

#### **4.5 Llano Estacado Regional Water Plan**

In Section 1, the Llano Estacado Region was described. In Section 2 projections of population and water demand were presented. In Section 3, existing water supplies were tabulated. In Section 4, the projected water demands of Section 2 were compared with the existing water supplies of Section 3 and needs (shortages) for additional supplies were calculated. In Section 4.4, water management strategies were identified, described, and evaluated. The information from Sections 1, 2, 3, and 4 was used in the development of the following water plan for the region.

For purposes of developing the 2006 Llano Estacado Regional Water Plan, the LERWPG adopted a municipal water conservation goal of reducing per capita water use by 1 percent per year for those WUGs that have projected needs (shortages) and that had per capita water use in year 2000 that was greater than the Llano Estacado Region average per capita water use in 2000 of 172 gallons per person per day (gpcd). The goal is to continue the municipal water conservation water management strategy of reducing per capita water use by 1 percent per year until per capita water use is reduced to the year 2000 Region average municipal water use of 172 gpcd.

Water management strategies included in the plan to meet the needs of specific water user groups include municipal water conservation and local groundwater development for municipalities, and irrigation BMPs and an irrigation water conservation water management strategy for irrigators, while strategies that are not specific to a particular water user group, but instead are region-wide strategies include weather modification and brush management. The plan does not propose any changes to existing water contracts or option agreements. Further, the plan was created in close cooperation with each Wholesale Water Provider in the region, and no strategy contained in the plan would adversely affect any existing water contracts, option agreements, or special water resources.

For each city with a projected need and a per capita water use of 172 gpcd or greater, municipal water conservation is included as a water management strategy until the goal of 172 gpcd is reached. Municipal water conservation beyond that which is estimated to be accomplished through low flow plumbing fixtures and the municipal water conservation strategy is not included, since municipal water conservation is estimated to cost more than the next

available source of water; e.g. in the range of \$483/acft to \$530/acft compared to costs of local groundwater in the range of approximately \$75/acft to approximately \$29 /acft.

Additional water supply to meet needs above those that can potentially be met through municipal water conservation is the expansion or replacement of existing wells or well fields with new wells. If the new wells or well fields are located on private property, the city will need to purchase that property or purchase water rights.

The proposed plan encourages the continued and expanded use of irrigation BMPs and an irrigation water conservation strategy to meet as much as possible of the projected irrigation needs of the region. Individual irrigators who have not already adopted irrigation BMPs and installed available efficient irrigation application equipment, such as Low Energy Precision Application (LEPA), Low Pressure Sprinkler Systems (LESA), and subsurface or drip irrigation will need to do so as soon as possible to conserve their current water supplies.

Non-specific strategies would contribute to increasing the region's water supplies on a widespread scale for all water user groups, as opposed to being specifically applicable to an individual user group. These include weather modification and brush control. Both weather modification and brush control have been and should continue to be carried out by underground water conservation districts, soil and water conservation districts, and private groups, as desired and supported by the citizens of local areas affected. The local choice is particularly appropriate for precipitation enhancement and brush control strategies.

The water management strategies are intended to assist in meeting the water needs of the region during all types of weather, but are especially directed at meeting needs during drought. In addition, these strategies were selected to contribute to sustainability of present supplies of groundwater. The detailed plans for each of the 21 counties of the Llano Estacado Planning Region are presented in alphabetic order below. In each county plan, each water user group of the county is listed, and if the user group has a projected need (shortage) during the planning horizon, a water management strategy to meet the need is included, except in the case of irrigated agriculture, for which it has been determined that it is not economically feasible to meet all of the projected needs at this time. The strategies selected are those that are estimated to be the lowest cost by virtue of the fact that they are the strategies located nearest to the location of need.

Drought Management is not a recommended water management strategy to meet projected water needs in Region O, in part because it cannot be demonstrated to be an economically feasible strategy. The TWDB socioeconomic impact analysis of unmet water

needs in Region O shows non-agricultural business impacts due to unmet water needs (shortages) of approximately \$27,000 per acft/yr in 2010 decreasing to approximately \$8,000 per acft/yr in 2060 (calculated from data in Table 4-24). Clearly, the cost for water to meet projected water needs is only a fraction of the business losses from not having the quantities of water needed. The Water Conservation water management strategies recommended in the 2006 Regional Water Plan, together with the other water management strategies appear to the LERWPG to be superior to the use of Drought Management strategies that are costly to the economy and the people of the region, and unpredictable as to time of occurrence and duration. The uncertainty and the cost associated therewith is not acceptable to the LERWPG, thus Drought Management is not included as a recommended water management strategy. **However, the LERWPG recognizes the individual cities “Demand Management and Drought Contingency Plans” that are on file with the TCEQ. The surface water supplies of this plan are included only at the firm yield quantities and the groundwater supplies are included at the quantities estimated to be available through existing facilities and aquifer capabilities. Therefore, the LERWPG depends upon water users to follow their respective drought management plans and to implement any additional water conservation needed during droughts that may affect existing and planned water management strategies.**

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#### 4.5.1 Bailey County Water Supply Plan

Table 4.5-1 lists each water user group in Bailey County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-1.  
Bailey County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Muleshoe	0	0	No projected surplus/shortage
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-87,235	-87,997	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-1, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.1.1 The City of Muleshoe

###### 4.5.1.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands through 2060.

###### 4.5.1.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Muleshoe.

- Municipal water conservation.

#### 4.5.1.1.3 Costs

Costs of the recommended plan for the City of Muleshoe are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-2 for a cost summary of this option.

**Table 4.5-2.  
Recommended Plan Costs by Decade for the City of Muleshoe**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	79	99	85	69	63	62
Annual Cost (\$/yr)	\$44,053	\$52,656	\$44,668	\$35,922	\$32,500	\$31,902
Unit Cost (\$/acft)	\$558	\$532	\$526	\$521	\$516	\$515

#### 4.5.1.2 Irrigation

##### 4.5.1.2.1 Description of Supply

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 176,117 acft/yr in 2000 declining to 70,074 acft/yr in 2060.

##### 4.5.1.2.2 Water Supply Plan

The use of irrigation BMPs in the past in Bailey County has increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Bailey County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

##### 4.5.1.2.3 Costs

- a. Irrigation water conservation:
  - Cost Source: Section 4.4.1.2, Table 4.4-11
  - Date to be Implemented: Prior to 2010
  - Total Cost: \$14,850,000

- Annual Cost: \$1,160,000; including debt service at 25 yrs useful life of systems (Table 4.5-3).

**Table 4.5-3.  
Recommended Plan Costs by Decade for Irrigation – Bailey County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	79,685	86,478	87,235	88,494	88,754	87,997
Irrigation Conservation Quantity (acft/yr)	23,295	20,965	18,869	16,982	15,284	13,755
Annual Cost (million dollars/ year)(Table 4.4-11)	1.16	1.16	1.16	1.16	1.16	1.16
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.2 Briscoe County Water Supply Plan

Table 4.5-4 lists each water user group in Briscoe County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-4.  
Briscoe County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Silverton	-123	-108	Projected shortage – see plan below
County Other (Quitague)	-92	-86	Projected shortage – see plan below
Industrial	0	0	No projected demand
Steam Electric	0	0	No projected demand
Mining	0	0	No projected demand
Irrigation	-12,114	-14,581	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected demand
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-2, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.2.1 The City of Quitague (Part of Briscoe County Other)

###### 4.5.2.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2014, at which time additional supplies will be needed due to poor water quality

###### 4.5.2.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Dimmitt through 2060.

- Local groundwater development beginning in 2010 needed to supply an additional 86 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala

Aquifer approximately 12 miles from the City of Quitaque into which the city could locate new municipal water supply wells.

#### 4.5.2.1.3 Costs

Costs of the recommended plan for the City of Quitaque to meet projected shortages through 2060 are:

- a. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-37
  - Date to be Implemented: 2010
  - Total Project Cost: \$1,031,448
  - Annual Cost: See Table 4.5-5 for a cost summary of this option.

**Table 4.5-5.  
Recommended Plan Costs by Decade for the City of Quitaque (Part of Briscoe County  
Other)**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	107	94	92	93	89	86
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	204	183	165	148	134	120
Annual Cost (\$/yr)	\$94,664	\$94,664	\$94,664	\$19,730	\$19,730	\$19,730
Unit Cost (\$/acft)	\$464	\$517	\$574	\$133	\$147	\$164

#### 4.5.2.2 The City of Silverton

##### 4.5.2.2.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2010, at which time additional supplies will be needed due to poor water quality

##### 4.5.2.2.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Silverton through 2060.

- Local groundwater development beginning in 2010 needed to supply an additional 107 acft acft/yr in 2010 and an additional 108 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately 12 miles from the City of Silverton into which the city could locate new municipal water supply wells.

#### 4.5.2.2.3 Costs

Costs of the recommended plan for the City of Silverton to meet projected shortages from 2010 to 2060 are:

- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-41
  - Date to be Implemented: 2010
  - Total Project Cost: \$1,031,448
  - Annual Cost: See Table 4.5-6 for a cost summary of this option.

**Table 4.5-6.  
Recommended Plan Costs by Decade for the City of Silverton**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	128	126	123	115	111	108
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	204	183	165	148	134	120
Annual Cost (\$/yr)	\$94,664	\$94,664	\$94,664	\$19,730	\$19,730	\$19,730
Unit Cost (\$/acft)	\$464	\$517	\$574	\$133	\$147	\$164

#### 4.5.2.3 Irrigation

##### 4.5.2.3.1 Description of Supply

- **Source:** Ogallala, Dockum, and Seymour Aquifers
- **Current Supply:** 30,746 acft/yr in 2000 declining to 6,510 acft/yr in 2060.

##### 4.5.2.3.2 Water Supply Plan

The use of irrigation BMPs in the past in Briscoe County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Briscoe

County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### 4.5.2.3.3 Costs

a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$6,420,000
- Annual Cost: \$500,000; including debt service at 25 yrs useful life of systems (Table 4.5-7).

**Table 4.5-7.  
Recommended Plan Costs by Decade for Irrigation – Briscoe County**

Plan Element	2010	2020	2030	2040	2050	2060
Projected Irrigation Need (Shortage) (acft/yr)	0	4,778	12,114	13,651	14,886	14,581
Irrigation Conservation Quantity (acft/yr)	10,070	9,063	8,157	7,341	6,607	5,947
Annual Cost (million dollars/yr) (Table 4.4-11)	6.42	6.42	6.42	6.42	6.42	6.42
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

### 4.5.3 Castro County Water Supply Plan

Table 4.5-8 lists each water user group in Castro County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-8.  
Castro County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Dimmitt	-1,137	-1,130	Projected shortage – see plan below
City of Hart	0	-256	Projected shortage – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected demand
Irrigation	-256,617	-351,552	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage
<sup>1</sup> From Table 4-3, Section 4.1 – Water Needs Projections by Water User Group. * Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.			

#### 4.5.3.1 The City of Dimmitt

##### 4.5.3.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2024, at which time additional supplies will be needed

##### 4.5.3.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Dimmitt through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2017 needed to supply an additional 1,250 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately 11 miles from the City of Dimmitt into which the city could locate new municipal water supply wells.

#### 4.5.3.1.3 Costs

Costs of the recommended plan for the City of Dimmitt to meet 2060 shortages are:

- Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-9 for a cost summary of this option.
- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-20
  - Date to be Implemented: 2017
  - Total Project Cost: \$3,405,336
  - Annual Cost: See Table 4.5-9 for a cost summary of this option.

**Table 4.5-9.**  
**Recommended Plan Costs by Decade for the City of Dimmitt**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	1,137	1,159	1,150	1,130
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	81	162	151	138	131	129
Annual Cost (\$/yr)	\$44,431	\$82,336	\$76,055	\$68,220	\$64,579	\$63,445
Unit Cost (\$/acft)	\$549	\$508	\$504	\$494	\$493	\$492
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	882	1,203	1,083	1,389	1,250
Annual Cost (\$/yr)	—	\$288,079	\$327,317	\$327,317	\$164,987	\$134,434
Unit Cost (\$/acft)	—	\$327	\$272	\$302	\$119	\$108

**4.5.3.2 The City of Hart**

**4.5.3.2.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2045, at which time additional supplies will be needed

**4.5.3.2.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Hart through 2060.

- Local groundwater development beginning in 2041 needed to supply an additional 352 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately two miles from the City of Hart into which the city could locate new municipal water supply wells.

**4.5.3.2.3 Costs**

Costs of the recommended plan for the City of Hart to meet 2060 shortages are:

- a. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-25
  - Date to be Implemented: 2041
  - Total Project Cost: \$509,256
  - Annual Cost: See Table 4.5-10 for a cost summary of this option.

**Table 4.5-10.  
Recommended Plan Costs by Decade for the City of Hart**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	260	256
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	—	—	391	352
Annual Cost (\$/yr)	—	—	—	—	\$62,333	\$62,333
Unit Cost (\$/acft)	—	—	—	—	\$159	\$177

### 4.5.3.3 Irrigation

#### 4.5.3.3.1 Description of Supply

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 508,153 acft/yr in 2000 declining to 46,905 acft/yr in 2060.

#### 4.5.3.3.2 Water Supply Plan

The use of irrigation BMPs in the past in Castro County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Castro County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### 4.5.3.3.3 Costs

##### a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$36,500,000
- Annual Cost: \$2,850,000; including debt service at 25 yrs useful life of systems (Table 4.5-11).

**Table 4.5-11.**  
**Recommended Plan Costs by Decade for Irrigation – Castro County**

Plan Element	2010	2020	2030	2040	2050	2060
Projected Irrigation Need (Shortage) (acft/yr)	146,143	191,640	265,617	355,946	357,087	351,552
Irrigation Conservation Quantity (acft/yr)	57,242	51,518	46,366	41,730	37,557	33,801
Annual Cost (million dollars/yr) (Table 4.4-11)	2.85	2.85	2.85	2.85	2.85	2.85
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

#### 4.5.4 Cochran County Water Supply Plan

Table 4.5-12 lists each water user group in Cochran County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-12.  
Cochran County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Morton	-565	-496	Projected shortage – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected demand
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-36,801	-72,579	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-4, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.4.1 City of Morton

###### 4.5.4.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

###### 4.5.4.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Morton through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2015 needed to supply an additional 561 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala

Aquifer approximately three miles from the City of Morton into which the city could locate new municipal water supply wells.

