,376	3,879	28,077	73,383	21,014	4,038	15.34	4,085,751	435,741	3,650,010	174	inf.	inf.	904
140	10,255	6,376	3,879	28,077	73,383	21,014	4,038	15.34	4,366,521	435,741	3,930,780	187	inf.	inf.	974
150	10,255	6,376	3,879	28,077	73,383	21,014	4,038	15.34	4,647,291	435,741	4,211,550	200	inf.	inf.	1,043

Table 6. Effects of offering $50 per acre not to irrigate while implementing dry-year option in Medina and Bexar counties

	Scenario		
	January 1	June 1	June 1
	Cutoff	Cutoff	Cutoff
		(Unanticipated)	(Anticipated)
Type of Land Use:			
Furrow Irrigation (acres)	0	14,825	16,694
Sprinkler Irrigation (acres)	3,531	6,763	6,763
Total Irrigated Acres	3,531	21,587	23,456
Acre Converted to Dryland	34,801	16,745	14,876
Total Acres	38,332	38,332	38,332
Irrigation Water:			
Applied	6,737	79,304	80,681
Reduction	87,660	15,092	13,716
Amount Used w/o Payment	94,397	94,397	94,397
Springflow Response:			
Current Year (Acre feet)	35,491	4,829	4,529
Comal - August (cfs)	66.86	12.17	11.06
Agricultural Income:			
From Operation ($)	1,159,786	975,916	1,059,068
Payments ($)	1,740,050	837,239	743,789
Total Agricultural Income	2,899,836	1,813,155	1,802,857
Cost of Implementing Program:			
Total Cost ($)	1,740,050	837,239	743,789
Cost of Water:			
Average Cost ($/Acre feet)	20	55	54
Marginal Cost ($/Acre feet)	32	75	62
Cost of Comal Springflow:			
Average Cost ($/Acre feet)	49	173	164
Marginal Cost ($/Acre feet)	78	231	180

Table 7. Potential water use reduction from implementing a dry-year option (acre feet).

County	Strategy	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
Uvalde	Jan 1 Cutoff	7,947	4,527	5,796	23,365	19,090	23,012	10,313	2,605	798	821	1,255	4,987	104,515
Medina	Jan 1 Cutoff	6,135	4,050	6,838	21,605	15,937	21,097	8,377	5,046	849	539	687	3,236	94,396
Medina	June 1 Cutoff Unanticipated	0	0	0	0	0	16,096	3,057	3,380	0	0	0	0	22,532
Medina	June 1 Cutoff Anticipated	(2,781)	1,675	2,163	(6,746)	(5,568)	19,512	6,641	4,137	633	436	110	801	21,014

Table 8. Potential springflow effect from implementing a dry-year option - Comal Springs (CFS).

County	Strategy	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Uvalde		0.22	1.87	2.15	5.10	7.00	10.32	11.71	11.58	12.05	11.38	11.44	10.49
Medina	Jan 1 Cutoff	11.61	15.71	19.79	42.17	53.16	69.28	71.65	71.81	66.05	57.28	51.86	48.45
Medina	June 1 Cutoff Unanticipated	0.00	0.00	0.00	0.00	0.00	14.74	16.33	18.16	16.55	14.27	12.82	11.56
Medina	June 1 Cutoff Anticipated		(1.71)	1.23	(6.21)	(10.97)	7.56	12.70	15.34	14.44	12.73	11.50	10.79

Table 9. Analysis of regional economic impacts from the dry-year option for the Edwards Aquifer Region, by selected scenario

Scenario	Economic Impact Variables Estimated						
	Final Demand (MM$)	Industrial Output (MM$)	Employee Income (MM$)	Property Income (MM$)	Total Income (MM$)	Value Added (MM$)	Employment (Number of Jobs)
1. Price offers with payments made from inside the region							
1.1 $10	-6.67	-8.38	-1.48	-2.97	-4.44	-4.90	-112.00
1.2 $60	-26.20	-32.54	-8.11	-9.88	-17.99	-19.62	-487.00
1.3 $90	-48.53	-59.99	-16.80	-17.07	-33.88	-36.75	-931.00
2. Price offers with payments made from outside the region							
2.1 $10	-6.43	-8.11	-1.29	-2.94	-4.23	-4.68	-106.00
2.2 $60	-21.41	-27.24	-4.50	-9.33	-13.83	-15.25	-370.00
2.3 $90	-36.58	-46.76	-7.79	-15.71	-23.49	-25.82	-639.00
3. Price offers without benefits from payments to farmers							
3.1 $10	-6.79	-8.99	-1.50	-3.22	-4.72	-5.23	-119.00
3.2 $60	-25.98	-34.57	-5.97	-11.83	-17.81	-19.67	-475.00
3.3 $90	-47.54	-63.44	-11.02	-21.42	-32.44	-35.81	-876.00
4. Administrative maximum aquifer withdrawal of 450,000 ac.ft.	-12.47	-15.74	-2.49	-5.70	-8.19	-9.04	-205.00
5. Administrative minimum springflow	-8.24	-10.42	-1.65	-3.74	-5.39	-5.94	-136.00

Table 10. Analysis of economic impacts from the dry-year option for Uvalde county, by selected scenario

