

**Final Report**

**Peak Water Demand in Texas Beef Cattle Feedlots**

**June 1st, 2007 through December 31st, 2008**

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**PROJECT SCOPE**

Texas AgriLife Research personnel conducted a study of two paired feedyards to determine the total water usage and peak water use demand. These two feedyards had been equipped with totalizing water meters which were read weekly as part of the Ogallala Aquifer project. As part of this TCFA funded project, additional sensors and data loggers were added allowing the determination of water usage on a minute by minute basis. This information was compiled to provide peak and average water consumption figures for a representative beef cattle feedyard in the Texas High Plains.

Data specific to this project has been collected at Feedyards A and E from June 1, 2007 through December 31, 2008. The major functional difference between the two feedyards for the purposes of this study was that Feedyard E had a dust control sprinkler system and Feedyard A did not.

**PROJECT RESULTS AND DISCUSSION**

**FEEDYARD A**

The primary data collection system at Feedyard A was configured to collect total water use by week and water use by minute for the entire facility. The feed mill at Feedyard A was equipped with a totalizing water meter to collect total weekly water use values only.

The number of cattle present in the feedyard during this study period ranged from a low of 8,927 head to a high of 15,430 head. The average number of cattle present throughout this study period was 12,435 head (Table 1).

**Table 1. Average Head Count on Feed by Month at Feedyard A**

Month	Head Count	
	2007	2008
January		14,133
February		13,277
March		13,145
April		11,928
May		8,927
June	11,811	11,597
July	10,397	12,970
August	10,168	12,580
September	11,296	11,793
October	14,452	11,512
November	15,430	13,214
December	14,446	13,196

We were only able to accurately measure water flow in the installation at Feedyard A when the rate exceeded 25 gpm (gallons per minute). This issue was caused by the size of the pipe (6 in. PVC) and the size and type of the water meter installed (6in. turbine flow meter) relative to the flowrate. The main water supply line at Feedyard A is significantly oversized for the flow that was present at the time of the study. This pipe may have been oversized for various reasons including allowing for future feedyard expansion. A 6 in. PVC pipe will flow over 400 gpm and still remain within irrigation industry standards

for water velocity design constraints. This flowrate is more than twice the average flowrate that we measured during this study. A flowrate of 30 gpm in a 6 in. PVC pipe will have a water flow velocity of less than 0.34 fps (feet per second) making measurement with a 6 in. turbine flow meter difficult at best. Turbine flow meters work best at velocities in excess of 1 fps. This issue created a situation where we were forced to experimentally derive a correction equation which assigned a set water flowrate during measured zero flow conditions. The back-correction procedure developed to correct the data was described in Progress Report 2.

**Peak Flowrate**

The maximum water flow recorded during this study at Feedyard A was 238 gpm or 0.018 gpm/hd (gallons per minute/head count). The average peak water use at the time of this study was 0.013 gpm/hd, these values ranged from a low of 0.011 gpm/hd to a high of 0.015 gpm/hd. The feedyard had an overall average of 0.005 gpm/hd; ranging from a low of 0.005 gpm/hd to a high of 0.007 gpm/hd (Table 2). The peak flow rate was roughly 2.5 times the average flow rate.

**Table 2. Peak and Average Flow rates for Feedyard A**

Month	Monthly Average Peak Flowrate		Monthly Average Flowrate	
	gpm	gpm/head	gpm	gpm/head
May-08	124	0.014	50	0.006
Jun-08	173	0.015	81	0.007
Jul-08	184	0.014	79	0.006
Aug-08	182	0.014	66	0.005
Sep-08	145	0.012	58	0.005
Oct-08	130	0.011	50	0.004
Nov-08	177	0.013	66	0.005
Dec-08	148	0.011	61	0.005
<b>Period Average</b>	158	0.013	64	0.005

**Peak Flowrate Timing**

The peak “summer” water usage demand at Feedyard A appears to peak between 13:00 and 14:00. The usage then tapers off before a secondary peak around 18:30 (Figure 1). The peak “winter” demand is somewhat less defined with the peak usage being between 11:00 and 18:00 (Figure 2).

