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# Water Loss Test Results for the Pipeline Units: I-19/I-18, I-7A and I-22 Hidalgo County Irrigation District No. 2

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Texas Water Resources Institute
*make every drop count*

# Water Loss Test Results for the Pipeline Units: I-19/I-18, I-7A, and I-22 Hidalgo County Irrigation District No.2

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**IRRIGATION TECHNOLOGY CENTER**
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**Hidalgo County Irrigation District No.2**

## Summary

This report summarizes three water loss tests conducted on parts of pipeline units I-19/I-18, I-7A (see figure 2), and I-22 for Hidalgo County Irrigation District No.2 (HCID2) that took place on February 15, 2007. The pipelines were tested using the ponding method, measuring the total water loss rates (see next section). The test results are summarized in Table 1.

Table 1. Pipeline Water Loss Test Results for HCID2 conducted February 15, 2007.

| Test ID | Pipeline Unit | Length (miles) | Avg. Δ in Total Depth (ft/hour) | Total Volume Loss ($ft^3$) | Water Loss Rates* | |
|---|---|---|---|---|---|---|
| | | | | | gal/mi/day | ac-ft/mi/yr |
| SJ16 | I-19/I-18 | 3.6 | 11.6 | 1157 | 57,900 | 64.9 |
| SJ17 | I-7A | 1.5 | 6.8 | 466 | 55,800 | 62.5 |
| SJ18 | I-22 | 2.7 | 5.0 | 605 | 40,500 | 45.4 |

* Water loss rates given are based on an in-service use of 24 hours/day and 365 days/year.

Test SJ16 included a 1 mile segment of pipeline Unit I-19 and 2.59 miles of pipeline Unit I-18; running north from Nolana Loop, then east from Col. Rowe Blvd, and ending near US Hwy 281 (see figure 3).

- Unit I-19: 1 mile of 48 inch FJRC (Flexible-Joint Reinforced Concrete) pipeline;
- Unit I-18: 0.25miles of 48 inch FJRC pipe, and 2.34 miles of 48 inch MJC (Mortar-Joint Concrete) pipeline.

Test SJ17 tested 1.5 miles of the mortar-joint pipeline Unit I-7A, consisting of 1 mile of 36 inch pipe, and 0.5 miles of 30 inch pipe. Test the section began east of Cesar Chavez Rd and ending just east of Tower Rd, north of El Dora Rd. (see figure 4).

Test SJ18 tested 2.68 miles of Unit I-22, beginning from the North Alamo Main canal, running east towards Tower Rd, just north of Gas Line Rd. (see figure 5).

- Mortar-Joint: 1.25 miles of 48 inch pipe, and 0.75 miles of 42 inch pipe;
- Flexible-Joint: 0.18 miles of 42 inch pipe, and 0.5 miles of 30 inch pipe.

Table 2 shows the water loss rates with a ± 10% estimated error range due to error in measurements and surface water level stability.

| Table 2. Water Loss Results with 10% Estimated Error Range | | | | | |
|---|---|---|---|---|---|
| Test ID | Pipeline Units | Water Loss Rates* | | | |
| | | gal/mile/day | | ac-ft/mile/year | |
| | | Low | High | Low | High |
| SJ16 | I-19/I-18 | 52080 | 63653 | 58.4 | 71.3 |
| SJ17 | I-7A | 50193 | 61347 | 56.2 | 68.7 |
| J18 | I-22 | 36490 | 44599 | 40.9 | 50.0 |

* Water loss rates given are based on an in-service use of 24 hours/day and 365 days/year.

Figure 1 shows a leaking pipeline control structure and standpipe with lateral gates that were shut-off during the test.

