A NEW IDEA

Newsletter of the Irrigation District Engineering and Assistance Program

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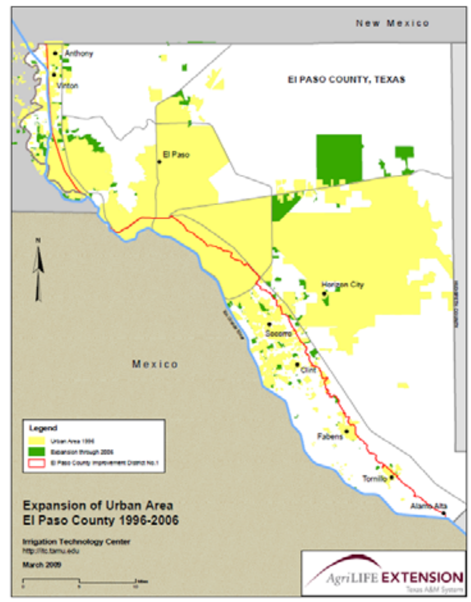
Urbanization of Irrigation Districts

Rapid urban growth in the southern border region of Texas is causing fragmentation of many irrigation districts, among other impacts to the region. The IDEA Team recently completed an analysis of the growth of urban areas over the ten-year period, 1996 to 2006, in border counties with irrigation districts. We found that the Lower Rio Grande Valley experienced an overall 31% increase in urban area. In El Paso, there was a 12% increase in urban area within the county and 8% within the irrigation district. However, in contrast, there was very little change in urbanized area in Maverick and Hudspeth Counties. Table 1 lists our estimates of the expansion of total urban area by county.



Urban Expansion in El Paso County

In the Lower Rio Grande Valley, the most urbanized district is Hidalgo County Municipal Utility District No.1 at 89.5% urbanization, while Valley Acres and Bayview Irrigation Districts are the least urbanized as a percentage of the district. Hidalgo County Irrigation District No.2 has the most urban area in terms of total acreage, while the largest increase in urban area as a percentage of the district was

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In Pursuit of the Perfect Liner

Since 1999, irrigation districts in the Lower Rio Grande Valley have been experimenting with various types of synthetic canal liners as an alternative to more costly canal lining and rehabilitation options. Since 2005, the IDEA Team has been evaluating the performance of these linings by conducting annual inspections in order to help answer the question: "*which liner is the best*?" The answer turns out to depend on several factors including where the liner is installed and whether or not the liner has a protective covering (or barrier).

As expected, synthetic liners with a protective covering performed better than those without. Synthetic liners significantly reduce water losses while the protective barrier (usually shotcrete) prevents damage. The higher initial costs for a liner with protective barrier may be off-set over the long run by reduced maintenance and repair costs, better performance, and less water loss. The two types of lining materials that were used with a

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AgriLIFE EXTENSION
Texas A&M System

Automation, Remote Monitoring and Control Demonstrations - Update

Irrigation districts face many challenges in their daily operations including increasing demand for flexible and efficient operation. Automation, remote monitoring (telemetry), and control show promise in addressing such issues and can result in more efficient water management, provide real-time flow control and measurement, reduce operational and maintenance costs, and provide alarming capabilities.

As a part of the Rio Grande Basin Initiative, the IDEA team is working with irrigation districts to demonstrate different aspects of telemetry, remote control, and automation. Various approaches and levels of technology are being used in order to evaluate their viability for Texas conditions.

Full Automation

Hidalgo County Irrigation District No.6 operates two reservoirs, Walker and District Lake, that are used for both irrigation and municipal uses. The District maintains maximum storage levels of both reservoirs to meet municipal and peak irrigation season demands. During large rainfall events, the District must release excess water out of the reservoirs back into the main canal, and then drain this volume of water through an emergency gate into the Rio Grande River to prevent flooding.

