

**Appendix M**

**Summary**  
**of**  
***Llano Estacado***  
***Regional Water Planning Group (Region O)***  
***2011 Regional Water Plan***  
***Phase I Report***

1. **Estimates of Population and Water Demands for New Ethanol Industries and Expanding Dairies;**
2. **Evaluation of Water Supplies and Desalination Costs of Dockum Aquifer Water; and**
3. **Video Conferencing Facilities Available for Coordination Between Regions A and O.**

**April 30, 2009**

The purposes of this study were to (1) make estimates of population and water demands for new ethanol plants and expanded numbers of dairies of the Llano Estacado Water Planning Region, (2) evaluate water supplies and desalination costs of Dockum Aquifer water, and (3) identify and describe video conferencing facilities available for coordination between Regions A and O. A summary of the results is presented below.

**Ethanol Plants:** In Deaf Smith, Hale, and Hockley Counties of the Llano Estacado Water Planning Region, as of 2008, three ethanol plants of 110 million gallons per year and one plant of 50 million gallons per year capacity have been constructed and either are in operation or will be in operation within a few months. These are new industries for the region, for which water supplies have not been included in previous regional water plans. The combined water requirements of these four plants are about 3.5 million gallons per day, or 3,920 acre-feet per year.

**Dairies and Dairy Cattle:** The number of dairies has increased from 37 in 2006 to 59 in 2008, with the estimated number of dairy cattle having increased from about 55,000 in 2005 to 130,498 head in 2008. During this period, milk production has increased from 4.14 million pounds per day in 2005 to 9.00 million pounds per day in March 2008. The projected number of head of dairy cattle in the eight-county area has been revised to 155,750 in 2010, 188,544 in 2020, and 280,714 head in 2060.

Revised projections of drinking water for dairy cattle and dairy milking parlor sanitation demands are 8,374 acre-feet per year in 2010, 11,198 acre-feet per year in 2030, and 15,093 acre-feet per year in 2060 compared to the 2006 Water Plan projection of 11,587 acre-feet per year in 2060.

The increased dairy production is projected to result in a larger number of dairy workers and their associated family members, resulting in an increased municipal water demand of 466 acre-feet per year for the increased population of 2,405 in 2010, increased municipal demand of 182 acre-feet per year in 2020, and for 2060 an increased demand of 769 acre-feet per year for the increased projected population of 4,255.

The irrigation water requirements for feed production for the revised dairy projections are 16,938 acre-feet per year higher in 2010, 20,504 acre-feet per year higher in 2020, 25,019 acre-feet per year higher in 2040, and 30,528 acre-feet per year higher in 2060.

**Increased Demand for Water for Ethanol Plants, Dairies, and Associated Population:** The total increased water demand for ethanol production, dairies, dairy population and dairy feed production is 23,362 acre-feet per year in 2010, of which 16.7 percent is for ethanol production, 8.7 percent is for dairies, 2.0 percent is for dairy worker population, and 72.5 percent is for dairy feed production. The total is 30,166 acre-feet per year in 2040, and 38,723 acre-feet per year in 2060, of which ethanol production is 10.1 percent, dairies are 9.1 percent, dairy worker population is 1.98 percent, and dairy feed production is 78.8 percent.

**Water Supply Potentials and Estimated Costs of Water from the Dockum Aquifer:** The Dockum Aquifer is a potential source of additional water in Bailey, Castro, Deaf Smith, Hale, and Parmer Counties. Dockum wells in the vicinity of Hereford and in northeast Castro County typically are 800-950 ft deep. The deepest well depths would be about 1,400 ft in Lamb County. Typical well yields of Dockum wells is estimated to range from about 400 gpm in Deaf Smith County area to about 200 gpm in the southern

part of the study area. The salinity of water in the Deaf Smith County area typically ranges from concentrations of 800 to 1,500 milligrams per liter of total dissolved solids. In southern part of the study area, the salinity is greater than 20,000 mg/L of total dissolved solids.

Potential well field designs were prepared for two well fields and at three pumping rates (0.2, 1, 3, and 10 million gallons per day (MGD)). The most economical water supply, not considering water treatment, was from the Deaf Smith well field pumping at a rate of 3 MGD. The delivery of raw water to a terminal near the well field is estimated to cost about \$305 per acre foot.

**Estimated Costs of Water from the Dockum Aquifer:** Costs were estimated to obtain and desalt raw water from the Dockum Aquifer, and to dispose to concentrates resulting from desalination. Costs were estimated for desalination using Reverse Osmosis (RO) and concentrate disposal using solar evaporation and deep well injection for 0.2 MGD, 1 MGD, 3 MGD, and 10 MGD sized Dockum Aquifer well fields having 1,500, 3,000, 5,000, and 20,000 mg/L concentrations of TDS. Estimated total costs for raw water, desalination, and concentrate disposal for water from the Dockum Aquifer with TDS of 1,500 mg/L range from \$5.35 per 1,000 gallons for a 0.2 MGD size facility, to \$3.76 per 1,000 gallons for a 1 MGD facility, to \$2.75 per 1,000 gallons for a 3 MGD facility, and \$2.29 per 1,000 gallons for a 10 MGD facility. Estimated total costs for raw water, desalination, and concentrate disposal for water from the Dockum Aquifer with TDS of 3,000 mg/L range from \$6.65 per 1,000 gallons for a 0.2 MGD size facility, to \$4.77 per 1,000 gallons for a 1 MGD facility, to \$3.07 per 1,000 gallons for a 3 MGD facility, and \$2.61 per 1,000 gallons for a 10 MGD facility. Estimated total costs for raw water, desalination, and concentrate disposal for water from the Dockum Aquifer with TDS of 5,000 mg/L range from \$7.94 per 1,000 gallons for a 0.2 MGD size facility, to \$5.57 per 1,000 gallons for a 1 MGD facility, to \$4.08 per 1,000 gallons for a 3 MGD facility, and \$3.23 per 1,000 gallons for a 10 MGD facility. Estimated total costs for raw water, desalination, and concentrate disposal for water from the Dockum Aquifer with TDS of 20,000 mg/L range from \$11.44 per 1,000 gallons for a 0.2 MGD size facility, to \$7.21 per 1,000 gallons for a 1 MGD facility, to \$5.62 per 1,000 gallons for a 3 MGD facility, and \$5.10 per 1,000 gallons for a 10 MGD facility.

**Interactive Video Conferencing Facilities:** Interactive Video Conferencing Services needed by Regions A and O include, (1) video conferencing equipped meeting rooms located conveniently to each regional water planning group, and (2) staffing to operate the conferencing equipment. Fully staffed interactive video conferencing facilities and services, with capabilities to meet the needs of Regions A and O are in existence and are available to both Regions A and O at Offices of the AgriLife Research Facilities of the Texas A&M University System in Amarillo and Lubbock, respectively. Consequently it appears that justification can not be made at this time for the purchase and installation of such facilities.

**Conclusions:** The revised projections of water demand for the ethanol and expanded dairy water using sectors, the Dockum Aquifer water supply analyses, and the description of available interactive video conferencing facilities presented in this report are available for use in development of the 2011 Llano Estacado Regional Water.