Figure 1. Leaking pipeline control structure

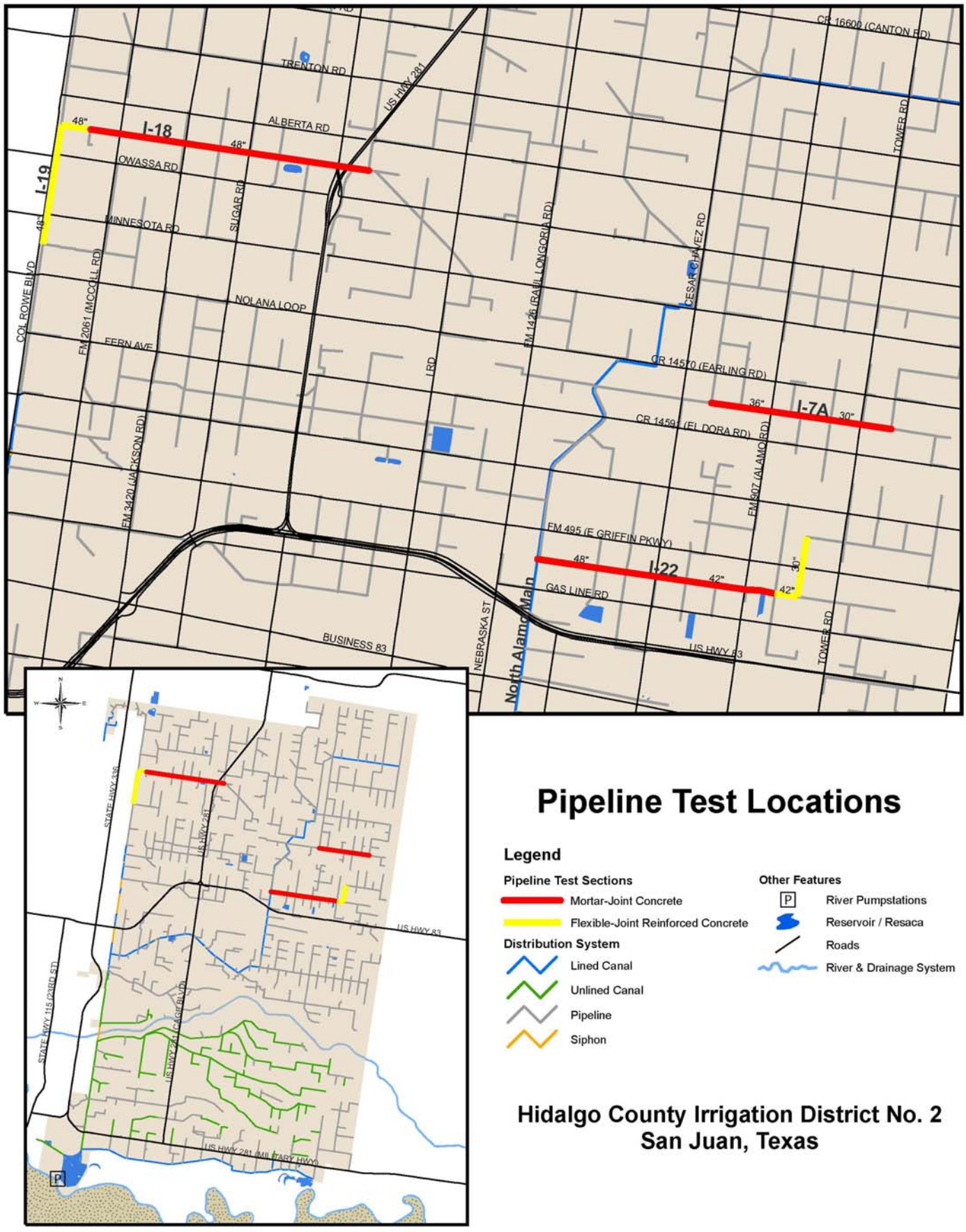


Figure 2. Hidalgo County Irrigation District No.2 pipeline test locations.


Figure 3. Detailed map of Test SJ16


Figure 4. Detailed map of Test SJ17


Figure 5. Detailed map of Test SJ18

**Pipeline Testing Procedures**

The pipelines were tested using the ponding method. These tests accounted for all the leaks occurring from gates, valves, and pipeline joints that are either undetectable or are difficult to measure (figures 6 and 7), classified as *total loss* tests; thus, measuring the total water loss rate.