Scenario	Final Demand (MM$)	Industrial Output (MM$)	Employee Income (MM$)	Property Income (MM$)	Total Income (MM$)	Value Added (MM$)	Employment (Number of Jobs)
1. Price offers with payments made from inside the region							
1.2 $60	-13.20	-20.01	-5.01	-5.59	-10.60	-11.56	-349.00
1.3 $90	-29.64	-44.43	-12.47	-11.81	-24.28	-26.38	-814.00
2. Price offers with payments made from outside the region							
2.2 $60	-10.99	-17.25	-3.27	-5.24	-8.51	-9.32	-271.00
2.3 $90	-22.44	-35.42	-6.77	-10.66	-17.44	-19.08	-559.00
3. Price offers without benefits from payments to farmers							
3.2 $60	-12.42	-19.26	-3.58	-5.96	-9.54	-10.47	-296.00
3.3 $90	-27.18	-42.13	-7.82	-13.06	-20.88	-22.91	-647.00
4. Administrative maximum aquifer withdrawal of 450,000 ac.ft.	-7.03	-10.43	-1.72	-3.65	-5.37	-5.88	-147.00
5. Administrative minimum springflow	-5.69	-8.52	-1.43	-2.90	-4.33	-4.74	-121.00

Table 11. Analysis of economic impacts from the dry-year option for Medina county, by selected scenario

Scenario	Economic Impact Variables Estimated						
	Final Demand (MM$)	Industrial Output (MM$)	Employee Income (MM$)	Property Income (MM$)	Total Income (MM$)	Value Added (MM$)	Employment (Number of Jobs)
1. Price offers with payments made from inside the region							
1.1 $10	-6.17	-8.43	-1.16	-3.21	-4.36	-4.81	-108.00
1.2 $60	-14.13	-19.03	-4.51	-6.16	-10.67	-11.68	-339.00
1.3 $90	-16.32	-21.83	-6.26	-6.45	-12.71	-13.87	-443.00
2. Price offers with payments made from outside the region							
2.1 $10	-5.82	-7.99	-0.91	-3.14	-4.05	-4.46	-93.00
2.2 $60	-10.01	-13.79	-1.56	-5.36	-6.92	-7.61	-159.00
2.3 $90	-9.69	-13.39	-1.50	-5.16	-6.66	-7.32	-153.00
3. Price offers without benefits from payments to farmers							
3.1 $10	-6.00	-8.23	-0.94	-3.24	-4.18	-4.61	-96.00
3.2 $60	-12.15	-16.64	-1.90	-6.57	-8.46	-9.34	-195.00
3.3 $90	-13.12	-17.98	-2.05	-7.10	-9.14	-10.09	-211.00
4. Administrative maximum aquifer withdrawal of 450,000 ac.ft.	-5.30	-7.25	-0.82	-2.86	-3.69	-4.07	-85.00
5. Administrative minimum springflow	-2.57	3.50	-0.40	-1.40	-1.80	-1.99	-41.00

Table 12. Analysis of economic impacts from the dry-year option for Bexar county, by selected scenario

Scenario	Final Demand (MM$)	Industrial Output (MM$)	Employee Income (MM$)	Property Income (MM$)	Total Income (MM$)	Value Added (MM$)	Employment (Number of Jobs)
	Economic Impact Variables Estimated						
1. Price offers with payments made from inside the region							
$60	-4.72	-5.59	-1.45	-1.78	-3.23	-3.48	-78.00
2. Price offers with payments made from outside the region							
$60	-3.56	-4.32	-0.58	-1.65	-2.23	-2.42	-51.00
3. Price offers without benefits from payments to farmers							
$60	-4.46	-5.51	-0.77	-2.12	-2.89	-3.16	-66.00

Table 13. Level and probability of recharge by year

YEAR	AMOUNT (ac ft)	PROBABILITY IN PERCENT
1956	43758	2
1951	140097	2
1963	170756	9
1989	214455	14
1980	406301	21
1974	658447	21
1976	894088	21
1958	1710171	7
1987	2003643	2

Table 14. Municipal and industrial water use for different prices and recharge years

PRICE LEVEL	AVG	1956	1951	1963	1989	1980	1974	1976	1958	1987
PRICE0	336482	354971	348255	347465	344001	345968	331572	320261	335478	334887
PRICE10	311557	329103	322731	321963	318728	320472	306980	296362	310133	309458
PRICE20	292358	309005	302990	302292	299225	300803	288041	277984	290715	289976
PRICE30	276931	292846	287140	286439	283529	284990	272829	263236	275168	274356
PRICE40	264156	279446	273988	273305	270519	271886	260233	251035	262321	261501
PRICE50	253331	268083	262841	262157	259483	260777	249562	240703	251457	250631
PRICE60	243994	258264	253187	252550	249961	251190	240356	231795	242102	241261
PRICE70	235822	249674	244767	244128	241621	242797	232300	224003	233915	233096
PRICE80	228584	242057	237266	236668	234232	235362	225166	217104	226683	225857
PRICE90	222110	235238	230589	229990	227620	228710	218785	210935	220215	219402
PRICE100	216270	229081	224549	223965	221654	222708	213029	205372	214385	213583
PRICE125	203837	215968	211688	211131	208946	209928	200777	193534	201987	201200
PRICE150	193710	205285	201202	200671	198590	199514	190796	183894	191899	191137
PRICE175	185234	196334	192423	191912	189920	190797	182445	175831	183464	182719
PRICE200	177995	188686	184921	184430	182512	183350	175311	168945	176264	175537
PRICE225	171709	182044	178409	177930	176078	176882	169118	162968	170016	169309
PRICE250	166179	176196	172677	172211	170416	171191	163669	157710	164522	163830
PRICE275	161259	170992	167571	167121	165378	166128	158822	153033	159635	158959
PRICE300	156842	166320	162992	162552	160855	161582	154470	148834	155250	154589
PRICE325	152844	162091	158844	158416	156761	157468	150532	145036	151283	150634
PRICE350	149203	158240	155067	154647	153030	153720	146944	141575	147669	147033
PRICE375	145865	154705	151602	151192	149611	150284	143656	138403	144357	143731
PRICE400	142790	151450	148412	148009	146460	147118	140626	135481	141307	140692
PRICE425	139943	148436	145457	145062	143544	144187	137822	132777	138484	137880
PRICE450	137297	145635	142711	142323	140833	141463	135216	130264	135860	135265
PRICE475	134829	143022	140149	139768	138304	138922	132784	127919	133413	132829
PRICE500	132519	140575	137750	137376	135936	136543	130508	125725	131123	130545

