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Seepage Test Loss Results
The Main Canal
Valley Municipal Utility District No. 2

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Texas Water Resources Institute
make every drop count

SEEPAGE LOSS TEST RESULTS
THE MAIN CANAL
VALLEY MUNICIPAL UTILITY DISTRICT NO. 2

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THE IRRIGATION TECHNOLOGY CENTER
A center of the Texas Water Resources Institute
Texas Cooperative Extension - Texas Agricultural Experiment Station,
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CONTENTS

SEEPAGE LOSS TEST RESULTS, THE MAIN CANAL
VALLEY MUNICIPAL UTILITY DISTRICT NO. 2

SUMMARY

This report summarizes the results of a seepage loss test conducted on a segment of the Main Canal of the Valley Municipal Utility District No. 2 (Rancho Viejo) during October 22 - 24, 2003.

The canal segment tested was located 1.95 miles north of 281 Military Hwy. The test segment was an unlined canal, approximately 600 ft long and varied from 23.8 to 25.3 feet in water-span width (Fig. 1 and 2).

The average seepage rate during the test was measured at 0.15 gal/ft^2/day (Table 1). Annual water loss is estimated at 23.03 ac-ft/mi/yr based on an in-service period of 365 days per year. Table 2 lists the seepage rate in terms of water level change.

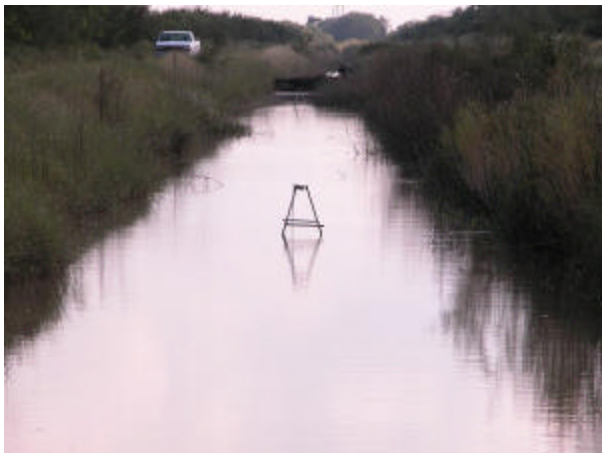

Figure 1. View of the Main Canal test segment with staff gauge.

Table 1. Seepage loss rate of the Main Canal, Valley Municipal Utility District No. 2. The test measured seepage loss only.

Test ID	Segment	Soil	Length (ft)	Seepage Rate (gal/ft^2/day)	Total Loss in Canal (ac-ft/mile) per day	per year*
RV1	Main Canal	Silty Clay**	600	0.15	0.063	23.03

*Based on 365 days per year
** Soil type of the surrounding area from the Soil Survey for Cameron County (USDA 1977)

Table 2. Seepage rate of the Main Canal in terms of change in water level.