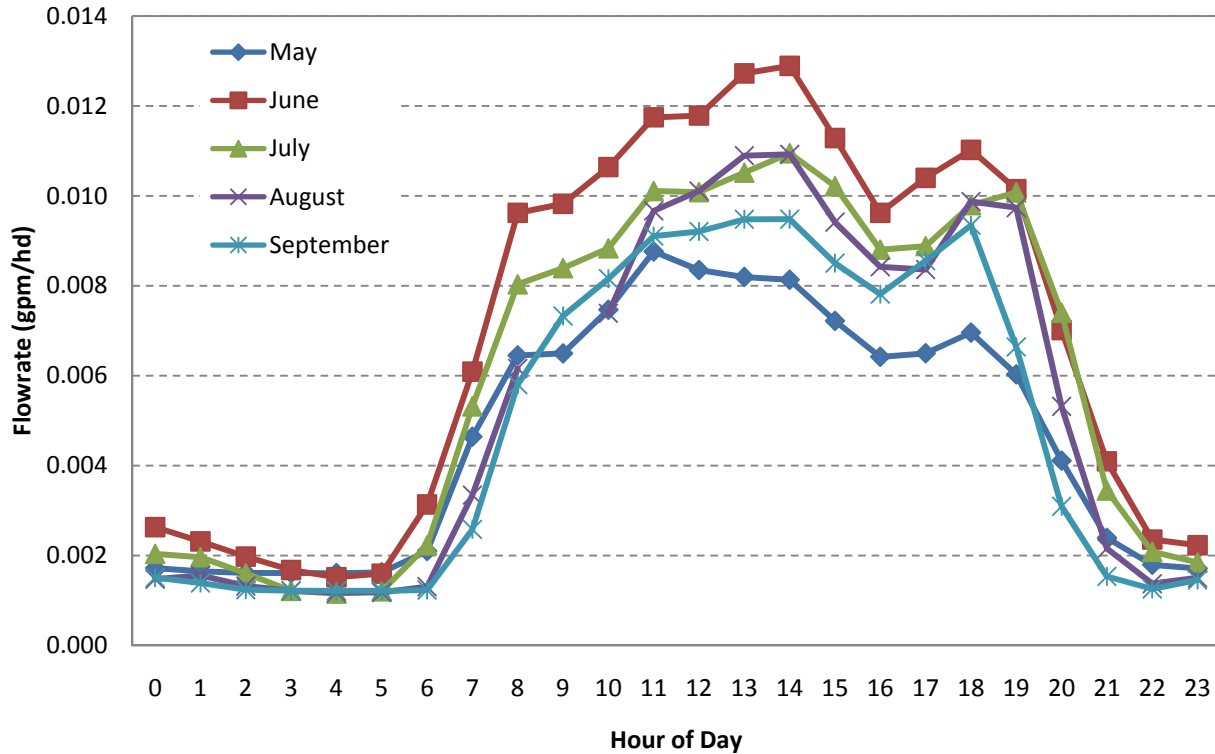


Figure 1. Water usage rate at Feedyard A during warm season

A possible explanation for the day time peaks in water usage is as follows: One method to interpret the two peaks of water usage in the ‘warm season’ period would be that the animals increase water intake in relation to the rise in temperature and feed consumption creating the first peak in water intake. Then at some point during the afternoon, the animals lay down to reduce their total solar gain (minimizing the reflected solar radiation from the pen surface) and reduce feed intake, resulting in a reduction in water intake. The animals again begin to consume water creating a second peak around dusk (reduced solar radiation, cooler ambient temperatures) as feed consumption resumes.

The single broad peak of water demand during the ‘cool season’ period is fairly uniform through the peak time period due to less solar radiation and heating occurring during this season. The demand for water during the ‘cool season’ period remained elevated during the night as Feedyard A uses overflow water troughs to hinder ice formation during periods when the temperature might be expected to drop below freezing. It can be seen from Figure 2 that the overflow from the troughs created a higher demand in November and December between 21:00 and 6:00 hours when compared with the data from October where the overflow system was presumably not yet turned on.

