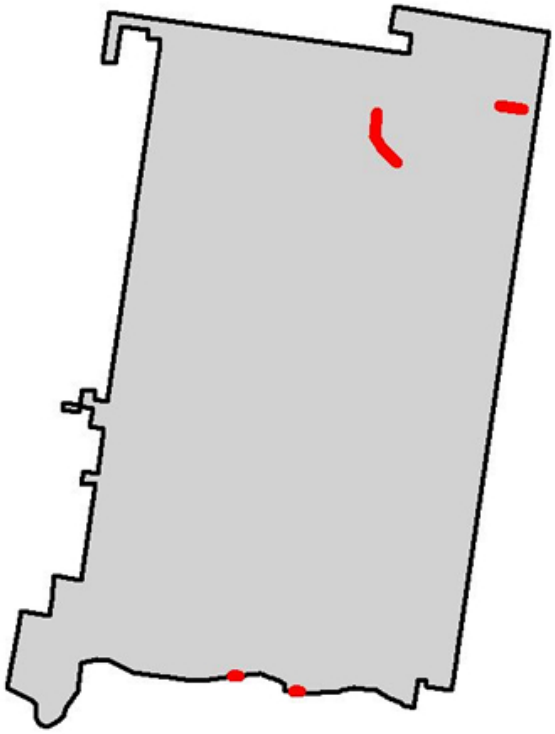
Seepage Loss Test Results
In Hidalgo County Irrigation District No. 2[1]

Report Prepared for

Hidalgo County Irrigation District No. 2



by

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Seepage Loss Test Results In Hidalgo County Irrigation District No. 2

Summary

The report summarizes seepage loss tests conducted in Hidalgo County Irrigation District No. 2 (HCID2) on two segments of Lateral A. Table 1 gives basic test segment attributes and loss rates as determined during Fall 2002. Also shown in Table 1 are loss rates measured in two previous tests conducted in the district. Lateral A is a concrete-lined canal location at the southern area of HCID2 running parallel just south of Military Hwy 281 (see attached map). The approximate length is 38,242 ft (7.24 miles). The canal averages approximately 18 feet in width. Maximum operating depths range from 4 to 6.5 ft and with a normal operating range of 2.7 to 6.0 ft.

Table 1: Seepage Loss Test Results for Lateral A and the Wisconsin canal of HCID2. All segments are concrete-lined.

Test	Segment	General Soil Type	Top Width (ft)	Length (ft)	Seepage Rate ($gal/ft^2/day$)	Total Loss in Canal (ac-ft/mile) per day	per year
1	Lat. A-9 Stewart Rd	silty clay	18.0	735.0	1.17	0.31	111.20
2	Lat. A-7 'I' Rd	silty clay	15.5	806.0	1.38	0.40	145.50
**RM-1	AL15 & AL16	clay loam	11.5	6463	2.43	0.42	152.77
**P2-1	Wisconsin	sandy clay loam	19.0	2557	2.77	0.80	293.40

**Corrected test calculations for RM-1 (Region M Study) & P2-1 (Phase II Study). These tests are not reported further in this report.

TEST METHOD

Loss rates were determined using the ponding method. In this method, the two ends of a canal segment are closed or sealed with earthen dams (Fig. 1), as are any valves or gates located with in the segment. Once sealed, water elevations were taken for at least 48 hours. One to three continuous-stage level recorders (Fig. 2) were used to supplement the 3 locations where stage levels were recorded manually. During the course of the tests, canal dimensions and water span were record and surveyed.

Soil samples were taken at two locations for each test site. Canal embankment (levee) samples were taken of the approximately 10 ft from the canal, 2 feet below the surface. Natural surrounding soil samples were taken at depths of approximately 6 , 7 and 10 feet. Groundwater levels were also recorded and surveyed adjacent to the canal test sites. Locations of sampling points are shown in Figure 3.

Figure 1. Earthen dam constructed on lateral A - Stewart Rd.

Figure 2. Continuous-stage level recorders on lateral A - Stewart Rd.