Note: Price is in $/ac ft. Use is in ac ft/yr.

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Appendix A. Input-output modeling multipliers

Table A1-1 Output Multipliers Of Bexar County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	1	0.2179	0.4478	1.6657	1.2179	1.6657
3	Ranch/Range Fed Cattle	1	0.2155	0.6143	1.8298	1.2155	1.8298
5	Cattle Feedlots	1	0.2016	0.5635	1.7651	1.2016	1.7651
6	Sheep, Lambs and Goats	1	0.0657	2.9668	4.0325	1.0657	4.0325
7	Hogs, Pigs and Swine	1	0.2117	0.517	1.7287	1.2117	1.7287
9	Miscellaneous Livestock	1	0.1981	0.2713	1.4693	1.1981	1.4693
10	Cotton	1	0.1744	0.5612	1.7356	1.1744	1.7356
11	Food Grains	1	0.292	0.5047	1.7967	1.2920	1.7967
12	Feed Grains	1	0.1758	0.4554	1.6312	1.1758	1.6312
13	Hay and Pasture	1	0.2284	0.4325	1.6610	1.2284	1.6610
16	Fruits	1	0.3014	0.4777	1.7791	1.3014	1.7791
18	Vegetables	1	0.1992	0.3933	1.5925	1.1992	1.5925
20	Miscellaneous Crops	1	0.1535	0.7211	1.8746	1.1535	1.8746

Table A1-2 Personal Income Multipliers Of Bexar County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.027	0.0713	0.1501	0.2484	3.6433	9.2074
3	Ranch/Range Fed Cattle	0.0532	0.0623	0.206	0.3215	2.1693	6.0377
5	Cattle Feedlots	0.0713	0.0584	0.189	0.3186	1.8190	4.4698
6	Sheep, Lambs and Goats	0.1406	0.0197	0.9948	1.1551	1.1404	8.2167
7	Hogs, Pigs and Swine	0.0538	0.0634	0.1734	0.2905	2.1784	5.4014
9	Miscellaneous Livestock	0.0245	0.0586	0.091	0.174	3.3925	7.1087
10	Cotton	0.0355	0.0493	0.1882	0.2729	2.3905	7.6973
11	Food Grains	0.034	0.0767	0.1692	0.2798	3.2570	8.2393
12	Feed Grains	0.0393	0.0478	0.1527	0.2398	2.2169	6.1022
13	Hay and Pasture	0.0291	0.0621	0.145	0.2362	3.1344	8.1196
16	Fruits	0.008	0.0872	0.1602	0.2554	11.8463	31.7630
18	Vegetables	0.0117	0.0536	0.1319	0.1972	5.574	16.8257
20	Miscellaneous Crops	0.0485	0.0419	0.2418	0.3321	1.8638	6.8529

Table A1-3 Total Income Multipliers Of Bexar County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III

1	Dairy Farm Products	0.2308	0.1135	0.2494	0.5937	1.4918	2.5722
3	Ranch/Range Fed Cattle	0.3205	0.1049	0.3421	0.7675	1.3274	2.395
5	Cattle Feedlots	0.3633	0.0983	0.3139	0.7755	1.2705	2.1343
6	Sheep, Lambs and Goats	0.7571	0.0326	1.6524	2.4421	1.0431	3.2256
7	Hogs, Pigs and Swine	0.3022	0.1046	0.288	0.6948	1.3462	2.2989
9	Miscellaneous Livestock	0.3437	0.0967	0.1511	0.5915	1.2815	1.7211
10	Cotton	0.3614	0.0812	0.3126	0.7552	1.2248	2.0898
11	Food Grains	0.4501	0.136	0.2811	0.8672	1.3023	1.9268
12	Feed Grains	0.6005	0.0825	0.2536	0.9366	1.1373	1.5597
13	Hay and Pasture	0.4795	0.1071	0.2409	0.8275	1.2233	1.7257
16	Fruits	0.1648	0.1592	0.2661	0.59	1.9659	3.5807
18	Vegetables	0.4945	0.1007	0.2191	0.8143	1.2037	1.6467
20	Miscellaneous Crops	0.6224	0.0747	0.4016	1.0987	1.12	1.7652

