Assessment of Flow Conditions and Seepage on the Rio Grande and Adjacent Channels, Isleta to San Marcial Summer 2001

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Prepared For:

New Mexico Interstate Stream Commission

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In Association with:

Mussetter Engineering, Inc.

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 Study Objectives

This study is Phase IV of a program of data collection designed to support the characterization of the flow regime in the study area by quantifying losses and gains occurring in the Rio Grande and adjacent channels in the Middle Rio Grande valley between Belen, New Mexico and Elephant Butte Reservoir. The key objective of this and earlier work was to gain a better understanding of surface water/groundwater interactions. Previous phases of this program focused on the region from San Acacia to Elephant Butte in the Rio Grande and the Low Flow Conveyance Channel (LFCC).[1] Phase IV expands on this body of work by lengthening the study area to include points as far north as the Isleta diversion structure and by including key drains and channels adjacent to the river.

The following key tasks were completed:

- Measurement of flows on the Rio Grande, LFCC, and adjacent channels to supplement the existing data set from which seepage is quantified;
- Calculation of channel seepage under summer flow conditions and development of a comparative analysis of results;
- Quantification of total flow in multiple channels at several cross-sections;
- Measurement of flows at locations of interest, including potential sites for the installation of continuous gages;
- Installation of monuments at measurement locations to allow for consistent future seepage runs;
- Collection of water quality data and water elevations at flow measurement points.

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[1] The results of Phases I and II are reported in *Field Assessment of Flow and Seepage Conditions along the Rio Grande and the Low Flow Conveyance Channel, San Acacia to Elephant Butte*, S.S. Papadopulos & Assoc., Inc, 2001. Phase III results were combined with Phase II results for discussion and analysis.

On behalf of the New Mexico Interstate Stream Commission (ISC), this program was conducted by S.S. Papadopulos & Associates, Inc. (SSPA), with technical and field support from Mussetter Engineering, Inc. (MEI) and the New Mexico Bureau of Geology and Mineral Resources (NMBGMR). Under cooperative agreement with the ISC, the NMBGMR provided six interns and supervisory staff to support this program of data collection activities.

1.2 Study Area

The region of study, shown in Figure 1, encompasses a length of the Rio Grande from Isleta Diversion Dam to south of San Marcial, at the end of the levee road just north of the Elephant Butte Reservoir delta. Flow measurements were taken at points along the river, the LFCC, and adjacent drains and irrigation canals in this area. This region includes two divisions of the Middle Rio Grande Conservancy District (MRGCD): the Belen Division and the Socorro Division; as well as two National Wildlife Refuges: the Bosque del Apache, and the Sevilleta.

For this project, we have found it convenient to divide the study area along the boundaries defined by the MRGCD, and to use MRGCD designations for the sub areas. Therefore, this report refers to measurement sites from Isleta to San Acacia as being located in the Belen Division; and to measurement sites below San Acacia as being located in the Socorro Division. While some measurement locations downstream of San Acacia are not within the boundaries of the MRGCD Socorro Division, for purposes of this report, the entire study area below San Acacia is described as the "Socorro Division." Provisional schematic diagrams of the conveyance channels within the Belen and Socorro Divisions, as defined for the purposes of this project, are shown in Figures 2 and 3, respectively (Note: These schematics are provisional and will be refined as part of future projects).

1.3 Background

The hydrologic system in the study area consists of the Rio Grande, ephemeral tributaries, the LFCC, a network of conveyance channels operated by the MRGCD and others, and the underlying aquifer. In the Belen Division, MRGCD diverts water for irrigation from the river at Isleta Diversion Dam. The MRGCD diverts water for the Socorro Division from the river at the San Acacia Diversion Dam and from the LFCC at Lemitar (the Lemitar check structure), Socorro (the 1200 check structure), and just north of San Antonio (Neil Cupp check structure). Within the MRGCD, water is conveyed through a network of irrigation canals, laterals, and drains. As water travels along the river, LFCC, and conveyance channels, it may interact with the underlying shallow aquifer in one of two ways. Water may seep up through the channel bed, thus contributing to a gain in channel flow; or water may seep down through the channel bed, resulting in a channel loss. This and previous studies are designed to characterize and quantify seepage rates in the river, LFCC, and adjacent channels. Although seepage rates will vary from year to year, depending on river supply, riparian, groundwater and climatic conditions, quantification of seepage rates under a given set of conditions is a valuable first step towards understanding the dynamics of surface water/groundwater exchanges. Additional background information is available in the report published for Phases I and II of the study. (SSPA 2001)

1.4 Report Organization

This report is organized into three key sections:

- Introduction to study area, study approach, and key background material,
- Description of the summer field program, and
- Calculations and data analyses.

The latter section is organized according to the divisions defined for this project (Belen or Socorro). Field data, measured and calculated discharges, calculated seepage rates, water surface elevations, and water quality data are reported and illustrated in tables and figures located in the appendices. A brief glossary of important terms is located at the end of the main report.

2.0 FIELD PROGRAM

2.1 Measurement Activities

The summer measurement program was divided into five measurement cycles, varying from 4 to 11 days each. Each measurement cycle typically included several *activities,* defined as seepage runs, valley cross-sections, or "other" field measurements. Each activity was assigned a unique Activity Code, based on the following elements:

- A character, designating the activity type (S for seepage run, X for valley cross-section, and B for other),
- A numeric value, designating the program phase (for the phase of this program described in this report, the value is 4), and
- A numeric value, assigned sequentially in time to each type of activity.

Activities were further defined by *activity plans*, which were prepared using a form or set of forms corresponding to the activity type. In general, activity plans included a list of measurement sites, descriptions, corresponding Measurement Location Codes, and rough sketches of the measurement sites. Measurement Location Codes were assigned by the field team to more easily identify measurement sites, e.g. RGSACA for the Rio Grande measurement site at San Acacia. A list of measurement location codes is located in Table 1. All field measurements can be distinguished by a trio of identifiers: Activity Code, Measurement Location Code, and measurement date. Listings of Activity Codes are located in Table 2 for seepage run activities and Table 3 for valley cross-sections and other activities.

2.2 Monumenting and Surveying

Two types of monuments were installed at measurement sites in the study area for the purpose of measuring water surface elevations. Permanent monuments, made of concrete with a nail set in the top, were set up at some locations which were likely to be measured again in the future. At the remaining measurement locations, pieces of rebar, two to four feet in length, were hammered into the ground for temporary use.

With few exceptions, all monuments were surveyed with a survey-grade GPS unit, capable of measuring absolute vertical elevations to within 0.1 feet. Using a surveyor's level, the field team measured water surface elevations relative to the monument, providing a high accuracy dataset from which absolute water surface elevations were calculated. For the more stable conveyance channels, this dataset can also be used to define rating curves, which relate water stage to discharge. Summary tables of elevations and GPS coordinates of permanent monuments are located in Appendix H.

2.3 Master Database

All field measurements and related information were entered via a computer-based entry form into a database created in Microsoft Access. For quality-assurance purposes, this data entry form required duplicate entries of all field measurements. A visual basic program then compared the datasets for accuracy before inserting the data into the database.

Based on activity plans and flow measurement field forms, the master database is organized by three key identifiers: Activity Code, Measurement Location Code, and measurement date. The database includes all field measurements, including channel width, depth, velocity, water surface elevation, and water quality parameters, as well as weather data, crew member information, and supplementary remarks made by the field crew. Appendix A provides an example report of field data generated from the master database. An electronic *pdf* file of the report representing all field data has been prepared and provided to the ISC, along with the master database.

2.4 Seepage Runs

Seepage run activities are illustrated on maps in Figures 4 through 20. Measured discharges for all seepage run activities are located in Appendix B.

2.4.1 Belen Division

Of the 23 seepage run activities completed, 15 were located in the Belen Division[2]. The following list summarizes river seepage run activities in this region, with upstream and downstream endpoints:

- S4-03, from Hwy 309 to Drain Unit 7 Extension
- S4-06, from upstream of the Los Lunas wastewater treatment plant outfall to Drain Unit 7 Extension
- S4-07, from Isleta to San Acacia
- S4-13, from upstream of Hwy 60 to Drain Unit 7
- S4-16, from upstream of Hwy 60 to San Acacia
- S4-19, from upstream of the Los Lunas wastewater treatment plant outfall to Hwy 309
- S4-22, from upstream of the Los Lunas wastewater treatment plant outfall to Hwy 309

The remaining seepage run activities in the Belen Division were located on irrigation canals and drains adjacent to the river. A brief summary is listed below:

- S4-08, La Joya Acequia
- S4-12, Lower San Juan Riverside Drain, upstream of Hwy 60 to Drain Unit 7
- S4-15, Lower San Juan Riverside Drain, from upstream of Hwy 60 to its end upstream of Salas Arroyo
- S4-17, west riverside drains, from upstream of Hwy 60 to San Acacia

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[2] Activity S4-04 was renamed X4-01 because measurements were intended to be part of valley-cross section activity. Seepage run S4-14 was not completed.

- S4-18, Peralta Riverside Drain, from site adjacent to Los Lunas wastewater treatment plant outfall on Rio Grande to Tome
- S4-20, Belen Riverside Drain, from site adjacent to Los Lunas wastewater treatment plant outfall on Rio Grande to upstream of Sausal Drain
- S4-21, Peralta Riverside Drain, from site adjacent to Los Lunas wastewater treatment plant outfall on Rio Grande to Hwy 309
- S4-23, Belen Riverside Drain, from site adjacent to Los Lunas wastewater treatment plant outfall on Rio Grande to Hwy 309

Because seepage runs in the Belen Division were not part of the previous phases of work (Phase I, II and III), activity plans for these seepage runs were developed during this phase of the program (Phase IV). Development of an activity plan typically involved inspection of schematics, maps and/or aerial photos to locate inflow/outflow points, discussion of the identified points with MRGCD staff (if applicable) and/or reconnaissance field checking. In some cases, the field check involved floating a reach of the channel to identify inflow or outflow locations. Due to the relative inaccessibility of channels in this region and the complexity of the irrigation network, some discontinuities in channel reaches were incorporated into activity plans. In these cases, results are reported for discrete sub-reaches. Additionally, despite best efforts, the possibility of minor undocumented inflows or outflows cannot be fully discounted in some reaches. Confirmatory seepage runs are recommended for any reach of high interest, not only to provide opportunity for confirmatory scouting, but also to assess channel losses under alternate flow or seasonal conditions.

2.4.2 Socorro Division

Nine seepage runs were completed in the Socorro Division:

- S4-01, Rio Grande, from San Acacia to the corral
- S4-02, LFCC, from below the Nine-mile outfall to the corral
- S4-05, Rio Grande, from San Acacia to the corral

- S4-09, Socorro Main Canal, from Chambon to downstream of Acequia Madre
- S4-10, Socorro Main Canal, from downstream of MRGCD gage to above riverside drain siphon
- S4-11, Socorro Main Canal, from upstream of Old San Antonio Lateral to the North Boundary of Bosque del Apache
- S4-24, Rio Grande, from Escondida Bridge to Neil Cupp
- S4-25, LFCC from below the Nine-mile outfall to Hwy 380

Activities S4-05, S4-24, and S4-25, were affected by pumping from the LFCC performed by the United States Bureau of Reclamation (USBR) to supplement river flows. The USBR performed LFCC pumping operations during the dates of these seepage runs. Therefore, logs of pumping activities were obtained from the USBR and pumping rates were used in calculations of channel seepage.

At some locations along the LFCC, outflows were not directly measured due to inaccessible or unsuitable channel conditions. In these cases, the upstream and downstream flow in the receiving channel (Riverside Drain) was gaged, and the outflow was calculated by subtraction. Measurements and calculations for the indirectly obtained outflows are provided in Appendix C.

With the exception of the seepage runs on the Socorro Main Canal, channel reaches were scouted and activity plans developed during previous phases of work. The team's familiarity with channels in the Socorro region and the good accessibility of the channels (i.e., via levee road) support a high degree of confidence that all permanent inflows and outflows were identified. However, early in the season and prior to the full-time start of the LFCC pumping plants, there may have been some intermittent testing of pumps that was unreported by the USBR and unknown to the field team.

2.5 Valley Cross-Sections

Two sets of flow measurements along valley cross sections were carried out in the region near the San Acacia Diversion Dam. Activities X4-01 and X4-02 were comprised of three cross-sections orthogonal to the river. Two sections (#2 and #3) were upstream of the dam and included the river and Drain Unit 7. The third section (#1) was measured downstream of the dam and included the river and the Socorro Main Canal.

Measurements along valley cross-sections were made for the purpose of quantifying total flow and the distribution of flow among channels in the reach immediately upstream and downstream of San Acacia. This type of measurement activity offers insight into the shift of water among adjacent channels, and overall gains and losses to surface-water flows in the valley.

2.6 Other Measurements

Seven activities were not associated with seepage runs or valley cross-sections. Of these, the first six, B4-01 through B4-06, were carried out at locations in the Socorro Division where the MRGCD has proposed the installation of permanent gages.

- B4-01, San Antonio Ditch at North Boundary of the Bosque del Apache ("North Boundary")
- B4-02, Socorro Main Canal South at North Boundary
- B4-03, Elmendorf Drain at North Boundary
- B4-04, Socorro Riverside Drain at North Boundary
- B4-05, Socorro Riverside Drain Wasteway at Brown Arroyo
- B4-06
    - Socorro Riverside Drain Wasteway at Brown Arroyo
    - San Antonio Ditch at North Boundary
    - Elmendorf Drain at North Boundary
    - Socorro Riverside Drain at North Boundary
    - Brown Arroyo Wasteway near Luis Lopez
    - Socorro Main Canal South at North Boundary

Activity B4-07 was designed as a "snapshot" in time of flows within the

MRGCD, including inflows, outflows, and diversions. In one day, the field team measured flow at the following locations:

- Inflows
    - Rio Grande at San Acacia
    - LFCC at San Acacia (#18)
    - Socorro Main at San Acacia
- Diversions, measured at points upstream and downstream on Riverside Drain
    - Lemitar
    - 1200 Diversion
    - Neil Cupp
- Outflows
    - Rio Grande at Highway 380
    - LFCC at Highway 380 (#8)
    - At the North Boundary of Bosque del Apache
        - San Antonio Ditch
        - Socorro Main Canal South
        - Socorro Riverside Drain
        - Elmendorf Drain

2.7 Station Lines

As done in previous phases, station lines were used to determine the actual distance along the channel of interest between all of the measurement locations (SSPA 2001). For locations on the river and LFCC within the Socorro Division that have been measured during earlier phases of this project, the same stations and station lines were used. Station lines were also developed for the following canals and drains:

- Socorro Main Canal
- Unit 7 Drain
- San Francisco Riverside Drain
- Peralta Riverside Drain
- La Joya Acequia
- Lower San Juan Drain
- Belen Riverside Drain

2.8 Field Procedures

The procedure used by our field teams to measure discharge is consistent with, and deemed to produce data as good or better than that collected according to standard USGS protocol for discharge measurements (Techniques of Water-Resource Investigations of the United States Geological Survey: Discharge Measurements at Gaging Stations; Book 3, chapter A8). Total flow at a location is calculated based on field measurements of velocity, depth, and width of section taken at a number of sections across the channel to be measured. The total flow across the channel is a sum of flows in the individual sections. The number of sections was selected with the goal of including no more than 5% of the total flow in any one section. Additional information on standard operating procedures can be found in Appendix K and in the report published for previous phases of this study (SSPA 2001).

3.0 DATA ANALYSIS

3.1 Seepage Rates in the Belen Division

Seepage runs in the Belen Division were performed on the river and adjacent drains. If a seepage run required more than one day for completion, each day's seepage was calculated separately. Seepage between two measurement locations in the channel was estimated by subtracting the sum of reach outflows from the sum of reach inflows for each day. Seepage calculations are shown in Appendix E and measured flows and seepage rates are plotted on figures, as noted below.

3.1.1 River Seepage Runs

Seven seepage run activities were conducted on the Rio Grande in the Belen Division. Activity S4-07 (Figure 9) represents the entire reach of the river within the Belen Division. The other six activities (S4-03, S4-06, S4-13, S4-16, S4-19, and S4-22) were conducted on sub reaches of the river.

When suitable upstream data are available, an adjustment in the measured flow can be made to minimize the impact of transient events occurring during the seepage run. However, for river seepage runs in the Belen Division, a suitable upstream gage is not available to provide data for this purpose. However, it was reasoned that daily seepage calculations could be made without adjustments for transient effects if there were no significant changes in the hydrograph at the Bernardo gage. For most of the seepage runs, this was true, and it was deemed reasonable to analyze the seepage runs without adjustments for transient effects; in the few cases where a transient flow was evident on the hydrograph, the effect of this transient flow on the quality of the data is reflected in qualitative confidence grade (see Section 3.2.4) assigned for that activity.

Within the Belen Division, losses varied from 0.6 cubic feet per second per mile (cfs/mile) below Highway 309 at Belen (S4-06, Figure 25) to 10.1 cfs/ mile upstream of Tome (S4-07, Figure 26). Seepage gains were highest above Highway 309, where the river gained approximately 5 cfs/mile in Activities S4-06 and S4-07. The river also gained nearly 6 cfs/mile between the Drain Unit 7 Extension and the measurement point RGASA#3, about 5.4 miles downstream (S4-07). While this lower reach was scouted once to identify undocumented sources of inflow and none were found, additional scouting is recommended to confirm this assessment. Table 4 provides a summary of calculated Rio Grande seepage rates in the Belen Division.

3.1.2 Drains, Canals, and other Conveyance Channels

The study area encompasses a complex network of drains, canals, and other channels used to transport water throughout the system. In an effort to gain a better understanding of seepage dynamics, seepage runs were performed on several of the channels in the conveyance network. In general, it is expected that drains will gain flow through seepage and canals will lose flow through seepage, although results suggest this is not always the case. The extent and location of these gains and losses are affected by a number of factors, including but not limited to depth to groundwater, total channel flow, and proximity to adjacent channels.

La Joya Acequia

Activity S4-08 was a seepage run performed on a seven-mile reach of the La Joya Acequia. In general, very little seepage was evident. Seepage calculations indicate losses and gains over six measured segments averaged 0.1 cfs/mile (Figure 27).

Lower San Juan Drain

Seepage run activities S4-12 and S4-15 were performed on a 6.6 mile reach of the Lower San Juan Drain. Results suggest the drain is losing flow through seepage during this period of observation. Loss per mile was calculated to be 2.2 cfs for S4-12 (Figure 31) and 1.3 cfs for S4-15 (Figure 33).

West Riverside Drains

This seepage run involved measurement locations on the San Francisco Drain and the Drain Unit 7 (S4-17, Figure 35). Drain Unit 7 was calculated to lose 2.3 cfs/mile in the upstream region of the 8.2 mile reach measured, and then gain 4.8 cfs/mile in the downstream region.

Peralta Riverside Drain

Activities S4-18 (Figure 36) and S4-21 (Figure 40) were seepage runs on the Peralta Riverside Drain. Two seepage calculations on a 7.3 mile reach indicated gains to this drain occurred between the measurement location adjacent to the Los Lunas wastewater outfall on the Rio Grande and the measurement location at Tome. In S4-18, the gain was 3.8 cfs/mile; in S4-21, the gain was 6.0 cfs/mile.

Belen Riverside Drain

The Belen Riverside Drain seepage runs were discontinuous due to the complexity of the conveyance network in some locations. Upstream of the intersection with Harlan Drain, calculated gains in this drain were approximately 1.8 cfs/mile for both seepage runs, S4-20 (Figure 38) and S4-23 (Figure 42). From the intersection with Harlan Drain to Tome, the results suggest that the drain gains flow, and downstream of Tome, they indicate that it loses flow.

3.2 Seepage Rates in the Socorro Division

Seepage runs in the Socorro Division were conducted on the river, LFCC, and adjacent drains. River flows were adjusted for lag time based on flows gaged by the USGS at San Acacia Dam. The purpose for this adjustment was to minimize the effects of transient changes in flow conditions on seepage rate calculations. The methodology used is outlined in detail in the report published for previous phases of the project (SSPA 2001).

3.2.1 River Seepage Runs

Activities S4-01 and S4-05 consisted of river seepage runs from San Acacia to a site near the downstream end of the levee road, known as the corral site. Consistent with the findings of previous phases, high loss rates occurred from the river in the region from Escondida Bridge to Highway 380. A shorter run, Activity S4-24 focused in on this region specifically.

