AN INTEGRATED APPROACH TO WATER CONSERVATION FOR AGRICULTURE IN THE TEXAS SOUTHERN HIGH PLAINS

Texas Alliance for Water Conservation
2nd Annual Report

APRIL 30, 2007

Texas Alliance for Water Conservation

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Water Conservation Demonstration Producer Board

Elected November 16, 2004
(Original Board of Directors to serve through April 2, 2007)

Board Member	Term
Eddie Teeter, Chair	1 year
Boyd Jackson, Co-Chair	3 years
Brian Teeple, Secretary	3 years
Keith Phillips	2 years
John Paul Schacht	1 year
Glenn Schur	3 years
Mark Beedy	2 years
Jeff Don Terrell	2 years
Jody Foster	1 year
Rick Kellison (ex officio), Project Director	

The Producer Board of Directors is composed of producer representatives within the focus area of Hale and Floyd Counties and is specifically charged to:

1) Ensure the relevance of this demonstration project to meet its objectives;
2) Help translate the results into community action and awareness;
3) Ensure the credibility and appropriateness of work carried out under this project;
4) Assure compatibility with and sensitivity to producer needs and concerns; and
5) Participate in decisions regarding actions that directly impact producers.

The board elects their chair, chair-elect, and secretary. Individuals serving on this board include representation of, but are not limited to producers cooperating in specific demonstration sites. The Chair serves as a full voting member of the Management Team. The Project Manager serves in an *ex officio* capacity on the Producer Board. Meetings of the Producer Board of Directors are on an as need basis to carry out the responsibilities of the project and occur at least annually in conjunction with the overall Management Team.

TEXAS ALLIANCE FOR WATER CONSERVATION PARTICIPANTS

Texas Tech University
Rick Kellison, Project Director*
Dr. Vivien Gore Allen*
Dr. Matt Baker*
Ms. Lucia Barbato*
Ms. Angela Beikmann,*
Secretary/Bookkeeper
Mr. Philip Brown
Dr. David Doerfert*
Dr. Phil Johnson*
Dr. Stephan Maas*
Dr. Eduardo Segarra*
Mr. Tom Sell*

Texas Cooperation Extension
Dr. Steven Klose*
Mr. Jeff Pate*
Dr. Calvin Trostle*
Mr. Jay Yates*

Texas A&M Experiment Station
Dr. Robert Lascano

High Plains Underground Water Conservation District #1
Mr. Jim Conkwright*
Mr. Scott Orr*

USDA - Natural Resource Conservation Service
Mr. Monty Dollar (retired)*

USDA – Agricultural Research Service
Dr. Ted Zobeck
Dr. Veronica Acosta-Martinez

Producer Board Chairman
Mr. Eddie Teeter*

Post Doctoral Fellow
Dr. Will Cradduck

Graduate Research Assistants
Rebekka Martin (completed 2005)
Nithya Rajan
Swetha Dorbala
Pamela Miller
Song Cui
Justin Weinheimer
Jurahee Jones
Paul Braden

* Indicates Management Team member

‘An Integrated Approach to Water Conservation for Agriculture in the Texas Southern High Plains’

BACKGROUND

The Texas High Plains currently generates a combined annual economic value of crops and livestock that exceeds $5.6 billion ($1.1 crops; $4.5 livestock; TASS, 2004) but is highly dependent on water from the Ogallala Aquifer. Ground water supplies are declining while costs of energy required to pump water are escalating. Improved irrigation technologies including low energy precision application (LEPA) and sub-surface drip (SDI) irrigation have increased water use efficiencies to over 95% but have not always led to decreased water use. Diversified systems that include both crops and livestock have long been known for complimentary effects that increase productivity. Recent research in the Texas High Plains (Allen et al., 2005) has demonstrated lower irrigated water use, improved soil health (Acosta-Martinez et al., 2004), greater profitability per unit of water invested, and diversified income sources for an integrated crop and livestock system compared with a cotton monoculture. At cotton yields average for the region, profitability was greater for the integrated system than a cotton monoculture.

No single technology will successfully address water conservation. Rather, the approach must be an integration of agricultural systems, best irrigation technologies, improved plant genetics, and management strategies that reduce water demand, optimize water use and value, and maintain an appropriate level of productivity and profitability. Water conservation must become both an individual goal and a community ethic. Educational programs are needed at all levels to raise awareness of the necessity for, the technology to accomplish, and the impact of water conservation on regional stability and economics. As state and global populations increase with an increasing demand for agricultural products, the future of the Texas High Plains, and indeed the State of Texas and the world depends on our ability to protect and appropriately use our water resources. Nowhere is there greater opportunity to demonstrate the implications of successfully meeting these challenges than in the High Plains of west Texas.

A multidisciplinary and multi-university/agency/producer team, coordinated though Texas Tech University, assembled during 2004 to address these issues. In September of 2004 the project *‘An Integrated Approach to Water Conservation for Agriculture in the Texas Southern High Plains’* was approved by the Texas Water Development Board and funding was received in February, 2005 to begin work on this demonstration project conducted in Hale and Floyd Counties. A producer Board of Directors was elected to oversee all aspects of this project. Twenty-six producer sites were identified to represent 26 different ‘points on a curve’ that characterize and compare cropping and livestock grazing system monocultures with an integrated crop/livestock approach to agriculture in this region. The purpose is to understand where and how water conservation can be achieved while maintaining acceptable levels of profitability.

OBJECTIVE

To conserve water in the Texas Southern High Plains while continuing agricultural activities that provide needed productivity and profitability for producers and communities.

REPORT OF YEAR 1 AND 2

In the first year of any demonstration or research project, the data should be interpreted with caution. As systems are begun and data collection is initiated, there are also many factors that do not function as they will over more time when everything becomes a mature system with data gathering techniques well developed. For each added year of reporting, some data will be missing because there is only a partial years accounting or because some data are not yet complete. However, because each annual report updates and corrects each previous year, the current year's annual report is the most complete and comprehensive accounting of results to date and will contain revisions and additions for the previous years.

Because this project uses existing farming systems that were already functioning at the beginning of the project, the startup time was minimized and even in the first year, interesting data emerged that had meaningful interpretations. These data become more robust and meaningful with each additional year's data.

It is important to recognize that these data and their interpretations are based on certain assumptions. These assumptions are critical to being able to compare information across the 26 different sites involved in this demonstration project. These assumptions are necessary to avoid differences that would be unique to a particular producer or site that have nothing to do with understanding how these systems function. Thus, we have adopted certain constants across all systems such as pumping depth of wells to avoid variables that do not influence system behavior but would bias economic results. This approach means that the economic data for an individual site are valid for comparisons of systems but do not represent the actual economic results of the specific location. Actual economic returns for each site are also being calculated and made available to the individual producer but are not a part of this report.

The assumptions necessary for system comparisons are elaborated below.

ASSUMPTIONS OF DATA COLLECTON AND INTERPRETATION

1. Although actual depth to water in wells located among the 26 sites varies, a pumping depth of 260 feet is assumed for all irrigation points. The actual depth to water influences costs and energy used to extract water but has nothing to do with the actual functions of the system to which this water is delivered. Thus, a uniform pumping depth is assumed.

2. All input costs and prices received for commodities sold are uniform and representative of the year and the region. Using an individual's actual costs for inputs would reflect the unique opportunities that an individual could have for purchasing in

bulk or being unable to take advantage of such economies and would thus represent differences between individuals rather than the system. Likewise, prices received for commodities sold should represent the regional average to eliminate variation due to an individual's marketing skill.

3. Irrigation system costs are unique to the type of irrigation system. Therefore, annual fixed costs were calculated for each type of irrigation system taking into account the average cost of equipment and expected economic life.

4. Variable cost of irrigation across all systems was based on a center pivot system using electricity as the energy source. The estimated cost per acre inch includes the cost of energy, repair and maintenance cost, and labor cost. The primary source of variation in variable cost from year to year is due to changes in the unit cost of energy.

5. Mechanical tillage operations for each individual site were accounted for with the cost of each field operation being based on typical custom rates for the region. Using custom rates avoids the variations among sites in the types of equipment owned and operated by individuals.

ECONOMIC ASSUMPTIONS

1. Irrigation costs were based on a center pivot system using electricity as the energy source.

Table 1. Electricity irrigation cost parameters for 2005 and 2006.

	2005	2006
Gallons per minute (gpm)	450	450
Pumping lift (feet)	260	250
Discharge Pressure (psi)	15	15
Pump efficiency (%)	60	60
Motor Efficiency (%)	88	88
Electricity Cost per kWh	$0.085	$0.09
Cost of Electricity per Ac. In.	$4.02	$4.26
Cost of Maintenance and Repairs per Ac. In.	$2.05	$2.07
Cost of Labor per Ac. In.	$0.75	$0.75
Total Cost per Ac. In.	$6.82	$7.08

2. Commodity prices are reflective of the production year; however, prices were held constant across sites.

Table 2. Commodity prices for 2005 and 2006.

	2005	2006
Cotton lint ($/lb)	$0.54	$0.56
Cotton seed ($/ton)	$100.00	$135.00
Grain Sorghum – Grain ($/cwt)	$3.85	$6.10
Corn – Grain ($/bu)	$2.89	$3.00
Corn – Food ($/bu)	$3.48	$3.55
Wheat – Grain ($/bu)	$2.89	$4.28
Sorghum Silage ($/ton)	$20.19	$18.00
Corn Silage ($/ton)	$20.12	$22.50
Wheat Silage ($/ton)	$18.63	$22.89
Oat Silage ($/ton)	-	$17.00
Millet Seed ($/lb)	$0.17	$0.17
Sunflowers ($/lb)	$0.21	$0.21
Alfalfa ($/ton)	$130.00	$150.00
Hay ($/ton)	$60.00	$60.00
WWB Dahl Hay ($/ton)	$65.00	$65.00
Hay Grazer ($/ton)	-	$110.00

3. Fertilizer and chemical costs (herbicides, insecticides, growth regulators, and harvest aids) are reflective of the production year; however, prices were held constant across sites for the product and formulation.

4. Other variable and fixed costs are given for 2005 and 2006 in Table 3.

Table 3. Other variable and fixed costs for 2005 and 2006.

	2005	2006
VARIABLE COSTS		
Boll weevil assessment: ($/ac)		
Irrigated cotton	$12.00	$12.00
Dryland cotton	$6.00	$6.00
Crop insurance ($/ac)		
Irrigated cotton	$17.25	$17.25
Dryland cotton	$12.25	$12.25
Corn	$15.00	$15.00
Cotton harvest – strip and module ($/lint lb)	$0.08	$0.08
Cotton ginning ($/cwt)	$1.95	$1.75
Bags, Ties, & Classing ($/480 lb bale)	$17.50	$19.30
FIXED COSTS		
Irrigation system:		
Center Pivot system	$33.60	$33.60
Drip system	$75.00	$75.00
Flood system	$25.00	$25.00
Cash rent:		
Irrigated cotton, grain sorghum, sunflowers, and grassland	$45.00	$45.00
Irrigated silage, corn, and alfalfa.	$75.00	$75.00
Dryland cropland	$15.00	$15.00

5. The custom tillage and harvest rates used for 2005 were based on rates reported in USDA-NASS, 2004 Texas Custom Rates Statistics, Bulletin 263, September 2005. The custom rates used for 2006 were 115% of the reported 2004 rates to reflect increased cost of operation due to rising fuel prices and other costs.

WEATHER DATA FOR 2005

The 2005 growing season was close to ideal in terms of temperatures and timing of precipitation. The precipitation and temperatures for this area are presented in Figure 1 along with the long-term means for this region. While hail events occurred in these counties during 2005, none of the specific sites in this project were measurably affected by such adverse weather events. Year 1, 2005, also followed a year of abnormally high precipitation. Thus, the 2005 growing season likely was influenced by residual soil moisture.

Precipitation for 2005, presented in Table 4, is the actual mean of precipitation recorded at the 26 sites during 2005 but begins in March when the sites were identified and equipped. Precipitation for January and February are amounts recorded at Halfway, TX; the nearest monitoring site.

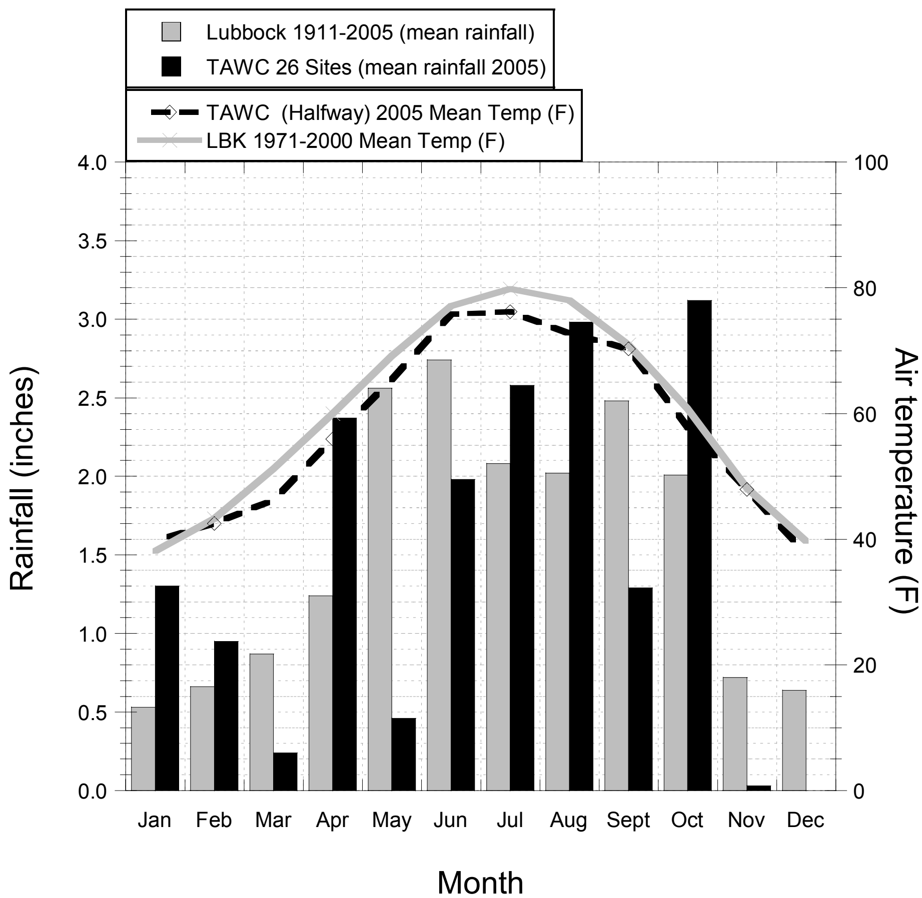

Figure 1. Temperature and precipitation for 2005 in the demonstration area compared with long term averages.

Table 4. Precipitation by each site in the Demonstration Project in Hale and Floyd Counties during 2005.

SITE	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
01	0	0	0.4	1.3	0.2	1.7	2.2	2.4	2	4.1	0	0	14.3
02	0	0	0.4	1.8	0.5	1.4	2.4	3.6	0.8	3.4	0	0	14.3
03	0	0	0.7	2	0.6	1.4	2.5	4	0.4	3.2	0	0	14.8
04	0	0	0.6	8	0.3	1.4	2.2	3.2	0.1	1	0	0	16.8
05	0	0	0.6	2.9	0.4	1.5	3.2	4.2	0.6	1.7	0	0	15.1
06	0	0	0.5	1.5	0.4	3	2.4	1	2	4.2	0	0	15
07	0	0	0.5	1.5	0.6	2.6	2.4	1.5	3.3	3	0	0	15.4
08	0	0	0	1.5	0.6	2.6	2.4	1.5	3.3	3	0	0	14.9
09	0	0	0.5	1.5	0.5	2.6	2	1	3	3.3	0	0	14.4
10	0	0	0.4	1	0.2	2	1.8	1	1.6	3.1	0	0	11.1
11	0	0	0	1.2	0.4	3	2	1.7	1.8	4.3	0	0	14.4
12	0	0	0	0.7	0.4	3.2	2	2.2	1.2	2.8	0	0	12.5
13	0	0	0	1.7	0.4	3.4	3	2.6	1.2	4	0	0	16.3
14	0	0	0	1.3	0.5	1.8	3	2.2	2.2	3	0	0	14
15	0	0	0.4	1.3	0.5	2	3.6	4	2	5.4	0	0	19.2
16	0	0	0	1.4	0.4	2	3.2	3.4	1.8	4.1	0	0	16.3
17	0	0	0	2	0.5	2.2	3	3.6	1.6	4.6	0	0	17.5
18	0	0	0	4	0.9	1	2.8	4.8	0	3	0	0	16.5
19	0	0	0	3.2	0.5	1	2	4.6	0	2.6	0	0	13.9
20	0	0	0	2.8	0.4	1.6	3.4	4	0.8	2	0.4	0	15.4
21	0	0	0	1.2	0.6	2.5	2	2.5	2	4	0.3	0	15.1
22	0	0	0	5.8	0.3	1.6	2.6	4	0.2	0.6	0	0	15.1
23	0	0	0	3	0.3	1.2	2.9	3.6	0.5	0.9	0	0	12.4
24	0	0	0.8	4.8	0.3	1	2.9	4	0.4	0.8	0	0	15
25	0	0	0	2.3	0.9	2	2.4	3.4	0	7.4	0	0	18.4
26	0	0	0	2	0.4	1.7	2.8	3.4	0.7	1.7	0	0	12.7
Average	0.0	0.0	0.2	2.4	0.5	2.0	2.6	3.0	1.3	3.1	0.0	0.0	15.0

WEATHER DATA FOR 2006

The 2006 growing season was one of the hottest and driest seasons on record marked by the longest period of days with no measurable precipitation ever recorded for the Texas High Plains. Most dryland cotton was terminated. Rains came in late August and again in October delaying harvests in some cases. No significant hail damage was received within the demonstration sites.

Precipitation for 2006, presented in Figure 2 and Table 5, is the actual mean of precipitation recorded at the 26 sites during 2006 from January to December. The drought and high temperatures experienced during the 2006 growing season did influence system behavior and results. This emphasizes why it is crucial to continue this type of real-world demonstration and data collection over a number of years and sets of conditions.

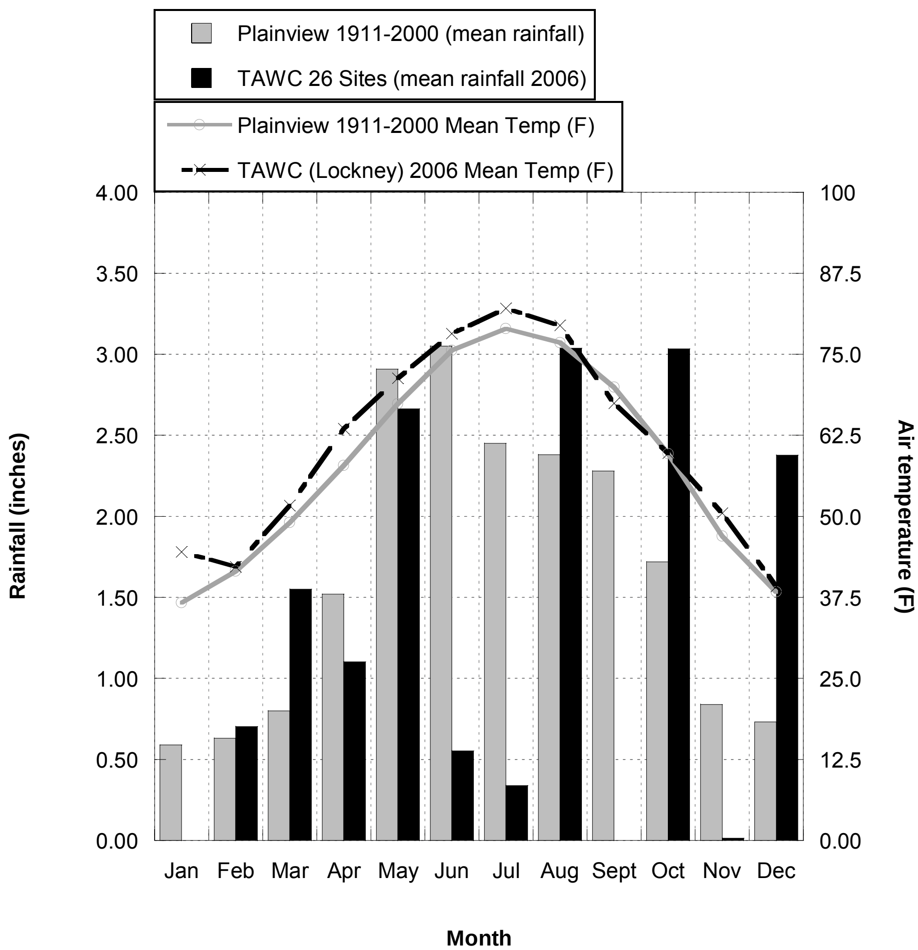

Figure 2. Temperature and precipitation for 2006 in the demonstration area compared with long term averages.

Table 5. Precipitation by each site in the Demonstration Project in Hale and Floyd Counties during 2006.

SITE	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
01	0	0.9	1.7	1.2	2.6	0.5	0.55	2.3	0	2.87	0	2.6	15.22
02	0	0.8	1.9	1.1	1.9	0.2	0	2.6	0	3.05	0	1.8	13.35
03	0	0.6	1.5	0.9	2.6	0.7	0.22	3	0	3.14	0	3.2	15.86
04	0	0.5	1.4	1.1	2.7	0.2	0.4	3.8	0	2.56	0	2.8	15.46
05	0	0.7	1.4	1.8	3.2	0.4	0.57	4	0	2.78	0	2.8	17.65
06	0	0.7	1.5	0.8	3	0.4	0.2	5.4	0	2.6	0	2.7	17.3
07	0	0.5	1.3	0.9	1.92	0.5	0.33	3.8	0	2.75	0	2.1	14.1
08	0	0.5	1.3	0.9	1.92	0.5	0.33	3	0	2.75	0	2.1	13.3
09	0	0.6	1.5	0.8	1.82	0.5	0.12	3.8	0	3.28	0	2.4	14.82
10	0	0.6	1.5	1	3	0.4	0.11	3.1	0	2.8	0.1	2.4	15.01
11	0	0.5	0.7	0.4	2.5	0.4	0.1	3.5	0	3.3	0	1.6	13
12	0	0.8	1.4	0.8	2.2	0.9	0.2	1.9	0	3.3	0	2	13.5
13	0	1	1.8	0.8	2.2	1.1	0.1	2.7	0	3.05	0	1.8	14.55
14	0	0.8	1.8	1	2.8	0.3	0	1.6	0	3.8	0	2.6	14.7
15	0	1.4	2.2	1.4	2.8	0.4	0	2	0	4.4	0.1	2.6	17.3
16	0	1	2.2	1.3	2	0.8	0.2	2.6	0	2.69	0	2.2	14.99
17	0	0.8	2	1.3	2	1	0.3	3.3	0	3.38	0.1	3.2	17.38
18	0	0.7	1.2	1.2	1.8	1.1	0.74	2.6	0	3.11	0	3.6	16.05
19	0	0.6	1.3	1.1	1.3	1.4	0.75	1.2	0	3.11	0	2.3	13.06
20	0	0.6	1.4	1.3	3.8	0.4	0.55	4.07	0	2.56	0	2.2	16.88
21	0	0.9	2.6	1.4	2.8	0.4	0.73	2.2	0	3.54	0.1	2.7	17.37
22	0	0.6	1.5	1.3	3.8	0.3	0.22	1.8	0	2.66	0	1.9	14.08
23	0	0.4	0.9	1.1	3.8	0.2	0.55	3.6	0	3.7	0	2	16.25
24	0	0.5	1.6	1.2	4	0.7	0.12	2.8	0	2.64	0	2.3	15.86
26	0	0.7	1.3	1.3	3	0.3	0.86	4.3	0	2.49	0	1.7	15.95
27	0	0.6	1.4	1.3	3.8	0.4	0.55	4.07	0	2.56	0	2.2	16.88
Average	0.0	0.7	1.6	1.1	2.7	0.6	0.3	3.0	0.0	3.0	0.0	2.4	15.40

SUPPLEMENTARY GRANTS TO PROJECT

Allen, V. G., C. Green, V. Lansford, C. P. Brown, D. Wester, E. Segarra, and others. 2005. Integrating crops and livestock to sustain agriculture. USDA-SARE $256,252 (Not funded)

Allen, V. G. and 8 co-investigators. 2005. Integrated Agriculture for Natural Resource Conservation in the Texas High Plains. USDA-NRCS Conservation Initiative Grants. $1 million (not funded).

Allen, V. G., Song Cui, and P. Brown. 2006. Finding a Forage Legume that can Save Water and Energy and Provide Better Nutrition for Livestock in West Texas. High Plains Underground Water Conservation District No. 1. $10,000. Funded.

Allen, V. G., Song Cui, and P. Brown. 2006. Finding a Forage Legume that can Save Water and Energy and Provide Better Nutrition for Livestock in West Texas. Metropolitan Rotary Club of Lubbock. $2,000 (not funded).

Allen, V. G. and multiple co-authors. 2006. Integrated Agriculture for Energy Conservation in the Texas High Plains. USDA-NRCS Conservation Initiative Grants. $808,029. (not funded)

DONATIONS TO PROJECT

2005

City Bank, Lubbock, TX. A 2003 GMC Yukon XL. Appraised value $16,500.

Table 6. Visitors to the Demonstration Project sites during 2005.

Date	Visitor(s)	Host(s)	Total
May 11	Stephan Maas and Nithya Rajan	Kellison	2
June 21	NRCS Chief Bruce Knight, et al	Kellison	38
July 12	HPUWCD #1 Board Tour	Kellison	8
Aug. 24	Steve Klose, Jay Yates and Jeff Pate	Kellison	3
Sept. 2	Ted Zobeck and guests	Kellison	4
Sept. 9	Judy Albus and guests	Kellison	5
Sept. 20	Floyd County Ag Tour	Kellison/Trostle/Allen	115
Oct. 13	Comer Tuck, Kraig Gallimore and Valley Project group	Kellison	12
Nov. 1	Don Ethridge	Kellison	1
Nov. 11	Will Cradduck and Jim Crownover	Kellison	2
Total Number of Visitors			**190**

Table 7. Presentations made during 2005.

Date	Presentation	Spokesperson
March 1	Radio interview (KRFE)	Allen
March 17	Radio interview	Kellison
May 17	Radio interview (KFLP)	Kellison
July 21	Presentation to Floyd County Ag Comm.	Kellison
August 17	Presentation to South Plains Association of Soil & Water Conservation Districts	Kellison
September 13	Presentation at Floyd County NRCS FY2006 EQIP meeting	Kellison
September 28	Presentation at Floyd County Ag Tour	Kellison/Trostle/Allen
October 20	Presentation to Houston Livestock and Rodeo group	Allen/Baker
November 3	Cotton Profitability Workshop	Pate/Yates
November 10	Presentation to Regional Water Planning Committee	Kellison
November 16	Television interview (KCBD)	Kellison
November 18	Presentation to CASNR Water Group	Kellison/Doerfert
December 1	Radio interview (KRFE)	Kellison
December 9	Radio interview (AgriTALK – nationally syndicated)	Kellison
December 15	Presentation at Olton Grain Coop Winter Agronomy meeting	Kellison

Table 8. Visitors to the Demonstration Project sites during 2006.

Date	Visitor(s)	Host(s)	Total
5-Apr	Monty Henson	Kellison	1
5-Apr	2006 Alabama "Pasture to Plate" Beef Study Tour	Kellison/Allen/Cradduck	50
6-Apr	AgCert Group	Kellison/Allen/Baker/Dollar/Trostle	2
15-May	Instructors/students from Norwest College, Powell, WY	Trostle	11
22-Jun	Jack Moreman Lynn Boomer	Kellison	2
13-Jul	Beef Breeding Cattle Group from North Carolina	Kellison/Cradduck	30
5-Aug	J. Fred Simms	Kellison/Cradduck	1
11-Aug	Hale County Field Day	Kellison	50
22-Aug	Senator Robert Duncan, Brandon Lipps, Katie Day	Kellison/Teeter	3
24-Aug	Song Cui and Yue Li (TTU graduate students)	Kellison/Cradduck	2
13-Sep	Katie Day, Deon Allen	Kellison	2
19-Sep	Floyd County Farm Tour	Allen/Trostle/TAWC producers	55
5-Oct	Grass trial meeting	Trostle/Crownover/Dollar/Allen Cradduck/Kellison	28
23-Oct	Senator Robert Duncan, Congressman Randy Neugebauer, Bill Mullican, Comer Tuck	Kellison/all TAWC participants	40
14-Nov	PBS interview and tour	Kellison/TAWC producers	5
Total Number of Visitors			**282**

Table 9. Presentations made during 2006.

Date	Presentation	Spokesperson(s)
24-26 Jan	Lubbock Southwest Farm & Ranch Classic	Kellison
7-Feb	Radio Interview	Kellison/Baker
2-Mar	South Plains Irrigation Management Workshop	Trostle/Kellison/Orr
30-Mar	Forage Conference	Kellison/Allen/Trostle
19-Apr	Floydada Rotary Club	Kellison
27-Apr	ICASALS Holden Lecture: "New Directions in Groundwater Management for the Texas High Plains"	Conkwright
15-Jun	Field Day @ New Deal Research Farm	Kellison/Allen/Cradduck/Doerfert
21-Jul	Summer Annual Forage Workshop	Trostle
27-Jul	National Organization of Professional Hispanic NRCS Employees annual training meeting, Orlando, FL	Cradduck (on behalf of Kellison)
11-Aug	2006 Hale County Field Day	Kellison
12-Sep	Texas Ag Industries Association Lubbock Regional Meeting	Doerfert (on behalf of Kellison)
11-Oct	TAWC Producer meeting	Kellison/Pate/Klose/Johnson
2-Nov	Texas Ag Industries Association Dumas Regional Meeting	Kellison
10-Nov	34th Annual Banker's Ag Credit Conference	Kellison
14-Nov	Interview w/Alphaeus Media	Kellison
28-Nov	Amarillo Farm & Ranch Show	Doerfert
8-Dec	2006 Olton Grain COOP Annual Agronomy Meeting	Kellison/Trostle
12-Dec	Swisher County Ag Day	Kellison/Yates
12-Dec	2006 Alfalfa and Forages Clinic, Colorado State University	Allen

RELATED PUBLICATIONS

REFEREED JOURNAL ARTICLES

Acosta-Martinez, V., T. M. Zobeck, and V. Allen. 2004. Soil microbial, chemical and physical properties in continuous cotton and integrated crop-livestock systems. Soil Sci. Soc. Am. J. 68:1875-1884.

Allen, V. G., M. T. Baker, E. Segarra and C. P. Brown. 2005. Integrated crop-livestock systems in irrigated, semiarid and arid environments. Agron. J. 99:346-360. (Invited paper).

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Descriptions and Summary of Results by Site

BACKGROUND

This project officially began with the announcement of the grant in September, 2004. However, it was February, 2005, before all of the contracts and budgets were finalized and actual field site selection could begin. By February, 2005, the Producer Board had been named and was functioning and the Management Team had been identified to expedite the decision-making process. Initial steps were taken immediately to advertise and identify individuals to hold the positions of Project Director and Secretary/Accountant. Both positions were filled by June of 2005. By autumn 2005, the FARM Assistance position was also filled.

Working through the Producer Board, 26 sites were identified that included 4,289 acres in Hale and Floyd Counties (Figure 3). Many of these sites were located in close proximity to soil moisture monitoring points maintained by the High Plains Underground Water Conservation District No. 1 (Figure 4). Personnel with the High Plains Underground Water Conservation District No. 1, under the direction of Scott Orr, began immediately to install and test the site monitoring equipment. This was completed during 2005 and was in place for most of the growing season. The 26 sites identified represent cotton monocultures, crop rotations, forage systems, and integrated crop and livestock systems (Figure 5). Total number of acres devoted to each crop and livestock enterprise and management type in 2005 are given in Table 10. These sites include subsurface drip, center pivot, and furrow irrigation as well as dryland examples (Table 10). It is important to note when interpreting data from Year 1 (2005), that this was an incomplete year. We were fortunate that this project made use of already existing and operating systems, thus, there was no time delay in establishment of systems. Efforts were made to locate the information to fill gaps that occur due to the time it took to bring these 26 sites on-line but information in regard to water use is based on estimates as well as actual measurements during this first year and should be interpreted with caution. However, it provided useful information as we began this long-term project. It is also important to note that the first year of any project is unlikely to resemble closely any following year because of all the factors involved in start-up and calibration of measurement techniques. This is always the case. As we entered year 2, we were positioned to collect increasingly meaningful data and all sites were complete.

In year 2, Site No. 25 was lost to the project due to a change in ownership of the land. However, Site 27 was added, thus, the project continues to monitor 26 sites. Total acreage in 2006 was 4,230, a difference of about 60 acres between the two years. Crop and livestock enterprises on these sites and the acres committed to each use by site is given in Table 11.

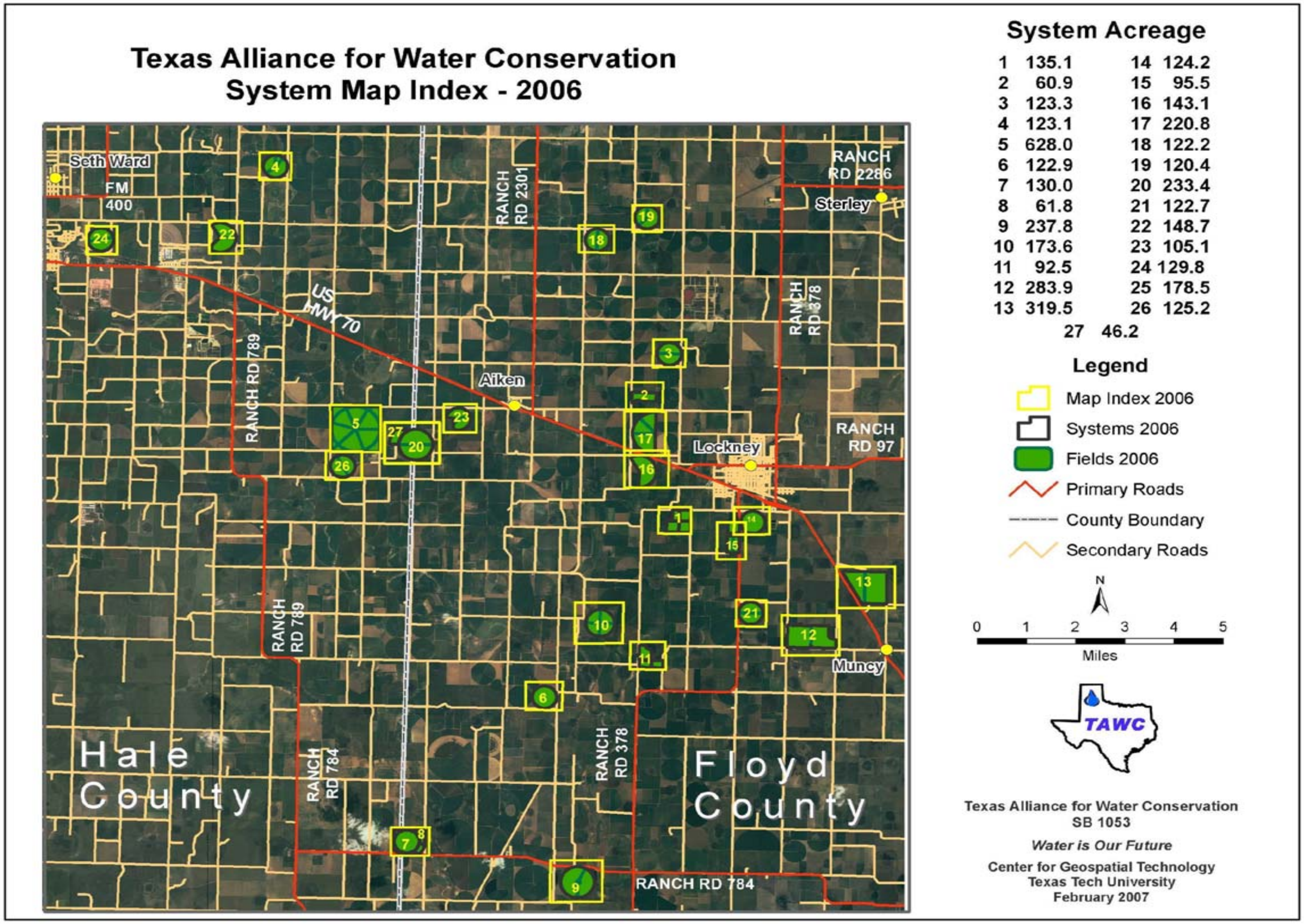


Figure 3. System map index for 2006 (Year 2)

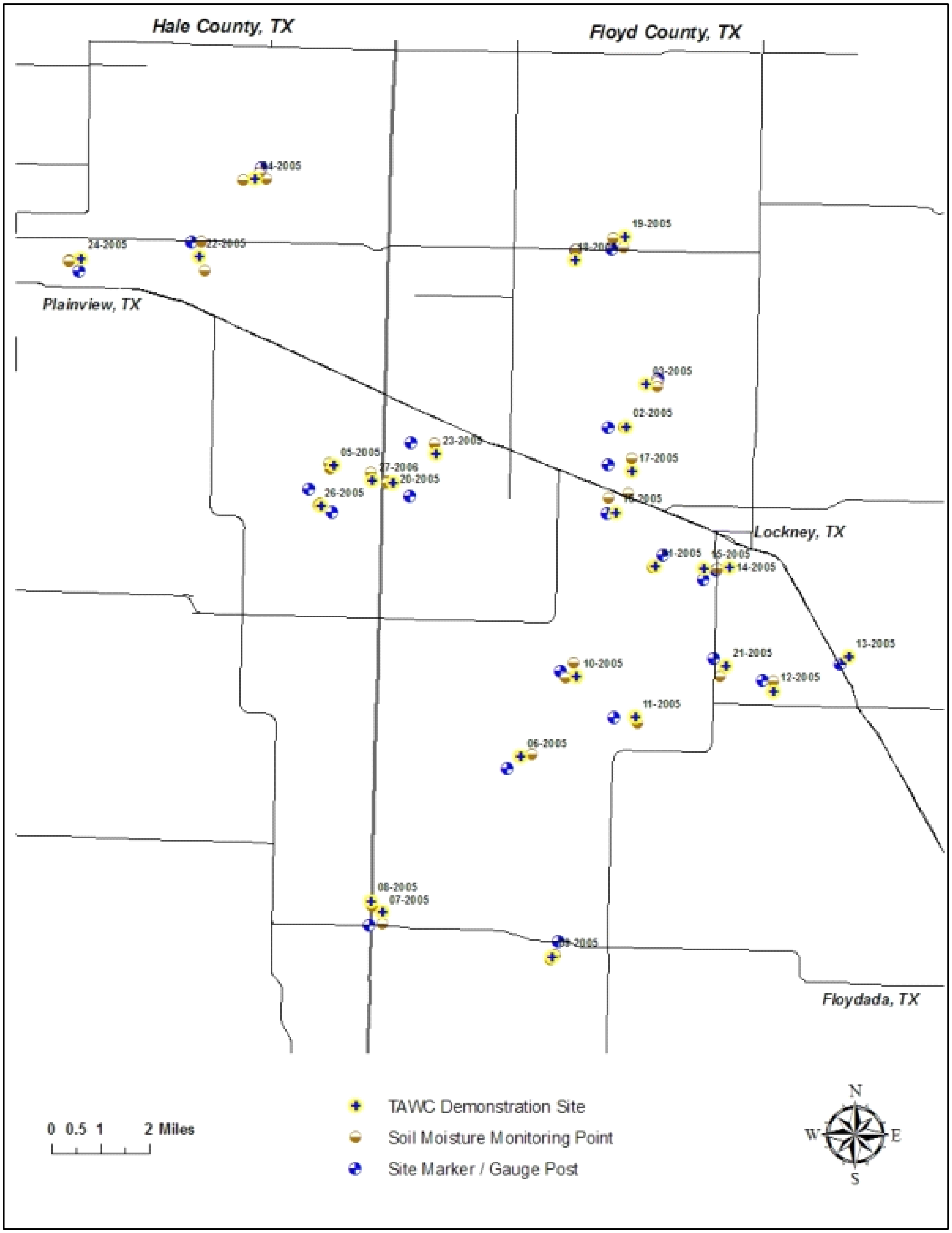


Figure 4. Location of soil moisture monitoring points in each of the 26 sites in the Demonstration Project.

Table 10. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 26 producer systems in Hale and Floyd Counties during 2005.

TAWC 2005 CROP ACRES - ACRES MAY OVERLAP DUE TO MULTIPLE CROPS PER YEAR AND GRAZING

Site	irrigation type	cotton	corn grain	corn silage	sorghum grain	sorghum forage	pearl millet	sunflowers	alfalfa	grass seed	perennial pasture	cattle	wheat	rye	triticale	oats
1	SDI	62.3														
2	SDI	60.9														
3	PIV	61.8			61.5											
4	PIV	109.8							13.3							
5	PIV/DRY								69.6		551.3	620.9				
6	PIV	122.9										122.9	122.9			
7	PIV									130.0						
8	SDI									61.8						
9	PIV	137.0									95.8	232.8		232.8		
10	PIV	44.5									129.1	129.1				
11	FUR	92.5														
12	DRY	151.2				132.7										
13	DRY	201.5											118.0			
14	PIV	124.2														
15	FUR	95.5														
16	PIV	143.1														
17	PIV	108.9		58.3							53.6					
18	PIV	61.5			60.7											
19	PIV	75.3					45.1									
20	PIV			115.8		117.6							117.6			
21	PIV	122.7														
22	PIV	72.7	76.0													
23	PIV	51.5						48.8								
24	PIV	64.7	65.1													
25	DRY	90.9			87.6											
26	PIV	62.9	62.3													
27	SDI	n/a														
Total 2005 acres		**2118.3**	**203.4**	**174.1**	**209.8**	**250.3**	**45.1**	**48.8**	**82.9**	**191.8**	**829.8**	**1105.7**	**358.5**	**232.8**	**0.0**	**0.0**

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation

Table 11. Irrigation type and total acres, by site, of crops, forages, and acres grazed by cattle in 26 producer systems in Hale and Floyd Counties during 2006.

TAWC 2006 CROP ACRES - ACRES MAY OVERLAP DUE TO MULTIPLE CROPS PER YEAR AND GRAZING

Site	irrigation type	cotton	corn grain	corn silage	sorghum grain	sorghum forage	pearl millet	sunflowers	alfalfa	grass seed	perennial pasture	cattle	wheat	rye	triticale	oats
1	SDI	135.2														
2	SDI	60.9														
3	PIV	123.3														
4	PIV	44.4				65.4			13.3				65.4			
5	PIV/DRY								69.6		551.3	620.9				
6	PIV	122.9														
7	PIV									130.0						
8	SDI									61.8						
9	PIV	137.0									95.8	95.8		137.0		
10	PIV					44.5					129.1	129.1				44.5
11	FUR	92.5														
12	DRY	132.7											151.2			
13	DRY	118.0											201.5			
14	PIV	124.2														
15	FUR	67.1			28.4											
16	PIV	143.1														
17	PIV	58.3		108.9							53.6	162.5	108.9			
18	PIV	60.7				61.2										61.2
19	PIV	75.1					45.3									
20	PIV			117.6		115.8									115.8	
21	PIV	61.3	61.4									61.3	61.3			
22	PIV	72.7	76													
23	PIV	51.5	48.8													
24	PIV	65.1		64.7												
25	DRY	n/a														
26	PIV	62.3	62.9													
27	SDI	46.2														
Total 2006 acres		**1854.5**	**249.1**	**291.2**	**28.4**	**286.9**	**45.3**	**0.0**	**82.9**	**191.8**	**829.8**	**1069.6**	**588.3**	**137.0**	**115.8**	**105.7**

PIV = pivot irrigation SDI = subsurface drip irrigation FUR = furrow irrigation DRY = dryland, no irrigation

Lastly, all numbers in this report continue to be checked and verified. THIS REPORT SHOULD BE CONSIDERED A DRAFT AND SUBJECT TO FURTHER REVISION. However, each year's annual report reflects revisions made to previous year's reports as well as the inclusion of additional data from previous years. Thus, the most current annual report will contain the most complete and correct report from each previous year and an overall summarization of the data.

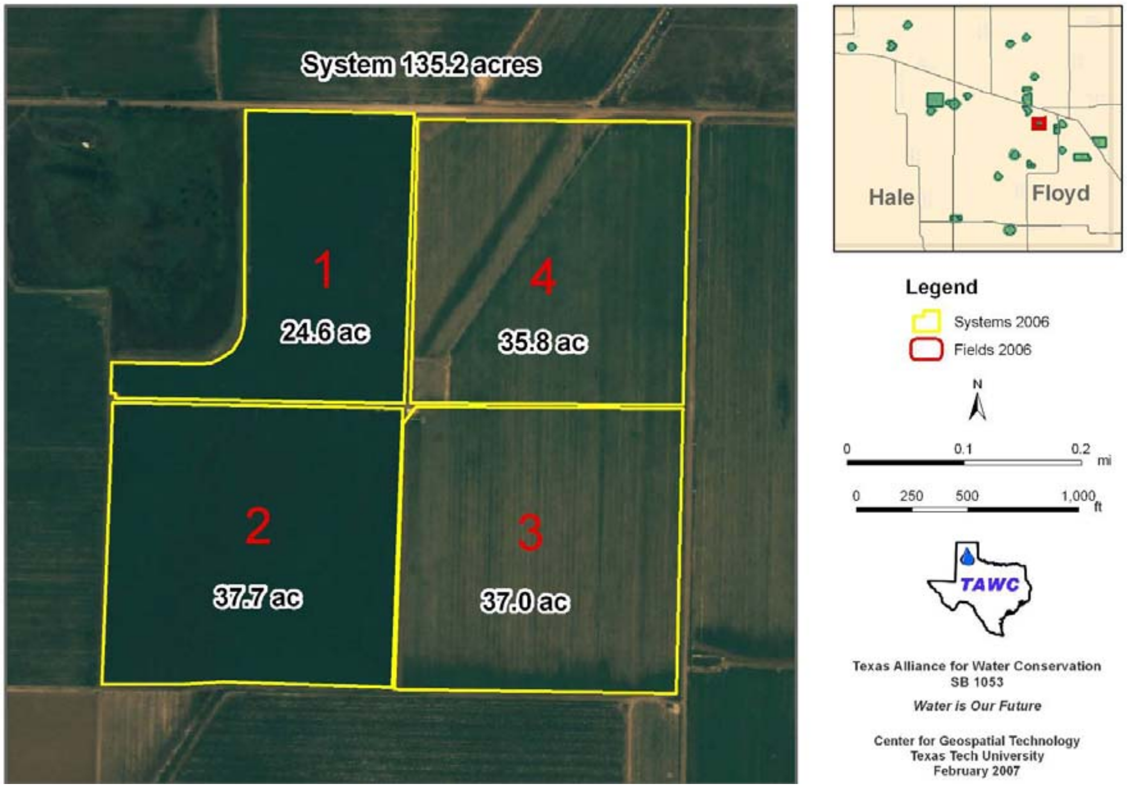
The results of years 1 and 2 follow and are presented by site.

Site	cotton	corn grain	corn silage	sorghum grain	sorghum forage	pearl millet	sunflowers	alfalfa	grass seed	perennial pasture	cattle	wheat	rye	triticale	oats
1	🔴🔵														
2	🔴🔵														
3	🔴🔵			🔴											
4	🔴🔵				🔵			🔴🔵				🔵			
5								🔴🔵		🔴🔵	🔴🔵				
6	🔴🔵										🔴	🔴			
7									🔴🔵						
8									🔴🔵						
9	🔴🔵									🔴🔵	🔴🔵		🔴🔵		
10	🔴				🔵					🔴🔵	🔴🔵				🔵
11	🔴🔵														
12	🔴🔵				🔴							🔵			
13	🔴🔵											🔴🔵			
14	🔴🔵														
15	🔴🔵			🔵											
16	🔴🔵														
17	🔴🔵		🔴🔵							🔴🔵	🔵	🔵			
18	🔴🔵			🔴	🔵										🔵
19	🔴🔵					🔴🔵									
20			🔴🔵		🔴🔵							🔴		🔵	
21	🔴🔵	🔵									🔵	🔵			
22	🔴🔵	🔴🔵													
23	🔴🔵	🔵					🔴								
24	🔴🔵	🔴	🔵												
25	🔴 -			🔴											
26	🔴🔵	🔴🔵													
27	- 🔵														
Total 2005	22	3	2	3	2	1	1	2	2	4	4	3	1	0	0
Total 2006	21	4	3	1	4	1	0	2	2	4	5	5	1	1	2

🔴 2005 🔵 2006

Figure 5. Crops, forage, and livestock present on the 26 producer sites in the Demonstration Project in 2005 and 2006.

System 01 - 2006



***Site 1 Description*:**

Total acres in system: 2005 – 62.3
2006 – 135.1

Field No. 1:
Acres: 24.6
Major soil type: Estacado clay loam, 1 to 3% slope

Field No. 2:
Acres: 37.7
Major soil type: Lofton clay loam, 0 to 1% slope
Pullman clay loam, 1 to 3% slope

Field No. 3:
Acres: 37.0
Major soil type: Pullman clay loam, 0 to 1% slope

Field No. 4:
Acres: 35.8
Major soil type: Pullman clay loam, 0 to 1% slope

Irrigation

Type: Sub-surface Drip

(Field 1 and 2 installed prior to 2004 crop year, Field 3 and 4 installed prior to 2006 crop year)

Pumping capacity, gal/min: 475

Fuel source: Electric

SITE 1 COMMENTS

Drip irrigated cotton system, conventional tillage, planted on forty-inch centers. This producer used limited tillage and added 62.3 additional acres of drip for the 2006 crop year.

Site No. 1

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	Limit-till
Cover crop	None	None
Variety	'FM960BR'	'FM 960B2R'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	2,024	1,751
Lint, lbs/inch irrigation water	173	83
Lint, lbs/inch total water	78	49
Seed, tons	1.44	1.26
Pounds water/lb of lint	2,909	4,685
Field No. 2		
Cotton		
Tillage system	Conventional	Limit-till
Cover crop	None	None
Variety	'D&PL 444BG/RR'	'FM 960B2R'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	1,480	1,751
Lint, lbs/inch irrigation water	127	83
Lint, lbs/inch total water	57	49
Seed, tons	1.01	1.26
Pounds water/lb of lint	3,978	4,685
Field No. 3		
Cotton		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	'Stoneville 4554 B2RF'
Row spacing, inches	-	40
Yield/acre		
Lint, lb	-	1,648
Lint, lbs/inch irrigation water	-	78
Lint, lbs/inch total water	-	46
Seed, tons	-	1.18
Pounds water/lb of lint	-	4,977

Field No. 4

Cotton

Tillage system	-	Conventional
Cover crop	-	None
Variety	-	'Stoneville 4554 B2RF'
Row spacing, inches	-	40

Yield/acre

Lint, lb	-	1,648
Lint, lbs/inch irrigation water	-	78
Lint, lbs/inch total water	-	46
Seed, tons	-	1.18
Pounds water/lb of lint	-	4,977

Fertilizer, lbs/system acre

Nitrogen	180	163
Phosphorus (P_2O_5)	62	5.76[1]
Potassium (K_2O)	trace	1.0
Zinc	3.5	0

Water use, inches

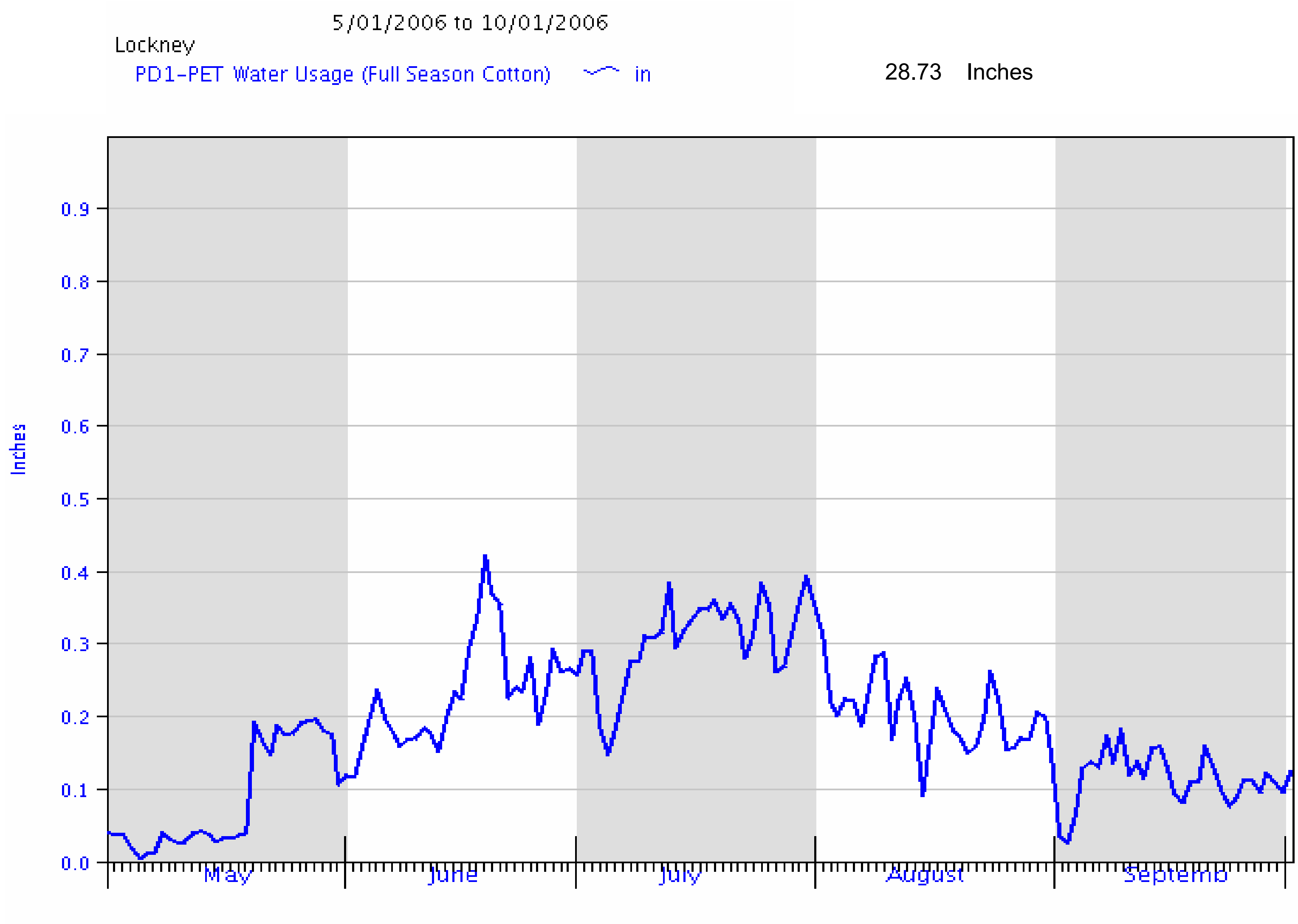
Irrigation		
By field		
Field 1	11.7	21
Field 2	11.7	21
Field 3	-	21
Field 4	-	21
By system	11.7	21
Precipitation	14.3	15.2
Total system (irrigation + precipitation)	26.0	26.2

Income and Expense, $/system acre

Projected returns	1,016.58	1,113.78
Costs		
Total variable costs	837.38	782.60
Total fixed costs	120.00	120.00
Total all costs	932.55	887.88
Net returns		
Per system acre	84.02	225.90
Per acre inch of irrigation water	7.19	10.76
Per pound of Nitrogen	0.47	1.38

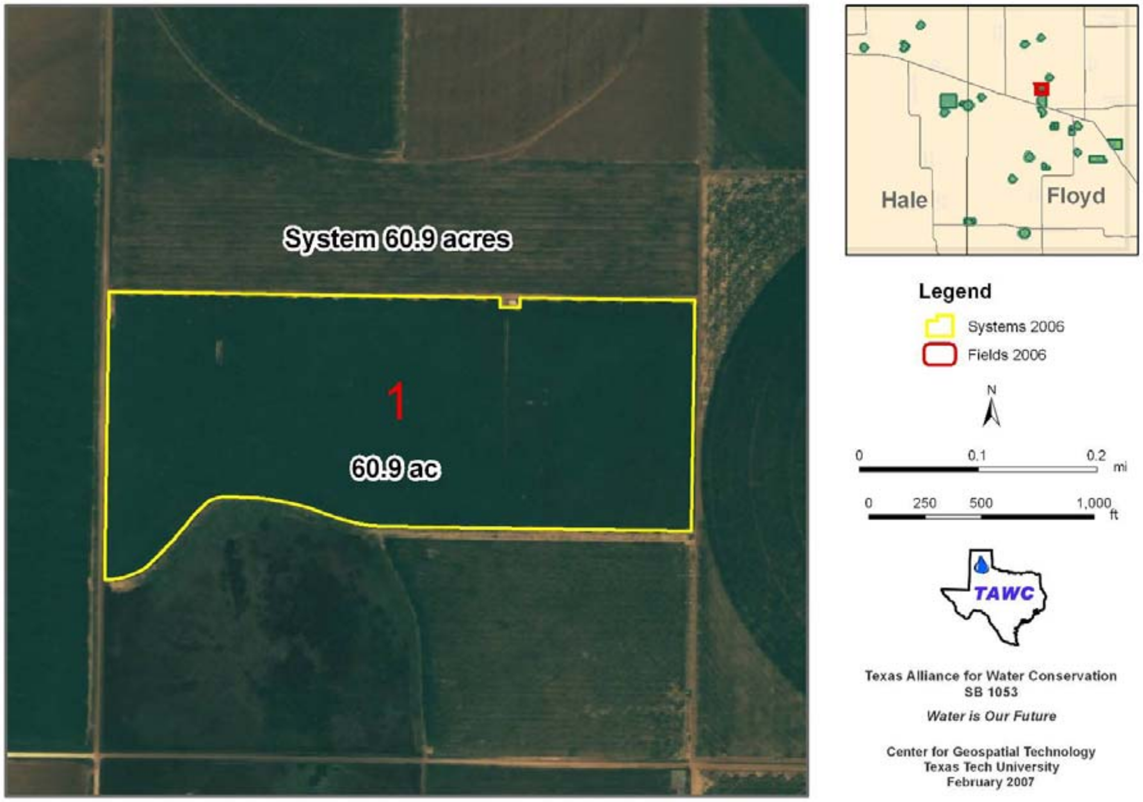
[1] Phosphorus was applied through subsurface drip irrigation.