This "emergency gate" is located at a remote area of the district. The road to the gate can become inaccessible during rain events, requiring district personnel to walk two miles, often at night, to open the gate manually. Thus, the first priority was to automate the emergency gate. Commercial automation and control equipment was used for this project, along with a radio telemetry system to the District office. The project was completed in summer of 2008, and the gate has operated successfully since.

The next phase of the project was to expand the system to include the other gates on the reservoirs to fully automate the system for flood control. Earlier this year, a gate on each of the district's reservoirs was automated and synchronized to open at the same water level as the emergency gate. This control provides the district with the ability to automatically relieve the system of excess water. These reservoir gates are also tied into the same telemetry system as the emergency gate.

The user interface and control software used for this project is ClearSCADA, a commercial human machine interface (HMI) software package. The team helped set up this software on a dedicated computer at the District office. The District has the ability to remotely view reservoir levels, make remote changes to individual gate sites, and analyze past operational data.

Radial Gate: Remote Monitoring and Control

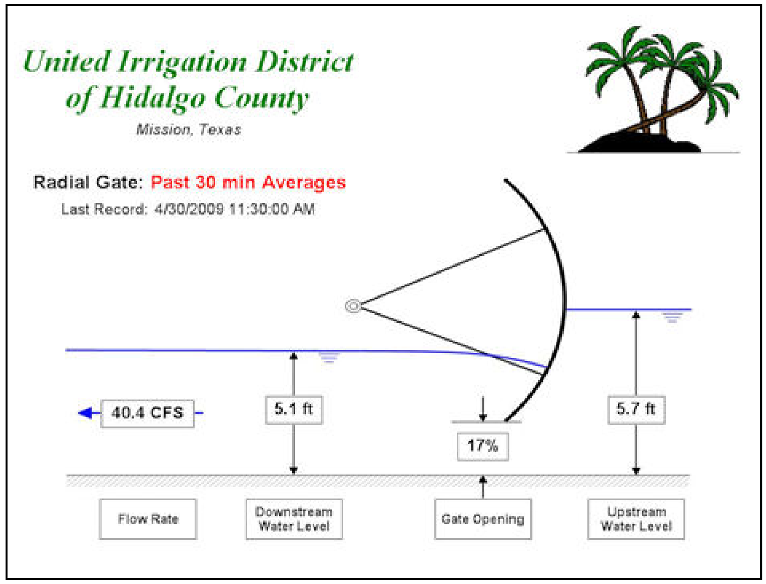
In 2007, the IDEA team worked with the United Irrigation District in replacing an old sluice gate structure with a radial gate and setting up the gate for remote control. For this demonstration, instead of the more complex commercial automation and control equipment, the team set up an easier-to-use and less expensive system. A remote control system was designed as the first step toward full automation.

The gate is located in Bryan Canal (with a capacity of 225 cfs) which serves the eastern side of the district and as well as a city diversion point. The original gate structure controlling this portion of the district consisted of three manually controlled sluice gates, only two of which were in operation. Sluice gates are more difficult to automate and would not provide adequate flow uniformity for flow measurement. "Radial gates" are widely used to control canal flows and water levels. They require less energy during hoisting, provides smoother, uniform flows, and can more easily pass debris. Radial gates can also be calibrated to compute flow, thereby eliminating the need for a flow meter. Typical open channel flow meters cost upwards of $7000.

The telemetry system uses a direct-connect cable to communicate between the gate site and the district office computer. The user-interface and control software used for this project is LoggerNet-RTMC Pro. Two water level sensors were installed upstream and downstream of the gate. District personnel now can view real-time upstream and downstream water level conditions, and remotely make changes to gate position from the district office.

Next we calibrated of the gate to establish flow automatic flow control parameters. We temporally installed a Doppler flow meter to collect the information needed for gate calibration. The gate was successfully calibrated in August 2009.