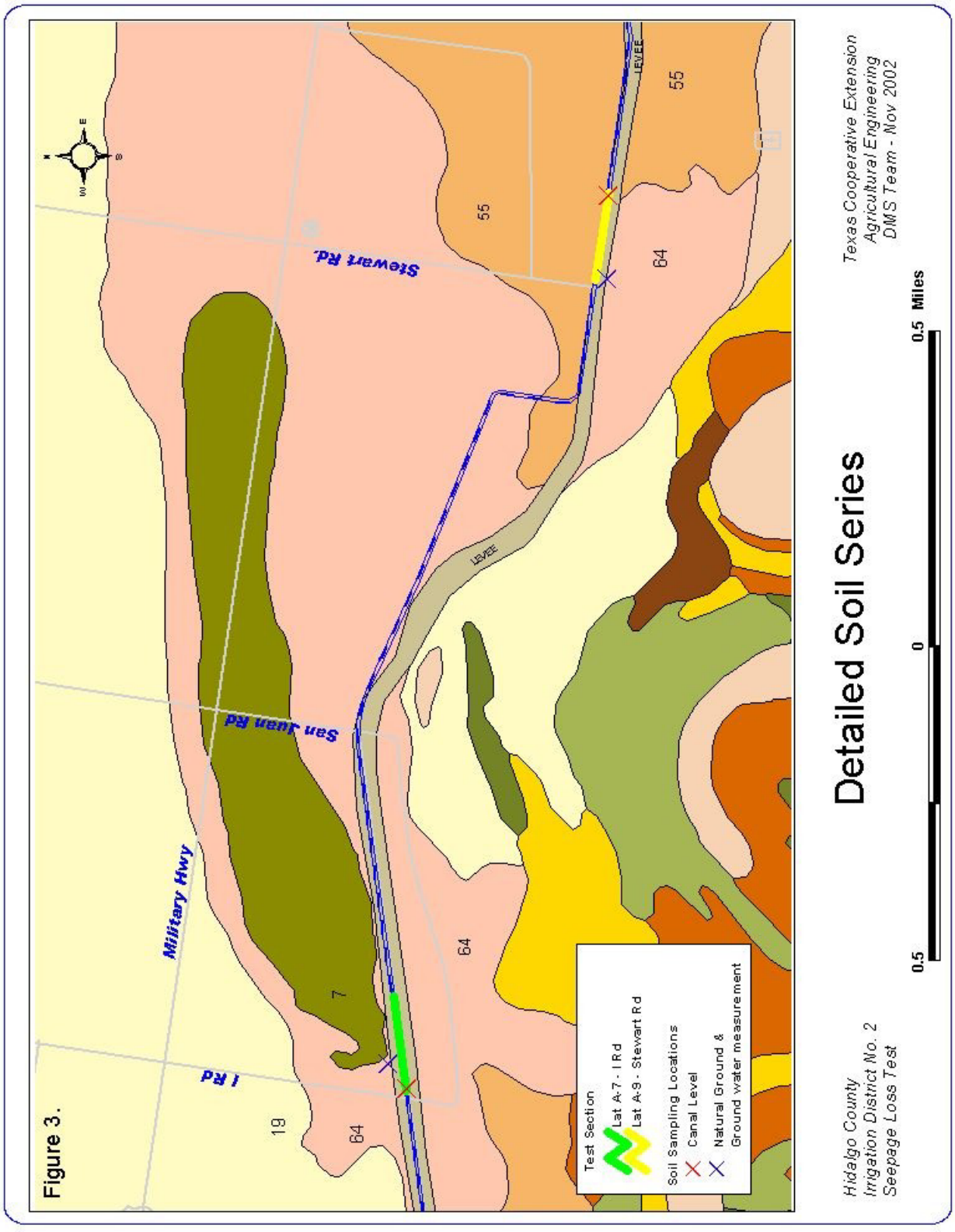

Figure 3. Detailed Soil Series with soil sampling locations (see table 8).