Test ID	ft/hr	ft/day	in/hr	in/day
RV1	0.0008	0.02	0.01	0.24

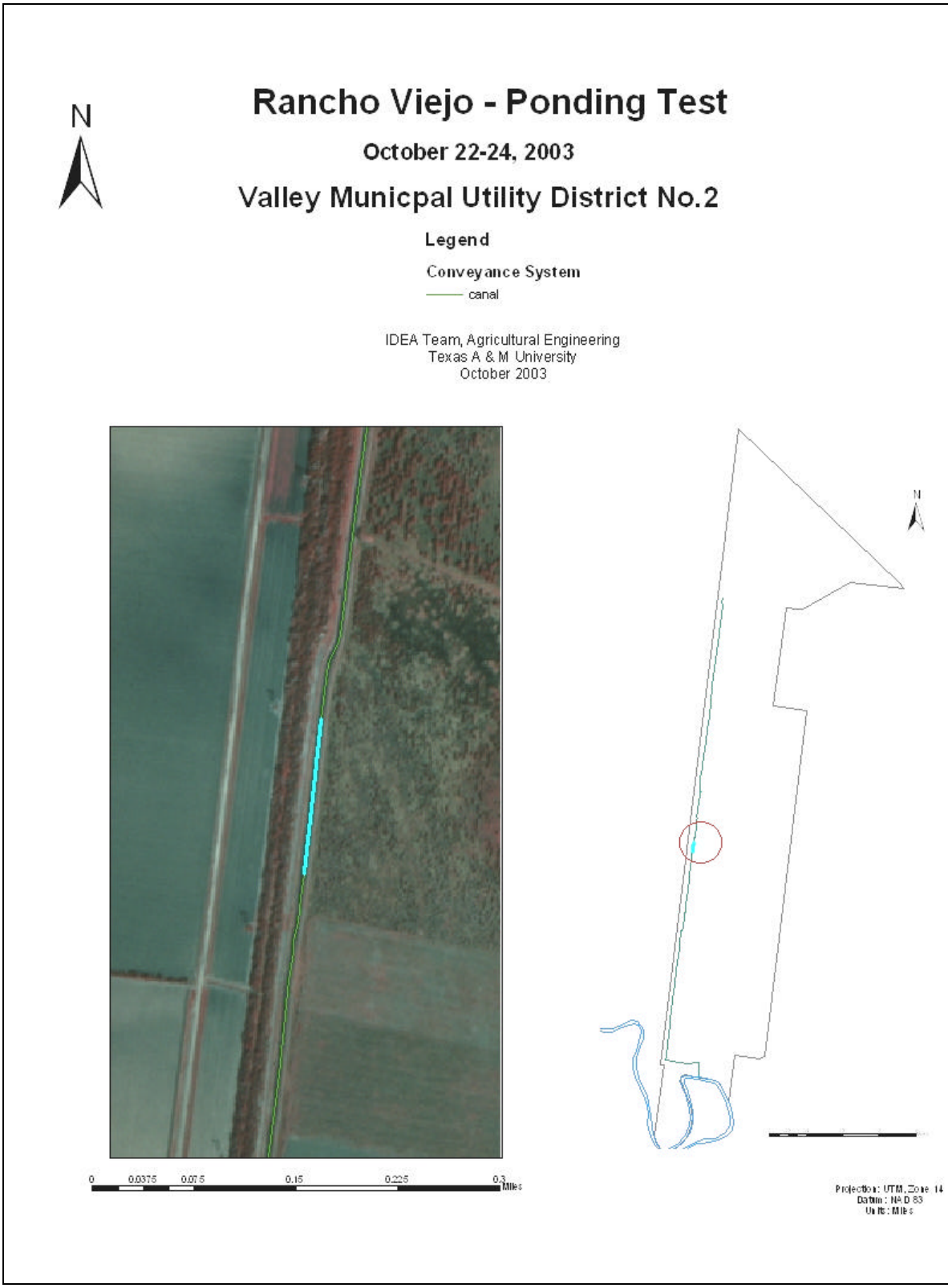

Figure 2. Map and aerial photograph of the Main Canal test segment.

MATERIALS AND METHODS

Seepage was measured using the ponding method. In this method, the two ends of a canal segment are closed or sealed with earthen dams. Once sealed, water elevations are taken for approximately 48 hours. Two staff gauges were placed in the test segment, and stage levels were recorded manually. Canal dimensions and water spans were also surveyed during the test. The segment did not contain valves or gates within the canal; thus, the seepage rate was measured. The location of the test segment is shown in Figure 2.

Table 3 provides details on the test segment, data collected and recorded changes in water depths during the test. The canal cross sections at the two staff gauges are illustrated in Figurers 4 and 5. Also shown on these charts are the water depths at the beginning of the test. A photograph of the staff gauge and its located in the canal is shown in Figure 6.

Figure 3. Upstream test dam and the centrifugal pump (a 3-inch "gator-pump") used to fill the test segment to normal operating depth.

Table 3. Data for Test RV1: Main Canal.

District: Valley Municipal Utility District No. 2	**Test ID:** RV1
Canal: Main Canal	**Lining Type:** Unlined
Water Span Width: 23.8 – 25.3 feet	**Date:** Oct 22-24, 2003
Test Segment Length: 600 feet	**Start Time:** 11:30 am **Finish Time:** 11:31 am
Test Starting Depths: A: 3.08 feet **B:** 3.27 feet	
Location: North of 281 (Military Hwy), East of FM 1421.	

