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**Water Loss Test Results:  
West Main Canal  
United Irrigation District of  
Hidalgo County**

**Eric Leigh**

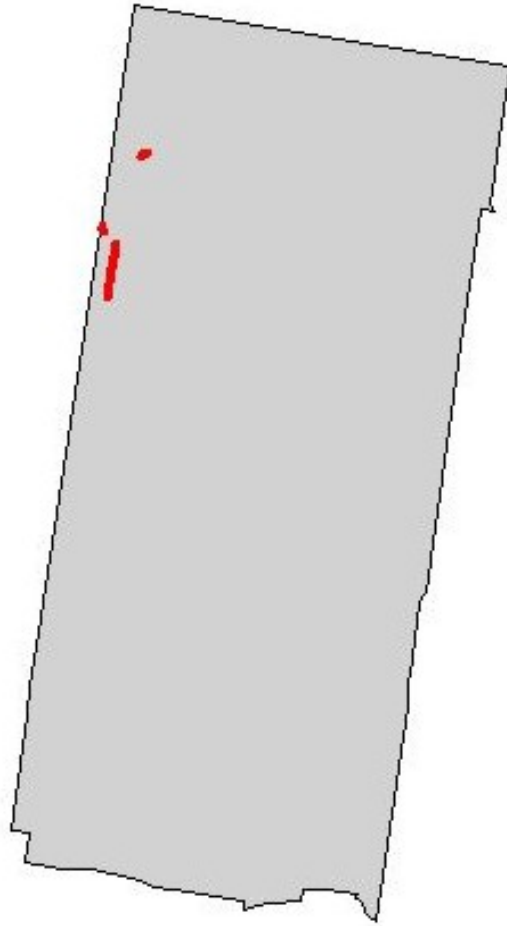
**Texas AgriLife Extension Associate, Biological and Agricultural Engineering, College Station**

**Guy Fipps**

**Texas AgriLife Extension Professor and Extension Agricultural Engineer, Biological and Agricultural Engineering, College Station**

**April 6, 2006**

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UNITED IRRIGATION DISTRICT  
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Report Prepared by:  
Eric Leigh and Guy Fipps,<sup>1</sup> P.E.

April 6, 2006

**IRRIGATION TECHNOLOGY CENTER**  
**Texas Cooperative Extension – Texas Agricultural Experiment Station**  
**Texas A&M University System**

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<sup>1</sup> Extension Associate, and Professor and Extension Agricultural Engineer, respectively, Department of Biological and Agricultural Engineering, 2117 TAMU, College Station, TX 77843-2117.

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## Water Loss Test Results: West Main Canal United Irrigation District of Hidalgo County

### SUMMARY

This report summarizes the results of ponding tests conducted in United Irrigation District of Hidalgo County (United) to measure losses in three segments of the West Main Canal. The ponding tests took place during July 10-12, 2001 and February 22-23, 2002, respectively.

The three test segments were located as follows:

- Test segment UN1 – East of Inspiration Rd beginning just south of 7 Mile Rd.
- Test segment UN2 – East of Inspiration Rd and 8 Mile Rd.
- Test segment UN3 – East of Inspiration Rd and north of 6 Mile Rd.

Test results are summarized in Tables 1 and 2 and were as follows:

- The average seepage loss rate measured for Test Segment UN1 was 2.29 gal/ft<sup>2</sup>/day.
- The average seepage loss rate measured for Test Segment UN2 was 2.11 gal/ft<sup>2</sup>/day.
- Test Segment UN3 had two turnout gates (unable to be verified as leaking) that may have contributed to the total loss rate of 2.11 gal/ft<sup>2</sup>/day. Test was performed with water level being only 50% total depth.

Table 1. Summary of ponding test results conducted on the West Main Canal.								
Test ID	District Segment ID	Soil**	Length (ft)	Top Width (ft)	Test Type	Loss rate Gal/ft <sup>2</sup> /day	Total Loss in Canal (ac-ft/mile)	
							per day	per year
UN1	West Main	sandy clay loam	600	11.79	seepage	2.29	0.59	214.3
UN2	West Main	fine sandy loam	600	8.17	seepage	2.11	0.36	132.2
UN3	West Main	fine sandy loam	4039	18.46*	total***	2.11	0.46	167.8

\*Average Top Width

\*\* Soil type of the surrounding area from the Soil Survey for Hidalgo County (USDA 1978)

\*\*\* Turnout gates located within the test segment may have contributed to losses

Table 2. Test results for the West Main Canal in terms of change in water level.				
Test ID	ft/hr	ft/day	in/hr	in/day
UN1	0.019	0.447	0.223	5.36
UN2	0.017	0.398	0.199	4.77
UN3	0.016	0.388	0.194	4.65



Figure 1. Large cracks and aquatic vegetation shown above contribute to higher total losses of canal segments.