Table A1-4 Value Added Multipliers Of Bexar County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.2356	0.126	0.2866	0.6483	1.5348	2.7513
3	Ranch/Range Fed Cattle	0.3414	0.1204	0.3932	0.8551	1.3526	2.5043
5	Cattle Feedlots	0.3821	0.1128	0.3608	0.8557	1.2951	2.2391
6	Sheep, Lambs and Goats	0.7982	0.0375	1.8992	2.7349	1.0469	3.4265
7	Hogs, Pigs and Swine	0.3247	0.1203	0.331	0.776	1.3705	2.39
9	Miscellaneous Livestock	0.3661	0.1064	0.1737	0.6462	1.2907	1.7651
10	Cotton	0.3949	0.0923	0.3593	0.8465	1.2338	2.1436
11	Food Grains	0.4839	0.166	0.3231	0.9729	1.3430	2.0108
12	Feed Grains	0.6458	0.099	0.2915	1.0363	1.1533	1.6048
13	Hay and Pasture	0.5321	0.1286	0.2769	0.9376	1.2416	1.7620
16	Fruits	0.1769	0.1745	0.3058	0.6571	1.9866	3.7157
18	Vegetables	0.5163	0.113	0.2518	0.8811	1.2188	1.7065
20	Miscellaneous Crops	0.6334	0.0861	0.4616	1.1812	1.1359	1.8647

Table A1-5 Employment Multipliers Of Bexar County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	10.0389	3.0174	7.5722	20.6285	1.3006	2.0549
3	Ranch/Range Fed Cattle	15.0786	2.8332	10.3882	28.3	1.1879	1.8768
5	Cattle Feedlots	13.7826	2.6497	9.5302	25.9625	1.1923	1.8837
6	Sheep, Lambs and Goats	84.21	0.8731	50.1718	135.2549	1.0104	1.6062
7	Hogs, Pigs and Swine	12.3142	2.7619	8.7436	23.8197	1.2243	1.9343
9	Miscellaneous Livestock	5.747	2.4316	4.5874	12.766	1.4231	2.2213
10	Cotton	12.9537	3.4108	9.4909	25.8554	1.2633	1.996
11	Food Grains	11.0972	3.6187	8.5348	23.2507	1.3261	2.0952
12	Feed Grains	11.0741	2.2042	7.701	20.9793	1.199	1.8944
13	Hay and Pasture	9.7501	2.8625	7.3149	19.9275	1.2936	2.0438
16	Fruits	7.0268	6.9025	8.0785	22.0077	1.9823	3.132
18	Vegetables	7.2835	4.1859	6.6519	18.1214	1.5747	2.488
20	Miscellaneous Crops	18.5856	2.4402	12.1943	33.2202	1.1313	1.7874

Table A2-1 Output Multipliers Of Kinney County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	1	0.2236	0.184	1.4076	1.2236	1.4076
3	Ranch/Range Fed Cattle	1	0.123	0.1912	1.3143	1.123	1.3143
6	Sheep, Lambs and Goats	1	0.0418	0.7222	1.764	1.0418	1.764
9	Miscellaneous Livestock	1	0.1049	0.1329	1.2378	1.1049	1.2378
13	Hay and Pasture	1	0.1188	0.1665	1.2853	1.1188	1.2853

Table A2-2 Personal Income Multipliers Of Kinney County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	1	0.2236	0.184	1.4076	1.2236	1.4076
3	Ranch/Range Fed Cattle	1	0.123	0.1912	1.3143	1.123	1.3143
6	Sheep, Lambs and Goats	1	0.0418	0.7222	1.764	1.0418	1.764
9	Miscellaneous Livestock	1	0.1049	0.1329	1.2378	1.1049	1.2378
13	Hay and Pasture	1	0.1188	0.1665	1.2853	1.1188	1.2853

Table A2-3 Total Income Multipliers Of Kinney County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.2459	0.1021	0.101	0.4489	1.4151	1.8258
3	Ranch/Range Fed Cattle	0.3455	0.0579	0.1049	0.5083	1.1677	1.4715
6	Sheep, Lambs and Goats	0.7608	0.0196	0.3964	1.1768	1.0258	1.5468
9	Miscellaneous Livestock	0.3815	0.0496	0.0729	0.504	1.13	1.3211
13	Hay and Pasture	0.484	0.0536	0.0914	0.6289	1.1107	1.2995

Table A2-4 Value Added Multipliers Of Kinney County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III

1	Dairy Farm Products	0.2507	0.1094	0.1239	0.4839	1.4363	1.9304
3	Ranch/Range Fed Cattle	0.3676	0.0638	0.1287	0.5601	1.1735	1.5237
6	Sheep, Lambs and Goats	0.7982	0.0216	0.4862	1.306	1.0271	1.6362
9	Miscellaneous Livestock	0.4039	0.0541	0.0894	0.5475	1.1339	1.3553
13	Hay and Pasture	0.5321	0.0604	0.1121	0.7046	1.1136	1.3242

Table A2-5 Employment Multipliers Of Kinney County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	10.4592	5.458	3.3274	19.2447	1.5218	1.84
3	Ranch/Range Fed Cattle	13.9395	2.6033	3.4582	20.0011	1.1868	1.4348
6	Sheep, Lambs and Goats	61.598	0.8815	13.0612	75.5407	1.0143	1.2263
9	Miscellaneous Livestock	9.2362	2.2581	2.4029	13.8972	1.2445	1.5046
13	Hay and Pasture	11.7033	2.701	3.0112	17.4155	1.2308	1.4881