Staff Gage Readings

Date	**A**		**B**	
	Time	**Feet**	**Time**	**Feet**
22 Oct	11:30	5.4	11:32	5.34
	12:34	5.39	12:36	5.32
	13:28	5.39	13:30	5.32
23 Oct	9:36	5.38	9:36	5.31
	15:02	5.37	15:03	5.3
24 Oct	9:46	5.35	9:51	5.28
	10:45	5.35	10:46	5.27
	11:30	5.35	11:31	5.27
True depth adjustment factor (ft)		-2.12		-2.24

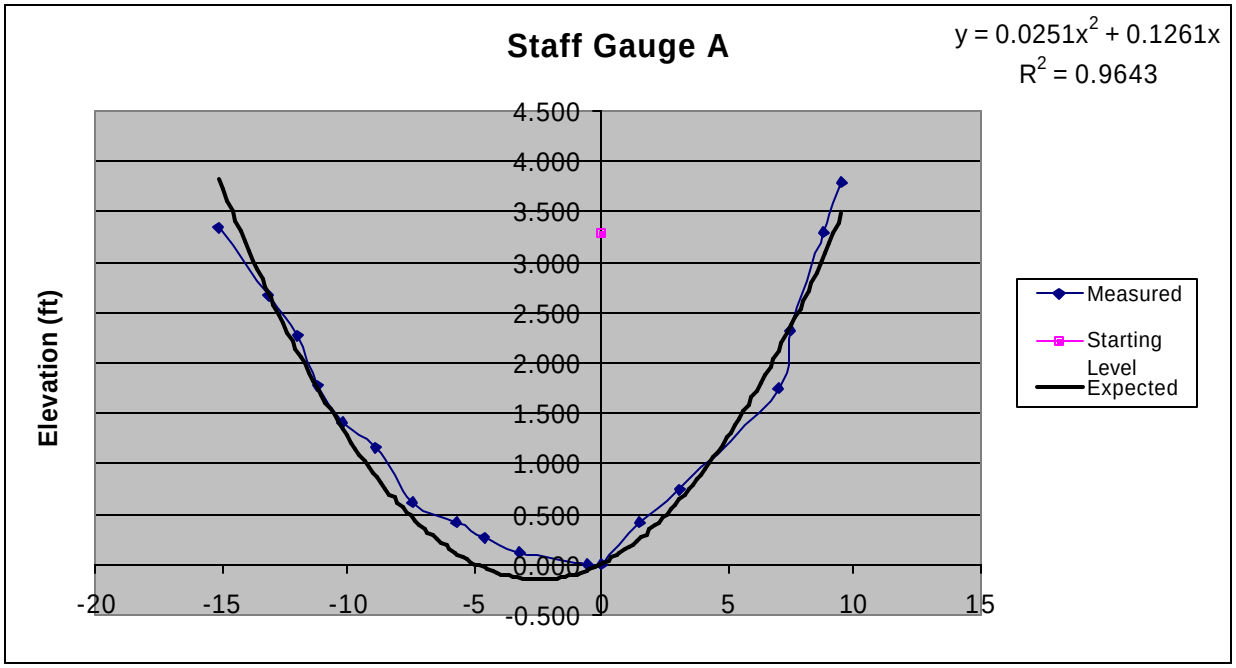

Figure 4. Cross-section at Staff Gauge A.