# United Irrigation District of Hidalgo County

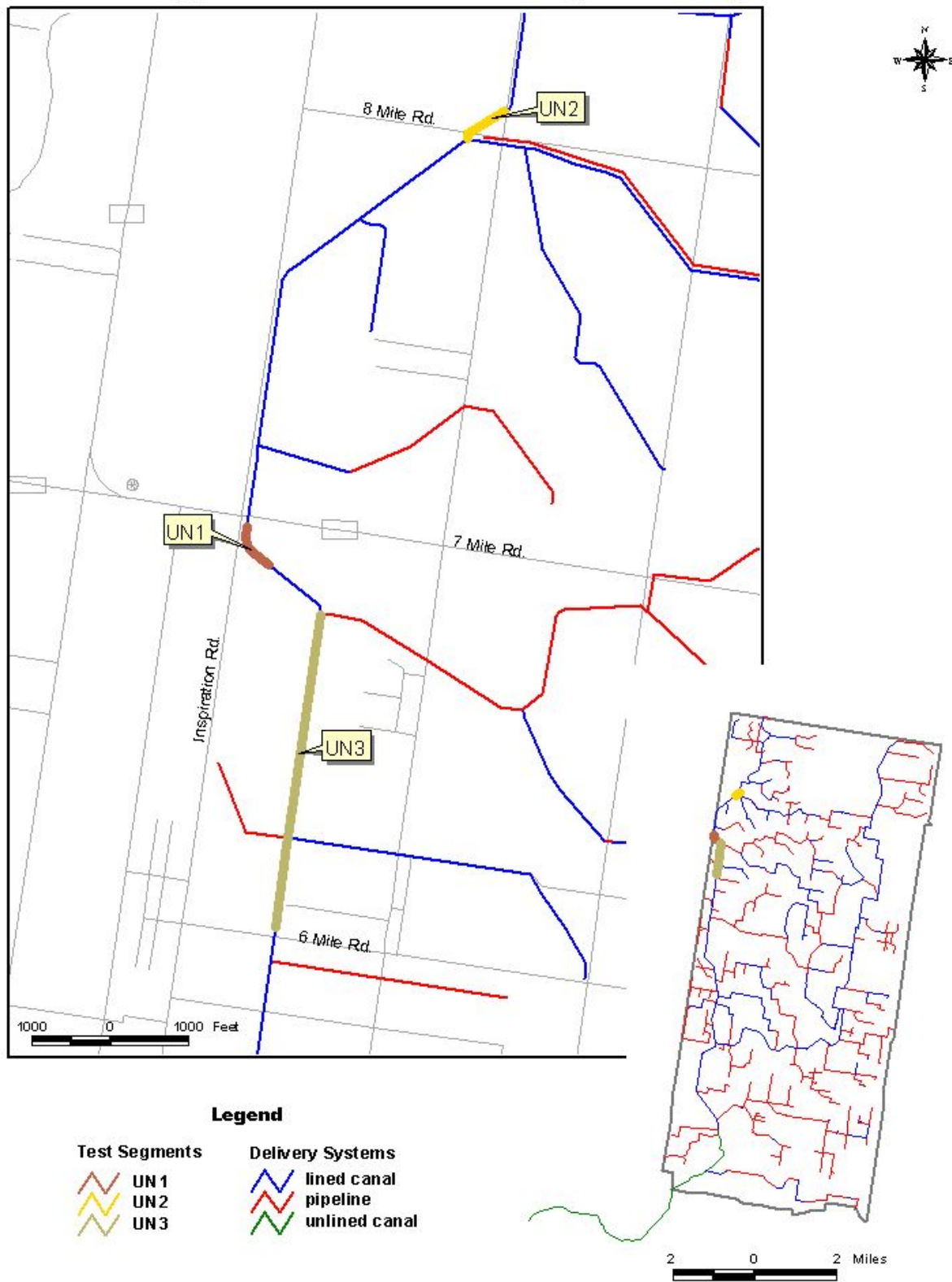


Figure2. District Map and locations of test segments.