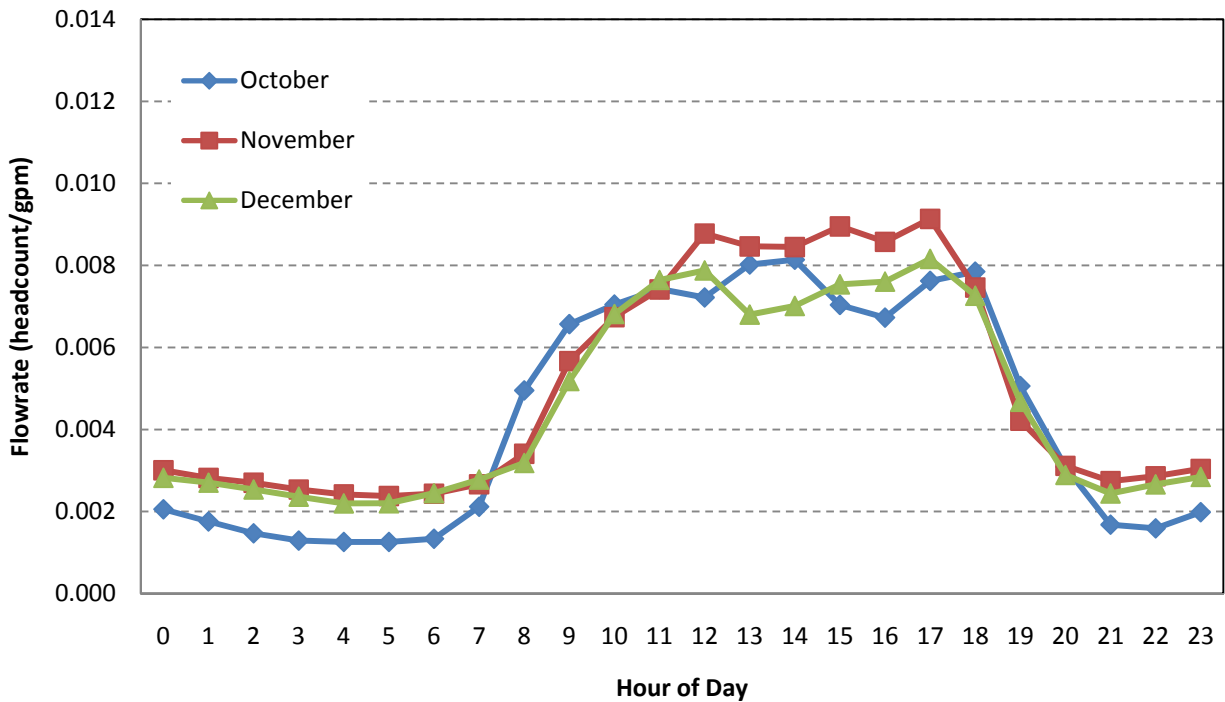


Figure 2. Water usage at Feedyard A during cool season

**Feed Mill Water Usage**

The feed mill water usage at Feedyard A remained fairly consistent throughout the study period. There was a noticeable decline in feed mill water usage as distillers grains were introduced into the ration beginning in January 2008 (Figure 3). The feed mill water use increased during December 2008 when the use of distillers grains as a ration component was discontinued. The maximum amount of water used per 1000 lbs of corn was 36 gal/1000lbs (gallons of water/1000 pounds of corn fed). The minimum amount of water used per 1000 lbs of corn was 16 gal/1000 lbs. The average amount of water used per 1000 lbs of corn was 24 gal/1000 lbs (Figure 4).

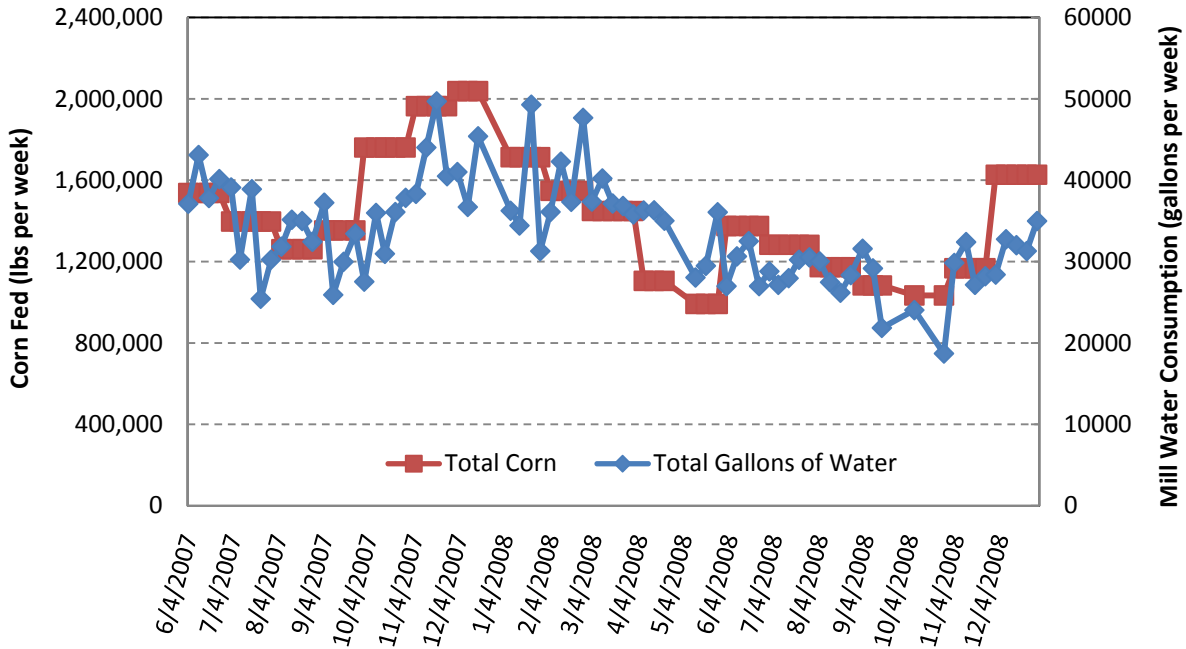


Figure 3. Feedyard A Feed Mill throughput and water usage

\*Corn weight calculated as a percentage of total feed ration weight as reported by feedyard