Site 1-1,2,3,4



5/01/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton) in
28.73 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August
Septemb

System 02 - 2006



***Site 2 Description*:**

Total acres in system: 60.9

Field No. 1:

Acres: 60.9

Major soil type: Pullman clay loam, 0 to 1% slope
Olton clay loam, 1 to 3% slope

Irrigation

Type: Sub-surface Drip (installed prior to 2004 crop year)
Pumping capacity, gal/min: 360
Number of wells: 2
Fuel source: Electric

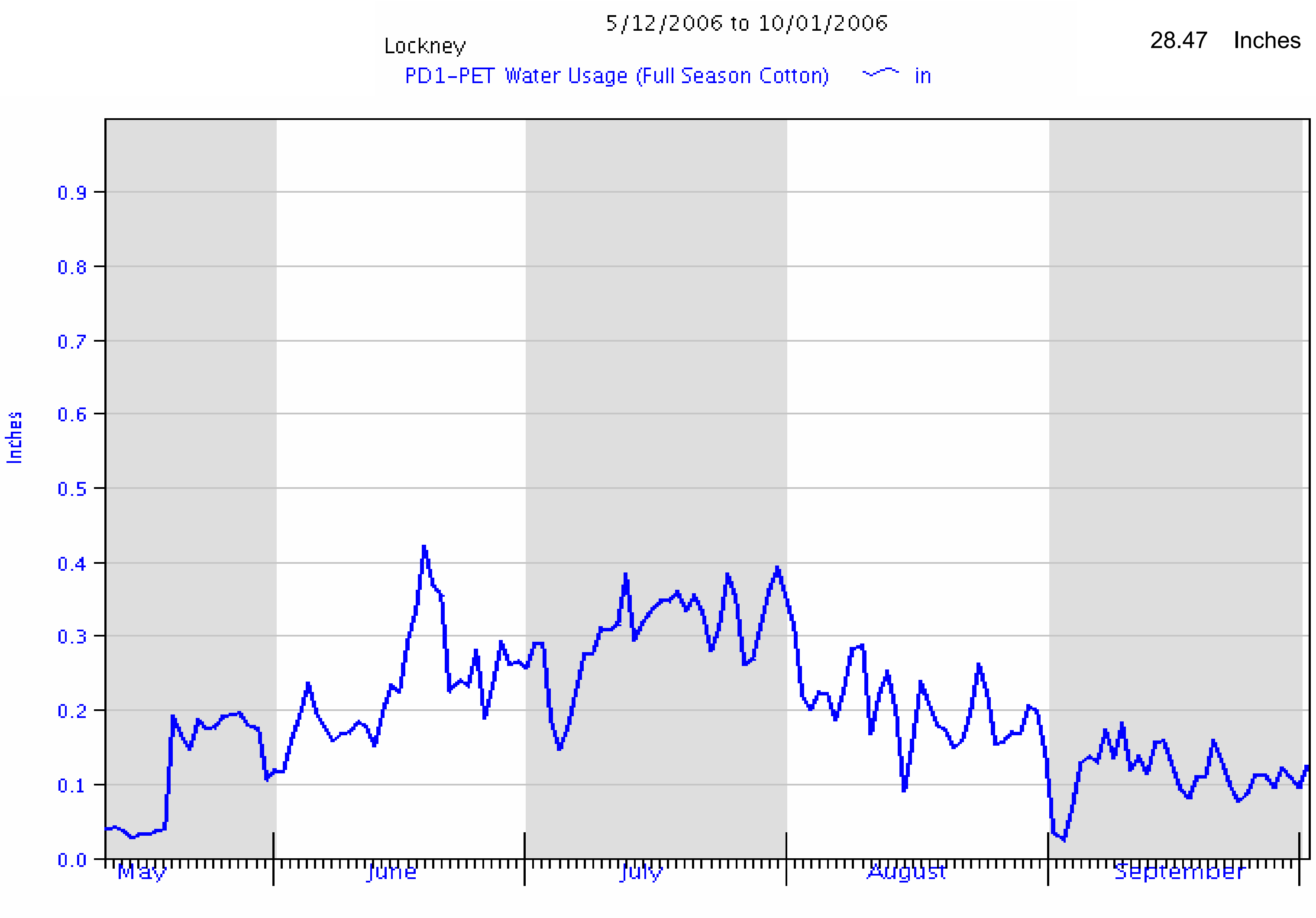
SITE 2 COMMENTS

Drip irrigated cotton system, conventional tillage, planted on thirty-inch centers. This was the third growing season for this farm to be in drip.

Site No. 2

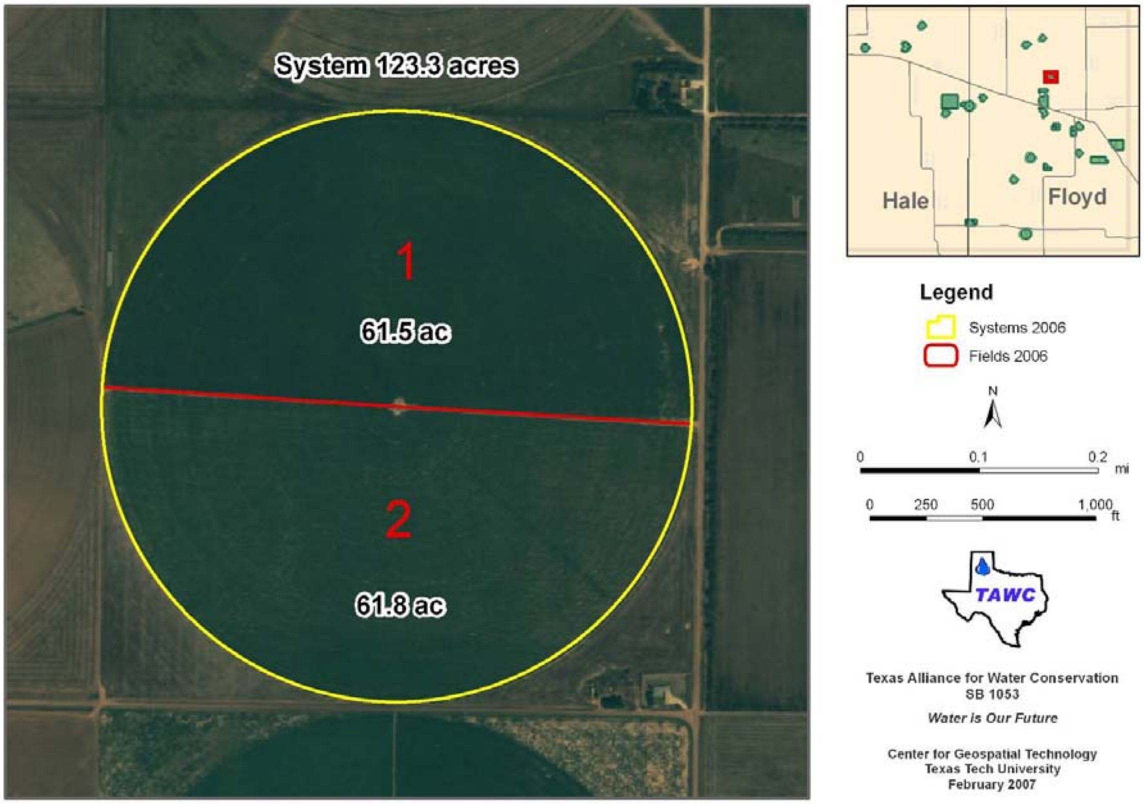
Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	Conventional
Cover crop	None	None
Variety	'981 Fibermax LL' '9058 Flex'	'9963 B2 Flex'
Row spacing, inches	30	30
Yield/acre		
Lint, lb	1,454.8	1,965.5
Lint, lbs/inch irrigation water	164	104
Lint, lbs/inch total water	62.7	61
Seed, tons	1.2	1.4
Pounds water/lb of lint	3,611	3,727
Pounds of lint/lb of N fertilizer		
Fertilizer, lbs/system acre		
Nitrogen	132	120
Phosphorus (P_2O_5)	40	0
Potassium (K_2O)	0	0
Other	0	0
Water use, inches		
Irrigation		
By field		
Field 1	8.9	19.0
By system	8.9	19.0
Precipitation	14.3	13.4
Total system (irrigation + precipitation)	23.2	32.4
Income and Expense, $/system acre		
Projected returns	924.43	1,289.28
Costs		
Total variable costs	617.49	860.57
Total fixed costs	120.00	120.00
Total all costs	737.49	980.57
Net returns		
Per system acre	186.94	308.71
Per acre inch of irrigation water	21.00	16.26
Per pound of Nitrogen	1.42	2.57

Site 2-1



5/12/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton) in
28.47 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August
September

System 03 - 2006



***Site 3 Description*:**

Total acres in system: 123.3

Field No. 1:
Acres: 61.5
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2:
Acres: 61.8
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Center Pivot (MESA)
Pumping capacity, gal/min: 450
Number of wells: 2
Fuel source: 1 natural gas; 1 electric

SITE 3 COMMENTS

This is a pivot irrigated system, conventional tillage, and is planted on forty-inch centers to cotton.




Site No. 3

Item	Year 1	Year 2
Crops		
Field No. 1		
Grain sorghum		
Tillage system	Conventional	-
Variety	'DeKalb 40Y'	-
Row spacing, inches	40	-
Yield/acre		
Grain, cwt	45.7	-
Grain, lbs/inch irrigation water	609	-
Grain, lbs/inch total water	205	-
Pounds water/lb of grain	1,105	-
Field No. 1		
Cotton		
Tillage system	-	Limit-till
Cover crop	-	None
Variety	-	'Nexgen 1553'
Row spacing, inches	-	40
Yield/acre		
Lint, lb	-	914.5
Lint, lbs/inch irrigation water	-	92
Lint, lbs/inch total water	-	35
Seed, tons	-	0.66
Pounds water/lb of lint	-	6,414
Field No. 2		
Cotton		
Tillage system	Conventional	Limit-till
Cover crop	None	None
Variety	'Nexgen 1553'	'BW 50R'
Row spacing, inches	40	40
Yield/acre		
Lint, lbs	1,106	1,187.6
Lint, lbs/inch irrigation water	126	119
Lint, lbs/inch total water	47	46
Seed, tons	0.87	0.83
Pounds water/lb lint	4,730	4,939

Fertilizer, lbs/system acre

Nitrogen	93	105
Phosphorus (P_2O_5)	0	51
Potassium (K_2O)	0	0
Other	0	0

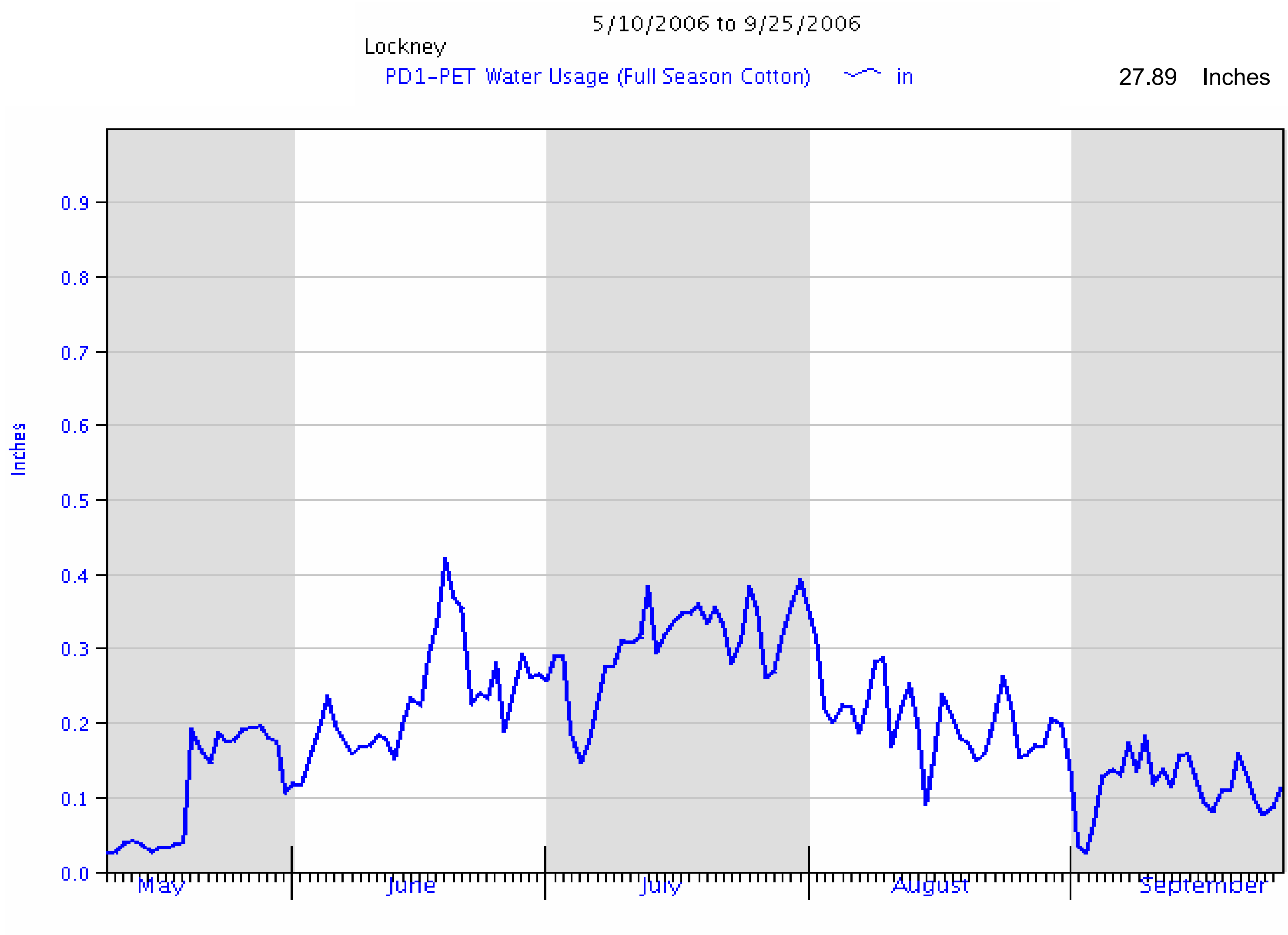
Water use, inches

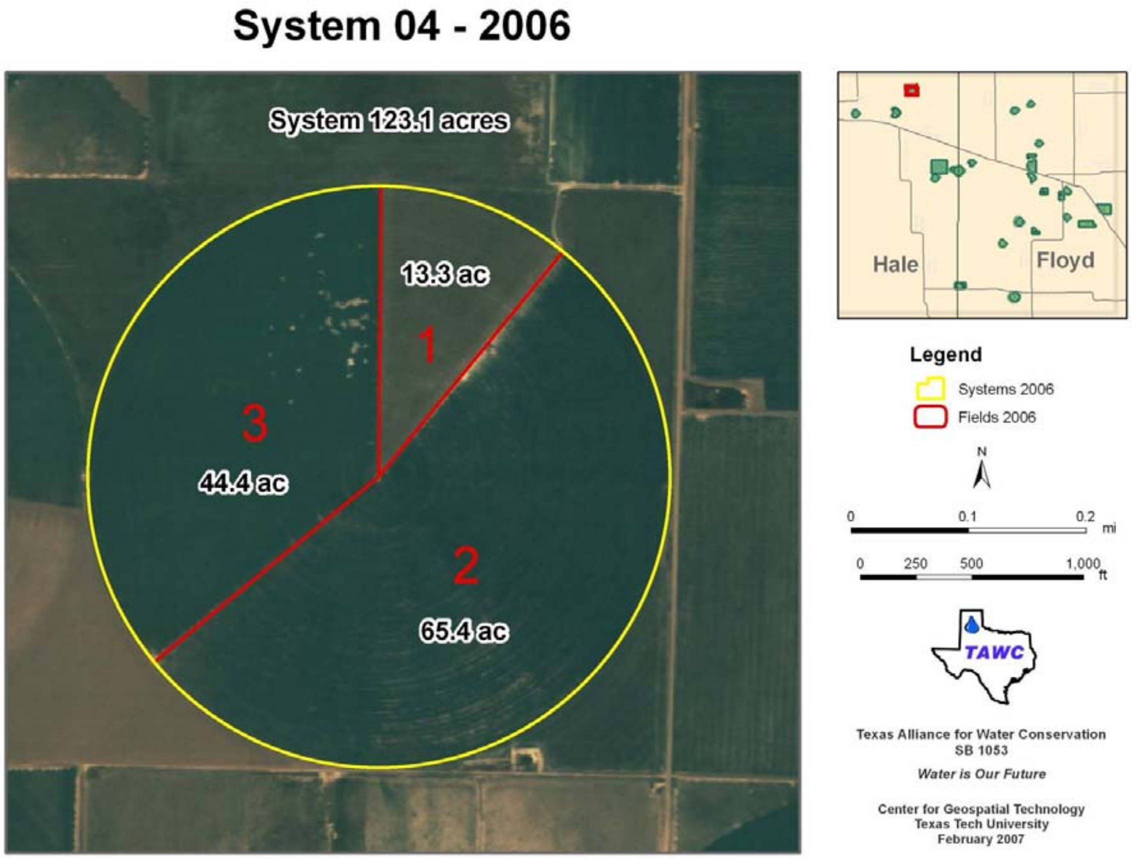
Irrigation		
By field		
Field 1	7.5	10
Field 2	8.8	10
By system	8.3	10
Precipitation	14.8	15.9
Total system (irrigation + precipitation)	23.1	25.9

Income and Expense, $/system acre

Projected returns	431.77	689.44
Costs		
Total variable costs	315.37	505.05
Total fixed costs	78.60	78.60
Total all costs	393.97	583.65
Net returns		
Per system acre	37.79	105.79
Per acre inch of irrigation water	4.66	10.58
Per pound of Nitrogen	0.41	1.01

Site 3-1,2


5/10/2006 to 9/25/2006
Lockney
PD1-PET Water Usage (Full Season Cotton)
in
27.89 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August
September



***Site 4 Description*:**

Total acres in system: 123.1

Field No. 1:
Acres: 13.3
Major soil type: Estacado loam; 1 to 3% slope
Drake soils, 3 to 8% slope

Field No. 2:
Acres: 65.4
Major soil type: Pullman clay loam, 0 to 1 % slope

Field No. 3:
Acres: 44.4
Major soil type: Pullman clay loam, 0 to 1 % slope

Irrigation
Type: Center Pivot (LESA)
Pumping capacity, gal/min: 500
Number of wells: 3
Fuel source: 1 natural gas; 2 electric

SITE 4 COMMENTS

Pivot irrigated system, conventional tillage, and cotton is planted on forty-inch centers. Field 1 is planted to alfalfa and the hay is used in this producer's cow/calf operation. Field 2 was planted to wheat and harvested for silage and then planted to forage sorghum. The forage sorghum was harvested for silage and the regrowth was harvested for hay and sold. Field 3 was planted to cotton.

Site No. 4

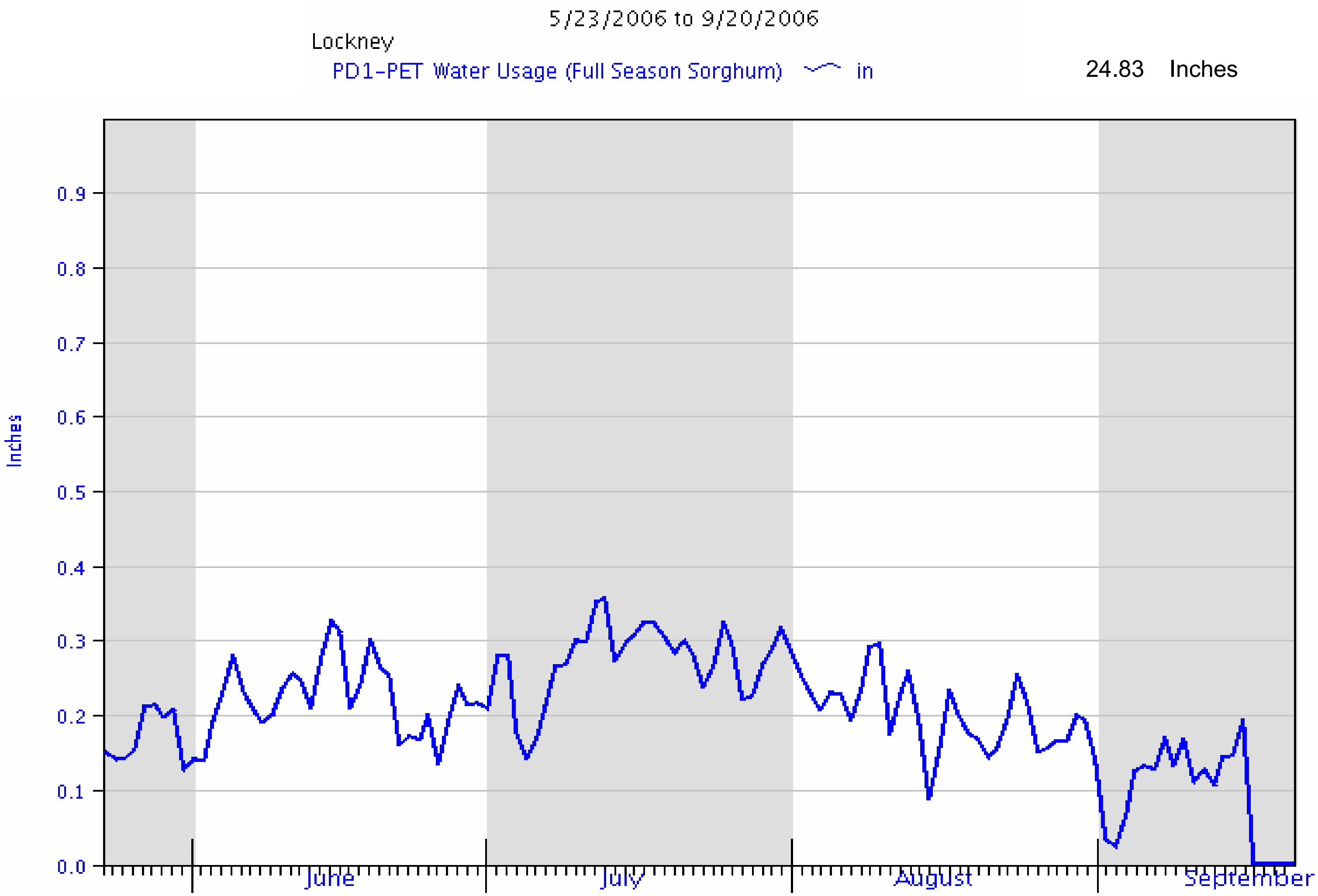
Item	Year 1	Year 2
Crops		
Field No. 1		
Alfalfa		
Variety	'Pioneer'	'Pioneer'
Yield/acre		
Hay, tons	8.3	9.18
Hay, lbs/inch irrigation water	1,620	532
Hay, lbs/inch total water	614	367
Pounds total water/pound alfalfa hay	369	617
Field No. 2		
Cotton		
Tillage system	Conventional	-
Cover crop	Wheat	-
Variety	'Fibermax 989'	-
Row spacing, inches	40	-
Yield/acre		
Lint, lb	1,201.9	-
Lint, lbs/inch irrigation water	240	-
Lint, lbs/inch total water	55	-
Seed, tons	0.93	-
Pounds water/lb lint	4,108	-
Field No. 2 (double-cropped in 2006)		
Wheat		
Tillage system	-	Conventional
Variety	-	'Jagalene'
Row spacing, inches	-	8
Yield/acre		
Wheatlage, tons	-	6.98
Wheatlage, lbs/inch irrigation water	-	859
Wheatlage, lbs/inch total water (irrigation + precipitation during growing season)	-	442
Pounds total water/pound wheatlage	-	513
Field No. 2 (double-cropped in 2006)		
Forage Sorghum		
Tillage system		No-till into wheat stubble

Cover crop	-	wheat
Variety	-	'Surpass'
Row spacing, inches	-	7
Yield/acre		
Silage, tons	-	14.4
Hay, tons (6.12 bales @ 1,175lb/bale)	-	3.6
Forage, lbs/inch irrigation water	-	2250
Forage, lbs/inch total water	-	915
Pounds water/pound forage (as fed)	-	247
Field No. 3		
Cotton		
Tillage system	Limit-till	Limit-till
Cover crop	Wheat	None
Variety	'PayMaster 2226'	FM 989 RR
Row spacing, inches	40	
Yield/acre		
Lint, lb	873.4	1,805.9
Lint, lbs/inch irrigation water	184	111
Lint, lbs/inch total water	41	57
Seed, tons	0.74	1.27
Pounds of water/lb of cotton lint	5,588	3,964
Fertilizer, lbs/system acre		
Nitrogen	109	234
Phosphorus (P_2O_5)	71	55.
Potassium (K_2O)	0	4
Sulfur	0	6.8
Water use, inches		
Irrigation		
By field		
Field 1	10.3	34.5
Field 2	5.0	16.3 (wheat)
Field 2	-	16.0 (sorghum)
Field 3	4.8	16.3
By system	5.5	26.7
Precipitation, annual	16.8	15.5
Total system (irrigation + precipitation)	22.3	42.2

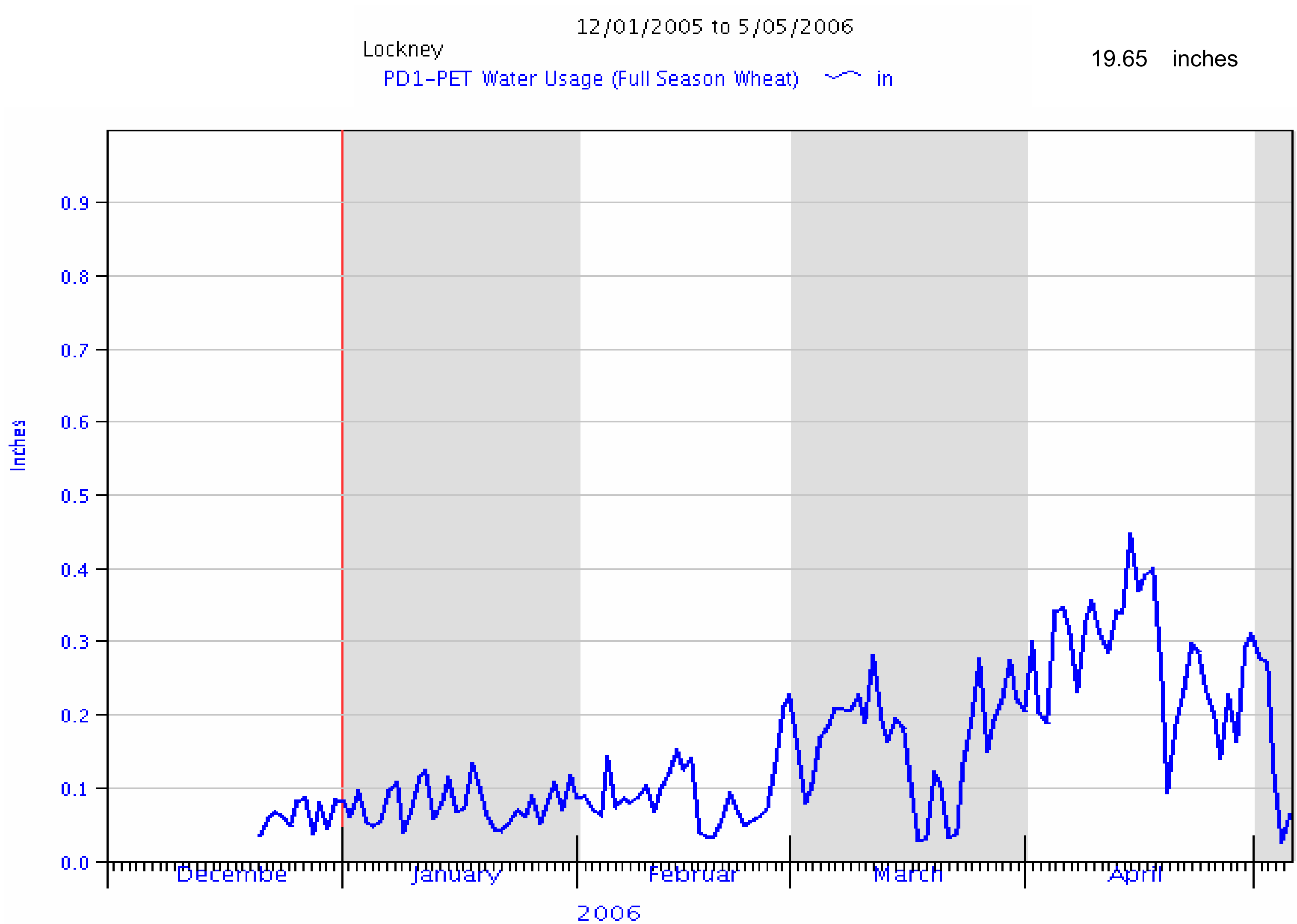
Income and Expense, $/system acre

Projected returns	727.99	984.83
Costs		
Total variable costs	535.72	590.66
Total fixed costs	81.80	81.84
Total all costs	617.56	672.50
Net returns		
Per system acre	110.44	312.33
Per acre inch of irrigation water	19.06	11.69
Per pound of Nitrogen	1.01	1.33

Site 4-2


5/23/2006 to 9/20/2006
Lockney
PD1-PET Water Usage (Full Season Sorghum) in
24.83 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
June
July
August
September

Site 4-2


12/01/2005 to 5/05/2006
Lockney
PD1-PET Water Usage (Full Season Wheat)
in
19.65 inches
Inches
0.9
0.8
0.7
0.6
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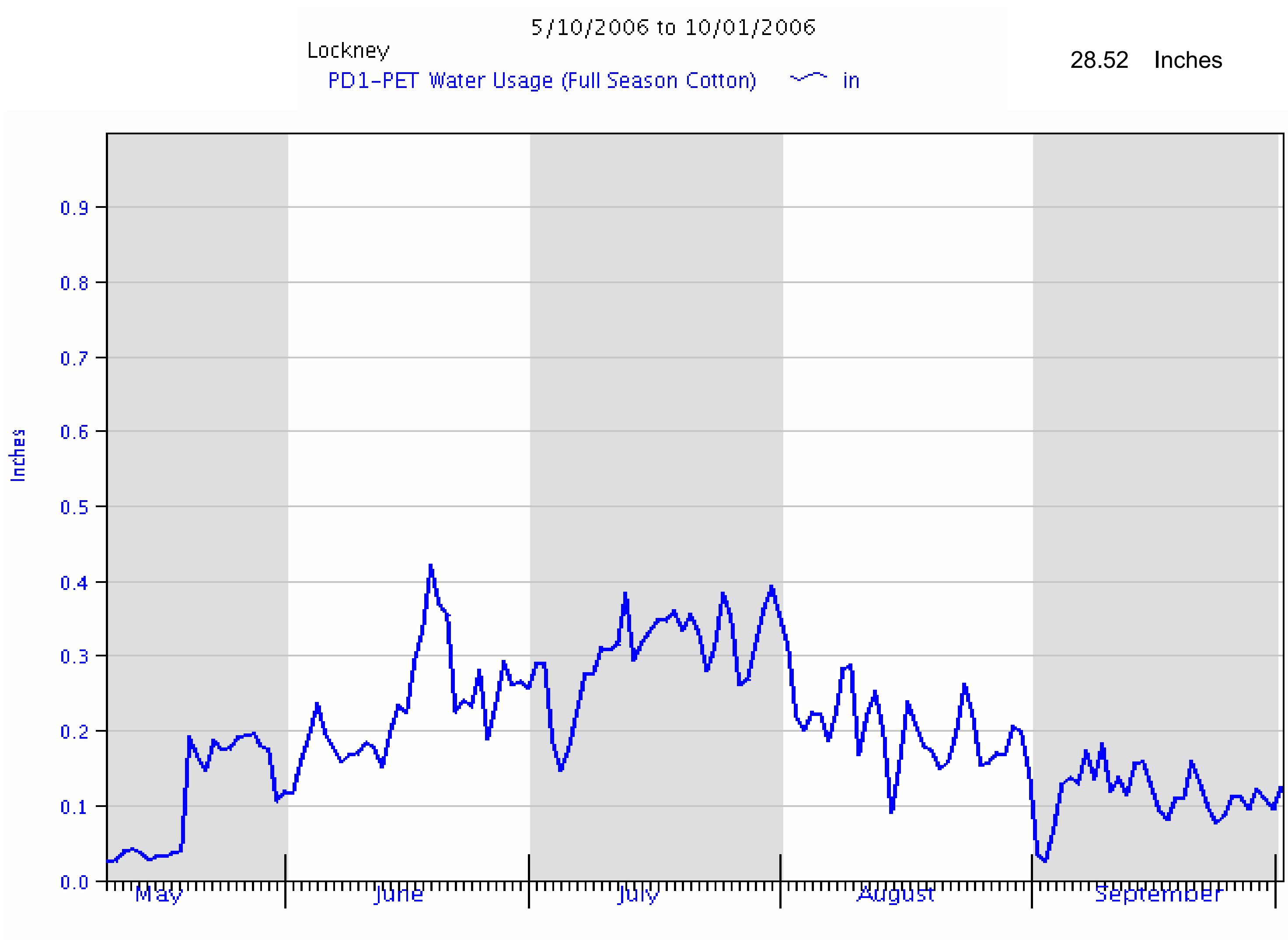
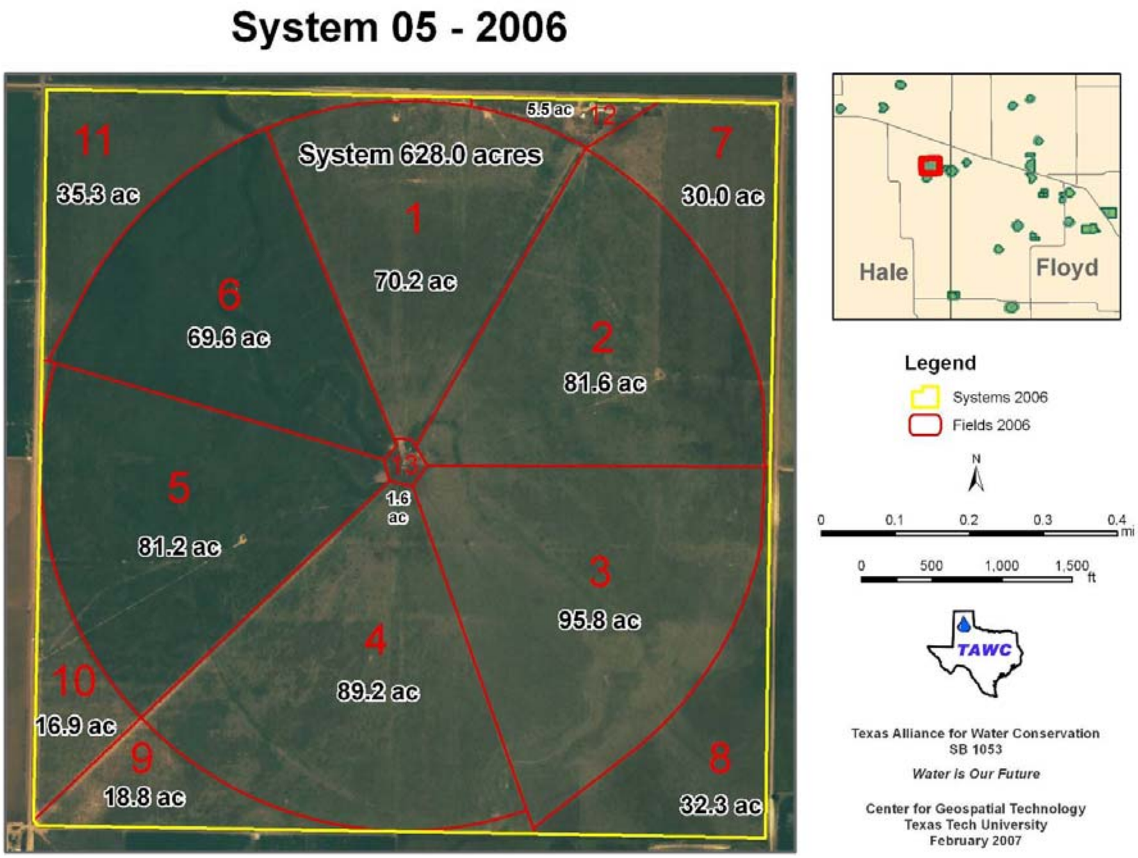
2006

Site 4-3


5/10/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton) in
28.52 Inches
Inches
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
May
June
July
August
September



***Site 5 Description*:**

Total acres in system: 628.0 (487.6 irrigated; 133.3 dryland, 7.1 facilities)

Irrigated

Field No. 1: Klein/plains/dahl/blue grama/buffalo mixture
Acres: 70.2
Major soil type: Bippus loam, 0 to 1% slope
Mansker loam, 0 to 3% slope

Field No. 2: Plains/blue grama/klein mixture
Acres: 81.6
Major soil type: Bippus loam, 0 to 1% slope
Mansker loam, 0 to 3 and 3 to 5% slope
Olton loam, 0 to 1% slope

Field No. 3: Plains/klein/blue grama mixture
Acres: 95.8
Major soil type: Bippus loam, 0 to 1% slope

Field No. 4: Plains/blue grama/klein mixture
Acres: 89.2
Major soil type: Bippus loam, 0 to 1% slope
Olton loam, 0 to 1 and 1 to 3% slope

Field No. 5: Plains/klein/blue grama mixture
Acres: 81.2
Major soil type: Olton loam, 0 to 1%slope
Bippus loam, 0 to 1% slope
Mansker loam, 0 to 3% slope

Field No. 6: Alfalfa/plains/blue grama/klein mixture
Acres: 69.6
Major soil type: Bippus loam, 0 to 1% slope

Dryland

Field No. 7: Plains/blue grama mixture
Acres: 30.0
Major soil type: Pullman clay loam, 0 to 1% slope

Field No. 8: Plains/blue grama/sand dropseed/buffalo mixture
Acres: 32.3
Major soil type: Bippus loam, 0 to 1% slope
Randall clay
Estacado loam, 1 to 3% slope

Field No. 9: Plains/blue grama mixture
Acres: 18.8
Major soil type: Olton loam, 1 to 3%slope
Mansker loam, 3 to 5% slope
Bippus fine sandy loam, overwash, 1 to 3% slope

Field No. 10: Plains/blue grama mixture
Acres: 16.9
Major soil type: Olton loam, 0 to 1% slope
Pullman clay loam, 0 to 1% slope

Field No. 11: Plains/blue grama mixture
Acres: 35.3
Major soil type: Bippus loam, 0 to 1% slope

Field No. 12 and 13: Pens and Barns
Acres: 7.7

Irrigation

Type: Center Pivot (MESA)
Pumping capacity, **gal/min**: 1100
Number of wells: 4
Fuel source: electric

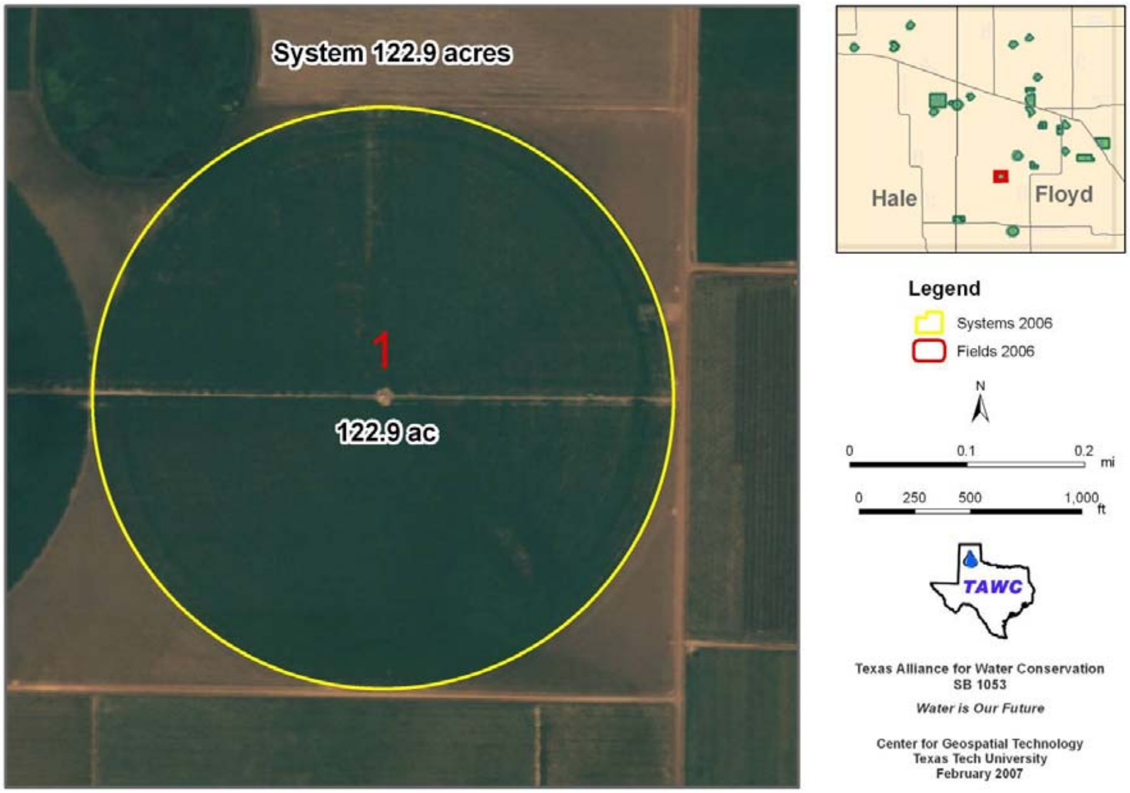
SITE 5 COMMENTS

This is a commercial, spring calving cow/calf operation. The 494.7 acres of irrigated grass is broken into six cells. This producer usually moves all cattle off site in early winter after the calves are weaned. Cows will calve on wheat and are then moved back on site.

Site No. 5

Item	Year 1	Year 2
Crop/Livestock system		
Bull calves, head/system acre	0.2134	0.2325
Heifer calves, head/system acre	0.1672	0.1672
Grass hay, tons	0	0.25
Field No.s 1, 2, 3, 4, 5, Irrigated		
Varieties	Plains old world bluestem, klinegrass, bluegrama	
Field No. 6, Irrigated		
Varieties	Plains old world bluestem, alfalfa	
Field No.s 7, 8, 9, 10, 11, Dryland		
Varieties	Plains old world bluestem, bluegrama	
Fertilizer, lbs/system acre		
Nitrogen	21	67
Phosphorus (P_2O_5)	57	16
Potassium (K_2O)	0	0
Sulphur	10	27
Water use, inches		
Irrigation		
By system	1.2	9.6
Precipitation	15.1	17.7
Total system (irrigation + precipitation)	16.3	27.3
Income and Expense, $/system acre		
Projected returns	279.80	378.29
Costs		
Total variable costs	89.52	163.44
Total fixed costs	64.39	64.39
Total all costs	153.91	227.83
Net returns		
Per system acre	125.89	150.46
Per acre inch of irrigation water	93.34	15.62
Per pound of Nitrogen	1.28	2.25

System 06 - 2006



***Site 6 Description*:**

Total acres in system: 122.9

Field No. 1:

Acres: 122.9

Major soil type: Pullman clay loam, 0 to 1% slope

Irrigation

Type: Center Pivot (LESA)

Pumping capacity, gal/min: 500

Number of wells: 4

Fuel source: natural gas

SITE 6 COMMENTS

This is a pivot irrigated cotton system, conventional tillage, and planted on forty-inch centers.

Site No. 6

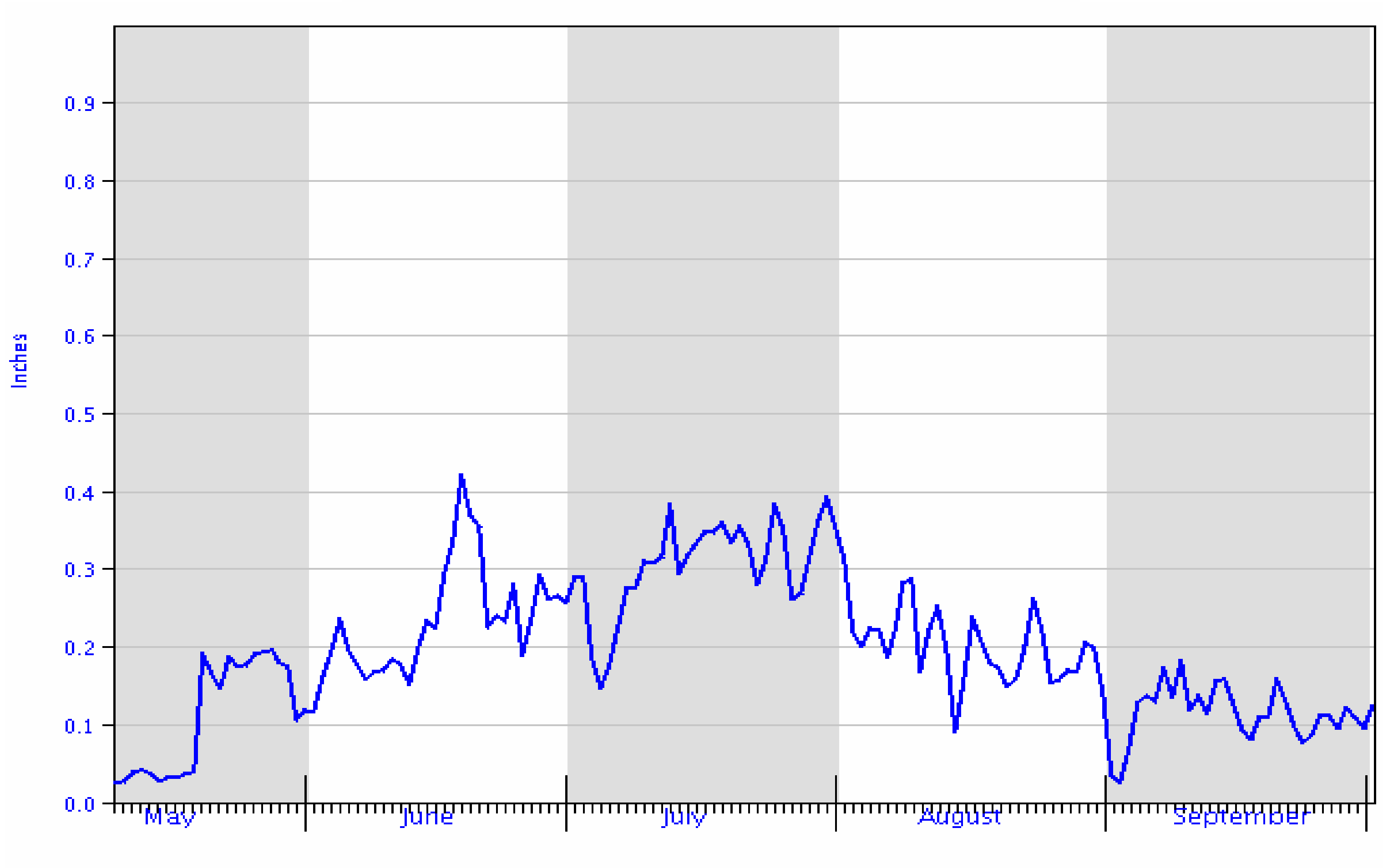
Item	Year 1	Year 2
Livestock,		
Stocker steers, gain/system, lbs	477	none in '06
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	Conventional
Cover crop	wheat (grazed)	none
Variety	'Stoneville 2448'	'Stoneville 4554-B2RF'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	1,216	1530
Lint, lbs/inch irrigation water	107	112
Lint, lbs/inch total water	46	50
Seed, tons	0.97	0.98
Pounds of water/lb lint	4907	4,574
Fertilizer, lbs/system acre		
Nitrogen	110	114
Phosphorus (P_2O_5)	24	52
Potassium (K_2O)	0	0
Other	0	0
Water use, inches		
Irrigation		
By field		
Field 1	11.4	13.6
By system	11.4	13.6
Precipitation	15.0	17.3
Total system (irrigation + precipitation)	26.4	30.9
Income and Expense, $/system acre		
Projected returns	758.20	988.99
Costs		
Total variable costs	577.69	588.60
Total fixed costs	78.60	78.60
Total all costs	656.29	667.20
Net returns		
Per system acre	102.63	321.79
Per acre inch of irrigation water	9.04	23.64
Per pound of Nitrogen	0.83	2.83

Site 6-1

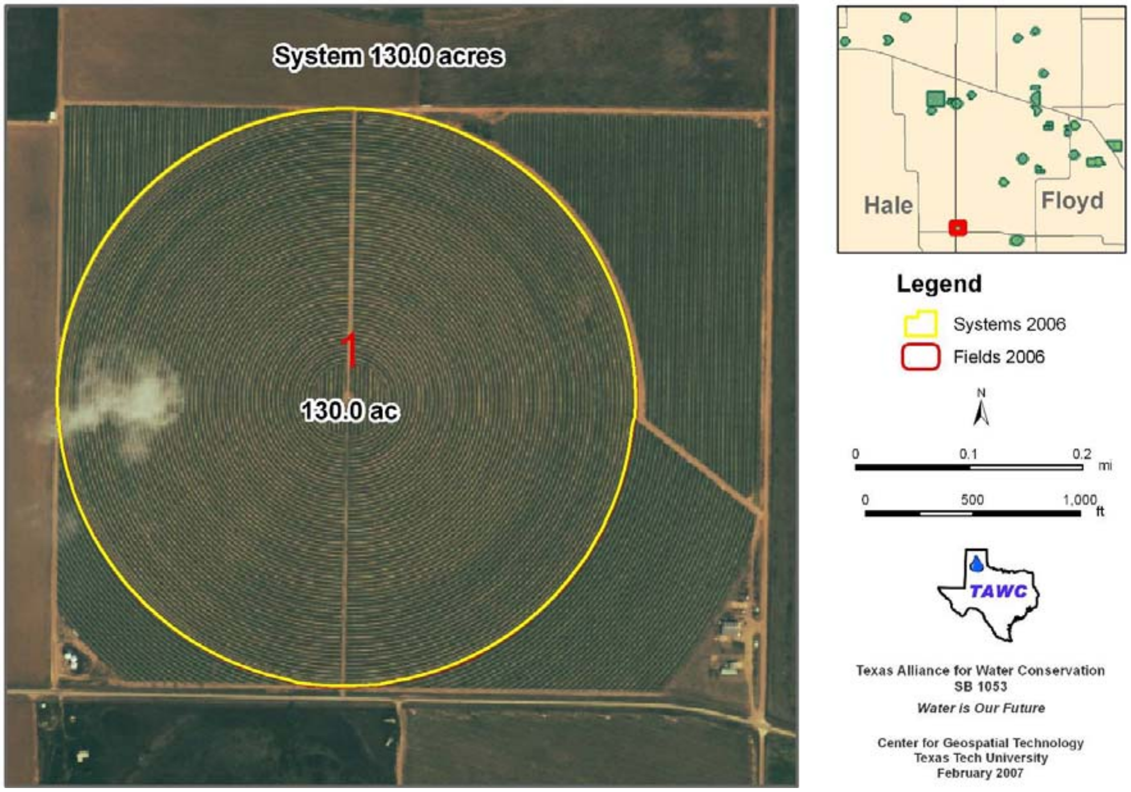
5/10/2006 to 10/01/2006 28.52 Inches

Lockney

PD1-PET Water Usage (Full Season Cotton) in



System 07 - 2006



***Site 7 Description*:**

Total acres in system: 130.0

Field No. 1: Sideoats grama, "Haskell"
Acres: 130.0
Major soil type: Pullman clay loam; 0 to 1% slope

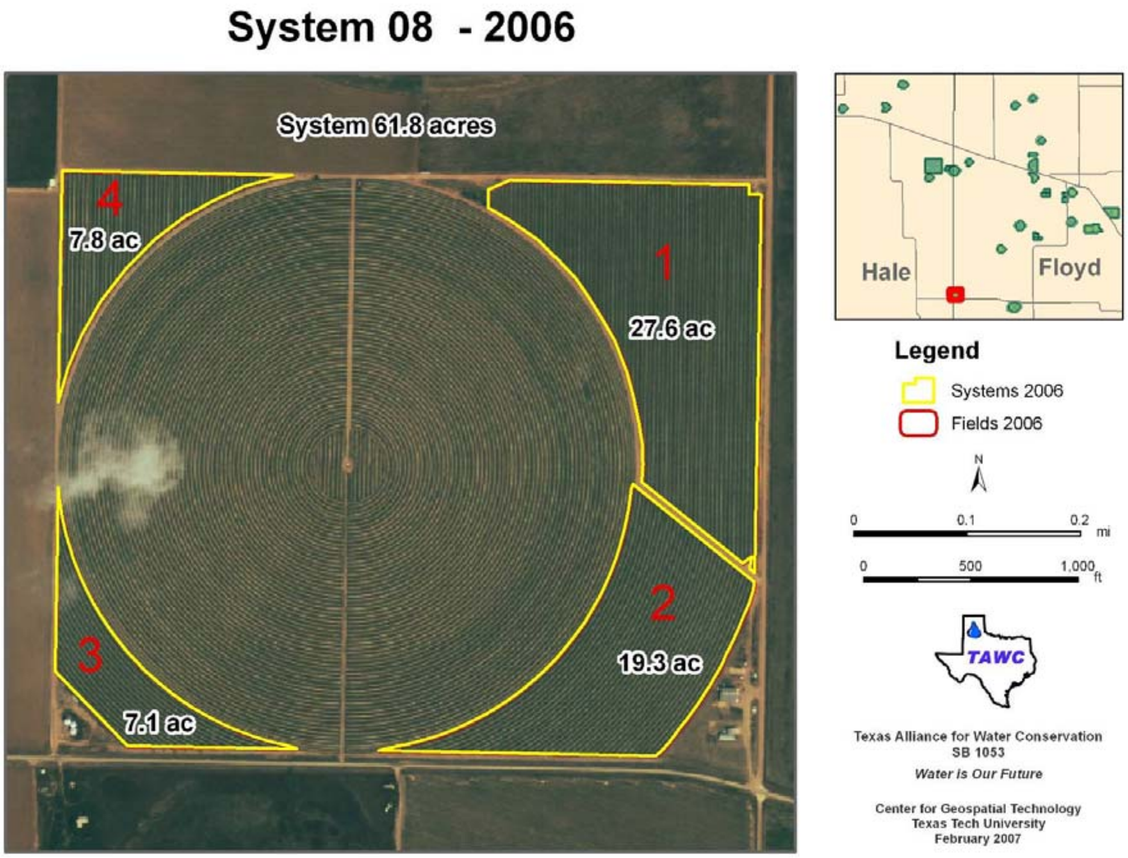
Irrigation
Type: Center Pivot (LESA)
Pumping capacity, gal/min: 500
Number of wells: 4
Fuel source: electric

SITE 7 COMMENTS

This is a pivot irrigated circle of side-oats grama grown for seed production and the residue is baled for hay and sold. This field was established twelve years ago.