## MATERIALS AND METHODS

Canal loss rates were measured using the ponding method. In this method, the two ends of a canal segment are closed or sealed with earthen dams as shown in Figure 3. Once sealed, water elevations are taken for approximately 24 to 48 hours. Five to six staff gauges (Fig. 4) were placed in each test segment, and stage levels were recorded manually. Canal dimensions and water spans were also surveyed during the test.

The tests are classified as follows:

- Test segment UN1 did not contain valves or gates within the canal; thus, the seepage rate was measured.
- Test segment UN2 did not contain valves or gates within the canal; thus, the seepage rate was measured.
- Test segment UN3 contained several leaking turnout gates; thus, we classify this as a total loss test since the gates contributed to the measured losses.

Tables 3, 4, and 5 provide details on the test segments; data collected and recorded changes in water depths during the tests. The canal cross-sections at each of the staff gauges are illustrated in Figure 6 for test UN1, Figure 10 for test UN2, and Figure 12 for test UN3. Also shown on these charts are the water depths at the beginning of the test.



Figure 3. Photo of the earthen dam being built on test segment UN1.

## Appendix A: Detailed Test Results

Test ID: UN1

Table 3. Data for Test UN1: West Main				
<b>District:</b> United Irrigation District of Hidalgo County			<b>Test ID:</b> UN1	
<b>Canal:</b> West Main			<b>Lining Type:</b> Lined	
<b>Starting Water Span Widths:</b> SG1: 11.21 ft, SG3: 11.24 ft, SG5: 11.26 ft			<b>Date:</b> Jul 10-12, 2001	
<b>Test Segment Length:</b> 600 feet			<b>Start Time:</b> 7:00 pm <b>Finish Time:</b> 6:00 pm	
<b>Test Starting Depths:</b> SG1: 4.28 feet, SG3: 4.32 feet, SG5: 4.36 feet				
<b>Location:</b> East of Inspiration Rd beginning just south of 7 Mile Rd.				
Staff Gage Readings				
Date	Time	SG1	SG3	SG5
Jul 10	19:00	2.438	4.313	1.938
	20:00	2.417	4.292	1.833
Jul 11	09:40	2.021	3.917	1.521
	11:00	1.979	3.875	1.500
	12:00	1.958	3.854	1.469
	19:00	1.833	3.729	1.333
Jul 12	11:00	1.625	3.521	1.125
	18:00	1.563	3.438	1.063
<b>True depth adjustment factor (ft)</b>		<b>1.843</b>	<b>.008</b>	<b>2.423</b>

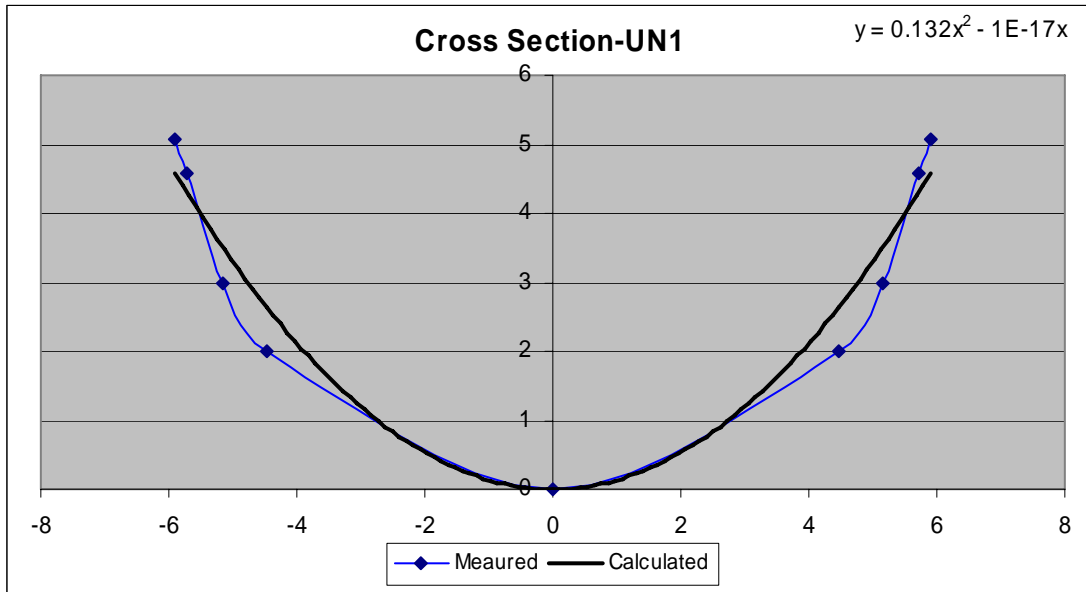


Figure 4. Cross-section for Test Segment UN1.