Office Computer Screen Display



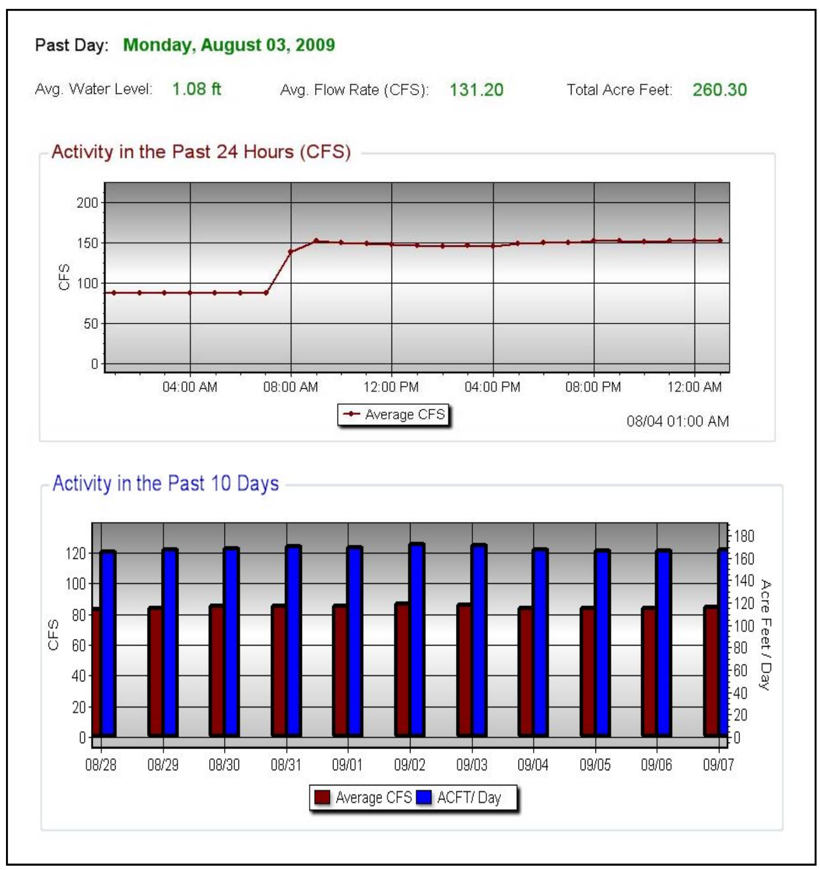
Remote Weir Monitoring

In cooperation with Cameron County Irrigation District No.6 in Los Fresnos, Texas, the IDEA team installed a simple, low-cost telemetry project that automatically records water level and calculates the flow rate of the main district weir. The data is automatically transferred to the district's headquarters via telephone line. Previously, the District manually read the data at the weir and called in the information to the district office twice a day.

We set up a user interface on a computer at the district office to enable the district manager to view the flow in real time. In addition, we created a web page for the district which displays the flow data from the weir using hourly and daily graphs.

35 ft Weir: Weir blade is at 0 water level.

Online Screen Display



Lining Evaluation Project

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protective barrier were PVC and polyester.

Liners installed without a protective barrier are susceptible to damage from the sun (UV), animals, intentional and unintentional vandalism, and normal district operational activities. An example of unintentional vandalism is children swimming in the canals.

Four types of liners have been used without a protective barrier: polypropylene, PVC alloy, EPDM rubber, and polyurethane. Many of the rubber lined sections showed serious deterioration. The PVC alloy is the hardest of the liners and is more resistant to vandalism and animal damage. The other two liners did well in remote canals.

Proper installation of liners was found to be critical. For example, liners that were not stretched properly during installation left folds and loose material that seem to be a natural draw for damage. Folds and loose material are easily grabbed, pulled, and torn.

The IDEA Team recommends that districts institute a regular inspection and repair program. Once a tear or cut happens, it will tend to expand and be susceptible to further damage until it is repaired. When planning a lining project, a district should evaluate the location and consider the potential for damage. Liners in high traffic areas will experience more damage. A more durable liner such as the PVC or even better, a liner with a protective barrier should be considered.