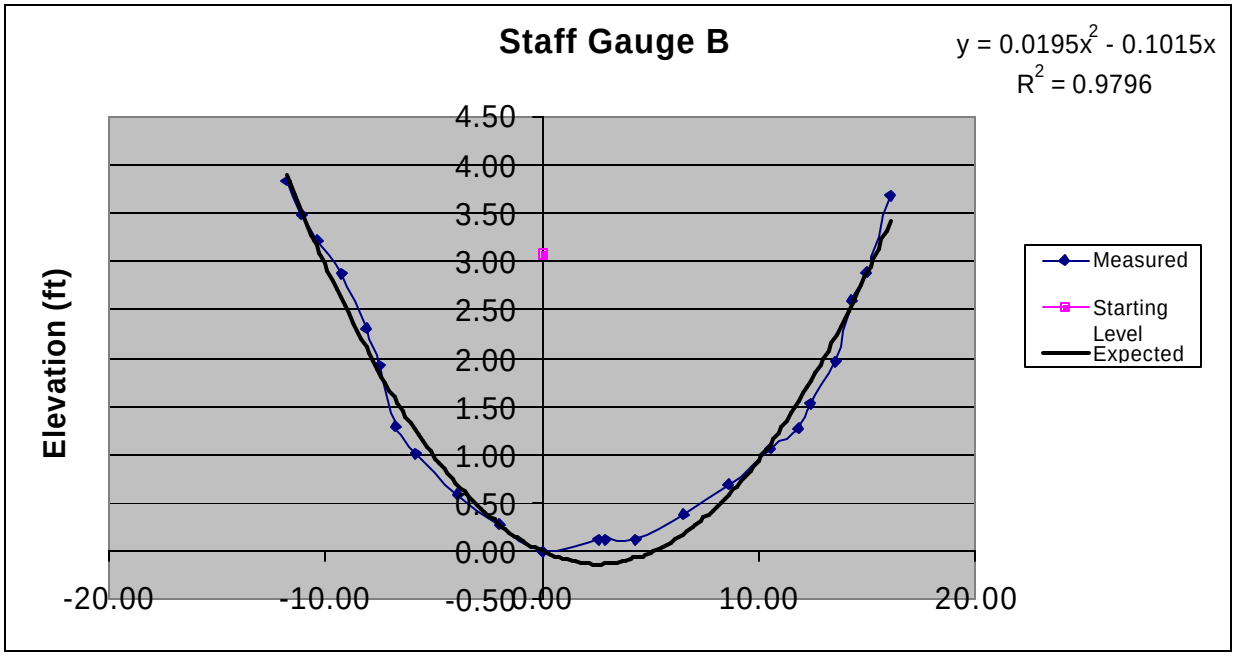

Figure 5. Cross-section at Staff Gauge B.

Figure 6. Test canal shown with Staff Gauge.

SOIL DESCRIPTIONS

General Soil Series

5 – Rio Grande-Matamoros association: Nearly level to gently sloping, well drained and moderately well drained silt loams and silty clays (source: Soil Survey of Cameron County, Texas USDA, 1977).

Detailed Soil Units

Table 4. Soil Series Key Codes and Permeability Ranges.

Soil Unit	**Permeability (in/hr)**
HA- Harlingen Clay	<0.06

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 5 – 7. Table 8 gives seepage rates versus lining type as reported in the scientific literature.

Table 5. 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/ft2/day	ac-ft/mi/yr
Lined						
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	217.7
UN2	01	8	3	M	2.09	121.2
Unlined						
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 6. 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	Loss Rate	
					gal/ft2/day	ac-ft/mi/yr
Lined						
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	154.3

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

Table 7. 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/ft2/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 9. Canal seepage rate reported in published studies.	
Lining/soil type	**Seepage rate (gal/ft^2/day)**
Unlined[1]	2.21-26.4
Portland cement[2]	0.52
Compacted earth[2]	0.52
Brick masonry lined[3]	2.23
Earthen unlined[3]	11.34
Concrete[4]	0.74 - 4.0
Plactic[4]	0.08-3.74
Concrete[4]	0.06-3.22
Gunite[4]	0.06-0.94
Compacted earth[4]	0.07-0.6
Clay[4]	0.37-2.99
Loam[4]	4.49-7.48
Sand[4]	4.0-19.45

[1] DeMaggio (1990). Technical Memorandum: San Luis unit drainage program project files. US Bureau of Reclamation, Sacramento.

[2] U.S. Bureau of Reclamation (1963). Lining for Irrigation Canals.

[3] Nayak, et al. (1996). The influence of canal seepage on groundwater in Lugert Lake irrigation area. Oklahoma Water Resources Research Institute.

[4] Nofziger (1979). Profit potential of lining watercourses in coastal commands of Orissa. Environment and Ecology 14(2):343-345.

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