Table A3-1 Output Multipliers Of Medina County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	1	0.2543	0.2796	1.5338	1.2543	1.5338
3	Ranch/Range Fed Cattle	1	0.1809	0.354	1.5349	1.1809	1.5349
5	Cattle Feedlots	1	0.3121	0.3855	1.6975	1.3121	1.6975
6	Sheep, Lambs and Goats	1	0.0534	1.2428	2.2962	1.0534	2.2962
7	Hogs, Pigs and Swine	1	0.1804	0.2611	1.4415	1.1804	1.4415
9	Miscellaneous Livestock	1	0.1755	0.181	1.3565	1.1755	1.3565
10	Cotton	1	0.2642	0.3779	1.6421	1.2642	1.6421
11	Food Grains	1	0.1804	0.2697	1.4502	1.1804	1.4502
12	Feed Grains	1	0.1093	0.2792	1.3885	1.1093	1.3885
13	Hay and Pasture	1	0.139	0.2541	1.3931	1.139	1.3931
16	Fruits	1	0.3217	0.3088	1.6305	1.3217	1.6305
18	Vegetables	1	0.1995	0.2421	1.4416	1.1995	1.4416
20	Miscellaneous Crops	1	0.1208	0.5198	1.6406	1.1208	1.6406
21	Oil Bearing Crops	1	0.1538	0.2809	1.4347	1.1538	1.4347

Table A3-2 Personal Income Multipliers Of Medina County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.0241	0.0526	0.0859	0.1627	3.1792	6.7401
3	Ranch/Range Fed Cattle	0.0461	0.0382	0.1088	0.1931	1.8281	4.1897
5	Cattle Feedlots	0.0635	0.0462	0.1185	0.2281	1.7269	3.5927
6	Sheep, Lambs and Goats	0.1399	0.0116	0.382	0.5335	1.0826	3.8125
7	Hogs, Pigs and Swine	0.0473	0.039	0.0803	0.1666	1.8251	3.5216
9	Miscellaneous Livestock	0.0223	0.0364	0.0556	0.1143	2.6355	5.1344
10	Cotton	0.0315	0.0671	0.1162	0.2147	3.1287	6.8153
11	Food Grains	0.0305	0.0448	0.0829	0.1583	2.4684	5.1838
12	Feed Grains	0.039	0.0266	0.0858	0.1514	1.6812	3.8817
13	Hay and Pasture	0.0295	0.0335	0.0781	0.1412	2.1359	4.781
16	Fruits	0.0074	0.0808	0.0949	0.1832	11.8948	24.6882
18	Vegetables	0.0105	0.0512	0.0744	0.1362	5.8777	12.961
20	Miscellaneous Crops	0.0484	0.0305	0.1598	0.2386	1.6306	4.9351
21	Oil Bearing Crops	0.0348	0.0368	0.0863	0.158	2.0577	4.5363

Table A3-3 Total Income Multipliers Of Medina County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.2065	0.129	0.1543	0.4898	1.6247	2.3721
3	Ranch/Range Fed Cattle	0.2886	0.0888	0.1954	0.5728	1.3076	1.9847
5	Cattle Feedlots	0.3237	0.1289	0.2128	0.6654	1.3983	2.0556
6	Sheep, Lambs and Goats	0.7536	0.0266	0.686	1.4662	1.0353	1.9455
7	Hogs, Pigs and Swine	0.2659	0.0897	0.1441	0.4997	1.3372	1.8794
9	Miscellaneous Livestock	0.3126	0.0836	0.0999	0.4961	1.2675	1.587
10	Cotton	0.3211	0.1193	0.2086	0.649	1.3716	2.0211
11	Food Grains	0.4046	0.0847	0.1489	0.6382	1.2093	1.5773
12	Feed Grains	0.5959	0.051	0.1541	0.801	1.0855	1.3441
13	Hay and Pasture	0.4867	0.065	0.1403	0.692	1.1335	1.4217
16	Fruits	0.152	0.1545	0.1704	0.4769	2.0164	3.1377
18	Vegetables	0.4433	0.0964	0.1336	0.6733	1.2176	1.519
20	Miscellaneous Crops	0.621	0.0574	0.2869	0.9654	1.0925	1.5545
21	Oil Bearing Crops	0.5141	0.0707	0.155	0.7398	1.1376	1.4391

Table A3-4 Value Added Multipliers Of Medina County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.2113	0.1409	0.1807	0.5329	1.667	2.5223
3	Ranch/Range Fed Cattle	0.3101	0.098	0.2288	0.6369	1.316	2.0539
5	Cattle Feedlots	0.3425	0.1413	0.2491	0.7329	1.4127	2.1401
6	Sheep, Lambs and Goats	0.7982	0.0293	0.8032	1.6307	1.0368	2.0431
7	Hogs, Pigs and Swine	0.2883	0.099	0.1688	0.5561	1.3435	1.9289
9	Miscellaneous Livestock	0.335	0.0917	0.117	0.5437	1.2737	1.6228
10	Cotton	0.3546	0.1261	0.2442	0.725	1.3556	2.0444
11	Food Grains	0.4384	0.0961	0.1743	0.7088	1.2192	1.6169
12	Feed Grains	0.6458	0.0572	0.1804	0.8834	1.0885	1.3679
13	Hay and Pasture	0.546	0.0728	0.1642	0.7831	1.1334	1.4342
16	Fruits	0.1641	0.1637	0.1996	0.5273	1.9975	3.2137
18	Vegetables	0.4651	0.1027	0.1565	0.7242	1.2208	1.5573
20	Miscellaneous Crops	0.6334	0.0624	0.336	1.0318	1.0985	1.6289
21	Oil Bearing Crops	0.5521	0.0796	0.1815	0.8132	1.1441	1.4729