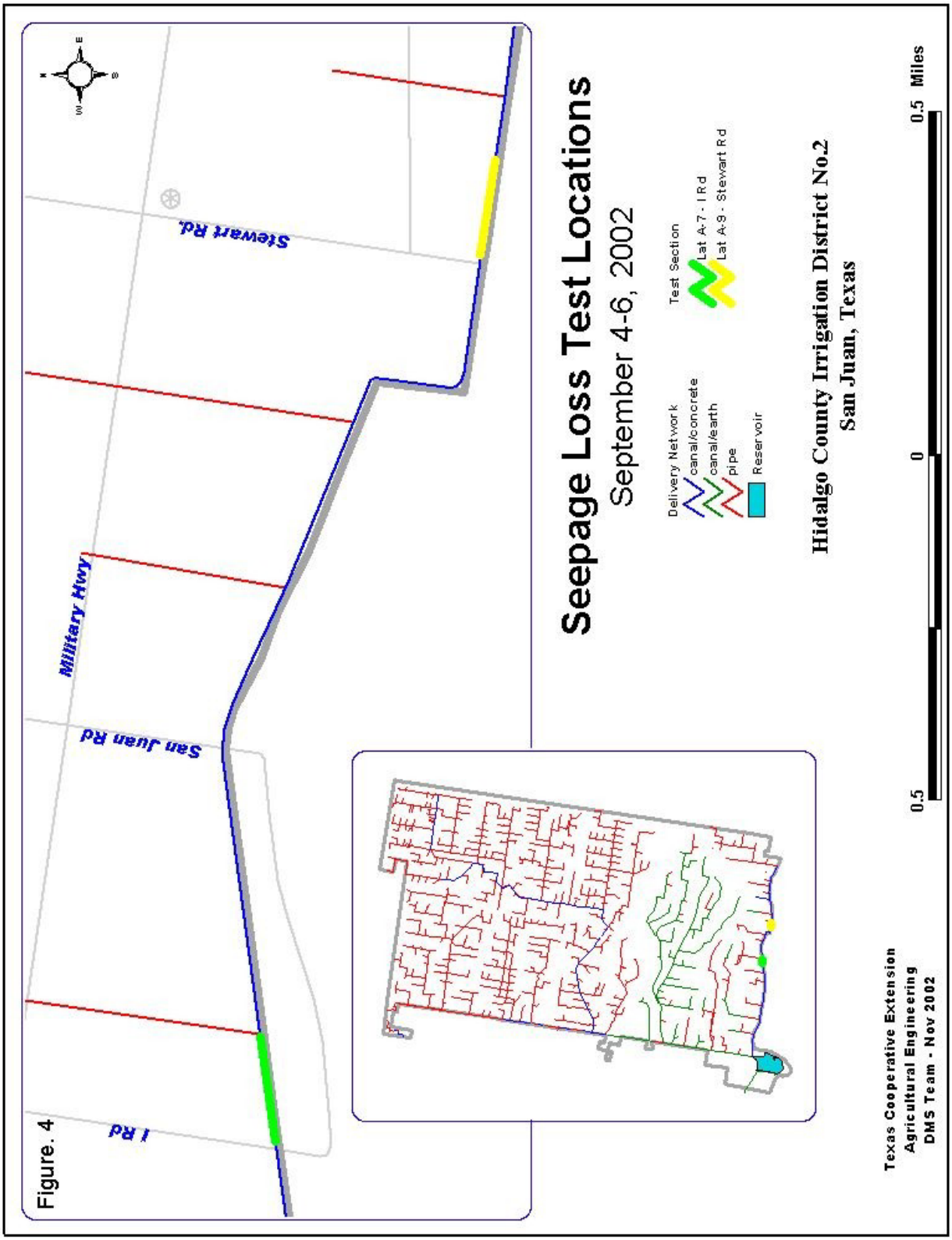

Figure 4. Test location map.

DETAILED TEST RESULTS

Table 2 gives additional data and information on the test of Lateral A- Steward Rd. Given are canal dimensions, testing dates and time, and stage level measurements. Figures 6, 7 and 8 show the measured canal profile, which is compared to an ideal canal profile. The ideal profile was developed by fitting an equation to the measured data as shown. Table 3 gives the loss rated in 4 methods commonly used to characterize water loss in canals. Annual water loss rates assume that the canal is in service 365 days per year. Figure 9 shows cracks in Lateral A, which are characteristic of this segment.

The same information is provided for Lateral A – I Rd. in Tables 4 and 5 and in Figure 11.