#### 4.5.4.1.3 Costs

Costs of the recommended plan for the City of Morton to meet 2060 shortages are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-13 for a cost summary of this option.
- b. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-31
  - Date to be Implemented: 2015
  - Total Project Cost: \$922,944
  - Annual Cost: See Table 4.5-13 for a cost summary of this option.

**Table 4.5-13.**  
**Recommended Plan Costs by Decade for the City of Morton**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	560	565	547	521	496
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	44	79	72	62	57	54
Annual Cost (\$/yr)	\$24,150	\$40,611	\$36,593	\$31,006	\$28,125	\$26,756
Unit Cost (\$/acft)	\$549	\$514	\$508	\$500	\$493	\$495
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	855	770	693	623	561
Annual Cost (\$/yr)	—	\$119,542	\$119,542	\$119,542	\$52,490	\$52,490
Unit Cost (\$/acft)	—	\$140	\$155	\$172	\$84	\$94

#### 4.5.4.2 Irrigation

##### 4.5.4.2.1 Description of Supply

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 120,412 acft/yr in 2000 declining to 22,165 acft/yr in 2060.

#### 4.5.4.2.2 Water Supply Plan

The use of irrigation BMPs in the past in Cochran County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Cochran County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### 4.5.4.3.3 Costs

a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$10,390,000
- Annual Cost: \$810,000; including debt service at 25 yrs useful life of systems (Table 4.5-14).

**Table 4.5-14.  
Recommended Plan Costs by Decade for Irrigation – Cochran County**

Plan Element	2010	2020	2030	2040	2050	2060
Projected Irrigation Need (Shortage) (acft/yr)	39,909	38,301	36,801	35,359	76,543	72,579
Irrigation Conservation Quantity (acft/yr)	16,294	14,665	13,198	11,879	10,691	9,622
Annual Cost (million dollars/yr) (Table 4.4-11)	0.81	0.81	0.81	0.81	0.81	0.81
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.5 Crosby County Water Supply Plan

Table 4.5-15 lists each water user group in Crosby County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-15.  
Crosby County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Crosbyton	45	-336	Projected shortage – see plan below
City of Lorenzo	-37	-108	Projected shortage – see plan below
City of Ralls	-4	-318	Projected shortage – see plan below
County Other	100	100	Projected surplus
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-8,365	-6,268	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-5, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.5.1 The City of Crosbyton

###### 4.5.5.1.1 Description of Supply

- **Source:** Ogallala Aquifer and White River Reservoir
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed

###### 4.5.5.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Crosbyton through 2060.

- Local groundwater development in partnership with the White River MWD beginning in 2007 needed to supply an additional 400 acft/yr in 2060.

#### 4.5.5.1.3 Costs

Costs of the recommended plan for the City of Crosbyton to meet 2060 shortages are:

- Local groundwater development in partnership with the White River MWD:
  - Cost Source: Section 4.4.3.10, Table 4.4-65
  - Date to be Implemented: 2007
  - Annual Cost: See Table 4.5-16 for a cost summary of this option.

**Table 4.5-16.**  
**Recommended Plan Costs by Decade for the City of Crosbyton**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	336
<b>Local Groundwater Development (with the White River MWD)</b>						
Quantity Available (acft/yr)	400	400	400	400	400	400
Annual Cost (\$/yr)	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000
Unit Cost (\$/acft)	\$40	\$40	\$40	\$40	\$40	\$40

#### 4.5.5.2 The City of Lorenzo

##### 4.5.5.2.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2025, at which time additional supplies will be needed

##### 4.5.5.2.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Lorenzo through 2060.

- Local groundwater development beginning in 2021 needed to supply an additional 150 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately two miles from the City of Lorenzo into which the city could locate new municipal water supply wells.

#### 4.5.5.2.3 Costs

Costs of the recommended plan for the City of Lorenzo to meet 2060 shortages are:

- a. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-30
  - Date to be Implemented: 2021
  - Total Project Cost: \$276,408
  - Annual Cost: See Table 4.5-17 for a cost summary of this option.

**Table 4.5-17.  
Recommended Plan Costs by Decade for the City of Lorenzo**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	37	69	92	108
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	206	185	167	150
Annual Cost (\$/yr)	—	—	\$32,947	\$32,947	\$32,947	\$12,866
Unit Cost (\$/acft)	—	—	\$160	\$178	\$197	\$86

#### 4.5.5.3 The City of Ralls

##### 4.5.5.3.1 Description of Supply

- **Source:** White River Reservoir
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed.

##### 4.5.5.3.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Ralls through 2060.

- Local groundwater development in partnership with the White River MWD beginning in 2007 needed to supply an additional 400 acft/yr in 2060.

#### 4.5.5.3.3 Costs

Costs of the recommended plan for the City of Ralls to meet 2060 shortages are:

- a. Local groundwater development in partnership with the White River MWD:
  - Cost Source: Section 4.4.3.10, Table 4.4-65
  - Date to be Implemented: 2007
  - Annual Cost: See Table 4.5-18 for a cost summary of this option.

**Table 4.5-18.  
Recommended Plan Costs by Decade for the City of Ralls**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	4	7	323	318
<b>Local Groundwater Development (with the White River MWD)</b>						
Quantity Available (acft/yr)	400	400	400	400	400	400
Annual Cost (\$/yr)	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000
Unit Cost (\$/acft)	\$40	\$40	\$40	\$40	\$40	\$40

#### 4.5.5.4 Irrigation

##### 4.5.5.4.1 Description of Supply

- **Source:** Ogallala and Seymour Aquifers, and Reclaimed Water
- **Current Supply:** 113,987 acft/yr in 2000 declining to 81,300 acft/yr in 2060.

##### 4.5.5.4.2 Water Supply Plan

The use of irrigation BMPs in the past in Crosby County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Crosby County irrigation farmers (Section 4.4.1.2).

#### 4.5.5.3.3 Costs

- a. Irrigation water conservation:
  - Cost Source: Section 4.4.1.2, Table 4.4-11
  - Date to be Implemented: Prior to 2010
  - Total Cost: \$23,060,000
  - Annual Cost: \$1,810,000; including debt service at 25 yrs useful life of systems (Table 4.5-19).

**Table 4.5-19.**  
**Recommended Plan Costs by Decade for Irrigation – Crosby County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	9,288	8,831	8,416	7,982	6,677	6,318
Irrigation Conservation Quantity (acft/yr)	36,166	32,549	29,294	26,365	23,728	21,355
Annual Cost (million dollars/yr) (Table 4.4-11)	1.81	1.81	1.81	1.81	1.81	1.81
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.6 Dawson County Water Supply Plan

Table 4.5-20 lists each water user group in Dawson County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-20.  
Dawson County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Lamesa	383	428	Projected surplus
City of O'Donnell (part)	41	42	Projected surplus
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-89,366	-72,634	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected demand
Range & All Other Livestock	0	0	No projected surplus/shortage
<sup>1</sup> From Table 4-6, Section 4.1 – Water Needs Projections by Water User Group. * Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.			

##### 4.5.6.1 The City of Lamesa

###### 4.5.6.1.1 Description of Supply

- **Source:** Ogallala Aquifer and Lake Meredith
- **Current Supply:** Adequate to meet demands through 2060.

###### 4.5.6.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Lamesa.

- Municipal water conservation.

#### 4.5.6.1.3 Costs

Costs of the recommended plan for the City of Lamesa are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-21 for a cost summary of this option.

**Table 4.5-21.  
Recommended Plan Costs by Decade for the City of Lamesa**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	250	670	904	880	847	815
Annual Cost (\$/yr)	\$134,047	\$332,256	\$442,242	\$427,946	\$410,949	\$395,392
Unit Cost (\$/acft)	\$536	\$496	\$489	\$486	\$485	\$485

#### 4.5.6.2 Irrigation

##### 4.5.6.2.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** 148,713 acft/yr in 2000 declining to 30,468 acft/yr in 2060.

##### 4.5.6.2.2 Water Supply Plan

The use of irrigation BMPs in the past in Dawson County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Dawson County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### 4.5.6.3.3 Costs

- a. Irrigation water conservation:
  - Cost Source: Section 4.4.1.2, Table 4.4-11
  - Date to be Implemented: Prior to 2010
  - Total Cost: \$870,000

- Annual Cost: \$70,000; including debt service at 25 yrs useful life of systems (Table 4.5-22).

**Table 4.5-22.**  
**Recommended Plan Costs by Decade for Irrigation – Dawson County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	94,961	94,047	89,366	85,466	78,758	72,634
Irrigation Conservation Quantity (acft/yr)	1,365	1,228	1,105	995	895	806
Annual Cost (million dollars/yr) (Table 4.4-11)	0.87	0.87	0.87	0.87	0.87	0.87
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.7 Deaf Smith County Water Supply Plan

Table 4.5-23 lists each water user group in Deaf Smith County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-23.  
Deaf Smith County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Hereford	3,751	3,789	Projected surplus
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected demand
Irrigation	-222,867	-240,636	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-7, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.7.1 The City of Hereford

###### 4.5.7.1.1 Description of Supply

- **Source:** Ogallala Aquifer and Dockum Aquifer
- **Current Supply:** Adequate to meet demands through 2060.

###### 4.5.7.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Hereford.

- Municipal water conservation.

#### 4.5.7.1.3 Costs

Costs of the recommended plan for the City of Hereford are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-24 for a cost summary of this option.

**Table 4.5-24.  
Recommended Plan Costs by Decade for the City of Hereford**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	350	952	1,154	1,127	1,118	1,121
Annual Cost (\$/yr)	\$188,447	\$473,021	\$566,170	\$549,000	\$543,239	\$544,839
Unit Cost (\$/acft)	\$538	\$497	\$491	\$487	\$486	\$486

#### 4.5.7.2 Irrigation

##### 4.5.7.2.1 Description of Supply

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 379,010 acft/yr in 2000 declining to 66,705 acft/yr in 2060.

##### 4.5.7.2.2 Water Supply Plan

The use of irrigation BMPs in the past in Deaf Smith County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Deaf Smith County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### 4.5.7.3.3 Costs

- a. Irrigation water conservation:
  - Cost Source: Section 4.4.1.2, Table 4.4-11
  - Date to be Implemented: Prior to 2010
  - Total Cost: \$36,710,000

- Annual Cost: \$2,870,000; including debt service at 25 yrs useful life of systems (Table 4.5-25).

**Table 4.5-25.**  
**Recommended Plan Costs by Decade for Irrigation – Deaf Smith County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	168,687	193,852	222,867	252,925	245,329	240,636
Irrigation Conservation Quantity (acft/yr)	57,571	51,814	46,633	41,969	37,772	33,995
Annual Cost (million dollars/yr) (Table 4.4-11)	2.87	2.87	2.87	2.87	2.87	2.87
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.8 Dickens County Water Supply Plan

Table 4.5-26 lists each water user group in Dickens County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-26.  
Dickens County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Spur	0	-257	Projected shortage – see plan below
County Other	80	74	Projected surplus
Industrial	0	0	No projected demand
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-3,133	-2,737	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected demand
Range & All Other Livestock	0	0	No projected surplus/shortage
<p><sup>1</sup> From Table 4-8, Section 4.1 – Water Needs Projections by Water User Group.  * Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.</p>			

##### 4.5.8.1 The City of Spur

###### 4.5.8.1.1 Description of Supply

- **Source:** White River Reservoir
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed.

###### 4.5.8.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Spur.

- Municipal water conservation; and
- Local groundwater development in partnership with the White River MWD beginning in 2007 needed to supply an additional 400 acft/yr in 2060.

#### 4.5.8.1.3 Costs

Costs of the recommended plan for the City of Spur are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-27 for a cost summary of this option.
- b. Local groundwater development in partnership with the White River MWD:
  - Cost Source: Section 4.4.3.10, Table 4.4-65
  - Date to be Implemented: 2007
  - Annual Cost: See Table 4.5-27 for a cost summary of this option.

**Table 4.5-27.**  
**Recommended Plan Costs by Decade for the City of Spur**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	151	257
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	26	70	97	94	91	91
Annual Cost (\$/yr)	\$13,799	\$34,637	\$47,632	\$45,581	\$44,214	\$44,214
Unit Cost (\$/acft)	\$531	\$495	\$491	\$485	\$486	\$486
<b>Local Groundwater Development (with the White River MWD)</b>						
Quantity Available (acft/yr)	400	400	400	400	400	400
Annual Cost (\$/yr)	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000
Unit Cost (\$/acft)	\$40	\$40	\$40	\$40	\$40	\$40

#### 4.5.8.2 Irrigation

##### 4.5.8.2.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** 10,290 acft/yr in 2000 declining to 5,171 acft/yr in 2060.

##### 4.5.8.2.2 Water Supply Plan

The use of irrigation BMPs in the past in Dickens County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Dickens

County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### 4.5.8.3.3 Costs

a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$1,630,000
- Annual Cost: \$130,000; including debt service at 25 yrs useful life of systems (Table 4.5-28).

**Table 4.5-28.**  
**Recommended Plan Costs by Decade for Irrigation – Dickens County**

Plan Element	2010	2020	2030	2040	2050	2060
Projected Irrigation Need (Shortage) (acft/yr)	3,407	3,266	3,133	2,999	2,868	2,737
Irrigation Conservation Quantity (acft/yr)	2,561	2,305	2,074	1,867	1,680	1,512
Annual Cost (million dollars/yr) (Table 4.4-11)	0.13	0.13	0.13	0.13	0.13	0.13
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.9 Floyd County Water Supply Plan

Table 4.5-29 lists each water user group in Floyd County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-29.**  
**Floyd County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Floydada	0	0	No projected surplus/shortage
City of Lockney	-240	-212	Projected shortage – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected demand
Steam Electric	0	0	No projected demand
Mining	0	0	No projected demand
Irrigation	-108,796	-99,985	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage
<sup>1</sup> From Table 4-9, Section 4.1 – Water Needs Projections by Water User Group. * Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.			