Measurements in S4-01 (Figure 21), conducted at some of the higher river flows encountered in this program (780-1080 cfs), provide results generally consistent with trends previously observed (SSPA 2000). However, due to the length of time over which this run was conducted and due to the occurrence of transient flow during this period, this run has been given low confidence and quality ratings. As previously observed, highest loss rates occur between Brown Arroyo and Highway 380. Short sub-reach anomalies and uncertainty in the overall calculated rate of seepage occur due to transient conditions, despite efforts to normalize flows using lag time adjustments. Furthermore, the USBR reported pumping activities in these reaches during the time of the S4-01 activity, but did not include record of any official pumping operations during the seepage run. It is possible that pumps were being tested in these reaches during the seepage run, which would explain the uncharacteristic gain calculated in the reach immediately upstream of Highway 380 and perhaps explain other anomalies.

In later seepage runs, pumping activities were reported and incorporated into seepage calculations. In these activities, Brown Arroyo to Neil Cupp also experienced high loss rates: for S4-05 (Figure 24) the calculated loss rate was 25 cfs/mile; and for S4-24 (Figure 45), 8.4 cfs/mile.

A summary of Socorro Division river seepage calculations for this and previous phases of flow assessment is located in Table 5. Figure 47 illustrates cumulative losses on the river for all phases, and Figure 48 compares the total cumulative loss on the river with the reference flow at San Acacia. The data suggest that the total cumulative loss on the Rio Grande in the Socorro Division may not be directly related to the flow at the top of the reach at San Acacia. Over six measurement activities, conducted at different times of the year, the San Acacia reference flow ranged from approximately 200 cfs to 800 cfs, with the calculated total cumulative loss ranging from about 250 cfs to 350 cfs. Similarly, no relationship is apparent between the magnitude of seepage loss and the season, i.e. irrigation or non-irrigation. However, the number of good quality runs conducted under varying flow conditions in different seasons is insufficient to confirm the absence of such relationships.

3.2.2 LFCC

Seepage run measurements on the LFCC were conducted as activities S4-02 (Figure 22) and S4-25 (Figure 46). Calculated rates show generally consistent gains (5 to 19 cfs/mile) throughout the LFCC, with two exceptions. Activity S4-02, in the southern reach of the LFCC, identifies two losing reaches: from Highway 380 to the North Boundary of the Bosque del Apache, and from Fort Craig to the corral site. The loss above the Bosque del Apache is atypical and may be subject to unreported test pumping by the USBR or to transient effects. It is also possible that localized seepage out of the LFCC occurs due to higher water levels (backwater effects) behind the diversion structure for the Bosque del Apache. Over the full reach, the results are consistent with conditions previously observed. Table 6 shows a summary of LFCC seepage calculations for this and previous phases of flow assessment.

3.2.3 Socorro Main Canal Seepage Runs

Seepage runs were conducted on three reaches of the Socorro Main Canal. Two of these reaches are located north of Socorro. The third reach is located south of Highway 380 and north of the Bosque del Apache. Data collected on the reach furthest upstream, measured as activity S4-10 (Figure 29), suggest the occurrence of both losses and gains. In activity S4-09 (Figure 28), measurements on the middle section indicate losses of 11.8 cfs/mile and 7.3 cfs/mile, representing 31% and 9% of flow in each segment. Measurements at the downstream section, S4-11 (Figure 30), indicate an average gain of 12.7 cfs/mile through seepage. These results are probably insufficient to draw conclusions concerning conditions on these reaches of the Socorro Main Canal, as some difficulty was experienced in controlling transient effects. However, this work establishes some background for designing future confirmatory seepage runs.

3.2.4 Data Quality Criteria

Grading Seepage Runs

For each activity, consistent efforts were made by the project team to identify and respond to issues that may impact the quality of the seepage run. Even with rigorous planning and effort by the field team, numerous factors potentially impact the quality of seepage runs. Such factors may include:

- Unidentified minor ungaged inflows or outflows,
- Unreported USBR pumping from the LFCC,
- Field data not collected sequentially upstream to downstream,
- Error or noise in data exceeding gains or losses, especially in short reaches,
- Logistical problems in field, and
- Transient flows due to operational changes or weather events.

While painstaking efforts in this program produced generally reliable and high quality results, some seepage run activities were assessed as superior in quality to others. In an effort to distinguish levels of quality among the seepage runs, the following qualitative grading system was devised. Please note that this is not a strictly quantitative rating, and that the judgment of the hydrologist doing the analyses was used in assigning grades to individual seepage runs.

QUALITATIVE CONFIDENCE GRADE	**ATTRIBUTES**
A	• Measurements were performed quickly and in order. • No substantial impacts were attributed to transient flows. • High confidence in knowledge of all inflows and outflows to system.
B	• For seepage runs spanning more than one day, a significant difference in flow is observed from the evening of one day to the morning of the subsequent day. • Minor effects of transient flows are suspected. • Measurements suggest possible unreported pumping activities.
C	• Significant transient flow observed on hydrograph during time potentially affecting seepage run measurements. • Measurements performed out of order, i.e. not upstream to downstream.

Grades for individual seepage runs are noted on respective illustrative figures for the seepage runs.

Rating Socorro Division River Seepage Runs

In addition to applying qualitative confidence grades to seepage runs, river seepage runs in the Socorro Division have been rated in quality based on criteria reflecting the variability between reference discharge and wave time discharge in the lag time calculation. This procedure is outlined in detail in the previous seepage run report (SSPA 2001). To rate the relative quality of river seepage run results with respect to the change in flow conditions, the following criteria were applied:

Excellent: All wave discharge variations less than 10% of reference flow.

Good: Wave discharge variations predominantly less than 20% of reference flow

Fair: Wave discharge variation predominantly less than 25% of reference flow, but some points may exceed 30%

Poor: A significant number of reaches are subject to wave discharge variations exceeding 30%; and/or, other evidence of significant transient impacts was observed.

Ratings and summary results for Socorro Division river seepage runs for all phases are located in Table 5.

3.2.5 Summary of Seepage Loss and Gain

Phase IV of the seepage program expands on the body of work accomplished in Phases I, II and III of the assessment of flow conditions in the Middle Rio Grande region (SSPA 2001). At locations previously measured in the Socorro Division, analyses of the Phase IV dataset correspond well with earlier conclusions:

- Results indicate the Rio Grande experienced high loss rates between Brown Arroyo and Neil Cupp and from Highway 380 to the North Boundary of the Bosque del Apache; and,

- Measurements show gains to the LFCC were consistent throughout the entire study reach (5 to 19 cfs/mile), with the exception of reaches possibly impacted by unrecorded USBR pumping.

New seepage run measurements contribute to a better understanding of surface water/groundwater interactions beyond the original study area. Below is a brief summary of seepage characteristics observed in the expanded area of study during this period of observation:

- In the Belen Division, the Rio Grande exhibited both gains and losses through seepage, unlike the consistently losing dynamics of the Rio Grande in the Socorro Division;
- Little seepage was evident from the La Joya Acequia;
- The Lower San Juan Drain exhibited losses;
- Drain Unit 7 in the Belen Division appeared to lose flow through seepage at the upstream end, and gain flow in the downstream end of the study area;
- The Peralta Riverside Drain exhibited gains; and,
- The Belen Riverside Drain exhibited both gains and losses in sub-reaches.

3.3 Valley Cross-Sections

Appendix G contains tables and supporting figures for valley cross-section activities X4-01 and X4-02. Both activities were designed to simultaneously measure flow on the river and the adjacent channel locations on Drain Unit 7 or the Socorro Main Canal at two locations within the five-mile reach immediately upstream of San Acacia and at one location just downstream of the San Acacia Diversion Structure. In both cases, river losses approximately corresponded to gains in the adjacent channel.

These activities suggest that no large net gains or losses are occurring to the river/drain system in the lower few miles of the Albuquerque Basin just north of San Acacia. However, gains may be occurring to the shallow aquifer-stream system and these gains may be roughly balanced by riparian depletions in this reach and therefore not show up as additional surface water flow.

3.4 Water Quality

Water quality parameters were recorded at each measurement location where logistically possible. Water temperature, pH, and electrical conductance were measured using an Oyster pH/conductivity/temperature meter along the edge of the waterway at an appropriate depth to cover the probe. Temperature measurements have an accuracy of ±0.2°C, conductivity ±0.5% and pH ±0.01. Appendix I contains tabulated summaries of measured values for each activity and figures illustrating the data.

As shown in the appendix, the data suggest that the Rio Grande is generally warmer than the surrounding drains and conveyances, including the LFCC, in the summer months, in both Belen and Socorro Divisions. Some trends indicate an increase in temperature downstream within a given activity; however, measurements were taken in shallow water within close proximity to the bank and were conducted from upstream to downstream throughout the day. This would suggest a diurnal heating of the shallow, near bank waters throughout the day leading to slightly higher measurements downstream later in the day.

Measurements of pH indicate similar values in all measured waterways. The electrical conductance increases downstream and is similar between the river and surrounding drains and conveyances. Overall, the current findings are consistent with the previous assessment (SSPA, 2001).

GLOSSARY

Activity – A seepage run, valley cross-sections, or “other” field measurement plan.

Flow Adjustment – A technique used to account for transient flow conditions in the calculation of seepage along a reach of the Rio Grande.

Low Flow Conveyance Channel (LFCC) – The major channel which begins at San Acacia and runs parallel to the Rio Grande channel. The channel was Constructed for the purpose of minimizing conveyance losses between San Acacia and Elephant Butte; however, it has not been operated for this purpose since the mid-1980s due to physical degradation of the outfall channel.

Phase I – A program reconnaissance phase, with measurements taken from July 15, 2000 through July 27, 2000.

Phases II and III – The sets of measurements taken from August 15, 2000 through February 4, 2001 in five distinct cycles. Results from Phase III were combined with Phase II for analysis and discussion.

Phase IV – The subject of this report, a set of measurements taken during Summer 2001 flow measurement program.

Reach – A length of waterway designated by two endpoints.

Rio Grande – In this context, the main channel of the Rio Grande system.

Riparian Depletions – Losses from the system due to evapotranspiration by riparian, or riverbank, vegetation.

Seepage – The process by which water enters or leaves the surface water system through the bed of a waterway; also, the quantity of water entering or leaving the system.

Seepage Run – A set of flow measurements taken along a reach or sub reach that are used to calculate the seepage in that reach or sub reach.

Sub Reach – A length of waterway designated as a portion of a defined reach.

Transient Flow Conditions – Changes in flow magnitude over a period of time during which flows may be influenced by flood waves, rainfall, and other transitory events.

Valley Cross-Section – A set of flow measurements taken at several locations in a line orthogonal to the flow of the river system. These measurements are taken over a very short time frame so that the total system flow may be characterized by the relative amounts of river, LFCC, and other waterway flows.

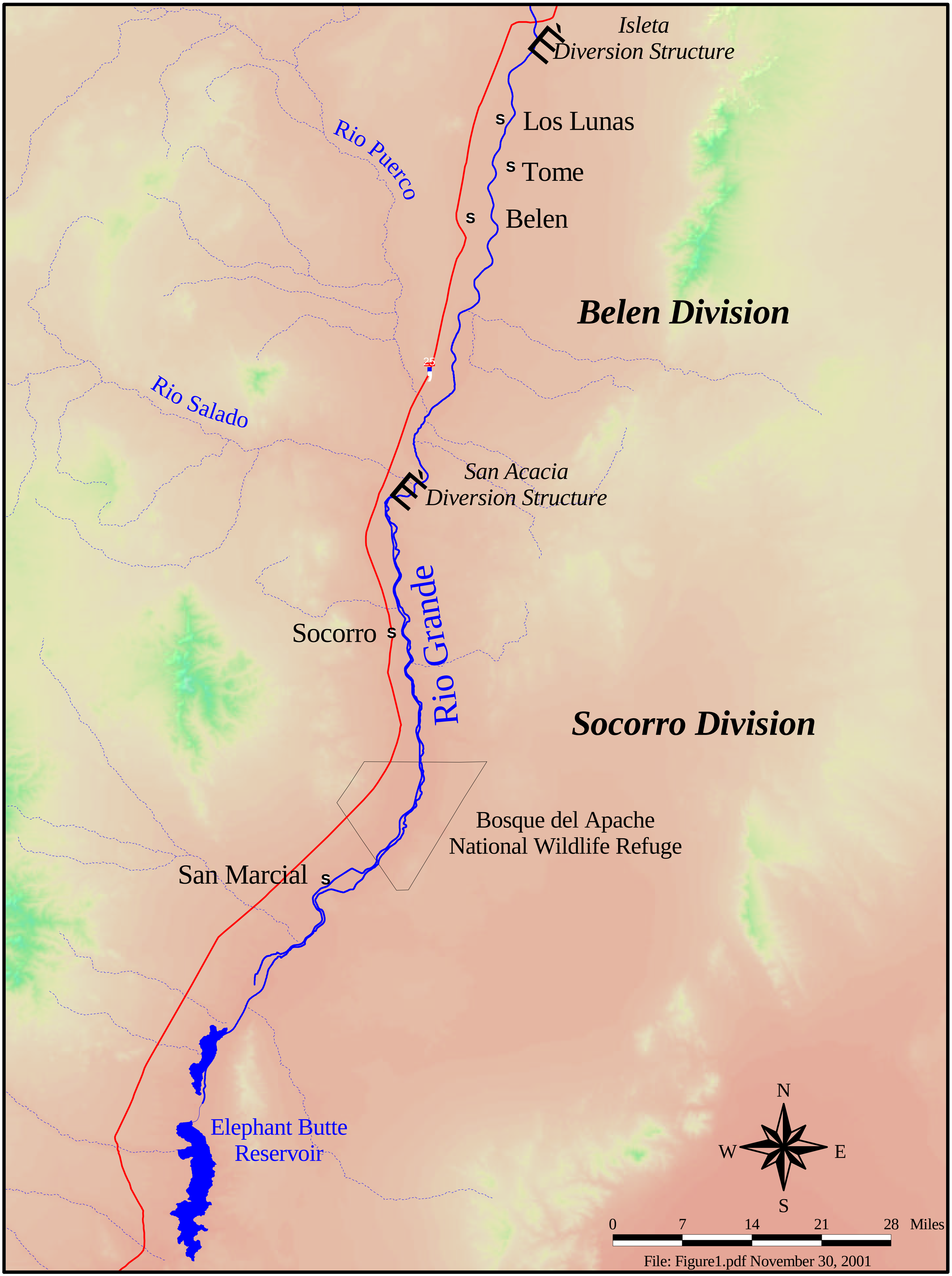

Figure 1. Project Location

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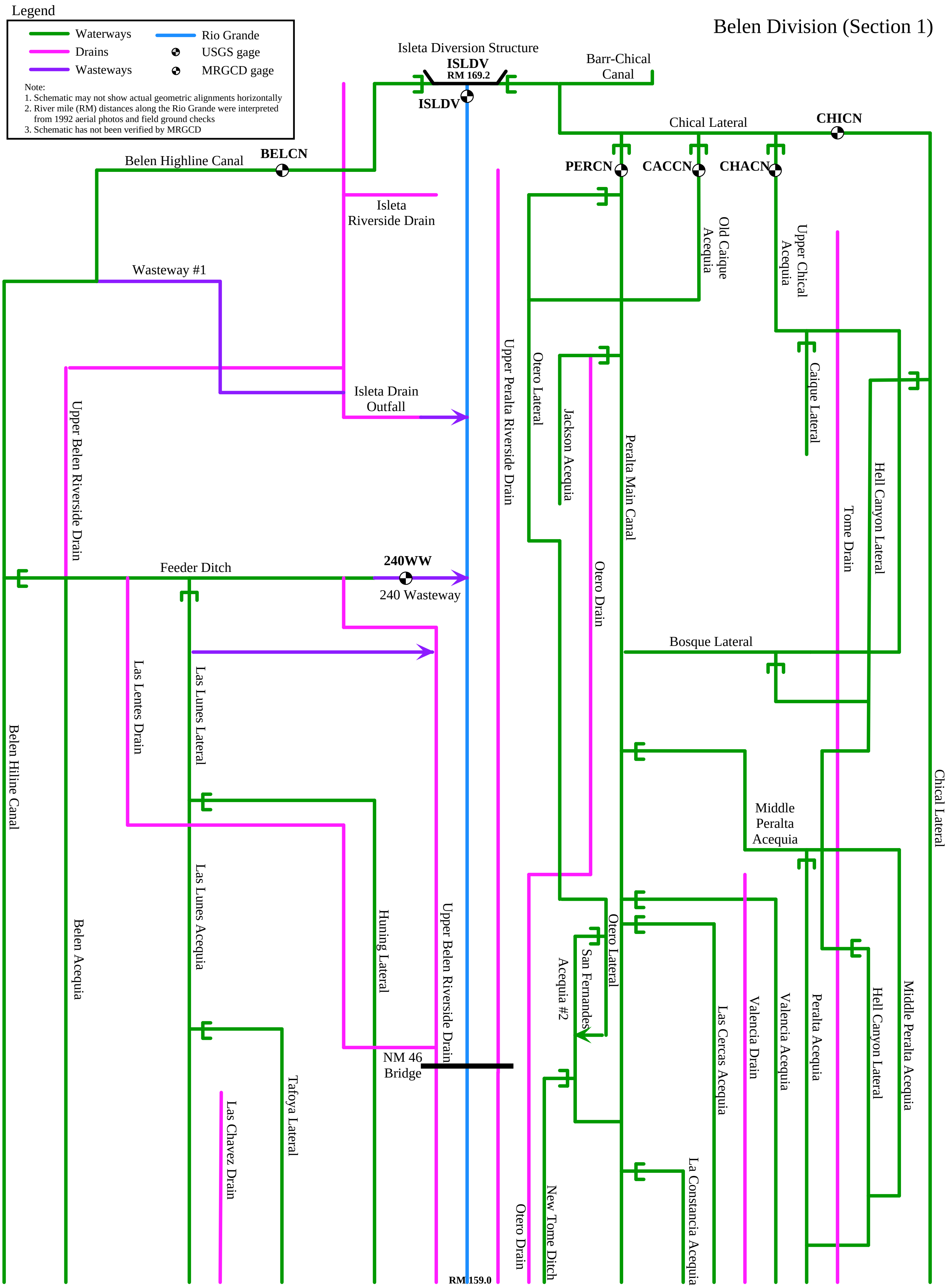

Figure 2a. Belen Schematics from Isleta Diversion Structure at Rivermile (RM) 169.2 to RM 159.0

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Belen Division (Section 2)

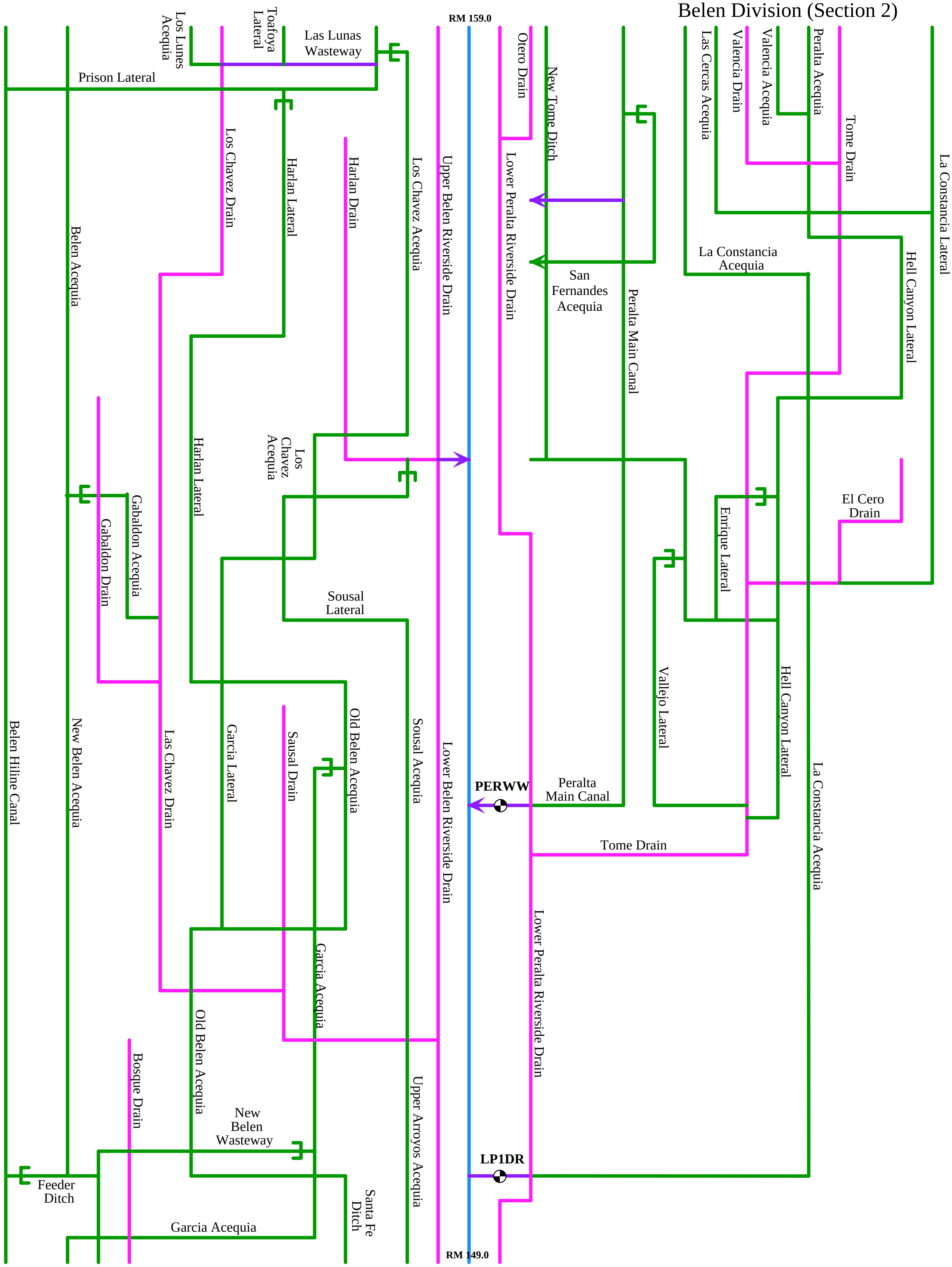

Figure 2b. Belen Schematics from RM 159.0 to RM 149.0

Draft 6/3/2002

Belen Division (Section 3)