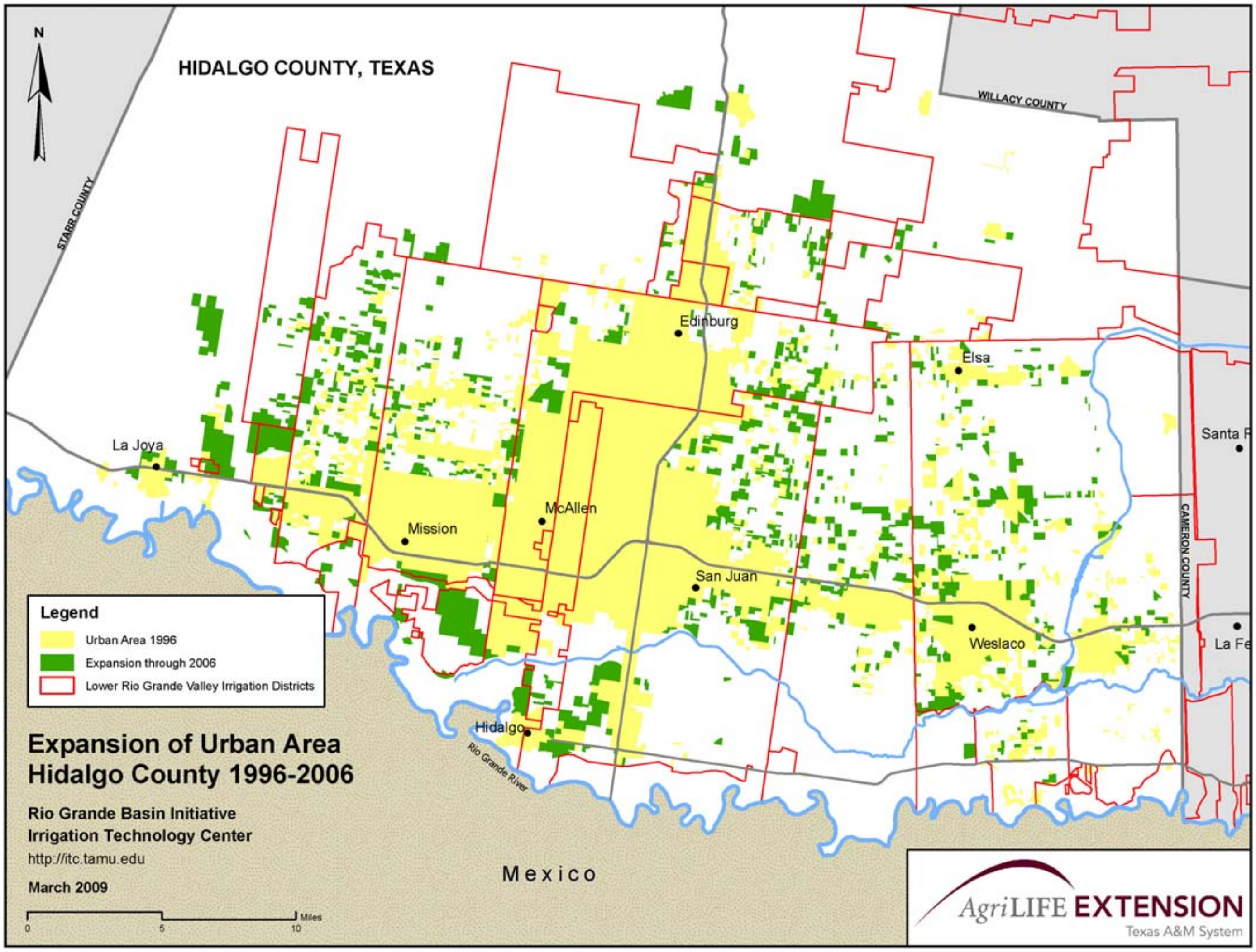
Additional details and results of our analysis are provided in the report "*Evaluation of Canal Lining Projects in the Lower Rio Grande Valley of Texas,*" which maybe viewed or downloaded from the IDEA website (http://idea.tamu.edu).