Table 2. Test Information for Lateral A – Stewart Rd,

District:	Hidalgo County Irrigation District 2	**Test ID:**	Lat A - Stewart Rd
Canal:	Lateral A – 9	**Lining Type:**	Concrete
Top Width:	18 feet	**Date:**	Sept 4 – 6, 2002
Test Length:	735 feet	**Start Time:**	12:30 am
Total Depth:	3.9 feet	**Finish Time:**	12:33 pm

Location: East of Stewart Rd, south of Military Hwy (281).

Staff Gage Readings

	Date	SG1		SG2		SG3	
		Readings	Time	Readings	Time	Readings	Time
1	4-Aug	2.74	12:32	2.74	12:31	2.84	12:30
2		2.74	13:38	2.72	13:43	2.84	13:44
3		2.74	14:38	2.70	14:40	2.82	14:43
4		2.72	15:36	2.68	15:38	2.82	15:40
5		2.72	16:30	2.68	16:32	2.80	16:34
6	5-Aug	2.58	08:57	2.54	08:59	2.67	09:00
7		2.56	11:59	2.52	12:01	2.65	12:03
8		2.54	15:06	2.50	15:06	2.62	15:07
9	6-Aug	2.42	09:51	2.40	09:53	2.50	09:55
10		2.40	12:33	2.38	12:30	2.49	12:31

Table 3. Average Unit Area Loss Rate (Lateral A – Stewart Rd)				
$ft^3/ft^2/hour$	**ft/day**	**inches/day**	**$gal/ft^2/day$**	**acre-ft/mile/year**
0.007	0.18	2.1	1.17	111.20

Figure 5. Large crack in the canal lining and aquatic vegetation growing from the bottom of the canal (lateral A - Stewart Rd)

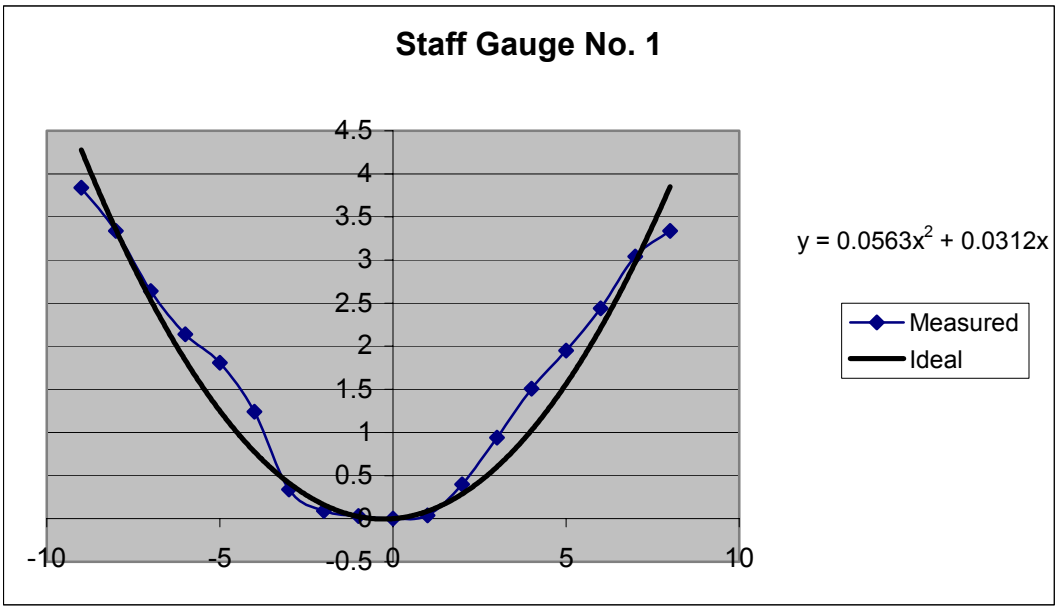

Figure 6. Cross-section of Staff Gauge 1 of lateral A - Stewart Rd.