Figure 6. Leaking from standpipe

Figure 7. Leaking from turnout valve

These tests were performed under the district's normal operating water levels, with all downstream check-gates and turnout valves closed. Once the pipeline was filled, the head gates were shut and water surface elevations were measured at selected standpipe stations with measuring tapes and a water sounding meter and referenced to the inside top rim of the standpipe (Figure 8). Each test lasted between 1.0 to 1.5 hours, recording water level measurements at 10 minute intervals (8-10 measurements per test).

Figure 8. Askar Karimov, Extension Associate, is shown taking the measurement from the top inside rim of a standpipe.

**Appendix A: Water Level Measurements & Pipeline Information**

HCID2 provided our team with basic pipeline size and attribute information on the pipeline units test. Table 3, 5, and 7 contains the test measurements and times. Tables 4, 6, and 8 contain the type of structures and diameter sizes used for test calculations.

Test SJ16

| Table 3. Test SJ16: Unit I-19/I-18 Test Measurements | | |
|---|---|---|
| 2/15/2007 | Standpipe #1 | Standpipe #2 |
| Time | WL-Reading (ft) | Reading (ft) |
| 11:50 | 6.6 | 3.6 |
| 12:00 | 11.4 | 8.9 |
| 12:10 | 15.2 | 12.3 |
| 12:20 | 17.4 | 13.8 |
| 12:30 | 17.8 | 14.7 |
| 12:40 | 18.5 | 15.1 |
| 12:50 | 18.2 | 15.2 |
| 13:00 | 18.5 | 15.3 |

| Table 4. Test SJ16: Unit I-19/I-18 – Test Structures and Attributes | | | | | | | |
|---|---|---|---|---|---|---|---|
| Structure | Air Vent | Air Vent | Air Vent | Air Vent | Air Vent | Standpipe | Standpipe #1 |
| Diameter (in): | 15 | 15 | 21 | 15 | 15 | 48 | 48 |
| Area ($ft^2$): | 1.23 | 1.23 | 2.41 | 1.23 | 1.23 | 12.57 | 12.57 |
| Vol Loss ($ft^3$): | 14.2 | 14.24 | 27.91 | 14.24 | 14.24 | 145.80 | 145.80 |
| US GALs: | 106.5 | 106.5 | 208.75 | 106.51 | 106.51 | 1090.63 | 1090.63 |

| Table 4 cont. Test SJ16: Unit I-19/I-18 – Test Structures and Attributes | | | | | | | |
|---|---|---|---|---|---|---|---|
| Structure | Standpipe | Standpipe | Standpipe | Standpipe | Standpipe #2 | Air Vent | Air Vent |
| Diameter (in) | 48 | 30 | 36 | 42 | 72 | 21 | 21 |
| Area ($ft^2$): | 12.57 | 4.91 | 7.07 | 9.62 | 28.27 | 2.41 | 2.41 |
| Vol Loss ($ft^3$) | 145.80 | 56.95 | 82.01 | 111.63 | 328.04 | 27.91 | 27.91 |
| US GALs: | 1090.63 | 426.03 | 613.48 | 835.01 | 2453.91 | 208.75 | 208.75 |

Test SJ17

| Table 5. Test SJ17: Unit I- Test Measurements | | |
|---|---|---|
| 2/15/2007 | Standpipe #1 | Standpipe #2 |
| Time | Reading (ft) | Reading (ft) |
| 13:40 | 6.5 | 6.2 |
| 13:50 | 10.7 | 13.1 |
| 14:00 | 11.5 | 13.6 |
| 14:10 | 11.7 | 13.7 |
| 14:20 | 11.8 | 13.9 |
| 14:30 | 12.0 | 13.9 |
| 14:40 | 12.2 | 14.0 |
| 14:50 | 11.9 | 14.1 |
| 15:00 | 12.0 | 14.1 |
| 15:10 | 12.0 | 14.2 |

| Table 6. Test SJ17: Unit I-7A – Test Structures and Attributes | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Structure: | Standpipe #1 | Air Vent | Air Vent | Standpipe | Standpipe | Standpipe | Standpipe #2 | Standpipe |
| Diameter: | 48 | 15 | 12 | 48 | 48 | 48 | 42 | 36 |
| Area ($ft^2$): | 12.57 | 1.23 | 0.79 | 12.57 | 12.57 | 12.57 | 9.62 | 7.07 |
| Vol Loss ($ft^3$): | 84.90 | 8.29 | 5.31 | 84.90 | 84.90 | 84.90 | 65.00 | 47.76 |
| US GALs: | 635.11 | 62.02 | 39.69 | 635.11 | 635.11 | 635.11 | 486.25 | 357.25 |