Site No. 7

Item	Year 1	Year 2
Crops		
Field No. 1		
Sideoats grama		
Variety	'Haskell'	'Haskell'
Row spacing	40	40
Yield/acre		
Seed, lb	300	300
Hay, tons	3.5	2.89
Seed, lbs/inch irrigation water	31	39
Seed, lbs/inch total water	19	14
Pounds water/lb of seed	19,053	16,494
Fertilizer, lbs/system acre		
Nitrogen	156	108
Phosphorus (P_2O_5)	56	56
Potassium (K_2O)	0	0
Sulphur	8	8
Water use, inches		
Irrigation		
By field		
Field 1	9.8	7.8
By system	9.8	7.8
Precipitation	15.4	14.1
Total system (irrigation + precipitation)	25.2	21.9
Income and Expense, $/system acre		
Projected returns	1,328.48	1,760.10
Costs		
Total variable costs	824.55	994.14
Total fixed costs	78.60	78.60
Total all costs	903.15	1,072.74
Net returns		
Per system acre	425.32	687.36
Per acre inch of irrigation water	37.81	88.69
Per pound of Nitrogen	2.73	6.28



***Site 8 Description*:**

Total acres in system: 61.8

Field No. 1: Sideoats grama, "Haskell"
Acres: 27.6
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2: Sideoats grama, "Haskell"
Acres: 19.3
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3: Sideoats grama, "Haskell"
Acres: 7.1
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 4: Sideoats grama, "Haskell"
Acres: 7.8
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Sub-surface Drip (SDI); 40 inch centers
Pumping capacity, gal/min: 360
Number of wells: 4
Fuel source: electric

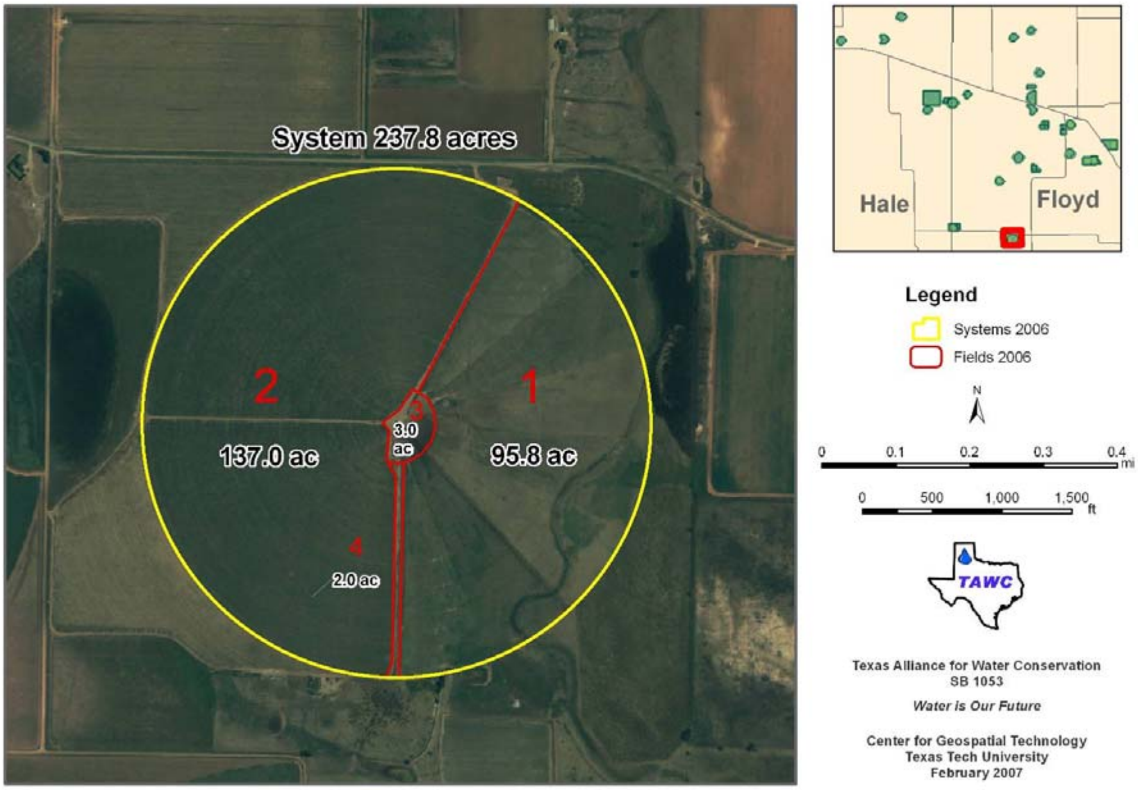
SITE 8 COMMENTS

This is a drip irrigated field of side-oats grama grown for seed production and the residue is baled for hay and sold. These four fields were put into drip three years ago. Prior to the installation of drip these fields were flood irrigated.

Site No. 8

Item	Year 1	Year 2
Crops		
Field No. 1, 2, 3, 4		
Sideoats grama		
Variety	'Haskell'	'Haskell'
Row spacing	40	40
Yield/acre		
Seed, lb	325	235
Hay, tons	3.7	1.36
Seed, lbs/inch irrigation water	28.9	30
Seed, lbs/inch total water	12.2	11
Pounds water/lb of seed	18,570	20,237
Fertilizer, lbs/system acre		
Nitrogen	156	108
Phosphorus (P_2O_5)	56	56
Potassium (K_2O)	0	0
Sulphur	8	8
Water use, inches		
Irrigation		
By field		
Field 1, 2, 3, 4	11.3	7.8
By system	11.3	7.8
Precipitation	15.4	13.3
Total system (irrigation + precipitation)	26.7	21.0
Income and Expense, $/system acre		
Projected returns	1,229.02	1,297.04
Costs		
Total variable costs	759.13	800.68
Total fixed costs	120.00	120.00
Total all costs	879.13	920.68
Net returns		
Per system acre	349.90	376.36
Per acre inch of irrigation water	35.56	48.56
Per pound of Nitrogen	2.24	3.48

System 09 - 2006



***Site 9 Description*:**

Total acres in system: 237.8 (232.8 in production, 5.0 pens and feed alley)

Field No. 1: Klein/buffalo/annual forb/interseeded rye mixture
Acres: 95.8
Major soil type: Mixed shallow soils

Field No. 2:
Acres: 137.0
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3 and 4: Pens and Feed Alley
Acres: 5.0

Irrigation
Type: Center Pivot (MESA)
Pumping capacity, gal/min: 900
Number of wells: 4
Fuel source: 2 natural gas; 2 diesel

SITE 9 COMMENTS

This is a no-till, pivot irrigated cotton/grass/livestock system. Field 2 is planted to cotton and after harvest is planted to rye for grazing. After being grazed the rye is terminated and then planted to cotton. The grass is also interseeded with rye for fall and winter grazing. This producer uses this system for a stocker cattle operation.








Site No. 9

Item	Year 1	Year 2
Livestock, Stocker cattle		
Crops		
Field No. 1		
Pasture		
Variety	Kleingrass/buffalograss	Kleingrass/buffalograss
Interseeded	Elbon rye	Elbon rye
Yield/acre		
Grazing, gain (cwt)	4.01	3.73
Hay, tons	0.66	0
Hay, lbs/inch irrigation water	880	-
Hay, lbs/inch total water	83	-
Pounds water/lb of hay	2,728	-
Field No. 2		
Cotton		
Tillage system	No-till	No-till
Cover crop	Rye, for grazing	Rye, no grazing
Variety	'FiberMax 989 BR'	'FM 989 B2R'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	1,394	1,154
Lint, lbs/inch irrigation water	137	66
Lint, lbs/inch total water	67	36
Seed, tons	0.85	0.87
Pounds water/lb of lint	3,395	6,348
Fertilizer, lbs/system acre		
Compost, tons/acre	3	3[2]
Nitrogen	88	90
Phosphorus (P_2O_5)	88	90
Potassium (K_2O)	88	90
Sulphur	21	21

[2] Compost provided 88 lbs of nitrogen in 2005 and 90 lbs of nitrogen in 2006 plus all other nutrients.

Water use, inches

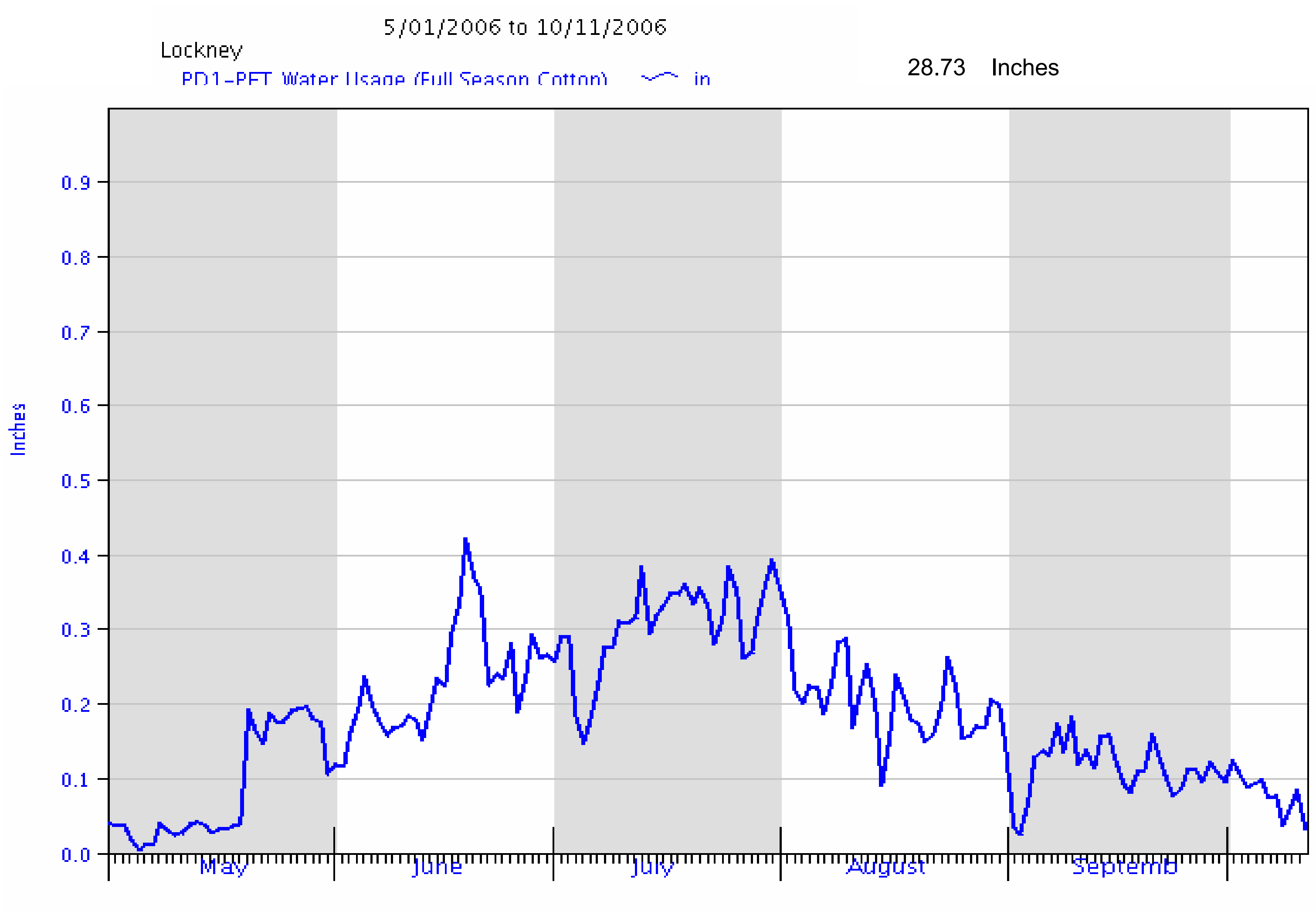
Irrigation		
By field		
Field 1	1.5	0.0
Field 2	10.2	17.6
By system	6.5	10.6
Precipitation	14.4	14.8
Total system (irrigation + precipitation)	20.9	25.4

Income and Expense, $/system acre

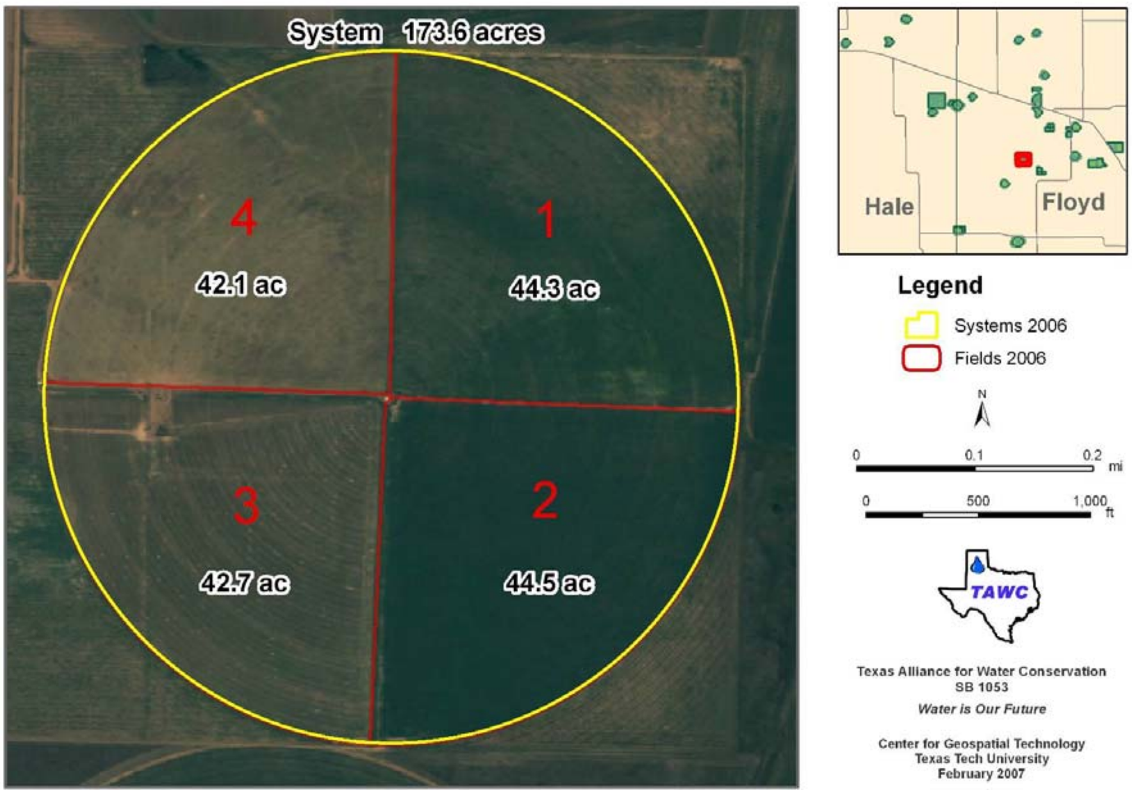
Projected returns	732.28	493.00
Costs		
Total variable costs	357.19	352.77
Total fixed costs	76.95	76.95
Total all costs	434.14	429.71
Net returns		
Per system acre	298.14	63.29
Per acre inch of irrigation water	46.17	6.26
Per pound of Nitrogen	3.39	0.04

Site 9-2

28.73 Inches



System 10 - 2006



***Site 10 Description*:**

Total acres in system: 173.6

Field No. 1: early grass establishment
Acres: 44.3
Major soil type: Pullman clay loam; 0 to 1% slope
Lofton clay loam, 0 to 1% slope
Estacado clay loam, 0 to 1% slope

Field No. 2:
Acres: 44.5
Major soil type: Pullman clay loam; 0 to 1% slope
Estacado clay loam, 0 to 1% slope

Field No. 3: Old world bluestem, "WW B. Dahl"
Acres: 42.7
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 4: Bermudagrass/johnsongrass mixture
Acres: 42.1
Major soil type: Pullman clay loam; 0 to 1 and 1 to 3% slope
Lofton clay loam, 0 to 1% slope

Irrigation

Type: Center Pivot (LESA)
Pumping capacity, gal/min: 800
Number of wells: 2
Fuel source: electric

SITE 10 COMMENTS

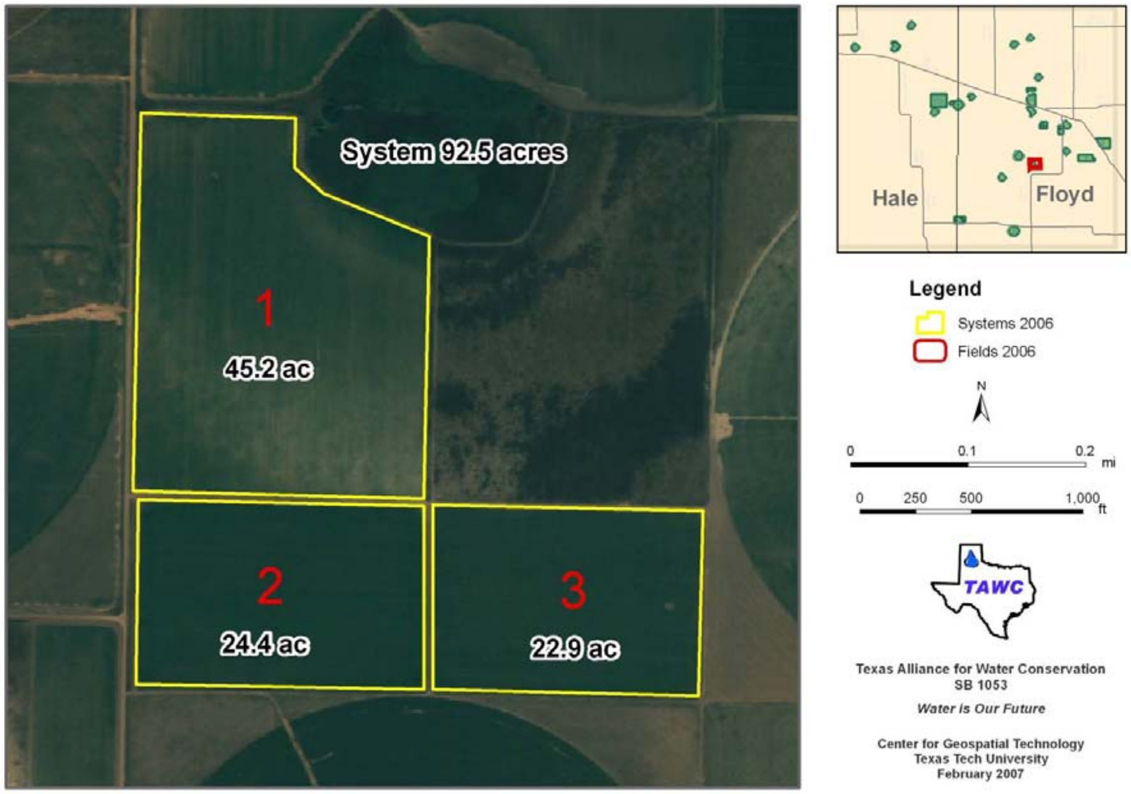
This is a four cell, pivot irrigated forage/livestock system. Two of the cells are planted to Old-World bluestem and one cell is planted to bermudagrass. The fourth cell has been planted to oats and then to forage sorghum with both being harvested for hay. This producer runs a registered cow/calf program.

Site No. 10

Item	Year 1	Year 2
Livestock	Cow-calf	Cow-calf
Crops		
Field No. 1		
Grass (established in 2005)		
Variety	WW-B. Dahl old world bluestem	
Yield/acre		
Grazed, animal days/acre	0	77.95
Field No. 2		
Cotton		
Tillage system	Conventional	-
Cover crop	None	-
Variety	'FM832LL'	-
Row spacing, inches	40	-
Yield/acre		
Lint, lb	1,535	-
Lint, lbs/inch irrigation water	128	-
Lint, lbs/inch total water	66	-
Seed, tons	1.05	-
Pounds water/lb of lint	3,408	-
Field No. 2A		
Oats		
Variety	-	Troy
Row spacing, inches	-	7, cross-seeded
Yield/acre		
Hay, tons	-	1.79
Field No. 2B		
Haygrazer		
Variety	-	
Row spacing, inches	-	7
Yield/acre		
Hay, tons	-	2.20

Field No. 3		
Old World Bluestem		
Variety	'WW-B. Dahl'	'WW-B. Dahl'
Yield/acre		
Grazed, head days/acre	125.29	80.87
Hay, tons	2.03	0
Field No. 4		
Bermudagrass (seeded in 2005)		
Variety	'Giant' and 'common'	'Giant' and 'common'
Yield/acre		
Grazed, animal days/acre	127.08	82.03
Hay, tons	0	1.80
Fertilizer, lbs/system acre		
Nitrogen	40	51
Phosphorus (P_2O_5)	0	0
Potassium (K_2O)	0	0
Other	0	0
Water use, inches		
Irrigation		
By field		
Field 1	6	13.2
Field 2	12	4.9 (oats)
Field 2	-	16.5 (sorghum)
Field 3	6	16.1
Field 4	10	14.0
By system	8.5	16.1
Precipitation	11.1	15.1
Total system (irrigation + precipitation)	19.6	31.1
Income and Expense, $/system acre		
Projected returns	503.21	460.47
Costs		
Total variable costs	228.32	164.16
Total fixed costs	87.17	78.60
Total all costs	315.49	242.76
Net returns		
Per system acre	187.72	217.71
Per acre inch of irrigation water	22.06	13.52
Per pound of Nitrogen	4.69	4.25

System 11 - 2006



***Site 11 Description*:**

Total acres in system: 92.5

Field No. 1:
Acres: 45.2
Major soil type: Lofton clay loam, 0 to 1% slope
Olton clay loam, 1 to 3% slope

Field No. 2
Acres: 24.4
Major soil type: Pullman clay loam; 0 to 3% slope

Field No. 3
Acres: 22.9
Major soil type: Pullman clay loam; 0 to 3% slope

Irrigation
Type: Furrow
Pumping capacity, gal/min: 490
Number of wells: 1
Fuel source: electric

SITE 11 COMMENTS

This is a flood irrigated cotton system under conventional tillage and planted on forty-inch centers.

Site No. 11

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	Conventional
Cover crop	none	None
Variety	'ADF 3511'	'FM 989 RR'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	723.8	1123.01
Lint, lbs/inch irrigation water	79	67
Lint, lbs/inch total water	34	38
Seed, tons	0.58	0.81
Pounds water/lb of lint	6,571	6,030
Field No. 2		
Cotton		
Tillage system	Conventional	Conventional
Cover crop	none	None
Variety	'ADF 3511'	'NexGen 2448 RR'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	723.8	1,109.51
Lint, lbs/inch irrigation water	79	66
Lint, lbs/inch total water	34	37
Seed, tons	0.58	0.80
Pounds water/lb of lint	6,571	6,103
Field No. 3		
Cotton		
Tillage system	Conventional	Conventional
Cover crop	none	None
Variety	'ADF 3511'	'NexGen 2448 RR'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	723.8	789.69
Lint, lbs/inch irrigation water	79	47
Lint, lbs/inch total water	34	26
Seed, tons	0.58	0.57

Pounds water/lb of lint	6,571	8,572

Fertilizer, lbs/system acre

Nitrogen	40	50
Phosphorus (P_2O_5)	45	25
Potassium (K_2O)	0	0
Sulphur	10	0

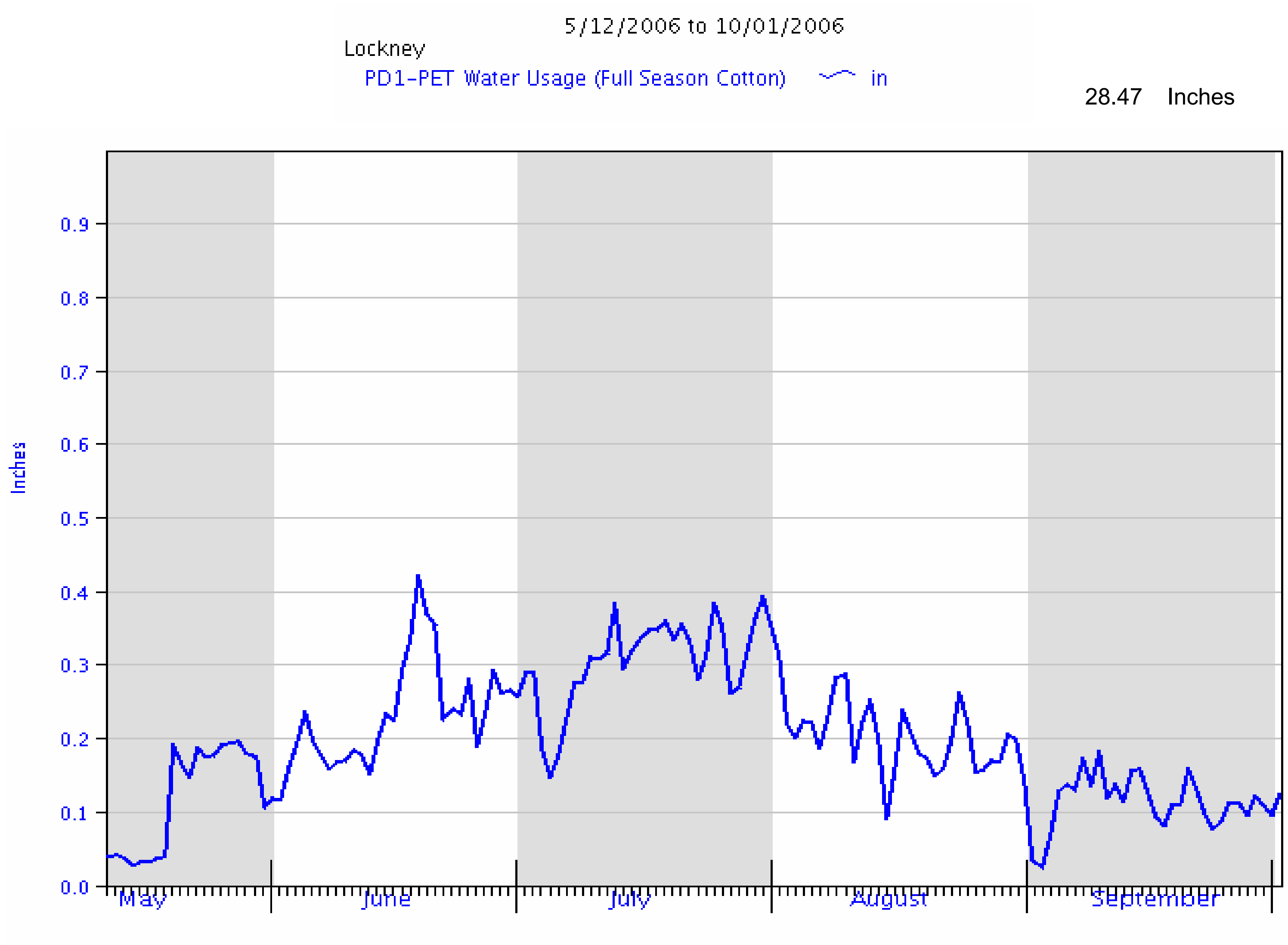
Water use, inches

Irrigation		
By field		
Field 1	9.2	16.9
Field 2	9.2	16.9
Field 3	9.2	16.9
By system	9.2	16.9
Precipitation	14.4	13.0
Total system (irrigation + precipitation)	21.0	29.9

Income and Expense, $/system acre

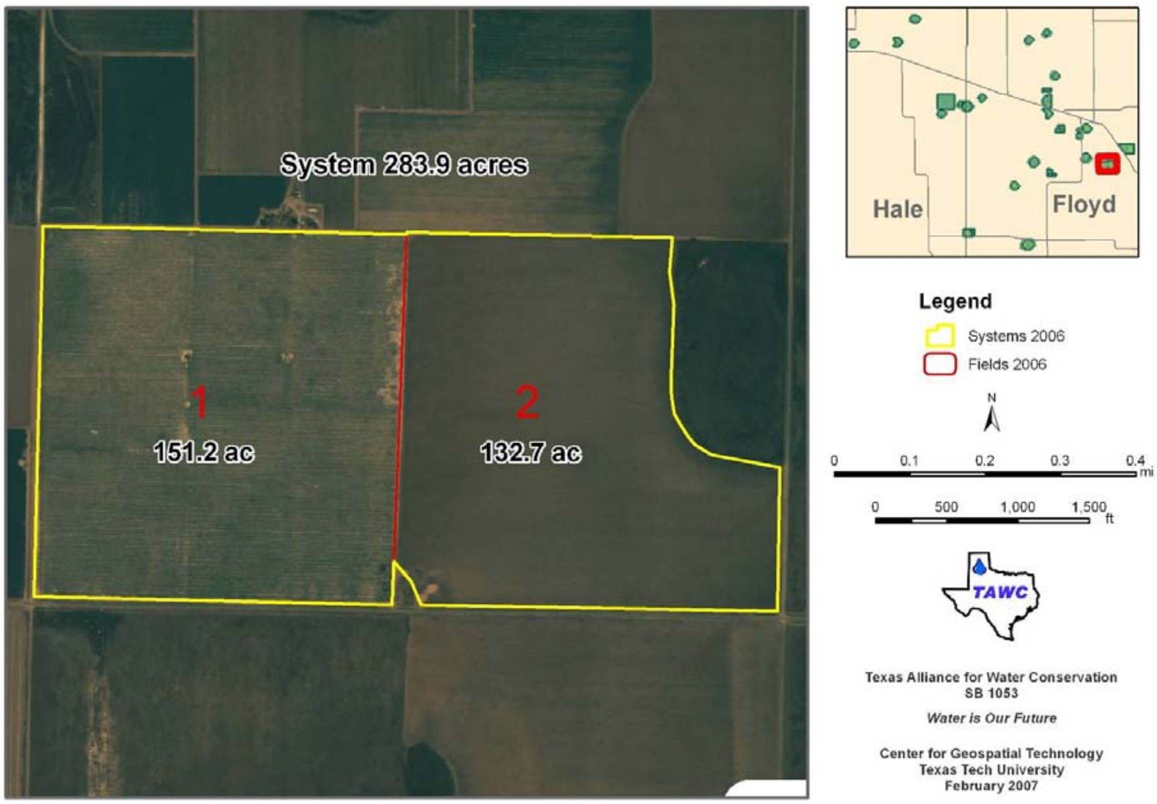
Projected returns	461.24	681.64
Costs		
Total variable costs	386.35	523.45
Total fixed costs	70.00	70.00
Total all costs	456.85	593.45
Net returns		
Per system acre	4.39	88.18
Per acre inch of irrigation water	0.48	5.22
Per pound of Nitrogen	0.11	1.76

Site 11-1,2,3



5/12/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton) in
28.47 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August
September

System 12 - 2006



***Site 12 Description*:**

Total acres in system: 283.9

Field No. 1:
Acres: 151.2
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2:
Acres: 132.7
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Dryland

SITE 12 COMMENTS

This dryland system uses cotton and small grains in rotation. This year the cotton was planted in forage sorghum residue on forty-inch centers under limited tillage. Small grains are drilled after cotton harvest.

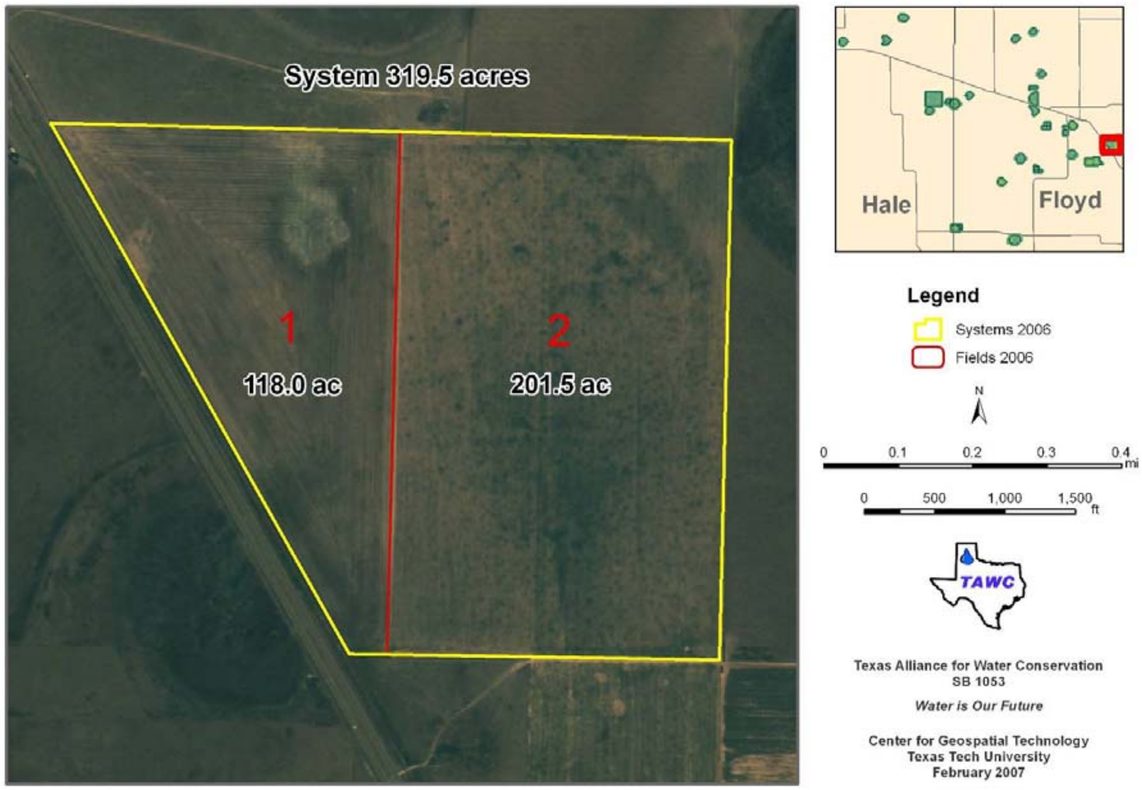
Site No. 12

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	No-till	-
Cover crop	Wheat	-
Variety	'PayMaster 2266'	-
Row spacing, inches	40	-
Yield/acre		
Lint, lb	615	-
Lint, lbs/inch irrigation water	NA	-
Lint, lbs/inch total water	49	-
Seed, tons	0.47	-
Pounds water/lb of lint	4,603	-
Field No. 1		
Wheat		
Tillage system	-	No-till
Cover crop	-	wheat
Variety	-	Tam 202
Row spacing, inches	-	7
Yield/acre		
Forage, lb	-	0
Forage, lbs/inch irrigation water	-	0
Forage, lbs/inch total water	-	0
Pounds water/lb of forage	-	0
Field No. 2		
Wheat/Forage sorghum		
Tillage system	No-till	-
Cover crop		-
Variety		-
Row spacing, inches	40	-
Yield/acre		
Forage, lb	0	-
Forage, lbs/inch irrigation water	0	-
Forage, lbs/inch total water	0	-
Pounds water/lb of forage	0	-

Field No. 2

Cotton		
Tillage system	-	Limit-till
Cover crop	-	Sorghum stubble
Variety	-	'PayMaster 2266'
Row spacing, inches	-	40
Yield/acre		
Lint, lb	-	0
Lint, lbs/inch irrigation water	-	NA
Lint, lbs/inch total water	-	0
Seed, tons	-	0
Pounds water/lb of lint	-	0
Fertilizer, lbs/system acre		
Nitrogen	0	8
Phosphorus (P_2O_5)	0	25
Potassium (K_2O)	0	0
Other	0	0
Water use, inches		
Irrigation		
By field		
Field 1	Dryland	Dryland
Field 2	Dryland	Dryland
By system		
Precipitation	12.5	13.5
Total system (irrigation + precipitation)	12.5	13.5
Income and Expense, $/system acre		
Projected returns	198.49	71.56
Total variable costs	154.50	70.28
Total fixed costs	7.99	15.00
Total all costs	162.49	85.28
Net returns		
Per system acre	36.00	-13.72
Per acre inch of irrigation water	NA	NA
Per pound of Nitrogen	NA	NA

System 13 - 2006



***Site 13 Description*:**

Total acres in system: 319.5

Field No. 1:
Acres: 118.0
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2
Acres: 201.5
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Dryland

SITE 13 COMMENTS

This dryland site uses cotton and small grains in rotation. Cotton is planted on forty-inch centers under limited tillage. Small grains are drilled after cotton harvest.

Site No. 13

Item	Year 1	Year 2
Crops		
Field No. 1		
Wheat		
Tillage system	Conventional	-
Cover crop	NA	-
Variety	Tam111	-
Row spacing, inches	40	-
Yield/acre		
Grain, bu	34.5	-
Grain, lbs/inch irrigation water	NA	-
Grain, lbs/inch total water	127	-
Pounds water/lb of grain	1,783	-
Field No. 1		
Cotton		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	NG 3350 RF
Row spacing, inches	-	40
Yield/acre		
Lint, lb	-	187
Lint, lbs/inch irrigation water	-	NA
Lint, lbs/inch total water	-	13
Seed, tons	-	0.12
Pounds water/lb of lint	-	17,681
Field No. 2		
Cotton		
Tillage system	Conventional	
Cover crop	None	
Variety	'HS2326'	NG 3350 RF
Row spacing, inches		
Yield/acre		
Lint, lb	602	187
Lint, lbs/inch irrigation water	NA	NA
Lint, lbs/inch total water	37	13
Seed, tons	0.45	0.12

Pounds water/lb of lint	6,136	17,681
Field No. 2		
Wheat		
Tillage system	-	Crop lost
Cover crop	-	to drought
Variety	-	Tam 111
Row spacing, inches	-	7

Yield/acre

Grain, bu	-	-
Grain, lbs/inch irrigation water	-	-
Grain, lbs/inch total water	-	-
Pounds water/lb of grain	-	-

Fertilizer, lbs/system acre

Nitrogen	25	1.7
Phosphorus (P_2O_5)	0	0
Potassium (K_2O)	0	0
Other	0	0

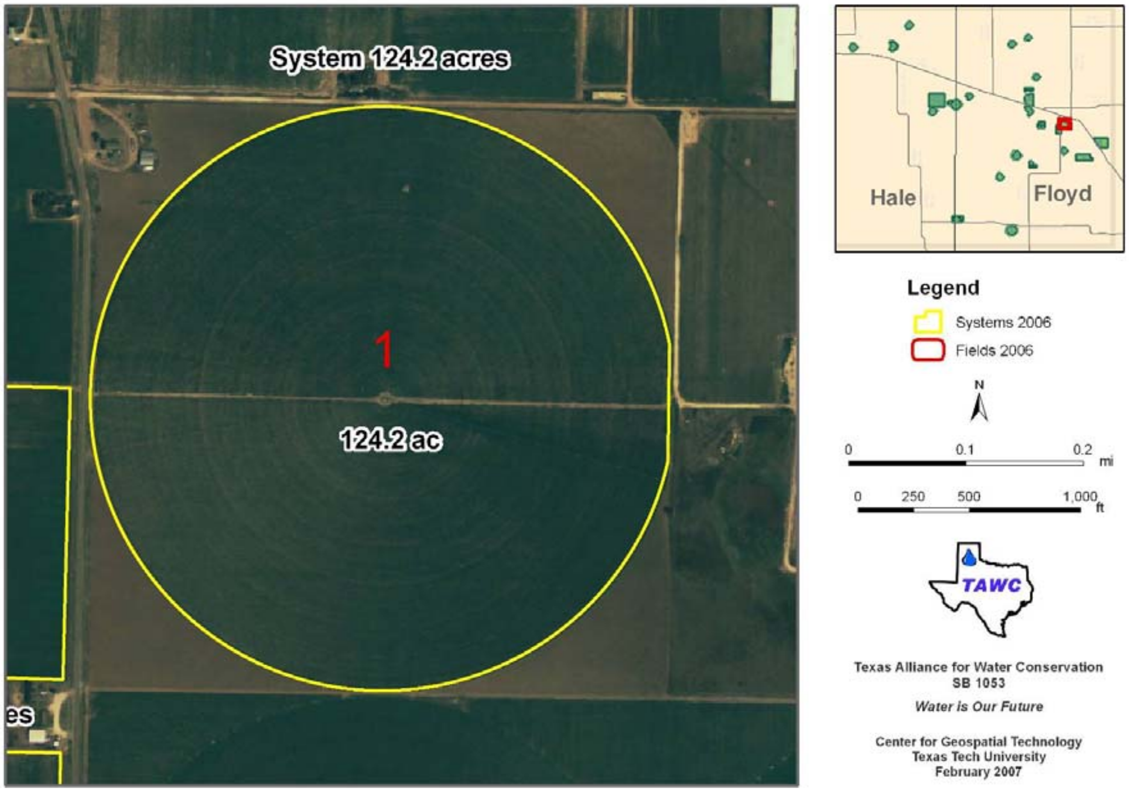
Water use, inches

Irrigation		
By field		
Field 1	Dryland	Dryland
Field 2	Dryland	Dryland
By system		
Precipitation	16.3	14.6
Total system (irrigation + precipitation)	16.3	14.6

Income and Expense, $/system acre

Projected returns	265.97	54.35
Costs		
Total variable costs	203.60	72.90
Total fixed costs	15.00	15.00
Total all costs	218.60	87.90
Net returns		
Per system acre	47.37	-33.56
Per acre inch of irrigation water	NA	NA
Per pound of Nitrogen	1.89	-

System 14 - 2006



***Site 14 Description*:**

Total acres in system: 124.2

Field No. 1:

Acres: 124.2

Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot

Pumping capacity, gal/min: 300

Number of wells: 3

Fuel source: electric

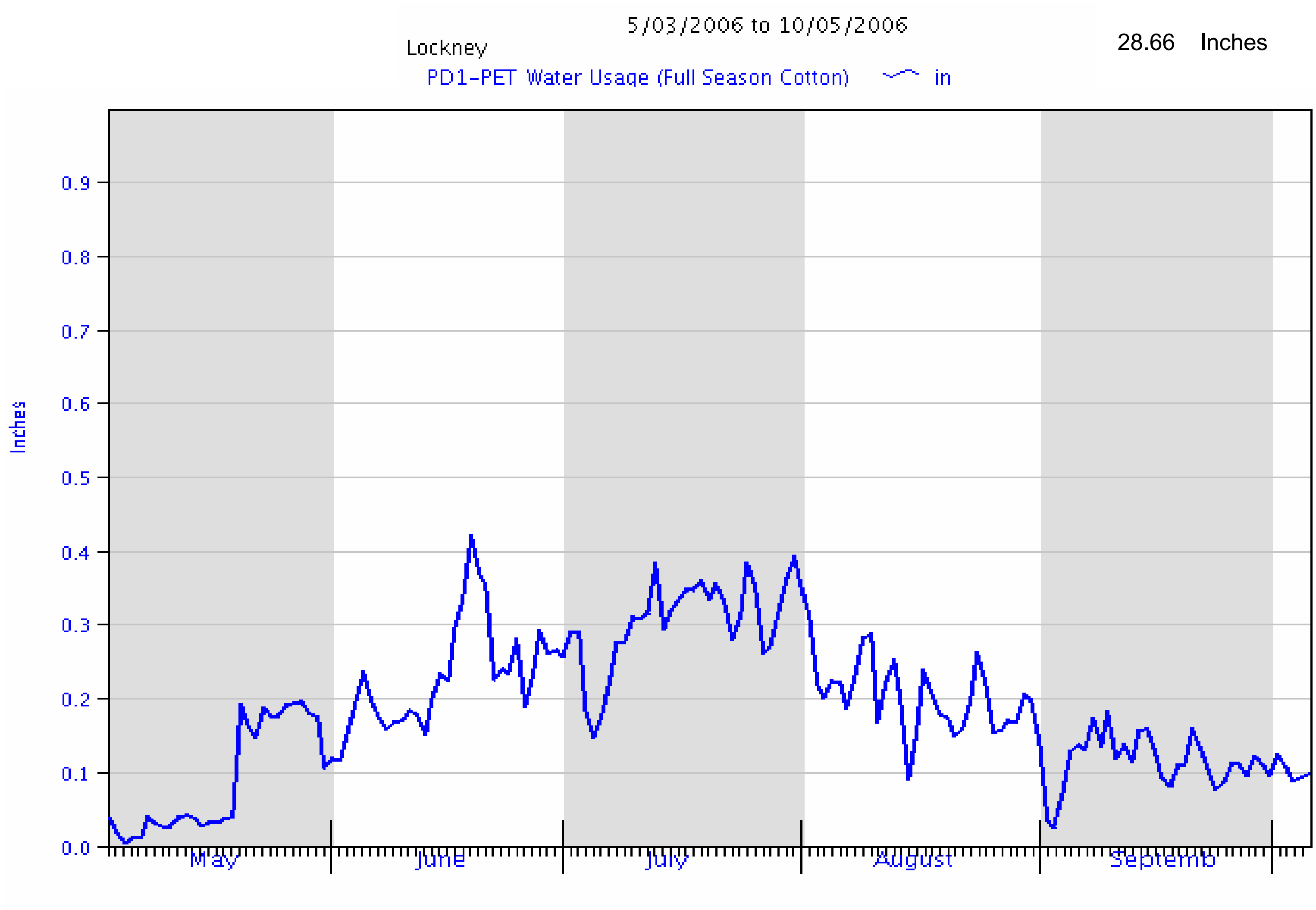
SITE 14 COMMENTS

This is a pivot irrigated site with limited water available. The producer uses conventional tillage and plants on forty-inch centers.

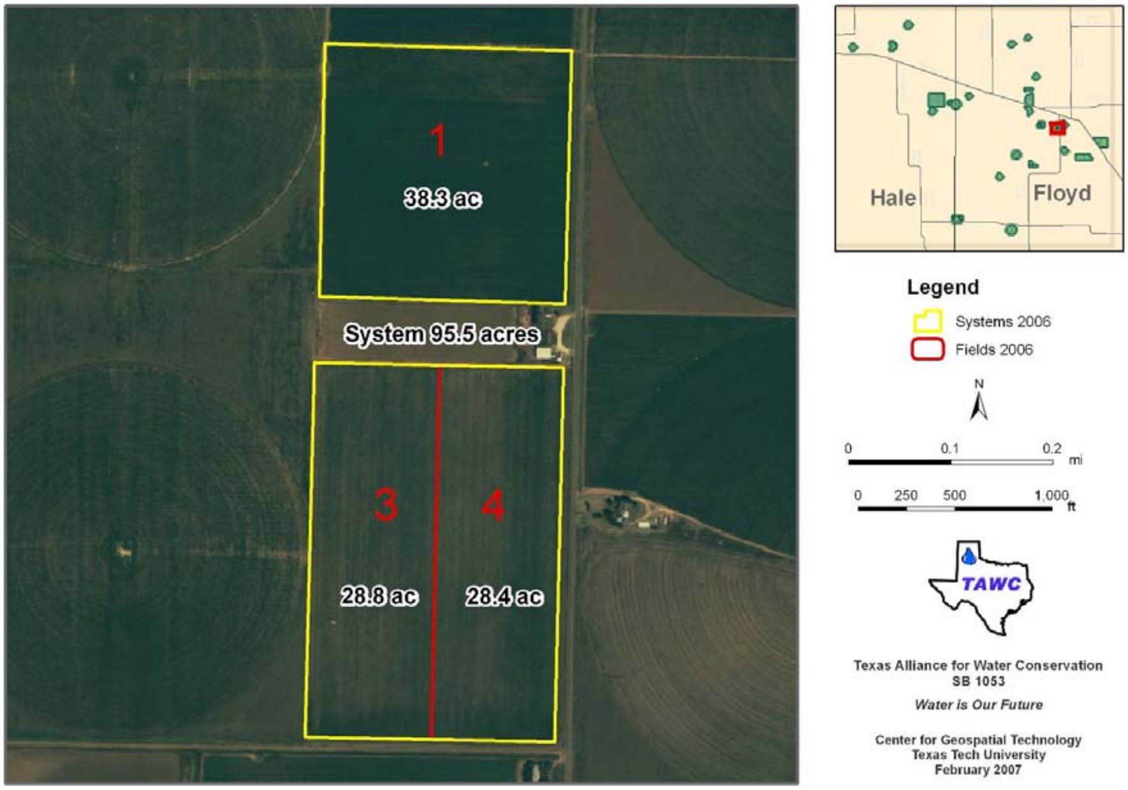
Site No. 14

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	Conventional
Cover crop	None	None
Variety	'Fibermax 960 RR' Paymaster 2266'	'Paymaster 2266'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	1,004	768.48
Lint, lbs/inch irrigation water	148	124
Lint, lbs/inch total water	48	36
Seed, tons	0.76	0.59
Pounds water/lb of lint	4,680	6,165
Fertilizer, lbs/system acre		
Nitrogen	81	107
Phosphorus (P_2O_5)	77	25
Potassium (K_2O)	0	0
Sulphur	21	0
Water use, inches		
Irrigation		
By field		
Field 1	6.8	6.2
By system	6.8	6.2
Precipitation	14.0	14.7
Total system (irrigation + precipitation)	20.8	20.9
Income and Expense, $/system acre		
Projected returns	621.42	509.82
Costs		
Total variable costs	421.91	386.41
Total fixed costs	78.60	78.60
Total all costs	500.51	465.01
Net returns		
Per system acre	120.90	44.81
Per acre inch of irrigation water	17.91	7.20
Per pound of Nitrogen	1.49	0.42

Site 14-1


5/03/2006 to 10/05/2006
Lockney
28.66 Inches
PD1-PET Water Usage (Full Season Cotton) in
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August
Septemb

System 15 - 2006



***Site 15 Description*:**

Total acres in system: 95.5

Field No. 1:
Acres: 38.3
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2: *2005 only, split into fields 3 and 4 for 2006*
Acres: 57.2
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. : *2006 only*
Acres: 28.8
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 4: *2006 only*
Acres: 28.4
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Furrow
Pumping capacity, gal/min: 290
Number of wells: 1
Fuel source: natural gas

SITE 15 COMMENTS

This flood irrigated site added grain sorghum for 2006. He uses conventional tillage by relisting his beds each growing season and plants on forty-inch centers.