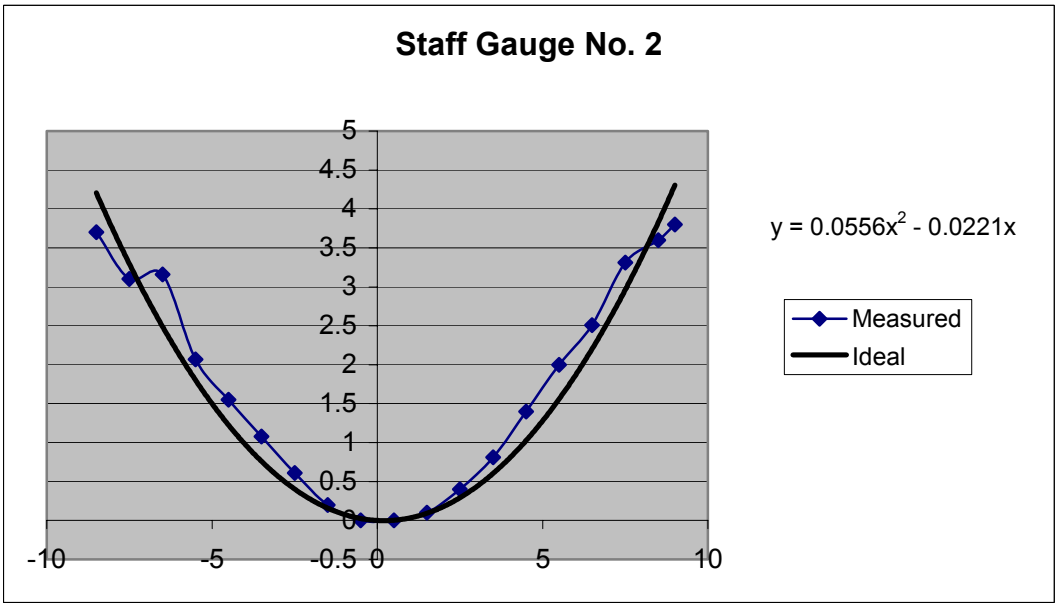

Figure 7. Cross-section of Staff Gauge 2 of lateral A - Stewart Rd.

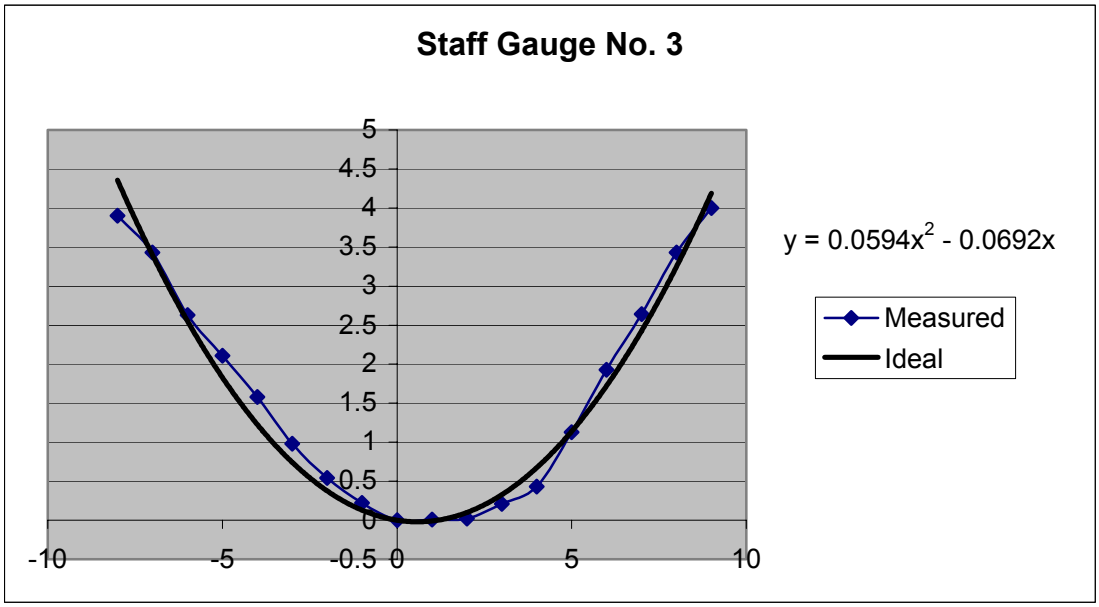

Figure 8. Cross-section of Staff Gauge 3 of lateral A - Stewart Rd.