##### 4.5.9.1 The City of Lockney

###### 4.5.9.1.1 Description of Supply

- **Source:** Ogallala Aquifer and Lake Mackenzie
- **Current Supply:** Adequate to meet demands until approximately 2025, at which time additional supplies will be needed

###### 4.5.9.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Lockney through 2060.

- Local groundwater development beginning in 2021 needed to supply an additional 299 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala

Aquifer approximately two miles from the City of Lockney into which the city could locate new municipal water supply wells.

#### 4.5.9.1.3 Costs

Costs of the recommended plan for the City of Lockney to meet 2030 shortages are:

- a. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-29
  - Date to be Implemented: 2021
  - Total Project Cost: \$278,280
  - Annual Cost: See Table 4.5-30 for a cost summary of this option.

**Table 4.5-30.  
Recommended Plan Costs by Decade for the City of Lockney**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	240	234	224	212
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	410	369	332	299
Annual Cost (\$/yr)	—	—	\$47,072	\$47,072	\$47,072	\$24,833
Unit Cost (\$/acft)	—	—	\$115	\$128	\$142	\$83

#### 4.5.9.2 Irrigation

##### 4.5.9.2.1 Description of Supply

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 237,922 acft/yr in 2000 declining to 85,742 acft/yr in 2060.

##### 4.5.9.2.2 Water Supply Plan

The use of irrigation BMPs in the past in Floyd County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Floyd County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

**4.5.9.3.3 Costs**

## a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$43,660,000
- Annual Cost: \$3,413,000; including debt service at 25 yrs useful life of systems (Table 4.5-31).

**Table 4.5-31.  
Recommended Plan Costs by Decade for Irrigation – Floyd County**

Plan Element	2010	2020	2030	2040	2050	2060
Projected Irrigation Need (Shortage) (acft/yr)	90,731	106,390	108,796	108,830	105,039	99,985
Irrigation Conservation Quantity (acft/yr)	68,471	61,624	55,462	49,916	44,924	40,432
Annual Cost (million dollars/yr) (Table 4.4-11)	3.41	3.41	3.41	3.41	3.41	3.41
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.10 Gaines County Water Supply Plan

Table 4.5-32 lists each water user group in Gaines County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-32.**  
**Gaines County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Seagraves	-502	-499	Projected shortage – see plan below
City of Seminole	0	0	No projected surplus/shortage
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected demand
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-119,178	-139,897	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage
<sup>1</sup> From Table 4-10, Section 4.1 – Water Needs Projections by Water User Group. * Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.			

##### 4.5.10.1 The City of Seagraves

###### 4.5.10.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed

###### 4.5.10.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Seagraves through 2060.

- Local groundwater development beginning in 2006 needed to supply an additional 519 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately four miles from the City of Seagraves into which the city could locate new municipal water supply wells.

#### 4.5.10.1.3 Costs

Costs of the recommended plan for the City of Seagraves to meet 2060 shortages are:

- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-39
  - Date to be Implemented: 2006
  - Total Project Cost: \$1,224,828
  - Annual Cost: See Table 4.5-33 for a cost summary of this option.

**Table 4.5-33.**  
**Recommended Plan Costs by Decade for the City of Seagraves**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	449	482	502	513	506	499
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	645	790	711	640	576	519
Annual Cost (\$/yr)	\$119,185	\$142,875	\$142,875	\$77,597	\$53,891	\$53,891
Unit Cost (\$/acft)	\$185	\$181	\$201	\$121	\$94	\$104

#### 4.5.10.2 The City of Seminole

##### 4.5.10.2.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands through 2060.

##### 4.5.10.2.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Seminole.

- Municipal water conservation.

#### 4.5.10.2.3 Costs

Costs of the recommended plan for the City of Seminole are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-34 for a cost summary of this option.

**Table 4.5-34.  
Recommended Plan Costs by Decade for the City of Seminole**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	261	688	1,115	1,521	1,849	2,044
Annual Cost (\$/yr)	\$133,007	\$336,933	\$540,542	\$733,737	\$890,702	\$984,184
Unit Cost (\$/acft)	\$510	\$490	\$485	\$482	\$482	\$482

#### 4.5.10.3 Irrigation

##### 4.5.10.3.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** 415,068 acft/yr in 2000 declining to 160,930 acft/yr in 2060.

##### 4.5.10.3.2 Water Supply Plan

The use of irrigation BMPs in the past in Gaines County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Gaines County irrigation farmers (Section 4.4.1.2), however, the strategy is being applied to practically all of the irrigated acres of the county, and therefore does not have potential except for new irrigated acres in case any are placed into production.

##### 4.5.10.3.3 Costs

- a. Irrigation water conservation:
  - Cost Source: Section 4.4.1.2, Table 4.4-11
  - Date to be Implemented: Not applicable

- Total Cost: \$ 000
- Annual Cost: \$ 000; including debt service at 25 yrs useful life of systems (Table 4.5-35).

**Table 4.5-35.**  
**Recommended Plan Costs by Decade for Irrigation – Gaines County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	67,106	105,156	119,259	127,503	134,231	139,978
Irrigation Conservation Quantity (acft/yr)	0	0	0	0	0	0
Annual Cost (million dollars/yr) (Table 4.4-11)	0.00	0.00	0.00	0.00	0.00	0.00
Unit Cost (\$/acft) (Table 4.4-12)	0	0	0	0	0	0

#### 4.5.11 Garza County Water Supply Plan

Table 4.5-36 lists each water user group in Garza County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-36.  
Garza County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Post	183	-206	Projected shortage – see plan below
Lake Alan Henry WSD	-270	-270	New service area – see plan below
County Other	14	14	Projected surplus
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-3,995	-3,212	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected demand
Range & All Other Livestock	0	0	No projected surplus/shortage
<sup>1</sup> From Table 4-11, Section 4.1 – Water Needs Projections by Water User Group. * Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.			

##### 4.5.11.1 The City of Post

###### 4.5.11.1.1 Description of Supply

- **Source:** Lake Mackenzie (via Slaton) and White River Reservoir
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed

###### 4.5.11.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Post through 2060.

- Local groundwater development in partnership with the White River MWD beginning in 2007 needed to supply an additional 400 acft/yr in 2060.

#### 4.5.11.1.3 Costs

Costs of the recommended plan for the City of Post to meet 2060 shortages are:

- a. Local groundwater development in partnership with the White River MWD:
  - Cost Source: Section 4.4.3.10, Table 4.4-65
  - Date to be Implemented: 2007
  - Annual Cost: See Table 4.5-37 for a cost summary of this option.

**Table 4.5-37.  
Recommended Plan Costs by Decade for the City of Post**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	261	243	206
<b>Local Groundwater Development (with the White River MWD)</b>						
Quantity Available (acft/yr)	400	400	400	400	400	400
Annual Cost (\$/yr)	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000	\$16,000
Unit Cost (\$/acft)	\$40	\$40	\$40	\$40	\$40	\$40

#### 4.5.11.2 Lake Alan Henry WSD

##### 4.5.11.2.1 Description of Supply

- **Source:** Lake Alan Henry via contract with Lubbock.
- **Current Supply:** The new Lake Alan Henry WSD is projected to need supplies prior to 2010.

##### 4.5.11.2.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the Lake Alan Henry WSD through 2060.

- Supply from Lake Alan Henry beginning prior to 2010.

##### 4.5.11.2.3 Costs

Costs of the recommended plan for the Lake Alan Henry WSD to meet 2060 shortages are:

- a. Supply from Lake Alan Henry (See Section 4.4.3.1):
  - Cost Source: Section 4.4.3.1, Table 4.4-49

- Date to be Implemented: 2006
- Total Project Cost: \$5,613,000
- Annual Cost: See Table 4.5-38 for a cost summary of this option.

**Table 4.5-38.**  
**Recommended Plan Costs by Decade for the Lake Alan Henry WSD**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	270	270	270	270	270	270
<b>Supply from Lake Alan Henry</b>						
Quantity Available (acft/yr)	270	270	270	270	270	270
Annual Cost (\$/yr)	\$757,000	\$757,000	\$757,000	\$349,000	\$349,000	\$349,000
Unit Cost (\$/acft)	\$2,804	\$2,804	\$2,804	\$1,293	\$1,293	\$1,293

#### **4.5.11.3 Irrigation**

##### **4.5.11.3.1 Description of Supply**

- **Source:** Ogallala and Dockum Aquifers
- **Current Supply:** 13,243 acft/yr in 2000 declining to 5,259 acft/yr in 2060.

##### **4.5.11.3.2 Water Supply Plan**

The use of irrigation BMPs in the past in Garza County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Garza County irrigation farmers (Section 4.4.1.2). The strategy is projected to meet the irrigation water needs of Garza County.

##### **4.5.11.3.3 Costs**

###### **a. Irrigation water conservation:**

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$3,530,000
- Annual Cost: \$270,000; including debt service at 25 yrs useful life of systems (Table 4.5-39).

**Table 4.5-39.**  
**Recommended Plan Costs by Decade for Irrigation – Garza County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	4,712	4,301	3,995	3,721	3,455	3,212
Irrigation Conservation Quantity (acft/yr)	5,535	4,982	4,483	4,035	3,632	3,268
Annual Cost (million dollars/yr) (Table 4.4-11)	0.27	0.27	0.27	0.27	0.27	0.27
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

#### 4.5.12 Hale County Water Supply Plan

Table 4.5-40 lists each water user group in Hale County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-40.  
Hale County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Abernathy <sup>2</sup>	-714	-700	Projected shortage – see plan below
City of Hale Center	-509	-498	Projected shortage – see plan below
City of Petersburg	0	-306	Projected shortage – see plan below
City of Plainview	8,445	6,279	Projected surplus – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-138,840	-222,580	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-12, Section 4.1 – Water Needs Projections by Water User Group.  
<sup>2</sup> A portion of the City of Abernathy is located in Lubbock County. However, the city's total projected shortage is shown here.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.12.1 The City of Abernathy

###### 4.5.12.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

#### 4.5.12.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Abernathy through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2011 needed to supply an additional 863 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately 10 miles from the City of Abernathy into which the city could locate new municipal water supply wells.

#### 4.5.12.1.3 Costs

Costs of the recommended plan for the City of Abernathy to meet 2060 shortages are:

- Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-41 for a cost summary of this option.
- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-15
  - Date to be Implemented: 2011
  - Total Project Cost: \$2,974,092
  - Annual Cost: See Table 4.5-41 for a cost summary of this option.

**Table 4.5-41.**  
**Recommended Plan Costs by Decade for the City of Abernathy**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	690	714	717	715	700
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	50	60	55	44	40	39
Annual Cost (\$/yr)	\$27,248	\$30,749	\$27,918	\$22,039	\$19,943	\$19,545
Unit Cost (\$/acft)	\$545	\$512	\$508	\$501	\$499	\$501
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	823	942	848	959	863
Annual Cost (\$/yr)	—	\$259,189	\$282,878	\$282,878	\$141,335	\$126,058
Unit Cost (\$/acft)	—	\$315	\$300	\$334	\$147	\$146

**4.5.12.2 The City of Hale Center**

**4.5.12.2.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2025, at which time additional supplies will be needed.

**4.5.12.2.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Hale Center through 2060.

- Local groundwater development beginning in 2021 needed to supply an additional 599 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately four miles from the City of Hale Center into which the city could locate new municipal water supply wells.

**4.5.12.2.3 Costs**

Costs of the recommended plan for the City of Hale Center to meet 2060 shortages are:

- a. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-24
  - Date to be Implemented: 2021
  - Total Project Cost: \$1,224,828
  - Annual Cost: See Table 4.5-42 for a cost summary of this option.

**Table 4.5-42.  
Recommended Plan Costs by Decade for the City of Hale Center**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	509	513	507	498
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	607	740	666	599
Annual Cost (\$/yr)	—	—	\$88,801	\$112,490	\$112,490	\$62,365
Unit Cost (\$/acft)	—	—	\$146	\$152	\$169	\$104

### **4.5.12.3 The City of Petersburg**

#### **4.5.12.3.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2045, at which time additional supplies will be needed.

#### **4.5.12.3.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Petersburg through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2041 needed to supply an additional 369 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately one mile from the City of Petersburg into which the city could locate new municipal water supply wells.

#### **4.5.12.3.3 Costs**

Costs of the recommended plan for the City of Petersburg to meet 2060 shortages are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-43 for a cost summary of this option.
- b. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-34
  - Date to be Implemented: 2041
  - Total Project Cost: \$265,452
  - Annual Cost: See Table 4.5-43 for a cost summary of this option.

**Table 4.5-43.  
Recommended Plan Costs by Decade for the City of Petersburg**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	312	306
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	22	33	29	24	23	22
Annual Cost (\$/yr)	\$12,055	\$16,939	\$14,848	\$12,310	\$11,257	\$11,039
Unit Cost (\$/acft)	\$548	\$513	\$512	\$513	\$489	\$502
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	—	—	410	369
Annual Cost (\$/yr)	—	—	—	—	\$43,748	\$43,748
Unit Cost (\$/acft)	—	—	—	—	\$107	\$119

#### **4.5.12.4 The City of Plainview**

##### **4.5.12.4.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until through the planning period; however, the City is currently planning to drill four additional wells.

##### **4.5.12.4.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Plainview through 2060.

- Local groundwater development beginning in 2010 to supply an additional 1,181 acft/yr in 2060. These wells would be located within the City limits.

##### **4.5.12.4.3 Costs**

Costs of the recommended plan for the City of Plainview are:

- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-36
  - Date to be Implemented: 2010
  - Total Project Cost: \$528,000
  - Annual Cost: See Table 4.5-44 for a cost summary of this option.

**Table 4.5-44.  
Recommended Plan Costs by Decade for the City of Plainview**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	2,000	1,800	1,620	1,458	1,312	1,181
Annual Cost (\$/yr)	\$145,627	\$145,627	\$145,627	\$107,268	\$107,268	\$107,268
Unit Cost (\$/acft)	\$73	\$81	\$91	\$74	\$82	\$91

#### **4.5.12.5 Irrigation**

##### **4.5.12.5.1 Description of Supply**

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 365,725 acft/yr in 2000 declining to 77,816 acft/yr in 2060.