Table A3-5 Employment Multipliers Of Medina County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	9.93	3.5432	4.6142	18.0875	1.3568	1.8215
3	Ranch/Range Fed Cattle	14.6363	2.4251	5.8431	22.9045	1.1657	1.5649
5	Cattle Feedlots	14.242	4.3338	6.3617	24.9376	1.3043	1.751
6	Sheep, Lambs and Goats	58.4031	0.7183	20.5112	79.6327	1.0123	1.3635
7	Hogs, Pigs and Swine	10.1726	2.4124	4.31	16.895	1.2371	1.6608
9	Miscellaneous Livestock	6.6555	2.0651	2.9866	11.7072	1.3103	1.759
10	Cotton	13.0091	5.2017	6.2367	24.4475	1.3999	1.8793
11	Food Grains	10.7385	2.2601	4.4516	17.4502	1.2105	1.625
12	Feed Grains	12.13	1.3245	4.6078	18.0623	1.1092	1.4891
13	Hay and Pasture	10.5619	1.6844	4.194	16.4403	1.1595	1.5566
16	Fruits	8.0808	6.7995	5.0961	19.9764	1.8414	2.4721
18	Vegetables	7.3686	4.2992	3.9959	15.6638	1.5835	2.1257
20	Miscellaneous Crops	22.721	2.0082	8.5794	33.3085	1.0884	1.466
21	Oil Bearing Crops	11.5477	1.9867	4.6352	18.1697	1.172	1.5734

Table A4-1 Output Multipliers Of Uvalde County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	1	0.3296	0.3731	1.7027	1.3296	1.7027
3	Ranch/Range Fed Cattle	1	0.2086	0.4141	1.6227	1.2086	1.6227
5	Cattle Feedlots	1	0.3415	0.4501	1.7916	1.3415	1.7916
6	Sheep, Lambs and Goats	1	0.0634	1.6349	2.6983	1.0634	2.6983
7	Hogs, Pigs and Swine	1	0.2078	0.4135	1.6213	1.2078	1.6213
9	Miscellaneous Livestock	1	0.1896	0.2808	1.4704	1.1896	1.4704
10	Cotton	1	0.5692	0.65	2.2192	1.5692	2.2192
11	Food Grains	1	0.2365	0.3471	1.5835	1.2365	1.5835
12	Feed Grains	1	0.1395	0.318	1.4576	1.1395	1.4576
13	Hay and Pasture	1	0.1815	0.3177	1.4992	1.1815	1.4992
16	Fruits	1	0.5937	0.5434	2.1371	1.5937	2.1371
18	Vegetables	1	0.3779	0.3911	1.7691	1.3779	1.7691
20	Miscellaneous Crops	1	0.2086	0.5742	1.7828	1.2086	1.7828

Table A4-2 PERSONAL INCOME MULTIPLIERS OF UVALDE COUNTY

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.0256	0.0966	0.1224	0.2446	4.7773	9.5625
3	Ranch/Range Fed Cattle	0.0488	0.059	0.1358	0.2437	2.2081	4.9891
5	Cattle Feedlots	0.0673	0.0687	0.1476	0.2836	2.0213	4.2163
6	Sheep, Lambs and Goats	0.1404	0.0184	0.5363	0.6951	1.1309	4.9492
7	Hogs, Pigs and Swine	0.0512	0.0602	0.1356	0.2471	2.1759	4.8235
9	Miscellaneous Livestock	0.0237	0.0539	0.0921	0.1697	3.2793	7.1725
10	Cotton	0.0334	0.1887	0.2132	0.4353	6.6505	13.0348
11	Food Grains	0.0323	0.0692	0.1138	0.2153	3.1416	6.6647
12	Feed Grains	0.0392	0.0414	0.1043	0.1849	2.0571	4.7202
13	Hay and Pasture	0.029	0.0538	0.1042	0.187	2.8569	6.4549
16	Fruits	0.0077	0.1994	0.1783	0.3853	27.0273	50.2937
18	Vegetables	0.0111	0.1253	0.1283	0.2647	12.2537	23.7793
20	Miscellaneous Crops	0.0484	0.0661	0.1883	0.3029	2.3662	6.2566

Table A4-3 Total Income Multipliers Of Uvalde County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.2188	0.1614	0.2085	0.5887	1.7379	2.6909
3	Ranch/Range Fed Cattle	0.3063	0.1028	0.2314	0.6405	1.3355	2.0908
5	Cattle Feedlots	0.3428	0.1459	0.2515	0.7401	1.4255	2.1592
6	Sheep, Lambs and Goats	0.7563	0.0316	0.9136	1.7014	1.0417	2.2497
7	Hogs, Pigs and Swine	0.2878	0.1034	0.2311	0.6223	1.3593	2.162
9	Miscellaneous Livestock	0.3321	0.0944	0.1569	0.5835	1.2844	1.7567
10	Cotton	0.3403	0.2558	0.3632	0.9593	1.7517	2.8189
11	Food Grains	0.4281	0.1103	0.1939	0.7324	1.2576	1.7105
12	Feed Grains	0.5985	0.0658	0.1777	0.842	1.1099	1.4068
13	Hay and Pasture	0.4774	0.0856	0.1775	0.7405	1.1793	1.5512
16	Fruits	0.157	0.27	0.3037	0.7306	2.7201	4.6548
18	Vegetables	0.4696	0.1718	0.2186	0.86	1.3659	1.8313
20	Miscellaneous Crops	0.6218	0.0957	0.3209	1.0384	1.154	1.67