Figure 9. Cracking of lateral A - Stewart just down stream of the test section.

Table 4. Test Information for Lateral A – I Rd.

District:	Hidalgo County Irrigation District 2	**Test ID:**	Lat A - 'I' Rd
Canal:	Lateral A - 7	**Lining Type:**	Concrete
Top Width:	15.5 feet	**Date:**	Sept 4 – 6, 2002
Test Length:	806 feet	**Start Time:**	15:24
Total Depth:	5.44 feet	**Finish Time:**	13:57

Location: East of 'I' Rd, south of Military Hwy (281).

Staff Gage Readings

	Date	SG1		SG2		SG3	
		Readings	**Time**	**Readings**	**Time**	**Readings**	**Time**
1	4-Aug	3.00	15:24	2.17	15:25	2.83	15:27
2		2.98	16:20	2.13	16:21	2.79	16:22
3		2.96	17:20	2.13	17:20	2.79	17:23
4	5-Aug	2.74	09:10	1.92	09:15	2.79	09:13
5		2.70	12:13	1.88	12:12	2.77	12:11
6		2.66	15:14	1.83	15:13	2.75	15:12
7	6-Aug	2.46	09:39	1.63	09:40	2.54	09:42
8		2.40	13:57	1.63	13:39	2.50	13:47

Figure 10: Continuous stage level recorders on Lateral A – "I" Rd.

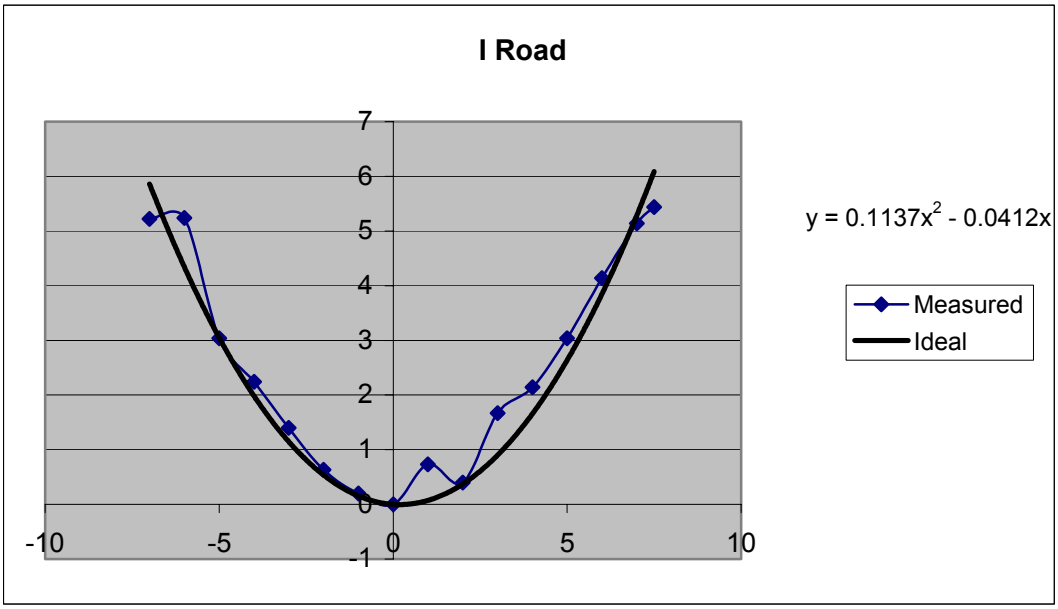

Figure 11: Lateral A - I Rd cross-section

Figure 12: Large amounts aquatic vegetation growing next to lateral A - I Rd.

Table 5. Average Loss Rates for Lateral A – I Rd.				
$ft^3/ft^2/hour$	**ft/day**	**inches/day**	**$gal/ft^2/day$**	**acre-ft/mile/year**
0.008	0.25	3.06	1.38	145.50

Groundwater measurements

Table 6. Canal and groundwater elevations (feet)		
Test Section	**M**	**N**
Lat. A – Stewart Rd	9.93	8.31
Lat.A – I Rd	8.75	6.3

M) Groundwater level elevation from to natural ground from (Figure 13).
N) Canal water level elevation from natural ground (figure 13).