Site No. 15

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	Conventional
Cover crop	None	None
Variety	'Paymaster 2326'	'FM 960 RR'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	377.5	1,327.9
Lint, lbs/inch irrigation water	82	94
Lint, lbs/inch total water	15	47
Seed, tons	0.54	0.86
Pounds water/lb of lint	15,477	4,860
Field No. 2		
Cotton		
Tillage system	Conventional	-
Cover crop	None	-
Variety	'Paymaster 2280'	-
Row spacing, inches	40	-
Yield/acre		
Lint, lb	911	-
Lint, lbs/inch irrigation water	198	-
Lint, lbs/inch total water	35	-
Seed, tons	0.76	-
Pounds water/lb of lint	6,414	-
Field No. 3		
Cotton		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	'FM 960 RR'
Row spacing, inches	-	40
Yield/acre		
Lint, lb	-	1,487.2
Lint, lbs/inch irrigation water	-	106
Lint, lbs/inch total water	-	52
Seed, tons	-	1.03

Pounds water/lb of lint	-	4,340

Field No. 4

Grain sorghum		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	'DK 40 Y'
Row spacing, inches	-	40

Yield/acre

Grain, cwt	-	29.87
Grain, lbs/inch irrigation water	-	705
Grain, lbs/inch total water	-	139
Pounds water/lb of grain	-	1,630

Fertilizer, lbs/system acre

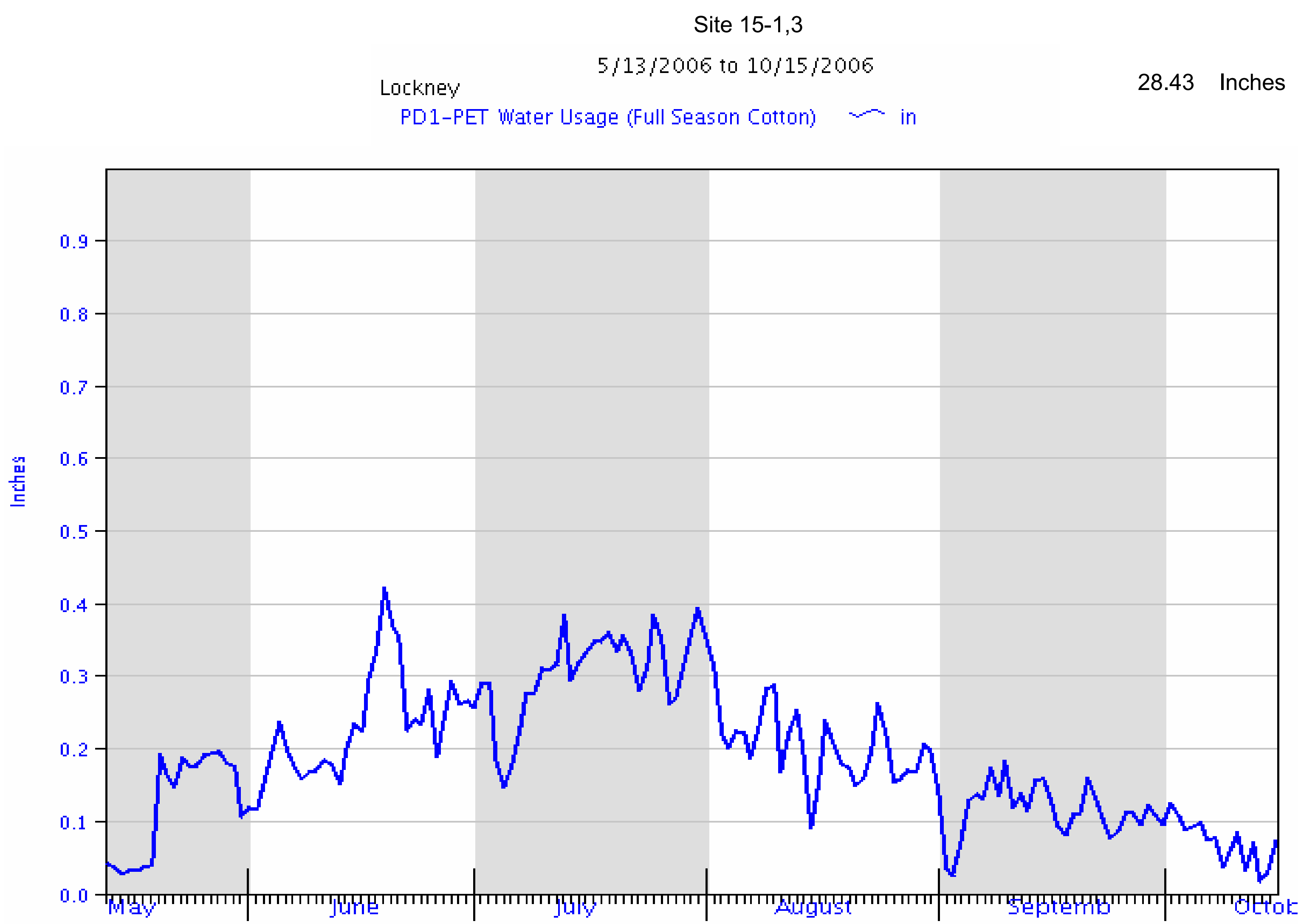
Nitrogen	80	95
Phosphorus (P_2O_5)	48	21
Potassium (K_2O)	0	0
Zinc	20	0

Water use, inches

Irrigation		
By field		
Field 1	4.6	14.1
Field 2	4.6	-
Field 3	-	14.1
Field 4	-	4.2
By system	4.6	11.2
Precipitation	19.2	17.4
Total system (irrigation + precipitation)	25.8	28.6

Income and Expense, $/system acre

Projected returns	517.14	692.32
Costs		
Total variable costs	384.49	460.43
Total fixed costs	70.00	70.00
Total all costs	454.49	530.43
Net returns		
Per system acre	62.65	161.89
Per acre inch of irrigation water	13.62	14.51
Per pound of Nitrogen	0.78	1.71


Site 15-1,3
5/13/2006 to 10/15/2006
Lockney
PD1-PET Water Usage (Full Season Cotton)
in
28.43 Inches
Inches
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
May
June
July
August
Septemb
Octob

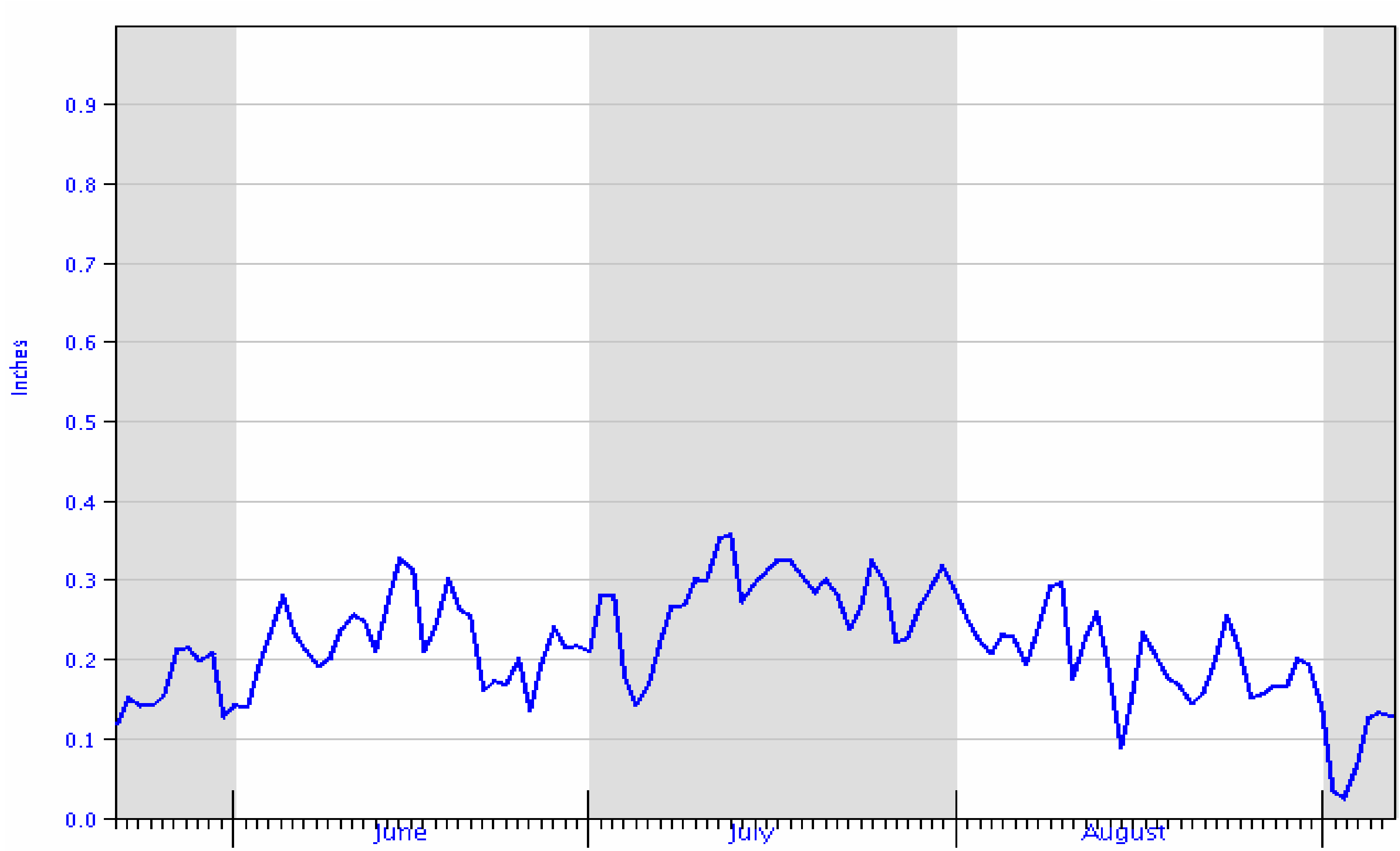
Site 15-4

5/22/2006 to 9/06/2006

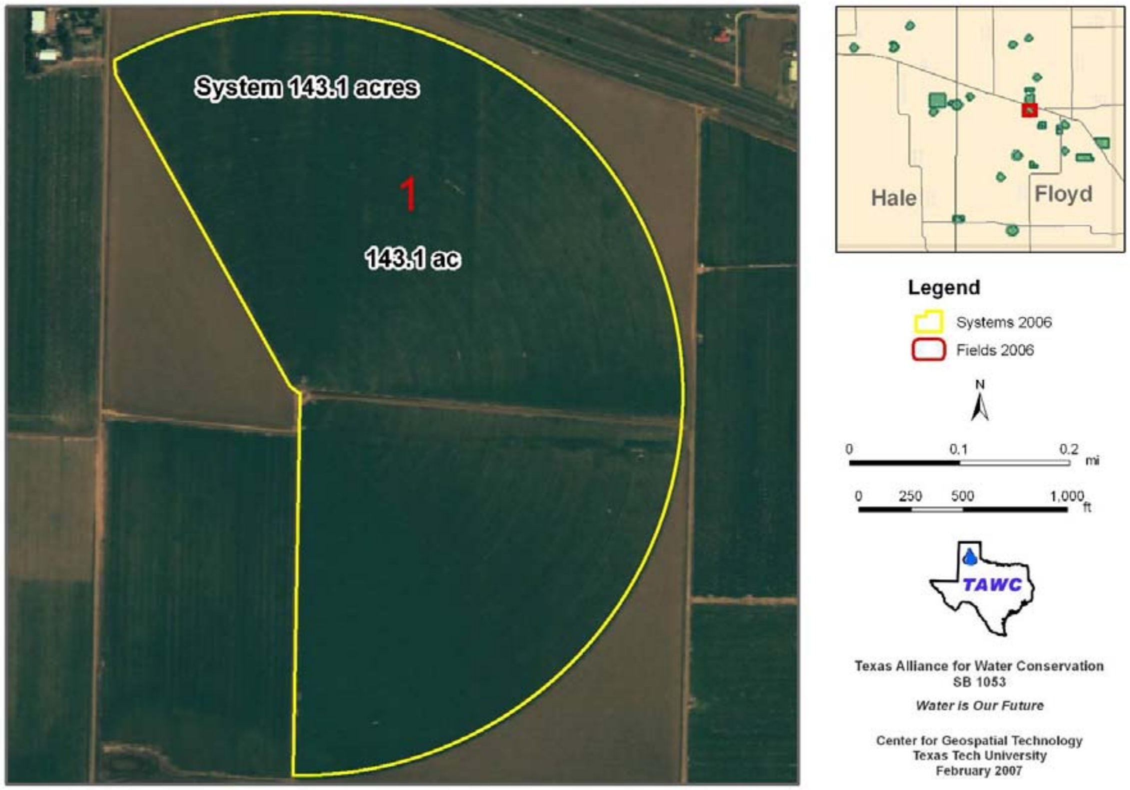
Lockney

PD1-PET Water Usage (Full Season Sorghum) in

23.54 Inches



System 16 - 2006



***Site 16 Description*:**

Total acres in system: 143.1

Field No. 1:

Acres: 143.1

Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Center Pivot (LESA)

Pumping capacity,gal/min: 600

Number of wells: 3

Fuel source: electric

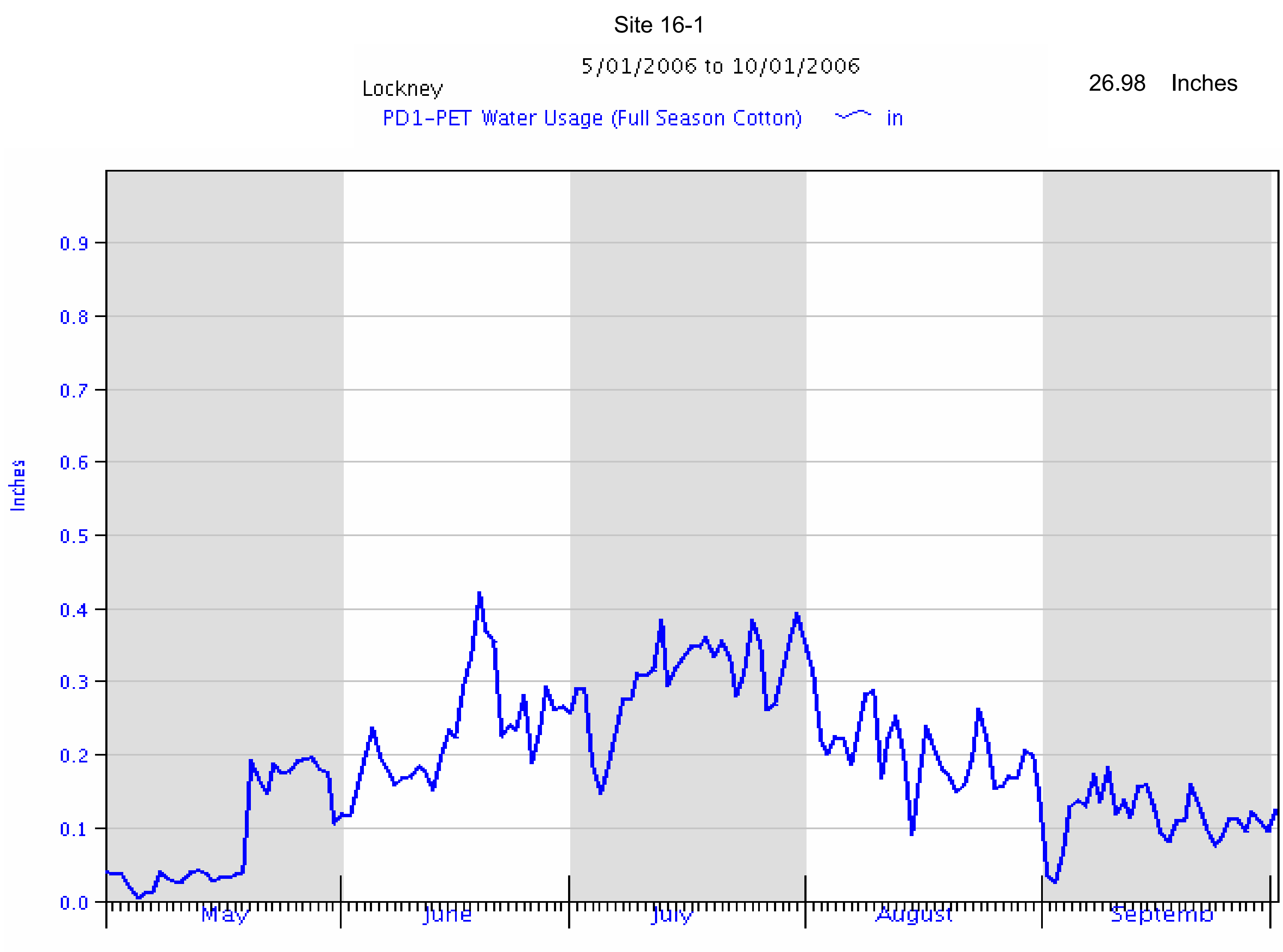
SITE 16 COMMENTS

This pivot irrigated cotton site uses conventional tillage and plants on forty-inch centers.

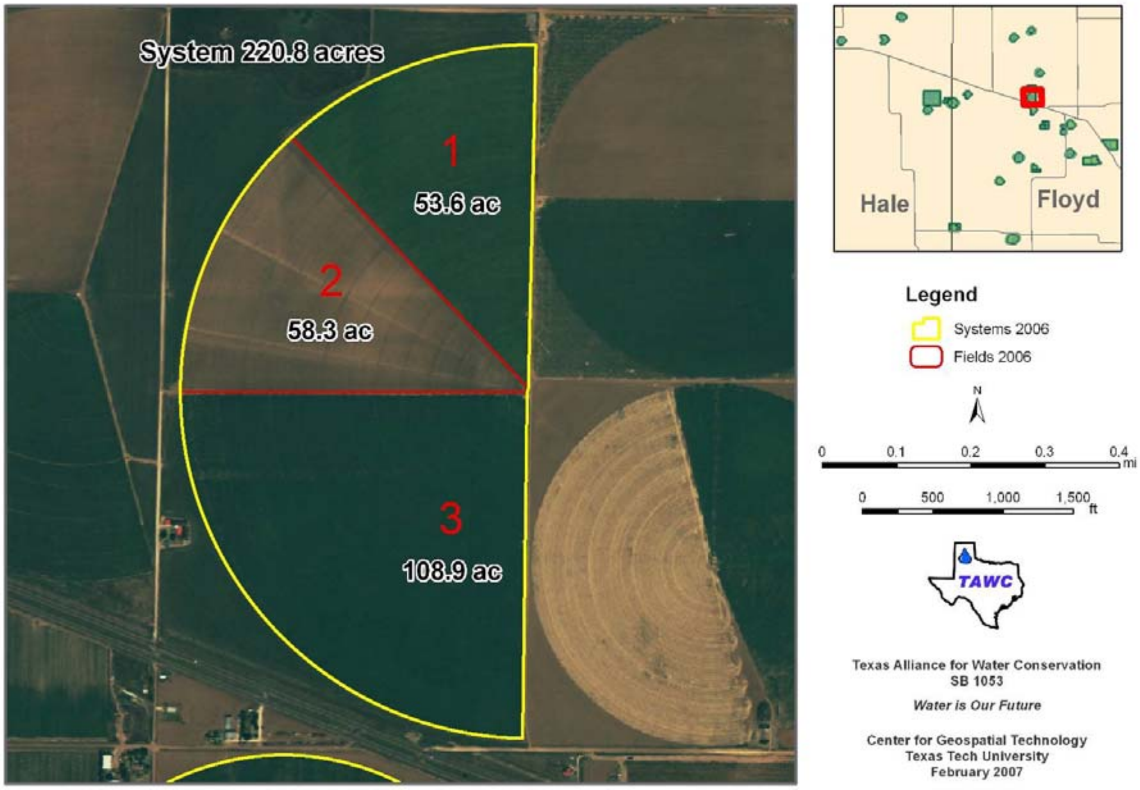
Site No. 16

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	Conventional
Cover crop	None	None
Variety	'FM 958'	'FM 958'
Row spacing, inches	40	40
Yield/acre		
Lint, lb	1,346.6	1175.4
Lint, lbs/inch irrigation water	178	96
Lint, lbs/inch total water	56	43
Seed, tons	0.95	0.76
Pounds water/lb of lint	4,011	5,245
Fertilizer, lbs/system acre		
Compost, tons/acre	0	3[2]
Nitrogen	83	124
Phosphorus (P_2O_5)	26	90
Potassium (K_2O)	0	90
Sulphur	1.8	21
Water use, inches		
Irrigation		
By field		
Field 1	7.6	12.2
By system	7.6	12.2
Precipitation	16.3	15.0
Total system (irrigation + precipitation)	23.9	27.2
Income and Expense, $/system acre		
Projected returns	821.74	761.36
Costs		
Total variable costs	619.46	611.68
Total fixed costs	78.60	78.60
Total all costs	698.06	690.28
Net returns		
Per system acre	123.68	71.08
Per acre inch of irrigation water	16.38	5.81
Per pound of Nitrogen	1.49	0.57

[2]Compost provided 90 lbs of N and all other nutrients in 2006.


Site 16-1
5/01/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton)
in
26.98 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August
Septemb

System 17 - 2006



***Site 17 Description*:**

Total acres in system: 220.8

Field No. 1:
Acres: 53.6
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2:
Acres: 58.3
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2:
Acres: 58.3
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Center Pivot (MESA)
Pumping capacity, gal/min: 900
Number of wells: 8
Fuel source: electric

SITE 17 COMMENTS

This is a cotton, silage corn, and old-world bluestem site using pivot irrigation. Wheat is planted after corn harvest, and the wheat is terminated where cotton is no-till planted the following year. Corn is planted on twenty-inch centers on clean tilled ground. The old-world bluestem is used for grazing and/or hay production.

Site No. 17

Item	Year 1	Year 2
Livestock, cow/calf	**None**	**yes**
Crops		
Field No. 1		
Old world bluestem		
Variety	'WW-B. Dahl'	'WW-B. Dahl'
Yield/acre		
Grazed, animal days	0	261.87
Hay, tons	5.91	1.08
Hay, lbs/inch irrigation water	1,703	293
Hay, lbs/inch total water	484	94
Pounds water/lb of hay	468	2,401
Field No. 2		
Corn		
Tillage system	Conventional	-
Cover crop	None	-
Variety	'NC + 1717'	-
Row spacing, inches	20	-
Yield/acre		
Silage, tons (as ensiled)	31.8	-
Silage, lbs/inch irrigation water	3,992	-
Silage, lbs/inch total water	1,902	-
Pounds water/lb of silage	119	-
Field No. 2		
Cotton		
Tillage system	-	Conventional
Cover crop	-	Wheat
Variety	-	'FM 960 B2R'
Row spacing, inches	-	20
Yield/acre		
Lint, tons	-	1,833.9
Lint, lbs/inch irrigation water	-	86
Lint, lbs/inch total water	-	54
Seed, tons	-	1.26
Pounds water/lb of lint	-	4,223

Field No. 3

Cotton		
Tillage system	Conventional	-
Cover crop	Wheat	-
Variety	'FiberMax 960 B2R'	-
Row spacing, inches	30	-
Yield/acre		
Lint, lb	1,658	-
Lint, lbs/inch irrigation water	176	-
Lint, lbs/inch total water	62	-
Seed, tons	0.21	-
Pounds water/lb of lint	3,677	-

Field No. 3

Corn (double cropped with non-irrigated TAM 105 wheat for grazing)		
Tillage system	-	Limit-till
Cover crop	-	None
Variety	-	NC+7117
Row spacing, inches	-	20
Yield/acre		
Grazed, animal days	-	122.73
Silage, tons (as ensiled)	-	29.09
Silage, lbs/inch irrigation water	-	4,461
Silage, lbs/inch total water	-	1,913
Pounds water/lb of silage	-	118

Fertilizer, lbs/system acre

Nitrogen	114	151
Phosphorus (P_2O_5)	31	8
Potassium (K_2O)	0	0
Other	0	0

Water use, inches

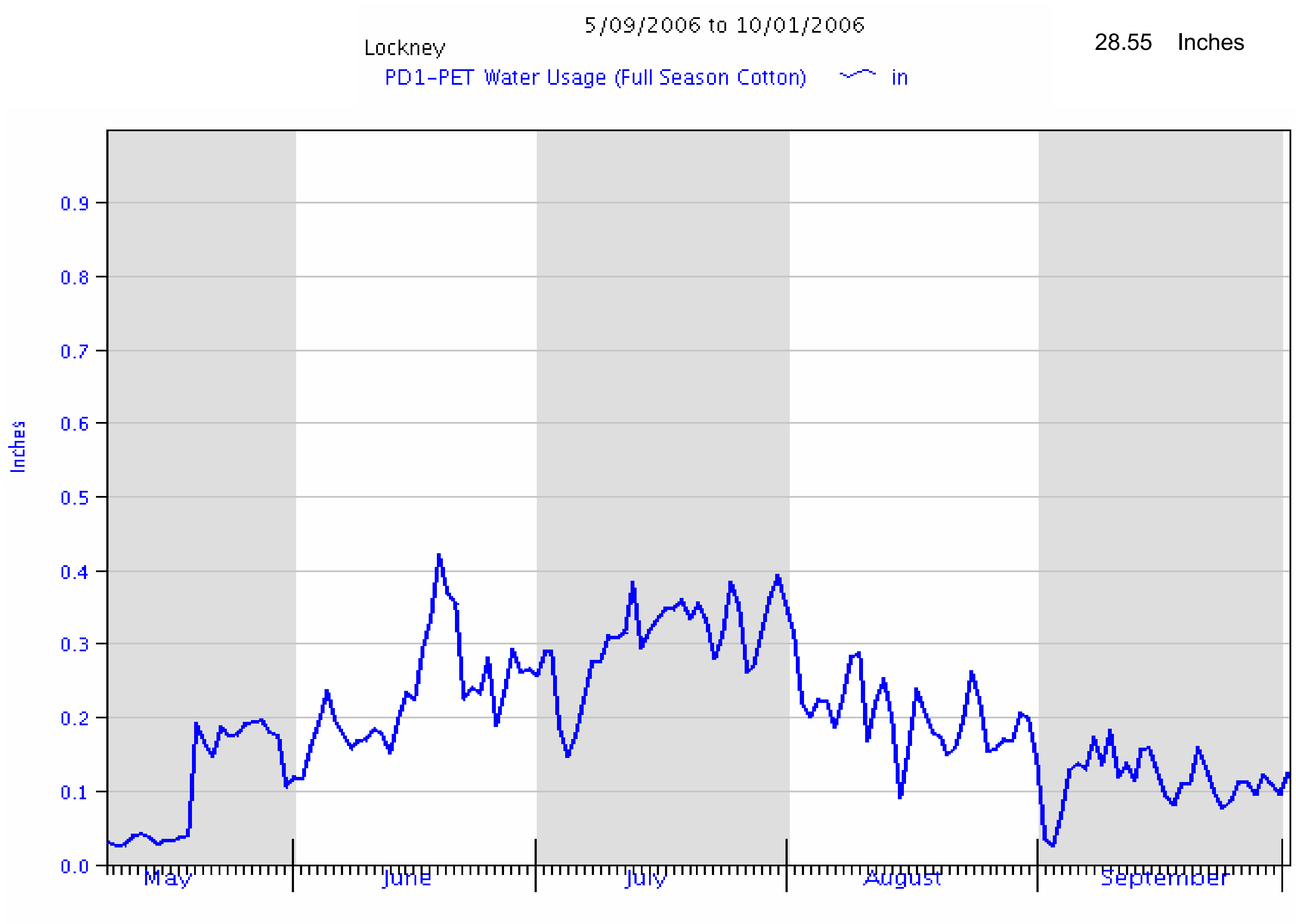
Irrigation		
By field		
Field 1	6.9	5.5
Field 2	15.9	16.8
Field 3	9.4	21.3
By system	10.5	16.2
Precipitation	17.5	17.4
Total system (irrigation + precipitation)	28.0	40.7

Income and Expense, $/system acre

Projected returns	762.52	708.89
Costs		
Total variable costs	487.61	373.28
Total fixed costs	86.47	93.40
Total all costs	574.08	466.68
Net returns		
Per system acre	188.44	242.21
Per acre inch of irrigation water	17.91	14.21
Per pound of Nitrogen	1.65	1.80

Site 17-2

28.55 Inches



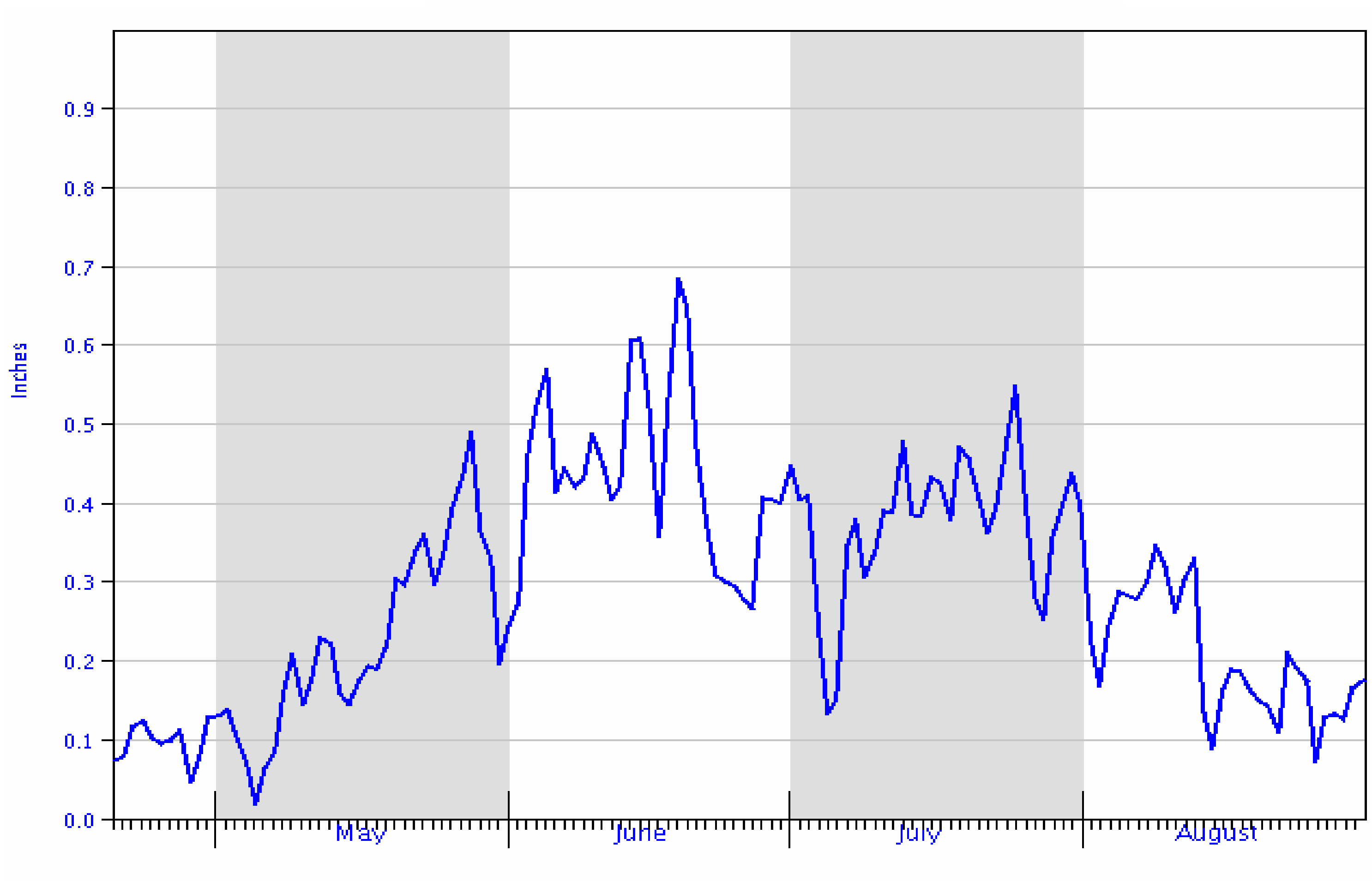
Site 17-3

4/20/2006 to 8/30/2006

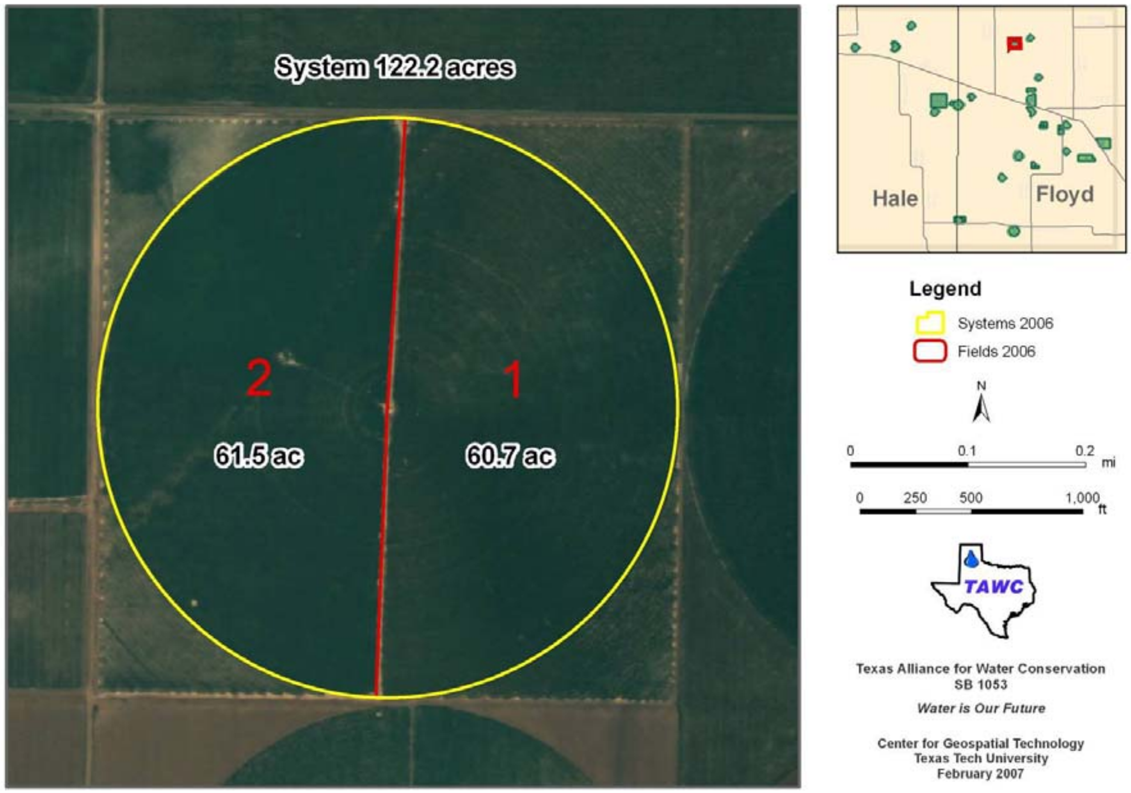
Bushland (ARS)

PD1-PET Wter Usage (Full Season Corn) in

36.32 Inches



System 18 - 2006



***Site 18 Description*:**

Total acres in system: 122.2

Field No. 1:
Acres 60.7
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2:
Acres: 61.5
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Center Pivot
Pumping capacity, gal/min: 250
Number of wells: 3
Fuel source: electric

SITE 18 COMMENTS

This is a pivot irrigated site with limited irrigation. Oats were drilled following cotton in 2005 with the oats harvested for silage. Forage sorghum was drilled no-till into the oat residue and harvested for hay. The other one-half circle was planted to cotton on forty-inch centers.

Site No. 18

Item	Year 1	Year 2
Crops		
Field No. 1		
Grain sorghum		
Tillage system	Conventional	-
Cover crop	No	-
Variety	'DeKalb 404'	-
Row spacing, inches	40	-
Yield/acre		
Grain, cwt	51	-
Grain, lbs/inch irrigation water	1,700	-
Grain, lbs/inch total water	262	-
Pounds water/lb of grain	866	-
Field No. 1		
Cotton		
Tillage system	-	Conventioinal
Cover crop	-	None
Variety	-	'AFD 3511 RR'
Row spacing, inches	-	40
Yield/acre		
Lint, lb	-	879.44
Lint, lbs/inch irrigation water	-	66
Lint, lbs/inch total water	-	29
Seed, tons	-	0.62
Pounds water/lb of lint	-	7,712
Field No. 2		
Cotton		
Tillage system	Conventional	-
Cover crop	No	-
Variety	'AFD 3511 RR'	-
Row spacing, inches	40	-
Yield/acre		
Lint, lb	992	-
Lint, lbs/inch irrigation water	113	-
Lint, lbs/inch total water	39	-
Seed, tons	0.83	-
Pounds water/lb of lint	5,764	-

Field No. 2

Oats		
Tillage system	-	Limit-till
Variety	-	Magnum

Yield/acre

Silage, tons	-	4.88
Silage, lbs/inch irrigation water	-	2,270
Silage, lbs/inch total water	-	480
Pounds water/lb of silage	-	472

Field No. 2

Hay grazer		
Tillage system	-	Drilled
Cover crop	-	Oat stubble
Variety	-	
Row spacing, inches	-	8

Yield/acre

Hay, tons	-	1.43
Hay, lbs/inch irrigation water	-	452
Hay, lbs/inch total water	-	128
Pounds water/lb of hay	-	1772

Fertilizer, lbs/system acre

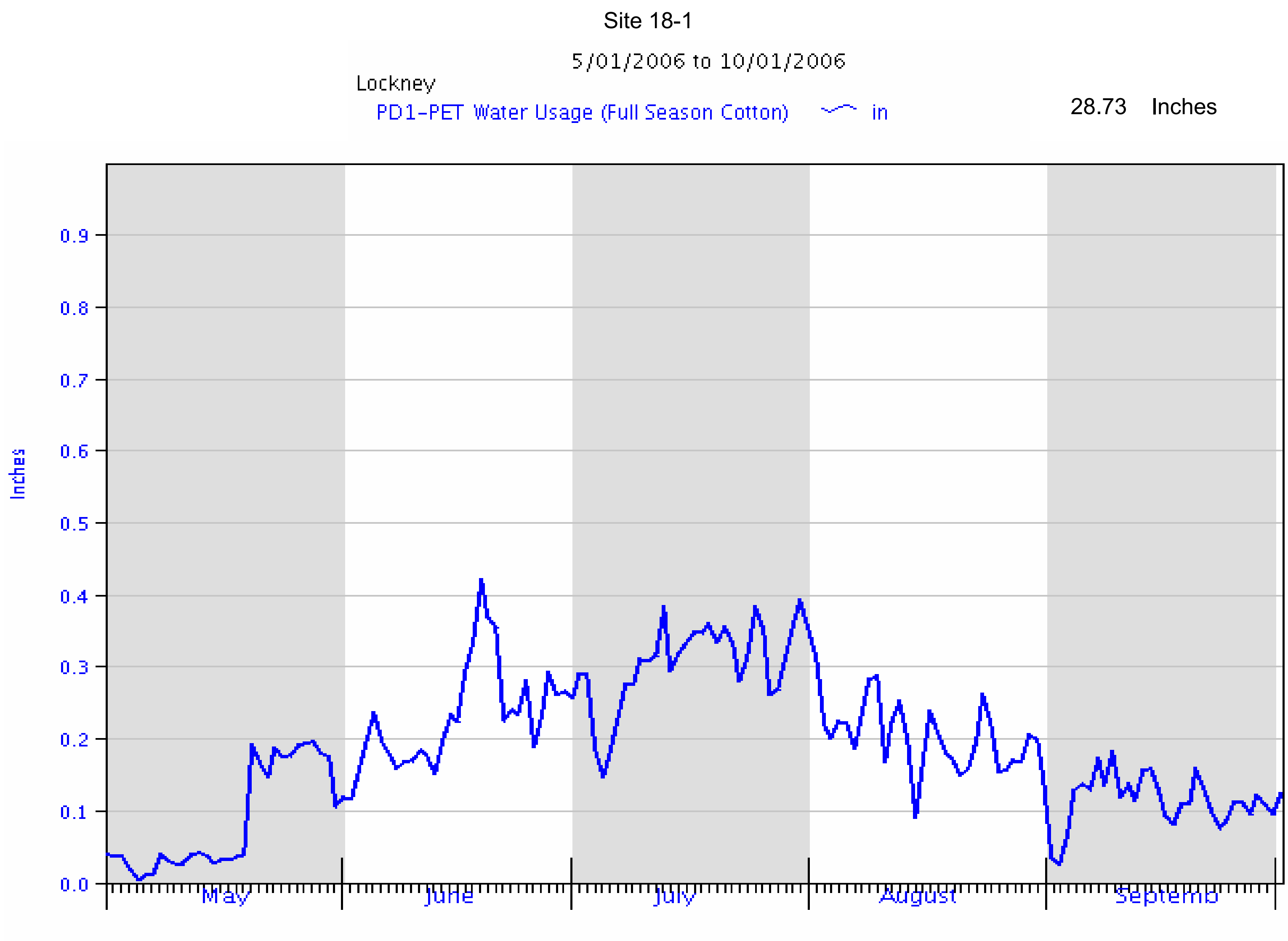
Nitrogen	73	56
Phosphorus (P_2O_5)	8	8.3
Potassium (K_2O)	0	0
Sulphur	7	6.8

Water use, inches

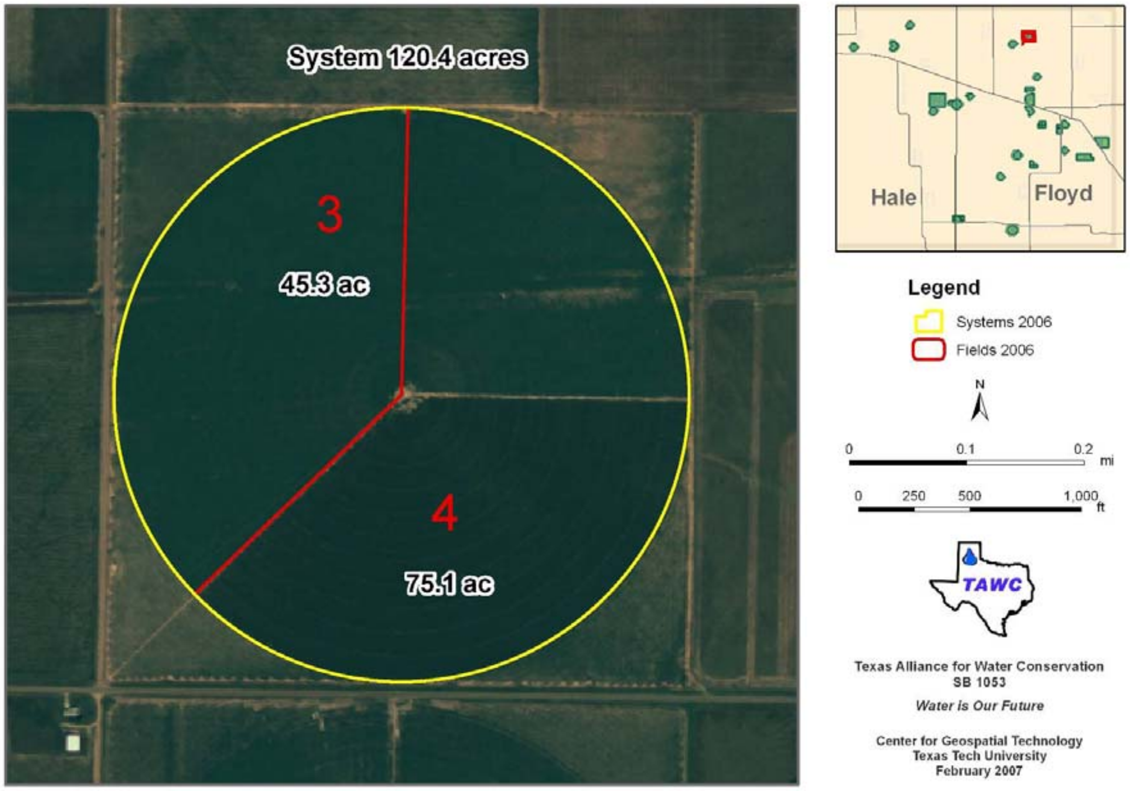
Irrigation		
By field		
Field 1	3.0	13.4
Field 2	8.75	6.3 (forage sorghum)
Field 2	-	4.3 (oats)
By system	5.9	12.0
Precipitation	16.5	16.1
Total system (irrigation + precipitation)	22.4	26.1

Income and Expense, $/system acre

Projected returns	400.54	406.79
Costs		
Total variable costs	305.20	360.50
Total fixed costs	78.60	78.60
Total all costs	383.80	439.10
Net returns		
Per system acre	16.75	-32.31
Per acre inch of irrigation water	2.84	-2.69
Per pound of Nitrogen	0.23	-


Site 18-1
5/01/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton) in
28.73 Inches
Inches
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
May
June
July
August
Septemb

System 19 - 2006



***Site 19 Description*:**

Total acres in system: 120.4

Field No. 1: *2005 only*
Acres: 75.3
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2: *2005 only*
Acres: 45.1
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3: *2006 only*
Acres: 45.3
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 4: *2006 only*
Acres: 75.1
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Center Pivot (LEPA)
Pumping capacity, gal/min: 400
Number of wells: 3
Fuel source: electric

SITE 19 COMMENTS

This is a pivot irrigated cotton and seed millet site. The seed millet comprises one-third of the system and is rotated around the circle. One-third of the cotton is planted following seed millet and one-third following cotton. This producer uses conventional tillage and plants on forty-inch centers.

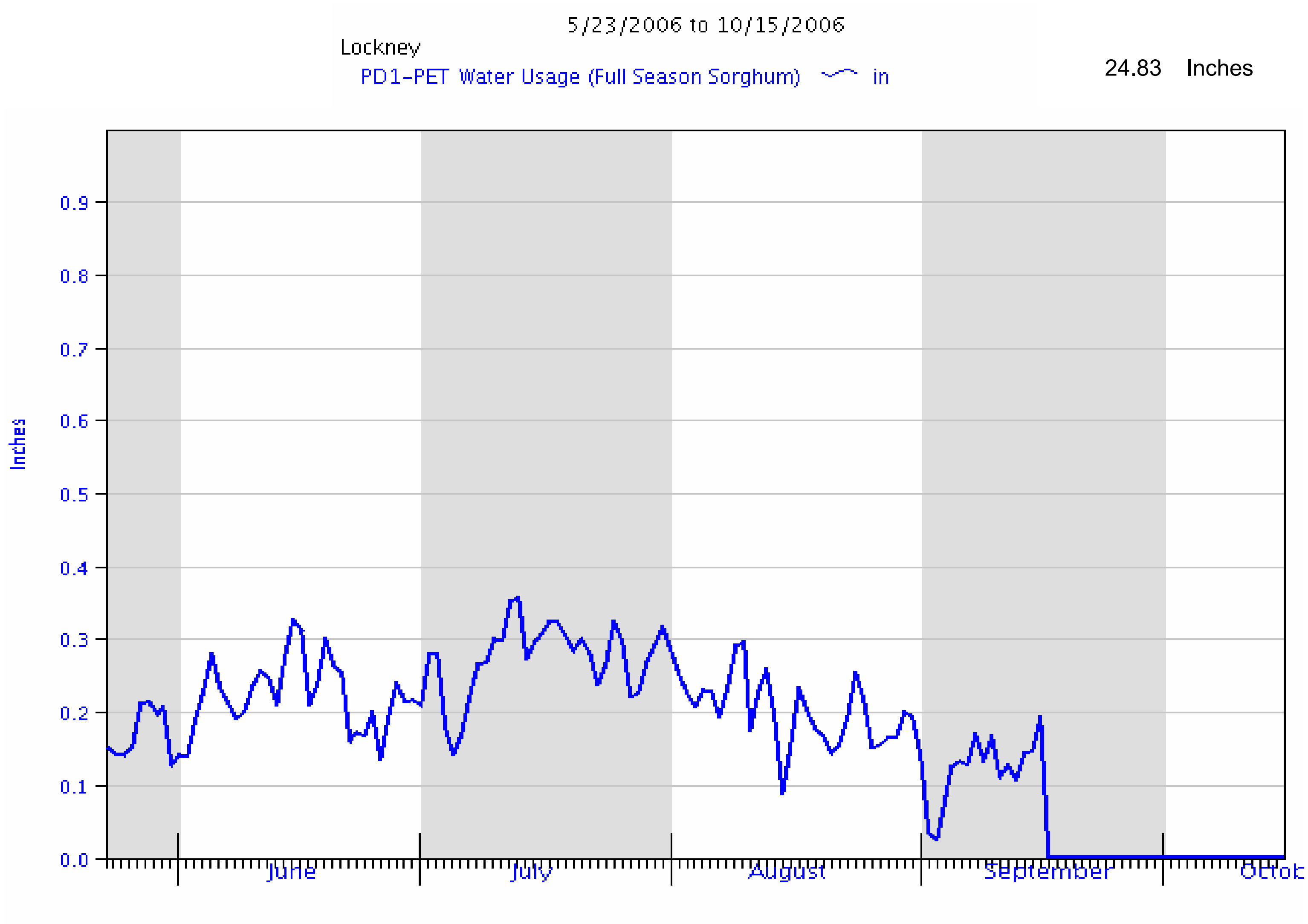



Site No. 19

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	-
Cover crop	No	-
Variety	'AFD 3511'	-
Row spacing, inches	40	
Yield/acre		
Lint, lb	948	-
Lint, lbs/inch irrigation water	108	-
Lint, lbs/inch total water	42	-
Seed, tons	0.71	-
Pounds water/lb of lint	5,411	
Field No. 2		
Pearlmillet		
Variety	Seed millet	-
Yield/acre		
Seed, lb	3,876	-
Seed, lbs/inch irrigation water	337	-
Seed, lbs/inch total water	153	-
Pounds water/lb of seed	1,484	-
Field No. 3		
Pearlmillet		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	Seed Millet
Row spacing, inches	-	40
Yield/acre		
Seed, lb	-	2,488
Seed, lbs/inch irrigation water	-	243
Seed, lbs/inch total water	-	107
Pounds water/lb of seed	-	2,121
Field No.4		
Cotton		
Tillage system		Conventional

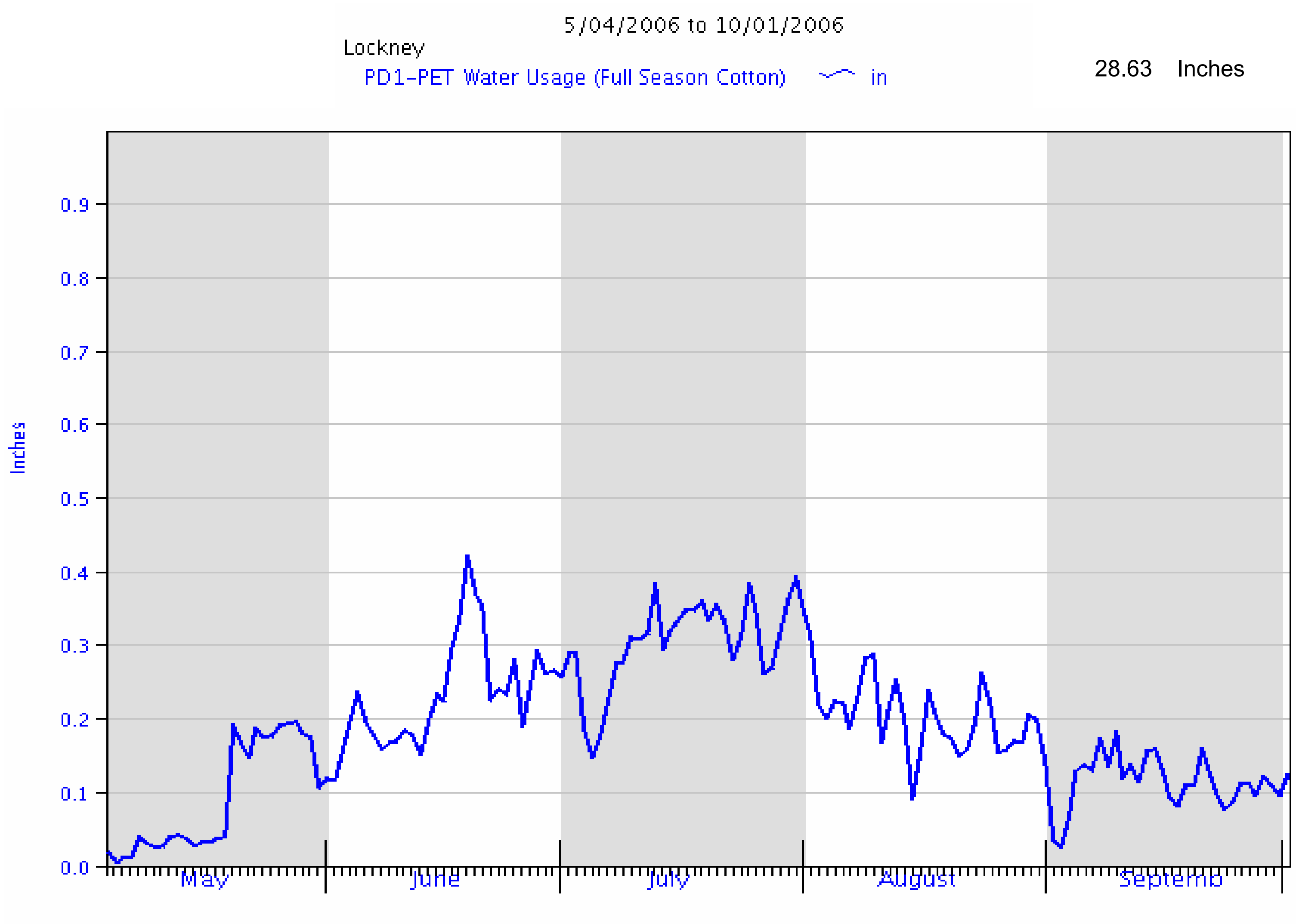
Cover crop		None
Variety		'FM 960 BR'
Row spacing, inches		40
Yield/acre		
Lint, lb	-	930.56
Lint, lbs/inch irrigation water	-	98
Lint, lbs/inch total water	-	41
Seed, tons	-	0.71
Pounds water/lb of lint	-	5,481
Fertilizer, lbs/system acre		
Nitrogen	108	80
Phosphorus (P_2O_5)	0	0
Potassium (K_2O)	0	0
Other	0	0
Water use, inches		
Irrigation		
By field		
Field 1	8.8	-
Field 2	11.5	-
Field 3	-	10.2
Field 4	-	9.5
By system	9.5	9.8
Precipitation	13.9	13.1
Total system (irrigation + precipitation)	23.4	22.8
Income and Expense, $/system acre		
Projected returns	611.44	543.76
Costs		
Total variable costs	345.86	369.88
Total fixed costs	78.00	78.60
Total all costs	424.46	448.48
Net returns		
Per system acre	186.97	95.28
Per acre inch of irrigation water	19.12	9.77
Per pound of Nitrogen	1.73	1.19

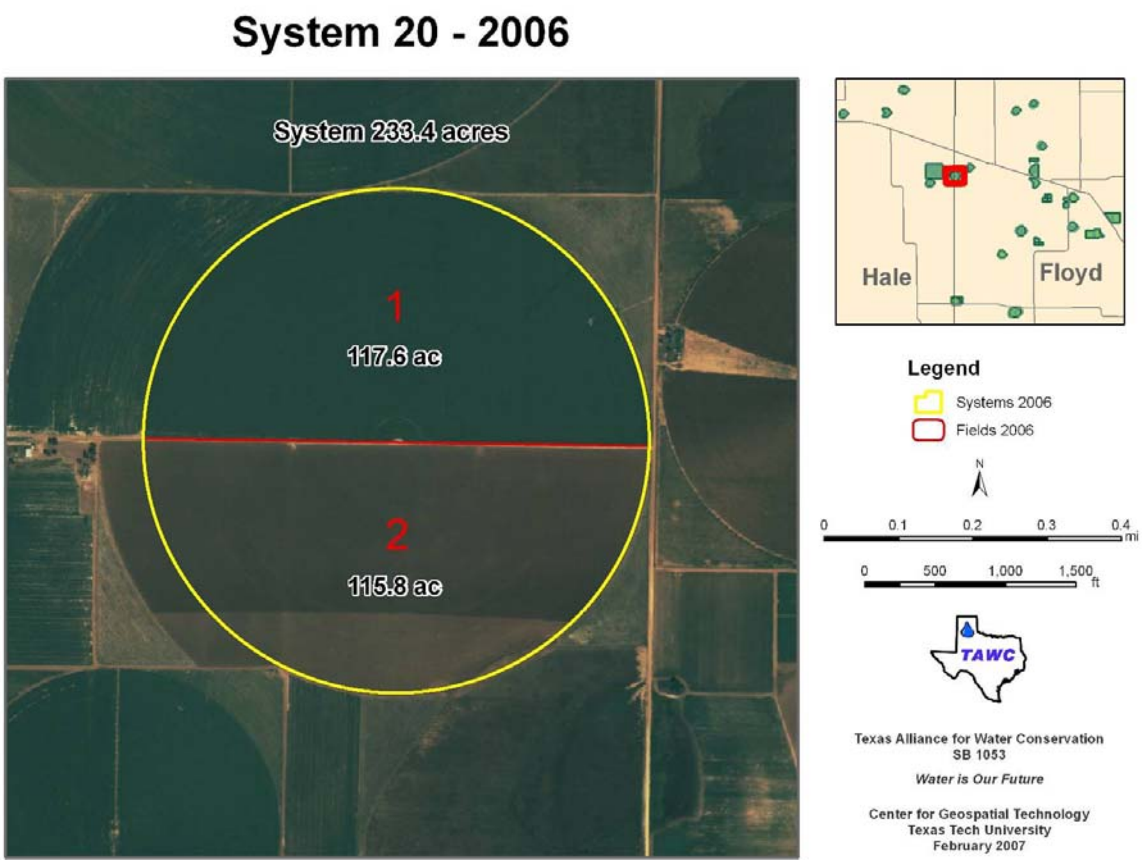
Site 19-3


5/23/2006 to 10/15/2006
Lockney
PD1-PET Water Usage (Full Season Sorghum) in
24.83 Inches
Inches
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
June
July
August
September
Octob

Site 19-4

28.63 Inches





***Site 20 Description*:**

Total acres in system: 233.4

Field No. 1:
Acres: 117.6
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2:
Acres: 115.8
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Center Pivot (LEPA)
Pumping capacity, gal/min: 1,000
Number of wells: 3
Fuel source: electric

SITE 20 COMMENTS

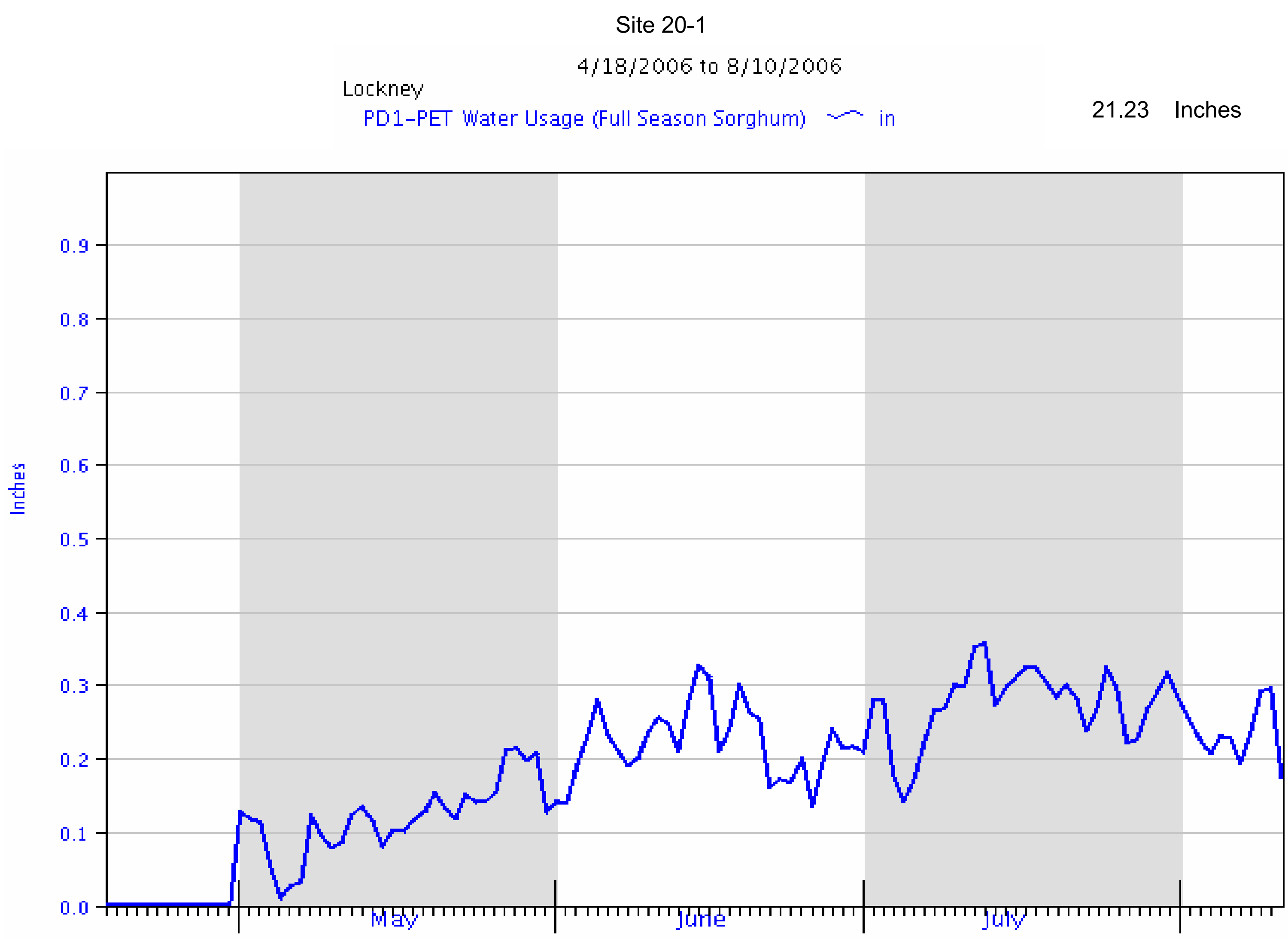
This is a corn, forage sorghum and triticale site with all crops harvested for silage. Triticale is broadcast planted following corn harvest and forage sorghum is planted no-till on twenty-inch centers following harvest. Corn is planted on twenty-inch centers with conventional tillage.