Figure 5. Photo of test segment UN1 showing aquatic vegetation problems.

**Test ID: UN2**

Table 4. Data for Test UN2: West Main					
<b>District:</b> United Irrigation District of Hidalgo County			<b>Test ID:</b> UN2		
<b>Canal:</b> West Main			<b>Lining Type:</b> Lined		
<b>Starting Water Span Widths (feet):</b> SG1: 7.94, SG2: 7.96, PT1: 7.98, SG3: 7.99			<b>Date:</b> Jul 10-12, 2001		
<b>Test Segment Length:</b> 600 feet			<b>Start Time:</b> 10:45 am		
			<b>Finish Time:</b> 12:00 pm		
<b>Test Starting Depths:</b> SG1: 2.7 ft, SG2: 2.725 ft, PT1: 2.75 ft, SG3: 2.771					
<b>Location:</b> East of Inspiration Rd at 8 Mile Rd.					
Staff Gage Readings					
Date	Time	SG1	SG2	PT1	SG3
Jul 10	10:45	2.08	2.60	2.25	2.77
	12:30	2.00	2.54	2.19	2.71
	14:00	1.94	2.43	2.09	2.65
	16:00	1.90	2.38	2.04	2.58
	19:30	1.80	2.31	1.97	2.5
Jul 11	10:00	1.55	2.27	1.72	2.25
	12:00	1.52	2.02	1.69	2.22
	19:00	1.45	1.95	1.60	2.13
Jul 12	11:00	1.27	1.79	1.45	1.98
	12:00	1.27	1.77	1.44	1.97
<b>True depth adjustment factor (ft)</b>		<b>0.62</b>	<b>0.12</b>	<b>0.50</b>	<b>0.00</b>

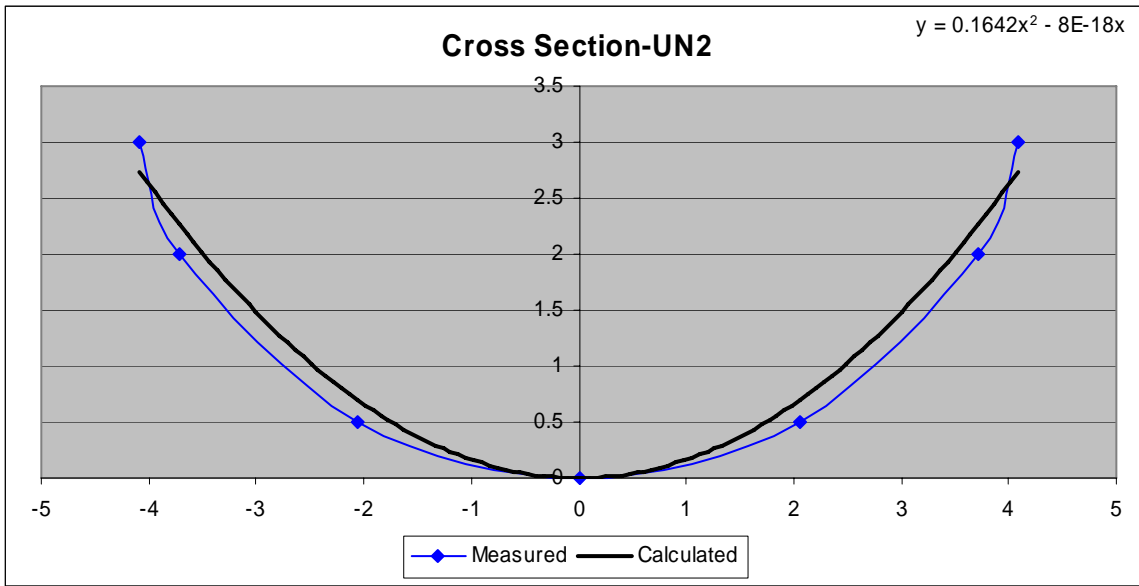


Figure 6. Cross-section for Test Segment UN2.



Figure 7. Photo of test segment UN2 showing aquatic vegetation problems.