##### **4.5.12.5.2 Water Supply Plan**

The use of irrigation BMPs in the past in Hale County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Hale County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

##### **4.5.12.3.3 Costs**

- a. Irrigation water conservation:
  - Cost Source: Section 4.4.1.2, Table 4.4-11
  - Date to be Implemented: Prior to 2010
  - Total Cost: \$34,630,000
  - Annual Cost: \$2,710,000; including debt service at 25 yrs useful life of systems (Table 4.5-45).

**Table 4.5-45.  
Recommended Plan Costs by Decade for Irrigation – Hale County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	20,936	55,140	138,840	206,322	223,800	222,580
Irrigation Conservation Quantity (acft/yr)	54,306	48,875	43,988	39,589	35,630	32,067
Annual Cost (million dollars/yr) (Table 4.4-11)	2.71	2.71	2.71	2.71	2.71	2.71
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.13 Hockley County Water Supply Plan

Table 4.5-46 lists each water user group in Hockley County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-46.  
Hockley County Surplus/Shortage\***

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Anton	-272	-243	Projected shortage – see plan below
City of Levelland	867	1,129	Projected surplus
City of Ropesville	-91	-81	Projected shortage – see plan below
City of Smyer	0	-62	Projected shortage – see plan below
City of Sundown	-353	-316	Projected shortage – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-81,283	-80,164	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-13, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.13.1 The City of Anton

###### 4.5.13.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed

#### 4.5.13.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Anton through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2006 needed to supply an additional 373 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately four miles from the City of Anton into which the city could locate new municipal water supply wells.

#### 4.5.13.1.3 Costs

Costs of the recommended plan for the City of Anton to meet 2060 shortages are:

- Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-47 for a cost summary of this option.
- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-17
  - Date to be Implemented: 2006
  - Total Project Cost: \$1,055,736
  - Annual Cost: See Table 4.5-47 for a cost summary of this option.

**Table 4.5-47.**  
**Recommended Plan Costs by Decade for the City of Anton**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	263	270	272	268	256	243
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	14	11	6	2	0	0
Annual Cost (\$/yr)	\$8,113	\$5,925	\$3,469	\$868	—	—
Unit Cost (\$/acft)	\$580	\$539	\$578	\$434	—	—
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	408	569	512	461	415	373
Annual Cost (\$/yr)	\$93,667	\$117,356	\$117,356	\$64,363	\$40,657	\$40,657
Unit Cost (\$/acft)	\$230	\$206	\$229	\$140	\$98	\$109

**4.5.13.2 The City of Ropesville**

**4.5.13.2.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2025, at which time additional supplies will be needed

**4.5.13.2.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Ropesville through 2060.

- Local groundwater development beginning in 2021 needed to supply an additional 141 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately two miles from the City of Ropesville into which the city could locate new municipal water supply wells.

**4.5.13.2.3 Costs**

Costs of the recommended plan for the City of Ropesville to meet 2060 shortages are:

- a. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-38
  - Date to be Implemented: 2021
  - Total Project Cost: \$276,408
  - Annual Cost: See Table 4.5-48 for a cost summary of this option.

**Table 4.5-48.  
Recommended Plan Costs by Decade for the City of Ropesville**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	91	89	85	81
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	193	174	157	141
Annual Cost (\$/yr)	—	—	\$32,947	\$32,947	\$32,947	\$12,866
Unit Cost (\$/acft)	—	—	\$171	\$189	\$210	\$91

**4.5.13.3 The City of Smyer**

**4.5.13.3.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2055, at which time additional supplies will be needed

**4.5.13.3.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Smyer through 2060.

- Local groundwater development beginning in 2051 needed to supply an additional 193 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately one mile from the City of Smyer into which the city could locate new municipal water supply wells.

**4.5.13.3.3. Costs**

Costs of the recommended plan for the City of Smyer to meet 2060 shortages are:

- a. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-42
  - Date to be Implemented: 2051
  - Total Project Cost: \$200,904
  - Annual Cost: See Table 4.5-49 for a cost summary of this option.

**Table 4.5-49.  
Recommended Plan Costs by Decade for the City of Smyer**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	62
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	—	—	—	193
Annual Cost (\$/yr)	—	—	—	—	—	\$26,775
Unit Cost (\$/acft)	—	—	—	—	—	\$139

#### **4.5.13.4 The City of Sundown**

##### **4.5.13.4.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

##### **4.5.13.4.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Sundown through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2016 needed to supply an additional 415 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately two miles from the City of Sundown into which the city could locate new municipal water supply wells.

##### **4.5.13.4.3 Costs**

Costs of the recommended plan for the City of Sundown to meet 2060 shortages are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-50 for a cost summary of this option.
- b. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-44
  - Date to be Implemented: 2016
  - Total Project Cost: \$753,720
  - Annual Cost: See Table 4.5-50 for a cost summary of this option.

**Table 4.5-50.  
Recommended Plan Costs by Decade for the City of Sundown**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	350	353	347	332	316
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	24	30	25	19	17	16
Annual Cost (\$/yr)	\$13,688	\$16,068	\$13,197	\$9,947	\$8,516	\$8,096
Unit Cost (\$/acft)	\$570	\$536	\$528	\$524	\$501	\$506
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	412	569	512	461	415
Annual Cost (\$/yr)	—	\$68,980	\$92,669	\$92,669	\$61,617	\$37,911
Unit Cost (\$/acft)	—	\$167	\$163	\$181	\$134	\$91

#### **4.5.13.5 Irrigation**

##### **4.5.13.5.1 Description of Supply**

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 179,041 acft/yr in 2000 declining to 57,585 acft/yr in 2060.

##### **4.5.13.5.2 Water Supply Plan**

The use of irrigation BMPs in the past in Hockley County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Hockley County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

##### **4.5.13.3.3 Costs**

###### **a. Irrigation water conservation:**

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$19,010,000
- Annual Cost: \$1,490,000; including debt service at 25 yrs useful life of systems (Table 4.5-51).

**Table 4.5-51.  
Recommended Plan Costs by Decade for Irrigation – Hockley County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	62,297	74,194	81,283	86,353	82,429	80,164
Irrigation Conservation Quantity (acft/yr)	29,808	26,827	24,145	21,730	19,557	17,601
Annual Cost (million dollars/yr) (Table 4.4-11)	1.49	1.49	1.49	1.49	1.49	1.49
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.14 Lamb County Water Supply Plan

Table 4.5-52 lists each water user group in Lamb County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-52.  
Lamb County Surplus/Shortage\***

Water User Group	Surplus/(Shortage) <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Amherst	-182	-181	Projected shortage – see plan below
City of Earth	0	-276	Projected shortage – see plan below
City of Littlefield	729	531	Projected shortage – see plan below
City of Olton	0	0	No projected surplus/shortage
City of Sudan	-244	-243	Projected shortage – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected surplus/shortage
Mining	0	0	No projected surplus/shortage
Irrigation	-201,254	-252,878	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-14, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.14.1 The City of Amherst

###### 4.5.14.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

#### 4.5.14.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Amherst through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2012 needed to supply an additional 275 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately five miles from the City of Amherst into which the city could locate new municipal water supply wells.

#### 4.5.14.1.3 Costs

Costs of the recommended plan for the City of Amherst to meet 2060 shortages are:

- Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-53 for a cost summary of this option.
- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-16
  - Date to be Implemented: 2012
  - Total Project Cost: \$840,312
  - Annual Cost: See Table 4.5-53 for a cost summary of this option.

**Table 4.5-53.**  
**Recommended Plan Costs by Decade for the City of Amherst**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	176	182	185	183	181
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	7	5	2	0	0	0
Annual Cost (\$/yr)	\$4,193	\$2,787	\$1,173	—	—	—
Unit Cost (\$/acft)	\$599	\$557	\$587	—	—	—
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	196	378	340	306	275
Annual Cost (\$/yr)	—	\$65,705	\$89,394	\$89,394	\$40,198	\$28,345
Unit Cost (\$/acft)	—	\$335	\$236	\$263	\$131	\$103

#### **4.5.14.2 The City of Earth**

##### **4.5.14.2.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2035, at which time additional supplies will be needed

##### **4.5.14.2.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Earth through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2031 needed to supply an additional 318 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately three miles from the City of Earth into which the city could locate new municipal water supply wells.

##### **4.5.14.2.3. Costs**

Costs of the recommended plan for the City of Earth to meet 2060 shortages are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-54 for a cost summary of this option.
- b. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-21
  - Date to be Implemented: 2031
  - Total Project Cost: \$619,608
  - Annual Cost: See Table 4.5-54 for a cost summary of this option.

**Table 4.5-54.  
Recommended Plan Costs by Decade for the City of Earth**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	283	280	276
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	21	42	40	36	35	34
Annual Cost (\$/yr)	\$11,708	\$21,208	\$19,834	\$18,018	\$17,077	\$16,850
Unit Cost (\$/acft)	\$558	\$505	\$496	\$501	\$488	\$496
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	—	393	354	318
Annual Cost (\$/yr)	—	—	—	\$71,353	\$71,353	\$71,353
Unit Cost (\$/acft)	—	—	—	\$182	\$202	\$224

#### **4.5.14.3 The City of Littlefield**

##### **4.5.14.3.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Needs new supplies for expanding industrial customer by 2010.

##### **4.5.14.3.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Littlefield.

- Municipal water conservation, and
- Local groundwater development beginning in 2010. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately three miles from the City of Littlefield into which the city could locate new municipal water supply wells.

##### **4.5.14.3.3 Costs**

Costs of the recommended plan for the City of Littlefield are:

- Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-55 for a cost summary of this option.
- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):

- Cost Source: Section 4.4.2, Table 4.4-28
- Date to be Implemented: 2010
- Total Project Cost: \$922,944
- Annual Cost: See Table 4.5-55 for a cost summary of this option.

**Table 4.5-55.  
Recommended Plan Costs by Decade for the City of Littlefield**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	129	303	292	276	266	263
Annual Cost (\$/yr)	\$70,808	\$152,596	\$146,044	\$136,419	\$130,723	\$129,023
Unit Cost (\$/acft)	\$549	\$504	\$500	\$494	\$491	\$491
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	900	810	729	656	590	531
Annual Cost (\$/yr)	\$119,543	\$119,543	\$119,543	\$52,491	\$52,491	\$52,491
Unit Cost (\$/acft)	\$133	\$148	\$164	\$80	\$89	\$99

#### **4.5.14.4 The City of Olton**

##### **4.5.14.4.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2025, at which time additional supplies will be needed

##### **4.5.14.4.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Olton through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2021 needed to supply an additional 610 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately three miles from the City of Olton into which the city could locate new municipal water supply wells.

#### 4.5.14.4.3 Costs

Costs of the recommended plan for the City of Olton to meet 2060 shortages are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-56 for a cost summary of this option.

**Table 4.5-56.  
Recommended Plan Costs by Decade for the City of Olton**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	532	542	536	529
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	27	17	12	3	0	0
Annual Cost (\$/yr)	\$15,163	\$9,679	\$6,787	\$1,759	—	—
Unit Cost (\$/acft)	\$562	\$569	\$566	\$586	—	—

#### 4.5.14.5 The City of Sudan

##### 4.5.14.5.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

##### 4.5.14.5.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Sudan through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2016 needed to supply an additional 283 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately four miles from the City of Sudan into which the city could locate new municipal water supply wells.

**4.5.14.5.3. Costs**

Costs of the recommended plan for the City of Sudan to meet 2060 shortages are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-57 for a cost summary of this option.
- b. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-43
  - Date to be Implemented: 2016
  - Total Project Cost: \$596,508
  - Annual Cost: See Table 4.5-57 for a cost summary of this option.

**Table 4.5-57.  
Recommended Plan Costs by Decade for the City of Sudan**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	236	244	249	246	243
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	15	12	12	4	1	3
Annual Cost (\$/yr)	\$8,265	\$6,594	\$6,270	\$2,396	\$1,022	\$1,568
Unit Cost (\$/acft)	\$551	\$550	\$523	\$599	\$1,022	\$523
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	432	389	350	315	283
Annual Cost (\$/yr)	—	\$70,809	\$70,809	\$70,809	\$27,473	\$27,473
Unit Cost (\$/acft)	—	\$164	\$182	\$202	\$87	\$97

**4.5.14.6 Irrigation****4.5.14.6.1 Description of Supply**

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 385,564 acft/yr in 2000 declining to 45,547 acft/yr in 2060.

**4.5.14.6.2 Water Supply Plan**

The use of irrigation BMPs in the past in Lamb County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Lamb

County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### 4.5.14.3.3 Costs

a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$10,410,000
- Annual Cost: \$810,000; including debt service at 25 yrs useful life of systems (Table 4.5-58).

**Table 4.5-58.**  
**Recommended Plan Costs by Decade for Irrigation – Lamb County**

Plan Element	2010	2020	2030	2040	2050	2060
Projected Irrigation Need (Shortage) (acft/yr)	113,357	157,565	201,254	239,149	249,944	252,878
Irrigation Conservation Quantity (acft/yr)	16,324	14,691	13,222	11,900	10,710	9,639
Annual Cost (million dollars/yr) (Table 4.4-11)	0.81	0.81	0.81	0.81	0.81	0.81
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

#### 4.5.15 Lubbock County Water Supply Plan

Table 4.5-59 lists each water user group in Lubbock County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-59.  
Lubbock County Surplus/Shortage**

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Abernathy			See Hale County
City of Idalou	0	-272	Projected shortage – see plan below
City of Lubbock	8,413	9,003	Projected surplus – see plan below
City of New Deal	-20	-20	Projected shortage – see plan below
City of Ransom Canyon	0	0	Projected surplus
City of Shallowater	-190	-184	Projected shortage – see plan below
City of Slaton	499	533	Projected surplus
City of Wolfforth	-1,522	-1,787	Projected shortage – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected surplus/shortage
Mining	0	0	No projected surplus/shortage
Irrigation	-89,289	-90,742	Projected shortage –see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-15, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.15.1 The City of Abernathy (See Hale County)

##### 4.5.15.2 The City of Idalou

##### 4.5.15.2.1 Description of Supply

- **Source:** Ogallala Aquifer

- **Current Supply:** Adequate to meet demands until approximately 2035, at which time additional supplies will be needed

#### 4.5.15.2.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Idalou through 2060.

- Local groundwater development beginning in 2031 needed to supply an additional 332 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately four miles from the City of Idalou into which the city could locate new municipal water supply wells.