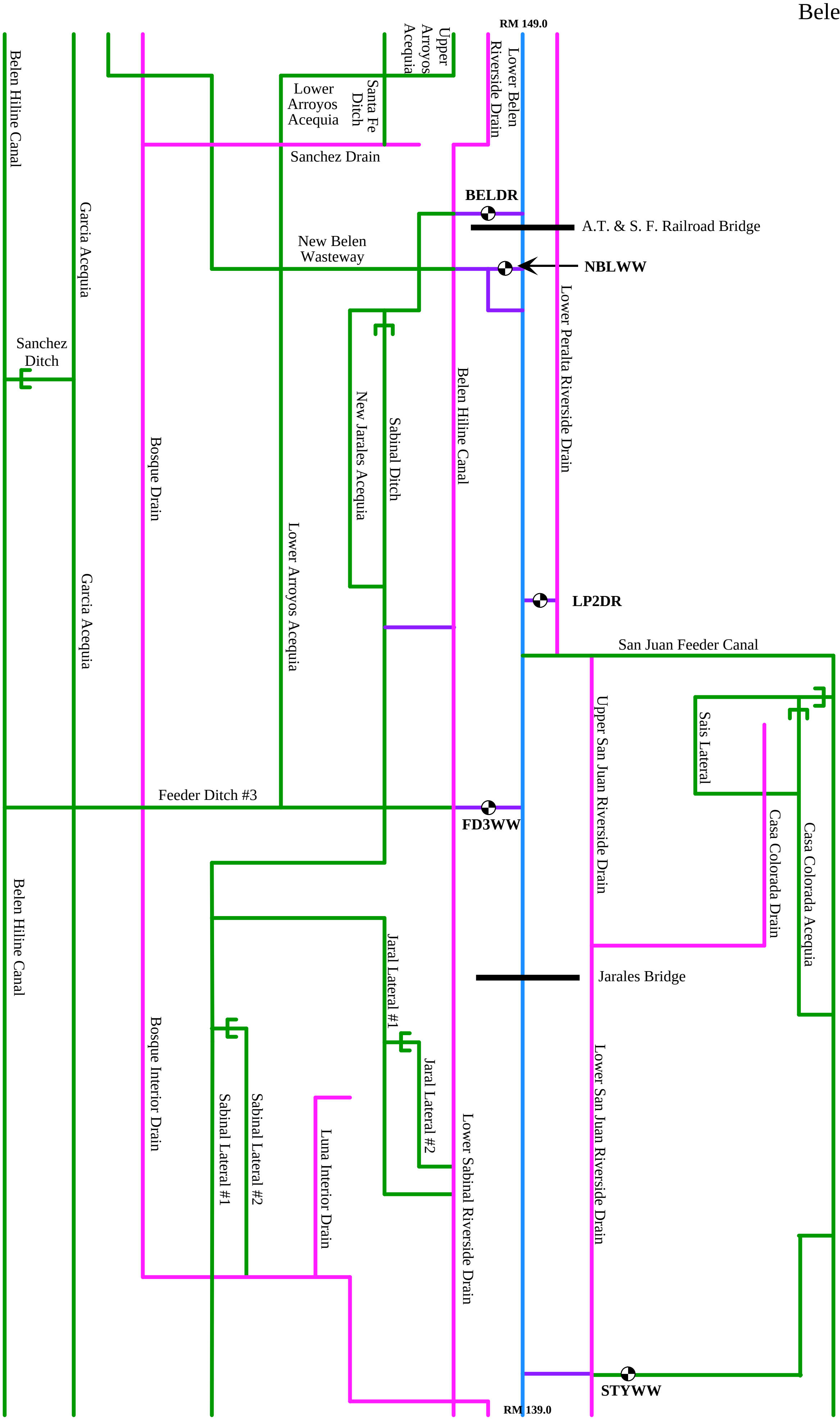

Figure 2c. Belen Schematics from RM 149.0 to RM 139.0

Draft 6/3/2002

Belen Division (Section 4)

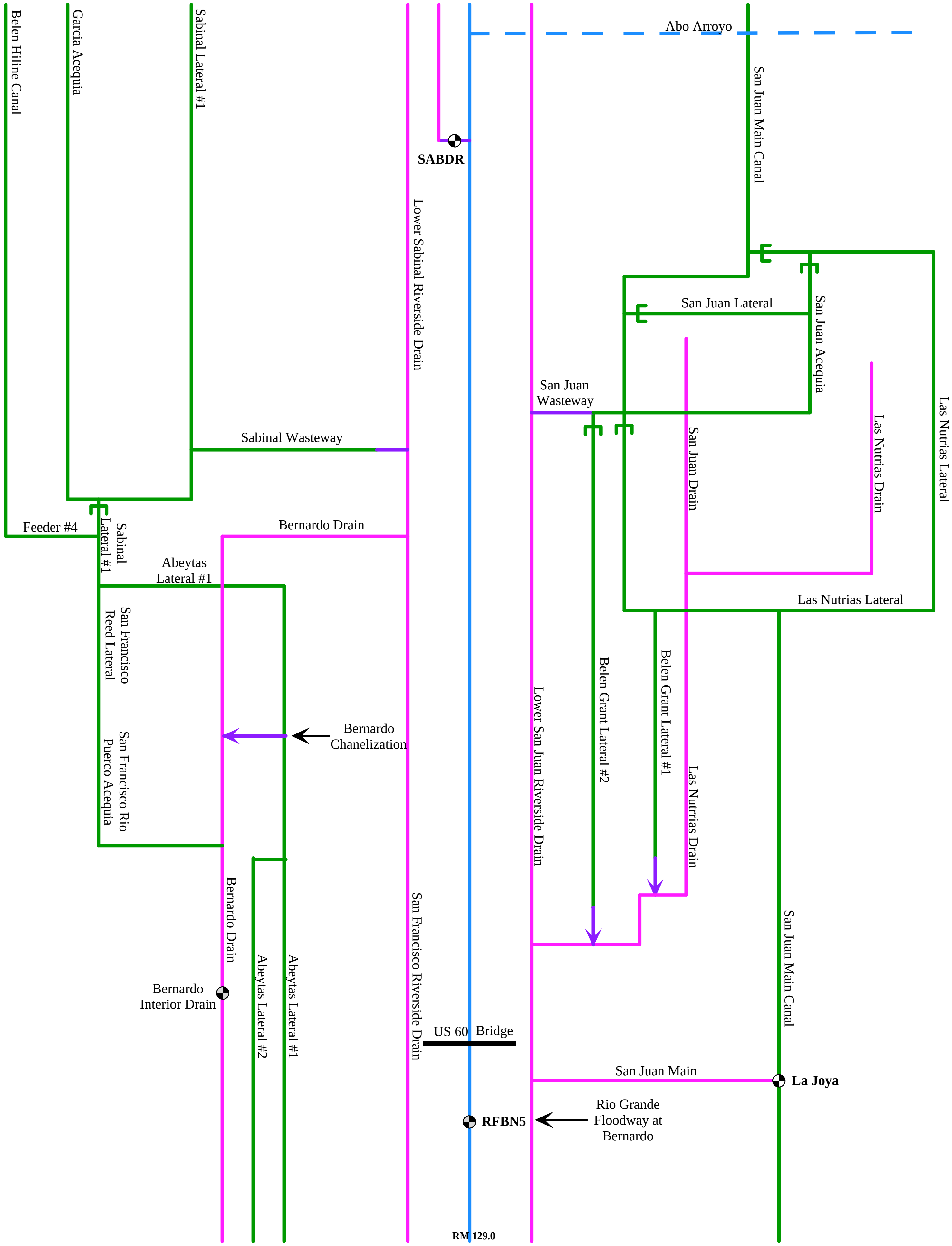

Figure 2d. Belen Schematics from RM 139.0 to RM 129.0

Draft 6/3/2002

Belen Division (Section 5)

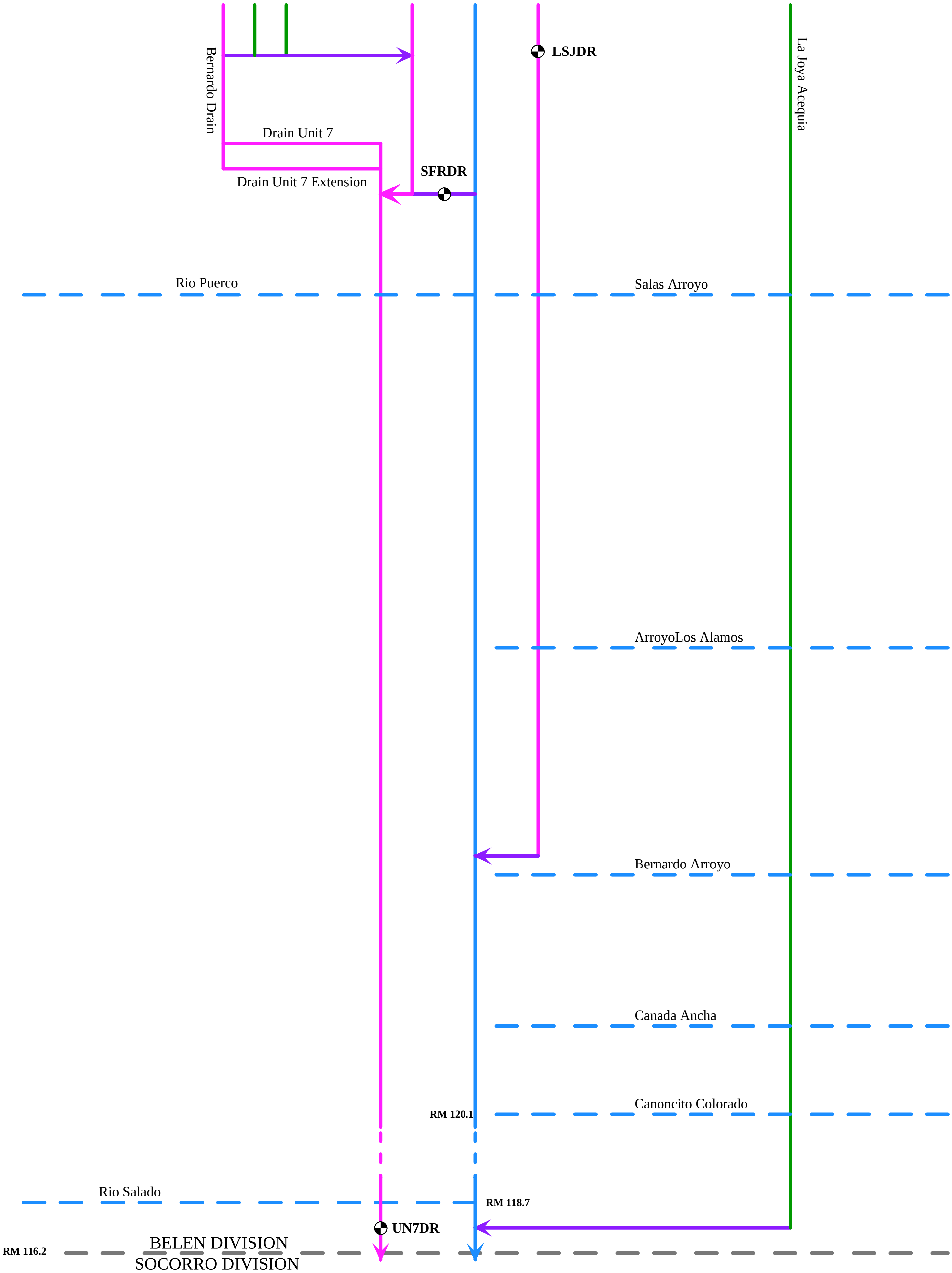

Figure 2e. Belen Schematics from RM 129.0 to the Socorro Division Boundary at RM 116.2

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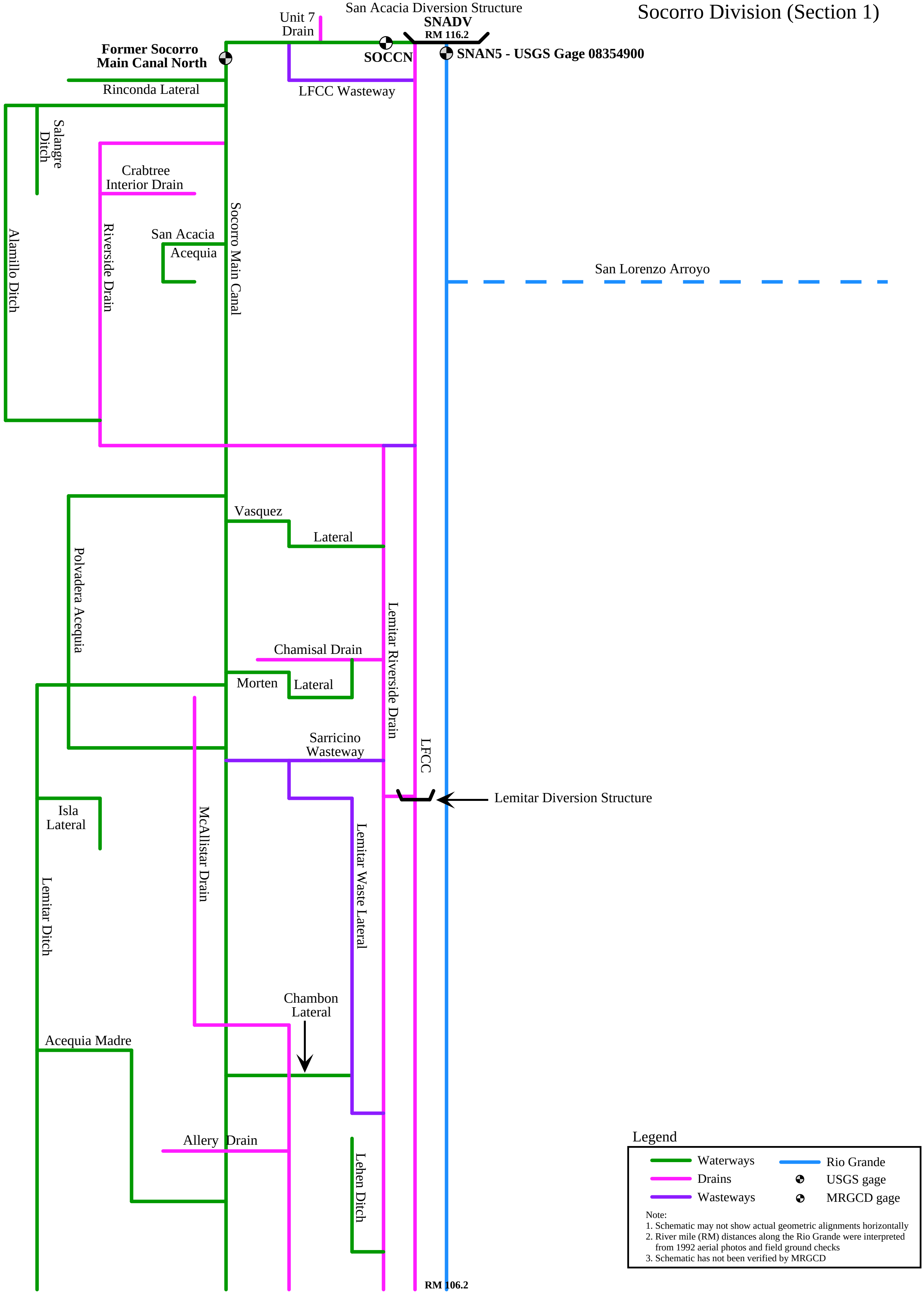
Socorro Division (Section 1)



Note:
1. Schematic may not show actual geometric alignments horizontally
2. River mile (RM) distances along the Rio Grande were interpreted from 1992 aerial photos and field ground checks
3. Schematic has not been verified by MRGCD

Figure 3a. Belen Schematics from San Acacia Diversion Structure at Rivermile (RM) 116.2 to RM 106.2

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Socorro Division (Section 2)

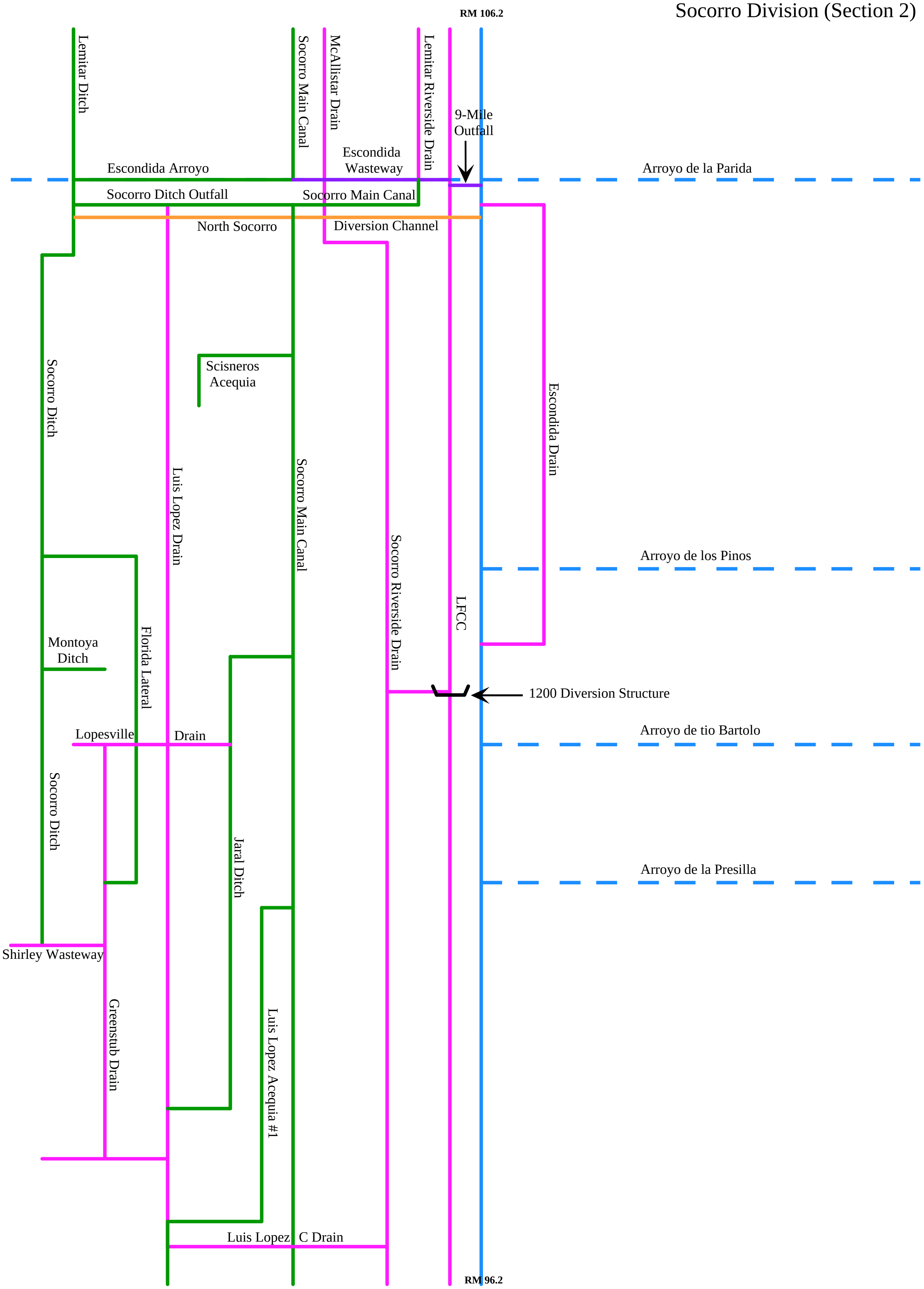

Figure 3b. Socorro Schematics from RM 106.2 to RM 96.2

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Socorro Division (Section 3)