Table A4-4 Value Added Multipliers Of Uvalde County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.2236	0.1733	0.2426	0.6395	1.7751	2.8603
3	Ranch/Range Fed Cattle	0.3278	0.1125	0.2693	0.7096	1.3431	2.1646
5	Cattle Feedlots	0.3616	0.1588	0.2927	0.8131	1.4392	2.2486
6	Sheep, Lambs and Goats	0.7982	0.0346	1.0632	1.8959	1.0433	2.3754
7	Hogs, Pigs and Swine	0.3103	0.1133	0.2689	0.6924	1.365	2.2317
9	Miscellaneous Livestock	0.3546	0.1027	0.1826	0.6399	1.2897	1.8046
10	Cotton	0.3738	0.2642	0.4227	1.0607	1.7067	2.8374
11	Food Grains	0.4619	0.124	0.2257	0.8116	1.2685	1.757
12	Feed Grains	0.6458	0.0733	0.2068	0.9259	1.1135	1.4338
13	Hay and Pasture	0.5321	0.0954	0.2066	0.8342	1.1793	1.5676
16	Fruits	0.169	0.2809	0.3534	0.8034	2.6618	4.7524
18	Vegetables	0.4914	0.1796	0.2544	0.9254	1.3654	1.883
20	Miscellaneous Crops	0.6334	0.1018	0.3734	1.1087	1.1608	1.7503

Table A4-5 Employment Multipliers Of Uvalde County

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	9.9682	6.2918	6.0155	22.2754	1.6312	2.2347
3	Ranch/Range Fed Cattle	14.6508	3.396	6.6766	24.7234	1.2318	1.6875
5	Cattle Feedlots	14.2443	5.3696	7.2563	26.8703	1.377	1.8864
6	Sheep, Lambs and Goats	69.1399	1.0377	26.3594	96.537	1.015	1.3963
7	Hogs, Pigs and Swine	14.6231	3.3972	6.6668	24.687	1.2323	1.6882
9	Miscellaneous Livestock	9.2362	2.9992	4.5266	16.762	1.3247	1.8148
10	Cotton	12.7544	15.1464	10.4798	38.3807	2.1875	3.0092
11	Food Grains	10.9679	4.1568	5.5955	20.7203	1.379	1.8892
12	Feed Grains	11.3932	2.4669	5.1276	18.9877	1.2165	1.6666
13	Hay and Pasture	10.639	3.2072	5.1225	18.9687	1.3015	1.7829
16	Fruits	8.0808	15.2462	8.7618	32.0889	2.8867	3.971
18	Vegetables	7.4319	9.6141	6.3063	23.3523	2.2936	3.1422
20	Miscellaneous Crops	19.9207	4.7262	9.2576	33.9045	1.2372	1.702

Table A5-1 Output Multipliers Of Edwards Area

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	1	0.2906	0.5104	1.8009	1.2906	1.8009
3	Ranch/Range Fed Cattle	1	0.315	0.6666	1.9816	1.315	1.9816
5	Cattle Feedlots	1	0.3087	0.6502	1.959	1.3087	1.959
6	Sheep, Lambs and Goats	1	0.0959	2.369	3.4649	1.0959	3.4649
7	Hogs, Pigs and Swine	1	0.2488	0.5399	1.7887	1.2488	1.7887
9	Miscellaneous Livestock	1	0.239	0.329	1.568	1.239	1.568
10	Cotton	1	0.3388	0.7271	2.0658	1.3388	2.0658
11	Food Grains	1	0.3432	0.5424	1.8856	1.3432	1.8856
12	Feed Grains	1	0.197	0.5079	1.7049	1.197	1.7049
13	Hay and Pasture	1	0.2519	0.4799	1.7318	1.2519	1.7318
16	Fruits	1	0.455	0.6589	2.1139	1.455	2.1139
18	Vegetables	1	0.3104	0.5082	1.8186	1.3104	1.8186
20	Miscellaneous Crops	1	0.2054	0.8771	2.0826	1.2054	2.0826
21	Oil Bearing Crops	1	0.2895	0.5477	1.8372	1.2895	1.8372