#### 4.5.15.2.3 Costs

Costs of the recommended plan for the City of Idalou to meet 2060 shortages are:

- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-26
  - Date to be Implemented: 2031
  - Total Project Cost: \$596,508
  - Annual Cost: See Table 4.5-60 for a cost summary of this option.

**Table 4.5-60.**  
**Recommended Plan Costs by Decade for the City of Idalou**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	274	273	272
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	—	410	369	332
Annual Cost (\$/yr)	—	—	—	\$70,809	\$70,809	\$70,809
Unit Cost (\$/acft)	—	—	—	\$173	\$192	\$213

#### 4.5.15.3 The City of Lubbock

##### 4.5.15.3.1 Description of Supply

- **Source:** Ogallala Aquifer and Lake Meredith
- **Current Supply:** Adequate to meet demands through 2060.

#### **4.5.15.3.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Lubbock.

- Municipal water conservation, and
- Lake Alan Henry Pipeline
- City of Lubbock Well Field
- Lubbock Expand Bailey County Well Field
- CRMWA Expand Capacity of Groundwater Supply
- Lubbock Brackish Groundwater Desalination
- Jim Bertram Lake System Expansion, and
- Lubbock North Fork Scalping Operation.

#### **4.5.15.3.3 Costs**

Costs of the recommended plan for the City of Lubbock are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-61 for a cost summary of this option.
- b. Lake Alan Henry Pipeline:
  - Cost Source: Section 4.4.3.2, Table 4.4-50
  - Date to be Implemented: Prior to 2020
  - Total Project Cost: \$174,909,000
  - Annual Cost: See Table 4.5-61 for a cost summary of this option.
- c. City of Lubbock Well Field:
  - Cost Source: Section 4.4.3.3, Table 4.4-51
  - Date to be Implemented: Prior to 2010
  - Total Project Cost: \$7,718,000
  - Annual Cost: See Table 4.5-61 for a cost summary of this option.
- d. Lubbock Expand Capacity of Bailey County Well Field
  - Cost Source: Section 4.4.3.4, Table 4.4-52
  - Date to be Implemented: Prior to 2010
  - Total Project Cost: \$2,541,000
  - Annual Cost: See Table 4.5-61 for a cost summary of this option.
- e. CRMWA Expand Capacity of Groundwater Supply
  - Cost Source: Section 4.4.3.5, Table 4.4-53

- Date to be Implemented: Prior to 2010
  - Total Project Cost: (\$59,052,000 to expand 31,659 acft/yr; annual cost is \$6,843,000; Lubbock share of expansion is 37.058 percent of cost and quantity.)
  - Annual Cost: See Table 4.5-61 for a cost summary of this option.
- f. Lubbock Brackish Groundwater Desalination
- Cost Source: Section 4.4.3.6, Table 4.4-54
  - Date to be Implemented: 2020
  - Total Project Cost: \$10,051,230
  - Annual Cost: See Table 4.5-61 for a cost summary of this option.
- g. Lubbock Jim Bertram Lake System Expansion
- Cost Source: Section 4.4.3.7, Table 4.4-57
  - Date to be Implemented: 2020
  - Total Project Cost: \$150,759,000
  - Annual Cost: See Table 4.5-61 for a cost summary of this option.
- h. Lubbock North Fork Scalping Operation
- Cost Source: Section 4.4.3.8, Table 4.4-63
  - Date to be Implemented: 2045
  - Total Project Cost: \$50,055,000
  - Annual Cost: See Table 4.5-61 for a cost summary of this option.

**Table 4.5-61.  
Recommended Plan Costs by Decade for the City of Lubbock**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation (Strategy is included until the regional goal of 172 gpcd is reached)</b>						
Quantity Available (acft/yr)	1,180	489	0	0	0	0
Annual Cost (\$/yr)	\$613,515	\$254,508	—	—	—	—
Unit Cost (\$/acft)	\$520	\$520	—	—	—	—
<b>Lake Alan Henry Pipeline</b>						
Quantity Available (acft/yr)	0	22,230	22,230	22,230	22,230	22,230
Annual Cost (\$/yr) (millions)	—	\$26.584	\$26.584	\$26.584	\$26.584	\$26.584
Unit Cost (\$/acft)	—	\$1,196	\$1,196	\$1,196	\$1,196	\$1,196
<b>City of Lubbock Well Field</b>						
Quantity Available (acft/yr)	5,600	5,600	5,600	5,600	5,600	5,600
Annual Cost (\$/yr) (millions)	\$1.644	\$1.644	\$1.644	\$1.644	\$1.644	\$1.644
Unit Cost (\$/acft)	\$294	\$294	\$294	\$294	\$294	\$294
<b>Expand Bailey County Well Field</b>						
Quantity Available (acft/yr)	5,600	5,600	5,600	5,600	5,600	5,600
Annual Cost (\$/yr)	\$213,000	\$213,000	\$213,000	\$213,000	\$213,000	\$213,000
Unit Cost (\$/acft)	\$38	\$38	\$38	\$38	\$38	\$38
<b>CRMWA Expand Groundwater Supply (See 4.5.15.3.3e above)</b>						
Quantity Available (acft/yr)	14,911	14,911	14,911	14,911	14,911	14,911
Annual Cost (\$/yr) (millions)	\$2.536	\$2.536	\$2.536	\$2.536	\$2.536	\$2.536
Unit Cost (\$/acft)*	\$216	\$216	\$216	\$216	\$216	\$216
<b>Lubbock Brackish Groundwater Desalination</b>						
Quantity Available (acft/yr)**	3,360	3,360	3,360	3,360	3,360	3,360
Annual Cost (\$/yr) (millions)*	\$1.700	\$1.700	\$1.700	\$1.700	\$1.700	\$1.700
Unit Cost (\$/acft)*	\$506	\$506	\$506	\$506	\$506	\$506
<b>Lubbock Jim Bertram Lake System Expansion</b>						
Quantity Available (acft/yr)**	0	21,200	21,200	21,200	21,200	21,200
Annual Cost (\$/yr) (millions)*	—	\$14.575	\$14.575	\$14.575	\$14.575	\$14.575
Unit Cost (\$/acft)*	—	\$688	\$688	\$688	\$688	\$688
<b>Lubbock North Fork Scalping Operation</b>						
Quantity Available (acft/yr)**	0	0	0	0	4,000	4,000
Annual Cost (\$/yr) (millions)*	—	—	—	—	4.296	4.296
Unit Cost (\$/acft)*	—	—	—	—	\$1,074	\$1,074

#### 4.5.15.4 The City of New Deal

##### 4.5.15.4.1 Description of Supply

- **Source:** City of Slaton (CRMWA)
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

##### 4.5.15.4.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of New Deal through 2060.

- Local groundwater development beginning in 2011 needed to supply an additional 127 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately four miles from the City of New Deal into which the city could locate new municipal water supply wells.

##### 4.5.15.4.3 Costs

Costs of the recommended plan for the City of New Deal to meet 2060 shortages are:

- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-32
  - Date to be Implemented: 2011
  - Total Project Cost: \$427,416
  - Annual Cost: See Table 4.5-62 for a cost summary of this option.

**Table 4.5-62.**  
**Recommended Plan Costs by Decade for the City of New Deal**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	12	20	20	25	20
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	193	174	157	141	127
Annual Cost (\$/yr)	—	\$45,290	\$45,290	\$45,290	\$14,239	\$14,239
Unit Cost (\$/acft)	—	\$235	\$260	\$288	\$101	\$112

#### 4.5.15.5 The City of Ransom Canyon

##### 4.5.15.5.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands through 2060.

##### 4.5.15.5.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Ransom Canyon.

- Municipal water conservation.

##### 4.5.15.5.3 Costs

Costs of the recommended plan for the City of Ransom Canyon are:

- Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-63 for a cost summary of this option.

**Table 4.5-63.**  
**Recommended Plan Costs by Decade for the City of Ransom Canyon**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	48	158	303	477	632	665
Annual Cost (\$/yr)	\$24,171	\$75,913	\$144,307	\$225,880	\$298,937	\$314,704
Unit Cost (\$/acft)	\$504	\$480	\$476	\$474	\$473	\$473

#### 4.5.15.6 The City of Shallowater

##### 4.5.15.6.1 Description of Supply

- **Source:** Ogallala Aquifer and City of Lubbock (Lake Meredith)
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed

#### 4.5.15.6.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Shallowater through 2060.

- Local groundwater development beginning in 2006 needed to supply an additional 255 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately two miles from the City of Shallowater into which the city could locate new municipal water supply wells.

#### 4.5.15.6.3 Costs

Costs of the recommended plan for the City of Shallowater to meet 2060 shortages are:

- a. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-40
  - Date to be Implemented: 2006
  - Total Project Cost: \$375,804
  - Annual Cost: See Table 4.5-64 for a cost summary of this option.

**Table 4.5-64.**  
**Recommended Plan Costs by Decade for the City of Shallowater**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	157	180	190	184	192	184
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	432	389	350	315	283	255
Annual Cost (\$/yr)	\$52,769	\$52,769	\$52,769	\$25,466	\$25,466	\$25,466
Unit Cost (\$/acft)	\$122	\$136	\$151	\$81	\$90	\$100

#### 4.5.15.7 The City of Wolfforth

##### 4.5.15.7.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed

#### 4.5.15.7.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Wolfforth through 2060.

- Local groundwater development beginning in 2007 needed to supply an additional 1,792 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately two miles from the City of Wolfforth into which the city could locate new municipal water supply wells.

#### 4.5.15.7.3 Costs

Costs of the recommended plan for the City of Wolfforth to meet 2060 shortages are:

- a. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-47
  - Date to be Implemented: 2007
  - Total Project Cost: \$3,957,513
  - Annual Cost: See Table 4.5-65 for a cost summary of this option.

**Table 4.5-65.  
Recommended Plan Costs by Decade for the City of Wolfforth**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	1,097	1,424	1,522	1,614	1,719	1,787
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	1,164	2,132	1,919	1,727	1,991	1,792
Annual Cost (\$/yr)	\$96,626	\$396,581	\$396,581	\$357,740	\$163,582	\$163,582
Unit Cost (\$/acft)	\$83	\$186	\$207	\$207	\$82	\$91

#### 4.5.15.8 Irrigation

##### 4.5.15.8.1 Description of Supply

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 302,880 acft/yr in 2000 declining to 81,005 acft/yr in 2060.

#### 4.5.15 8.2 Water Supply Plan

The use of irrigation BMPs in the past in Lubbock County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Lubbock County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### 4.5.15.3.3 Costs

a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$33,810,000
- Annual Cost: \$2,640,000; including debt service at 25 yrs useful life of systems (Table 4.5-66).

**Table 4.5-66.**  
**Recommended Plan Costs by Decade for Irrigation – Lubbock County**

Plan Element	2010	2020	2030	2040	2050	2060
Projected Irrigation Need (Shortage) (acft/yr)	60,963	79,271	89,289	100,821	94,300	90,742
Irrigation Conservation Quantity (acft/yr)	53,014	47,713	42,942	38,648	34,783	31,305
Annual Cost (million dollars/yr) (Table 4.4-11)	2.64	2.64	2.64	2.64	2.64	2.64
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

#### 4.5.16 Lynn County Water Supply Plan

Table 4.5-67 lists each water user group in Lynn County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-67.  
Lynn County Surplus/Shortage**

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of O'Donnell (part)	122	143	Projected surplus
City of Tahoka	44	113	Projected surplus
City of Wilson	-65	-55	Projected shortage – see plan below
County Other	100	100	Projected surplus
Industrial	0	0	No projected demand
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	28,082	42,915	Projected surplus – see plan below
Beef Feedlot Livestock	0	0	No projected demand
Range & All Other Livestock	0	0	No projected surplus/shortage
<sup>1</sup> From Table 4-16, Section 4.1 – Water Needs Projections by Water User Group. * Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.			

##### 4.5.16.1 The City of Wilson

###### 4.5.16.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

###### 4.5.16.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Wilson through 2060.

- Local groundwater development beginning in 2011 needed to supply an additional 127 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately two miles from the City of Wilson into which the city could locate new municipal water supply wells, and
- Purchase water from the City of Lubbock.

#### 4.5.16.1.3 Costs

Costs of the recommended plan for the City of Wilson to meet 2060 shortages are:

- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-46
  - Date to be Implemented: 2011
  - Total Project Cost: \$276,408
  - Annual Cost: See Table 4.5-68 for a cost summary of this option.
- Purchase from Lubbock
  - Cost Source: Estimated by City of Wilson
  - Date to be Implemented: 2007
  - Total Cost:
  - Annual Cost: See Table 4.5-68 for a cost summary of this option.

**Table 4.5-68.**  
**Recommended Plan Costs by Decade for the City of Wilson**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	68	65	63	60	55
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	193	174	157	141	127
Annual Cost (\$/yr)	—	\$32,947	\$32,947	\$32,947	\$12,866	\$12,866
Unit Cost (\$/acft)	—	\$171	\$189	\$210	\$91	\$101
<b>Purchase from Lubbock</b>						
Quantity Available (acft/yr)	61	61	16	61	61	61
Annual Cost (\$/yr)	43,250	43,250	43,250	17,750	17,750	17,750
Unit Cost (\$/acft)	\$709	\$709	\$709	\$291	\$291	\$291

#### 4.5.16.2 Irrigation

##### 4.5.16.2.1 Description of Supply

- **Source:** Ogallala and Edwards-Trinity Aquifers, and Reclaimed Water
- **Current Supply:** 132,810 acft/yr in 2000 declining to 129,302 acft/yr in 2060.

##### 4.5.16.2.2 Water Supply Plan

The use of irrigation BMPs in the past in Lynn County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Lynn County irrigation farmers (Section 4.4.1.2) even though there is no projected need (shortage) during the planning period. Irrigation water conservation will contribute to extending the future life of the aquifer in the county.

##### 4.5.16.3.3 Costs

a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$12,000,000
- Annual Cost: \$940,000; including debt service at 25 yrs useful life of systems (Table 4.5-69).