Site No. 20

Item	Year 1	Year 2
Crops		
Field No. 1		
Wheat/forage sorghum double cropped		
Tillage system	Conventional	-
Variety	Wheat: 'Weather Master'	-
	Sorghum 'DeKalb 5907'	-
Row spacing, inches	20	-
Yield/acre (as ensiled)		
Wheat silage, tons	16.1	-
Sorghum silage, tons	26.0	-
Silage, lbs/inch irrigation water	3,742	-
Silage, lbs/inch total water	2,245	-
Pounds water/lb of silage	101	-
Field No. 1		
Corn		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	Pioneer 32B33
Row spacing, inches	-	20
Yield/acre (as ensiled)		
Silage, tons	-	29.54
Silage, lbs/inch irrigation water	-	2,382
Silage, lbs/inch total water	-	1,417
Pounds water/lb of silage	-	160
Field No. 2		
Corn, followed by triticale		
Tillage system	Conventional	-
Variety	'Pioneer 32B29'	-
Row spacing, inches	20	-
Yield/acre (as ensiled)		
Silage, tons	30	-
Silage, lbs/inch irrigation water	3,000	-
Silage, lbs/inch total water	1,714	-
Pounds water/lb of silage	132	-

Field No. 2

Triticale/sorghum silage double-cropped		
Tillage system	-	Limit-till
Cover crop	-	
Variety	-	Slick triticale
Variety	-	DeKalb 5909 sorghum
Row spacing, inches	-	20
Yield/acre, (as ensiled)		
Triticale, tons	-	21.3
Sorghum, tons	-	26.4
Silage, lbs/inch irrigation water	-	5,021
Silage, lbs/inch total water	-	2,657
Pounds water/lb of silage	-	85
Fertilizer, lbs/system acre		
Nitrogen	436	232
Phosphorus (P_2O_5)	127	46
Potassium (K_2O)	71	0
Zinc	24	0
Water use, inches		
Irrigation		
By field		
Field 1	22.5	24.8
Field 2	20.0	10.0 (triticale)
Field 2	-	9.0 (sorghum)
By system	21.5	21.9
Precipitation	15.0	16.88
Total system (irrigation + precipitation)	36.5	38.8
Income and Expense, $/system acre		
Projected returns	715.09	757.29
Costs		
Total variable costs	654.87	327.67
Total fixed costs	109.44	53.88
Total all costs	764.30	381.55
Net returns		
Per system acre	-48.60	375.73
Per acre inch of irrigation water	-2.16	17.14
Per pound of Nitrogen	-0.11	1.62


Site 20-1
4/18/2006 to 8/10/2006
Lockney
PD1-PET Water Usage (Full Season Sorghum) in
21.23 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July

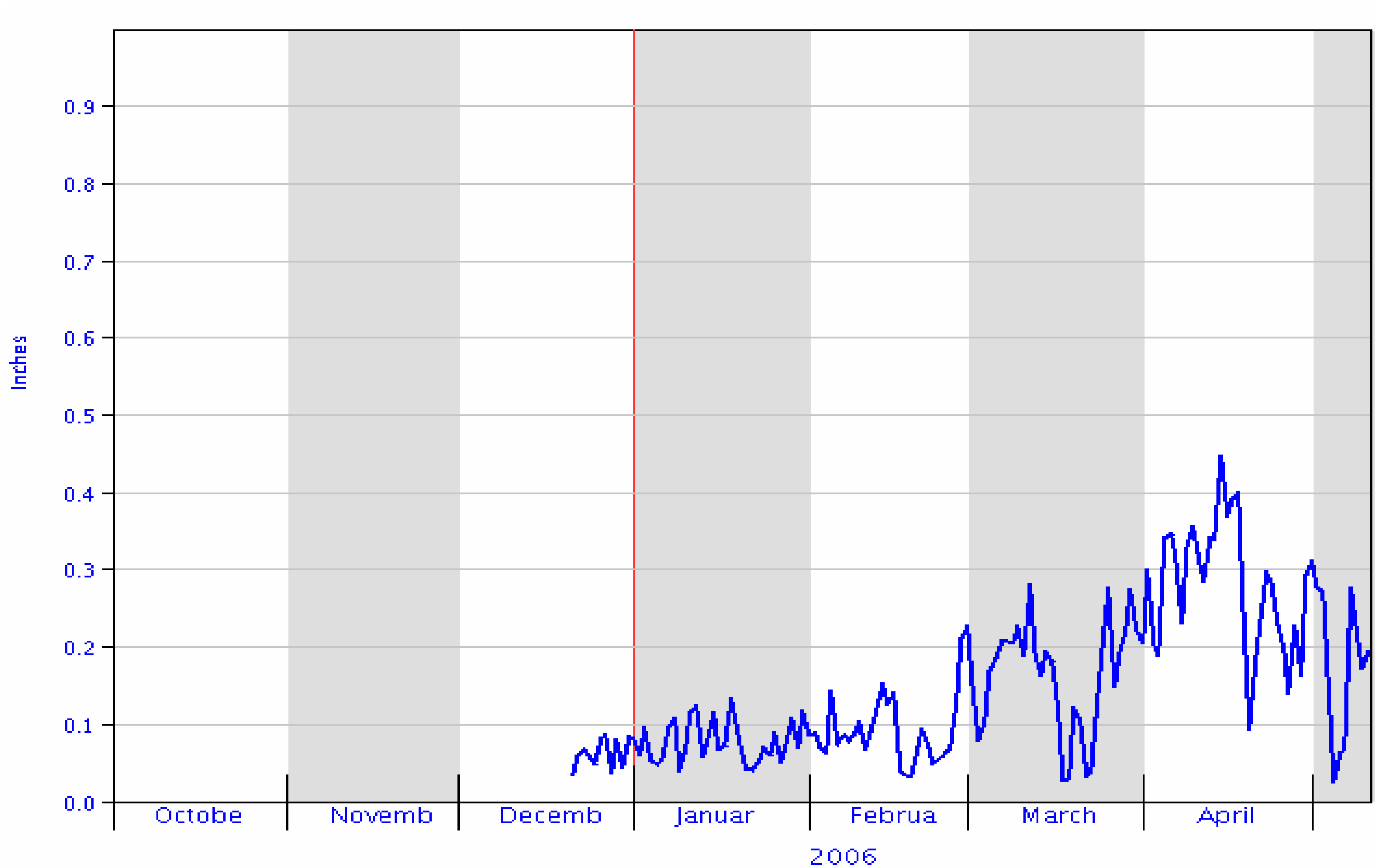
Site 20-2

10/01/2005 to 5/10/2006

20.57 Inches

Lockney

PD1-PET Water Usage (Full Season Wheat) in

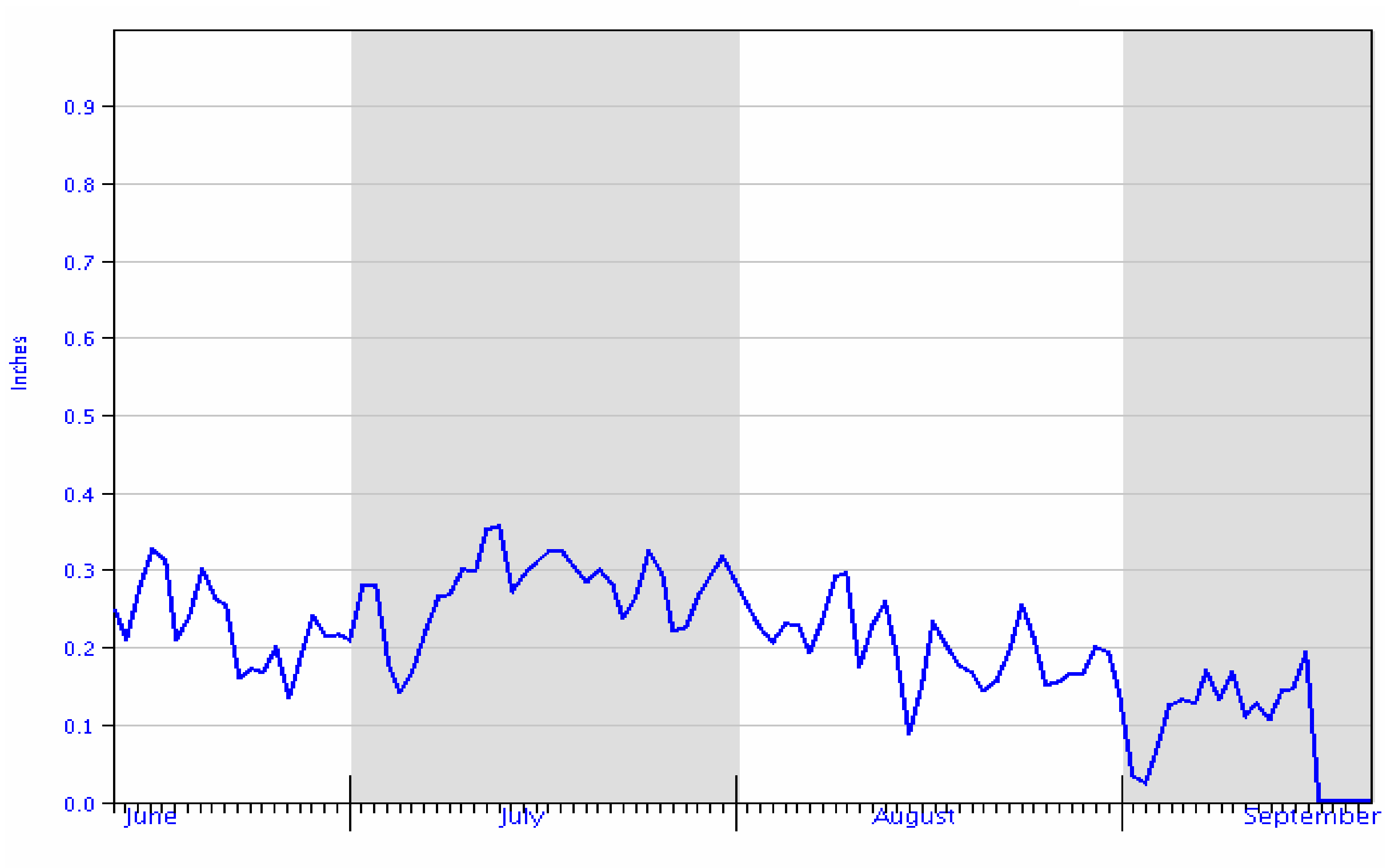


Site 20-2

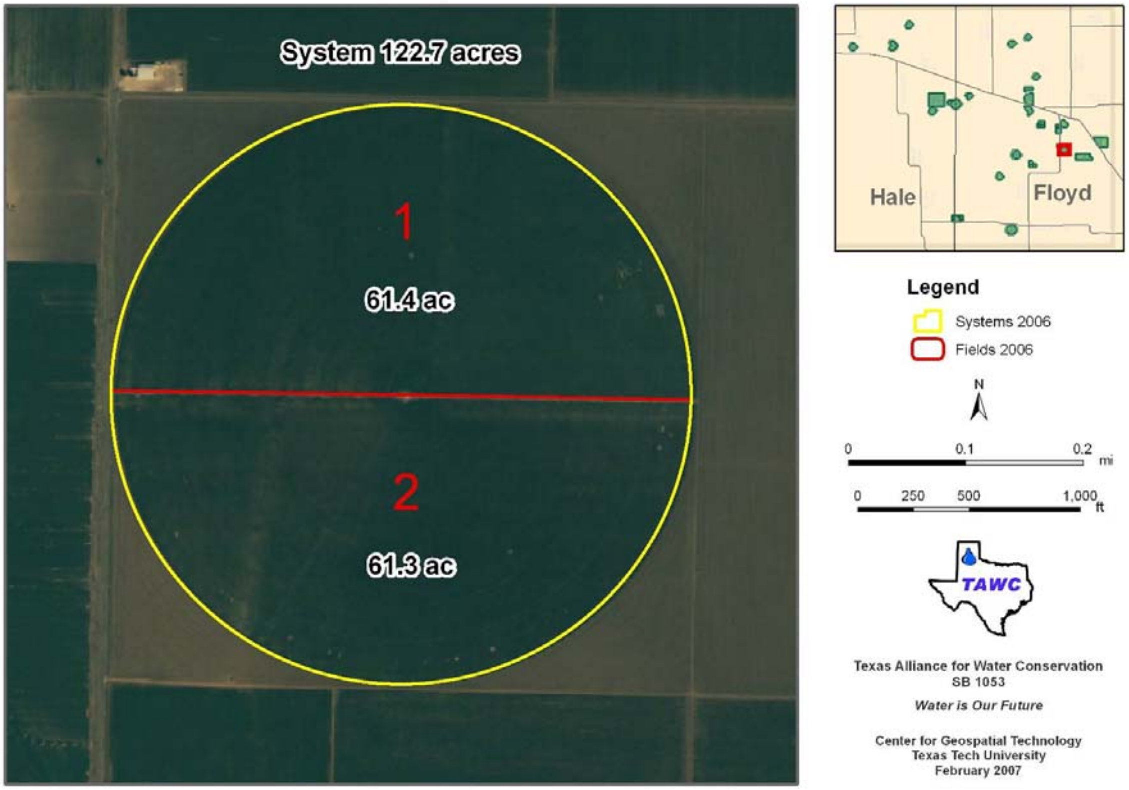
6/12/2006 to 9/20/2006

Lockney

PD1-PET Water Usage (Full Season Sorghum) in   20.98 Inches



System 21 - 2006



***Site 21 Description*:**

Total acres in system: 122.7

Field No. 1:
Acres: 61.4
Major soil type: Pullman clay loam, 0 to 1% slope

Field No. 2:
Acres: 61.3
Major soil type: Pullman clay loam

Irrigation
Type: Center pivot (LEPA)
Pumping capacity, gal/min: 500
Number of wells: 1
Fuel source: electric

SITE 21 COMMENTS

This is a pivot irrigated corn and cotton site. Following cotton harvest in 2005 wheat was drilled on one-half of the pivot. The wheat was grazed, terminated and cotton planted no-till on forty-inch centers. Corn was planted on forty-inch centers with conventional tillage.

Site No. 21

Item	Year 1	Year 2
Cattle, stocker steers, contract grazing	None	yes
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	-
Cover crop	None	-
Variety	'DP 444 BF/RR'	-
Row spacing, inches	40	-
Yield/acre		
Lint, lb	1,279	-
Lint, lbs/inch irrigation water	189	-
Lint, lbs/inch total water	59	-
Seed, tons	0.79	-
Pounds water/lb of lint	3,825	-
Field No. 1		
Corn		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	'Pioneer 34K77'
Row spacing, inches	-	40
Yield/acre		
Grain, bu	-	124.67
Grain, lbs/inch irrigation water	-	383
Grain, lbs/inch total water	-	196
Pounds water/lb of grain	-	1,155
Field No. 2		
Wheat		
Cotton		
Tillage system	Conventional	Conventional
Cover crop	None	Wheat
Variety	'FM 960 RR/BR'	'FM 960 RR BR'
Row spacing, inches	40	40

Yield/acre		
Wheat, animal days	-	31.81
Cotton		
Lint, lb	1,228	1,201
Lint, lbs/inch irrigation water	182	82.5
Lint, lbs/inch total water	57	38
Seed, tons	0.82	0.88
Pounds water/lb of lint	3,983	6,019
Fertilizer, lbs/system acre		
Nitrogen	153	166
Phosphorus (P_2O_5)	15	26
Potassium (K_2O)	0	0
Sulphur	11	0
Water use, inches		
Irrigation		
By field		
Field 1	6.8	18.3
Field 2	6.8	14.6
By system	6.8	16.4
Precipitation	14.8	17.4
Total system (irrigation + precipitation)	21.6	33.8
Income and Expense, $/system acre		
Projected returns	757.28	626.15
Costs		
Total variable costs	566.88	458.53
Total fixed costs	78.60	78.60
Total all costs	634.78	531.21
Net returns		
Per system acre	122.51	94.94
Per acre inch of irrigation water	18.15	5.79
Per pound of Nitrogen	0.80	0.57

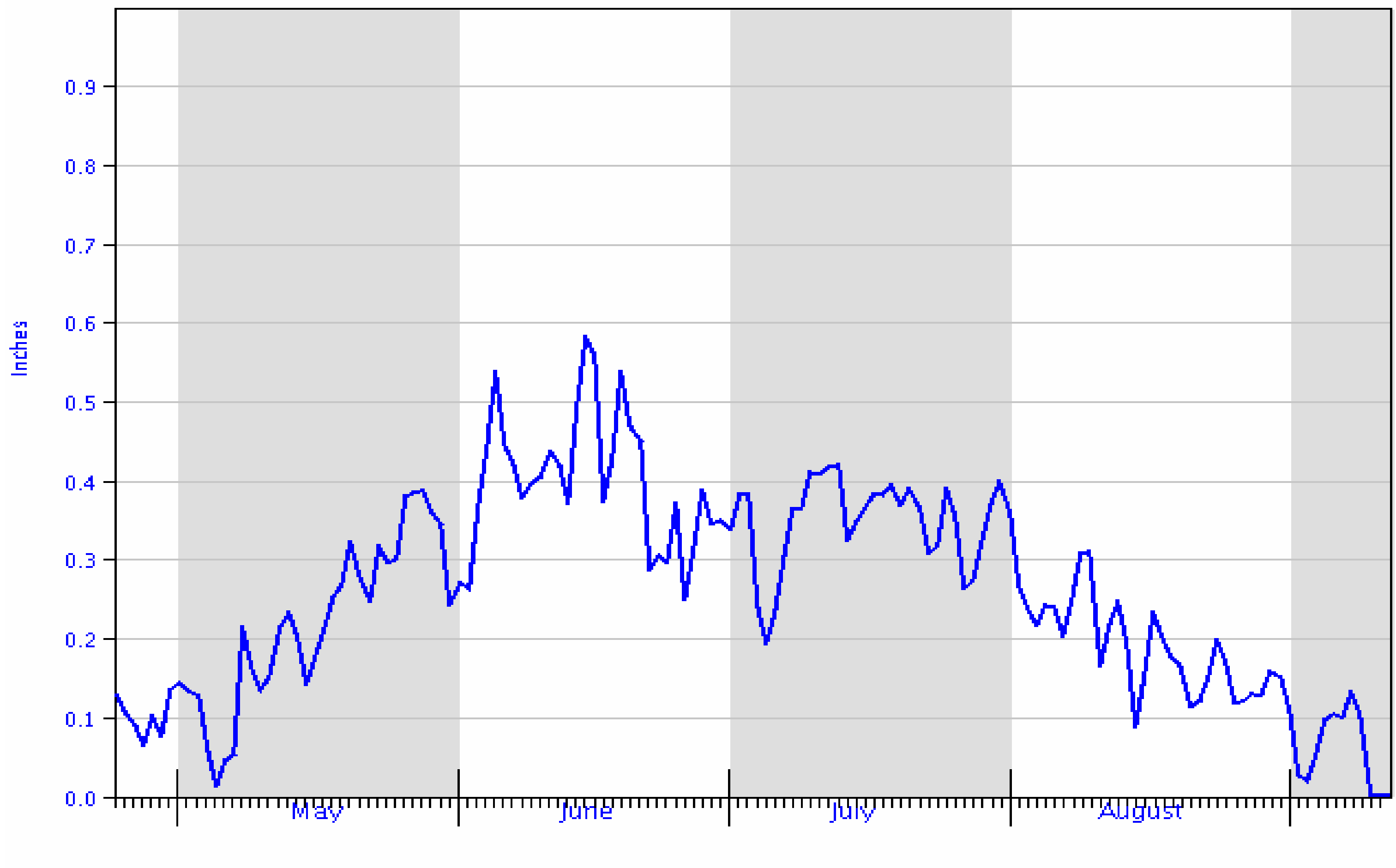
Site 21-1

4/24/2006 to 9/11/2006

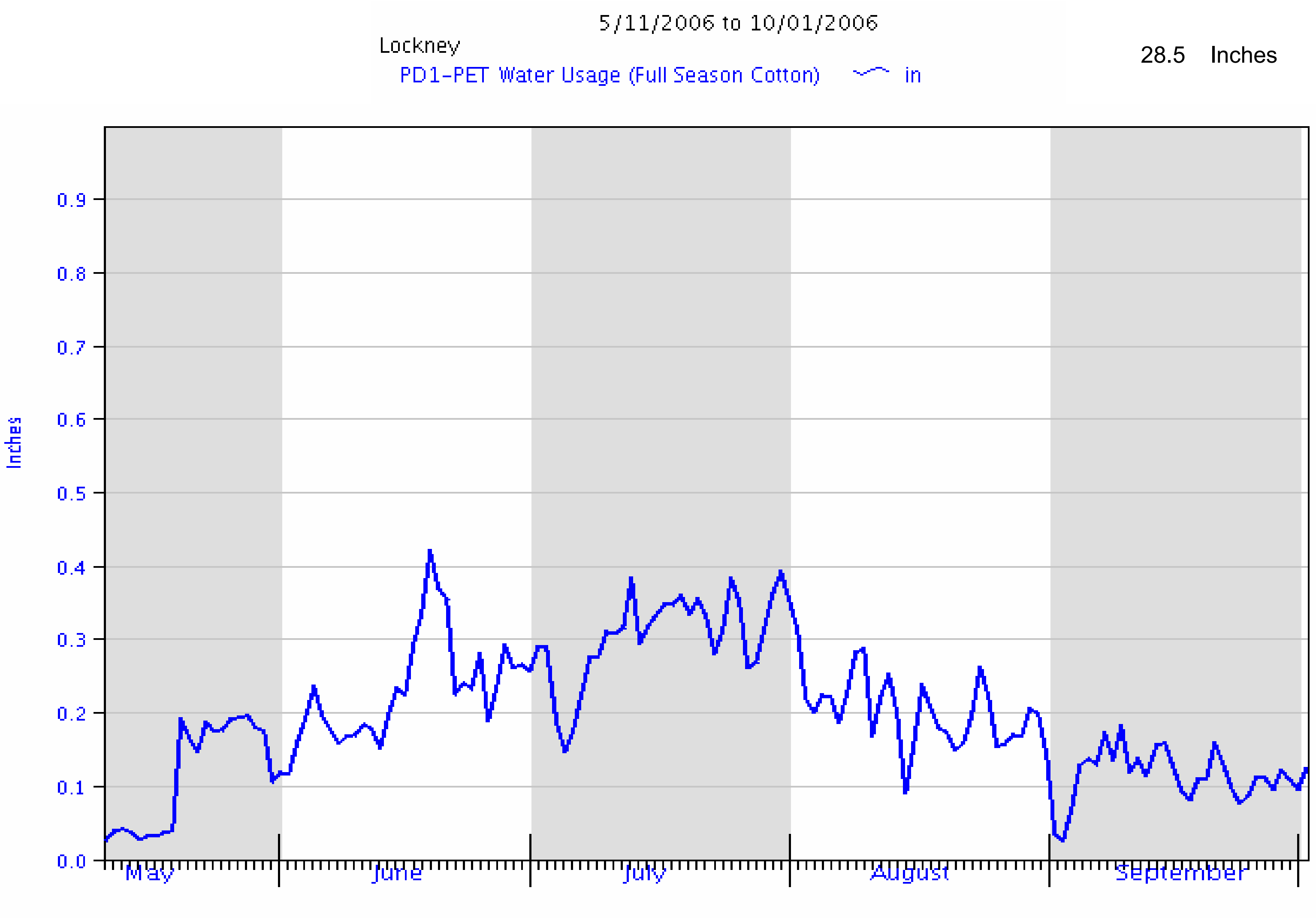
Lockney

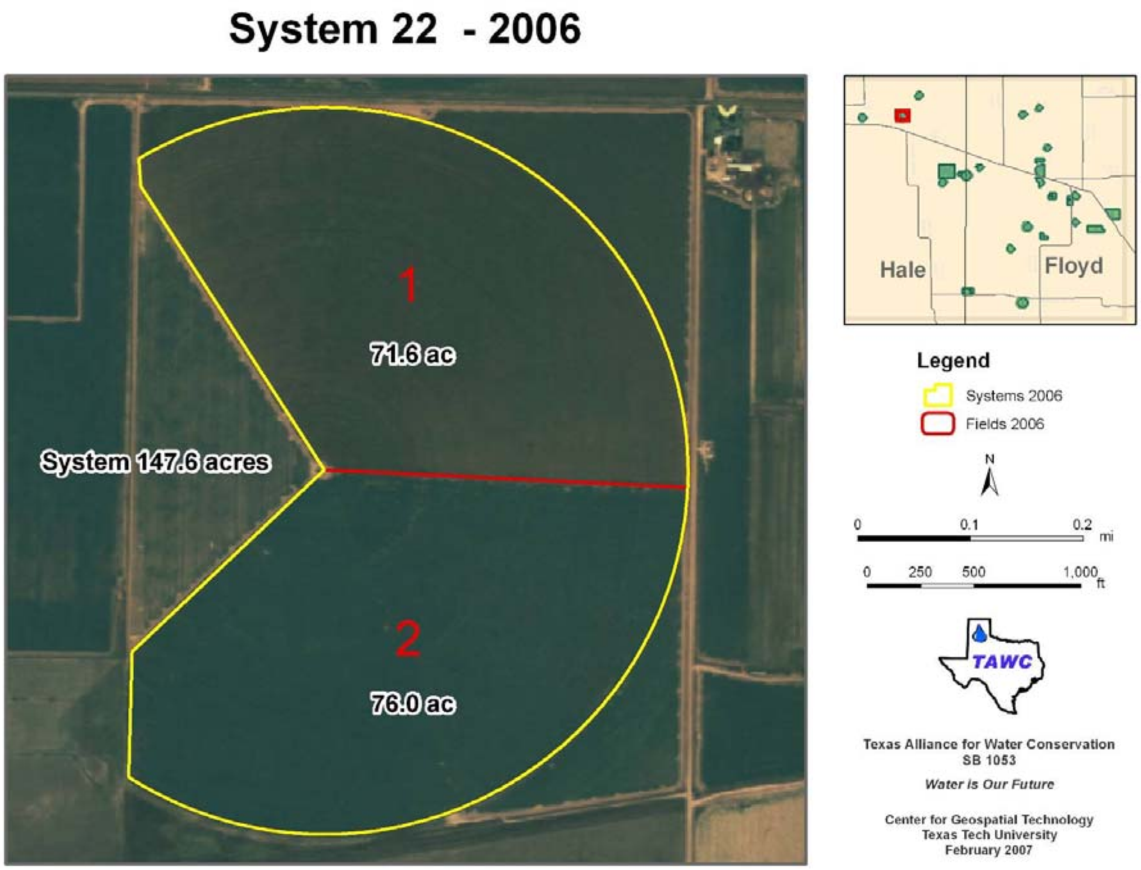
PD1-PET Wter Usage (Full Season Corn) in

36.93 Inches



Site 21-2


5/11/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton)
in
28.5 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August
September



***Site 22 Description*:**

Total acres in system: 148.7

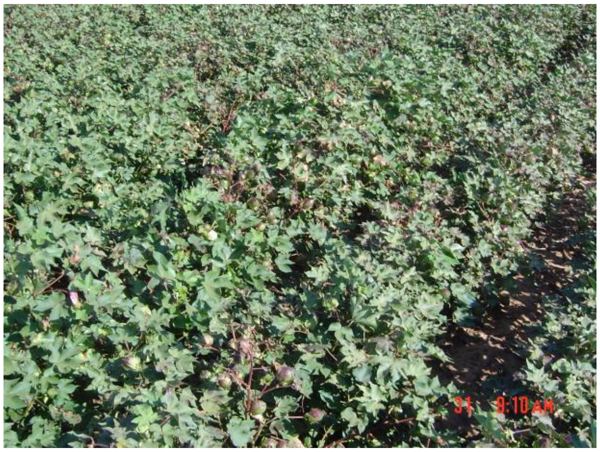
Field No. 1:
Acres: 72.7
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2:
Acres: 76.0
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Center Pivot (LEPA)
Pumping capacity, gal/min: 800
Number of wells: 4
Fuel source: electric

SITE 22 COMMENTS

This is a pivot irrigated corn and cotton system. Corn follows cotton each year with conventional tillage.


Site No. 22

Item	Year 1	Year 2
Crops		
Field No. 1		
Corn		
Tillage system	Conventional	-
Cover crop	None	-
Variety	'Pioneer 33M54'	-
Row spacing, inches	40	-
Yield/acre		
Grain, bu	236	-
Grain, lbs/inch irrigation water	696	-
Grain, lbs/inch total water	388	-
Pounds water/lb of grain	584	-
Field No. 1		
Cotton		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	'PM 2266'
Row spacing, inches	-	30
Yield/acre		
Lint, lb	-	2,181.3
Lint, lbs/inch irrigation water	-	124
Lint, lbs/inch total water	-	69
Seed, tons	-	1.42
Pounds water/lb of lint	-	3,293
Field No. 2		
Cotton		
Tillage system	Conventional	-
Cover crop	None	-
Variety	'Paymaster 2266'	-
Row spacing, inches	40	-
Yield/acre		
Lint, lb	1,177	-
Lint, lbs/inch irrigation water	100	-
Lint, lbs/inch total water	44	-
Seed, tons	0.94	-

Pounds water/lb of lint	5,176	-
Field No. 2		
Corn		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	'Pioneer 33M54'
Row spacing, inches	-	30
Yield/acre		
Grain, bu	-	185.93
Grain, lbs/inch irrigation water	-	397
Grain, lbs/inch total water	-	258
Pounds water/lb of grain	-	877
Fertilizer, lbs/system acre		
Compost, tons/acre	0	1.5[2]
Nitrogen	184	194
Phosphorus (P_2O_5)	110	45
Potassium (K_2O)	15	45
Sulphur	8	10.5
Water use, inches		
Irrigation		
By field		
Field 1	19.0	17.6
Field 2	11.8	26.2
By system	15.3	22.0
Precipitation	15.1	14.1
Total system (irrigation + precipitation)	30.4	27.5
Income and Expense, $/system acre		
Projected returns	706.62	1,034.25
Costs		
Total variable costs	461.39	669.27
Total fixed costs	78.60	78.60
Total all costs	539.99	748.27
Net returns		
Per system acre	166.63	285.98
Per acre inch of irrigation water	10.90	12.98
Per pound of Nitrogen	0.91	1.47

[2] Compost provided 45 lb of nitrogen and all other nutrients in 2006.

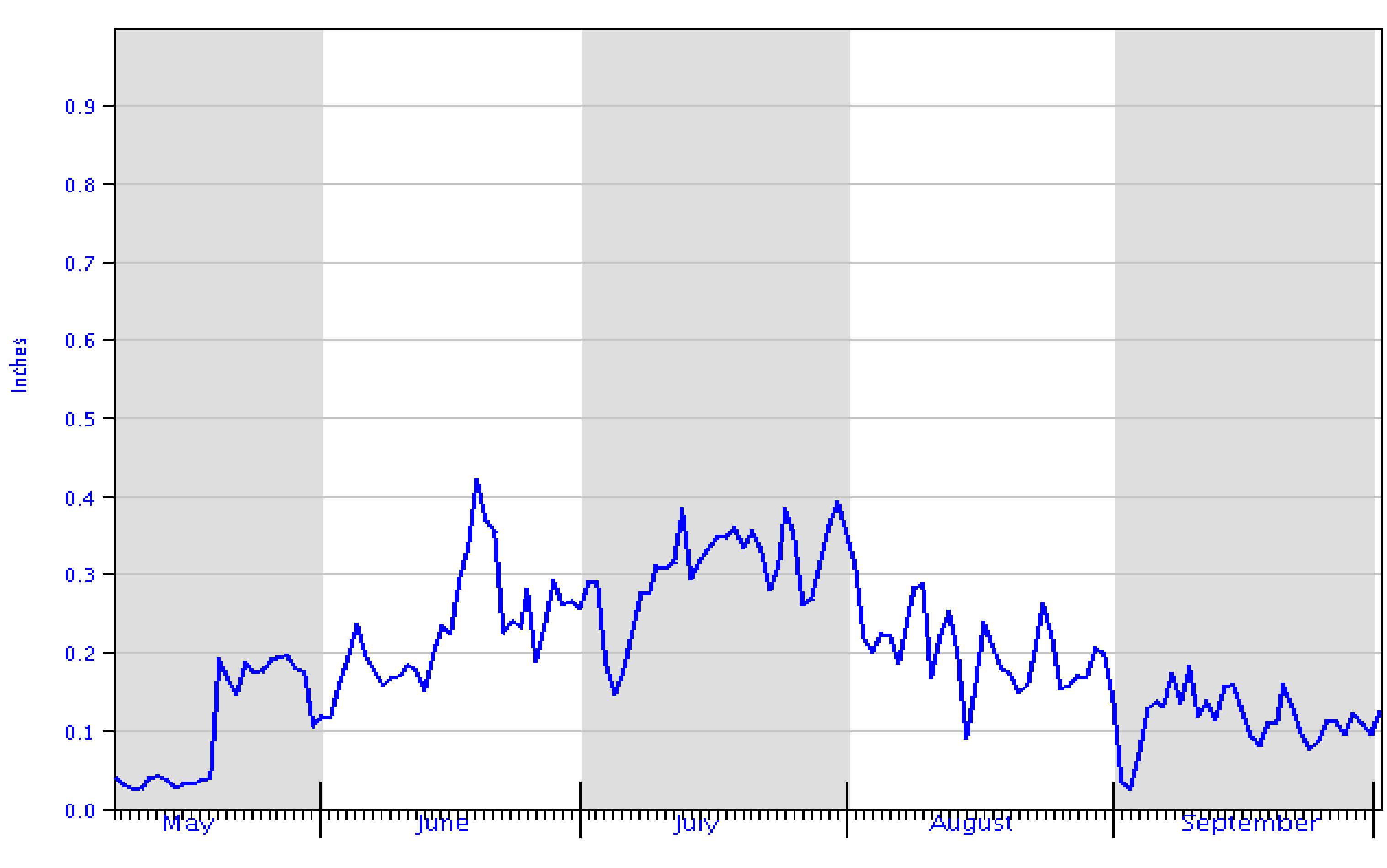
Site 22-1

5/08/2006 to 10/01/2006

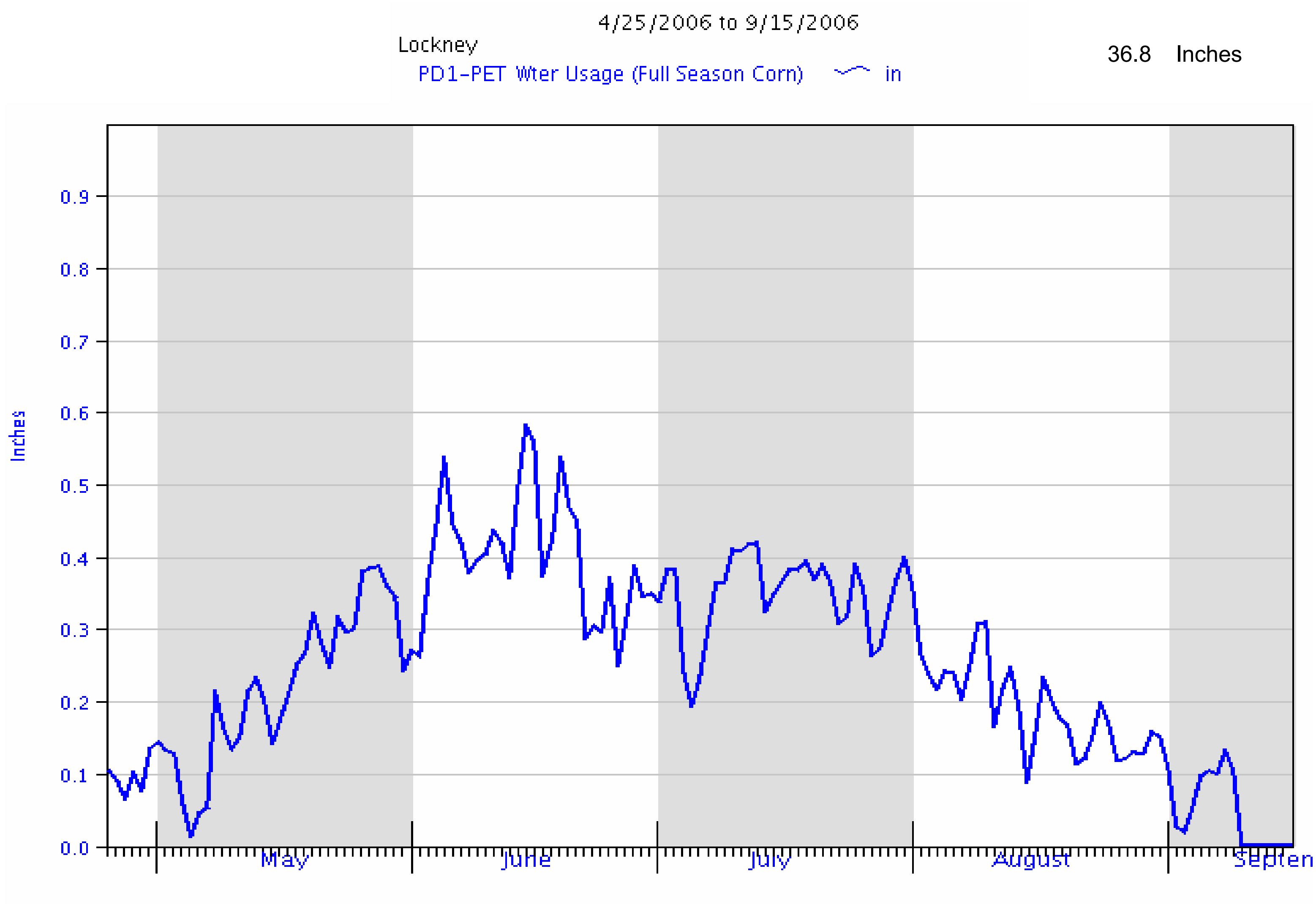
Lockney

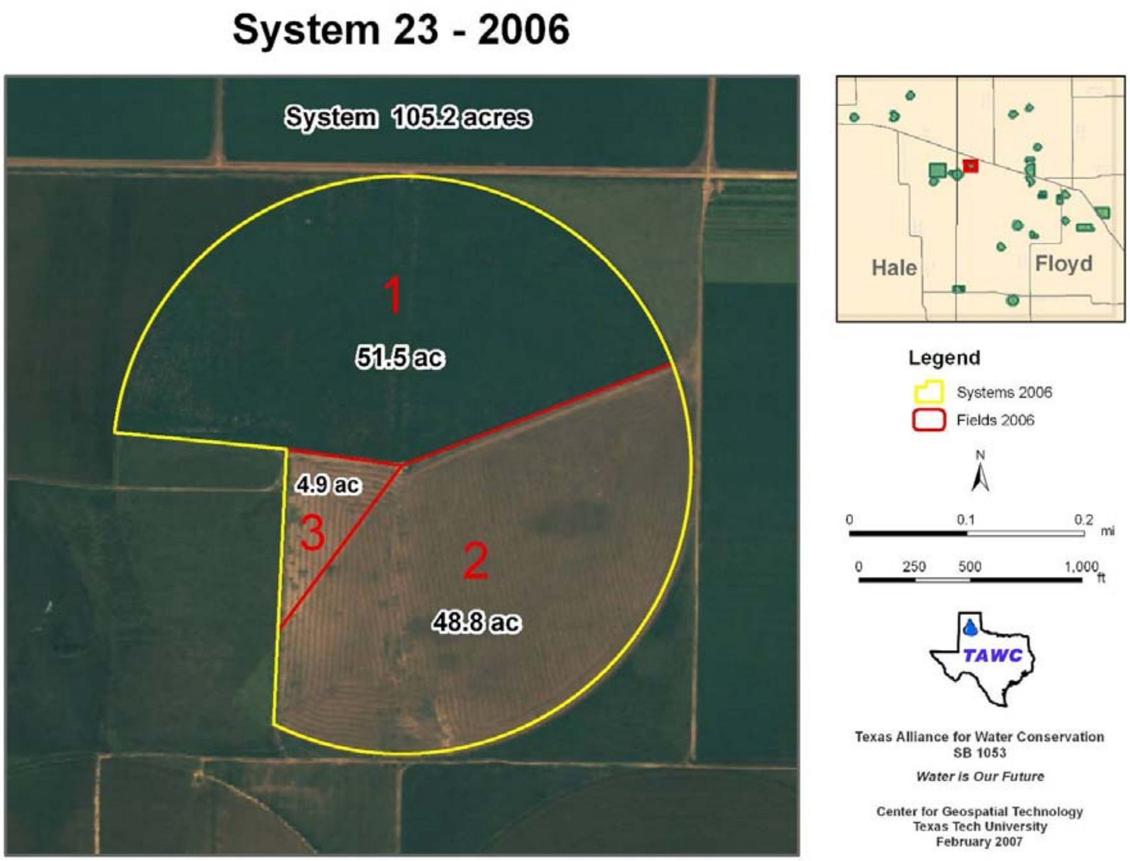
PD1-PET Water Usage (Full Season Cotton) in

28.59 Inches



Site 22-2


4/25/2006 to 9/15/2006
Lockney
PD1-PET Wter Usage (Full Season Corn)
in
36.8 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August
Septen



***Site 23 Description*:**

Total acres in system: 105.2

Field No. 1:
Acres: 51.5
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2:
Acres: 48.8
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3:
Acres: 4.9
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Center Pivot (LESA)
Pumping capacity, gal/min: 800
Number of wells: 2
Fuel source: natural gas

SITE 23 COMMENTS

This is a pivot irrigated corn and cotton system. Cotton was planted on twenty-inch centers on last year's cotton ground. Corn was planted on last year's sunflower ground on forty-inch centers.


Site No. 23

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	‘Conventional’	‘Conventional’
Cover crop	None	None
Variety	‘Americot 427R’	‘Americot 427R’
Row spacing, inches	40	20
Yield/acre		
Lint, lb	1,205	1,343
Lint, lbs/inch irrigation water	219	115
Lint, lbs/inch total water	67	48
Seed, tons	0.87	0.88
Pounds water/lb of lint	3,364	4,708
Field No. 2		
Sunflowers		
Tillage system	Conventional	-
Cover crop	None	-
Variety	‘Blacks’	-
Row spacing, inches	20	-
Yield/acre		
Seed, lb	2,857	-
Seed, lbs/inch irrigation water	476	-
Seed, lbs/inch total water	155	-
Pounds water/lb of seed	1,459	-
Field No. 2		
Corn		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	
Row spacing, inches	-	20
Yield/acre		
Grain, bu	-	157
Grain, lbs/inch irrigation water	-	484
Grain, lbs/inch total water	-	256
Pounds water/lb of grain	-	886

Fertilizer, lbs/system acre

Compost, tons/acre	0	1.5[2]
Nitrogen	90	209.
Phosphorus (P_2O_5)	0	45
Potassium (K_2O)	0	45
Sulphur	0	12.5

Water use, inches

Irrigation		
By field		
Field 1	5.5	11.7
Field 2	6.0	18.2
By system	5.4	14.8
Precipitation	12.4	16.3
Total system (irrigation + precipitation)	17.8	31.1

Income and Expense, $/system acre

Projected returns	669.15	718.70
Costs		
Total variable costs	319.93	512.71
Total fixed costs	78.60	78.60
Total all costs	398.53	591.31
Net returns		
Per system acre	270.62	127.39
Per acre inch of irrigation water	47.07	8.59
Per pound of Nitrogen	3.04	0.61

[2] Compost provided 45 lb of nitrogen and all other nutrients in 2006.

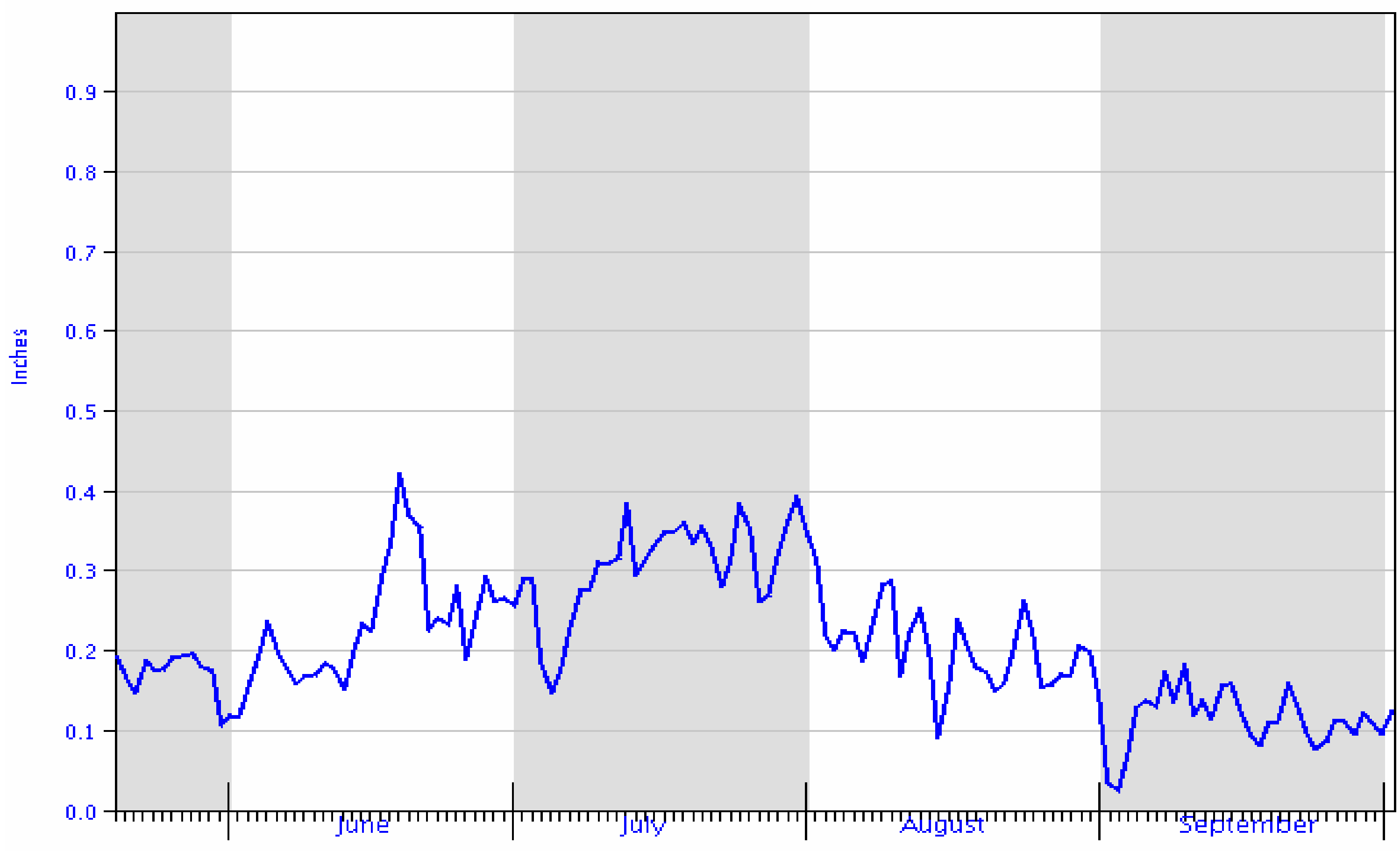
Site 23-1

5/20/2006 to 10/01/2006

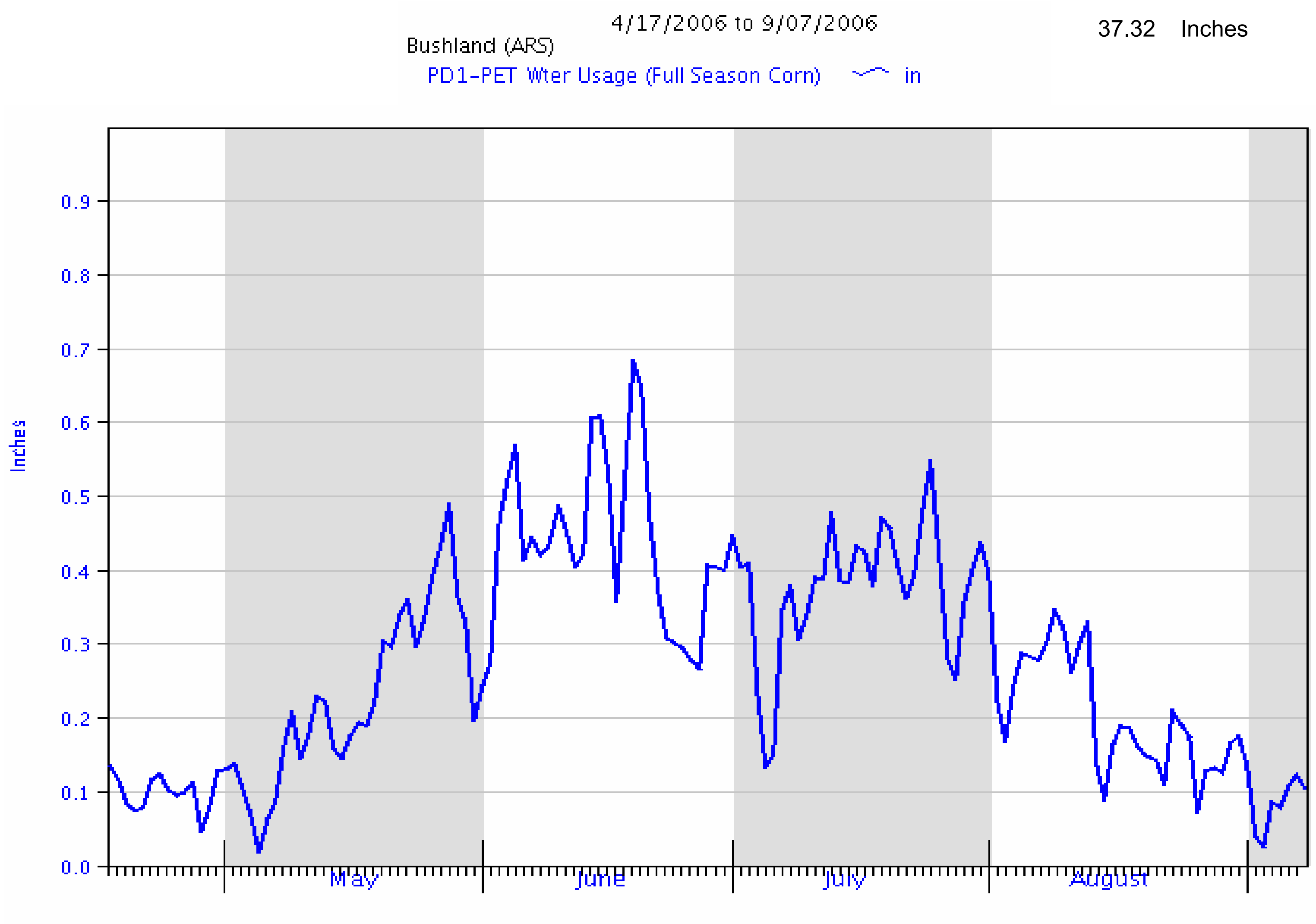
Lockney

PD1-PET Water Usage (Full Season Cotton) in

28.2 Inches

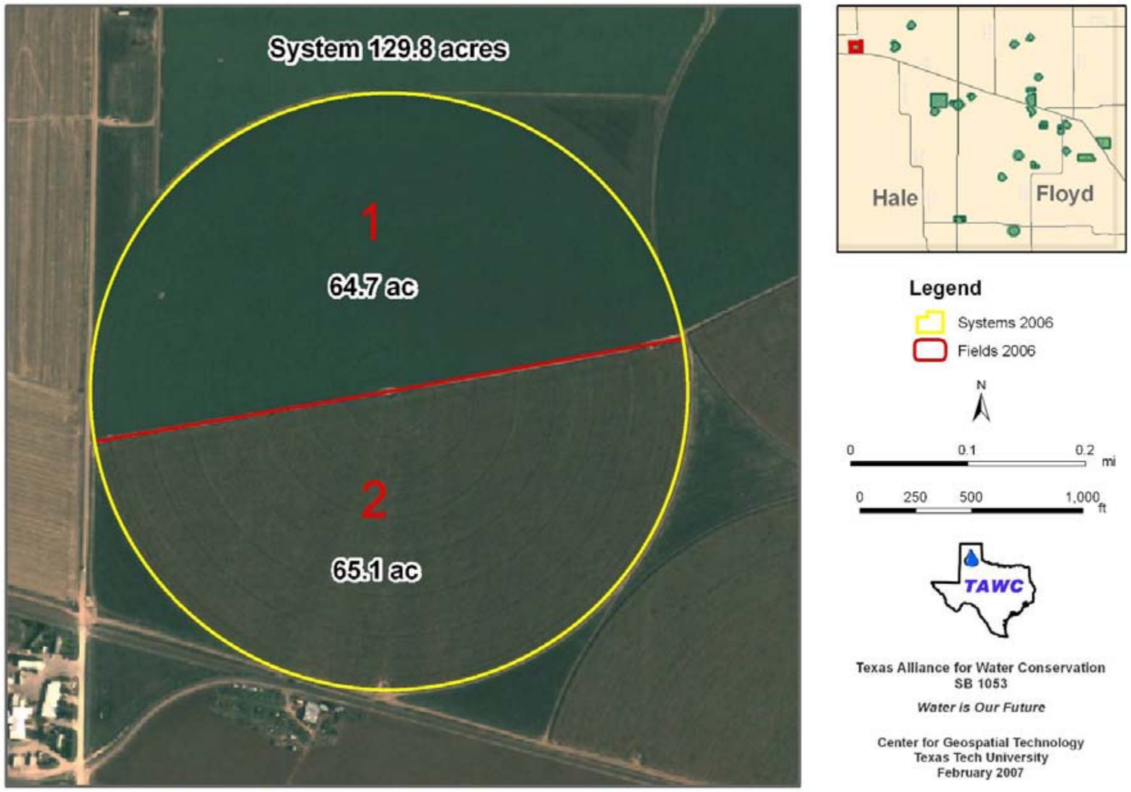


Site 23-2



4/17/2006 to 9/07/2006
37.32 Inches
Bushland (ARS)
PD1-PET Wter Usage (Full Season Corn) in
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August

System 24 - 2006



***Site 24 Description*:**

Total acres in system: 129.8

Field No. 1:
Acres: 64.7
Major soil type: Pullman clay loam; 0 to1% slope

Field No. 2
Acres: 65.1
Major soil type: Pullman clay loam; 0 to1% slope

Irrigation
Type: Center Pivot (LESA)
Pumping capacity,gal/min: 700
Number of wells: 1
Fuel source: diesel

SITE 24 COMMENTS

This is a corn and cotton system using pivot irrigation. Cotton was planted on 2005 corn ground on twenty-inch centers. White food corn was planted on twenty-inch centers following cotton with conventional till used on both crops.