**Test ID: UN3**

Table 5. Data for Test UN3: West Main					
<b>District:</b> United Irrigation District of Hidalgo County			<b>Test ID:</b> UN3		
<b>Canal:</b> West Main			<b>Lining Type:</b> Lined		
<b>Starting Water Span Widths (feet):</b> SG1:10.16, SG2:10.21, SG5:10.36, SG6:10.41 ft			<b>Date:</b> Feb 22- 23, 2002		
<b>Test Segment Length:</b> 4039 feet			<b>Start Time:</b> 4:19 pm <b>Finish Time:</b> 3:35 pm		
<b>Test Starting Depths:</b> SG1: 3.9 ft, SG2: 3.93 ft, SG5: 4.00 ft, SG6: 4.025 ft					
<b>Location:</b> East of Inspiration Rd, north of 6 Mile Rd.					
Staff Gage Readings					
Date	Time	SG1	SG2	SG5	SG6
Feb 22	18:00	2.25	3.39	3.68	2.20
Feb 23	09:00	2.15	3.25	3.58	2.04
	17:00	2.08	3.19	3.52	2.00
	19:00	1.85	3.00	3.25	1.79
<b>True depth adjustment factor (ft)</b>		<b>1.65</b>	<b>0.54</b>	<b>0.32</b>	<b>2.05</b>

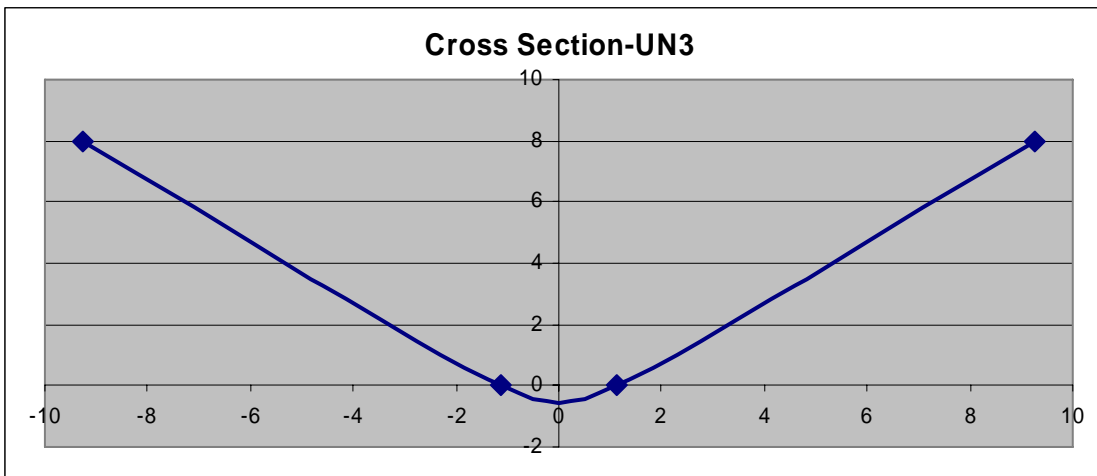


Figure 8. Cross-section for Test Segment UN3.

## Appendix C: Soil Descriptions

### General Soil Series

3 – Brennan-Hidalgo: Deep, moderately permeable soils that typically have a dark brown or dark grayish brown fine sandy loam surface layer (source: Soil Survey of Hidalgo County, Texas USDA, 1978).

### Detailed Soil Units

<b>Soil Unit</b>	<b>Permeability (in/hr)</b>
3 – Brennan fine sandy loam	0.6 – 6.0
25 – Hidalgo fine sandy loam	0.6 – 2.0
28 – Hidalgo sandy clay loam	0.6 – 2.0

## Appendix C: Other Test Results

Texas Cooperative Extension has conducted approximately 50 total loss tests and seepage loss tests in the Lower Rio Grande River Basin since 1998. The results are summarized in Tables 11 – 13. Table 14 gives seepage rates versus lining type as reported in the scientific literature.

Table 7. Results of seepage loss tests conducted by Texas Cooperative Extension in the Lower Rio Grande River Basin.						
Test ID	Year	Canal Width (ft)	Canal Depth (ft)	Class	Loss Rate	
					gal/ft <sup>2</sup> /day	ac-ft/mi/yr
<b><u>Lined</u></b>						
16HC2	03			M		
LF1	03	12	5	M	1.77	152.9
LF2	03	10	6	M	4.61	369.1
MA4	03	12	5	S	8.85	529.7
SJ4	00	15	4	M	1.17	111.2
SJ5	02	14	5	M	1.38	145.5
UN1	01	12	6	M	2.32	214.3
UN2	01	8	3	M	2.09	132.2
<b><u>Unlined</u></b>						
BR1	03	60	11	M	3.14	794.6
MA3	03	19	5	S	13.9	1690.1
RV1	03	38	4	M	0.15	23.0
SB4	02	16	4	S	0.64	68.3
SB5	02	18	3	S	1.67	188.3
SB6	02	20	5	S	1.44	189.0
SB7	02	16	4	S	0.42	47.4
SB8	02	20	5	S	0.83	104.0

Classification of canal: M = main, S = secondary



Table 8. Results of total loss tests in lined canals (leaking gates and valves may have contributed to measured loss rates) conducted by Texas Cooperative Extension in the Lower Rio Grande River Basin.