Test SJ18

| Table 7. Test SJ18: Unit I- Test Measurements | | |
|---|---|---|
| 2/15/2007 | Standpipe #1 | Standpipe #2 |
| Time | Reading (ft) | Reading (ft) |
| 13:50 | 4.0 | 6.6 |
| 14:00 | 5.6 | 8.8 |
| 14:10 | 6.7 | 9.9 |
| 14:20 | 7.5 | 10.6 |
| 14:30 | 8.0 | 11.1 |
| 14:40 | 8.3 | 11.6 |
| 14:50 | 8.6 | 11.8 |
| 15:00 | 8.9 | 12.0 |
| 15:10 | 9.1 | 12.2 |

| Table 8. Test SJ18: Unit I-22 – Test Structures and Attribute | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Structure: | Standpipe #1 | Standpipe | Standpipe | Standpipe | Standpipe | Standpipe | Standpipe # 2 | Air Vent | Air Vent | Air Vent | Air Vent |
| Diameter: | 60 | 60 | 60 | 48 | 60 | 42 | 48 | 21 | 21 | 18 | 21 |
| Area ($ft^2$): | 19.63 | 19.63 | 19.63 | 12.57 | 19.63 | 9.62 | 12.57 | 2.41 | 2.41 | 1.77 | 2.41 |
| Vol Loss ($ft^3$): | 97.15 | 97.15 | 97.15 | 62.18 | 97.15 | 47.60 | 62.18 | 11.90 | 11.90 | 8.74 | 11.90 |
| US GALs: | 726.75 | 726.75 | 726.75 | 465.12 | 726.75 | 356.11 | 465.12 | 89.03 | 89.03 | 65.41 | 89.03 |

**Appendix B: Other Reported Seepage Rates and Water Loss Test Results**

Texas Cooperative Extension has conducted over 70 total loss tests and seepage loss tests in canals and pipelines the Lower Rio Grande River Basin since 1998. Most of these results are summarized in Tables 9 – 12. Table 13 gives seepage rates versus lining type as reported in the scientific literature.

Table 9. Results of pipeline seepage loss test conducted by Texas Cooperative Extension in the lower Rio Grande River Basin

| Test ID | Year | Type* | Pipeline Test Diameter (in) (Wt. Avg.) | Water Loss Rates** | |
|---|---|---|---|---|---|
| | | | | gal/mi/day | ac-ft/mi/yr |
| UN4 | 04 | FJRC | 70 | 26,402 | 30.0 |
| UN5 | 04 | FJRC | 70 | 40,940 | 46.0 |
| UN6 | 04 | FJRC | 70 | 1,119 | 1.3 |
| UN8 | 05 | FJRC | 70 | 1,839 | 2.1 |
| UN9 | 06 | FJRC | 70 | 1,407 | 1.6 |

* Type: FJRC (Flexible Joint Reinforced Concrete Pipeline)
** Water loss rates given are based on an in-service use of 24 hours/day and 365 days/year.

Table 10. 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* | Water Loss Rate** | |
|---|---|---|---|---|---|---|
| | | | | | $gal/ft^2/day$ | 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
** Water loss rates given are based on an in-service use of 24 hours/day and 365 days/year.

Table 11. 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/ft$^2$/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

** Water loss rates given are based on an in-service use of 24 hours/day and 365 days/year.

| Table 12. 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$^2$/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

** Water loss rates given are based on an in-service use of 24 hours/day and 365 days/year.

| Table 13. 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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Hidalgo County Irrigation District No.2

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