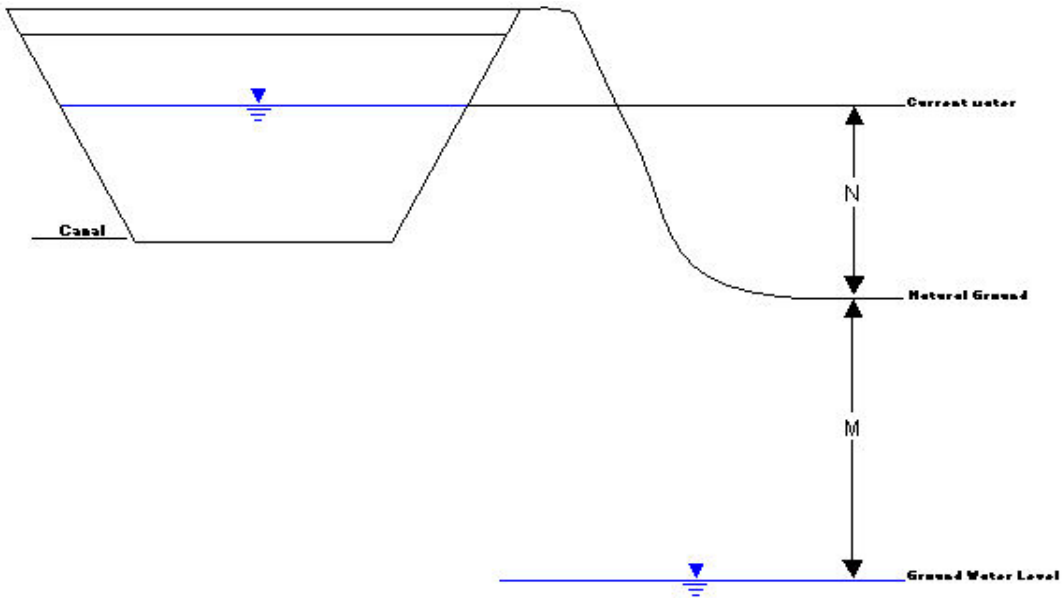

Figure 13. Groundwater measurement diagram.

Literature Review

Very little information has been reported in scientific literature on canal seepage and reduction from district rehabilitation projects. All the data that we have found for seepage rates versus lining type are given in Tables 7 and 8.

Table 7. 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).
[2] U.S. Bureau of Reclamation (1963).
[3] Nayak, et al. (1996).
[4] Nofziger (1979).

Table 8. Canal seepage rates reported for the Lower Rio Grande Valley.

Soil Type	**Seepage Loss Rate (gal/ft^2 /day)**
clay	1.5
silty clay loam	2.24
clay loam	2.99
silt loam earth	4.49
loam	7.48
fine sandy loam	9.35
Sandy loam	11.22

Source: Texas Board of Water Engineers (1946).

Soil Descriptions[3]

General Soil Series[4]

9 – Harlingen-Runn-Reynosa: Deep, very slowly, slowly, and moderately permeable soils that typically have a grayish brown clay, silty clay, or silty clay loam surface layer.

2 – Rio Grande-Matamoros: Deep, moderate and slowly permeable soils that typically have a light brownish gray brown silt loam or silty clay surface layer.

Detailed Soil Units

Table 9: Detailed Soil Units / Permeability	
Soil Unit[5]	**Permeability In\hr**
07 – Cameron silty clay	0.2 – 6.0
19 – Harlingen clay	< 0.06
55 – Reynosa silty clay loam	0.6 – 2.0
64 – Runn silty clay	0.06 – 0.6

Acknowledgements

DMS TEAM

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Noemi Perez, Extension Agricultural Technician
Gabriel Ortega, Extension Assistant
Bryan Treese, Extension Assistant (former)
Daniel Wishard, Student Worker
Brock Faulkner, Student Worker

HIDALGO COUNTY IRRIGATION DISTRICT

Helpful planning and assistance in canal ponding testing was provided by the District office personnel and canal riders.