Test ID	Year	Canal Width (ft)	Canal Depth (ft)	*Class	<u>Loss Rate</u>	
					gal/ft <sup>2</sup> /day	ac-ft/mi/yr
<b><u>Lined</u></b>						
16HC1	03	14	5	M	1.89	192.4
BV1	99	10	5	M	7.97	510.5
BV2	99	9	4	M	8.53	451.5
DL1	00	20	6	M	0.16	18.8
DL2	00	7	4	S	4.12	236.2
DO1	03	5	3	S	1.68	65.2
DO2	03	6	4	S	2.18	121.5
DO3	03	6	3	S	2.71	107.2
ED1	00	6	4	S	34.32	1519.6
ED2	00	6	4	S	21.5	858.2
ED3	00	3	2	T	10.22	308.2
ED4	00	4	3	S	18.72	567.7
ED6	99	9	4	M	8.53	451.5
HA2	00	10	4	M	2.26	135.2
HA3	98	15	2	S	0.64	45.5
ME1	98	38	7	M	1.26	281.9
ME2	98		4	M	1.88	163.5
SJ1	99	12	5	M	2.58	126.8
SJ6	03	12	3	M	1.88	1.63
SJ7	03	19	4	M	1.98	227.1
UN3	02	12	6	M	2.02	169.7

\*Classification of canal: M = main, S = secondary, T = tertiary

Table 9. Results of total loss tests in unlined canals (leaking gates and valves may have contributed to measured loss rates) conducted by Texas Cooperative Extension in the Lower Rio Grande River Basin.

Test ID	Year	Canal Width (ft)	Canal Depth (ft)	Class	Loss Rate	
					gal/ft <sup>2</sup> /day	ac-ft/mi/yr
BV3	99	55	8	M	0.15	53.4
ED5	02	105	7	M	2.39	1213.2
MA1	99	50	10	M	1.98	227.1
MA2	99	20	5	S	4.32	371.4
SB1	00	29	7	S	1.27	215.5
SJ2	00	23	6	M	2.74	293.2
SJ3	00	30	5	S	0.95	132.6

Classification of canal: M = main, S = secondary

Table 10. Canal seepage rate reported in published studies.

Lining/soil type	Seepage rate (gal/ft <sup>2</sup> /day)
Unlined <sup>1</sup>	2.21-26.4
Portland cement <sup>2</sup>	0.52
Compacted earth <sup>2</sup>	0.52
Brick masonry lined <sup>3</sup>	2.23
Earthen unlined <sup>3</sup>	11.34
Concrete <sup>4</sup>	0.74 - 4.0
Plactic <sup>4</sup>	0.08-3.74
Concrete <sup>4</sup>	0.06-3.22
Gunite <sup>4</sup>	0.06-0.94
Compacted earth <sup>4</sup>	0.07-0.6
Clay <sup>4</sup>	0.37-2.99
Loam <sup>4</sup>	4.49-7.48
Sand <sup>4</sup>	4.0-19.45

<sup>1</sup>DeMaggio (1990). Technical Memorandum: San Luis unit drainage program project files. US Bureau of Reclamation, Sacramento. <sup>2</sup>U.S. Bureau of Reclamation (1963). Lining for Irrigation Canals. <sup>3</sup>Nayak, et al. (1996). The influence of canal seepage on groundwater in Lugert Lake irrigation area. Oklahoma Water Resources Research Institute. <sup>4</sup>Nofziger (1979). Profit potential of lining watercourses in coastal commands of Orissa. Environment and Ecology 14(2):343-345.

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The following persons contributed to this study:

Biological and Agricultural Engineering Department  
2117 Texas A&M University  
College Station, 77843-2117

Guy Fipps, Professor and Extension Agricultural Engineer  
Eric Leigh, Extension Associate  
Brian Treese, Extension Assistant (former)

Texas A&M Research and Extension Center  
2401 US Highway 83  
Weslaco, 78596-8398

Martin Barroso, Extension Agricultural Technician (former)

Web Address: <http://idea.tamu.edu>

### United Irrigation District of Hidalgo County

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