**Table 4.5-69.**  
**Recommended Plan Costs by Decade for Irrigation – Lynn County**

Plan Element	2010	2020	2030	2040	2050	2060
Projected Irrigation Need (Shortage) (acft/yr)	0	0	0	0	0	0
Irrigation Conservation Quantity (acft/yr)	18,814	16,933	15,240	13,716	12,344	11,110
Annual Cost (million dollars/yr) (Table 4.4-11)	0.94	0.94	.094	0.94	0.94	0.94
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.17 Motley County Water Supply Plan

Table 4.5-70 lists each water user group in Motley County and their corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-70.  
Motley County Surplus/Shortage**

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Matador	0	0	No projected surplus/shortage
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-1,208	-1,025	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected demand
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-17, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

#### 4.5.17.1 The City of Matador

##### 4.5.17.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands through 2060.

##### 4.5.17.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Matador.

- Municipal water conservation.

#### 4.5.17.1.3 Costs

Costs of the recommended plan for the City of Matador are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-71 for a cost summary of this option.

**Table 4.5-71.  
Recommended Plan Costs by Decade for the City of Matador**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	28	64	91	109	124	121
Annual Cost (\$/yr)	\$14,415	\$31,589	\$44,339	\$52,734	\$59,871	\$58,540
Unit Cost (\$/acft)	\$515	\$494	\$487	\$484	\$482	\$484

#### 4.5.17.2 Irrigation

##### 4.5.17.2.1 Description of Supply

- **Source:** Ogallala and Seymour Aquifers
- **Current Supply:** 12,097 acft/yr in 2000 declining to 6,616 acft/yr in 2060.

##### 4.5.17.2.2 Water Supply Plan

The use of irrigation BMPs in the past in Motley County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Motley County irrigation farmers (Section 4.4.1.2). however, information available indicates that practically all of the presently irrigated acreages are equipped with efficient application systems. Irrigation water conservation will contribute to extending the future life of the aquifer in the county.

**4.5.17.3.3 Costs**

## a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$000,000
- Annual Cost: \$000,000; including debt service at 25 yrs useful life of systems (Table 4.5-72).

**Table 4.5-72.****Recommended Plan Costs by Decade for Irrigation – Motley County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	1,332	1,266	1,208	1,154	1,092	1,025
Irrigation Conservation Quantity (acft/yr)	0	0	0	0	0	0
Annual Cost (million dollars/yr) (Table 4.4-11)	0.00	0.00	0.00	0.00	0.00	0.00
Unit Cost (\$/acft) (Table 4.4-12)	0	0	0	0	0	0

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#### 4.5.18 Parmer County Water Supply Plan

Table 4.5-73 lists each water user group in Parmer County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-73.  
Parmer County Surplus/Shortage**

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Bovina	0	0	No projected surplus/shortage
City of Farwell	-410	-371	Projected shortage – see plan below
City of Friona	-879	-791	Projected shortage – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected demand
Irrigation	-361,463	-350,451	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-18, Section 4.1 – Water Needs Projections by Water User Group.  
\* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.18.1 The City of Farwell

###### 4.5.18.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

###### 4.5.18.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Farwell through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2015 needed to supply an additional 265 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately three miles from the City of Farwell into which the city could locate new municipal water supply wells.

#### 4.5.18.1.3 Costs

Costs of the recommended plan for the City of Farwell to meet 2060 shortages are:

- Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-74 for a cost summary of this option.
- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-22
  - Date to be Implemented: 2015
  - Total Project Cost: \$619,608
  - Annual Cost: See Table 4.5-74 for a cost summary of this option.

**Table 4.5-74.**  
**Recommended Plan Costs by Decade for the City of Farwell**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	405	410	408	393	371
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	41	109	173	194	186	176
Annual Cost (\$/yr)	\$21,675	\$53,822	\$84,360	\$93,938	\$90,015	\$85,044
Unit Cost (\$/acft)	\$529	\$494	\$488	\$484	\$484	\$483
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	404	363	327	294	265
Annual Cost (\$/yr)	—	\$71,353	\$71,353	\$71,353	\$26,339	\$26,339
Unit Cost (\$/acft)	—	\$177	\$197	\$218	\$90	\$99

#### **4.5.18.2 The City of Friona**

##### **4.5.18.2.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2025, at which time additional supplies will be needed

##### **4.5.18.2.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Friona through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2010 needed to supply an additional 971 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately 4 miles from the City of Friona into which the city could locate new municipal water supply wells.

##### **4.5.18.2.3 Costs**

Costs of the recommended plan for the City of Friona to meet 2060 shortages are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-75 for a cost summary of this option.
- b. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-23
  - Date to be Implemented: 2010
  - Total Project Cost: \$1,615,812
  - Annual Cost: See Table 4.5-75 for a cost summary of this option.

**Table 4.5-75.  
Recommended Plan Costs by Decade for the City of Friona**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	879	870	838	791
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	46	34	20	5	0	0
Annual Cost (\$/yr)	\$25,727	\$19,130	\$11,206	\$2,821	-	-
Unit Cost (\$/acft)	\$559	\$563	\$560	\$564	-	-
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	121	549	1,332	1,198	1,079	971
Annual Cost (\$/yr)	\$86,462	\$125,701	\$204,177	\$132,618	\$117,341	\$86,788
Unit Cost (\$/acft)	\$715	\$229	\$153	\$111	\$109	\$89

### **4.5.18.3 Irrigation**

#### **4.5.18.4.1 Description of Supply**

- **Source:** Ogallala Aquifer and Reclaimed Water
- **Current Supply:** 419,139 acft/yr in 2000 declining to 39,225 acft/yr in 2060.

#### **4.5.18.4.2 Water Supply Plan**

The use of irrigation BMPs in the past in Parmer County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Parmer County irrigation farmers (Section 4.4.1.2). However, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### **4.5.18.3.3 Costs**

##### a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$15,240,000
- Annual Cost: \$1,190,000; including debt service at 25 yrs useful life of systems (Table 4.5-76).

**Table 4.5-76.  
Recommended Plan Costs by Decade for Irrigation – Parmer County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	160,562	330,545	361,463	357,751	354,041	350,451
Irrigation Conservation Quantity (acft/yr)	23,900	21,510	19,359	17,423	15,681	14,113
Annual Cost (million dollars/yr) (Table 4.4-11)	1.19	1.19	1.19	1.19	1.19	1.19
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.19 Swisher County Water Supply Plan

Table 4.5-77 lists each water user group in Swisher County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-77.  
Swisher County Surplus/Shortage**

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Happy	0	0	No projected surplus/shortage
City of Kress	-105	-96	Projected shortage – see plan below
City of Tulia	-416	-417	Projected shortage – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected demand
Steam Electric	0	0	No projected demand
Mining	0	0	No projected demand
Irrigation	-95,114	-106,999	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected surplus/shortage
Range & All Other Livestock	0	0	No projected surplus/shortage

<sup>1</sup> From Table 4-19, Section 4.1 – Water Needs Projections by Water User Group.  
 \* Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.

##### 4.5.19.1 The City of Kress

###### 4.5.19.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed.

###### 4.5.19.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Kress through 2060.

- Local groundwater development beginning in 2006 needed to supply an additional 120 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately six miles from the City of Kress into which the city could locate new municipal water supply wells.

#### 4.5.19.1.3 Costs

Costs of the recommended plan for the City of Kress to meet 2060 shortages are:

- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-27
  - Date to be Implemented: 2006
  - Total Project Cost: \$578,424
  - Annual Cost: See Table 4.5-78 for a cost summary of this option.

**Table 4.5-78.**  
**Recommended Plan Costs by Decade for the City of Kress**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	104	104	105	103	100	96
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	204	184	165	149	134	120
Annual Cost (\$/yr)	\$57,634	\$57,634	\$57,634	\$15,611	\$15,611	\$15,611
Unit Cost (\$/acft)	\$283	\$313	\$349	\$105	\$117	\$130

#### 4.5.19.2 The City of Tulia

##### 4.5.19.2.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2005, at which time additional supplies will be needed.

##### 4.5.19.2.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Tulia through 2060.

- Municipal water conservation; and
- Local groundwater development beginning in 2006 needed to supply an additional 510 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately four miles from the City of Tulia into which the city could locate new municipal water supply wells.

#### 4.5.19.2.3 Costs

Costs of the recommended plan for the City of Tulia are:

- Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-79 for a cost summary of this option.
- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-45
  - Date to be Implemented: 2006
  - Total Project Cost: \$992,160
  - Annual Cost: See Table 4.5-79 for a cost summary of this option.

**Table 4.5-79.**  
**Recommended Plan Costs by Decade for the City of Tulia**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	417	417	416	416	416	417
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	18	0	0	0	0	0
Annual Cost (\$/yr)	\$10,101	—	—	—	—	—
Unit Cost (\$/acft)	\$561	—	—	—	—	—
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	864	778	700	630	567	510
Annual Cost (\$/yr)	\$133,310	\$133,310	\$133,310	\$54,022	\$54,022	\$54,022
Unit Cost (\$/acft)	\$154	\$171	\$190	\$86	\$95	\$106

**4.5.19.3 Irrigation**

**4.5.19.3.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** 173,007 acft/yr in 2000 declining to 58,866 acft/yr in 2060.

**4.5.19.3.2 Water Supply Plan**

The use of irrigation BMPs in the past in Swisher County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Swisher County irrigation farmers (Section 4.4.1.2), which is projected to meet the irrigation needs through 2020. However, it is not economically feasible to meet all of the irrigation needs (shortages) beyond 2020, at this time.

**4.5.19.3.3 Costs**

a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$48,750,000
- Annual Cost: \$3,810,000; including debt service at 25 yrs useful life of systems (Table 4.5-80).

**Table 4.5-80.  
Recommended Plan Costs by Decade for Irrigation – Swisher County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	21,780	59,582	95,136	104,736	107,033	107,037
Irrigation Conservation Quantity (acft/yr)	76,453	68,808	61,927	55,734	50,161	45,145
Annual Cost (million dollars/yr) (Table 4.4-11)	3.81	3.81	3.81	3.81	3.81	3.81
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

#### 4.5.20 Terry County Water Supply Plan

Table 4.5-81 lists each water user group in Terry County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-81.  
Terry County Surplus/Shortage**

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Brownfield	-280	-457	Projected shortage – see plan below
City of Meadow	0	0	No projected surplus/shortage
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected surplus/shortage
Steam Electric	0	0	No projected demand
Mining	0	0	No projected surplus/shortage
Irrigation	-95,597	-84,972	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected demand
Range & All Other Livestock	0	0	No projected surplus/shortage
<sup>1</sup> From Table 4-20, Section 4.1 – Water Needs Projections by Water User Group. * Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.			

##### 4.5.20.1 The City of Brownfield

###### 4.5.20.1.1 Description of Supply

- **Source:** Ogallala Aquifer and Canadian River Municipal Water Authority
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

###### 4.5.20.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Brownfield through 2060.

- Municipal water conservation,
- Expand supplies from CRMWA.

#### 4.5.20.1.3 Costs

Costs of the recommended plan for the City of Brownfield to meet 2060 shortages are:

a. Municipal water conservation:

- Cost Source: Section 4.4.1, Table 4.4-7
- Date to be Implemented: Prior to 2010
- Annual Cost: See Table 4.5-82 for a cost summary of this option.

b. Expand Supplies from CRMWA:

- Cost Source: Section 4.4.3.5, Table 4.4-53
- Date to be Implemented: Prior to 2010
- Total Project Cost: Purchase at per acre-foot cost from CRMWA (Based on calculation of Brownfield share of CRMWA supply at 1.56 percent, or 494 acft/yr)
- Annual Cost: See Table 4.5-82 for a cost summary of this option.

**Table 4.5-82.**  
**Recommended Plan Costs by Decade for the City of Brownfield**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	115	280	435	458	457
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	272	774	1,282	1,549	1,544	1,535
Annual Cost (\$/yr)	\$142,733	\$381,674	\$623,402	\$748,812	\$745,193	\$741,052
Unit Cost (\$/acft)	\$525	\$493	\$486	\$483	\$483	\$483
<b>Expand Supplies from CRMWA *</b>						
Quantity Available (acft/yr)*	494	494	494	494	494	494
Annual Cost (\$/yr)*	% of total	%	%	%	%	% of total
Unit Cost (\$/acft)*	\$216	\$216	\$216	\$216	\$216	\$216
* See 4.5.20.1.3 c, above.						

#### 4.5.20.2 Irrigation

##### 4.5.20.2.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** 184,848 acft/yr in 2000 declining to 57,984 acft/yr in 2060.

#### 4.5.20.2.2 Water Supply Plan

The use of irrigation BMPs in the past in Terry County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Terry County irrigation farmers (Section 4.4.1.2), however, information available indicates that nearly all of presently irrigated acres are equipped with efficient application systems, thus, there is very little potential for additional irrigation conservation through use of this water management strategy. As is the case elsewhere in Region O, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### 4.5.20.3.3 Costs

a. Irrigation water conservation:

- Cost Source: Section 4.4.1.2, Table 4.4-11
- Date to be Implemented: Prior to 2010
- Total Cost: \$1,360,000
- Annual Cost: \$100,000; including debt service at 25 yrs useful life of systems (Table 4.5-83).

**Table 4.5-83.  
Recommended Plan Costs by Decade for Irrigation – Terry County**

Plan Element	2010	2020	2030	2040	2050	2060
Projected Irrigation Need (Shortage) (acft/yr)	74,855	92,101	101,339	106,651	98,164	90,149
Irrigation Conservation Quantity (acft/yr)	2,135	1,922	1,729	1,556	1,401	1,261
Annual Cost (million dollars/yr) (Table 4.4-11)	0.10	0.10	0.10	0.10	0.10	0.10
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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#### 4.5.21 Yoakum County Water Supply Plan

Table 4.5-84 lists each water user group in Yoakum County and its corresponding surplus or shortage in years 2030 and 2060. For each water user group with a projected shortage, a water supply plan has been developed and is presented in the following subsections.