Liner showing top-anchor cuts

Canal liner with a protective barrier is shown being installed

Liner has been torn and pulled off the canal sidewall

Urbanization



Urban Expansion in Hidalgo County

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in HCID16, HCID18 and HCID19.

For this analysis, "irrigation district" refers to irrigation, water control, water improvement, conservation, reclamation, or municipal utility districts that deliver agricultural irrigation water and hold Class A agricultural water rights or a similar allocation. "Urban area" is defined as a continuous developed or developing area that is no longer in agricultural use. Included are all residential communities and subdivisions that are clearly identifiable from aerial photographs with or without homes on the properties. We also included properties with more than one home, dwelling, or other structure on a single piece of property. Single home dwellings on large properties outside the city limits were excluded.

Table 1. Urban Expansion of Counties: 1996 through 2006

Counties	Urban Area 1996	Urban Area 2006
	Acreage	Acreage
Cameron	66,189	81,635
El Paso	208,180	234,155
Hidalgo	118,466	160,099
Maverick	9,816	12,019
Willacy	3,084	3,509

The complete report, *Expansion of Urban Area in Irrigation Districts of the Rio Grande River Basin, 1996–2006: A Map Series,* includes five county and individual maps of the districts which show the expansion in urban area over this 10 year period. It is available for viewing and download from the IDEA website (http://idea.tamu.edu).

Personnel News

Dr. Gabriele Bonaiti

Dr. Gabriele Bonaiti joined the IDEA team as a visiting scholar in February of this year and is headquartered in College Station. Gabriele works on GIS database integration and WebGIS development.

Gabriele is also head of the Agricultural Office for the Drainage and Irrigation District Riviera Berica, Veneto Region, in northeast Italy. His principal duties include irrigation scheduling, water derivation authorization, GIS development, irrigation project design and implementation.

Gabriele may be reached at (979) 862-2593, email: gbonaiti@ag.tamu.edu.

Karimov Relocations to College Station

Askar Karimov, Extension Associate, has relocated his headquarters from Weslaco to Texas A&M University in College Station. Since returning, Askar has begun work on a doctoral degree in the Biological and Agricultural Engineering Department under Dr. Guy Fipps. His research is the development of algorithms for automatic control of irrigation canals. Askar will continue working as a member of the IDEA program team providing technical assistance and project support. Askar can be reached at (979) 862-3111, email: akarimov@ag.tamu.edu.

Askar Karimov

Daniel Delgado

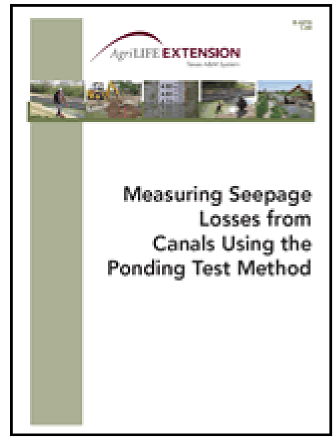
Daniel Delgado, Extension Assistant–Engineer, joined the team in August 2009, and is headquartered at the Texas AgriLife Extension Center in Weslaco. Daniel grew up in San Benito, Texas, and then attended the University of Texas–San Antonio, receiving a B.S. (2008) in civil engineering. He may be contacted at (956) 969-5615, email: hddelgado@ag.tamu.edu.

David Flahive, System Analyst, has rejoined the IDEA team working on database applications for districts and programming support for the IDEA Team. David works part-time remotely from Argentina.