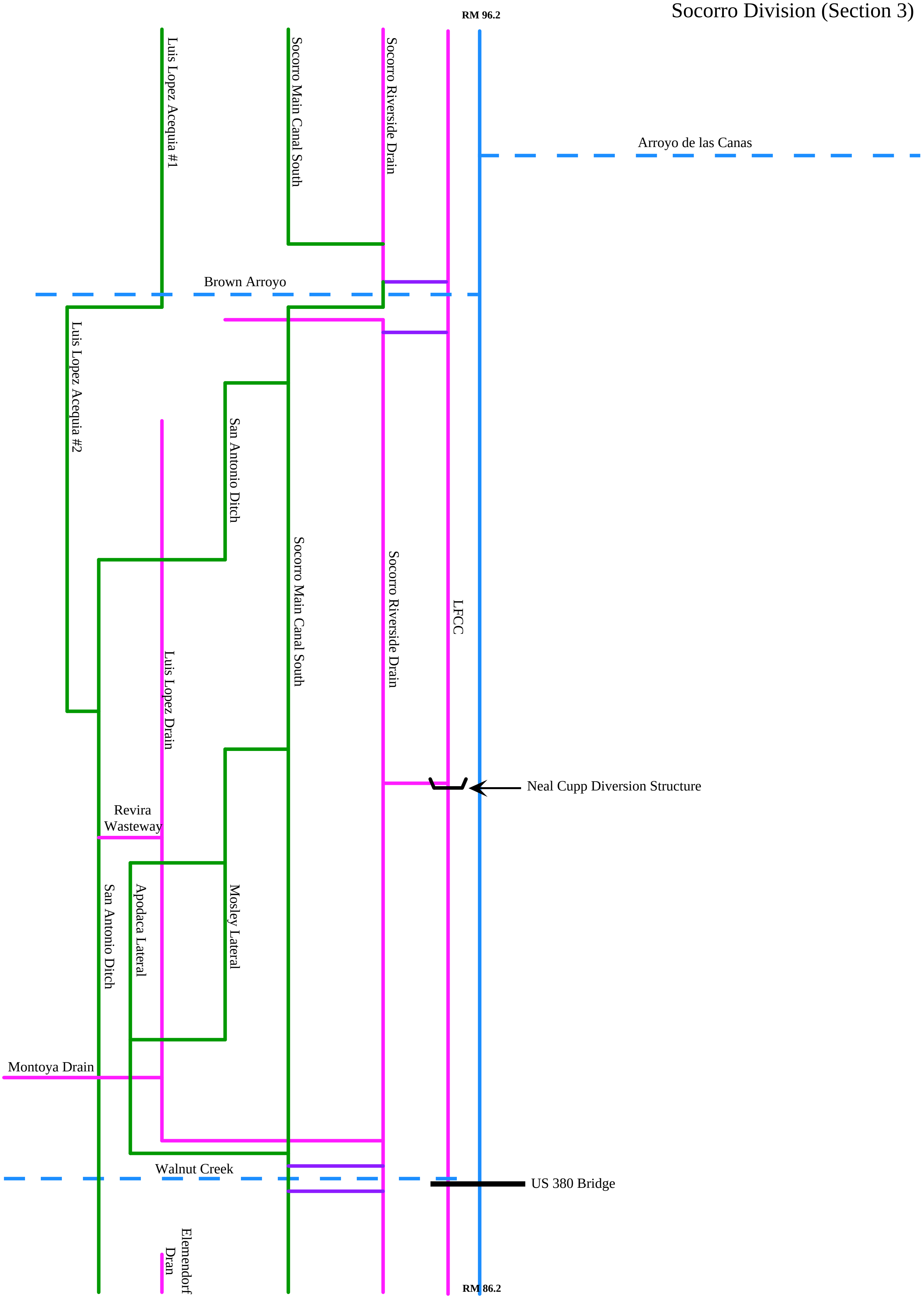

Figure 3c. Socorro Schematics from RM 96.2 to RM 86.2

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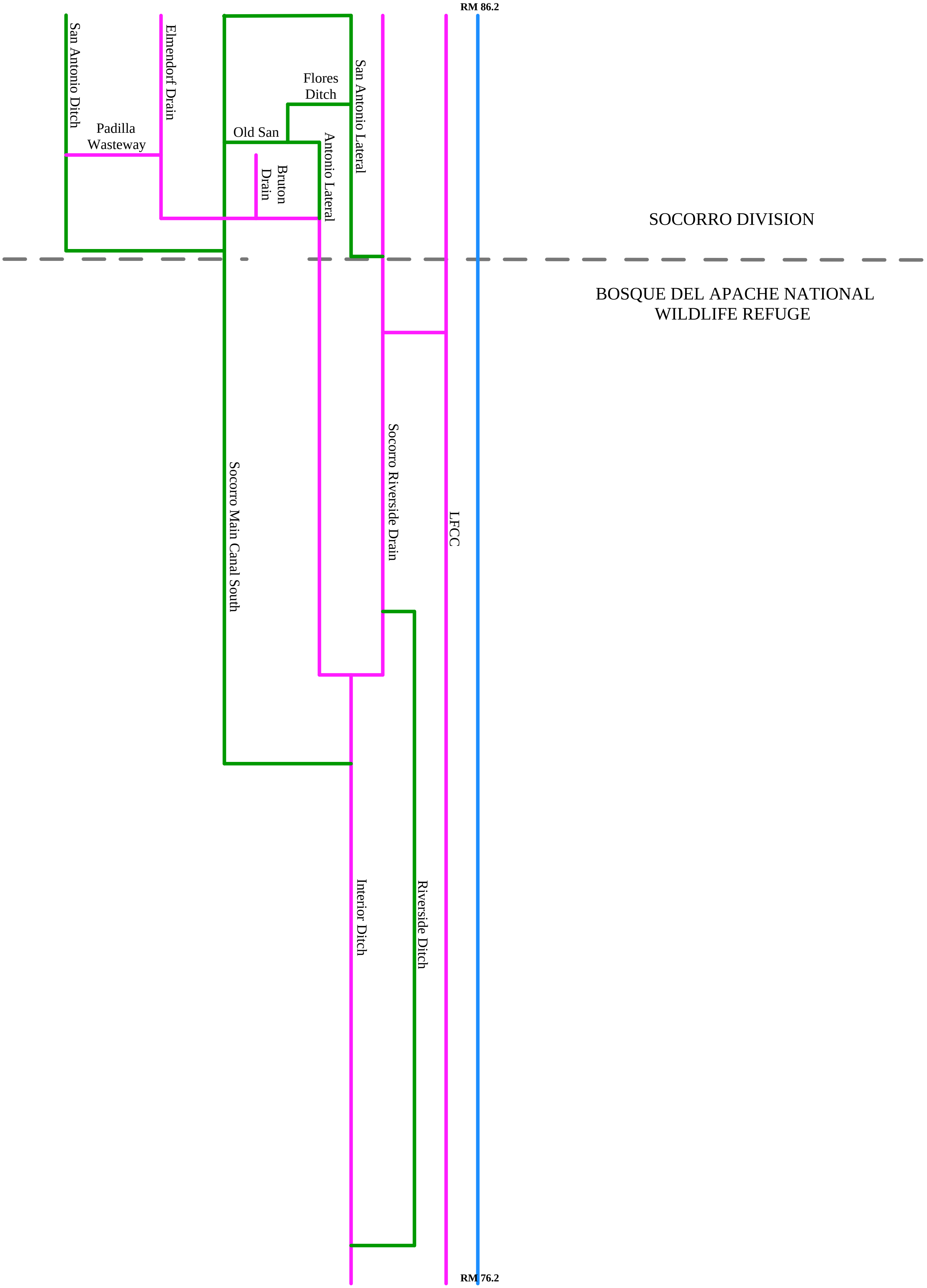


Figure 3d. Socorro Schematics from RM 86.2 to RM 76.2

Draft 6/3/2002

Socorro Division (Section 5)

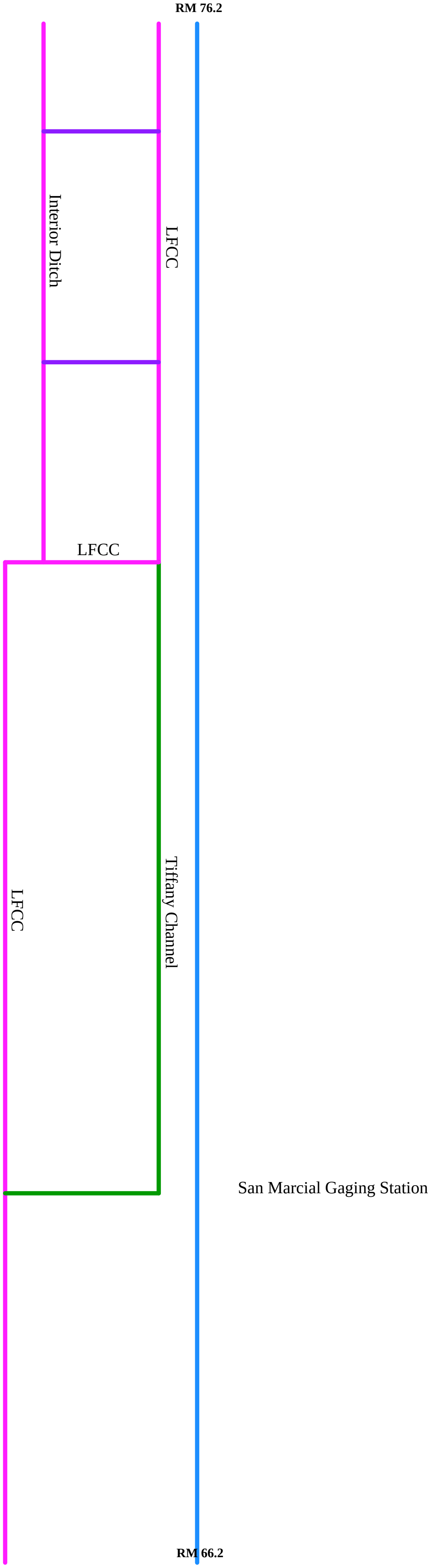


Figure 3e. Socorro Schematics from RM 76.2 to RM 66.2

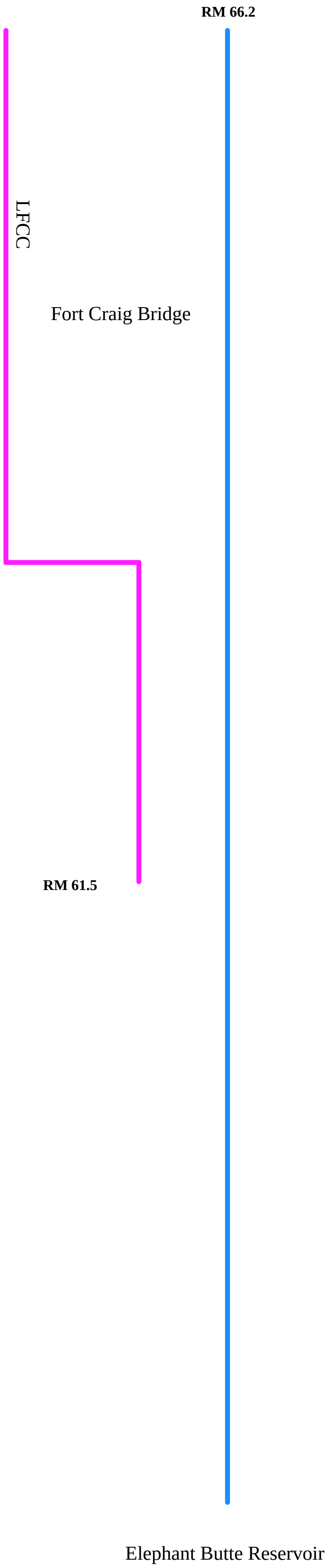
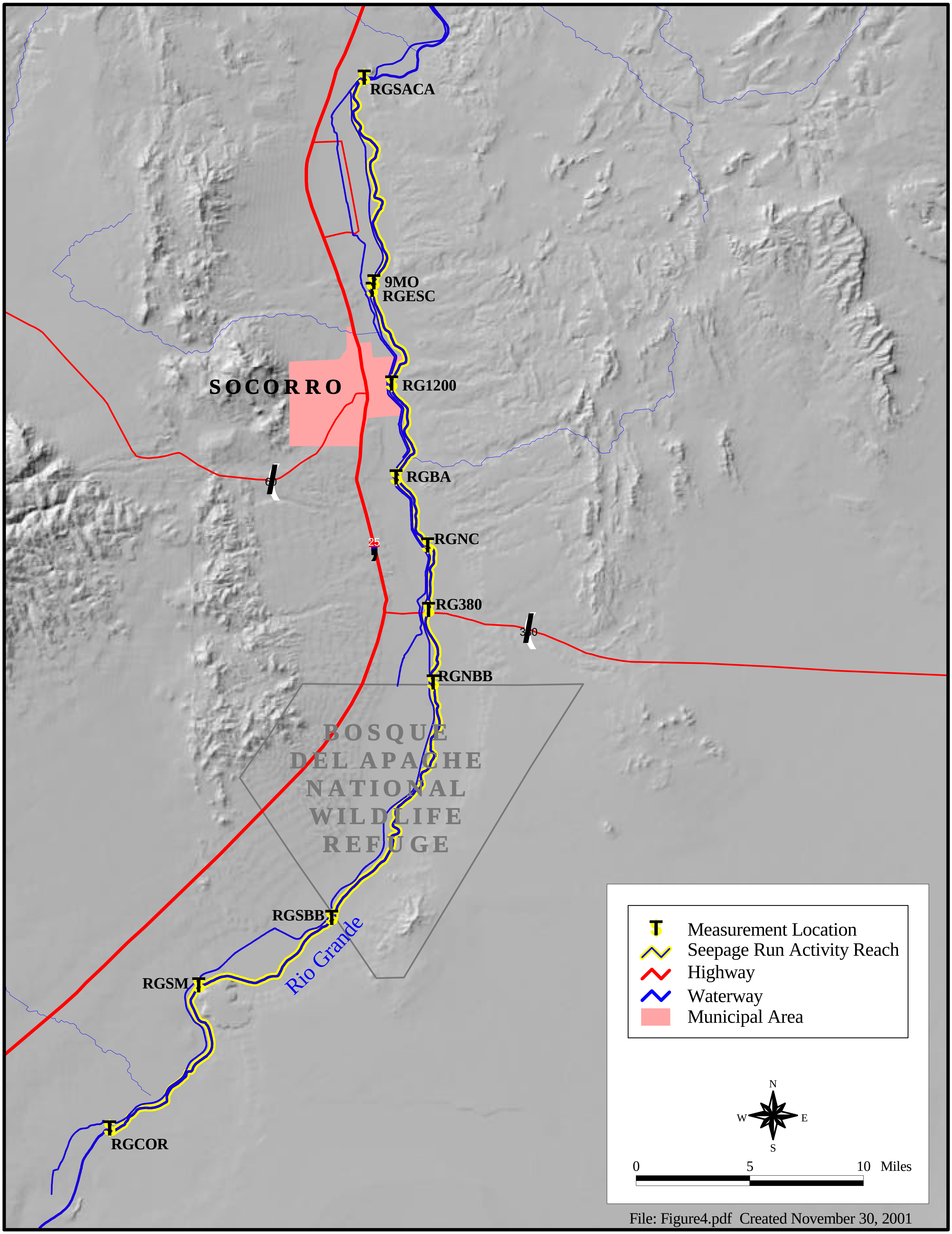


Figure 3f. Socorro Schematics from RM 66.2 to Elephant Butte Reservoir



File: Figure4.pdf Created November 30, 2001

Figure 4. Seepage Run Activity S4-01

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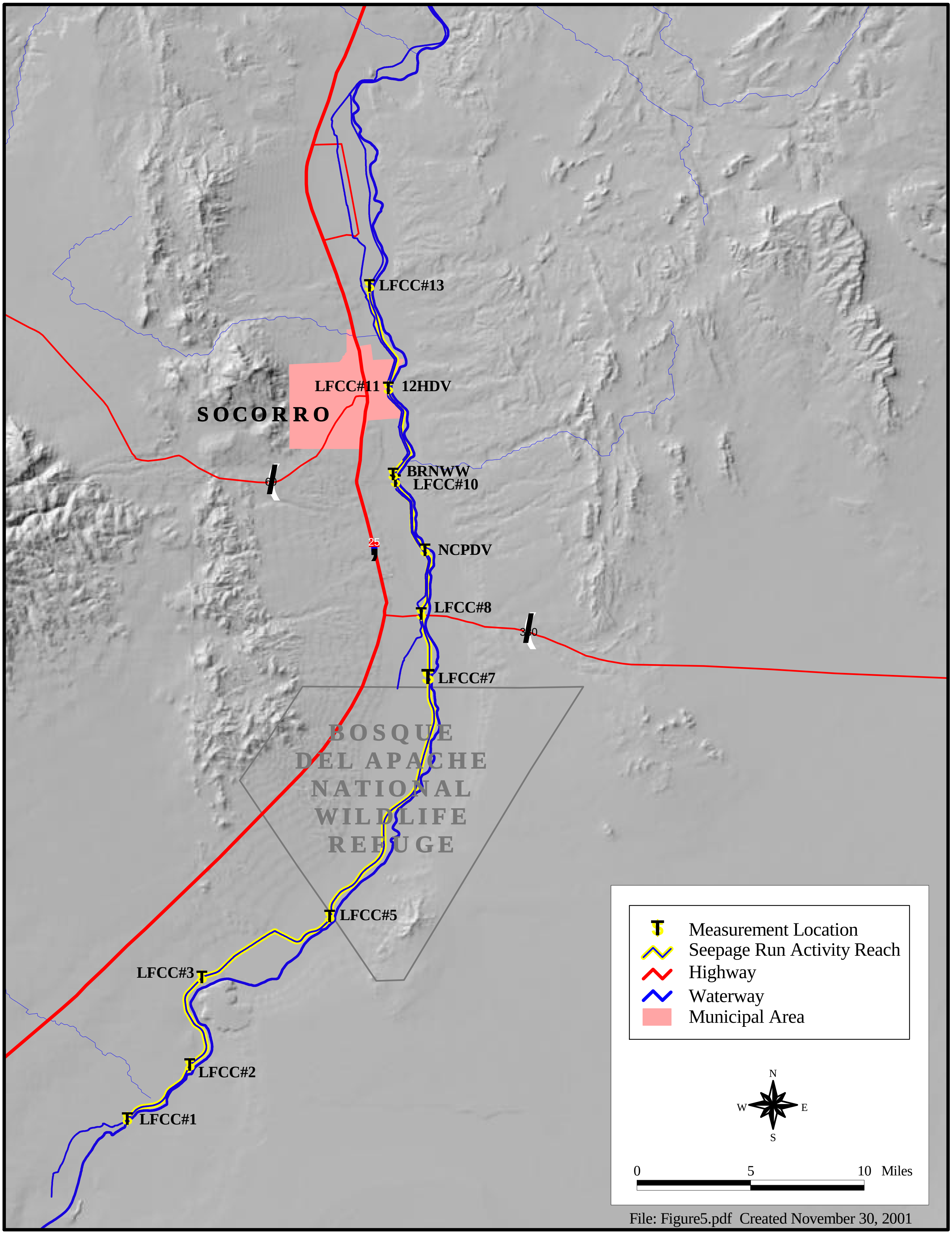