**Table 4.5-84.  
Yoakum County Surplus/Shortage**

Water User Group	Surplus/Shortage <sup>1</sup>		Comment
	2030 (acft/yr)	2060 (acft/yr)	
City of Denver City	-1,172	-1,141	Projected shortage – see plan below
City of Plains	-468	-457	Projected shortage – see plan below
County Other	0	0	No projected surplus/shortage
Industrial	0	0	No projected demand
Steam Electric	0	0	No projected surplus/shortage
Mining	0	0	No projected surplus/shortage
Irrigation	-21,476	-18,485	Projected shortage – see plan below
Beef Feedlot Livestock	0	0	No projected demand
Range & All Other Livestock	0	0	No projected surplus/shortage
<sup>1</sup> From Table 4-21, Section 4.1 – Water Needs Projections by Water User Group. * Computations are at the county level of detail, and although the county data show a surplus or shortage, there no doubt are individual water users of each county who have a shortage when the county shows an overall surplus; e.g., the projected surplus water is not located such that those who have shortages can obtain it.			

##### 4.5.21.1 The City of Denver City

###### 4.5.21.1.1 Description of Supply

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2025, at which time additional supplies will be needed

###### 4.5.21.1.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Denver City through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2021 needed to supply an additional 1,076 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately 14 miles from the City of Denver City into which the city could locate new municipal water supply wells.

#### 4.5.21.1.3 Costs

Costs of the recommended plan for the City of Denver City to meet 2060 shortages are:

- Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-85 for a cost summary of this option.
- Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-19
  - Date to be Implemented: 2021
  - Total Project Cost: \$3,764,772
  - Annual Cost: See Table 4.5-85 for a cost summary of this option.

**Table 4.5-85.**  
**Recommended Plan Costs by Decade for the City of Denver City**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	1,172	1,220	1,181	1,141
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	89	284	318	317	303	292
Annual Cost (\$/yr)	\$48,191	\$140,813	\$155,825	\$154,386	\$146,917	\$141,927
Unit Cost (\$/acft)	\$541	\$496	\$490	\$487	\$485	\$486
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	—	1,476	1,328	1,195	1,076
Annual Cost (\$/yr)	—	—	\$384,239	\$384,239	\$384,239	\$110,728
Unit Cost (\$/acft)	—	—	\$260	\$289	\$322	\$103

#### **4.5.21.2 The City of Plains**

##### **4.5.21.2.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** Adequate to meet demands until approximately 2015, at which time additional supplies will be needed

##### **4.5.21.2.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended to meet the projected shortages of the City of Plains through 2060.

- Municipal water conservation, and
- Local groundwater development beginning in 2012 needed to supply an additional 405 acft/yr in 2060. There appears to be adequate saturated thickness of the Ogallala Aquifer approximately three miles from the City of Plains into which the city could locate new municipal water supply wells.

##### **4.5.21.2.3 Costs**

Costs of the recommended plan for the City of Plains to meet 2060 shortages are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-86 for a cost summary of this option.
- b. Local groundwater development (See Section 4.4.2 for scheduling and a cost summary of this option):
  - Cost Source: Section 4.4.2, Table 4.4-35
  - Date to be Implemented: 2012
  - Total Project Cost: \$771,276
  - Annual Cost: See Table 4.5-86 for a cost summary of this option.

**Table 4.5-86.  
Recommended Plan Costs by Decade for the City of Plains**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	448	468	488	473	457
<b>Municipal Water Conservation</b>						
Quantity Available (acft/yr)	41	117	196	202	194	188
Annual Cost (\$/yr)	\$21,727	\$57,861	\$95,509	\$97,970	\$94,089	\$90,917
Unit Cost (\$/acft)	\$530	\$495	\$487	\$485	\$485	\$484
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	618	556	501	451	405
Annual Cost (\$/yr)	—	\$95,448	\$95,448	\$95,448	\$39,415	\$39,415
Unit Cost (\$/acft)	—	\$154	\$172	\$191	\$87	\$97

### **4.5.21.3 Irrigation**

#### **4.5.21.3.1 Description of Supply**

- **Source:** Ogallala Aquifer
- **Current Supply:** 127,273 acft/yr in 2000 declining to 76,183 acft/yr in 2060.

#### **4.5.21.3.2 Water Supply Plan**

The use of irrigation BMPs in the past in Yoakum County have increased water use efficiency and thereby contributed to maintaining levels of irrigation production in the region. The Irrigation Water Conservation Water Management Strategy is recommended for Yoakum County irrigation farmers (Section 4.4.1.2), however, information available indicates that nearly all of presently irrigated acres are equipped with efficient application systems, thus, there is very little potential for additional irrigation conservation through use of this water management strategy. As is the case elsewhere in Region O, it is not economically feasible to meet all of the irrigation needs (shortages) at this time.

#### **4.5.21.3.3 Costs**

- Irrigation water conservation:
  - Cost Source: Section 4.4.1.2, Table 4.4-11
  - Date to be Implemented: Prior to 2010
  - Total Cost: \$680,000

- Annual Cost: \$50,000; including debt service at 25 yrs useful life of systems (Table 4.5-87).

**Table 4.5-87.**  
**Recommended Plan Costs by Decade for Irrigation – Yoakum County**

<b>Plan Element</b>	<b>2010</b>	<b>2020</b>	<b>2030</b>	<b>2040</b>	<b>2050</b>	<b>2060</b>
Projected Irrigation Need (Shortage) (acft/yr)	23,779	22,574	21,476	20,432	19,434	18,485
Irrigation Conservation Quantity (acft/yr)	1,074	966	870	783	704	634
Annual Cost (million dollars/yr) (Table 4.4-11)	0.05	0.05	0.05	0.05	0.05	0.05
Unit Cost (\$/acft) (Table 4.4-12)	50	55	62	68	76	84

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**4.5.22 Water Supply Plans for Wholesale Water Providers**

Table 4.5-88 lists each Wholesale Water Provider identified by the Llano Estacado RWPG and their corresponding surplus or shortage in years 2030 and 2060. Water supply plans have been developed for CRMWA, City of Lubbock, and WRMWD are described below. Mackenzie Municipal Water Authority is also projected have a shortage during the planning period; however no plan has been developed for this entity. Instead, a plan to develop locally available groundwater has been developed for each of the MMWA customers with a projected need.

**Table 4.5-88.  
Wholesale Water Provider Surplus/Shortage**

<i>Water User Group</i>	<i>Surplus/Shortage<sup>1</sup></i>		<i>Comment</i>
	<i>2030 (acft/yr)</i>	<i>2060 (acft/yr)</i>	
Canadian River Municipal Water Authority (CRMWA)	772	-7,032	Projected shortage – see plan below
City of Lubbock	6,509	6,799	Projected surplus
Mackenzie Municipal Water Authority (MMWA)	-2,128	-1,936	Projected shortage – see comment above
White River Municipal Water District (WRMWD)	-686	-1,489	Projected shortage – see plan below

<sup>1</sup> From Table 4-23, Section 4.2 – Water Needs Projections by Major Water Provider.

**4.5.22.1 Canadian River Municipal Water Authority (CRMWA)(See Section 4.4.3.5)**

**4.5.22.1.1 Description of Supply**

- **Source:** Ogallala Aquifer and Lake Meredith System
- **Current Supply:** Adequate to meet demands through 2060.

**4.5.22.2.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the CRMWA System.

- Expand Capacity of Groundwater Supply.

#### 4.5.22.2.3 Costs

Costs of the recommended plan for CRMWA are:

- Cost Source: Section 4.4.3.5, Table 4.4-53
- Date to be Implemented: Prior to 2010
- Total Project Cost: \$59,052,000
- Annual Cost: See Table 4.5-89 for a cost summary of this option.

**Table 4.5-89.**  
**Recommended Plan Costs by Decade for the Canadian River Municipal Water Authority**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>CRMWA Expand Groundwater Supply</b>						
Quantity Available (acft/yr)	31,659	31,659	31,659	31,659	31,659	31,659
Annual Cost (\$/yr) (millions)	\$6.843	\$6.843	\$6.843	\$6.843	\$6.843	\$6.843
Unit Cost (\$/acft)	\$216	\$216	\$216	\$216	\$216	\$216

#### 4.5.22.2 The City of Lubbock (See Sections 4.4.3 and 4.5.15.3)

##### 4.5.22.2.1 Description of Supply

- **Source:** Ogallala Aquifer and Lake Meredith
- **Current Supply:** Adequate to meet demands through 2060.

##### 4.5.22.2.2 Water Supply Plan

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the City of Lubbock.

- Municipal water conservation, and
- Lake Alan Henry Pipeline
- City of Lubbock Well Field
- Lubbock Expand Bailey County Well Field
- CRMWA Expand Capacity of Groundwater Supply
- Lubbock Brackish Groundwater Desalination
- Jim Bertram Lake System Expansion, and
- Lubbock North Fork Scalping Operation.

#### **4.5.22.2.3 Costs**

Costs of the recommended plan for the City of Lubbock are:

- a. Municipal water conservation:
  - Cost Source: Section 4.4.1, Table 4.4-7
  - Date to be Implemented: Prior to 2010
  - Annual Cost: See Table 4.5-90 for a cost summary of this option.
- b. Lake Alan Henry Pipeline:
  - Cost Source: Section 4.4.3.2, Table 4.4-50
  - Date to be Implemented: Prior to 2020
  - Total Project Cost: \$174,909,000
  - Annual Cost: See Table 4.5-90 for a cost summary of this option.
- c. City of Lubbock Well Field:
  - Cost Source: Section 4.4.3.3, Table 4.4-51
  - Date to be Implemented: Prior to 2010
  - Total Project Cost: \$7,718,000
  - Annual Cost: See Table 4.5-90 for a cost summary of this option.
- d. Lubbock Expand Capacity of Bailey County Well Field
  - Cost Source: Section 4.4.3.4, Table 4.4-52
  - Date to be Implemented: Prior to 2010
  - Total Project Cost: \$2,541,000
  - Annual Cost: See Table 4.5-90 for a cost summary of this option.
- e. CRMWA Expand Capacity of Groundwater Supply
  - Cost Source: Section 4.4.3.5, table 4.4-53
  - Date to be Implemented: Prior to 2010
  - Total Project Cost: (\$59,052,000 to expand 31,659 acft/yr; annual cost is \$6,843,000; Lubbock share of expansion is 37.058 percent of cost and quantity.)
  - Annual Cost: See Table 4.5-90 for a cost summary of this option.
- f. Lubbock Brackish Groundwater Desalination
  - Cost Source: Section 4.4.3.6 table 4.4-54
  - Date to be Implemented: Prior to 2010
  - Total Project Cost: \$10,051,230
  - Annual Cost: See Table 4.5-90 for a cost summary of this option.
- g. Jim Bertram Lake System Expansion
  - Cost Source: Section 4.4.3.7, table 4.4-57
  - Date to be Implemented: Prior to 2020
  - Total Project Cost: \$150,759,000
  - Annual Cost: See Table 4.5-90 for a cost summary of this option.

## h. Lubbock North Fork Scalping Operation

- Cost Source: Section 4.4.3.8, table 4.4-62
- Date to be Implemented: Prior to 2045
- Total Project Cost: \$50,055,000
- Annual Cost: See Table 4.5-90 for a cost summary of this option.

**Table 4.5-90.**  
**Recommended Plan Costs by Decade for the City of Lubbock**

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation (Strategy is included until the regional goal of 172 gpcd is reached)</b>						
Quantity Available (acft/yr)	1,180	489	0	0	0	0
Annual Cost (\$/yr)	\$613,515	\$254,508	—	—	—	—
Unit Cost (\$/acft)	\$520	\$520	—	—	—	—
<b>Lake Alan Henry Pipeline</b>						
Quantity Available (acft/yr)	0	22,230	22,230	22,230	22,230	22,230
Annual Cost (\$/yr) (millions)	—	\$26.584	\$26.584	\$26.584	\$26.584	\$26.584
Unit Cost (\$/acft)	—	\$1,196	\$1,196	\$1,196	\$1,196	\$1,196
<b>City of Lubbock Well Field</b>						
Quantity Available (acft/yr)	5,600	5,600	5,600	5,600	5,600	5,600
Annual Cost (\$/yr) (millions)	\$1.644	\$1.644	\$1.644	\$1.644	\$1.644	\$1.644
Unit Cost (\$/acft)	\$294	\$294	\$294	\$294	\$294	\$294
<b>Expand Bailey County Well Field</b>						
Quantity Available (acft/yr)	5,600	5,600	5,600	5,600	5,600	5,600
Annual Cost (\$/yr)	\$213,000	\$213,000	\$213,000	\$213,000	\$213,000	\$213,000
Unit Cost (\$/acft)	\$38	\$38	\$38	\$38	\$38	\$38
<b>CRMWA Expand Groundwater Supply (See 4.5.15.3.3e above)</b>						
Quantity Available (acft/yr)	14,911	14,911	14,911	14,911	14,911	14,911
Annual Cost (\$/yr) (millions)	2.536	2.536	2.536	2.536	2.536	2.536
Unit Cost (\$/acft)*	\$216	\$216	\$216	\$216	\$216	\$216
<b>Lubbock Brackish Groundwater Desalination</b>						
Quantity Available (acft/yr)**	3,360	3,360	3,360	3,360	3,360	3,360
Annual Cost (\$/yr) (millions)*	1.700	1.700	1.700	1.700	1.700	1.700
Unit Cost (\$/acft)*	\$506	\$506	\$506	\$506	\$506	\$506

<b>Lubbock Jim Bertram Lake System Expansion</b>						
Quantity Available (acft/yr)**	21,200	21,200	21,200	21,200	21,200	21,200
Annual Cost (\$/yr) (millions)*	\$14.575	\$14.575	\$14.575	\$14.575	\$14.575	\$14.575
Unit Cost (\$/acft)*	\$688	\$688	\$688	\$688	\$688	\$688
<b>Lubbock North Fork Scalping Operation</b>						
Quantity Available (acft/yr)**	0	0	0	0	4,000	4,000
Annual Cost (\$/yr) (millions)*	—	—	—	—	\$4.296	\$4.296
Unit Cost (\$/acft)*	—	—	—	—	\$1,074	\$1,074

#### **4.5.22.3 White River Municipal Water District (See Section 4.4.3.6)**

##### **4.5.22.3.1 Description of Supply**

- **Source:** Reclaimed Water from Lubbock
- **Current Supply:** Adequate to meet demands through 2010.

##### **4.5.22.3.2 Water Supply Plan**

Working within the planning criteria established by the Llano Estacado RWPG and TWDB, the following water supply plan is recommended for the White River Municipal Water District.