Martin Barroso, GIS Specialist, serves at the chief contact for person for requests and assistance on GIS and related topics out of the Texas AgriLife Extension Center in Weslaco. Martin may be reached at (956) 969-5615, email: mabarroso@ag.tamu.edu.

Recent Publications

B-6218 Measuring Seepage Losses from Canals Using the Ponding Test



Measuring seepage loss rates is one of the best ways to prioritize canals for maintenance and rehabilitation and to determine the effectiveness of canal improvements quantified through pre- and post-rehabilitation testing.

The ponding test method is considered to be the most accurate way to measure seepage losses from irrigation canals, and is often used as the standard of comparison for other methods. In this method two ends of a canal segment are closed or sealed (usually with earthen dams) to create a ponded pool of water. The change in water level is measured over a period of 24 to 48 hours and used along with the canal dimensions to calculate the seepage loss rate for the canal.

This publication provides complete details for using this method. It includes sections on preparing for the test, constructing the dam, selecting and installing equipment, measuring canal shapes, and calculating seepage losses from data collected. There is a sample ponding test data form and equipment checklist. 20 pp., 14 color photos, 6 tables, 7 illustrations), $7.00.

Printed copies may be ordered from the Texas AgriLife Extension Bookstore http://agrilifebookstore.org.

The following publications are published by the Texas Water Resources Institute http://twri.tamu.edu and can be downloaded at the IDEA Website http://idea.tamu.edu.

EM-105 Expansion of Urban Area in Irrigation Districts of the Rio Grande River Basin, 1996–2006: A Map Series

This series includes maps of five counties: El Paso, Maverick, Cameron, Hidalgo, and Willacy, showing the expansion of urban area over this 10-year period (1996 to 2006). Also shown on the maps are the service areas of 30 irrigation districts that deliver water within the Rio Grande River Basin. Individual district maps are posted under the GIS/Maps link. Tables show estimates of percent increase of urban area in both county and irrigation district boundaries.

EM-102 Texas Legislative and Irrigation Districts of the Rio Grande River Basin: A Map Series

This series consists of nine maps showing the boundaries of legislative districts (state and federal) and 32 irrigation districts that deliver irrigation water. The tables include Texas Class A water rights for the irrigation districts of the Lower and Middle Rio Grande Regions, water allocations for the Upper Rio Grande Basin irrigation districts according to the Rio Grande Compact, and a listing of legislative districts by irrigation districts.

TR-353 Evaluation of Canal Lining Projects in the Lower Rio Grande Valley of Texas

Since 1999, irrigation districts in the Lower Rio Grande Valley of Texas have been experimenting with an assortment of canal lining materials. In 2005, the IDEA team initiated a program to track the long-term effectiveness and durability of these materials and to document installation and maintenance procedures which will help ensure good performance. This report provides a summary of the results from the first three years of this evaluation program.

AgriLIFE EXTENSION
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The Irrigation District Engineering and Assistance (IDEA) Program is under the direction of Dr. Guy Fipps and is a program of the Irrigation Technology Center, a center of the Texas Water Resources Institute, Texas A&M University System, administrated through Texas AgriLife Extension Service and Texas AgriLife Research.

The IDEA Program first began in 1990's with projects to introduce surge flow irrigation and lay-flat tubing into two districts and to determine changes needed in district operations to ensure the success of the technologies. In 1996, the program expanded into GIS (geographical information system) mapping and use for improved district management and regional water planning. IDEA Team members include Eric Leigh, Askar Karimov, Martin Barroso, Gabriele Bonaiti, and Daniel Delgado.

For more program information, see http://idea.tamu.edu.

Short Courses/Educational Opportunities

March 2010:

- Geographical Information System (GIS) for Irrigation District Mapping and Management

The following courses are available by request:

- GPS (Global Positing System) Surveying and Data Processing
- Water Measurement and Metering in Irrigation Districts
- Customized Individual and Group Training

For course schedule, see the IDEA Website.

Editors:
Eric Leigh
Guy Fipps

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