Site No. 24

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	Conventional	-
Cover crop	None	-
Variety	'PM 2280 BR'	-
Row spacing, inches	30	-
Yield/acre		
Lint, lb	989	-
Lint, lbs/inch irrigation water	106	-
Lint, lbs/inch total water	41	-
Seed, tons	0.88	-
Pounds water/lb of lint	5,576	-
Field No. 1		
Corn		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	Pioneer 33V62
Row spacing, inches	-	20
Yield/acre		
Silage, ton (as ensiled)	-	26.2
Silage, lb/inch irrigation water	-	2,029
Silage, lbs/inch total water	-	1,255
Pounds water/lb of silage	-	181
Field No. 2		
Corn		
Tillage system	Conventional	-
Cover crop	None	-
Variety	'Pioneer 33V62'	-
Row spacing, inches	20	-
Yield/acre		
Grain, bu	218	-
Grain, lbs/inch irrigation water	590	-
Grain, lbs/inch total water	342	-
Pounds water/lb of grain	662	-

Field No. 2

Cotton		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	FM 9060 Flex and FM 9063B2Flex
Row spacing, inches	-	20

Yield/acre

Lint, lb	-	1,160
Lint, lbs/inch irrigation water	-	90
Lint, lbs/inch total water	-	40
Seed, tons	-	0.85
Pounds water/lb of lint	-	5,640

Fertilizer, lbs/system acre

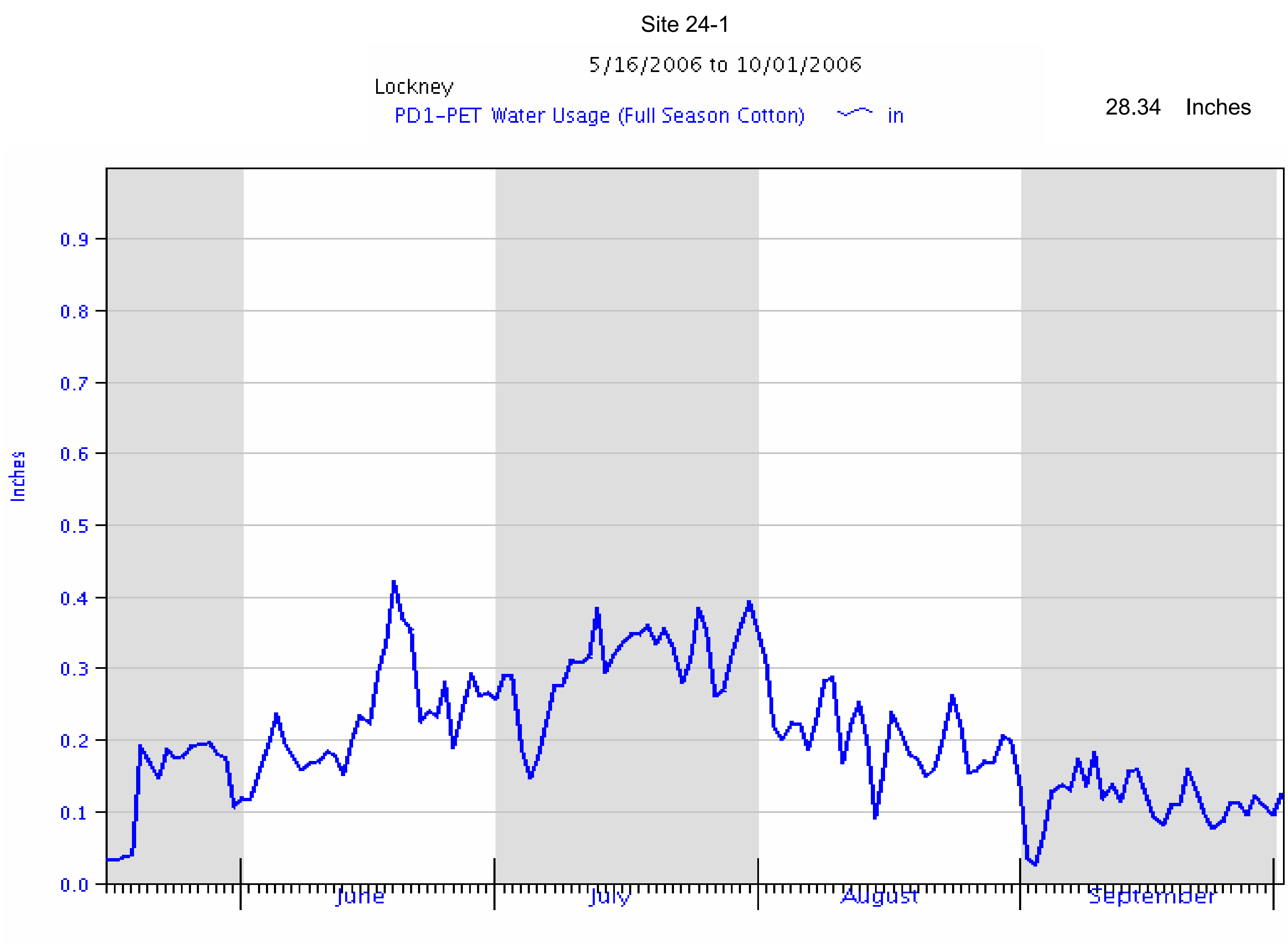
Nitrogen	187	170
Phosphorus (P_2O_5)	58	0
Potassium (K_2O)	0	0
Other	0	0

Water use, inches

Irrigation		
By field		
Field 1	9.4	25.8
Field 2	20.7	12.9
By system	14.7	19.4
Precipitation	15.0	16.0
Total system (irrigation + precipitation)	29.7	35.4

Income and Expense, $/system acre

Projected returns	686.63	676.57
Costs		
Total variable costs	443.10	514.75
Total fixed costs	93.66	93.65
Total all costs	536.75	608.40
Net returns		
Per system acre	149.87	68.17
Per acre inch of irrigation water	9.96	3.51
Per pound of Nitrogen	0.86	0.40


Site 24-1
5/16/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton) in
28.34 Inches
Inches
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
June
July
August
September

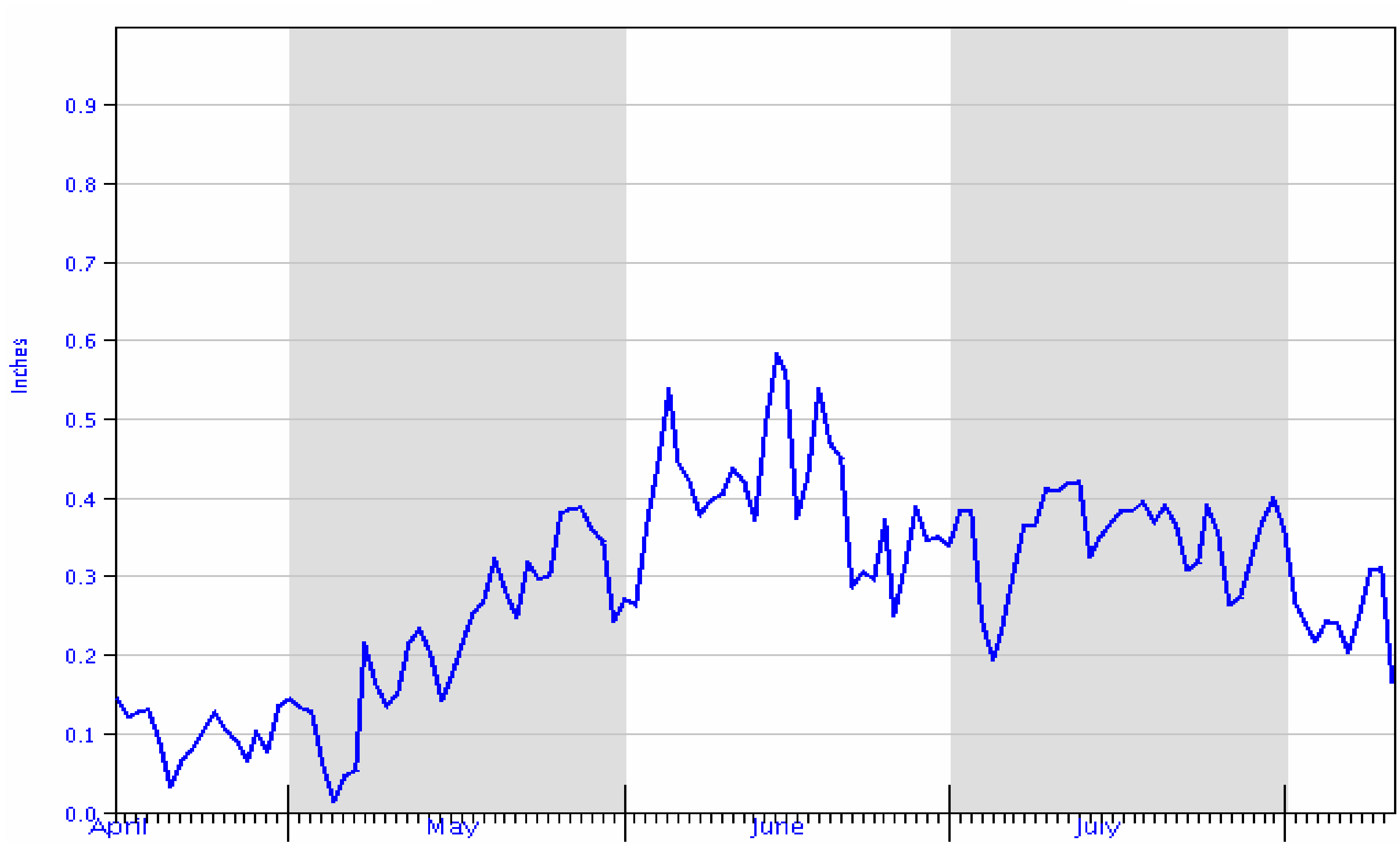
Site 24-2

4/15/2006 to 8/10/2006

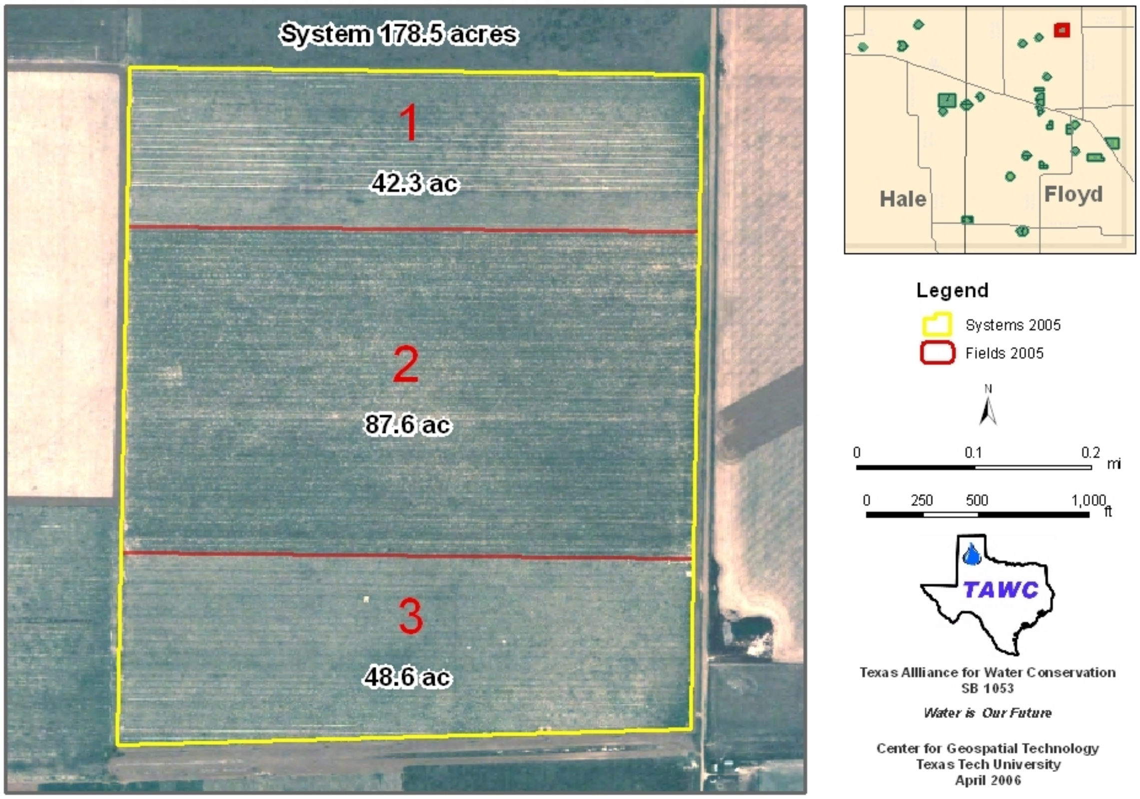
Lockney

PD1-PET Wter Usage (Full Season Corn) in

33.69 Inches



System 25



***Site 25 Description*:**

Total acres in system: 178.5

Field No. 1:
Acres: 42.3
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 2:
Acres: 87.6
Major soil type: Pullman clay loam; 0 to 1% slope

Field No. 3:
Acres: 48.6
Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation
Type: Dryland

SITE 25 COMMENTS

At this dryland site cotton and grain sorghum are grown in rotation. The cotton is planted in standing grain sorghum stalks. Cotton and grain sorghum are planted on forty-inch centers.

Site No. 25		Site 25 Terminated in
Item	**Year 1**	**Year 2**
Crops		
Field No. 1		
Cotton		
Tillage system	No-till or limit-till	
Cover crop	None	
Variety	'PM 2326 RR'	
Row spacing, inches	40	
Yield/acre		
Lint, lb	676	
Lint, lbs/inch irrigation water	dryland	
Lint, lbs/inch total water	37	
Seed, tons	0.58	
Pounds water/lb of lint	6,164	
Field No. 2		
Grain sorghum		
Tillage system	No-till or limit-till	
Cover crop	None	
Variety	'DeKalb 39Y'	
Row spacing, inches	40	
Yield/acre		
Grain, cwt	27.45	
Grain, lbs/inch irrigation water	dryland	
Grain, lbs/inch total water	149	
Pounds water/lb of seed	1,518	
Field No. 3		
Cotton		
Tillage system	No-till or limit-till	
Cover crop	None	
Variety	'PM 2326 RR'	
Row spacing, inches	40	
Yield/acre		
Lint, lb	676	
Lint, lbs/inch irrigation water	dryland	
Lint, lbs/inch total water	37	
Seed, tons	0.58	
Pounds water/lb of lint	6,164	

Fertilizer, lbs/system acre

Nitrogen	19	-
Phosphorus (P_2O_5)	0	-
Potassium (K_2O)	0	-
Other	0	-

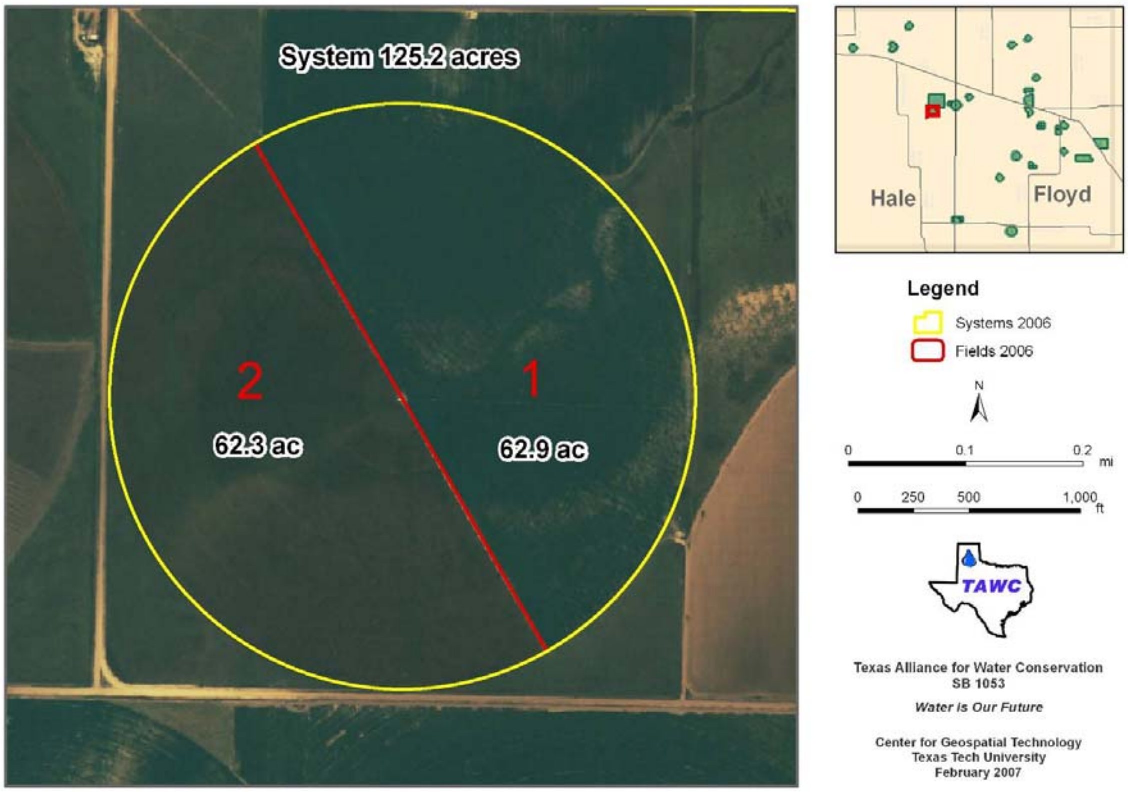
Water use, inches

Irrigation	Dryland	-
By field		
Field 1	0	-
Field 2	0	-
By system	0	-
Precipitation	18.4	-
Total system (irrigation + precipitation)	18.4	-

Income and Expense, $/system acre

Projected returns	267.30	-
Costs		
Total variable costs	184.71	-
Total fixed costs	15.00	-
Total all costs	199.71	-
Net returns		
Per system acre	67.58	-
Per acre inch of irrigation water	NA	-
Per pound of Nitrogen	3.56	-

System 26 - 2006



***Site 26 Description*:**

Total acres in system: 123.4

Field No. 1:
Acres: 62.9
Major soil type: Bippus loam; 0 to 3% slope
Mansker loam, 3 to 5% slope

Field No. 2:
Acres: 62.3
Major soil type: Bippus loam; 0 to 3% slope
Mansker loam, 3 to 5% slope

Irrigation
Type: Center Pivot
Pumping capacity, gal/min: 600
Number of wells: 2
Fuel source: 1 electric; 1 diesel

SITE 26 COMMENTS

This is a corn and cotton pivot irrigated site. Cotton was planted on twenty-inch centers following 2005 corn. Corn is planted on twenty-inch centers with both crops using conventional tillage.

Site No. 26

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system	Limit-till	-
Cover crop	None	-
Variety	‘PM 2379 RR’	-
Row spacing, inches	40	-
Yield/acre		
Lint, lb	1,213	-
Lint, lbs/inch irrigation water	143	-
Lint, lbs/inch total water	57	-
Seed, tons	0.93	-
Pounds water/lb of lint	3,958	-
Field No. 1		
Corn		
Tillage system	-	Conventional
Cover crop	-	None
Variety	-	‘Pioneer 3362’
Row spacing, inches	-	20
Yield/acre		
Grain, bu	-	161.9
Grain, lbs/inch irrigation water	-	426
Grain, lbs/inch total water	-	243
Pounds water/lb of grain	-	932
Field No. 2		
Corn		
Tillage system	Conventional	-
Cover crop	None	-
Variety	‘Pioneer 3362’	-
Row spacing, inches	20	-
Yield/acre		
Grain, bu	228	-
Grain, lbs/inch irrigation water	1021	-
Grain, lbs/inch total water	507	-
Pounds water/lb of grain	447	-

<u>Field No. 2</u>

Cotton		
Tillage system		Limit-till
Cover crop		None
Variety		'PM 2379 RR'
Row spacing, inches		20

Yield/acre

Lint, lb	-	2,112.3
Lint, lbs/inch irrigation water	-	199
Lint, lbs/inch total water	-	79
Seed, tons	-	1.37
Pounds water/lb of lint	-	2,852

Fertilizer, lbs/system acre

Compost, tons/acre	0	1.5[2]
Nitrogen	136	209
Phosphorus (P_2O_5)	48	45
Potassium (K_2O)	0	45
Sulfur	0	10.7

Water use, inches

Irrigation		
By field		
Field 1	8.5	21.3
Field 2	12.5	10.6
By system	10.5	16.0
Precipitation	12.7	16.0
Total system (irrigation + precipitation)	28.1	31.9

Income and Expense, $/system acre

Projected returns	779.52	969.66
Costs		
Total variable costs	484.55	632.67
Total fixed costs	93.53	93.67
Total all costs	578.08	726.34
Net returns		
Per system acre	192.44	243.32
Per acre inch of irrigation water	18.34	15.22
Per pound of Nitrogen	1.42	1.16

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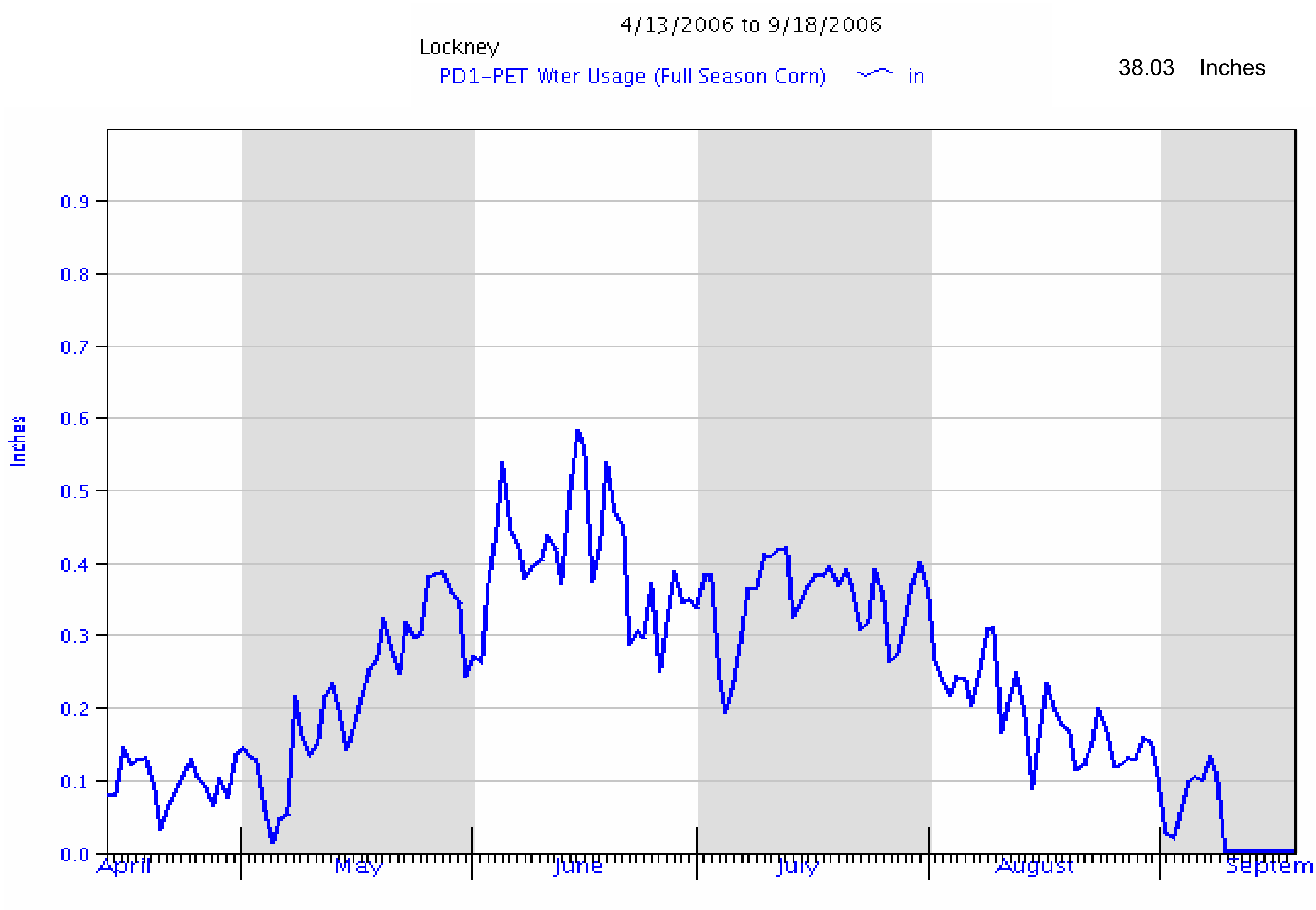
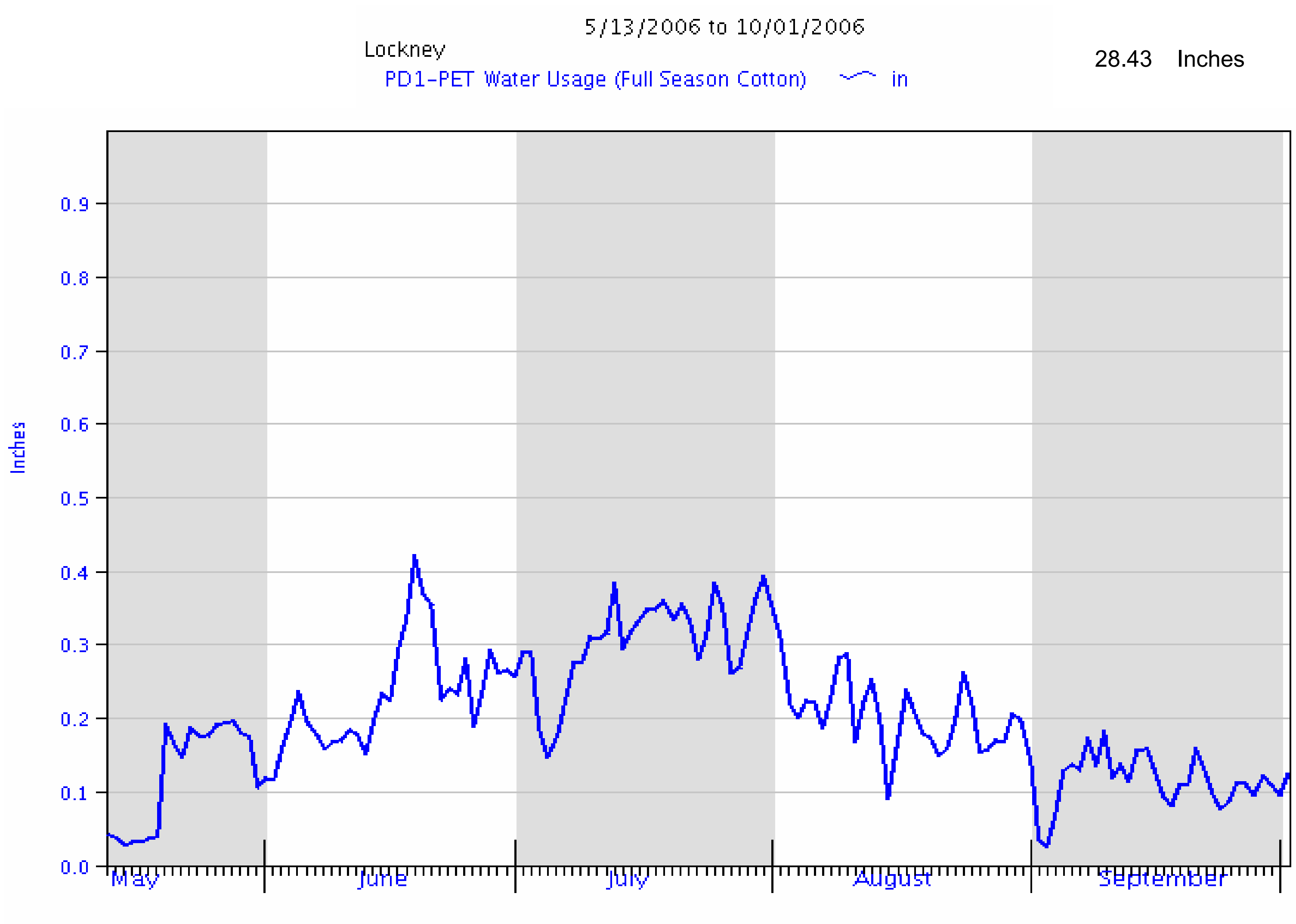
[2] Compost provided 45 lbs. of nitrogen plus all other nutrients in 2006.

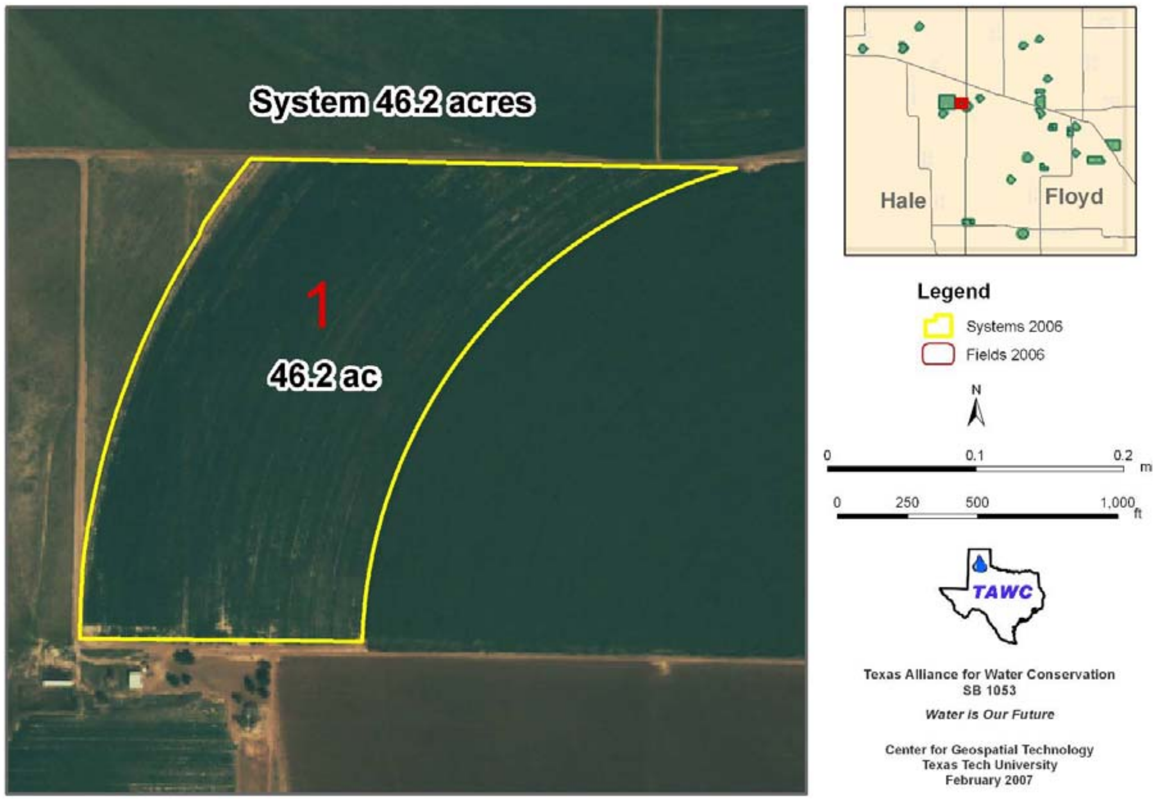
Site 26-1


4/13/2006 to 9/18/2006
Lockney
PD1-PET Wter Usage (Full Season Corn)
in
38.03 Inches
Inches
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
April
May
June
July
August
Septem

Site 26-2


5/13/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton) in
28.43 Inches
Inches
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
May
June
July
August
September

System 27 - 2006



***Site 27 Description*:**

Total acres in system: 46.2

Field No. 1:

Acres: 46.2

Major soil type: Pullman clay loam; 0 to 1% slope

Irrigation

Type: Sub-surface Drip (installed prior to 2006 crop year)

Pumping capacity, gal/min: NA

Number of wells: NA

Fuel source: electric

SITE 27 COMMENTS

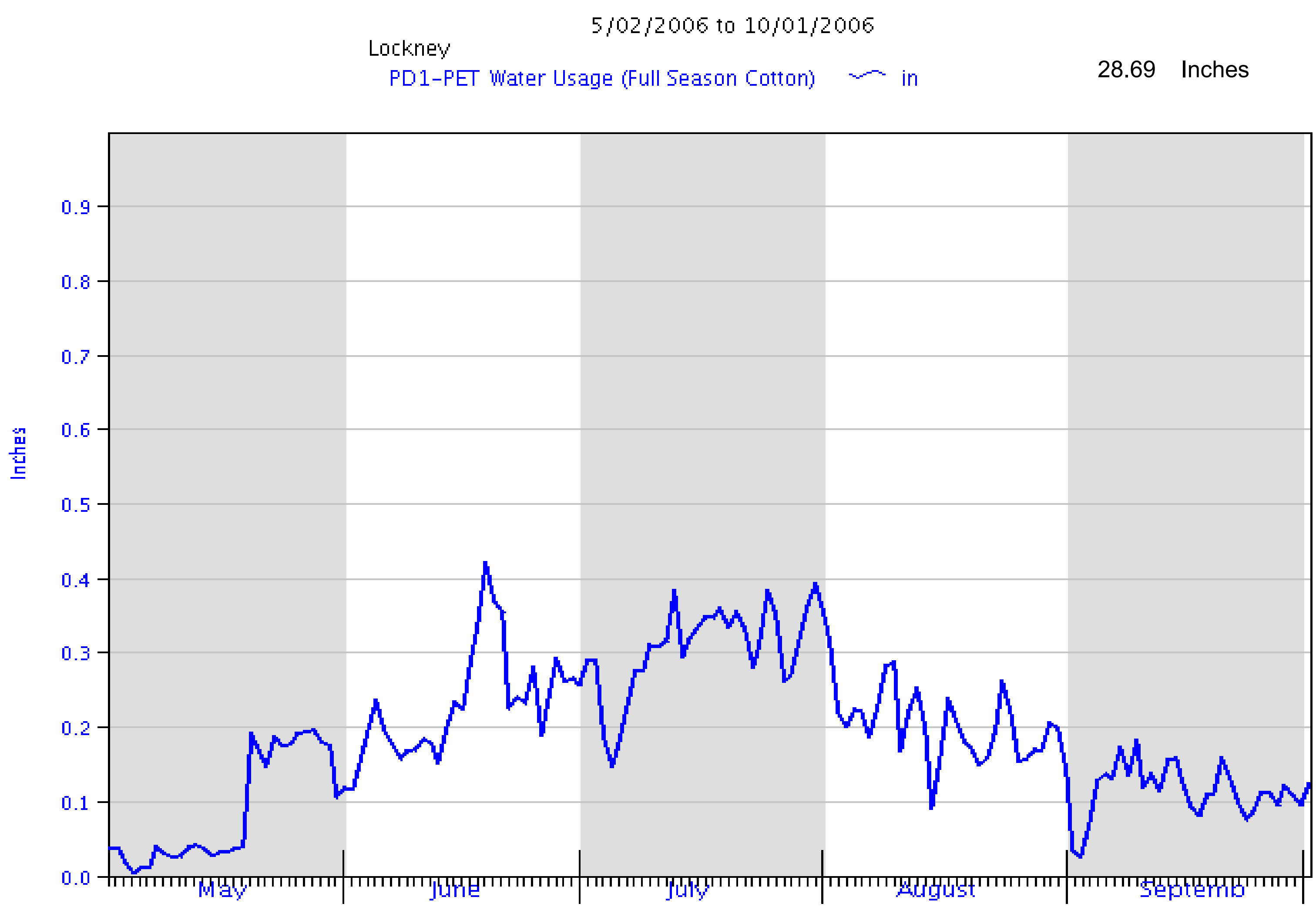
This is a new site using drip irrigation. Cotton was planted on forty-inch centers using conventional tillage.

Site No. 27 — Site 27 entered project in Year 2

Item	Year 1	Year 2
Crops		
Field No. 1		
Cotton		
Tillage system		Limit-till
Cover crop		Wheat
Variety		'BW 4630'
Row spacing, inches		40
Yield/acre		
Lint, lb		2,240
Lint, lbs/inch irrigation water		124
Lint, lbs/inch total water		64
Seed, tons		1.46
Pounds water/lb of lint		3,526
Fertilizer, lbs/system acre		
Nitrogen	-	145
Phosphorus (P_2O_5)	-	5.8[1]
Potassium (K_2O)	-	1
Other	-	0
Water use, inches		
Irrigation		
By field		
Field 1	-	18.00
By system	-	18.00
Precipitation	-	16.88
Total system (irrigation + precipitation)	-	34.88
Income and Expense, $/system acre		
Projected returns	-	1,450.96
Costs		
Total variable costs	-	912.97
Total fixed costs	-	120.00
Total all costs	-	1,032.97
Net returns		
Per system acre	-	417.99
Per acre inch of irrigation water	-	23.22
Per pound of Nitrogen	-	2.88

[1] Phosphorus was applied through subsurface drip irrigation.

Site 27-1


5/02/2006 to 10/01/2006
Lockney
PD1-PET Water Usage (Full Season Cotton) in
28.69 Inches
Inches
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
May
June
July
August
Septemb

OVERALL SUMMARY OF YEARS 1 AND 2

A key defining characteristic of this demonstration project is the fact that producers make the decisions on cropping and livestock practices. We simply document what these decisions are, the impact that they have on water use, and on the economic returns. This also provides a way to monitor over time what changes are occurring in crop and livestock enterprise decisions. Although it is too soon, with 2 years of data, to document trends and changes in land-use in this area, differences between the 2005 and 2006 growing seasons occurred and are interesting. When the number of sites that include different enterprises are compare between the two years, more sites included small grains, cattle, and corn in 2006 than in 2005 (Figure 6). No changes occurred in the number of sites with perennial forage or sorghum. The number of sites that included cotton declined by 1. The loss of site 25 and the gain of site 27 had no impact on cotton sites because both included cotton and were only about 30 acres different in acreage devoted to cotton. No sunflowers were grown in 2006, thus, the number of sites with 'other crops' declined by one.

A second way to look at these trends is to evaluate the total number of acres within these 26 sites that are devoted to each land use. Nearly half of the land included within these 26 sites is planted to cotton, while perennial forages and land grazed by cattle account for the other major land use in this region (Figure 7). It is important to note that cattle graze not only perennial forages but also graze some of the small grains and possibly other acres while some acres established in perennial forages are harvested entirely for hay and are not grazed. In 2006, acres planted in small grains approached that of perennial forages. Acres in corn and sorghum are each about one half the area planted to perennial forage. Within these 26 sites, total acreage of cotton and sorghum declined while the total number of acres planted to corn and small grains increased in 2006, compared with 2005

Total mean irrigation across all sites nearly doubled in 2006 compared with 2005 (Table 12). With higher temperatures, cotton yields increased in 2006 compared with 2005 but mean irrigation of cotton also increased between these two years. Irrigation of corn for both grain and silage increased in 2006 compared with the previous year but yields declined likely reflecting the negative impact of high temperature and limitations on water for corn production in this region. Sorghum silage irrigation was lower in 2006 than 2005 and may reflect the diversion of water resources to other crops. At this point, yields of sorghum silages reflect few sites and different management practices that make yield trends difficult to interpret but overall production was 26.0 and 20.4 tons/acre in 2005 and 2006, respectively.

Site 20 provides an interesting comparison of economics, water use, and total forage production of three silages types. Corn was grown for silage on about one half of this system while triticale and sorghum were double-cropped on the remaining acres. As shown in Figure 8, total biomass production and profitability were higher per acre for double cropped small grain and sorghum silage than for corn while total irrigated water use by the double crop management was less than one-half that of corn.

Table 12. Overall summary of crop production, irrigation, and economic returns within 26 production sites in Hale and Floyd Counties during 2005 and 2006.

Item	Year 1	Year 2
Mean Yields, per acre		
(only includes sites producing these crops)		
By Crop		
Cotton		
Lint, lbs	1,101	1,444
Corn		
Grain, lbs	12,712	8,814
Grain, bu	227	157
Silage, tons	30.9	28.3
Sorghum		
Silage, tons	26.0	20.4
Irrigation applied, inches		
By System		
Total irrigation water (system average)	8.4 (26) [2]	13.8 (26)
By Crop		
Cotton	8.7 (19)	14.3 (19)
Corn grain	17.4 (3)	21.0 (4)
Corn silage	18.0 (2)	24.0 (3)
Sorghum silage	15.0 (1)	12.5 (2)
Pearlmillet (seed)	11.5 (1)	10.2 (1)
Alfalfa	10.3 (1)	34.5 (1)
Small grain silage	7.5 (1)	10.2 (3)
Small grain hay	-	4.9 (1)
Small grain grazing	1.5 (3)	0.8 (2)
Perennial grasses	6.5 (7)	8.8 (7)
Income and Expense, $/system acre		
Projected returns	660.21	773.82
Costs		
Total variable costs	444.51	502.33
Total fixed costs	77.59	79.71
Total all costs	521.12	581.24
Net returns		
Per system acre	139.12	192.58
Gross margin per acre inch irrigation water	26.28	19.54
Per acre inch of irrigation water	21.15	16.11

[2] Numbers in parenthesis refer to the number of sites in the mean.

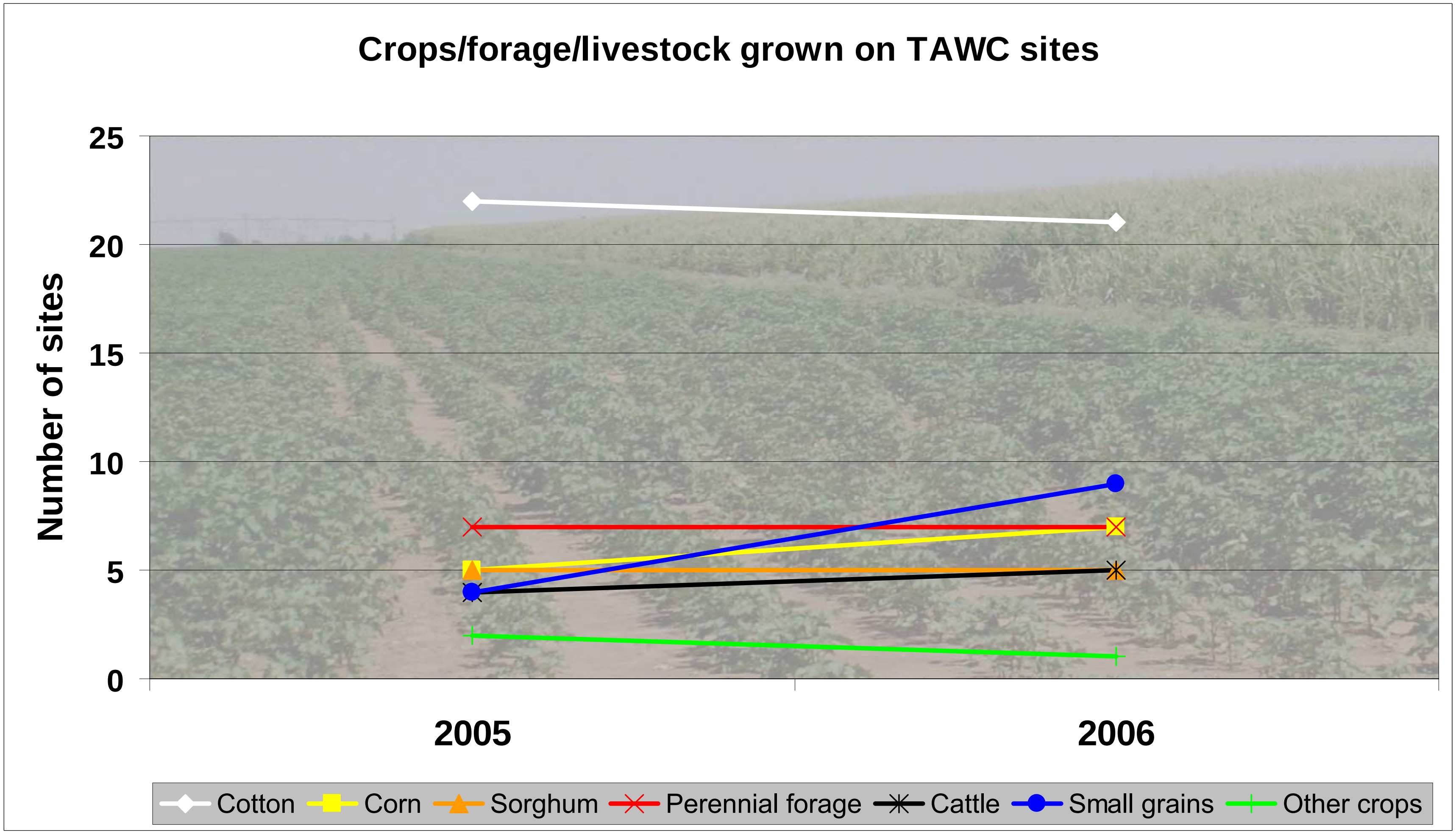


Figure 6. Number of systems (sites) that include cotton, corn, sorghum, perennial forages, cattle, small grains, and other crops within the 26 producer systems located in Hale and Floyd Counties. 'Other crops' include pearlmillet and sunflowers.

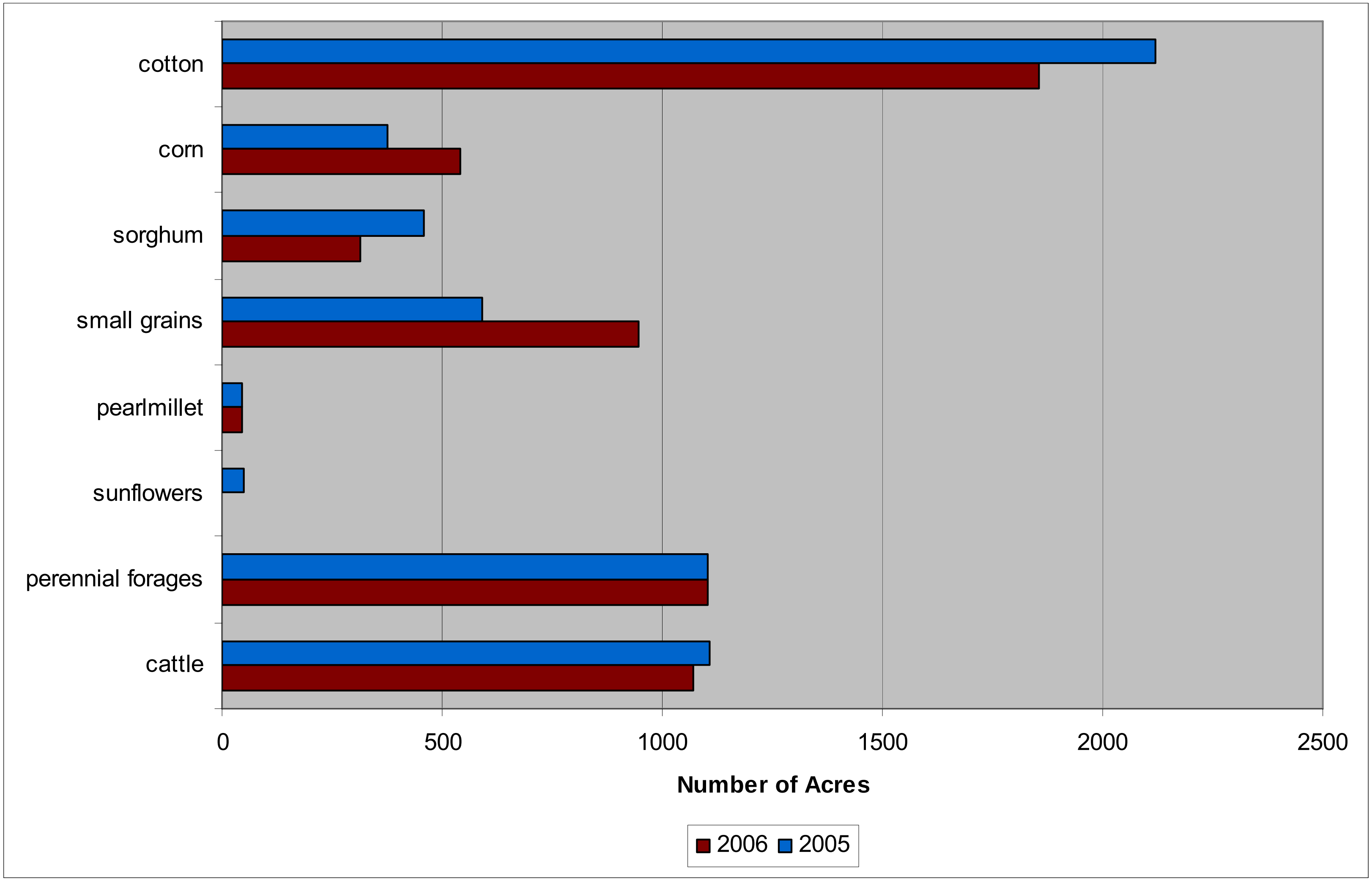


Figure 7. Total number of acres planted to cotton, corn, sorghum, small grains, pearlmillet, sunflowers, perennial forages and acres grazed by cattle in 26 producer systems in Hale and Floyd Counties.

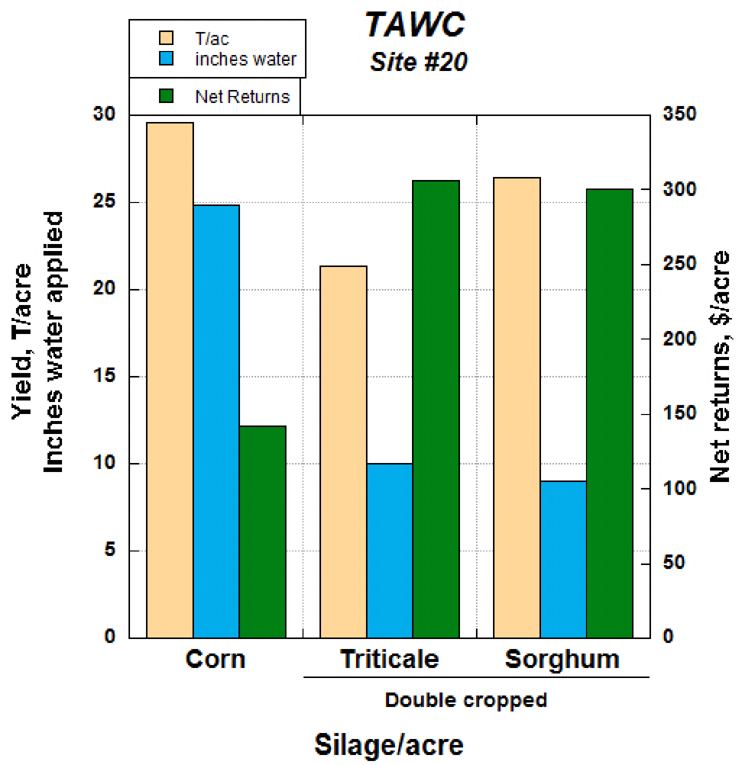


Figure 8. Yield, irrigation applied, and net returns per acre of corn, triticale, and sorghum silages in 2006. Sorghum and triticale were double-cropped.

These field-scale results are consistent with research data from Texas A&M, Amarillo and suggest that if quality of these forages are comparable, where water is limited, sorghum and triticale silages may increase profitability while conserving more water for this region and may be useful in meeting the requirements of the livestock industries, particularly the dairy industry. Much more information is now beginning to emerge as results are analyzed from these 26 sites regarding returns to investments of water, energy, and fertility. Patterns of response will become increasingly clear as we include additional years of data. Related research from both Texas A&M and Texas Tech University are providing additional validity to observations emerging from the Demonstration Project.

Results of year 1 and year 2 are summarized in Table 12, Table 13 and Table 14 for the 26 systems being monitored. It is important to understand that these systems are compared on a basis that equalizes those factors that are not unique to the system and that do not influence the systems results. (see Assumptions, page 10) These factors include depth to water, prices paid for fertilizers and pesticides, and other factors that vary among locations but do not reflect the functioning of the particular system. Thus, results of these analyses do not reflect the profitability of the individual site under the specific conditions and marketing opportunities of the individual system. This does, however, allow us to make comparisons among systems that are not biased by individual variability. This allows us to see how the system functions per se.

The 2005 growing season in Hale and Floyd Counties was near ideal in terms of precipitation amount and distribution. Harvest conditions were excellent for the cotton crop. Dryland systems benefited likely from soil moisture stored from the previous high-rainfall year as well as the timely rains that occurred during the growing season. The 2006 growing season was characterized by one of the most severe and extended drought periods on record for this region. Pumping of water reached near capacity levels. Total seasonal rainfall was similar between the two years but distribution during the growing season differed dramatically.

Net returns per system acre were greater in 2006 than 2005 but gross margin per acre inch of irrigation water and net returns per inch of irrigation water applied were lower in 2006 than in 2005 (Table 12). The differences between these two years underscore the importance of multiple years of observation but some patterns are beginning to emerge. It will take additional years of data to begin to understand how these systems function over a range of environmental conditions. Several systems were influenced by planting costs incurred in 2005 for crops or forages that were not harvested or grazed until 2006, thus, influencing the profitability of these systems in 2005. Most of these systems are now fully operational but other systems are changing as producers make operational decisions. This is what was intended and provides a truly unique ability to monitor what is happening on the Texas High Plains. Decisions for planting in late 2006 and early 2007 are being influenced by the relative prices for cotton, corn grain, cattle, water availability, and loan potentials. This large demonstration project is an absolutely one-of-a-kind chance to measure and interpret what changes are happening and to understand the dynamics of these systems such that practices that conserve water and remain economically viable can be identified and translated to other locations.

Table 13. Summary of results from monitoring 26 producer sites during 2005 (Year 1).

System	Site No.	Acres	Irrigation Type[1]	System inches	$/system acre	$/inch water
Cotton	1	61	SDI	11.7	84.02	7.19
Cotton	2	58	SDI	8.9	186.94	21.00
Cotton	14	125	CP	6.8	120.90	17.91
Cotton	16	145	CP	7.6	123.68	16.38
Cotton	21	123	CP	6.8	122.51	18.15
Cotton	11	95	Fur	9.2	4.39	0.48
Cotton	15	98	Fur	4.6	62.65	13.62
Cotton/grain sorghum	3	125	CP	8.3	37.79	4.66
Cotton/grain sorghum	18	120	CP	5.9	16.75	2.84
Cotton/grain sorghum	25	179	DL	0.0	67.58	na
Cotton/forage sorghum	12	250	DL	0.0	36.00	na
Cotton/pearlmillet	19	120	CP	9.5	186.97	19.12
Cotton/corn	22	148	CP	15.3	166.63	10.90
Cotton/corn	24	129	CP	14.7	149.87	9.96
Cotton/corn	26	123	CP	10.5	192.44	18.34
Cotton/sunflowers	23	110	CP	5.4	270.62	47.07
Cotton/alfalfa	4	123	CP	5.5	110.44	19.06
Cotton/wheat	13	315	DL	0.0	47.37	na
Cotton/corn silage/grass	17	223	CP	10.5	188.44	17.91
Corn/wheat/sorghum silages	20	220	CP	21.5	-48.60	-2.16
Cotton/wheat/stocker cattle	6	123	CP	11.4	162.63	9.04
Cotton/grass/stocker cattle	9	237	CP	6.5	298.14	46.17
Cotton/grass/cattle	10	175	CP	8.5	187.72	22.06
Forage/beef cow-calf	5	630	CP	1.23	125.89	93.34
Forage/Grass seed	7	61	SDI	9.8	425.32	37.81
Forage/Grass seed	8	130	CP	11.3	346.90	35.56

[1]SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland.

Table 14. Summary of results from monitoring 26 producer sites during 2006 (Year 2).

System	Site No.	Acres	Irrigation Type[1]	System inches	$/system acre	$/inch water	Gross margin per inch irrigation
Cotton	1	135	SDI	21.0	225.90	10.76	15.77
Cotton	2	61	SDI	19.0	308.71	16.25	22.56
Cotton	27	46	SDI	18.0	417.99	23.22	29.89
Cotton	3	123	CP	10.0	105.79	10.58	18.44
Cotton	6	123	CP	13.6	321.79	23.64	29.42
Cotton	14	124	CP	6.2	44.81	7.20	19.84
Cotton	16	143	CP	12.2	71.08	5.81	8.43
Cotton	11	93	Fur	16.9	88.18	5.22	9.37
Cotton/grain sorghum	15	96	Fur	11.2	161.89	14.51	20.78
Cotton/forage sorghum	12	284	DL	0.0	-13.72	Na	Na
Cotton/forage sorghum/oats	18	122	CP	12.0	-32.31	-2.69	3.86
Cotton/pearlmillet	19	120	CP	9.8	95.28	9.77	17.83
Cotton/corn	22	149	CP	22.0	285.98	12.98	16.55
Cotton/corn	24	130	CP	19.4	68.17	3.51	8.34
Cotton/corn	26	123	CP	16.0	243.32	15.22	21.08
Cotton/corn	23	105	CP	14.8	127.39	8.59	13.90
Cotton/alfalfa/wheat/forage sorghum	4	123	CP	26.7	312.33	11.69	14.75
Cotton/wheat	13	320	DL	0.0	-33.56	Na	Na
Corn/triticale/sorghum silages	20	233	CP	21.9	375.73	17.14	19.60
Cotton/stocker cattle	21	123	CP	16.4	94.94	5.79	10.22
Cotton/grass/stocker cattle	9	237	CP	10.6	63.29	6.26	13.87
Cotton/corn silage/wheat/cattle	17	221	CP	13.0	242.21	14.89	20.64
Forage/beef cow-calf	5	628	CP	9.6	150.46	15.62	22.31
Forage/beef cow-calf	10	174	CP	16.1	217.71	13.52	18.40
Forage/Grass seed	7	130	CP	7.8	687.36	88.69	98.83
Forage/Grass seed	8	62	SDI	10.1	376.36	48.56	64.05

[1]SDI – Subsurface drip irrigation; CP – center pivot; Fur – furrow irrigation; DL – dryland

REPORTS BY SPECIFIC TASK

TASK 2: PROJECT ADMINISTRATION AND SUPPORT

2.1 Project Director: Rick Kellison. From a weather standpoint year two has been a complete opposite from year one. We went into this growing season with very little reserve soil moisture and we had one of the driest growing seasons on record. Because of the lack of rainfall we did not have any replants due to hail storms and this is out of the ordinary for our area.

I had the opportunity to conduct twelve site tours during the 2006 growing season. On April 6th we had a group of fifty producers from Alabama tour the integrated forage livestock sites. On April 7th we had a group with AgCert tour all twenty six sites. Eddie Teeter and I hosted Senator Robert Duncan, Katie Day, and Brandon Lipps for a tour on August 22nd. This was an opportunity for us to share goals and ideas for the project with Senator Duncan. On October 25th TAWC hosted Senator Robert Duncan, U.S. Congressman Randy Neugebauer, Bill Mullican, Comer Tuck, Katie Day, Jimmy Clark and Tom Sell for a tour of selected sites. After the tour, we had a short program on Randy and Lanney Bennett's demonstration sites with approximately twenty five guests in attendance. Eddie Teeter, Glen Schur, Boyd Jackson and I were interviewed by a PBS crew from Austin on November 14th. They were touring various locations throughout the state for a documentary on water shortages in Texas.