Figure 5. Seepage Run Activity S4-02

S. S. Papadapulos & Associates, Inc.

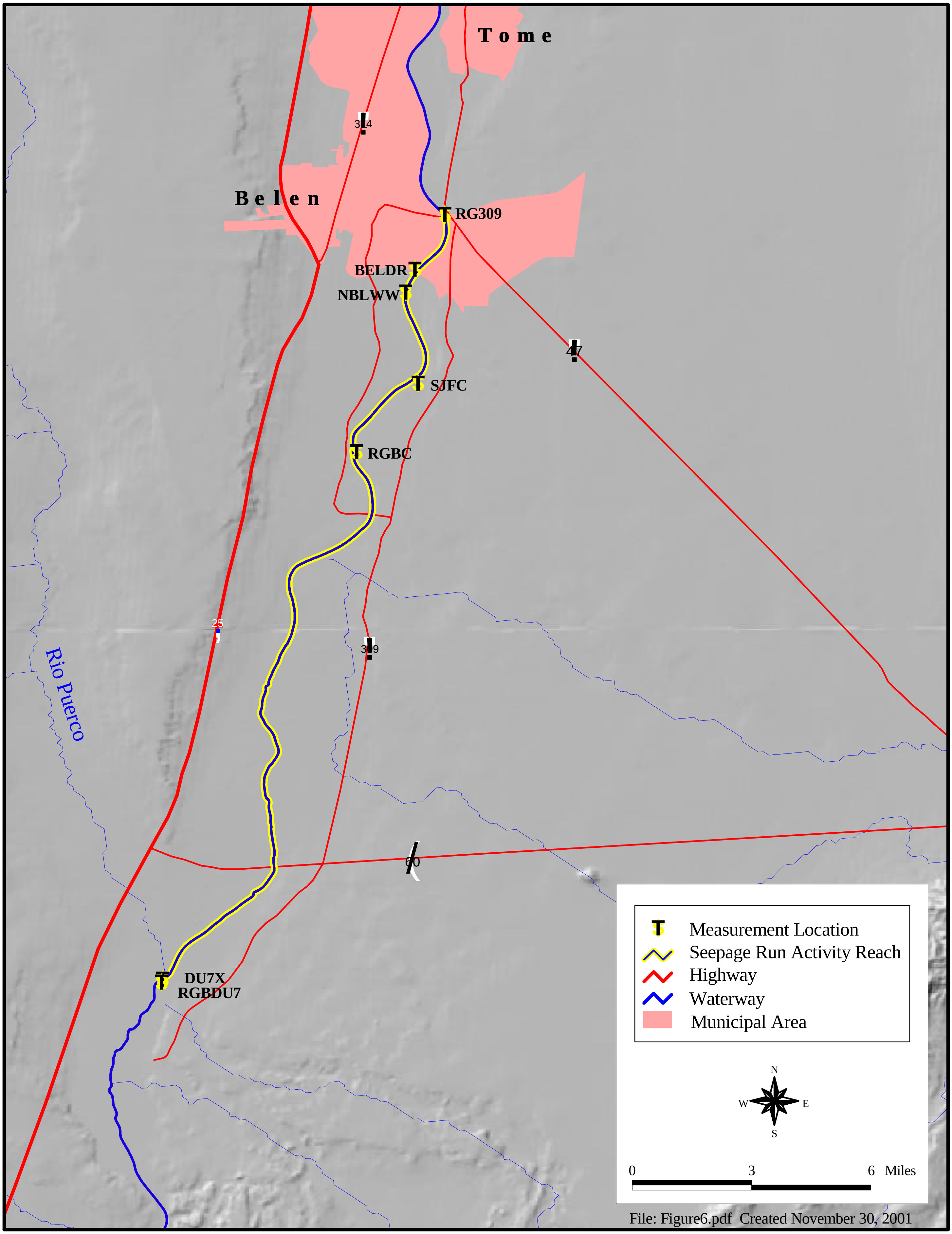

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Figure 6. Seepage Run Activity S4-03

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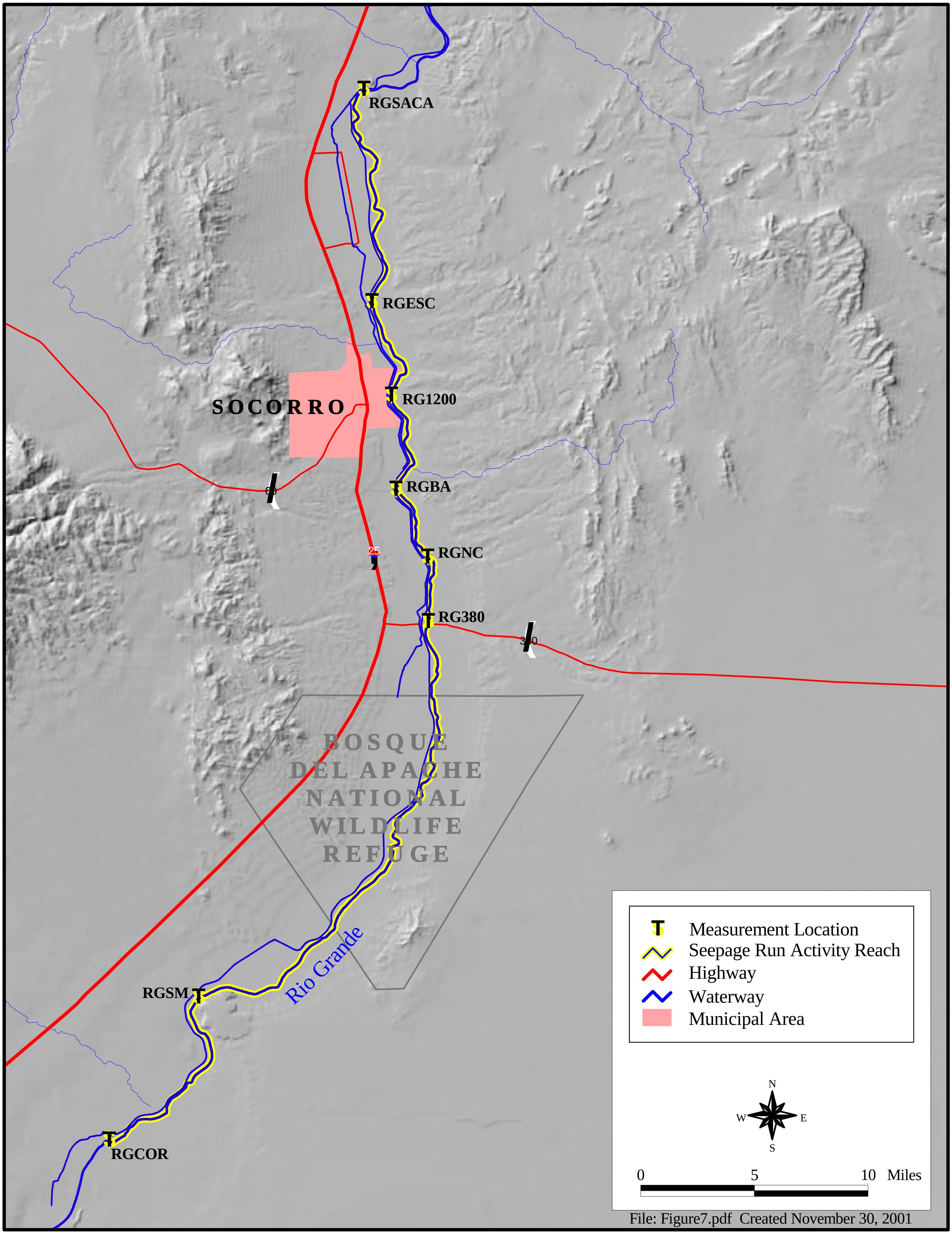

Figure 7. Seepage Run Activity S4-05

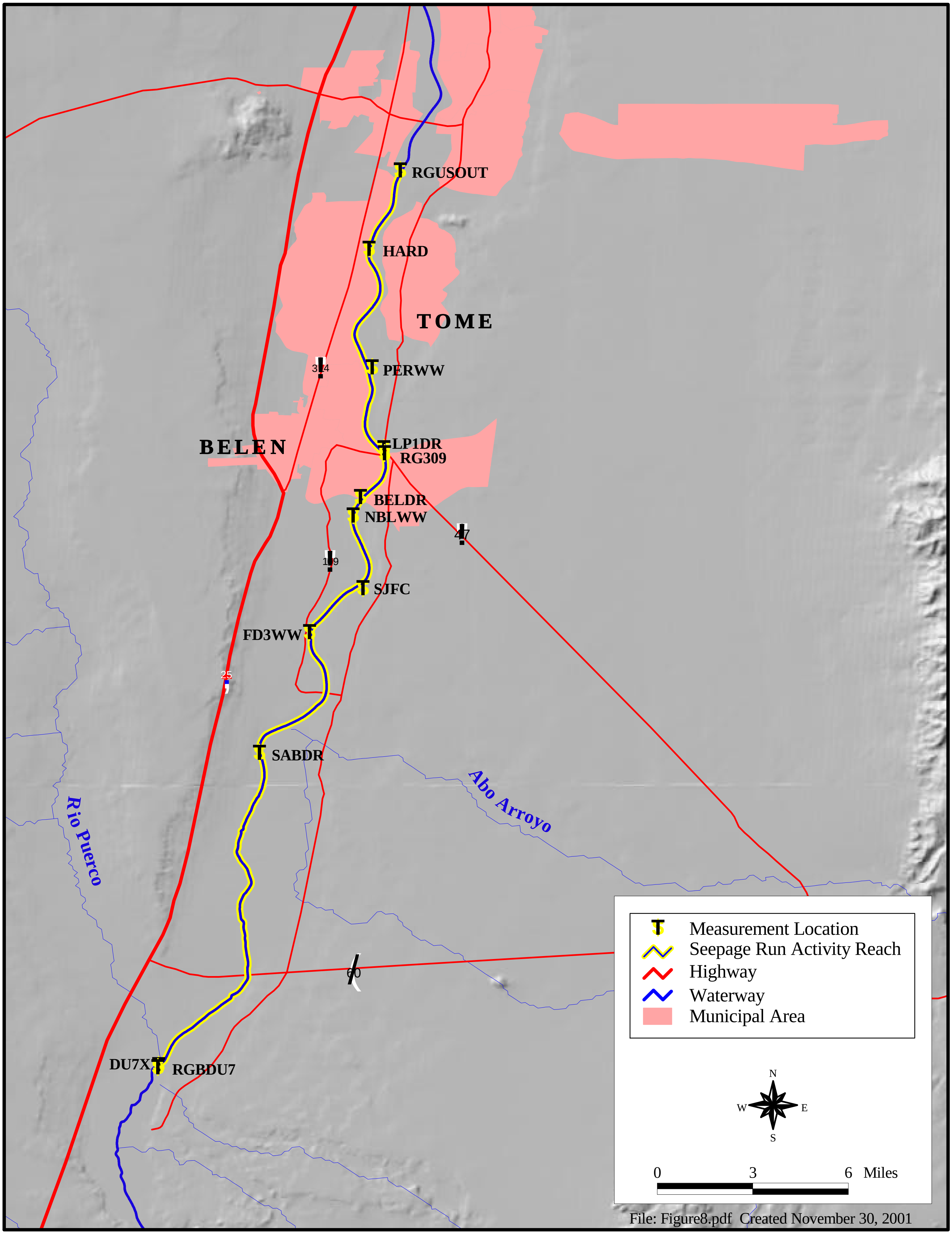

Figure 8. Seepage Run Activity S4-06

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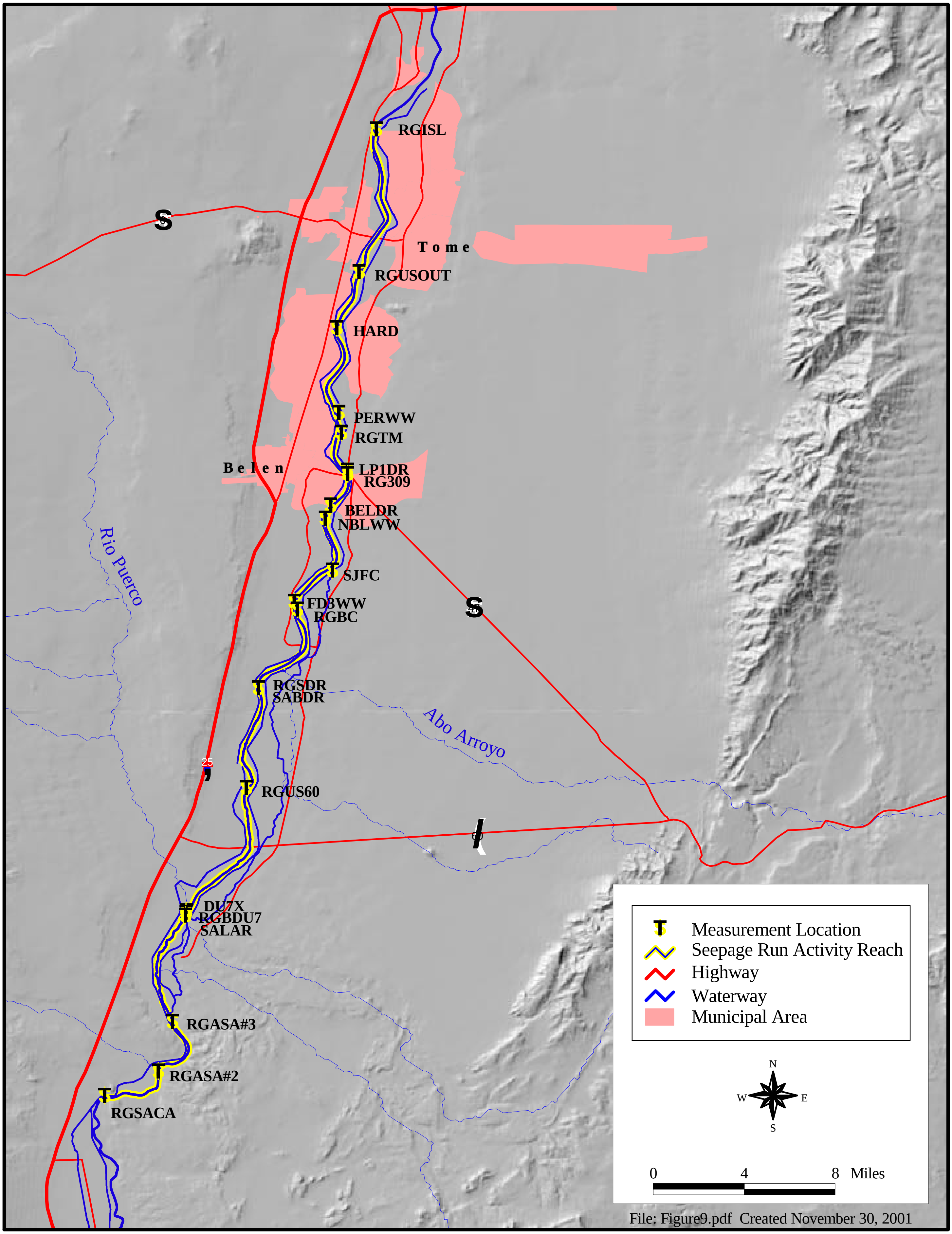

Figure 9. Seepage Run Activity S4-07

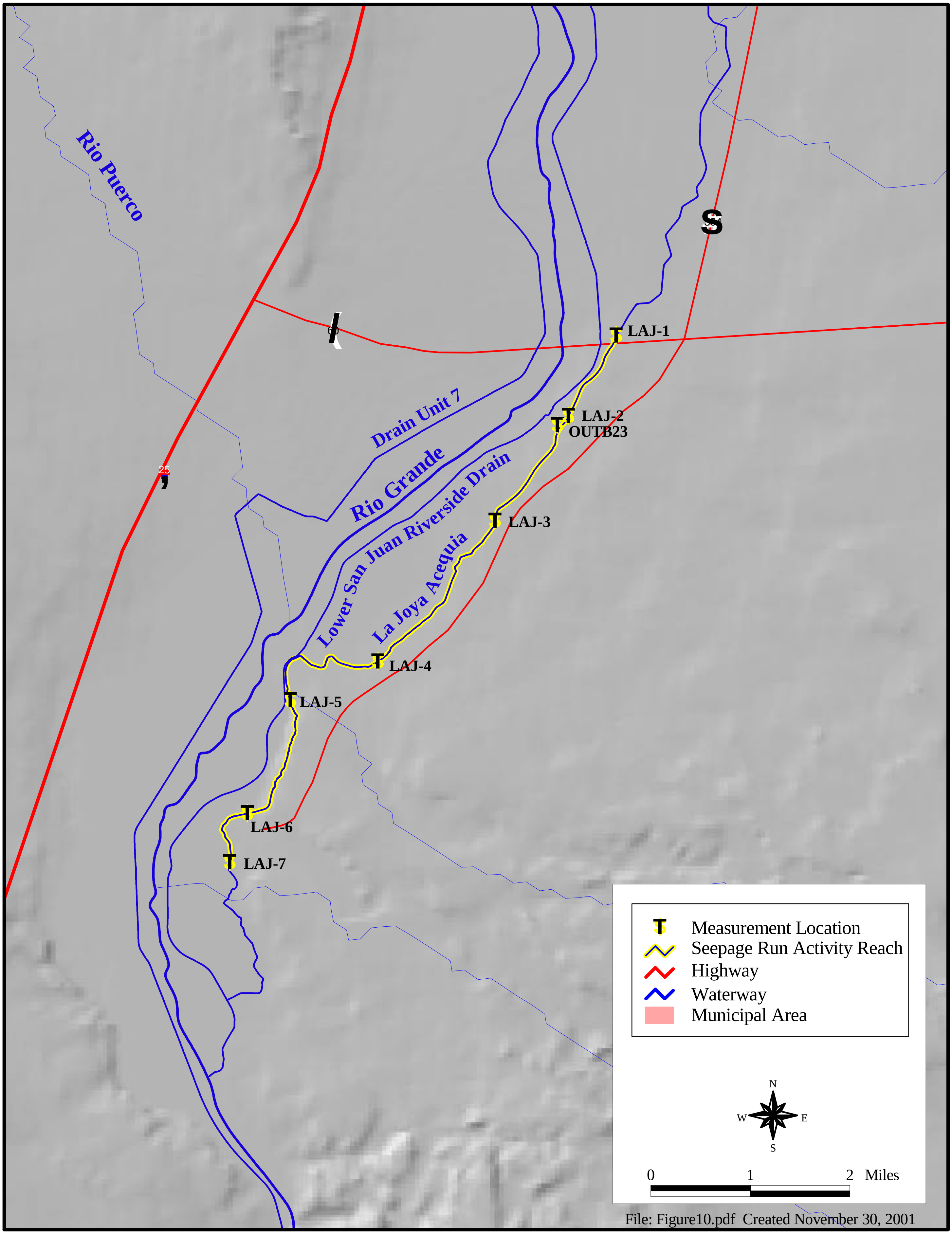

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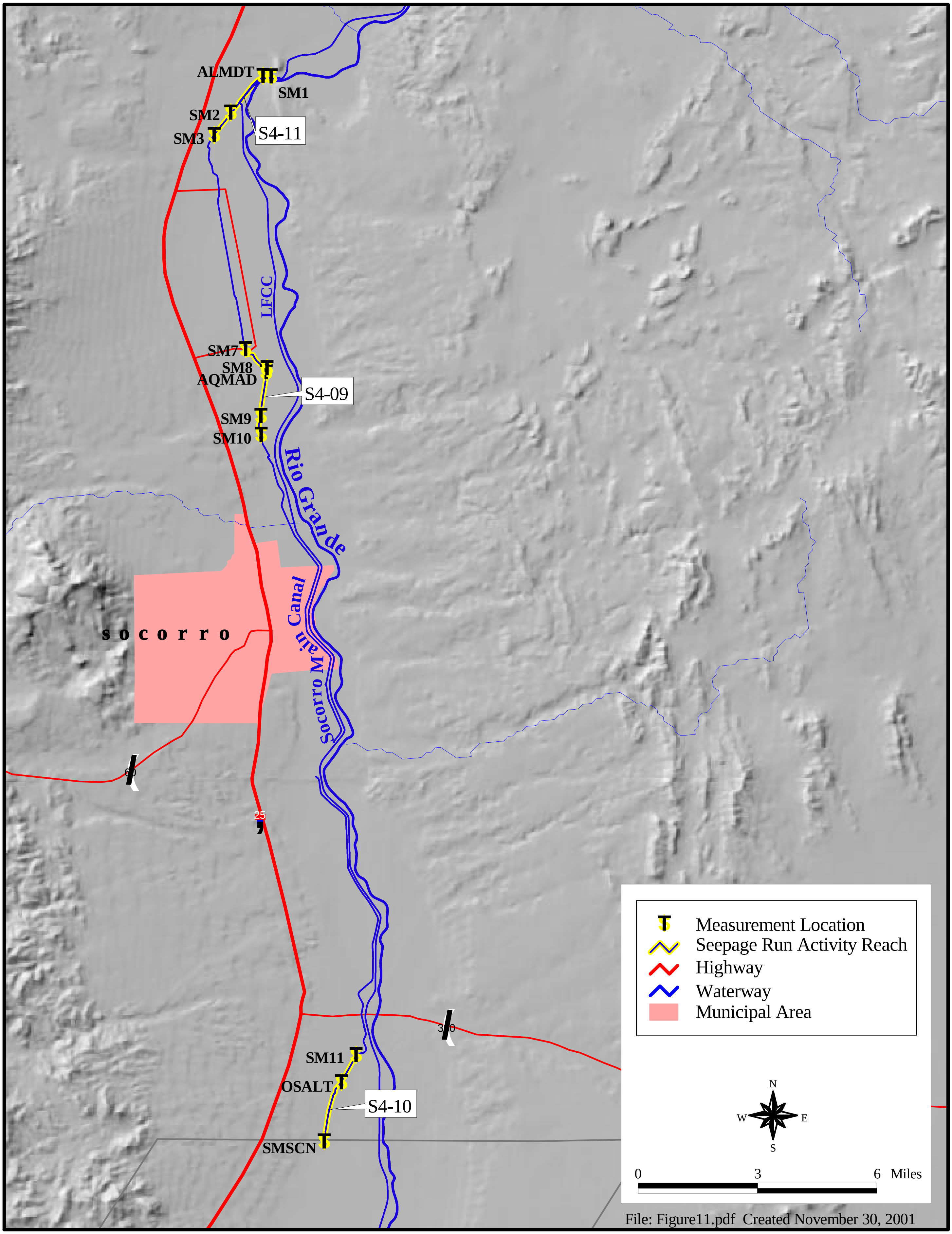
Figure 10. Seepage Run Activity S4-08