\*\*This chart does not take into account corn fed by head number, only by total mass of corn fed

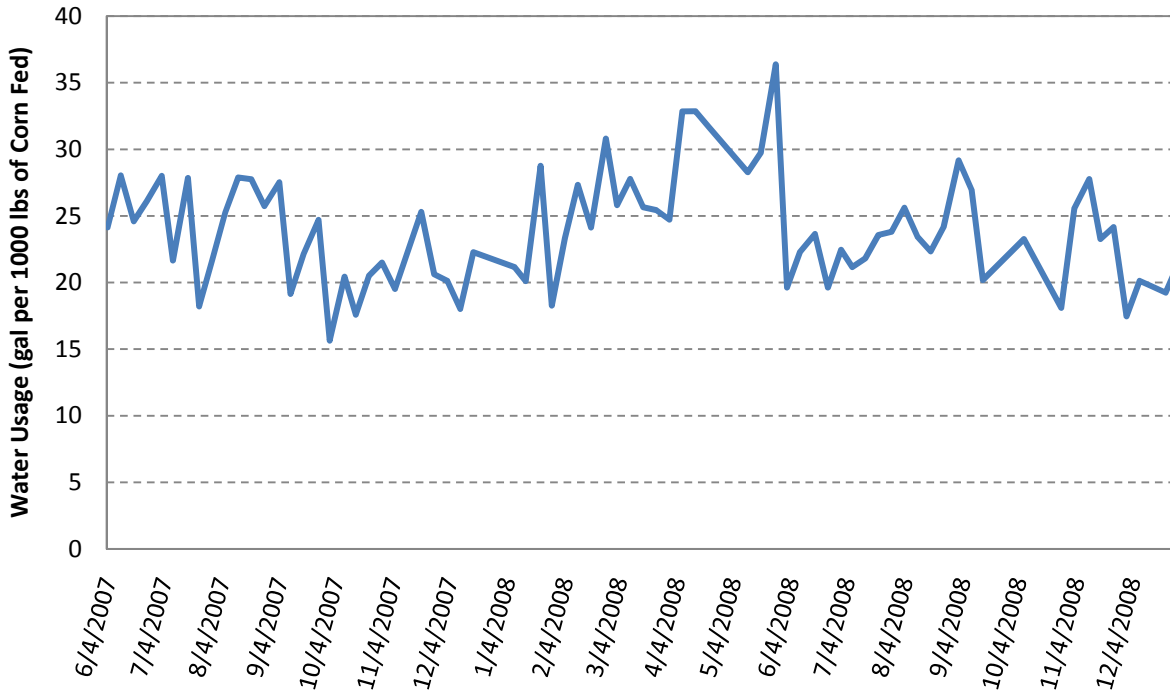


Figure 4. Feedyard A Feed Mill processing water usage

## FEEDYARD E

The primary data collection system at Feedyard E was configured to collect total water use by week for the entire facility. The dust control sprinkler system at Feedyard E was configured to collect total weekly water use and peak water use by minute.

The total weekly water use demand for the entire feedyard averaged 1,074,549 gallons per week during an initial phase of the 2007 study period. The peak dust control sprinkler system flow at Feedyard E was approximately 800 gallons per minute.

### *Sprinkler System Flowrate*

Feedyard E, where only the dust control sprinkler system was intensely monitored for flowrate, had a maximum average flow rate of 800 gpm. The typical dust control sprinkler system application during the 2007 study period was 95,592 gallons which is equal to an application rate of 0.042 in. (1.07 mm). The typical dust control sprinkler system application during the 2008 study period was 80,000 gallons which is equal to an application rate of 0.034 in. (0.86 mm).

## PROJECT SUMMARY AND IMPLICATIONS

### FEEDYARD A

- The overall average flow rate was 0.005 gpm/hd during the period monitored.
- The peak average water use during the period of this study was 0.013 gpm/hd.
- The highest recorded flow rate during the period of the study was 0.015 gpm/hd.
- Peak demand occurred between 13:00 and 14:00 during warm season conditions.
- The peak flow rate was roughly 2.5 times the average flow rate.
- The average amount of water used in feed processing was 24 gal/1000 lb of corn.
- The feed mill uses about 10.5% of the total water used by the feedyard facility

### FEEDYARD E

- The maximum flow rate for the sprinkler dust control system at Feedyard E was approximately 800 gpm.
- The daily typical dust control sprinkler application rate varied between 0.86 to 1.07 mm/day.
- Sprinkler water use as a percentage of total water use is 22% during summer and 16% over the total monitoring period.
  - A feedyard installing a sprinkler system and operating it in the same manner as Feedyard E would increase their water usage by about 19%.