TAWC and Texas Cooperative Extension Service hosted three producer meetings this year. The first was an irrigation scheduling meeting held at the Floyd County Unity Center with approximately thirty producers present. On March 30th we had over eighty producers attend our forage conference held at the Plainview County Club and on February 6th, 2007 a cow/calf beef workshop was held at the Floyd County Unity Center.

The Hale County Farm Tour visited two of our sites and the Floyd County Farm tour visited three of the demonstration sites with a total of approximately one hundred producers attending. On October 5th, twenty eight producers attended a turn row meeting on the Eddie Teeter farm highlighting Dr. Calvin Trostle's grass variety trial.

On July 30th five of our producer board and six members of the management team traveled to Harlingen to visit the LRGV Project. This was a very valuable trip and gave all of us a better understanding of the problems producers face in that area of the state.

During 2006 I made eight presentations to various producer meetings and organizations explaining TAWC and two radio interviews.

On January 26th, 2007 TAWC hosted a meeting to determine the best method to help disseminate Dr. Brent Bean's forage research data. Dr. Bean has conducted some very timely research that demonstrates as much as a forty percent reduction in water use to produce the same quantity and quality of silage as compared to corn silage. With the recent influx of dairies into the Texas Panhandle we saw this as an excellent opportunity to have an impact on water use. One projection is the number of dairy cows will double in the next four years. Dr. Brent Bean, Dr. Calvin Trostle, Dr. Vivien Allen, Dr. David Doerfert, Ricky Rice, Dr. Will Cradduck and I were in attendance. A brochure will be developed to distribute to producers, dairies and feed yards.

We have had our monthly management team meeting the second Thursday of each month with excellent attendance. I have visited each of the demonstration sites on a regular basis.

2.2 Secretary/Bookkeeper: Angela Beikmann. *(three-quarter time position).* Year 2 main objectives for the secretarial and bookkeeping support role for the TAWC project include the following.

Accurate Accounting of All Expenses for the Project. This includes a formal budget amendment to include a line item for "vehicle insurance," monthly reconciliation of accounts with TTU accounting system, quarterly reconciliation of subcontractors' invoices, preparation of itemized quarterly reimbursement requests, and preparation of Task and Expense Budget reported for Year 2 of the project.

Administrative Support for Special Events. A Forage Workshop was held in March, 2006. Registration materials, workshop materials, continuing education certificates and advertisements were prepared and distributed. Lodging provisions for workshop speakers were arranged.

A Field Day event was held in June, 2006. Advertisements, invitations and event materials were prepared and distributed. Project display was developed on site.

Project participants toured the Lower Rio Grande Valley demonstration project in July, 2006. Travel arrangements were made for eleven participants.

TAWC project site tour and program was held in October, 2006. Invitations and advertisements were prepared and distributed for this event. In attendance were Senator Robert Duncan, Congressman Randy Neugebauer, Bill Mullican, representatives from TTU, TAMU, HPUWCD and local producers.

TAWC project site tour and meetings were held on January 11, 2007. Appropriate correspondence and arrangements were made for Dr. Jeff Jordan to visit the project sites and meet with the Advisory Council and TAWC Management Team. PowerPoint presentation was assembled with slides from task leaders and/or project participants. This was presented at the Management Team meeting.

Ongoing Administrative Support. Quarterly reports have been assembled and forwarded to TWDB. These quarterly reports, dated February 28, 2006, May 31, 2006, August 31, 2006, November 30, 2006 and February 28, 2007, coincide with quarterly reimbursement requests submitted by TTU.

Management Team meeting minutes have been recorded and transcribed for each meeting. These meetings were held on February 16, March 9, April 13, May 11, June 8, July 13, August 10, September 14, October 12, November 9, and December 14, 2006, and January 11 and February 8, 2007.

Weather station data was collected and forwarded to each TAWC producer on a regular basis during the growing season. Collection and distribution of this data will be done again for Year 3 as requested.

Daily administrative tasks include many clerical procedures and documents pertaining to a business/education setting

2.3 Database team, geodatabase and research enterprise website development: Lucia Barbato, Paul Braden, Swetha Dorbala.

Database team. For the first half of 2006 the database team consisted of Lucia Barbato, Paul Braden, Swetha Dorbala from the TTU Center for Geospatial Technology (CGST). Ms. Dorbala, graduate student computer science, was recruited to another department at Texas Tech University in July 2006. The database team works closely with other members of the Texas Alliance for Water Conservation team.

Objectives. The objective of the database team is to develop a research enterprise database and website for data entry, management and reporting of research results from researchers and management involved in the project. The data to be managed includes cattle, climate, crop, economic, soil and system information.

Database Accomplishments. From July 5th through December 31st, 2005 the database team efforts included completing a user needs assessment, producing a draft user needs assessment and developing a prototype database design using SQL Server 2000. The design concept for development of a website to access the database was initiated.

For the period January 1st through December 31st, 2006 the draft user needs assessment was circulated among management team members for review and comment. The document was finalized without significant modification. Based on the needs assessment, a draft physical database design and data dictionary document was completed and delivered to the management team. This draft physical design would serve as a blueprint for future database development and programming. The physical design document is a dynamic document and is revised as modifications are made to the database and as comments are incorporated from the management team. A draft SQL table schema and poster was developed to present a view of the tables designed for the database. The poster was presented to for team review.

At the same time a physical database design was developed for the New Deal SARE area for comparison of results with the TAWC efforts. An initial database with fifty tables was developed using SQL Server 2000 and hosted on machines in the Center for Geospatial Technology at Texas Tech University. The database design documentation is substantially completed and only minor modifications are anticipated as internal and external testing continues and modifications are made to the database.

Several meetings took place to discuss how cattle information was collected for analysis and how the changes to data collection affected the existing database, database design documents and web pages. These meetings resulted in the database team revising the field data collection forms to ensure that each distinctive cattle type would be differentiated.

The cattle information includes:

Dry Cows	Stocker Cattle
Finishing Cattle	Wintering Pregnant Cows
Growing Heifers, Bulls & Steers	Veterinary Treatment
Lactating Cows	Supplemental Feed
Mature Bulls	

Having the database differentiate cattle by type ensures accurate calculations of amount of water consumed. Modifications to the database design, web pages and documentation were made accordingly.

Crop information was also incorporated into the database. This information includes:

Field observations	Irrigation Information
Biomass Measurements	Irrigation Type
Crop Planted	Irrigation Water Use Efficiency
Crop Labor Costs	Pesticide Information
Harvest Yield	Tillage Type
Mechanical Outputs	Agriculture Remote Sensing Estimates
Fertilizer Information	

The climate information incorporated into the database design includes:

Monitoring Station
Degree Days
Precipitation Event
Mesonet Information
Mesonet Station

Soil information incorporated into the database design includes:

Soil Sample Information
Soil Moisture Sample
Annual Erosion

System information managed by the database includes:

System Information
Field Information
System Type Information
Field Type Information

Economic information includes economic summary information only.

System Numbering: A concerted effort was made to refine the numbering system used to identify producer fields and systems. A numbering system was required to ensure integrity for data collection and data entry. This system was developed in a way that would maintain the history of activities at each location. This numbering system was reviewed on several occasions by the management team. To maintain project history of a field, the field number will remain the same as long as the field geometry is unchanged. Whenever the geometry (acres or location) of a field changes, that field number is retired and a new field number is assigned.

Website Development: A website is currently in development with a home page, and functionality for initial data entry, editing and reporting research results. The website was designed to retrieve data from the SQL database for the main data categories (cattle, climate, crop, economic, soil and system). The code and structure of the web site was developed in a .NET environment which generated aspx web pages. Two documents were developed containing the aspx code and html code respectively. The website contains approximately 20,000 lines of code with about 5,000 unique lines of code.

Initially the website was developed using data from the New Deal SARE project. This activity was pursued since data were available for all aspects of the project for development testing purposes. The New Deal website was made available for external testing in May. All pages from the New Deal website were directly ported to the TAWC web for continued development.

Discussions with Dr. Allen and Rick Kellison identified the need to maintain the highest security possible for the databases that are accessed by the websites. A security system was developed that provides three level of access: administrator, super user, and user. Only users with administrative privileges can add new users as well as perform all other functions including data entry, editing data and contacts, and viewing reports. Super users have access to the home page, data entry, editing data and contacts, and viewing reports. At a minimum for anyone to access pre-developed reports, they must be granted user status by an administrator. Therefore access to any information other than the home page requires a log in or administrator approval.

Furthermore the websites will not be linked to any public websites to minimize possibility of locating the websites by random searches. Therefore only persons having a need to know about the data will be granted access and given the URL for the web address. Selected data, however, can be made available on the public website when the reports become available and are approved by management for public access. If in the future, the management desires other users to view the home page only, then it can be linked to the existing public TAWC website.

The navigation for the TAWC website was simplified to three buttons. These buttons allow navigation to the home page, reports pages, and pages with administrative functions. The administrative functions include data entry, editing and contacts management.

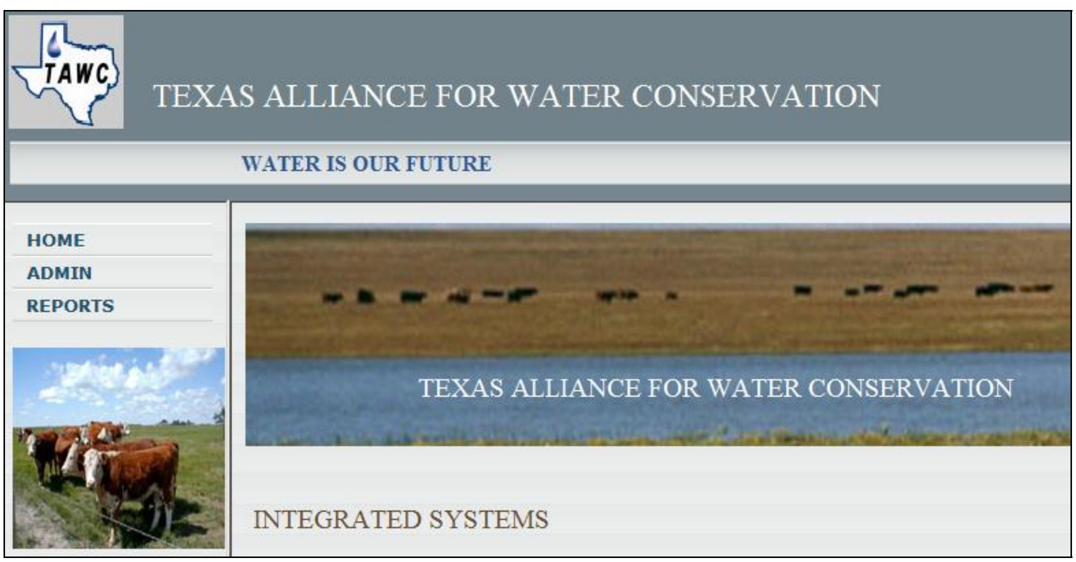


Figure 9. Home page for TAWC website.

The contacts information page was developed to store and retrieve information for producers, management team members, researchers, advisory council, students and others involved directly with the project. Initial data entry functionality was also developed for climate, economic, soil and system. This functionality is expected to be completed in Q2 of 2007.

The code to calculate and edit biomass measurements from the web page into the SQL database was completed. This functionality is anticipated to save considerable researcher time in the future. Subsequently the functionality for the cattle/stocker movement and cattle information functionality was also incorporated.

During initial testing of the website input from the principal tester, Phil Brown, identified the need to simultaneous view more than one record as data are input. Research into various methods to accommodate this functionality was conducted. The code was substantially reworked to incorporate a new structure called a data grid. A data grid allows researchers to view multiple records simultaneously on a webpage much like a spreadsheet. The data grid structure was integrated on .aspx pages, and were incorporated on web pages for small tables which can be viewed on a single screen.

	ID	Field	Irr Zone	MeterReadDate	IrrEnergyCost	TotGallons
Edit	359	Integrated C/L 1 A	SARE I-6	01/01/2001		4767700.0
Edit	360	Integrated C/L 1 A	SARE I-7	01/01/2001		4922100.0
Edit	361	Integrated C/L 2 D	SARE I-8	01/01/2001		5030700.0
Edit	363	Integrated C/L 2 B	SARE I-10	01/01/2001		4624200.0
Edit	364	Integrated C/L 3 A	SARE I-11	01/01/2001		4484600.0
Edit	365	Integrated C/L 3 A	SARE I-12	01/01/2001		4625800.0
Edit	366	Integrated C/L 1 B	SARE I-14	01/01/2001		4369200.0
Edit	368	Integrated C/L 1 D	SARE I-16	01/01/2001		4972200.0
Edit	369	Integrated C/L 2 A	SARE I-17	01/01/2001		4925100.0
Edit	370	Integrated C/L 2 A	SARE I-18	01/01/2001		4837100.0
Edit	371	Integrated C/L 3 B	SARE I-19	01/01/2001		4951800.0
Edit	373	Integrated C/L 3 D	SARE I-21	01/01/2001		4610900.0
Edit	1061	Integrated C/L 1 A	SARE I-6	01/01/2005		7366700.0
Edit	1062	Integrated C/L 1 A	SARE I-7	01/01/2005		7405000.0
Edit	1063	Integrated C/L 2 D	SARE I-8	01/01/2005		8669300.0

Figure 10. Sample data grid for data entry.

The website also supports standard html pages for data entry. Standard html pages are implemented for larger tables and whenever the number of fields required for input exceed what is reasonable to scroll left and right on a web page. It was a significant accomplishment to implement two different methods (aspx with data grids and html) for editing records in a single web site.

The ability to perform table validations was also investigated. A validation is a message displayed on the web page whenever a required field has not been populated. Validations were completed for tables related to crop management (including biomass, crop labor cost, irrigation information, harvest yield, crop planted, mechanical outputs, pesticides, and fertilizer) and contacts. Validations will be finalized in 2007.

During 2006 the basic functionality of the report framework was developed using SQL2000 reporting services. The reporting efforts are expected to continue in the next year as data are entered into the system and researchers desire feedback from the database.

With the completion of the basic web site functionality, efforts to make the web site more user-friendly were initiated. These efforts included setting up meetings with participants to test and comment on the web site. Updates to the website were made at the user site during testing as well as in the CGST lab. The website usability was significantly improved by incorporating additional data grid displays on data entry pages to display the ten previously entered records. This display will reduce the possibility of duplicate and other data entry errors. Additionally textual information was added to clarify instructions on the use of web pages where needed.

			System Numbering 2006				
Irrig. Type	**System Number**	**Field Number**	**Field Desc**	**System Acres**	**Irrig Field Acres**	**Non-Irrig Acres**	**Field Changes & Comments**
	1	-		135.2			
SDI (drip)	1	1	North-west field		24.6		
SDI (drip)	1	2	South-west field		37.7		
SDI (drip)	1	**3**	South-east field		37.0		**Field added 2006**
SDI (drip)	1	**4**	North-east field		35.8		**Field added 2006**
e irrigation station served all fields. Not able to report separate WUE by field.							
SDI (drip)	2	-	Single Drip Field	60.9	60.9		
	3	-		123.3			
pivot		1	North Half		61.5		
pivot		2	South Half		61.8		

Figure 11. Sample of system numbering spreadsheet.

<u>GIS Accomplishments</u>. The database team developed a set of GIS geodatabases for the TAWC and New Deal project areas. The purpose of these geodatabases is to allow creation of maps and to visualize changes in the systems over time. Development of these geodatabases involved a significant amount of geoprocessing to update data from previously created data. The systems and fields were re-GPSed by Will Cradduck and the geodatabase feature classes of fields, systems and annotations were updated. The system and field boundaries locations were validated by overlaying them on high-resolution orthophoto imagery acquired for the 2005 crop year. During the year the field and system boundaries underwent several iterations and modifications as new GPS data were integrated into the geodatabase.

A specialized GIS software extension was installed to develop a map series that included all 26 producer systems. This extension was available through the TTU GIS site license at no additional cost to the project. Implementing the map series was an important development since the size and scale of each producer system varied and would otherwise necessitate individual map set up for each system and take up considerably more time. The 26 maps are stored in six map documents rather than 26 for exporting and printing.

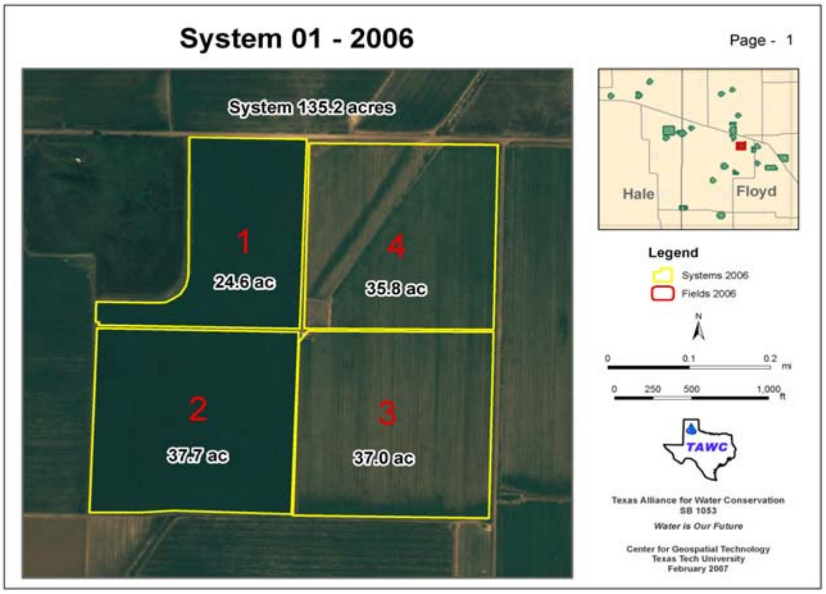


Figure 12. Example page from map book.

Each page in the map book includes a view of the system and field boundaries, the acreage of each field and the total acreage of the system. An inset map showing the location of the system in relation to the study area is included as are a legend and scale bars. Additionally two overview maps showing the location of all producer systems were developed. One overview map displays an orthophoto image in the background. The cartography for the second overview map was developed without the image in the background.

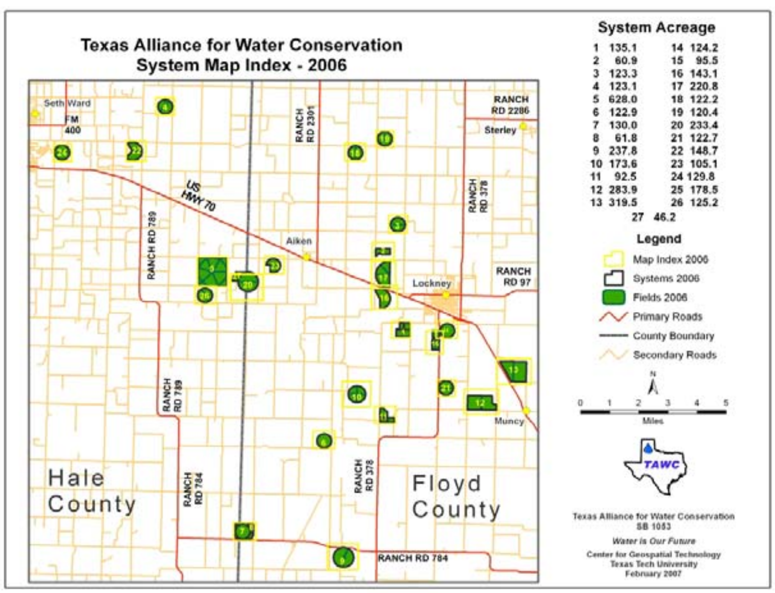


Figure 13. System location index map.

A draft map book was completed that included the producer's names and system numbers. To maintain anonymity a revised draft map book removed the producer's names. Review of the map books permitted the management team to revise and finesse the boundaries of each system. The GIS geodatabase was refined to incorporate the updated system and field boundaries.

TASK 3: FARM ASSISTANCE PROGRAM

DR. STEVEN KLOSE
JEFF PATE
JAY YATES

Year 2 project progress regarding task 3 in the overall project scope of work has occurred in several areas ranging from collaborating in project coordination and data organization to data collection and communication, as well as, providing additional services to the area producers in conjunction with the TAWC project. A brief summary of specific activities and results follows:

Project Collaboration. A primary activity of initiating the FARM Assistance task included collaborating with the entire project management team and coordinating the FARM Assistance analysis process into the overall project concepts, goals, and objectives. The assessment and communication of individual producer's financial viability remains crucial to the evaluation and demonstration of water conserving practices. Through TCE participation in management team meetings and other planning sessions, collaboration activities include early development of project plans, conceptualizing data organization and needs, and contributions to promotional activities and materials. TCE faculty contributed to the successful Floyd County Field Day highlighting the project objectives and demonstration sites for the local producers and other industry leaders.

Farm Field Records. Considerable progress was made in planning and coordinating data collection with new project leader, Phil Johnson, in Agricultural Economics at Texas Tech. Together we developed plans for what data to collect, how it will be collected, how it is stored, and how our two tasks will handle data sharing. Further progress was made in communicating and coordinating database needs with the project database team. TCE has taken the lead in the area of data retrieval in that FARM Assistance staff have begun meeting with producers three times per year to obtain field records and distribute them to other members of the management team. TCE assisted many of the project participants individually with the completion of their individual site demonstration records (farm field records). TCE faculty has completed the collection, organization, and sharing of site records for most of the 2006 site demonstrations.

FARM Assistance Strategic Analysis Service. Demonstrator participation in the formal FARM Assistance service is growing. As is typical with the FARM Assistance service, participants need re-assurance that the process does not require an overwhelming commitment of time or data. An assurance of their confidentiality is also needed to secure their cooperation and commitment. To help provide some of these assurances and serve as an example, Eddie Teeter (chairman of the producer advisory board) volunteered early. TCE faculty completed his whole farm strategic analysis, and subsequently other participants committed to the analysis. To secure cooperation TCE has promoted the service through numerous phone calls, e-mails, and personal visit contacts with project participants.

In addition to individual analysis, FARM Assistance staff has developed a model farm operation that depicts much of the production in the demonstration area. While confidentiality will limit some of the analysis results to averages across demonstrations, the model farm can be used to more explicitly illustrate financial impacts of water conservation practices on a viable whole farm or family operation.

FARM Assistance Site Analysis. While the whole farm analysis offered to demonstrators as a service is helpful to both the individual as well as the long-term capacities of the project, the essential analysis of the financial performance of the individual sites continues. FARM Assistance faculty completed and submitted economic projections and analysis of each site based 2005 demonstration data. These projections will serve as a baseline to for future site and whole farm strategic analysis, as well as providing a demonstration of each site's financial feasibility and profitability. 2006 analysis will be completed this summer, as yield data has only recently been finalized for the 2006 crop.

TASK 4: ECONOMIC ANALYSIS

DR. EDUARDO SEGARRA
DR. PHIL JOHNSON
JUSTIN WEINHEIMER

Objective. The economic assessment will evolve over time with the integration of the demonstration project; allowing baseline data to be developed for both economic and agronomic analysis. A joint effort between the Texas Cooperative Extension (TCE), Texas A&M University and the Texas Tech University Department of Agricultural and Applied Economics (AAEC) will develop and maintain detailed records of inputs and production (costs and returns) on each farm production scenario using enterprise budgets developed from producer field records and the TCE's FARM-Assistance program. These records will provide the base data for determining the economic impact of observed technologies for producers and water utilization.

Achievements**.**

(1) 2006 represented the second year of data collection from the 26 sites included in the project. Enterprise budgets for 2006 have been complied for 25 of the 26 sites. While the quality of data being reported in the producer field record books has improved from year one as producers became more comfortable with the type of date needed, improvement in data collection is expected to be enhanced in the coming year. The diversity of enterprises and production practices within the project requires that the data used to evaluate the systems be very detailed. An effort will be made this coming year to improve the data collection process by modifying the field record books (particularly with regard to livestock data) and meeting regularly with producers.

(2) In the process of compiling the 2006 budgets, certain methods of estimating costs and revenues were modified from those used to compile the 2005 budgets. Therefore, the 2005 budgets were revised to reflect the methods used for 2006. It is anticipated that revisions will be necessary to past budgets as the project continues to assure that the systems are comparable across years.

(3) Justin Weinheimer was hired as a research assistant in this task. Mr. Weinheimer has been working closely with other project personnel to assist in the data collection process and the development of the 2006 enterprise budgets. Mr. Weinheimer will be involved in the project and will complete his graduate research within the project.

TASK 5: PLANT WATER USE AND WATER USE EFFICIENCY

DR. STEPHAN MAAS
DR. ROBERT LASCANO
NITHYA RAJAN

The objective of this task is to estimate the actual amount of water used by crop, grassland, and pasture vegetation in the growth process. This quantity is called the daily crop water use (CWU), and can be accumulated over the growing season to estimate the total water used in growing a crop, grassland, or pasture. CWU does not include water lost from the field through soil evaporation, runoff, or deep percolation. CWU can be compared to the water applied to the field, either through irrigation and/or precipitation, to estimate the efficiency of water application in producing a crop.

In this task, daily CWU was estimated in a four-step process. In Step 1, Landsat-5 images containing the study region were analyzed to determine ground cover (GC) in each study field. GC is indicative of the amount of living vegetation in a field. Eight Landsat images (Table 15) were used in 2006 for this analysis. In Step 2, the remotely sensed GC values for each field were used in a mathematical model to simulate the GC of the vegetation on each day of the growing season. Daily weather data used in running the model simulations were obtained from the West Texas Mesonet station at Lockney. In Step 3, potential evapotranspiration (PET) was estimated for each day of the growing season from the Lockney weather data. In the final step, PET was multiplied by GC for each day of the growing season to determine daily CWU for each field in the project.

Table 15. Landsat-5 overpass dates for the 2006 growing season.

13 May 2006
29 May 2006
30 June 2006
16 July 2006
1 August 2006
18 September 2006
4 October 2006
20 October 2006

During the 2006 growing season, actual measurements of crop ground cover were made in many of the fields in the project. Depending upon the type of crop canopy, these measurements were made using either overhead photography, a Sunfleck Ceptometer, or a meter stick. These ground-based measurements could be compared with estimates of crop GC obtained from the Landsat image data. Results of this comparison are presented in Figure 14. In general, there is reasonable agreement between the measured and estimated values of GC. The average absolute error between measured and estimated GC is less than 7 percent. In Figure 14, the solid diagonal line represents 1:1 agreement between measured and estimated GC, while the dashed line represents the linear regression between the measured and estimated GC values in the graph. Statistical analysis indicates that there is no significant difference (at the 5% confidence level) between these two lines, suggesting that, in general, satellite estimates of crop GC obtained for the fields in this project are accurate to within a few percent.

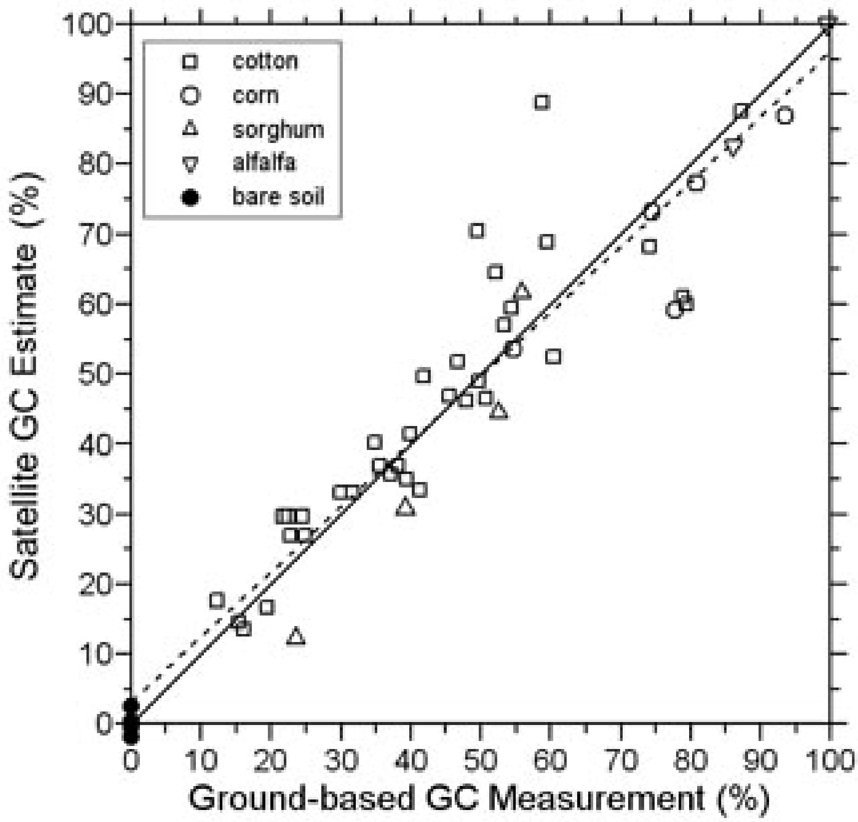


Figure 14. Measured and estimated GC values for fields in the project.

In 2006, actual measurements of field evapotranspiration (ET) were obtained for various fields in the project using two mobile eddy covariance (EC) systems. A photo of one of the EC systems is shown in Figure 15. The EC system contains a 3-dimensional sonic anemometer and an open-path infrared gas analyzer that are used to measure the vertical fluxes of water vapor and carbon dioxide in the air above the field. The system outputs 30-minute average values of ET that can be accumulated to produce a daily ET value. Daily ET was compared to daily estimates of CWU determined from Landsat data as an independent check of the accuracy of the method of using remote sensing data to estimate CWU. Since the ET values obtained using the mobile EC systems included soil evaporation, they were corrected using measurements of soil evaporation from microlysimeters installed in the field during the period of EC measurements. The microlysimeters consisted of 8-inch lengths of aluminum irrigation pipe (diameter = 6 inches) that were installed into the soil under the plant canopy. The microlysimeter and its undisturbed soil core were weighed at the time of installation, and re-weighed 24 hours later to calculate the loss of water due to soil evaporation. Microlysimeters were installed and weighed in the early morning hours (typically around 2:00 am) when soil evaporation was at a minimum. Values of soil evaporation obtained from the microlysimeter observations typically were around 1 mm per day.

Examples of estimated daily CWU for two fields in the project are presented in Figure 16 and Figure 17. Figure 16 shows daily values of CWU for a subsurface drip-irrigated cotton field (Field 2) estimated based on GC determined from Landsat image data, while Figure 17 shows similar estimates for a dryland cotton field (Field 13). Also shown in each figure are actual measurements of CWU determined from the mobile EC systems for the days that the EC systems were stationed at the fields. In general, there is reasonable agreement between the estimated and measured values of CWU for each field. For Field 2, for days with both measured (EC) and modeled CWU, the average measured daily CWU was 3.50 mm, while the average modeled CWU was 3.65 mm. Statistically, the difference between these two values is not significant at the 5% confidence level. For Field 13, for days with both measured (EC) and modeled CWU, the average measured daily CWU was 2.14 mm, while the average modeled CWU was 1.91 mm. Again, the difference between these two values is not significant at the 5% confidence level.

Figure 15. Mobile eddy covariance (EC) system located at Field 2.

Comparison of data like those in Figure 16 and Figure 17 allow assessments of the relative water use by different cropping systems in the project. The maximum daily CWU for the drip-irrigated cotton in Field 2 was around 7 mm/day, while the corresponding maximum daily CWU for the dryland cotton in Field 13 was only around 3 mm/day. Summing the daily CWU values over the growing season, the seasonal CWU for Fields 2 and 13 were, respectively, 360 mm (14.2 in) and 125 mm (4.9 in). These values represent estimates of the *actual amount of water needed to grow each crop* during the 2006 growing season. The sources of this water were the moisture in the soil at planting, the effective rainfall (rainfall minus any runoff) during the growing season, and (for irrigated fields) the effective irrigation (irrigation minus any runoff or evaporation) during the growing season. As would be expected, the dryland cotton used much less water than the subsurface drip-irrigated cotton.

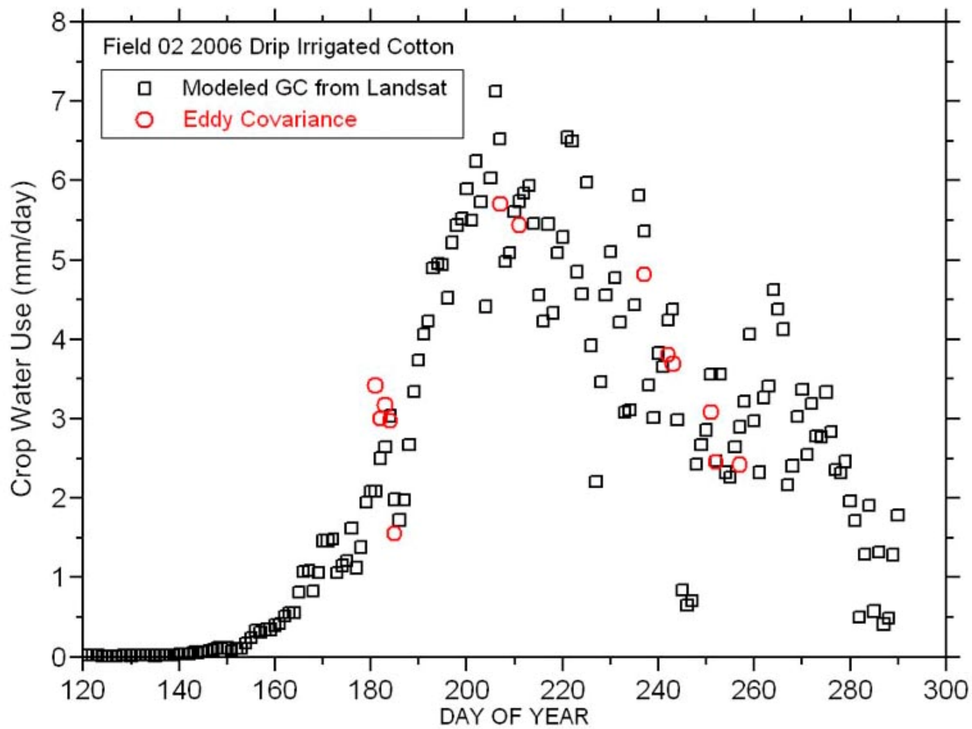


Figure 16. Modeled and observed daily CWU for the drip-irrigated cotton Field 2.

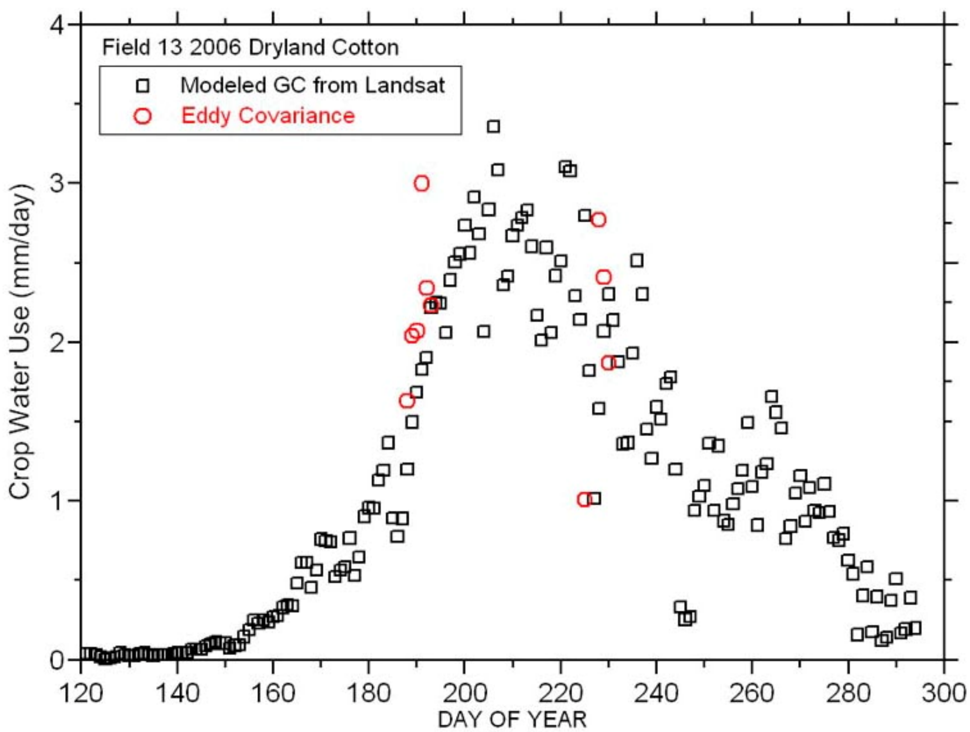


Figure 17. Modeled and observed daily CWU for the dryland cotton Field 13.

Figure 18 shows comparable results for an irrigated corn field (Field 24) in the project. Maximum daily CWU values in excess of 6 mm/day peak early in the growing season. As in the previous examples, there is reasonable agreement between the estimated and measured values of CWU for those days with EC observations. For days with both measured (EC) and modeled CWU, the average measured daily CWU was 4.48 mm, while the average modeled CWU was 3.99 mm. While the average measured value is around 10% greater than the average modeled value, the difference between these two values is not statistically significant at the 5% confidence level.

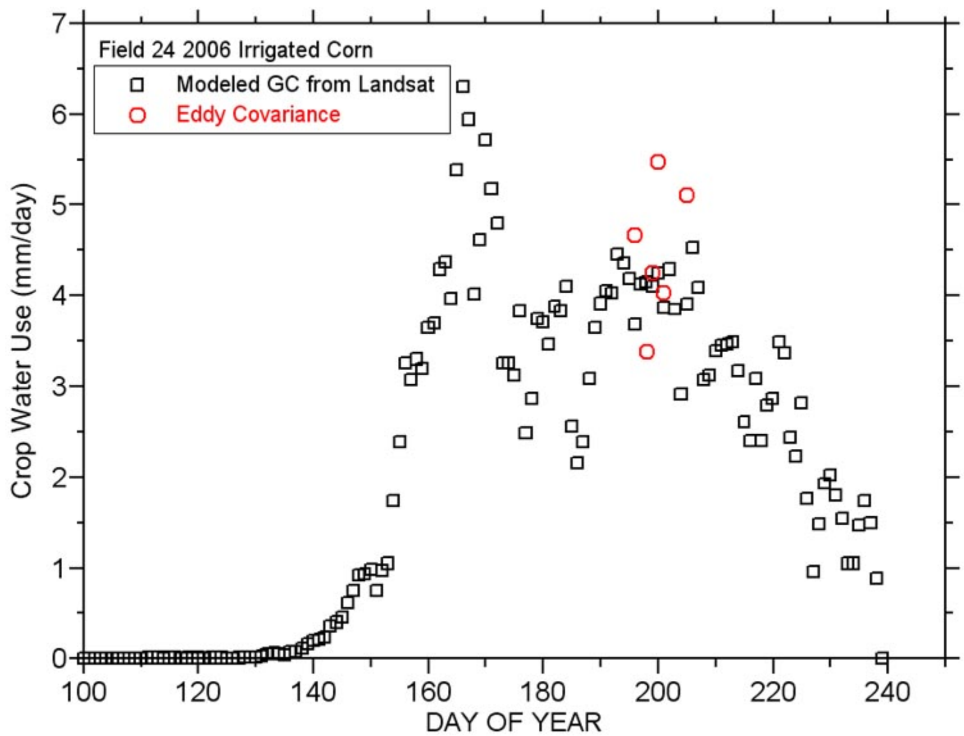


Figure 18. Modeled and observed daily CWU for the irrigated corn Field 24.

The seasonal CWU of field crops (cotton, corn, sorghum, and millet) grown during the 2006 summer growing season in the project is summarized in Table 16. These values were determined by accumulating the modeled daily CWU values from planting to crop maturity. For forage sorghum, model simulations accounted for cuttings reported for the crop. Again, values in the table represent estimates of the actual amount of water needed to grow each crop during the 2006 growing season.

The average seasonal CWU for the 26 irrigated cotton fields in the project was 294 mm (11.6 in). This is more than twice the average seasonal CWU for the two dryland cotton fields (132 mm, 5.2 in). The average seasonal CWU for the 7 corn fields in the project was 369 mm (14.5 in), which is approximately 25% greater than the corresponding average value for the irrigated cotton fields. The relatively few forage sorghum fields in the project does not allow a robust comparison of their CWU with that of corn, although one might expect less total CWU for the sorghum.

Table 16. Accumulated daily CWU over the growing season (planting to maturity) for the field crops in the project.

Field Number	Crop	CWU (mm)	CWU (in)
1-1	cotton	322	12.7
1-2	cotton	340	13.4
1-3	cotton	277	10.9
1-4	cotton	254	10.0
2-1	cotton	360	14.2
3-1	cotton	243	9.6
3-2	cotton	209	8.8
4-2	forage sorghum	336	13.2
4-3	cotton	377	14.9
6-1	cotton	295	11.6
9-2	cotton	175	6.9
11-1	cotton	280	11.0
11-2	cotton	252	9.9
11-3	cotton	227	8.9
12-2	cotton (dryland)	138	5.5
13-1	cotton (dryland)	125	4.9
14-1	cotton	222	8.7
15-1	cotton	250	9.8
15-2	cotton	290	11.4
15-3	grain sorghum	223	8.8
16-1	cotton	204	8.0
17-2	cotton	349	13.7
17-3	corn	357	14.1
18-1	cotton	190	7.5
19-1	millet	173	6.8
19-2	cotton	276	10.9
20-1	corn	373	14.7
20-2	forage sorghum	213	8.4
21-1	corn	290	11.4
21.2	cotton	315	12.4
22-1	cotton	362	14.3
22-2	corn	406	16.0
23-1	cotton	411	16.2
23-2	corn	367	14.5
24-1	corn	395	15.6
24-2	cotton	300	11.8
26-1	corn	394	15.5
26-2	cotton	447	17.6
27-1	cotton	414	16.3

We are currently developing a comprehensive model that can be used to simulate the daily and seasonal CWU of forage and grass species in the manner of the simulations made for the field crops in Table 16. At this time, examples of CWU estimated for grass and forage fields will be presented. Figure 19 shows estimates of daily CWU for an irrigated side oats grama crop (Field 8) determined from the Landsat observations, along with measured CWU from the EC observations made at that field. While there is no overlap of the two sets of daily CWU values, they do follow the expected trend of an increase in values to a peak at around the middle of the summer growing season, with a decline in values after the peak. From this trend, one can estimate an accumulated CWU over the 180-day period from day 120 to day 300 of approximately 435 mm (17.1 in). This is greater than the seasonal CWU for the field crops in Table 16, but the period of active growth for the grasses is generally longer.

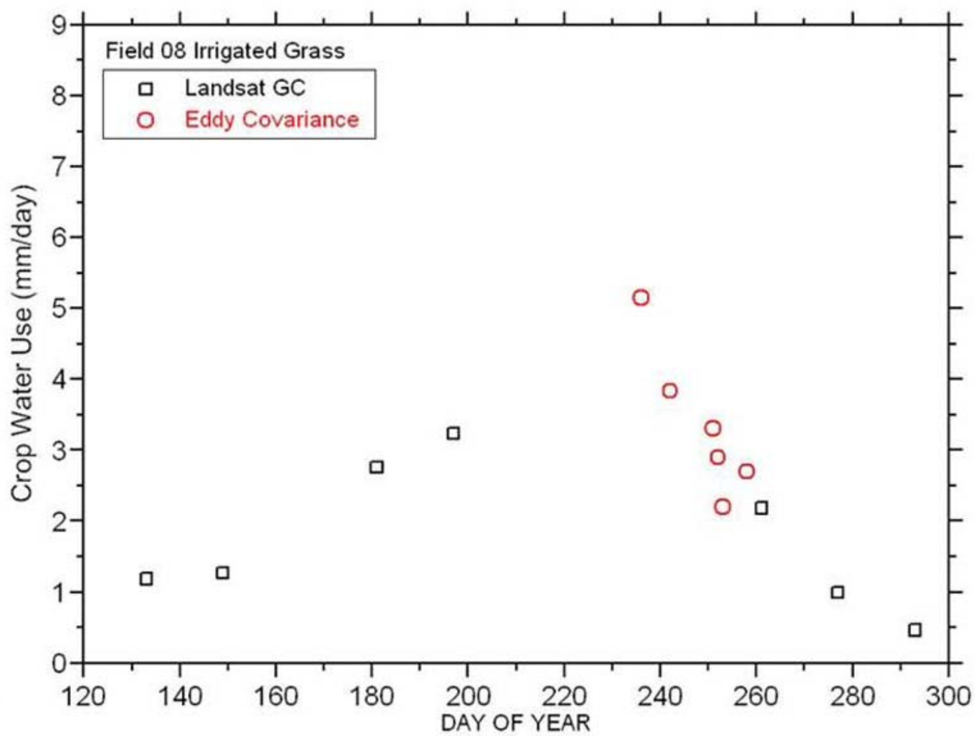


Figure 19. Estimated (from Landsat ground cover) and observed (EC) daily CWU for irrigated grass Field 8.

Figure 20 shows similar results for an irrigated alfalfa field (Field 4). Again, the values of CWU estimated from Landsat GC and measured using the mobile EC systems is consistent, with a general decreasing trend in daily CWU over the course of the summer growing season. Except for periods after cutting (in this case, days 156, 217, and 264), the GC is near 1005, so that daily CWU is controlled by potential evapotranspiration (PET). In this case, daily CWU approached daily PET. PET values in the first half of the season (days 160-180) range from 7 to 10 mm/day. PET tends to decrease over the second half of the season, as average daily temperature and daily solar radiation decreases. From the trend in daily CWU in Figure 20, one can estimate an accumulated CWU over the 180-day period from day 120 to day 300 of approximately 773 mm (30.4 in). This represents approximately 70% of PET (1099 mm, 43.3 in) over this period.

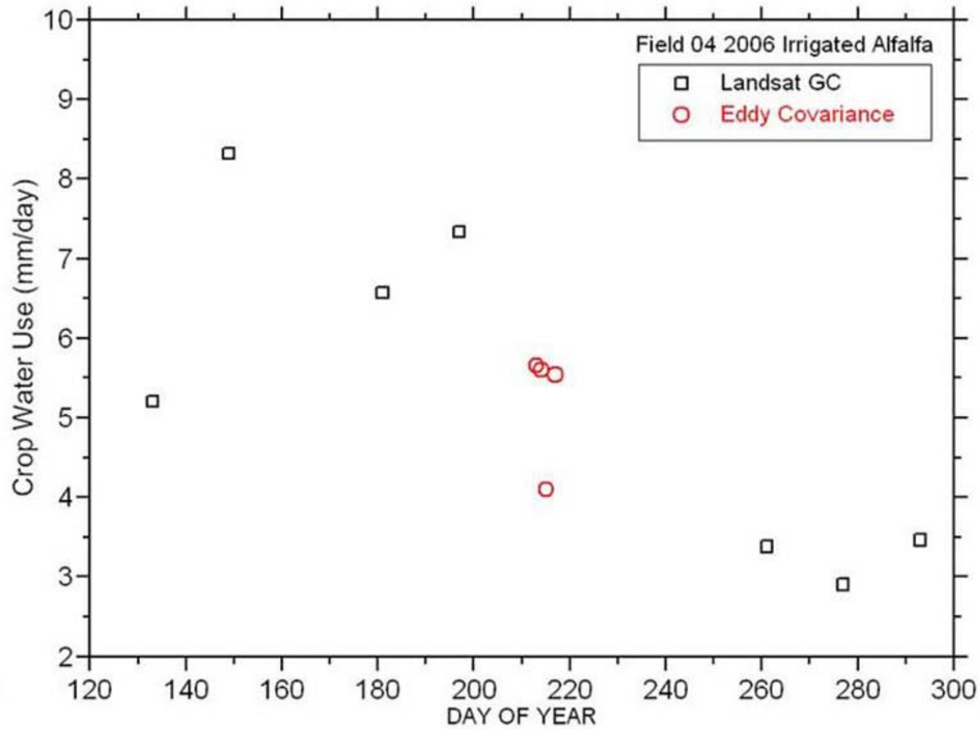


Figure 20. Estimated (from Landsat ground cover) and observed (EC) daily CWU for irrigated alfalfa Field 4.

In summary, differences in daily and accumulated CWU among the project fields were evident and were related to vegetation type and irrigation. In comparing the relative water use between different types of vegetation (such as different field crops, forages, and grasses), one must recognize that there are differences in both the daily values of CWU and the length of the period during which the vegetation is using water. These preliminary results on CWU were obtained during a relatively dry year, and may be compared with results presented in the annual report for 2005 (a year with above-average rainfall during the first half of the growing season).

Plans for the 2007 growing season include:

1.) Development and testing of a simulation model for estimating daily and seasonal CWU for forages and grasses. This model will include the effects of cutting and, possibly, herbivory by cattle. This model will require more frequent information, including field visit information and remote sensing data.

2.) Concentration of mobile EC system measurements on corn and forage sorghum. This will address the question of comparative CWU between these two species.

3.) Addition of frequent airborne multispectral imaging of project fields using TTAMRSS (a system that includes digital cameras capable of acquiring images in the red, near-infrared, and thermal infrared spectral wavebands). This imagery will supplement the Landsat-5 imagery normally acquired in the project.

4.) Supplementation of EC measurements of CWU by Dynamax stemflow gage measurements. These measurements will be used as an independent check of the accuracy of the EC measurements.

Presentations made involving aspects of the project:

Rajan, N., and S. J. Maas. 2006. Estimating daily and seasonal crop water use of High Plains cropping systems using remote sensing and crop modeling. p. 25-29. In Proc., 28th An. Southern Conserv. Systems Conf., Amarillo, TX.

Rajan, N., and S. J. Maas. 2006. A spectral crop coefficient for estimating crop water use. Abstracts, Annual Meetings, Amer. Soc. Agron., Indianapolis, IN.

TASK 6: COMMUNICATIONS AND OUTREACH

DR. MATT BAKER
DR. DAVID DOERFERT
PAMELA MILLER
JURAHEE JONES

During this past year, several activities were designed and implemented towards the goal of creating a community of practice around agricultural water conservation. These efforts focused on increasing the awareness of the project, its vision, and the project-related activities to audiences within and beyond the geographic scope of the project. While no quantitative formative data was collected, anecdotal evidence in the form of personal observation, individual discussions, and project inquiries highlight this year's progress towards our goal. Accomplishments are described below under each of the four communication and outreach tasks.

6.1 *Increase awareness, knowledge, and adoption of appropriate technologies among producers and related stakeholder towards the development of a true Community of Practice with water conservation as the major driving force.*

6.1 Accomplishments. Project-related tours and gatherings were provided to a number of individuals and groups including Texas Cooperative Extension Regional Directors, AgCert representatives from the US and Canada, U.S. Congressman Randy Neugebauer & Texas State Senator Robert Duncan (October 25, 2006), and Dr. Jeff Jordan, Coordinator, Southern Region SARE Office (January 11, 2007).

Efforts were made to have a presence of the project at major producer gatherings. During 2006, a booth was created and used at two regional producer shows: the Southwest Farm and Ranch Classic (January 2006, Lubbock) and the Amarillo Farm & Ranch Show (November 2006, Amarillo). The booth was staffed throughout the show hours to provide information and respond to questions from those that stop at the booth. Combined attendance at these two shows exceeded 5,000.

Dr. David Doerfert gave project-related presentations at (1) the 2006 Southwest Farm and Ranch Classic (January 2006, Lubbock); (2) the 2006 AAEC Cotton Research Symposium (April 2006, Lubbock); (3) the Texas Agricultural Industries Association meeting (Sept. 12, 2006, Lubbock); and (4) the 2006 Amarillo Farm & Ranch Show.

Signage was placed at all the field sites and at the entrance to the project area along the major highways. Individuals expressed that they stopped at the project booth during the Amarillo and Lubbock farm shows to find out more information because they had seen the road signs.

A project overview DVD was finalized and distributed through a variety of venues including producer workshops and meetings, farm shows (Lubbock, Amarillo), and individual inquires. To-date, more than 750 DVDs have been disseminated. A second DVD is in the works and will highlight the project activities and accomplishments to-date. Filming will begin in during the 2007 summer months and would be ready for release in 2008.

After the first six months of the project, it was learned that the project overviews and DVDs distributed at farm shows and meetings were being "lost" among other show and meeting materials and not being fully consumed. To address this problem, a 6" x 9" portfolio was developed with project logo that would contain the project materials in a manner that would keep the project visible to the various stakeholders. The selected portfolio were $3.89 each.

Since we added this dissemination tool, we have found that these portfolios are not only increasing the viewing of the project materials but are being used as the stakeholder attend other meetings and events. As a result, the logo on the portfolio is being seen and has generated additional inquiries and discussions about the project outside of official project events and activities.

The project continues to take advantage of opportunities to discuss the project through the various broadcast, print, and electronic media. During the past year, broadcast interviews were conducted with FOX34 (TV), local news radio (AM 1420 and AM 950). In addition, project-related stories were released through Texas Tech's *Vistas* magazine and the University's home page.

In addition to the aforementioned activities, project overviews and DVDs were distributed to attendees at the 2006 *International Conference on Water in Arid and Semiarid Lands* held on the Texas Tech campus Nov. 15-17, 2006.

6.2 *Project communication campaign planning, implementation, and related research activities.*

<u>6.2a — Accomplishments: Communications Planning.</u> The project web site was launched at the conclusion of the May 2nd Producer Board meeting.

Have developed, presented for review and approval a format for individual project site summaries for 2005 that will be used on the web site. The same format will be used to summarize the 2006 year. Once we have two years of information, a new format will be created on the web site to facilitate producer use of these summaries.

David Doerfert conducted a media training workshop with the producer board members in February 2006. The purpose of the training was to create an understanding of how the various media will conduct interviews and how they can effectively share the features and activities of the project through an interview.

Photo documentation of field sites has continued with 12 visits since the last annual report. Additional project photos were taken during tours of the project sites and at various related events.

A clipping service was hired to help the project monitor the extent and type of print media coverage on the TAWC project. A content analysis is planned for 2007.

<u>6.2a — Accomplishments: Research.</u> A telephone survey of producers in High Plains Water District was conducted in 2006 with calls being made by TTU Earl Survey Research Lab. Information gathered was used to guide producer-centered communication efforts.

A TAWC research poster was presented by project graduate assistant Pamela Miller at the annual Southern Region Conference of the American Association for Agricultural Education (AAAE), Feb. 4-8, 2006 in Orlando. This poster won second place in the graduate student division and was selected for presentation at the AAAE National Conference in Charlotte, NC in May 2006.

Two project-related research studies were completed as student theses.

1. Study #1 was a survey of 22 newspaper editors in the High Plains Underground Water District and how they make their decisions to include water-related stories in their newspapers. The results yielded the following conclusions:

   a. Editors unanimously felt water-related issues have grown in importance in the last 5 years but they reported that the extent of their water-related coverage remained constant.
   b. Twenty of the 22 editors thought water-related issues would continue to increase in importance over the next five years.
   c. Ranch and farm consumption related news was marked as very high in importance by the editors when they considered the local relevance, timeliness, and general importance to their readers.
   d. Editors were most likely to use local sources and connections to develop water-related stories.
   e. From a project such as TAWC, larger newspaper editors preferred "active" materials (e.g. a list of possible sources, fact sheets, and research data) as they were more likely to write their own stories. Smaller newspapers preferred "passive" materials (e.g. press releases, stories, and photographs) that are ready to print.

2. Study #2 was a survey of 167 high school agriculture teachers in west Texas on their knowledge of and confidence in teaching water-related topics to their agriculture students. The results yielded the following conclusions:

   a. The responding teachers believed that water issues have grown in importance over the past five years and agree that water will continue to grow in importance during the next five years with more than half strongly agreeing with that statement.
   b. The teachers tend to focus on local or regional news, yet they stated that they had reviewed little to no news related to water during the previous six months.
   c. More than 60% of the teachers indicated that they were aware of the *Texas Alliance for Water Conservation* project.
   d. The teachers perceived their knowledge level to be average in ten of the twelve water-related topics. The topics in which the educators felt they had the highest knowledge levels were farm and ranch consumption, brush management, individual home water conservation, and wildlife environment water management.
   e. The teachers' confidence in being able to teach on each of the 12 topics was consistently lower than their perceived knowledge levels.
   f. The extent to which teachers had seen, heard, or read about water-related news in the past six months had a positive relationship to their opinions about the importance of water.
   g. Teachers with more positive attitudes towards water management were more likely to believe that water will grow in importance over the next

five years. These positive attitudes may be influenced by the extent that teachers had seen, heard, or read water water-related news in the past six months. Further, these positive attitudes are stronger in those teachers that follow more local news coverage.

h. Teacher knowledge and confidence in teaching water-related issues was positively related to the extent that teachers had seen, heard, or read water water-related news in the past six months with those who had greater exposure to water supply news having higher knowledge and confidence levels.