File: Figure11.pdf Created November 30, 2001

Figure 11. Seepage Run Activities S4-09, S4-10, and S4-11

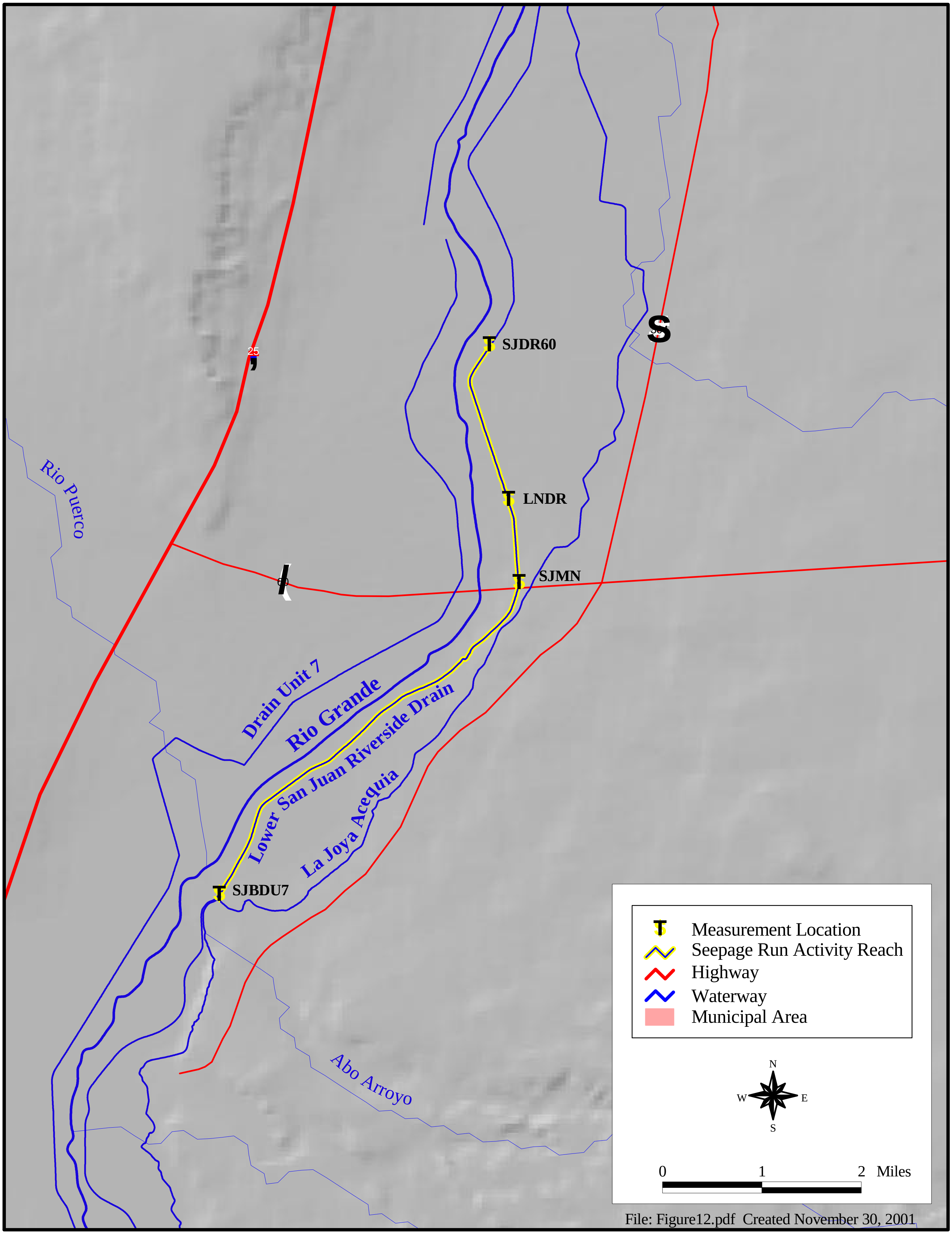


Figure 12. Seepage Run Activity S4-12

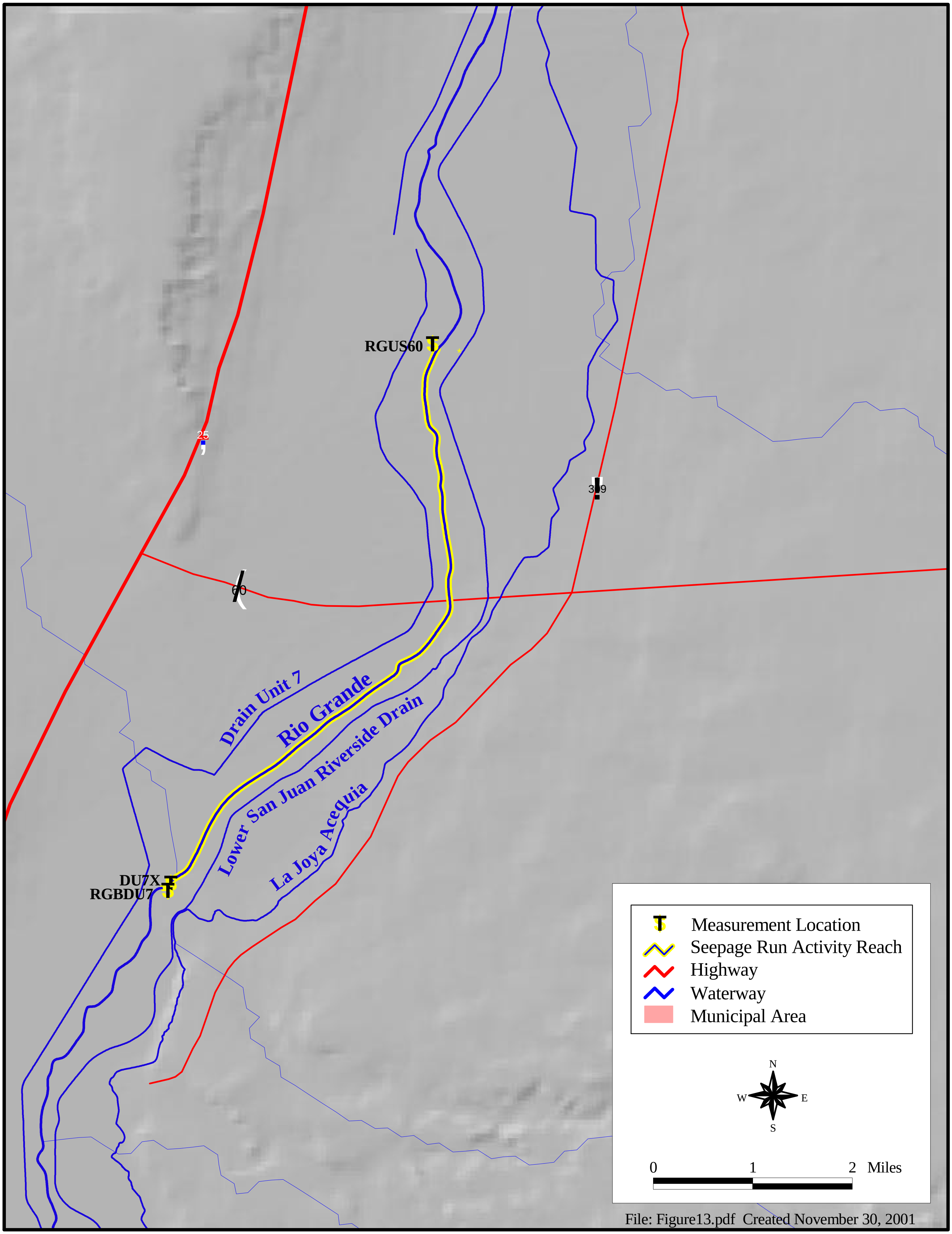


Figure 13. Seepage Run Activity S4-13

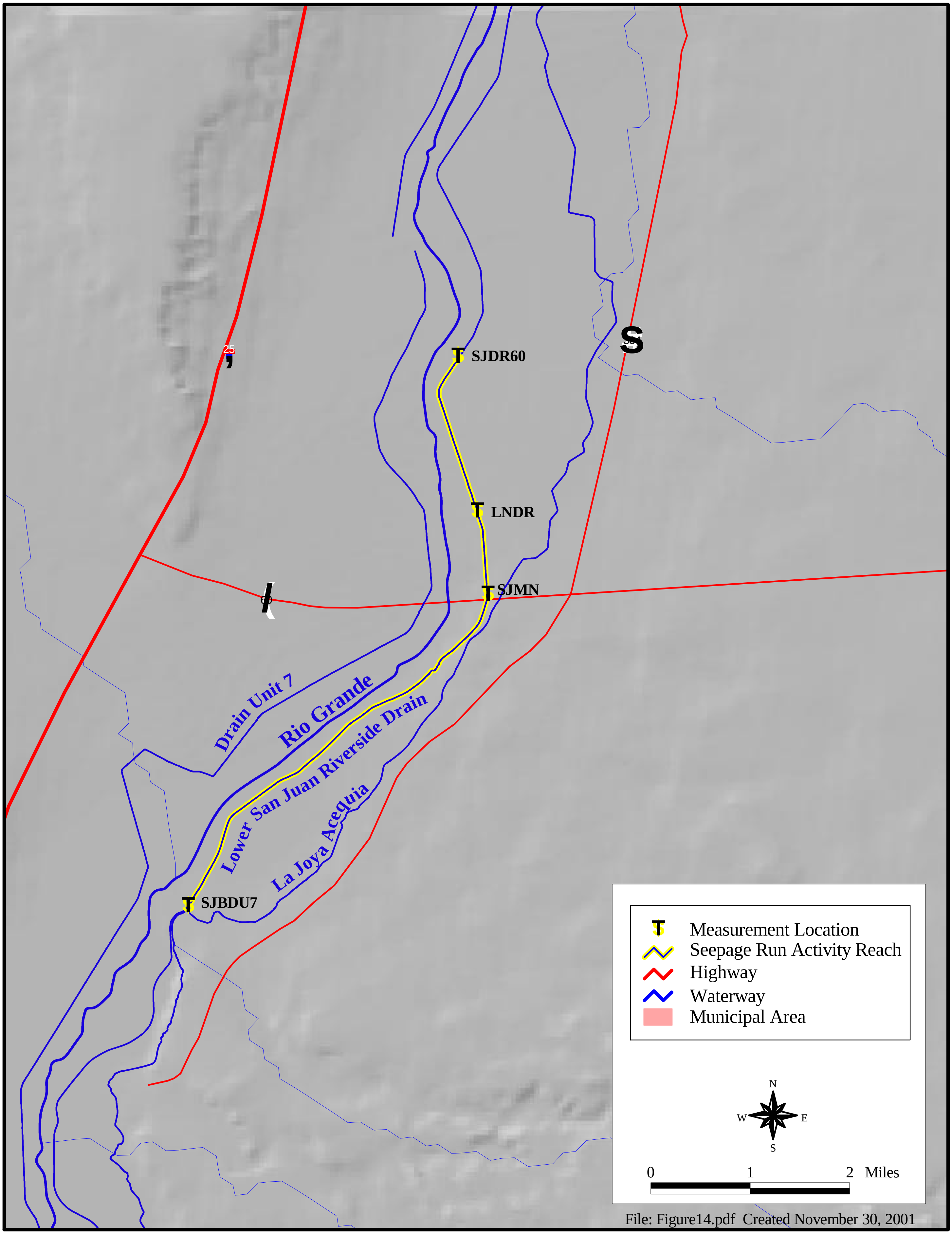


Figure 14. Seepage Run Activity S4-15

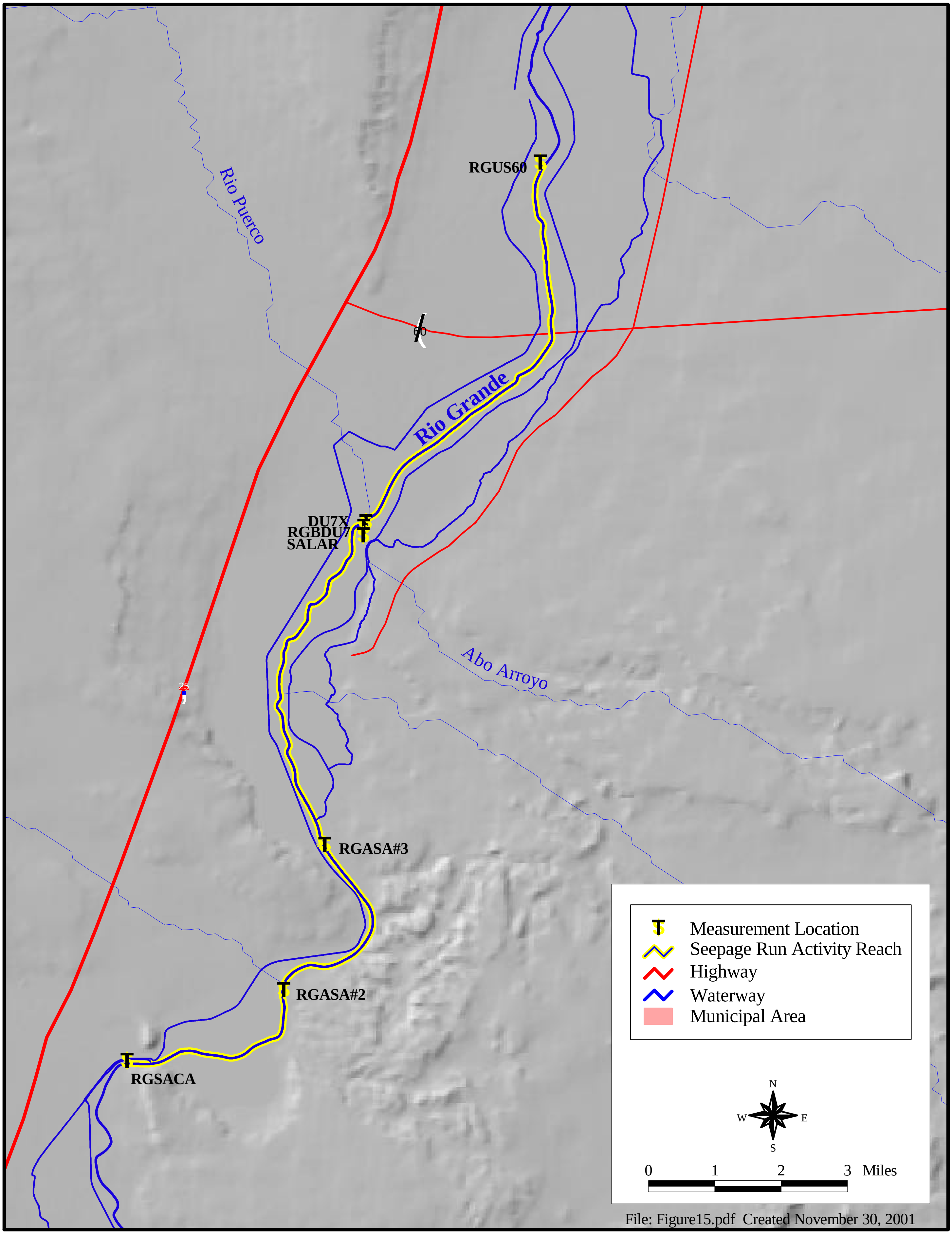


Figure 15. Seepage Run Activity S4-16

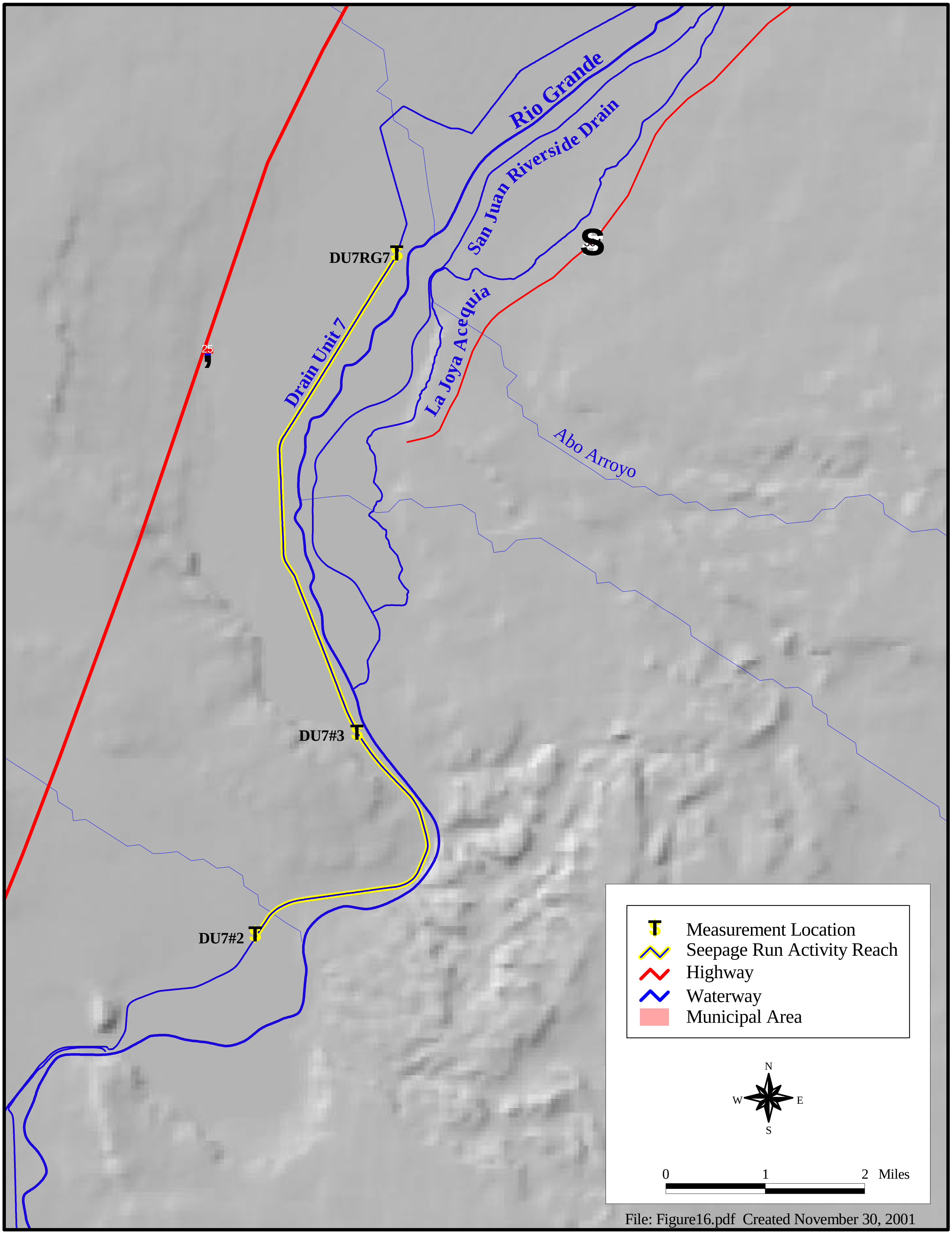
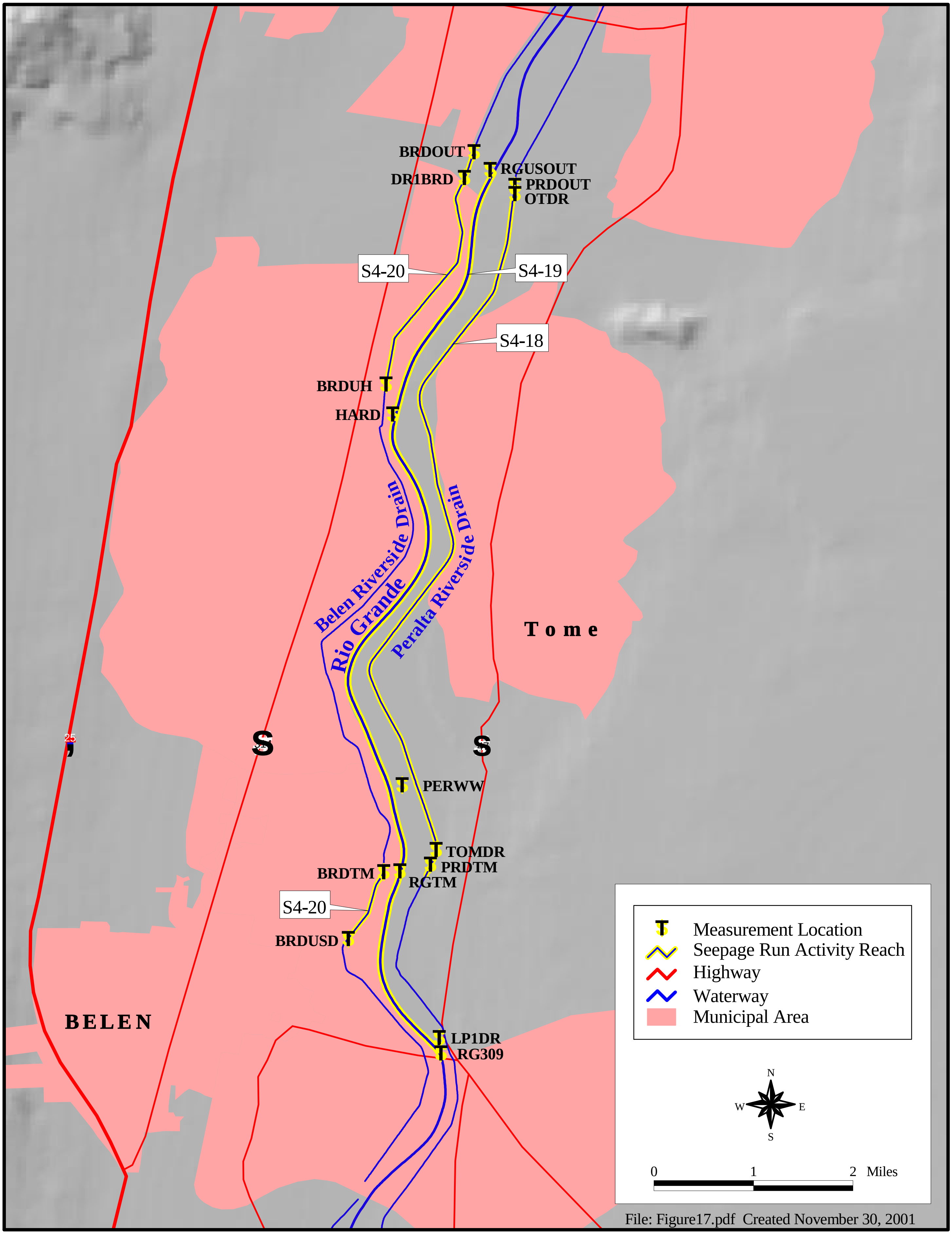