Table A5-2 Personal Income Multipliers Of Edwards Area

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.0255	0.0882	0.1705	0.2841	4.4568	11.1409
3	Ranch/Range Fed Cattle	0.0486	0.0761	0.2227	0.3474	2.5648	7.1439
5	Cattle Feedlots	0.0644	0.0741	0.2172	0.3557	2.1504	5.5218
6	Sheep, Lambs and Goats	0.1409	0.0248	0.7913	0.957	1.1758	6.7903
7	Hogs, Pigs and Swine	0.0519	0.071	0.1803	0.3032	2.3689	5.8461
9	Miscellaneous Livestock	0.0234	0.0664	0.1099	0.1997	3.8399	8.5382
10	Cotton	0.0324	0.0997	0.2429	0.375	4.0787	11.5751
11	Food Grains	0.0318	0.0898	0.1812	0.3028	3.8237	9.5189
12	Feed Grains	0.0391	0.0531	0.1696	0.2618	2.3582	6.7001
13	Hay and Pasture	0.0293	0.068	0.1603	0.2575	3.3224	8.7984
16	Fruits	0.0076	0.1341	0.2201	0.3618	18.5272	47.3031
18	Vegetables	0.0109	0.0865	0.1697	0.2672	8.9321	24.4887
20	Miscellaneous Crops	0.0484	0.0557	0.293	0.397	2.1506	8.2058
21	Oil Bearing Crops	0.0348	0.0764	0.1829	0.2942	3.1943	8.4472

Table A5-3 Total Income Multipliers Of Edwards Area

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.2182	0.1492	0.2836	0.651	1.6839	2.9835
3	Ranch/Range Fed Cattle	0.305	0.1442	0.3704	0.8197	1.4729	2.6871
5	Cattle Feedlots	0.3284	0.1411	0.3613	0.8307	1.4296	2.5297
6	Sheep, Lambs and Goats	0.759	0.0524	1.3162	2.1275	1.069	2.8031
7	Hogs, Pigs and Swine	0.2914	0.1225	0.3	0.7139	1.4202	2.4495
9	Miscellaneous Livestock	0.3285	0.1146	0.1828	0.6259	1.349	1.9055
10	Cotton	0.3302	0.1584	0.4039	0.8925	1.4798	2.7033
11	Food Grains	0.4215	0.1593	0.3014	0.8822	1.378	2.0929
12	Feed Grains	0.597	0.0922	0.2822	0.9714	1.1544	1.627
13	Hay and Pasture	0.4824	0.1177	0.2666	0.8667	1.2439	1.7965
16	Fruits	0.1567	0.2316	0.3661	0.7543	2.4778	4.8139
18	Vegetables	0.4603	0.1537	0.2823	0.8964	1.3339	1.9472
20	Miscellaneous Crops	0.6215	0.1002	0.4873	1.2089	1.1612	1.9453
21	Oil Bearing Crops	0.5141	0.1314	0.3043	0.9498	1.2556	1.8475

Table A5-4 Value Added Multipliers Of Edwards Area

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	0.223	0.1638	0.3258	0.7125	1.7345	3.1954
3	Ranch/Range Fed Cattle	0.3265	0.163	0.4255	0.915	1.4991	2.8023
5	Cattle Feedlots	0.3472	0.1593	0.415	0.9215	1.4588	2.6543
6	Sheep, Lambs and Goats	0.7982	0.0584	1.5121	2.3687	1.0731	2.9677
7	Hogs, Pigs and Swine	0.3139	0.1394	0.3446	0.7979	1.4443	2.5423
9	Miscellaneous Livestock	0.3509	0.1256	0.21	0.6865	1.3579	1.9564
10	Cotton	0.3637	0.1718	0.4641	0.9995	1.4723	2.7484
11	Food Grains	0.4553	0.1915	0.3462	0.9931	1.4207	2.181
12	Feed Grains	0.6458	0.1091	0.3242	1.0791	1.169	1.671
13	Hay and Pasture	0.5381	0.1394	0.3063	0.9838	1.2591	1.8283
16	Fruits	0.1688	0.2488	0.4206	0.8381	2.4739	4.9656
18	Vegetables	0.4821	0.1679	0.3244	0.9744	1.3483	2.0211
20	Miscellaneous Crops	0.6334	0.1123	0.5599	1.3056	1.1772	2.0611
21	Oil Bearing Crops	0.5521	0.1574	0.3496	1.0591	1.2851	1.9183

Table A5-5 Employment Multipliers Of Edwards Area

Code	Sector	Direct	Indirect	Induced	Total	Type I	Type III
1	Dairy Farm Products	10.0019	4.5896	8.6066	23.1981	1.4589	2.3194
3	Ranch/Range Fed Cattle	14.6225	4.4365	11.2418	30.3008	1.3034	2.0722
5	Cattle Feedlots	14.2414	4.3482	10.9649	29.5545	1.3053	2.0753
6	Sheep, Lambs and Goats	64.5843	2.2956	39.9491	106.8289	1.0355	1.6541
7	Hogs, Pigs and Swine	11.9643	3.4711	9.1044	24.5399	1.2901	2.0511
9	Miscellaneous Livestock	6.6181	3.1175	5.5484	15.284	1.4711	2.3094
10	Cotton	12.9065	7.88	12.2607	33.0472	1.6105	2.5605
11	Food Grains	10.8858	4.6217	9.1469	24.6545	1.4246	2.2648
12	Feed Grains	11.8502	2.67	8.5645	23.0846	1.2253	1.948
13	Hay and Pasture	10.3051	3.4138	8.0919	21.8108	1.3313	2.1165
16	Fruits	7.7487	11.089	11.1112	29.949	2.4311	3.865
18	Vegetables	7.3926	7.1354	8.5691	23.0971	1.9652	3.1244
20	Miscellaneous Crops	21.2912	3.7861	14.7916	39.8688	1.1778	1.8725
21	Oil Bearing Crops	11.5477	4.1112	9.2363	24.8952	1.356	2.1559