6.3 *Creation of longitudinal education efforts that include, but are not limited to, Farmer Field Schools and curriculum materials.*

<u>6.3 — Accomplishments.</u> Two farmer-oriented workshops (see below) were conducted by the project during 2006. For each workshop, 3-ring binders were created with handouts from the various speakers. A format for the binder was developed that was consistent with the brand image created for the project. In designing these binders, a vision of creating a library of topics help to guide the final product

- Irrigation Management workshop was held on Thursday, March 2 at Unity Center in Floyd County. Approximately 40 individuals attended the workshop.
- Forage Management workshop held on Thursday, March 30 at the Country Club in Hale County. Approximately 80 individuals attended the workshop.

6.4 *It is the responsibility of the leader for this activity to submit data and reports as required to provide quarterly and annual reports to the TWDB and to ensure progress of the project.*

<u>6.4 — Accomplishments.</u> Timely quarterly reports and project summaries were provided as requested.

TASK 7: INITIAL FARMER/PRODUCER ASSESSMENT OF OPERATIONS

DR. CALVIN TROSTLE

Support to Producers. Visited with eleven producers during 2006 about their operations as part of the ongoing producer assessment of their needs and what crop information they would like to have for their operation. Provided crop information to two producers in the demonstration area.

Also visited with Reed Millican, Vista Grande Dairy, Plainview, TX on May 15 about the dairy's forage needs. Several producers in the TAWC project are either discussing or have contracted with the dairy to supply forage (this includes small grains forage as silage; corn silage; sorghum/sudan or forage sorghum).

As noted in 2005 in accord with Task 7 objectives there were several producer questions that were raise which were addressed (refer to the 2005 report). The additional following interests among producers emerged in 2006 in response to the same set of 2005 questions.

1. What crop, forage, livestock, irrigation, and economic information do you need to make improvements in your farming operation?

- Hybrids of sorghum/sudan or forage sorghum would be appropriate for marketing to dairies?
- How much less water is required for forage sorghum vs. corn silage.
- Strategies to maximize small grains forage production for silage including approximate projection of forage yields if crop was harvested for silage rather than taken to grain.
- December information to producers regarding opportunities for 2007 grain sorghum prices > $6.50/cwt.

2. What production practices or diversification have you considered trying in your operation? (With the availability of FARM Assistance producers will have a better opportunity to gauge the economic effects of changes in practices.)

- Adding grain sorghum
- Converting some ground to permanent grass (specific decisions pending the results of the Lockney grass trial)
- Strategies to spread water use among different crops under the same pivot

3. What ideas do you have for reducing water use on your farm that you believe you could incorporate without reducing profitability?

- Realistic goal for corn production in 2007 based on available irrigation
- Potential water savings/efficiency if using drip irrigation

4. What improvements in irrigation efficiency do you believe you could make in your operation?

- Evaluate potential use of irrigation scheduling based on crop water demand

5. What types of crop, livestock, and irrigation demonstrations in the Lockney area would you like to see that might help you consider long-term sustainable options for your operation?

Small grains silage yields among types and varieties
More results from the Lockney grass trial
Yields and water use requirements of newest wheat varieties like TAM 112

Field Demonstrations

A) Small Grains Forage Trial

Harvest of two-date (mid-September & late October plantings) irrigated triticale and wheat variety trial for silage. The primary objective is to evaluate different varieties of these small grains for forage production, water use efficiency, and economic value for dairies. Little difference was found among wheat and triticale varieties as a whole suggesting that producer management would be more important than variety selection. Fall 2006 seedings to repeat this trial were implemented north of Lockney, but poor stand and geese feeding damage, led to loss of sufficient stand to preclude meaningful harvest results.

B) Lockney Range Grass & Irrigation Trial

Implemented the TAWC grass trial at Eddie Teeter's on April 3. Grasses included in the trial include:

WWB-Dahl Old World Bluestem (OWB)
Spar OWB
Caucasian OWB
Alamo switchgrass
Selection 75 Kleingrass
Plains buffalograss
Hatchita blue grama
Haskell sideoats grama
A blend of the three above grasses, Hatchita (50%), Haskell (40%), and Plains (10%)
Ozark sprigged bermuda (May 26)
Giant/Common seed bermuda (2:1 mix, May 30)
Wrangler seeded bermuda (May 30)

Establishment irrigation was applied through the summer. Some selected re-seeding will occur in spring 2007 particularly for WWB Dahl. Irrigation levels will be implemented in spring 2007. This field site was the subject of a successful turnrow meeting in October with 26 in attendance.

C) Plainview Silage for Dairy (Glenn Schur Farm)

In response to TAWC producer request implemented a simple sorghum/sudan trial to determine what type of sorghum/sudan (higher quality brown midrib, or BMR vs. conventional or photoperiod sensitive) might be best to supply to dairies. The answers for producers lies in how a dairy might pay, based on either quality or tonnage. Six hybrids were seeded May 23rd (three BMRs, two conventional, one photoperiod sensitive). Yield differences were found favoring the BMR hybrids and one conventional sorghum/sudan. We learned that sorghum/sudan harvest, being leafy and wet, requires some wilting in the field to ensure that excessive charges are not incurred hauling silage to the dairy. Because of this experience, the second harvest was baled. Forage samples have not yet been analyzed for feed value.

Opportunities to Expand TAWC Objectives

Project awareness: Commented on project on our different radio programs, answered producers phone calls, and information and the approach that the TAWC project is taking has helped shape at least four other programs and Extension activities in the Texas South Plains.

Leverage of funding: 1) Received second-year funding from the Texas A&M Ag. Program Cropping Systems Initiative to investigate irrigation, salinity, and forage quality issues in West Texas alfalfa production ($40,000). 2) Applied for U.S. EPA conservation protection grant to examine effect of buffer strips around irrigation pivots applying CAFO manure wasted to crop land and the nutrient/waste load of potential runoff.

Educational Outreach

Hosted a group of 9 agricultural students and 2 instructors from Norwest College, Powell, WY at the Glenn Schur farm on May 15th.

An Extension ag. Agent training and public meeting on summer annual forages was conducted in July (15 attending), and the program included a field tour of the sorghum/sudans at Glenn Schur's farm.

Spoke to 35 producers and industry personnel during the Floyd Co. farm tour on Sept. 19th about summer annual forage production and silage.

TAWC organized a 75-minute turnrow meeting at the perennial grass trial at Eddie Teeter's south of Lockney on October 5th. 26 attending, including 17 producers. Numerous questions came from producers about the grasses established during the first year of the trial.

Existing TCE publications and reports were provided in the TAWC target area to at least 8 producers.

Support to Overall Project. Activities include attending seven monthly management team meetings and/or producer advisory board meetings. Helped develop TAWC agenda for public meetings in September and the upcoming silage workshops in 2007.

TASK 8: INTEGRATED CROP/FORAGE/LIVESTOCK SYSTEMS AND ANIMAL PRODUCTION EVALUATION

DR. VIVIEN ALLEN
DR. WILL CRADDUCK
SONG CUI

All project sites have been toured on several occasions with project director Mr. Rick Kellison to obtain details on each site. Details included but were not limited to type and number of livestock, types of forage and crops, irrigation and tillage practices, individual management by producers, and general site descriptions.

Notes from field tours, producer interviews, records from Mr. Jeff Pate and Farm Assist, and visual inspection of all sites were used to assemble detailed summaries of all 26 sites. These summaries primarily document the crops, forages, and livestock present on each site, and management details for each site.

Regular visits to producer sites continued though 2006 to gather data for wildlife habitat, biomass, and to map changes to producer sites and new fields.

Meeting with various livestock producers have occurred to learn about their operation and details of management on their sites, and to clarify details of producer records, as well as to learn of any concerns and problems they may have encountered in their operation.

Adjusted 205-day weaning weights were calculated for Mr. Randy Bennett, and records were obtained from Mr. Bennett for 2006. All other livestock producers in the project have been contacted about livestock records. Weaning weight data was presented to Mr. Bennett and Mr. Jeff Pate to increase awareness of these services to producers in the project.

With assistance from Dr. Brad Dabbert and other team members, 7 wildlife species of interest were selected. Each site will be evaluated for potential habitat for bobwhite quail, lark bunting, eastern cottontail, black-tailed prairie dog, and pronghorn antelope, using models published by the U.S. Fish and Wildlife Service. In the future, sites may also be evaluated for ring-necked pheasant and white-winged dove habitat, as well as other wildlife, depending on the availability of an appropriate model. Each model has been evaluated in detail, and sampling protocols are in place that will accommodate all 5 models, as well as many models we may choose to add at a later date.

Vegetation and management data has been collected on all sites for 2006, and calculation of wildlife habitat has been completed. Each site continues to be evaluated for potential habitat for bobwhite quail, lark bunting, eastern cottontail, black-tailed prairie dog, and pronghorn antelope, using models published by the U.S. Fish and Wildlife Service. Up to 22 variables are being calculated from vegetation data for entry into the five models. This includes evaluating botanical composition on all perennial forage pastures on the sites. Detailed spreadsheet programs for habitat models have been completed for each species to facilitate habitat evaluation.

Selected sites have been evaluated for potential for improving wildlife habitat for 2006. Many options were being considered, including different management of existing crops, and altering vegetation composition in corners and playas. These are plans that each producer can take and implement, as well as examples of what can be done to manage for optimum wildlife habitat. Options for increasing wildlife habitat continue to be evaluated.

Biomass sampling was done on areas where biomass is the crop, including grazed forage and forage harvested as hay or silage. These samples will help to document current biomass as well as current management practices of the pastures. These samples will also help Dr. Stephen Maas calibrate his crop model to include live and dead biomass, and help to predict live and dead biomass on these and other areas using crop models and satellite imagery.

Sampling of biomass by clipping quadrants to document live and dead biomass on applicable producer sites has been completed for 2006. Samples have been weighed and biomass calculated. All biomass data with the correlating GPS location and picture has been forwarded to Dr. Stephen Maas and Nithya Rajan to aid in their crop modeling.

Mr. Phil Brown helped us to determine what GPS unit and software we will need to document the collection of habitat readings and biomass samples. The GPS unit has been purchased and has been set up with appropriate software. Desktop software is in place and will be updated if needed. All sites have been mapped with the GPS unit, and all points differentially corrected using desktop software. The GPS unit has also been used to mark a GPS location of each biomass sample, and to record the transects through pastures as they were walked to document botanical composition.

GPS unit operation continues to help in mapping changes and additions to sites, as well as mapping new sites. The GPS unit has also been used to mark a GPS location of each biomass sample, to record the transects through pastures as they were walked to document botanical composition, and to document where crops were only partially harvested or parts of one field were managed differently.

All new data has been differentially corrected using desktop software. Assistance has been given to Mrs. Lucia Barbato and Mr. Scott Orr to help with maintaining current and accurate maps of all sites. Maps for 2005 and 2006 have been finalized, and are available for use. Assistance has also been given to Mrs. Lucia Barbato to help with interpretation of the GPS data and field observations for integration into the geodatabase. Have assisted Mr. Paul Braden with details of setting up the database to handle livestock data.

Through collaboration of many team members, the 1st Annual Report has been completed and sent to the Texas Water Development Board. Summaries were included for all 26 producer sites.

A proposal for a Conservation Innovation Grant (CIG) has been submitted to NRCS. The proposal is titled "Integrated Agriculture for Energy Conservation in the Texas High Plains" and is for approximately $800,000.

Assistance has been given to Angela Beikmann, Scott Orr, and Rick Kellison to set up a weekly mailing of GDD and ET data to all producers in the project, and to begin to educate the producers about the importance of irrigation scheduling.

An informative presentation was given at the National Organization of Professional Hispanic NRCS Employees annual training meeting in Orlando, Florida for Mr. Rick Kellison. The presentation informed the audience about our water challenges in west Texas, the TAWC project and its importance, mission, goals, scope, and collaboration with other universities and local, state and federal agencies.

Have worked with Mr. Rick Kellison and Dr. Vivien Allen consulting with several producers about irrigation strategy, forage management, designing grazing systems, calculating drought forage loss, and forage antiquality factors. Participated in a meeting on October 5 with Mr. Kellison and Dr. Allen and representatives from a dairy to determine feasibility of including a higher percentage of water-conserving forages in a dairy ration. On October 30, participated in a planning meeting for the forage-crop-livestock systems research at Texas Tech.

Participated in the Floyd County field day on September 19. Presented warm season grass research and answered producer questions at the turnrow meeting organized by Dr. Calvin Trostle at his grass plots on October 5. Attended the producer meeting on October 11. Assisted with project tour by U.S. Congressman Neugebauer and Texas Senator Duncan on October 25. Attended and gave reports at September, October, and November management team meetings.

Have worked with Mr. Jeff Pate on collecting and interpreting data from livestock producers involved in the project. Have assisted Dr. Phil Johnson and Mr. Justin Weinheimer with developing budgets for the livestock producers in the project for 2006. Participated in a meeting with a number of team members that redesigned and improved some of the details of data collection from producers via record books.

Presented an invited talk at the conference "Charting the Course" in Austin, Texas on November 17. This was sponsored by the River Systems Institute, Texas State University, San Marcos and co-sponsored by Guadalupe-Blanco River Authority, Magnolia Charitable Trust, Texas Parks and Wildlife Department, Texas Water Resources Institute, Texas A&M University and US Geological Survey. The title of the talk was "Water Conservation in the Texas High Plains."

Participated in a tour of the New Deal Forage-Livestock Systems Research for Dr. Jeff Jordan, SARE-ACE Director on January 11. Presented a summary of Task 8 work to Dr. Jordan, the Sare-Ace Advisory council, and the management team as part of a larger presentation given by members of the management team.

Participated in a multidisciplinary, multi-agency planning meeting on January 26 that discussed putting together a silage publication targeted at livestock feeders and silage growers that targeted ways to reduce water use of silage production. Followed up meeting with comments for the publication.

Attended cow-calf workshop put on by TAWC and TCE on February 6th.

Attended and participated in various other field days, workshops, and producer meetings. Attended and gave reports at all 2006 management team meetings. Continue to work on 2006 Annual Report, and to revise and update data from the 2006 report.

Evaluation of producer sites for wildlife habitat of selected species.

<u>Objectives.</u> The overall objective of the TAWC project is to observe how producers use their water, and to identify practices that use less water and make more money. The presence and potential presence of wildlife may play an ever increasing role in economic viability of farming and ranching. Activities such as hunting and wildlife watching are becoming more popular in the region. Land prices in the nearby Rolling Plains are often based more on hunting potential than agricultural use, and hunting leases are as much or more lucrative than leases for agricultural use. With the right wildlife

habitat, hunting or similar leases may provide additional income for landowners and operators in this area.

Five wildlife species were chosen because they were native to the region, their potential economic and aesthetic impact on the land, and the availability of habitat models applicable to the species and area. These are lark bunting (*Calamospiza melanocorys*), northern bobwhite quail (*Colinus virginianus*), eastern cottontail rabbit (*Sylvilagus floridanus*), black-tailed prairie dog (*Cynomys ludovicianus*), and pronghorn antelope (*Antilocapra americana*). See Figure 21.

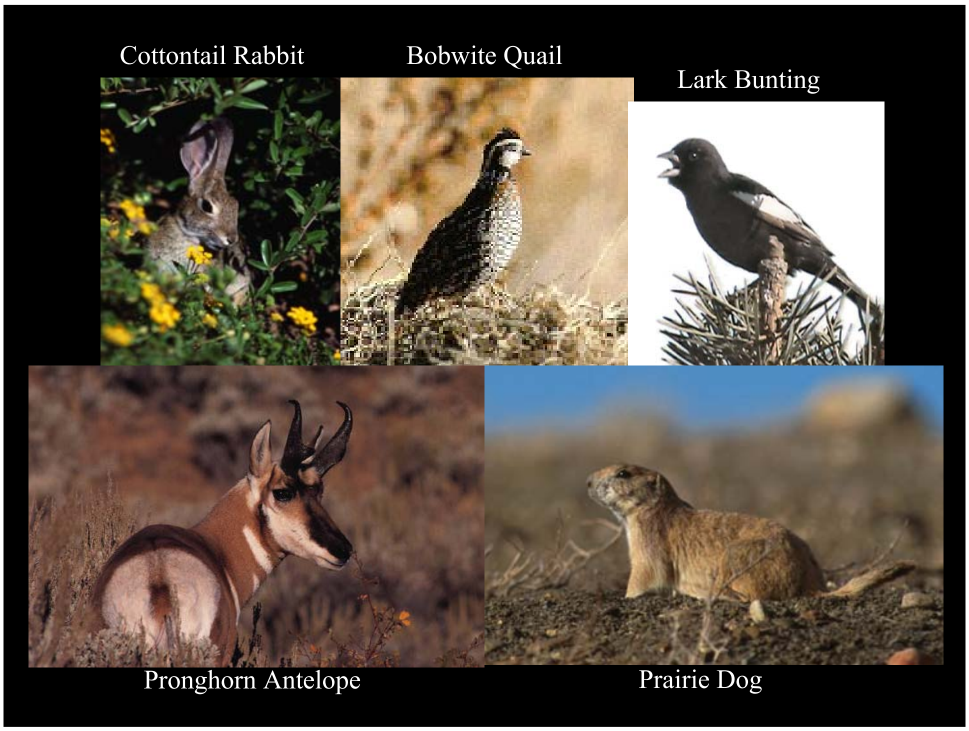


Figure 21. The five wildlife species for which habitat was evaluated on producer sites. *(Photos courtesy of U.S. Fish and Wildlife Service, Microsoft Clipart, and the State of Colorado.)*

<u>Methods.</u> Each site was evaluated using a wildlife Habitat Suitability Index (HSI) for each species. Wildlife HSIs are models used to determine the potential for wildlife habitat under a variety of conditions. These habitat models have been published by the U.S. Fish and Wildlife Service. These models are not based on actual wildlife presence, but on conditions that make the area favorable or unfavorable for specific wildlife species. Each model was designed to be applicable to its specific species in a geographic region that includes the southern High Plains. In general, the models are based on land use and cover type classification, management, vegetation, soil type, and degree of interspersion of specific wildlife requirements.

Cover types on each site were determined based on descriptions in U.S. Fish and Wildlife Service 103 ESM. Soil type and slope were determined from the USDA Soil Survey data, and verified in the field. Cropping and management practices were determined by observing field operations on a regular basis, and by interviews with producers. Botanical composition on perennial pastures was determined using the step-point method, walking transects in each field. Transects were followed using a GPS unit to maintain straight lines and uniform coverage. Canopy height measurements of vegetation were taken at 4 points around a central point. Each central point represented about 20 acres. The central points were placed randomly in vegetation representative of the area. Canopy heights were noted for grass, herbaceous, and woody growth at each site.

HSI calculations were completed using assumptions published with the corresponding HSI model, and assumptions may vary from one species to the next. Most HSI are based on the most limiting factors required by that species, and may not evaluate all actual requirements. Minimum acres required for habitat were ignored for all models, in order to evaluate other factors. For instance, pronghorn antelope require 11.8 sq miles as a minimum habitat area. It is also assumed that pronghorn obtain adequate free water from playas in the area. The other 4 species generally obtain adequate water from their diet and dew, but adequate water may be limiting in very dry years. HSI calculations are based only on conditions with the study area, and may be increased or very occasionally decreased by the surrounding environment.

Results. Habitat suitability index values range from 0 to 1, with 0 not providing at least one essential component of habitat for the specific animal species, and 1 providing all of the essential components required by that species. Sites were evaluated for wildlife habitat in Jan.-Feb. 2006 (Table 17) and summer 2006 (Table 18). Very few changes were noted, as would be expected. The HSI models are generally designed to work independent of season.

Many of the wildlife species require some type of perennial vegetation, primarily for winter food and year-round cover. This is especially true for lark bunting and quail. Therefore, those sites with only annual crops are severely limited in the amount of habitat they offer. Many of the producer sites have HSI values of 0. These are primarily sites devoted to annual plants and that have no perennial vegetation. However, this is without considering nearby habitat. If a cropped area provided winter food for quail in the form of waste grain, and a neighboring farm provided the necessary winter cover, then this cropped field is actually an essential component of the quail habitat.

There is a practical limit to how far wildlife will travel to find components of their habitat that meet their requirements. This is a factor in many of the HSI models. Therefore, farms that have smaller fields and are more diverse in vegetation types will have higher HSI values.

It may also be noted that very few sites, even those with perennial vegetation, had a high HSI for quail or antelope. This is because, according to the HSI model, quail habitat must have some type of woody cover, and pronghorn require woody vegetation such as sage for winter food. There is very little woody cover in the project area, and none within any of the project sites. However, quail are present and are frequently observed on project sites and in the study area and therefore, may use other plants for cover.

Conclusion. In general, those sites with perennial vegetation had higher HSI values, and should provide better wildlife habitat. The sites that had HSI values of 0 still may be of some value to wildlife, but lack all the components for a complete habitat for the animals. Sites and areas with perennial vegetation provide permanent homes for wildlife, while those sites with cultivation are only used by wildlife if they are close enough to areas of permanent vegetation. Sites with some component of perennial vegetation may show the most promise for additional income from recreational activities such as wildlife hunting and watching.

Table 17. Wildlife Habitat Suitability Indices[1] (HSI) of 25 producer sites in Jan - Feb 2006.

System	Site No.	Acres	Lark Bunting	Bobwhite Quail	Cottontail Rabbit	Black-tailed Prairie Dog	Pronghorn Antelope
			------------------------ HSI ------------------------				
Cotton	1	62.3	0	0	0	0	0.10
Cotton	2	60.9	0	0	0	0	0.10
Cotton	6	122.9	0	0	0	0	0.10
Cotton	11	92.5	0	0	0	0	0.10
Cotton	14	124.2	0	0	0	0	0.10
Cotton	15	95.5	0	0	0	0	0.10
Cotton	16	143.1	0	0	0	0	0.10
Cotton/corn	22	148.7	0	0	0	0	0.10
Cotton/corn	24	129.8	0	0	0	0	0.10
Cotton/corn	26	125.2	0	0	0	0	0.10
Cotton/grain sorghum	3	123.3	0	0	0	0	0.10
Cotton/wheat	13	319.5	0	0	0	0	0.10
Cotton/pearl millet	19	120.4	0	0	0	0	0.10
Cotton/sunflowers	23	105.1	0	0	0	0	0.10
Cotton/alfalfa/wheat silage	4	123.1	0	0	0.10	0	0.13
Cotton/forage sorghum/wheat	12	283.9	0	0	0	0	0.10
Cotton/grain sorghum/oat silage	18	122.2	0	0	0	0	0.10
Corn/sorghum/triticale silages	20	233.4	0	0	0	0	0.10
Cotton/wheat/cattle	21	122.7	0	0	0	0	0.10
Cotton/rye/impv.grass/cattle	9	237.8	0.35	0	0.23	0.37	0.10
Cotton/corn silage/wheat/grass/cattle	17	220.8	0.20	0	0.20	0.24	0.22
Native/impv. Grass/cattle	5	628.0	0.68	0	0.63	0.57	0.10
Imprv. Grass/ann. Hay/cattle	10	173.6	0.48	0	0.42	0.66	0.23
Improved grass: seed/hay	7	130.0	0.80	0	0.42	0.90	0.10
Improved grass: seed/hay	8	61.8	0.80	0	0.42	0.90	0.10

[1] A HSI of 0 does not meet the basic requirements of that species, a HSI of 1 fully meets all habitat requirements of that species. HSI models used were published by the US Fish and Wildlife Service.

Table 18. Wildlife Habitat Suitability Indices[1] (HSI) of 26 producer sites in summer 2006.

System	Site No.	Acres	Lark Bunting	Bobwhite Quail	Cottontail Rabbit	Black-tailed Prairie Dog	Pronghorn Antelope
			------------------------- HSI				-------------------------
Cotton	1	135.1	0	0	0	0	0.10
Cotton	2	60.9	0	0	0	0	0.10
Cotton	3	123.3	0	0	0	0	0.10
Cotton	6	122.9	0	0	0	0	0.10
Cotton	11	92.5	0	0	0	0	0.10
Cotton	14	124.2	0	0	0	0	0.10
Cotton	16	143.1	0	0	0	0	0.10
Cotton	27	46.2	0	0	0	0	0.10
Cotton/corn	22	148.7	0	0	0	0	0.10
Cotton/corn	23	105.1	0	0	0	0	0.10
Cotton/corn	24	129.8	0	0	0	0	0.10
Cotton/corn	26	125.2	0	0	0	0	0.10
Cotton/wheat	13	319.5	0	0	0	0	0.10
Cotton/grain sorghum	15	95.5	0	0	0	0	0.10
Cotton/pearl millet	19	120.4	0	0	0	0	0.10
Cotton/alfalfa/ann.silage	4	123.1	0	0	0.10	0	0.13
Cotton/forage sorghum/wheat	12	283.9	0	0	0	0	0.10
Cotton/sorghum hay/oat silage	18	122.2	0	0	0	0	0.10
Corn/sorghum/triticale silages	20	233.4	0	0	0	0	0.10
Cotton/corn/wheat/cattle	21	122.7	0	0	0	0	0.10
Cotton/rye/impv.grass/cattle	9	237.8	0.36	0	0.27	0.27	0.10
Cotton/corn silage/wheat/grass/cattle	17	220.8	0.21	0	0.23	0.21	0.10
Native/impv. Grass/cattle	5	628.0	0.85	0	0.61	0.76	0.10
Imprv. Grass/ann. Hay/cattle	10	173.6	0.56	0	0.50	0.50	0.23
Improved grass: seed/hay	7	130.0	0.86	0	0.45	1.00	0.10
Improved grass: seed/hay	8	61.8	0.86	0	0.45	1.00	0.10

[1] A HSI of 0 does not meet the basic requirements of that species, a HSI of 1 fully meets all habitat requirements of that species. HSI models used were published by the US Fish and Wildlife Service.

Theoretical alterations to sites for increased wildlife habitat.

Objectives. It was of interest to investigate how the wildlife potential of each site could be improved by surrounding conditions. This could include adjacent playa lakes, CRP acres, or other adjacent area that might be modified. Theoretical wildlife habitat indices have been calculated for selected sites for summer 2006. Each site continues to be evaluated for potential for improving wildlife habitat. Many options are being considered, including different management of existing crops, and altering vegetation composition in corners and playas. These are intended to be plans that each producer could take and implement, as well as examples of what can be done to manage for optimum wildlife habitat.

Methods. Several representative producer sites have been taken and theoretically modified to attempt to increase wildlife habitat of the sites (Table 19). Sites with pivots were selected for comparability and ease of calculations, and because they best represent the farms in the area. Management and cropping systems under the pivot were not altered, but the corners around the pivot were established in a theoretical vegetative cover and management strategy to increase wildlife habitat. The wildlife models mentioned above were used as a guide for this vegetation, and the vegetation is meant to complement the cropping systems in general and not as a stand-alone habitat. The vegetative cover and management parameters were designed around meeting the habitat requirements of as many of the 5 species mentioned above as possible, and this combination of vegetation is one that can exist in a dryland situation. For consistency, the additional corner acreage represents 21.4602% of the total acreage, which is typical for pivot corners. These corners have the same vegetation and management for each site, also for consistency.

Grasses and shrubs in all 4 corners

Theoretical areas of increased wildlife habitat in the corners around these pivots have a specific combination of vegetation and open space. These areas are composed of 37% canopy cover of shrubs, 33% canopy cover of herbaceous (non-woody) vegetation, and 30% bare ground or ground covered with litter less than 2" thick. This defines these areas as deciduous shrub savannah (DSS). These areas are dryland, and are not harvested or burned. Little to no maintenance should be required for a number of years after establishment. Preferred bob-white food plants will total 25% of the canopy cover, and will include parts of both the shrub and herbaceous canopy cover.

The shrub canopy cover would have an average canopy height of 40 cm. At least 4 species of shrub will comprise the shrub canopy, and will be those species generally palatable to pronghorn antelope. As mentioned above, part of the shrub canopy will also be of species that provide food for bobwhite quail. No trees were included to facilitate a return to conventional farming practices should the need arise.

Herbaceous canopy cover is comprised of grasses and broadleaf nonwoody plants. Each of these groups can have an annual and a perennial component. Here, 26.4% of the overall herbaceous canopy is perennial, while 26.4% (80%) of the overall herbaceous canopy is also grasses. It may be convenient to fill both requirements with perennial grasses, but this is not required. The average summer canopy height of grasses and of nonwoody broadleaf plants is 25 cm.

Bare ground or ground not covered with litter thicker than 2 inches is a requirement for the foraging activities of bobwhite quail and other species. Here, this

Table 19. Potential Wildlife HSIs of 26 producer sites in summer 2006 with theoretical corners added.

System	Site No.	Acres	Lark Bunting	Bobwhite Quail	Cottontail Rabbit	Black-tailed Prairie Dog	Pronghorn Antelope
			------------------------- HSI -------------------------				
Cotton	14	158.1	0.14	0.19	0.45	0.00	0.19
Cotton/corn	26	159.4	0.14	0.21	0.45	0.00	0.19
Cotton/sorghum hay/oat silage	18	155.6	0.14	0.25	0.45	0.00	0.19
Cotton/rye/impv. grass/cattle	9	302.8	0.42	0.22	0.56	0.21	0.29
Cotton/corn silage/wheat/grass/cattle	17	281.1	0.30	0.18	0.55	0.16	0.19
Native/impv. grass/cattle	5	622.9	0.81	0.18	0.75	0.56	0.19
Improved grass: seed/hay	7	165.5	0.81	0.20	0.75	0.75	0.19

[1] A HSI of 0 does not meet the basic requirements of that species, a HSI of 1 fully meets all habitat requirements of that species. HSI models used were published by the US Fish and Wildlife Service.

area must be other than ground under the canopy of vegetation, but some areas under the vegetative canopy may contribute to this requirement.

Specific vegetation species are not defined, as many combinations could achieve these parameters on a specific site. If a land manager wished to establish a vegetative cover that meets these suggestions, selections of specific species should also consider use of existing species, and adaptation of species to the site conditions, including factors such as soil type and climate.

As mentioned before, these parameters were designed around meeting the habitat requirements of as many of the 5 species mentioned above as possible. In general, large improvements in wildlife habitat were possible by only altering vegetation in the corners This is very important because of the potential for increased income and land value from a practice that requires little or no input beyond establishment, uses no additional water, and does not alter the existing cropping practices on the irrigated ground. Black-tailed prairie dog was the only species to lose habitat based on this composition of vegetation. This may be positive to some land managers, but may not always be the objective. Vegetation combinations can be favorable for some wildlife, while reducing habitat for others. It is always important to first define the wildlife management objectives, and then design the management and vegetation around those specific species.

Grasses and shrubs in 3 corners, playa in 1 corner

Wildlife HSI values were also determined for another set of theoretical conditions. The sites in the above sample were modified to have playa-type vegetation in one of the four corners, with the other three filled by the vegetation described above. Typical playa vegetation was based on work by Haukos and Smith (1997). These values are presented in Table 20. In general, wildlife habitat decreased slightly due to the absence of woody vegetation in playas. However, the playas and associated vegetation still were an important component to the wildlife habitat on these sites.

Further exploration of options for increasing wildlife habitat are needed. The presence of a playa without other perennial vegetation in the other corners would probably increase wildlife habitat for the site, and habitat would further increase with the establishment of woody vegetation near the playa. These and similar combinations are continuing to be explored.

<u>Conclusion.</u> It may be possible to greatly increase wildlife habitat on producer and similar sites with the addition of nearby perennial vegetation. It may also be possible to use corners and areas around playas to complement these systems and increase overall wildlife habitat. The theoretical addition of perennial vegetation around these existing production systems resulted in large increases in wildlife habitat. These examples only evaluated two combinations of vegetation; many other combinations are possible and may be better for specific species. Managing little-used corners around pivot-irrigated production systems for increased wildlife habitat shows great promise. This may be a practice that can increase the value of the land and potential income from recreation, while requiring no additional water use.

Table 20. Potential Wildlife HSIs of 26 producer sites in summer 2006 with theoretical corners added. One corner on each site is an unaltered playa with representative native vegetation.

System	Site No.	Acres	Lark Bunting	Bobwhite Quail	Cottontail Rabbit	Black-tailed Prairie Dog	Pronghorn Antelope
			HSI				
Cotton	14	158.1	0.13	0.16	0.42	0	0.17
Cotton/corn	26	159.4	0.13	0.18	0.42	0	0.17
Cotton/sorghum hay/oat silage	18	155.6	0.13	0.21	0.42	0	0.17
Cotton/rye/impv. grass/cattle	9	302.8	0.42	0.21	0.53	0.21	0.26
Cotton/corn silage/wheat/grass/cattle	17	281.1	0.30	0.13	0.52	0.16	0.17
Native/impv. grass/cattle	5	622.9	0.81	0.13	0.75	0.56	0.17
Improved grass: seed/hay	7	165.5	0.81	0.17	0.73	0.75	0.17

[1] A HSI of 0 does not meet the basic requirements of that species, a HSI of 1 fully meets all habitat requirements of that species. HSI models used were published by the US Fish and Wildlife Service.

TASK 9: EQUIPMENT, SITE INSTRUMENTATION, AND DATA COLLECTION FOR WATER MONITORING

JIM CONKWRIGHT
SCOTT ORR

9.1 Equipment Procurement & Installation.

Primary System
The following equipment is installed and is operating on site:
Electromagnetic flow meters
Pressure transducers
Data logging controllers with communication capabilities
Digital compass units have been installed at selected sites

Secondary System
The following equipment has been installed and is operating on site:
Tipping bucket rain gauges
Temperature Sensors
HPWD Manual read rain gauges

Soil Moisture Site Install
Neutron probe access sites have been installed at each location. Several locations have multiple probe access sites.

Water Metering & Atmospheric Install
Primary and secondary systems have been installed at each irrigated site. Non-irrigated sites have been equipped with manual HPWD read rain gauges only.
Water well level recorders / telemetry systems have been procured and installed at 10 well sites.
The Et weather station is operational.

9.2 Data Collection & Processing.

Data collection and site monitoring. Initial site information consisting of irrigation application method, operational flows and pressures, acres, crop, irrigation well (size, fuel type, number) and soil classifications have been recorded.

Sites equipped with electronic sensors are currently collecting data. Data is being transmitted and logged every 24 hours.

Soil moisture data is being collected on schedule.

Water well levels at selected sites are being logged and data telemetered to HPWD.

Each location equipped with electronic monitoring devices is being visited on a regular basis for calibration and maintenance.

Data Processing. Data collected has been validated, processed, and disseminated to team members. The water use efficiency estimations for year 2 of the project have been finalized for inclusion in the annual report.

Summary

Primary and secondary systems located at each site are functioning.
Water level monitoring is ongoing.
Data collection for year 2 has been completed and reports finalized.
Preparations for year three of the project are underway.

Table 21. Soil moisture, irrigation, and water use by site (2006).

Site ID	Crop	Acres	R1 Soil Moisture	R2 Soil Moisture	Remaining Soil Moisture	Irrigation Applied Inches Per Acre	Rainfall Seeding - Crop Term	Effective Rainfall	Total Crop Water Inches Per Acre	Yield Per Acre Lbs.	Yield Per Acre Inch Of Total Water (lbs.)	Yield Per Acre Inch Of Irrigation (lbs.)
1-1,2,3,4	Cotton	135.2	8.81	8.92	-0.11	21	8.82	6.17	27.06	1,694	63	81
2-1	Cotton	60.9	8.14	7.53	0.61	19	7.75	5.43	25.04	1,966	79	103
3-1,2	Cotton	123.3	7.79	6.68	1.11	10	6.52	4.56	15.67	1,051	67	105
4-1	Alfalfa	13.3	8.53	3.14	5.39	34.5	9.6	6.72	46.61	18,361	394	532
4-2	Forage Sorghum	65.4	7	6.52	0.48	16	7.1	4.97	21.45	28,823	1,344	1,801
4-2	Wheat	65.4	8.15	6.65	1.5	16.25	4.1	2.87	20.62	13,969	677	860
4-3	Cotton	44.4	8.15	6.65	1.5	16.25	7.5	5.25	23.00	1,805	78	111
5-1,2..13	Grass / Alfalfa	628	5.34	7.15	-1.81	9.63	11.37	7.96	15.78	NA	NA	NA
6-1	Cotton	122.9	5.02	5.1	-0.08	13.61	9	6.30	19.83	1,530	77	112
7	Grass	130	7.26	8.01	-0.75	7.75	7.45	5.22	12.22	5,808	475	749
8-1,2,3,4	Grass	61.8	6.43	7.67	-1.24	10.06	7.45	5.22	14.04	2,712	193	270
9-1	Rye	95.8	4.1	5.38	-1.28	NA	4.62	3.23	1.95	NA	NA	NA
9-2	Cotton	137	4.8	8.01	-3.21	17.55	7	4.90	19.24	1,154	9	66
10-1,2,3,4	Grass	173.6	9.6	5.82	3.78	16.01	9.62	6.73	26.52	NA	NA	NA
11-1,2,3	Cotton	92.5	8.03	7.65	0.38	16.88	9.8	6.86	24.12	1,036	43	61
12-1	Cotton	151.2	5.7	6.46	-0.76	NA	9.15	6.41	5.65	NA	NA	NA
13-1	Cotton	203.7	4.56	5.63	-1.07	NA	9.15	6.41	5.34	NA	NA	NA
14-1	Cotton	124.2	4.7	5.75	-1.05	6.22	6.7	4.69	9.86	768	78	124
15-1,3	Cotton	67.1	8.36	6.66	1.7	14.09	9.6	6.72	22.51	1,396	62	99
15-4	Sorghum	28.4	8.36	6.66	1.7	4.24	9.6	6.72	12.66	3,023	239	713
16-1	Cotton	143.1	7.8	8	-0.2	12.23	8.29	5.80	17.83	1,175	66	96
17-1	Grass	53.6	7.07	5.18	1.89	5.5	9.9	6.93	14.32	NA	NA	NA
17-2	Cotton	58.3	8.08	7.45	0.63	16.75	6.6	4.62	22.00	1,834	83	109
17-3	Corn Silage	108.9	8.13	5.84	2.29	21.3	7.9	5.53	29.12	58,181	1,998	2,732
18-1	Cotton	60.7	5.89	6.16	-0.27	13.39	9.35	6.55	19.67	904	46	68
18-2	Hay Grazer	61.5	5.89	6.16	-0.27	6.33	6.45	4.52	10.58	3,902	369	616
18-2	Oats	61.5	5.89	6.16	-0.27	4.3	4.2	2.94	6.97	9,756	1,400	2,269
19-3	Millet	45.3	7.34	8.36	-1.02	10.24	4.65	3.26	12.48	2,489	200	243
19-4	Cotton	75.1	5.78	5.45	0.33	9.46	4.65	3.26	13.05	902	69	95
20-1	Corn Silage	117.6	8.52	5.75	2.77	24.79	6.05	4.24	31.80	59,081	1,858	2,383
20-2	Tritacale	115.8	7.19	7.08	0.11	10	5.7	3.99	14.10	42,660	3,026	4,266
20-2	Sorghum Silage	115.8	7.19	7.08	0.11	9	5.02	3.51	12.62	52,798	4,182	5,866
21-1	Corn	61.4	6.66	8.13	-1.47	18.25	7.53	5.27	22.05	6,981	317	383
21-2	Cotton	61.3	3.91	5.27	-1.36	14.55	9.67	6.77	19.96	1,201	60	83
22-1	Cotton	72.7	7.54	7.25	0.29	17.64	6.12	4.28	22.21	2,181	98	124
22-2	Corn	76	4.34	6.72	-2.38	26.23	6.12	4.28	28.13	10,412	370	397
23-1	Cotton	51.4	4.81	7.27	-2.46	11.67	11.85	8.30	17.51	1,346	77	115
23-2	Corn	48.8	5.46	7.89	-2.43	18.15	9.25	6.48	22.20	8,800	396	485
24-1	Cotton	64.7	8.72	7.24	1.48	12.94	7.62	5.33	19.75	1,536	78	119
24-2	Corn Silage	65.1	8.18	8.57	-0.39	25.82	6.02	4.21	29.64	52,400	1,768	2,029
26-1	Corn	62.9	3.56	6.93	-3.37	21.28	9.76	6.83	24.74	9,717	638	457
26-2	Cotton	62.3	5.11	5.03	0.08	15.95	11.06	7.74	23.77	2,112	89	132
27-1	Cotton	46.2	7.81	6.77	1.04	18	10.72	7.50	26.54	2,240	84	124

Table 22. Soil moisture, irrigation, and water use by crop (2006).

COTTON / Irrigated	Site ID	Crop	Acres	R1 Soil Moisture	R2 Soil Moisture	Remaining Soil Moisture	Irrigation Applied Inches Per Acre	Total Gallons Applied Per Acre	Total Gallons Applied	Effective Rainfall	Total Crop Water - Inches Per Acre	Yield Per Acre (lbs.)	Yield Per Acre Inch Of Total Water (lbs.)	Yield Per Acre Inch Of Irrigation (lbs.)
	1-1,2,3,4	Cotton	135.2	8.81	8.92	-0.11	21	570,234	77,095,637	6.17	27.06	1,694	62.59	80.67
	2-1	Cotton	60.9	8.14	7.53	0.61	19	515,926	31,419,893	5.43	25.04	1,966	78.53	103.47
	3-1,2	Cotton	123.3	7.79	6.68	1.11	10	271,540	33,480,882	4.56	15.67	1,051	67.05	105.10
	4-3	Cotton	44.4	8.15	6.65	1.5	16.25	441,253	19,591,611	5.25	23.00	1,805	78.48	111.08
	6-1	Cotton	122.9	5.02	5.1	-0.08	13.61	369,566	45,419,654	6.30	19.83	1,530	77.16	112.42
	9-2	Cotton	137	4.8	8.01	-3.21	17.55	476,553	65,287,720	4.90	19.24	1,154	59.98	65.75
	11-1,2,3	Cotton	92.5	8.03	7.65	0.38	16.88	458,360	42,398,256	6.86	24.12	1,036	42.95	61.37
	14-1	Cotton	124.2	4.7	5.75	-1.05	6.22	168,898	20,977,117	4.69	9.86	768	77.94	123.55
	15-1,3	Cotton	66.5	8.36	6.66	1.7	14.09	382,600	25,442,891	6.72	22.51	1,396	62.02	99.08
	16-1	Cotton	143.1	7.8	8	-0.2	12.23	332,093	47,522,568	5.80	17.83	1,175	65.89	96.08
	17-2	Cotton	58.3	8.08	7.45	0.63	16.75	454,830	26,516,560	4.62	22.00	1,834	83.36	109.48
	18-1	Cotton	60.7	5.89	6.16	-0.27	13.39	363,592	22,070,038	6.55	19.67	904	45.97	67.51
	19-4	Cotton	75.1	5.78	5.45	0.33	9.46	256,877	19,291,451	3.26	13.05	902	69.15	95.35
	21-2	Cotton	61.3	3.91	5.27	-1.36	14.55	395,091	24,219,060	6.77	19.96	1,201	60.17	82.54
	22-1	Cotton	72.7	7.54	7.25	0.29	17.64	478,997	34,823,050	4.28	22.21	2,181	98.18	123.64
	23-1	Cotton	51.4	4.81	7.27	-2.46	11.67	316,887	16,288,001	8.30	17.51	1,346	76.89	115.34
	24-1	Cotton	64.7	8.72	7.24	1.48	12.94	351,373	22,733,818	5.33	19.75	1,536	77.76	118.70
	26-2	Cotton	62.3	5.11	5.03	0.08	15.95	433,106	26,982,522	7.74	23.77	2,112	88.84	132.41
	27-1	Cotton	46.2	7.81	6.77	1.04	18	488,772	22,581,266	7.50	26.54	2,240	84.39	124.44
TOTAL	**19**		1602.7					7,037,774	601,560,728					
MAX			143.10	8.81	8.92	1.70	21.00	570,234	77095636.80	8.30	27.06	2181.00	98	132.41
MIN			44.40	3.91	5.03	-3.21	6.22	168,898	16288001.05	3.26	9.86	768.48	42.95	61.37
AVG			84.35	6.75	6.78	-0.04	14.40	390,987	33420040.45	5.75	20.12	1421.74	71	100.20
COTTON / Dryland	12-1	Cotton	151.2	5.7	6.46	-0.76	Dryland	NA	NA	6.41	NA	NA	NA	NA
	13-1	Cotton	203.7	4.56	5.63	-1.07	Dryland	NA	NA	6.41	NA	NA	NA	NA

Table 22, continued

	Site ID	Crop	Acres	R1 Soil Moisture	R2 Soil Moisture	Remaining Soil Moisture	Irrigation Applied Inches Per Acre	Total Gallons Applied Per Acre	Total Gallons Applied	Effective Rainfall	Total Crop Water	Yield Per Acre (lbs.)	Yield Per Acre Inch Of Total Water (lbs.)	Yield Per Acre Inch Of Irrigation (lbs.)
CORN / Grain	21-1	Corn	61.4	6.66	8.13	-1.47	18.25	495,561	30,427,415	5.27	22.05	6,981	317	383
	22-2	Corn	76	4.34	6.72	-2.38	26.23	712,249	54,130,956	4.28	28.13	10,412	370	397
	23-2	Corn	48.8	5.46	7.89	-2.43	18.15	492,845	24,050,841	6.48	22.20	8,800	396	485
	26-1	Corn	62.9	3.56	6.93	-3.37	21.28	577,837	36,345,955	6.83	24.74	9,717	393	457
TOTAL	3		187.7					1,782,932	114,527,752					
MAX			76.00	5.46	7.89	-2.43	26.23	712,249	54,130,956	6.48	28.13	10412.00	396	485
MIN			48.80	3.56	6.93	-3.37	18.15	492,845	24,050,841	4.28	22.05	6981.00	317	383
AVG			62.57	4.51	7.41	-2.90	20.88	566,885	36,203,071	5.34	24.13	8731.00	361	421

CORN / Silage	17-3	Corn Silage	108.9	8.13	5.84	2.29	21.3	578,380	62,985,604	5.53	29.12	58,181	1,998	2,732
	20-1	Corn Silage	117.6	8.52	5.75	2.77	24.79	673,148	79,162,165	4.24	31.80	59,081	1,858	2,383
	24-2	Corn Silage	65.1	8.18	8.57	-0.39	25.82	701,116	45,642,670	4.21	29.64	52,400	1,768	2,029
TOTAL	3		226.5					1,251,528	142,147,769					
MAX			117.60	8.52	5.84	2.77	24.79	673,148	79,162,165	5.53	31.80	59,081	1,998	2,732
MIN			108.90	8.13	5.75	2.29	21.30	578,380	62,985,604	4.24	29.12	58,181	1,858	2,383
AVG			113.25	8.33	5.80	2.53	23.05	625,764	71,073,884	4.88	30.46	58,631	1,928	2,557

SORGHUM	4-2	Forage Sorghum	65.4	7	6.52	0.48	16	434,464	28,413,946	4.97	21.45	28,823	1,344	1,801
	15-4	Sorghum	29	8.36	6.66	1.7	4.24	115,133	3,338,856	6.72	12.66	3,023	239	
	20-2	Sorghum Silage	115.8	7.19	7.08	0.11	9	244,386	28,299,899	3.51	12.62	52,798	4,182	

FORAGE OTHER	4 - 1	Alfalfa	13.3	8.53	3.14	5.39	34.5	936,813	12,459,613	6.72	46.61	18,361	394	532
	4-2	Wheat	65.4	8.15	6.65	1.5	16.25	441,253	28,857,914	2.87	20.62	13,969	677	860
	5-1,2,..13	Alfalfa /Grass	628	5.34	7.15	-1.81	9.63	261,493	164,217,617	7.96	15.78	NA	NA	NA
	7 - 1	Grass	130.1	7.26	8.01	-0.75	7.75	210,444	27,378,699	5.22	12.22	5,808	475	749
	8 -1,2,3,4	Grass	61.8	6.43	7.67	-1.24	10.06	273,169	16,881,859	5.22	14.04		0	0
	9 - 1	Rye	95.8	4.1	5.38	-1.28	NA	NA	NA	3.23	1.95	NA	NA	NA
	10-1,2,3,4	Grass	173.6	9.6	5.82	3.78	16.01	434,736	75,470,090	6.73	26.52	NA	NA	NA
	17 - 1	Grass	53.6	7.07	5.18	1.89	5.5	149,347	8,004,999	6.93	14.32	NA	NA	NA
	18-2	Hay grazer	61.5	5.89	6.16	-0.27	6.33	171,885	10,570,916	4.52	10.58	3,902	369	616
	18-2	Oats	61.5	5.89	6.16	-0.27	4.3	116,762	7,180,875	2.94	6.97	9,756	1,400	2,269
	19-3	Millet	45.3	7.34	8.36	-1.02	10.24	278,057	12,595,980	3.26	12.48	2,489	200	243
	20 - 2	Triticale	115.8	7.19	7.08	0.11	10	271,540	31,444,332	3.99	14.10	42,660	3,026	4,266

Table 23. Irrigation, PET, and production by site (2006).

			WATER - INCHES		PET		PRODUCTION		
Site Number	Application Method	Crop	Irrigation	Rain/Irrig/Soil	PET Season Water Use	% Of PET Provided To Crop	Lbs/Ac	Lbs/Ac - Inch Irrigation	Lbs/Ac - Inch Rain/Irrig/Soil
1-1,2,3,4	SDI	Cotton	21	27.06	28.73	94%	4,127	197	152
2-1	SDI	Cotton	19	25.04	28.47	88%	1,966	103	79
3-1,2	CP	Cotton	10	15.67	27.89	56%	1,051	105	67
4-1	CP	Alfalfa	34.5	46.61	NA	NA	18,361	532	394
4-2	CP	Forage Sorghum	16	21.45	24.83	86%	28,823	1,801	1,344
4-2	CP	Wheat	16.25	20.62	19.65	105%	13,969	860	677
4-3	CP	Cotton	16.25	23.00	28.52	81%	1,805	111	78
5-1,2..13	CP	Grass / Alfalfa	9.63	15.78	NA	NA	NA	NA	NA
6-1	CP	Cotton	13.61	19.83	28.52	70%	1,530	112	77
7	CP	Grass	7.75	12.22	NA	NA	5,808	475	749
8-1,2,3,4	SDI	Grass	10.06	14.04	NA	NA	2,712	193	270
9-1	CP	Rye	NA	1.95	NA	NA	NA	NA	NA
9-2	CP	Cotton	17.55	19.24	28.73	67%	1,154	66	9
10-1,2,3,4	CP	Grass	16.01	26.52	NA	NA	NA	NA	NA
11-1,2,3	F	Cotton	16.88	24.12	28.47	85%	1,036	61	43
12-1	Dryland	Cotton	NA	5.65	NA	NA	NA	NA	NA
13-1	Dryland	Cotton	NA	5.34	NA	NA	NA	NA	NA
14-1	CP	Cotton	6.22	9.86	28.66	34%	768	124	78
15-1,3	F	Cotton	14.09	22.51	28.43	79%	1,409	100	63
15-4	F	Sorghum	4.24	12.66	23.54	54%	2,960	698	234
16-1	CP	Cotton	12.23	17.83	26.98	66%	1,175	96	66
17-1	CP	Grass	5.5	14.32	NA	NA	NA	NA	NA
17-2	CP	Cotton	16.75	22.00	28.55	77%	1,834	109	83
17-3	CP	Corn Silage	21.3	29.12	36.32	80%	58,181	2,732	1,998
18-1	CP	Cotton	13.39	19.67	28.73	68%	904	68	46
18-2	CP	Hay Grazer	6.33	10.58	NA	NA	3,902	616	369
18-2	CP	Oats	4.3	6.97	NA	NA	9,756	2,269	1,400
19-3	CP	Millet	10.24	12.48	24.83	50%	2,489	243	200
19-4	CP	Cotton	9.46	13.05	28.63	46%	902	95	69
20-1	CP	Corn Silage	24.79	31.80	21.23	150%	59,081	2,383	1,858
20-2	CP	Tritacale	10	14.10	20.57	69%	42,660	4,266	3,026
20-2	CP	Sorghum Silage	9	12.62	20.98	60%	52,798	5,866	4,182
21-1	CP	Corn	18.25	22.05	36.93	60%	6,981	383	317
21-2	CP	Cotton	14.55	19.96	28.5	70%	1,201	83	60
22-1	CP	Cotton	17.64	22.21	28.59	78%	2,181	124	98
22-2	CP	Corn	26.23	28.13	36.8	76%	10,412	397	370
23-1	CP	Cotton	11.67	17.51	28.2	62%	1,346	115	77
23-2	CP	Corn	18.15	22.20	37.32	59%	8,800	485	396
24-1	CP	Cotton	12.94	19.75	28.34	70%	1,536	119	78
24-2	CP	Corn Silage	25.82	29.64	33.69	88%	52,400	2,029	1,768
26-1	CP	Corn	21.28	24.74	38.03	65%	9,717	457	638
26-2	CP	Cotton	10.64	23.77	28.43	84%	2,575	242	139
27-1	CP	Cotton	18	26.54	28.69	93%	2,240	124	84

CP Center Pivot, F Furrow, SDI Subsurface Drip   NA - Not applicable or data not available   IC- Incomplete data

Budget

Table 24. Task and expense budget for 2005 (Year 1) and 2006 (Year 2).

2005-358-014 Task Budget	Task Budget	Year 1 (09/22/04 - 01/31/06) *revised*	Year 2 (02/01/06 - 02/28/07)
1	$ 5,450.00	$ 4,537.11	$ -
2	$ 2,667,550.00	$ 216,356.08	$ 335,696.85
3	$ 675,402.00	$ 21,111.97	$ 33,832.60
4	$ 610,565.00	$ 52,409.10	$ 40,940.08
5	$ 371,359.00	$ 42,427.73	$ 40,533.84
6	$ 633,173.00	$ 54,530.50	$ 75,387.27
7	$ 306,020.00	$ 37,013.79	$ 22,801.48
8	$ 334,692.00	$ 44,628.53	$ 43,062.62
9	$ 620,564.00	$ 145,078.00	$ 39,010.61
TOTAL	$ 6,224,775.00	$ 618,092.81	$ 631,265.35

Expense Budget	Total Budget	Year 1 (09/22/04 - 01/31/06)	Year 2 (02/01/06 - 02/28/07)
Salary and Wages [1]	$ 2,126,064.00	$ 230,131.35	$ 300,530.73
Fringe[2] (20% of Salary)	$ 288,379.00	$ 29,304.43	$ 35,534.29
Insurance	$ 313,514.00	$ 13,318.05	$ 26,528.94
Tuition and Fees	$ 200,514.00	$ 8,126.78	$ 16,393.00
Travel	$ 150,000.00	$ 14,508.18	$ 25,392.19
Capital Equipment	$ 76,554.00	$ 23,079.72	$ 12,742.67
Expendable Supplies	$ 381,035.00	$ 14,276.87	$ 16,769.54
Subcon	$ 1,741,376.00	$ 212,360.28	$ 103,388.58
Technical/Computer	$ 190,400.00	$ 9,740.00	$ 3,860.00
Communications	$ 365,000.00	$ 25,339.15	$ 44,040.05
Reproduction (incl under comm)			
Vehicle Insurance	$ 5,000.00	$ -	$ 397.06
Overhead	$ 386,939.00	$ 37,908.00	$ 45,688.30
Profit			
TOTAL	$ 6,224,775.00	$ 618,092.81	$ 631,265.35

Cost Sharing

Table 25. Cost sharing figures for 2005 (Year 1) and 2006 (Year 2).

	Total Cost Share	FY 1 (05)	FY 2 (06)	FY 3 (07)	FY 4 (08)	FY 5 (09)	FY 6 (10)	FY 7 (11)	FY 8 (12)	Balance
TTU	1,026,840.00	51,824.77	60,218.17							914,797.06
TCE	423,892.00	40,944.88	0							382,947.12
HPUWCD	200,000.00	0	50,000.00							150,000.00
TOTAL	1,650,732.00	92,769.65	110,218.17							1,447,744.18

Acknowledgements

<u>Producers of Hale and Floyd County</u>

Mark Beedy
Lanney Bennett
Randy Bennett
Troy Bigham
Louis (Bubba) Ehrlich
Bernie Ford
Gerald Ford
Jody Foster
Scott Horne
Boyd Jackson
Jimmy Kemp
Brett Marble
Charles Nelson
Keith Phillips
John Paul Schacht
Glenn Schur
Dan Smith
Don Sutterfield
Brian Teeple
Eddie Teeter
Jeff Don Terrell
Aaron Wilson