Figure 16. Seepage Run Activity S4-17



File: Figure17.pdf Created November 30, 2001

Figure 17. Seepage Run Activities S4-18, S4-19, and S4-20

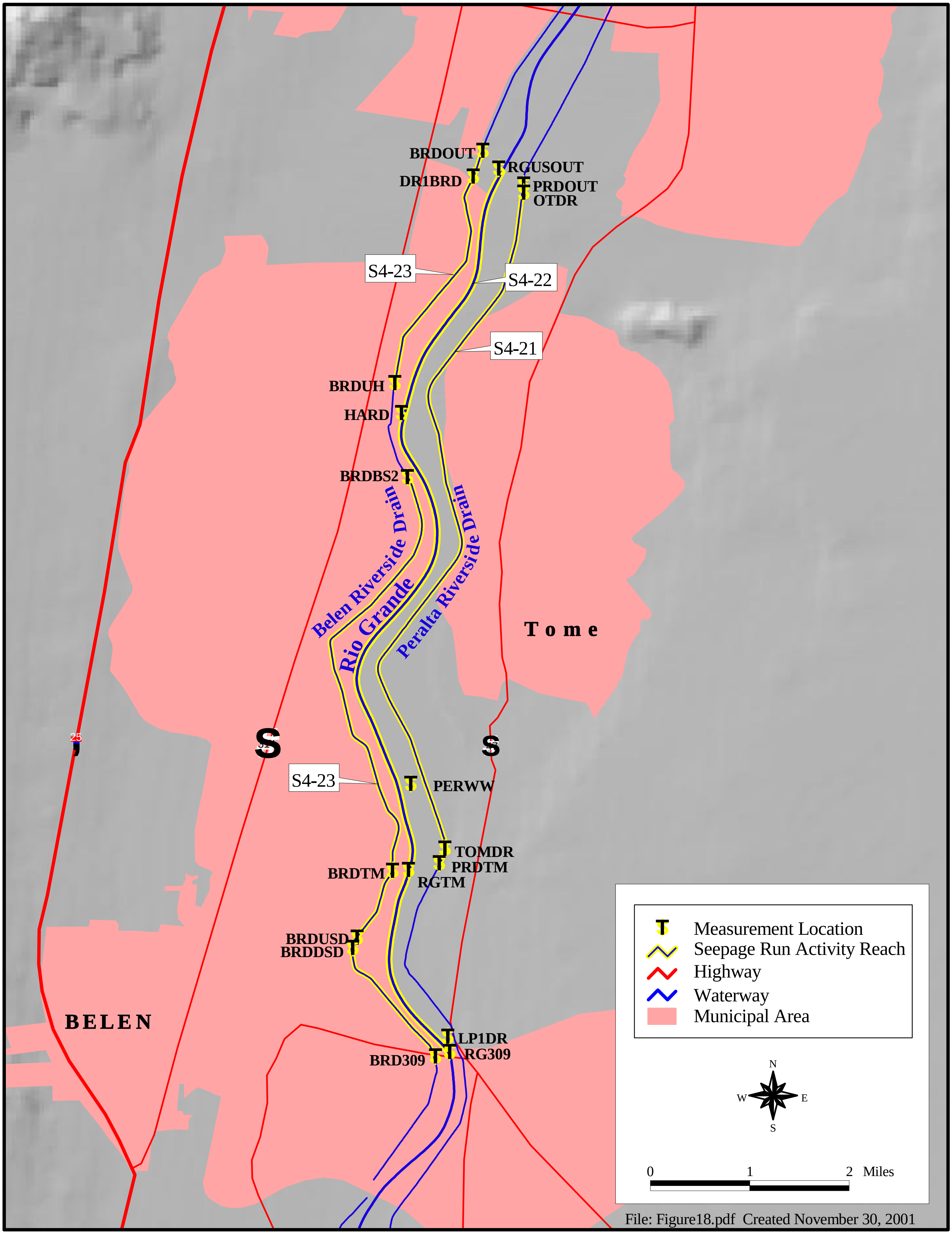
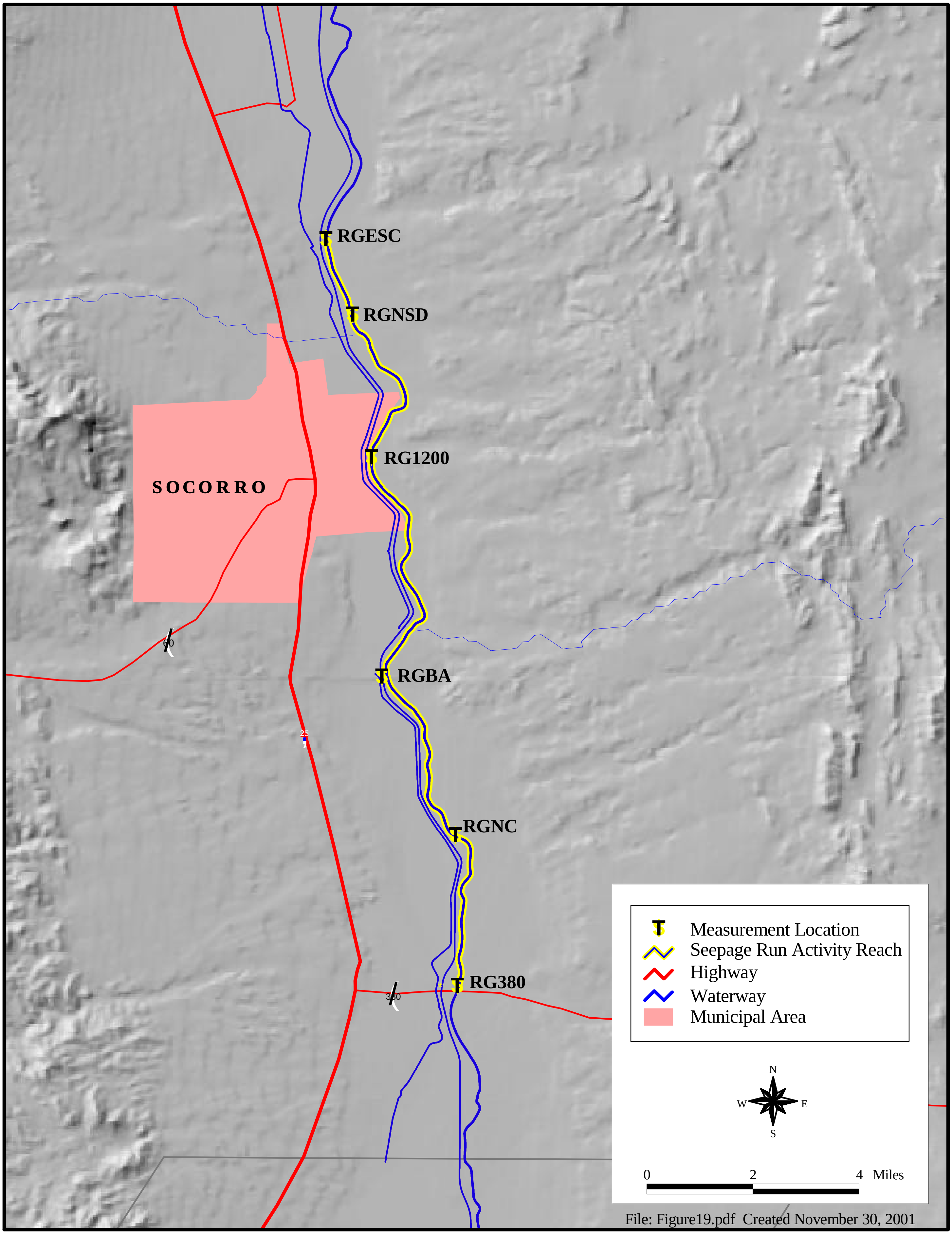


Figure 18. Seepage Run Activities S4-21, S4-22, and S4-23



File: Figure19.pdf Created November 30, 2001

Figure 19. Seepage Run Activity S4-24

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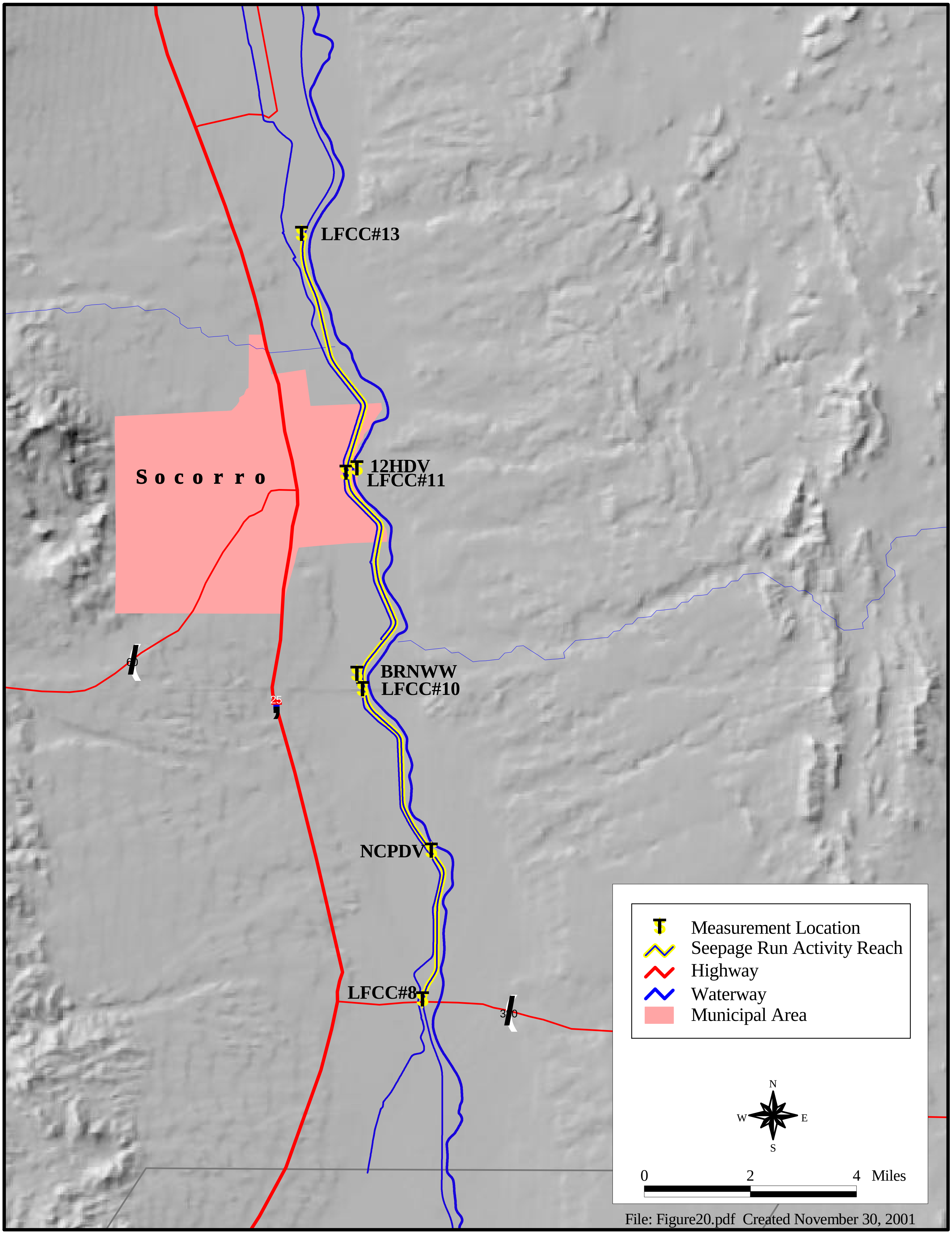
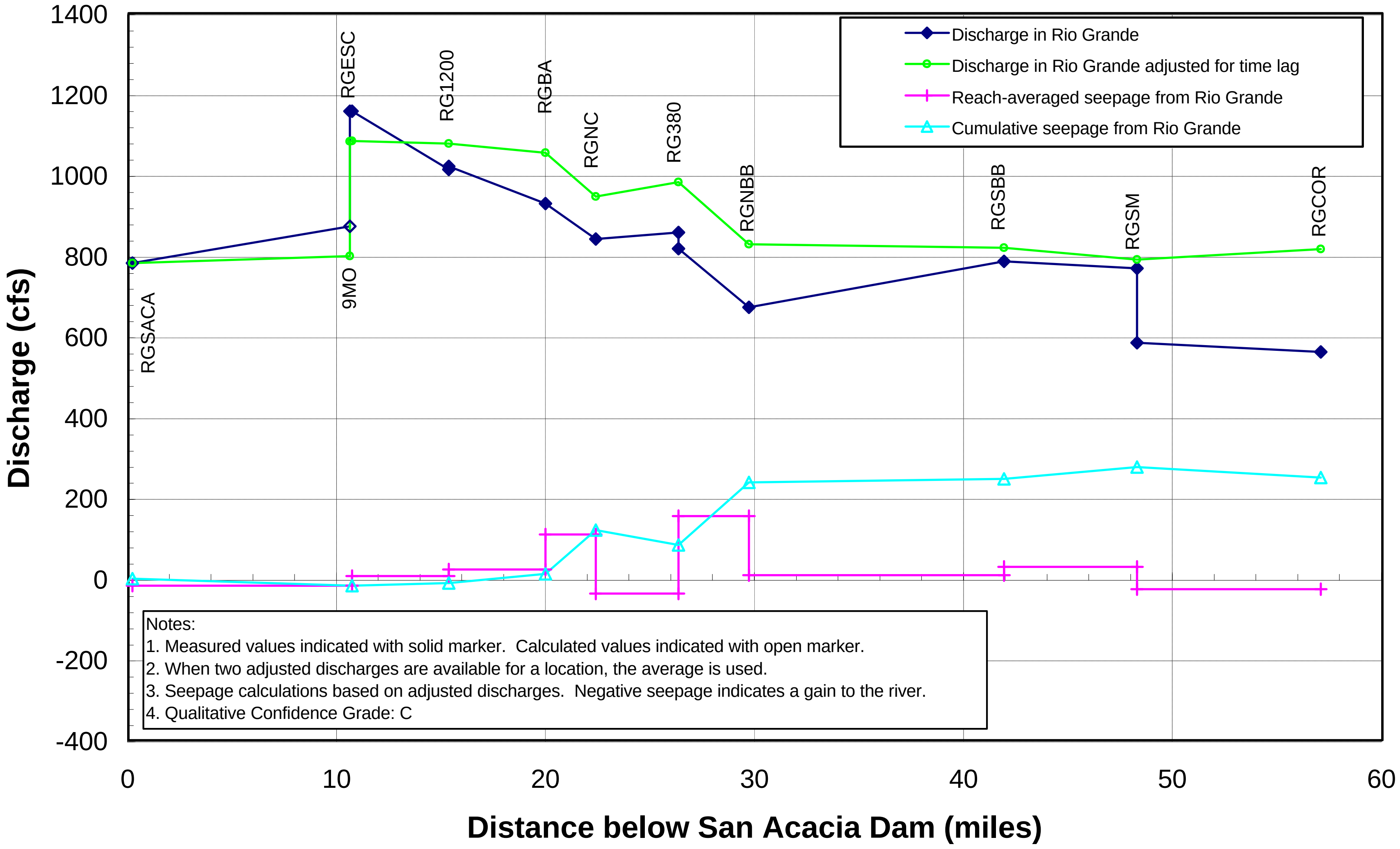