- Municipal water conservation, and
- Reclaimed Water, and
- Local groundwater development by 2010 on land owned by the District in Crosby County.

##### **4.5.22.3.3 Costs**

Costs of the recommended plan for the White River Municipal Water District are:

- a. Reclaimed Water:
  - Cost Source: Section 4.4.3.9, table 4.4-64
  - Date to be Implemented: Prior to 2020
  - Total Project Cost: \$29,746,680
  - Annual Cost: See Table 4.5-91 for a cost summary of this option.

- b. Local groundwater development (see Section 4.4.3.7 for a cost summary of this option).
- Cost Source: Section 4.4.3.10, Table 4.4-65
  - Date to be Implemented: 2010
  - Total Project Cost: \$813,000
  - Annual Cost: See Table 4.5-91 for a cost summary of this option.

**Table 4.5-91.**  
**Recommended Plan Costs by Decade for the White River Municipal Water District\***

<i>Plan Element</i>	<i>2010</i>	<i>2020</i>	<i>2030</i>	<i>2040</i>	<i>2050</i>	<i>2060</i>
Projected Shortage (acft/yr)	0	0	0	0	0	0
<b>Municipal Water Conservation (By Member Cities)</b>						
Quantity Available (acft/yr)	26	70	97	94	91	91
Annual Cost (\$/yr)	\$13,799	\$34,637	\$47,632	\$45,581	\$44,214	\$44,214
Unit Cost (\$/acft)	\$531	\$495	\$491	\$485	\$486	\$486
<b>Reclaimed Water*</b>						
Quantity Available (acft/yr)	—	2,240	2,240	2,240	2,240	2,240
Annual Cost (\$/yr) (millions)	—	\$2.821	\$2.821	\$2.821	\$2.821	\$2.821
Unit Cost (\$/acft)	—	\$1,259	\$1,259	\$1,259	\$1,259	\$1,259
<b>Local Groundwater Development</b>						
Quantity Available (acft/yr)	—	7,742	7,742	7,742	7,742	7,742
Annual Cost (\$/yr)	—	\$310,000	\$310,000	\$310,000	\$310,000	\$310,000
Unit Cost (\$/acft)	—	\$40	\$40	\$40	\$40	\$40
* This water management strategy augments the quantity of water that can be obtained from White River Lake for diversion to the District's existing water treatment plant located at the lake. The purpose of the WMS is to maintain the District's capability to supply water to its member cities.						

#### **4.5.23 Region-Wide Water Management Strategies Included in the Llano Estacado Water Plan**

##### **4.5.23.1 Precipitation Enhancement (See Section 4.4.4.1 for a description of this option)**

Weather modification is included in the Llano Estacado Regional Water Plan. Weather modification, or precipitation enhancement, has the potential to increase the quantity of water that would be available to all water user groups in the Llano Estacado Region, as well as reduce pumpage requirements from the Ogallala Aquifer. Several cloud seeding operations are being carried out in Texas, including the Southern Ogallala Rainfall Enhancement (SOAR) program, which includes 2.3 million acres in Gaines, Terry, and Yoakum Counties at an annual cost of \$109,200, or 4.7 cents per acre per year.

Although available data and cloud seeding experience are not adequate to give reliable estimates of long-term increases in precipitation, the present information indicates that precipitation can be increased by cloud seeding. For the 3,593 square mile (2,300,000-acre) SOAR area, an increase in precipitation of one and one-half inches would result in an increase of about 287,500 acft of water per year to the land surface. At a cost of 4.7 cents per acre, the cost per acft of water is \$0.38.

Additional precipitation during the growing season, which is the period during which present cloud seeding projects are operated, would directly and immediately benefit dryland and irrigated agriculture. Crop and grazing yields will be increased, irrigation water pumped from the Ogallala Aquifer can be reduced, and lawn irrigation can be reduced. The latter effect will contribute to meeting projected municipal water needs by reducing the quantities used per year from present supplies. Additionally, increased runoff could increase the water supply in public water supply reservoirs. An increase of water supply in playa lakes would increase natural recharge and provide water for wildlife.

##### **4.5.23.2 Brush Control (See Section 4.4.4.2 for a description of this option)**

Brush control is included in the Llano Estacado Regional Water Plan. Brush control could increase water supply in the Llano Estacado Region by increasing the runoff into lakes and reservoirs. The areas of the region where significant concentrations of brush occur are in the east “caprock counties” and in the western counties. In addition, there are approximately one million acres in the U.S. Department of Agriculture’s (USDA) Conservation Reserve Program (CRP) located within the region. As the current contracts with USDA expire on these CRP areas and as

the USDA programs change, some of the land may be returned to cultivated row crops; however, some of the land is expected to remain in grass. If these grassland acres are not managed to prevent brush infestation, these areas could become brush covered and thereby further contribute to the brush problem of the region.

Of the 21 counties in the region, 13 counties meet the condition of having 50,000 or more acres of mesquite and shinnery oak combined. The counties located in the southwest corner of the region and along the caprock have the highest acreages of mesquite and shinnery oak and would primarily be the locations where brush control can be applied to increase water supplies. As has been demonstrated in Crosby County on the White River Reservoir watershed, brush control can contribute to increased inflows to a reservoir. The existing Alan Henry Reservoir and the proposed Post Reservoir are located in Garza County, which has over 185,000 acres of mesquite and shinnery oak. Brush control projects on the watersheds of these two reservoirs could result in increased firm yields and thereby contribute to the region's water supply.

The capital outlay to implement brush control upon 50 percent of the mesquite and shinnery oak infested acres in counties having more than 50,000 acres of these two species of brush is estimated at \$40.78 million, with an annual cost of \$2.74 million (see Section 4.4.4.2 for a discussion of costing assumptions and procedures). For example, if brush control were to be implemented on the Alan Henry Reservoir contributing watershed, the annual cost would be approximately \$324,675. If the yield of the reservoir were increased by 10 percent, or 2,250 acft/yr, the cost per acft of raw water yield at the reservoir would be \$144, or \$0.44 per thousand gallons. The owners of the Alan Henry Reservoir and the proposed Post Reservoir should cooperate with the landowners of the watersheds and the Texas State Soil and Water Conservation Board to implement brush control on these watersheds.

#### **4.5.23.3 Desalt Brackish Groundwater (See Section 4.4.4.3 for a description of this option)**

Desalting brackish groundwater is included in the Llano Estacado Regional Water Plan. The potential source of water for this option is the Santa Rosa Aquifer of the Dockum Formation, which underlies the entire area of the Llano Estacado Water Planning Region. Data currently available indicate that the quality of water in the Santa Rosa in the majority of the planning region is unsuitable for most uses without treatment, including most municipal and

irrigation uses. Water treatment costs are estimated at \$303 to \$369 per acft, depending upon brine concentration of the feedwater. Individual cities that need water could consider this source.

#### **4.5.23.4 Post Reservoir (See Section 4.4.4.4 for a description of this option)**

Post Reservoir is included in the Llano Estacado Regional Water Plan. The proposed Post Reservoir Project is located on the North Fork of the Double Mountain Fork of the Brazos River northeast of Post, Texas in Garza County. Post Reservoir could serve as a future water supply source for cities and industries in the eastern part of the planning area. The firm yield of Post Reservoir is 9,500 acft/yr. The cost of raw water at the reservoir is \$231 per acft.

#### **4.5.23.5 Research and Development of Drought Tolerant Crops and New Technology (See Section 4.4.4.5 for a description of this option)**

Research and development of drought tolerant crops, new technology, and demonstration initiatives to expedite transfer of available technology to are included in the Llano Estacado Regional Water Plan. In addition, the Llano Estacado Regional Water Planning Group recommends that funding be continued at adequate levels to accomplish these objectives.

#### **4.5.23.6 Reuse of Municipal Effluent (See Section 4.4.4.6 for a description of this option)**

Of the total quantities of water used for municipal purposes, approximately 45 percent to 65 percent is returned to the respective municipal wastewater treatment plants for treatment and disposal. In the Llano Estacado Water Planning Region a large percentage of this treated effluent or reclaimed water is used for irrigation of open spaces, golf courses, and neighboring farmland. The quantity is between 45 percent and 65 percent of the quantity of municipal use and could be a significant source of water in the future for a number of uses, including perhaps municipal use, if treatment levels can be increased to the extent that the use of such water does not pose a health risk. The Llano Estacado Regional Water Planning Group recommends that funding be made available to universities, water districts, and the cities to further study the quantity of water available from this option and to study treatment technologies to make this option feasible for a larger number of uses.

**4.5.23.7 Stormwater Capture and Use (See Section 4.4.4.7 for a description of this option)**

In some cities of the Llano Estacado Water Planning Region disposal of stormwater has become a serious problem. Lubbock is one of the cities having this problem. Therefore, in this water-short region, it has become desirable to evaluate the possibility to capture, treat, as appropriate and needed, and use this water as a source of supply for non-potable as well as potable uses. The Llano Estacado Regional Water Planning Group recommends that funding be made available to the cities and water districts to further study the quantity of water available from this option and to study ways to successfully integrate flood protection, storage, and treatment, as needed, of this stormwater for useful purposes.

**4.5.23.8 Agricultural Water Conservation Practices on Farms (See Section 4.4.1.2 for a description of this option)**

Agricultural water conservation practices on farms are included in the Llano Estacado Regional Water Plan in order to sustain the present water supplies, enhance agricultural profitability, and enhance playa basins for wildlife habitat and aquifer recharge. In the Llano Estacado Region, both irrigation and non-irrigated, or dryland farming is projected. For the most part, the irrigated acreages are those acres lying above saturated sections of the Ogallala Formation that have sufficient quantities of water to justify drilling, equipping, and pumping irrigation wells. Such wells supply water that is used to supplement precipitation for crop production.

Irrigated and dryland farming attempt to maximize the efficiency of use of irrigation water and precipitation in the area. This is done through the use of Low Energy Precision Application (LEPA) and Low Pressure Sprinkler (LESA) irrigation systems, furrow diking, plant residue management, bench leveling, and terracing.

**4.5.24 Public Education**

Underground water conservation districts, cities, universities, the Texas Agricultural Extension Service and other water agencies will continue existing education and information dissemination programs. In addition, Llano Estacado Region water suppliers and agencies will build a strong cooperative relationship with formal and informal educators including the region's Educational Service Centers and Independent School Districts.

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#### **4.5.25 Drought and Drought Response**

Water supplies are included in Section 3 of the Llano Estacado Regional Water Plan as firm yields during drought of record for surface water sources, and dependable supplies during drought of record for groundwater sources, i.e., drought of record conditions underlie the calculations of water supply available from each source, included in Section 3 for each water user group. Therefore, each source of supply is for drought conditions. In addition, in accordance with requirements of SB 1, TCEQ has required retail water suppliers to prepare drought contingency plans. However, Texas Water Code Section 16.053(e)(3)(A) and 31 TAC 357.5(e)(7) require that for each source of water supply in the regional water planning area designated in accordance with 31 TAC 357.7(a)(1), the regional water plan shall identify: (A) factors specific to each source of water supply to be considered in determining whether to initiate a drought response, and (B) actions to be taken as part of the response.

Given that the major source of water for all uses in the Llano Estacado Region is the Ogallala Aquifer, with surface water from the Canadian River Municipal Water Authority, White River Municipal Water District, and Mackenzie Municipal Water Authority, for some municipal and industrial uses, the effects of drought are through increased demands upon the water supply facilities to provide larger quantities of water from each water supply source. For example, in the region, demands increase during droughts, placing ever-greater demands upon wells, pumps, motors, storage facilities, and the aquifer and surface water reservoirs. Therefore, the primary factor specific to each water supply is atmosphere conditions affecting precipitation, evaporation, and evapotranspiration. Thus, when atmospheric conditions result in: (1) reduced precipitation and (2) increased evaporation and evapotranspiration, the Llano Estacado Regional Water Plan recommendation is that drought response be initiated as described below.

Drought Trigger Conditions will be based on local atmospheric conditions using the currently available PET stations. For the purposes of this planning cycle, it is recommended that local precipitation be factored into the consideration of implementing a drought trigger. Recommended drought triggers are presented as follows.

##### **4.5.25.1 Drought Triggers**

**Alert Stage of Drought:** Precipitation at less than 50 percent of the 30 year average for the month and 55 percent of the 30 year average of the preceding twelve months.

**Warning Stage of Drought:** Precipitation at less than 25 percent of the 30 year average for the month and 45 percent of the 30 year average of the preceding twelve months.

The Llano Estacado Water Planning Area will be divided into geographical areas based on location of existing PET stations for drought trigger and response purposes. The current locations of a PET stations within Region O are Dimmitt, Earth, Farwell, Halfway, Lamesa, Lubbock, and Seminole.

The drought trigger and response zones in the Llano Estacado Water Planning Area are shown in Table 4.5-92.

**Table 4.5-92.**  
**Drought Trigger and Response Zones**  
**in the Llano Estacado Water Planning Area**

<b>PET Stations</b>	<b>Counties</b>
Dimmitt	Castro, Deaf Smith, and Swisher
Earth	Cochran and Lamb
Farwell	Bailey and Parmer
Halfway	Briscoe, Floyd, Hale, and Motley
Lamesa	Dawson, Garza, and Lynn
Lubbock	Crosby, Dickens, Hockley, and Lubbock
Seminole	Gaines, Terry, and Yoakum

#### **4.5.25.2 Drought Response**

As the LERWPG is a planning body only, with no implementation authority, it is emphasized that these drought triggers and responses are recommendations only. Since local public water suppliers and water districts are all required to have adopted a Drought Contingency Plan that contains drought responses unique to each specific entity, these entities are the only ones who have the authority to manage their particular water supply or area of authority. Therefore, the LERWPG recommends that these entities carry out their respective plans based upon the triggers listed above.

For example:

1. When the Alert Stage Drought Conditions have been triggered as described above, the (RELEVANT BODY, COMMITTEE, ETC.) will notify all affected entities in the

- relevant geographical area. Those entities exercise their authority to implement their own Drought Contingency Plans, as they deem necessary.
2. When the Warning Stage Drought Conditions have been triggered as described above, the (RELEVANT BODY, COMMITTEE, ETC.) will notify all affected entities in the relevant geographical area. These entities exercise their authority to implement their own Drought Contingency Plans, as they deem necessary.

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