[3] Soil Surveys of Hidalgo County, USDA, SCS, TAES (1979)
[4] See General Soils Map (Figure 14).
[5] See Detailed Soil Map (Figure 3).

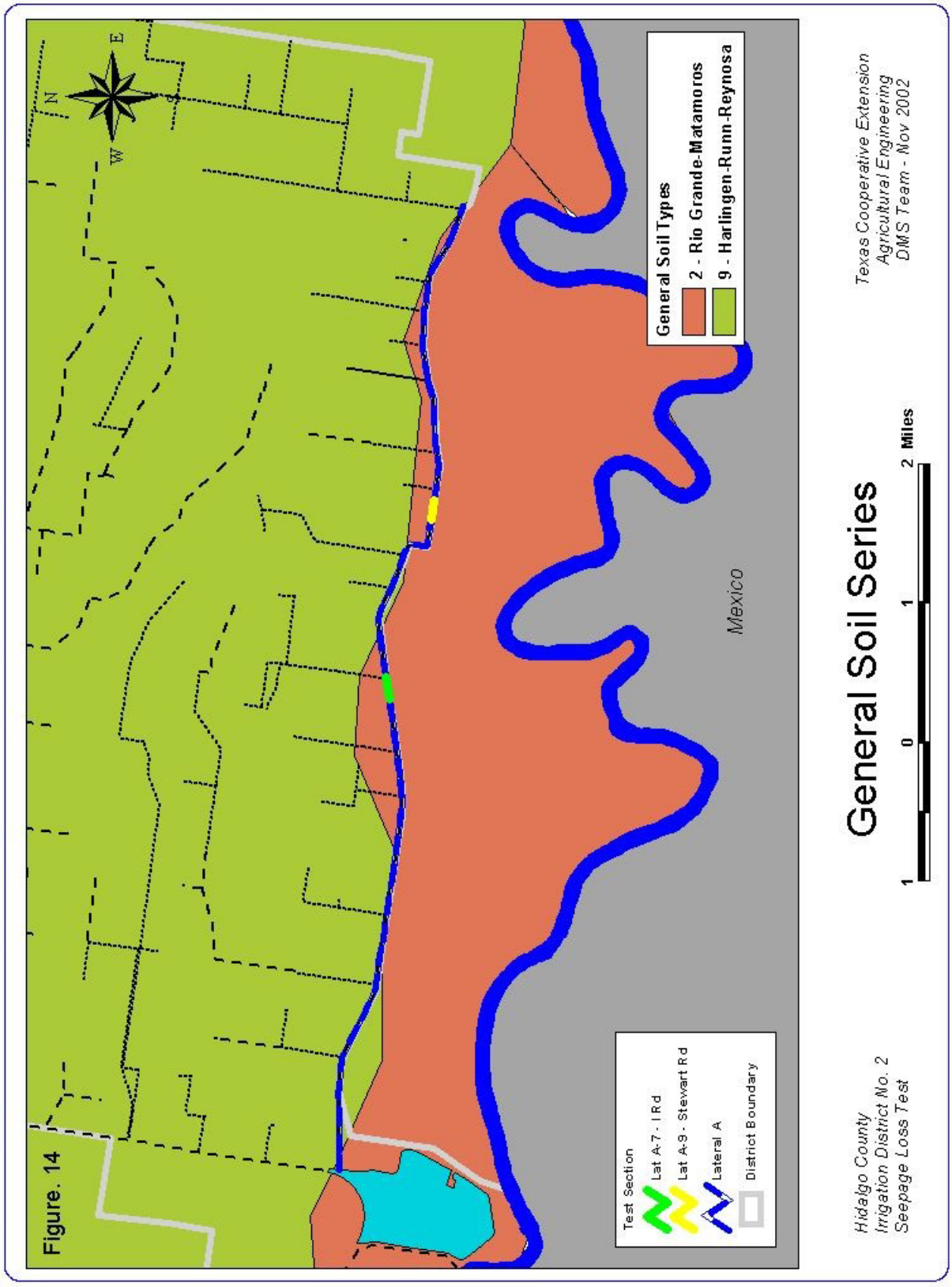

Figure 14. General Soil Series Map

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