File: Figure20.pdf Created November 30, 2001

Figure 20. Seepage Run Activity S4-25

Figure 21

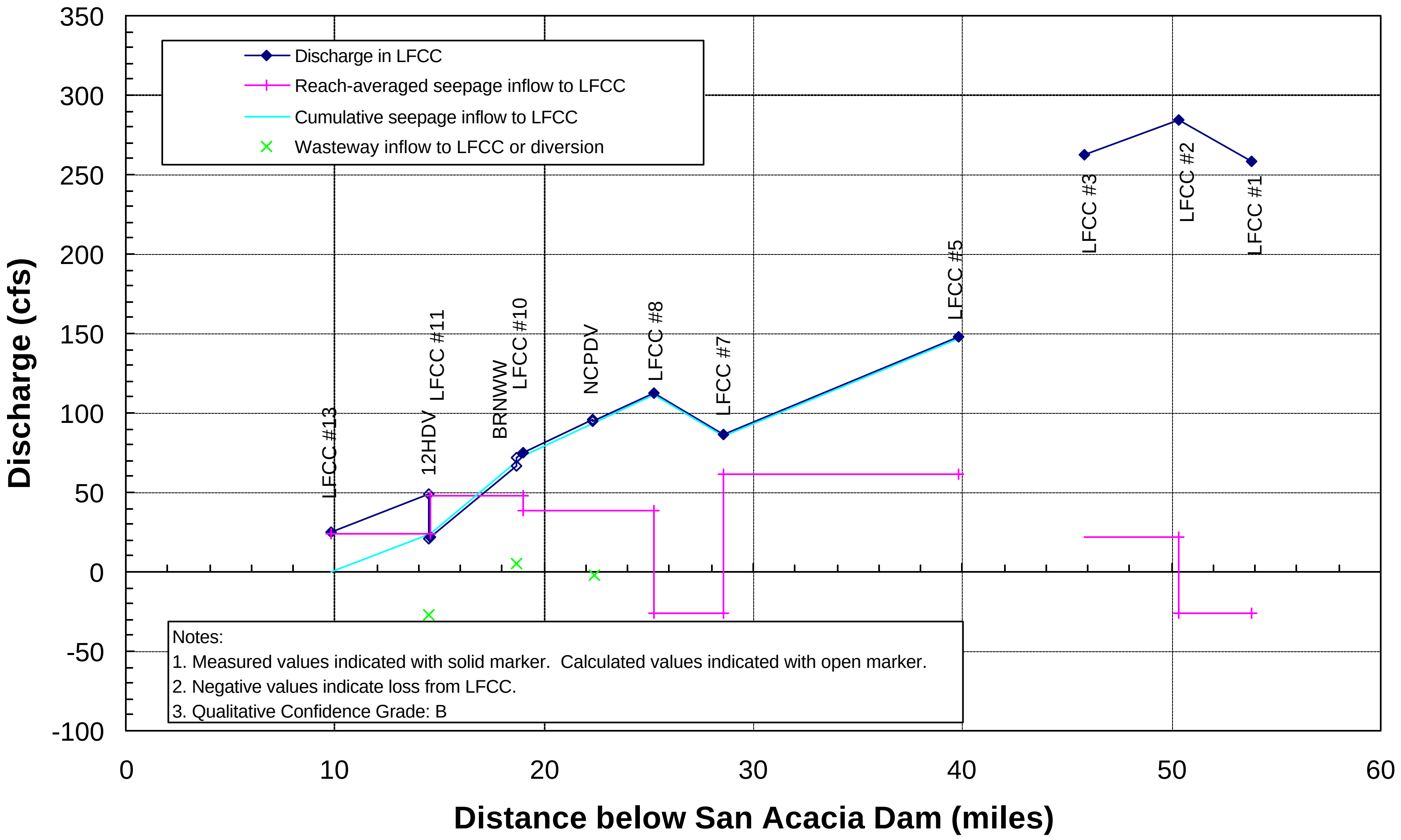
Measured Discharge, Adjusted Discharge, and Estimated Seepage for the Rio Grande Seepage Run, Socorro Division, S4-01, June 9-12, 2001



Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. When two adjusted discharges are available for a location, the average is used.
3. Seepage calculations based on adjusted discharges. Negative seepage indicates a gain to the river.
4. Qualitative Confidence Grade: C

Figure 22

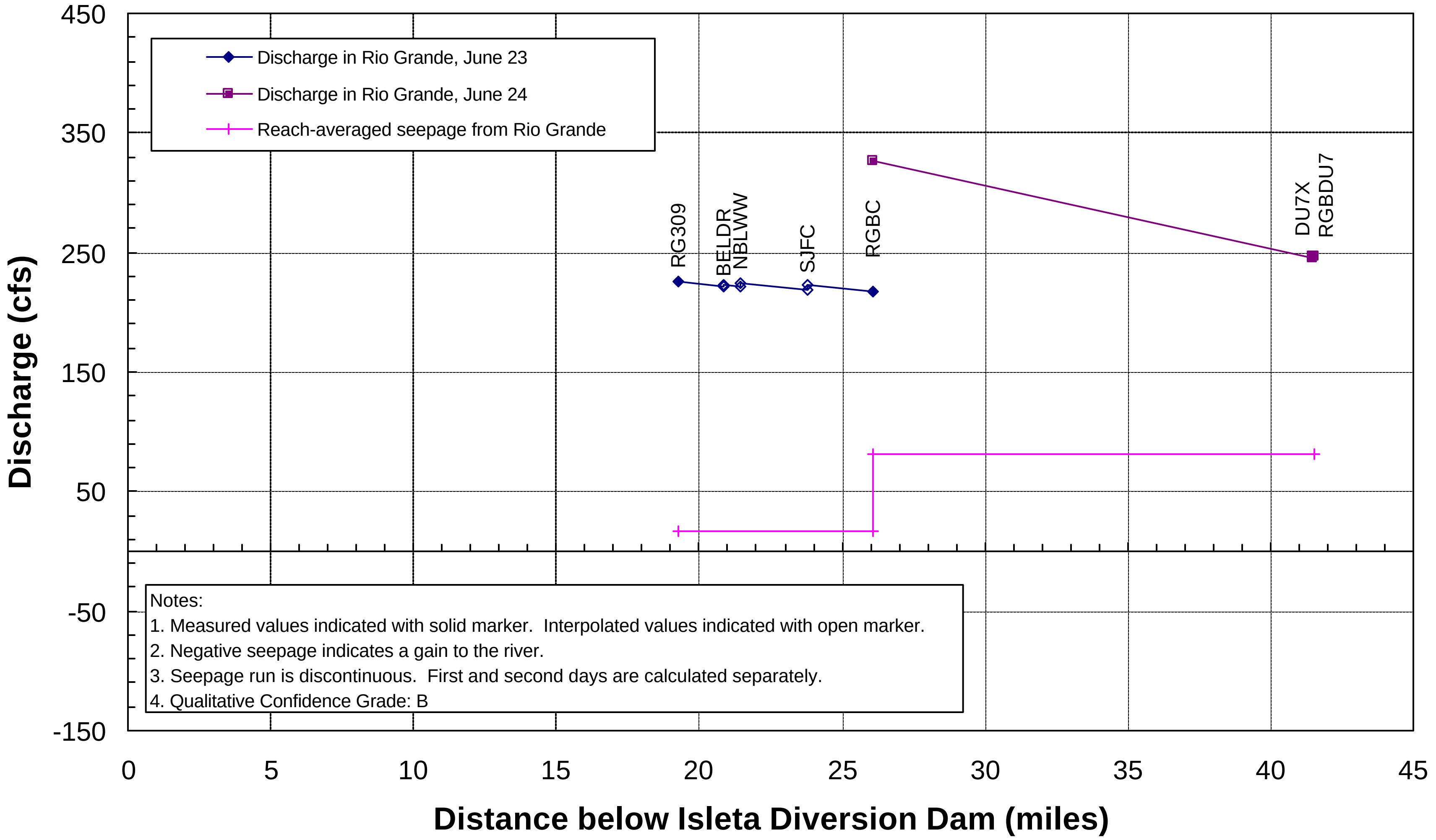
Measured Discharge and Estimated Seepage for the LFCC Seepage Run, Socorro Division, S4-02, June 10-13, 2001



Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. Negative values indicate loss from LFCC.
3. Qualitative Confidence Grade: B

Figure 23

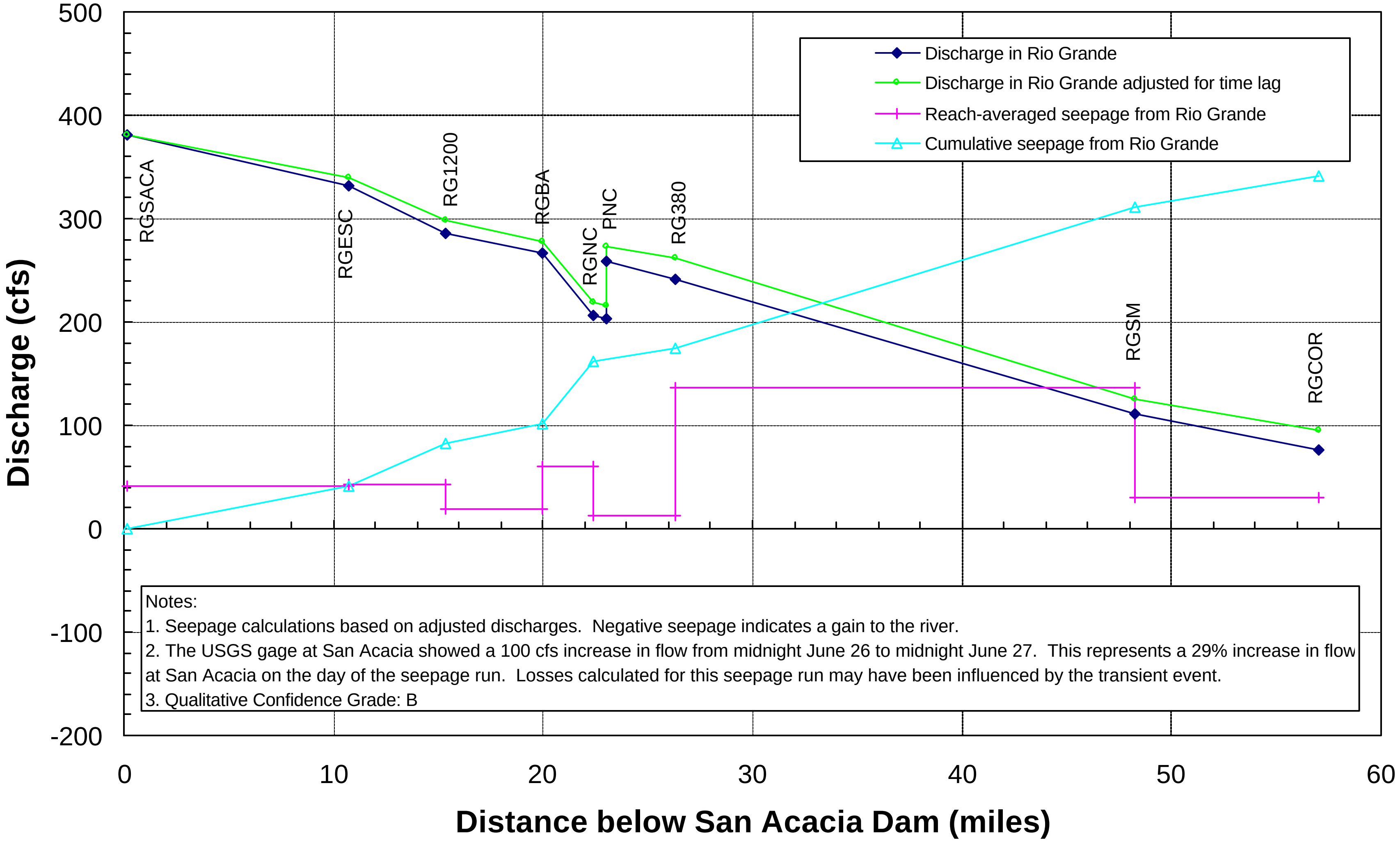
Measured Discharge and Estimated Seepage for the Rio Grande Seepage Run, Belen Division, S4-03, June 23-24, 2001



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Negative seepage indicates a gain to the river.
3. Seepage run is discontinuous. First and second days are calculated separately.
4. Qualitative Confidence Grade: B

Figure 24

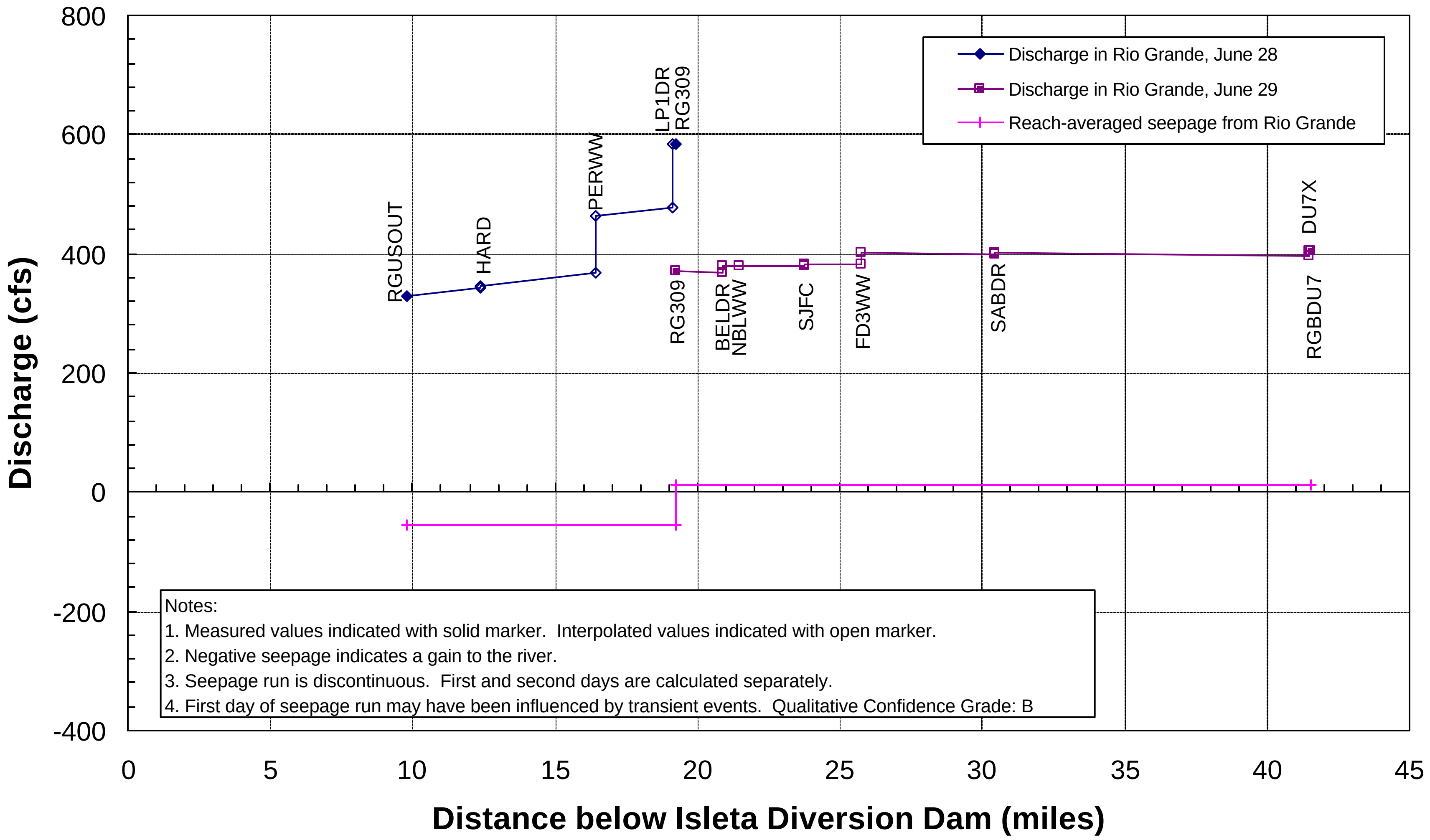
Measured Discharge, Adjusted Discharge, and Estimated Seepage for the Rio Grande Seepage Run, Socorro Division, S4-05, June 27, 2001



Notes:
1. Seepage calculations based on adjusted discharges. Negative seepage indicates a gain to the river.
2. The USGS gage at San Acacia showed a 100 cfs increase in flow from midnight June 26 to midnight June 27. This represents a 29% increase in flow at San Acacia on the day of the seepage run. Losses calculated for this seepage run may have been influenced by the transient event.
3. Qualitative Confidence Grade: B

Figure 25

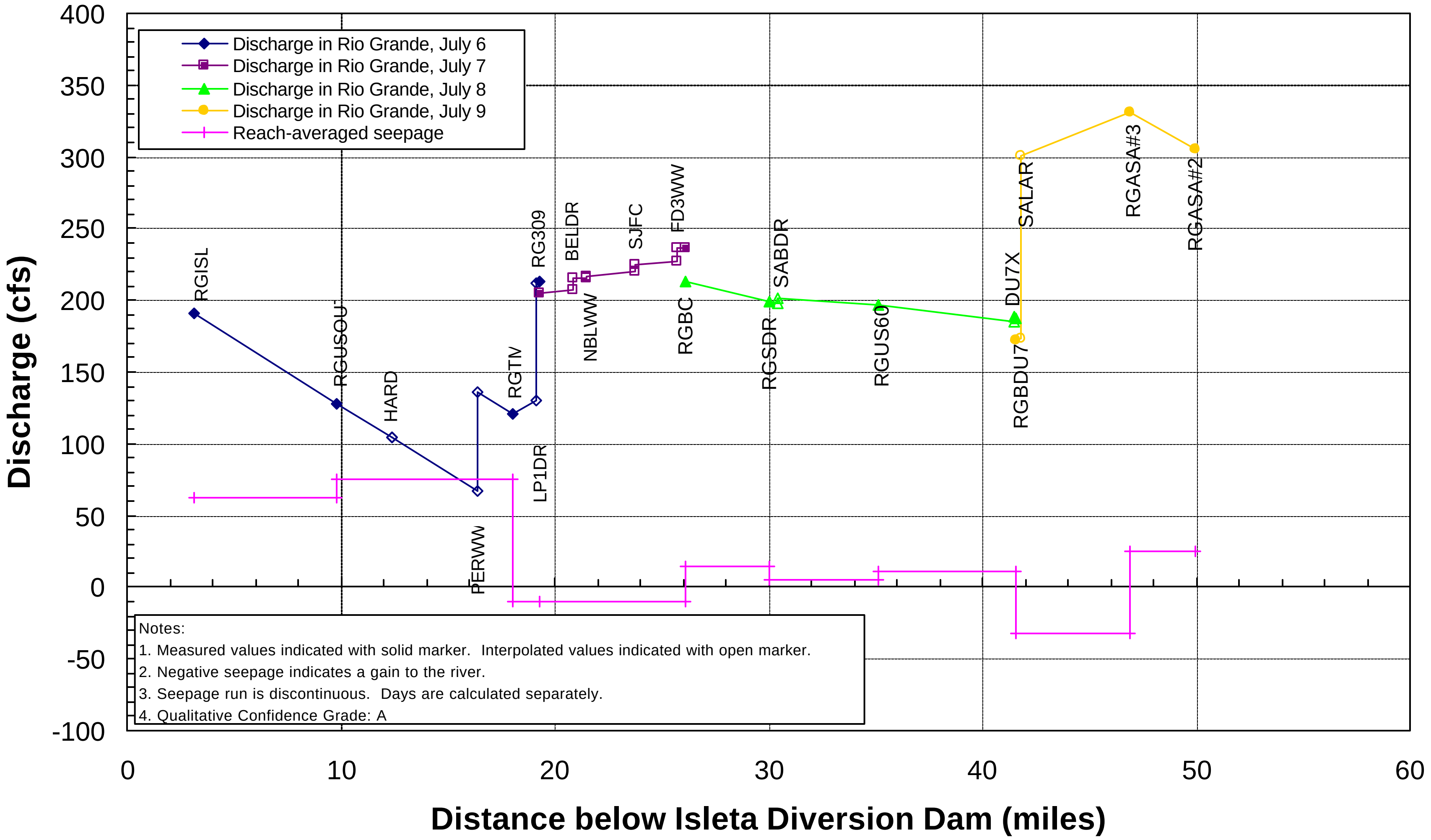
Measured Discharge and Estimated Seepage for the Rio Grande Seepage Run, Belen Division, S4-06, June 28-29, 2001



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Negative seepage indicates a gain to the river.
3. Seepage run is discontinuous. First and second days are calculated separately.
4. First day of seepage run may have been influenced by transient events. Qualitative Confidence Grade: B

Figure 26

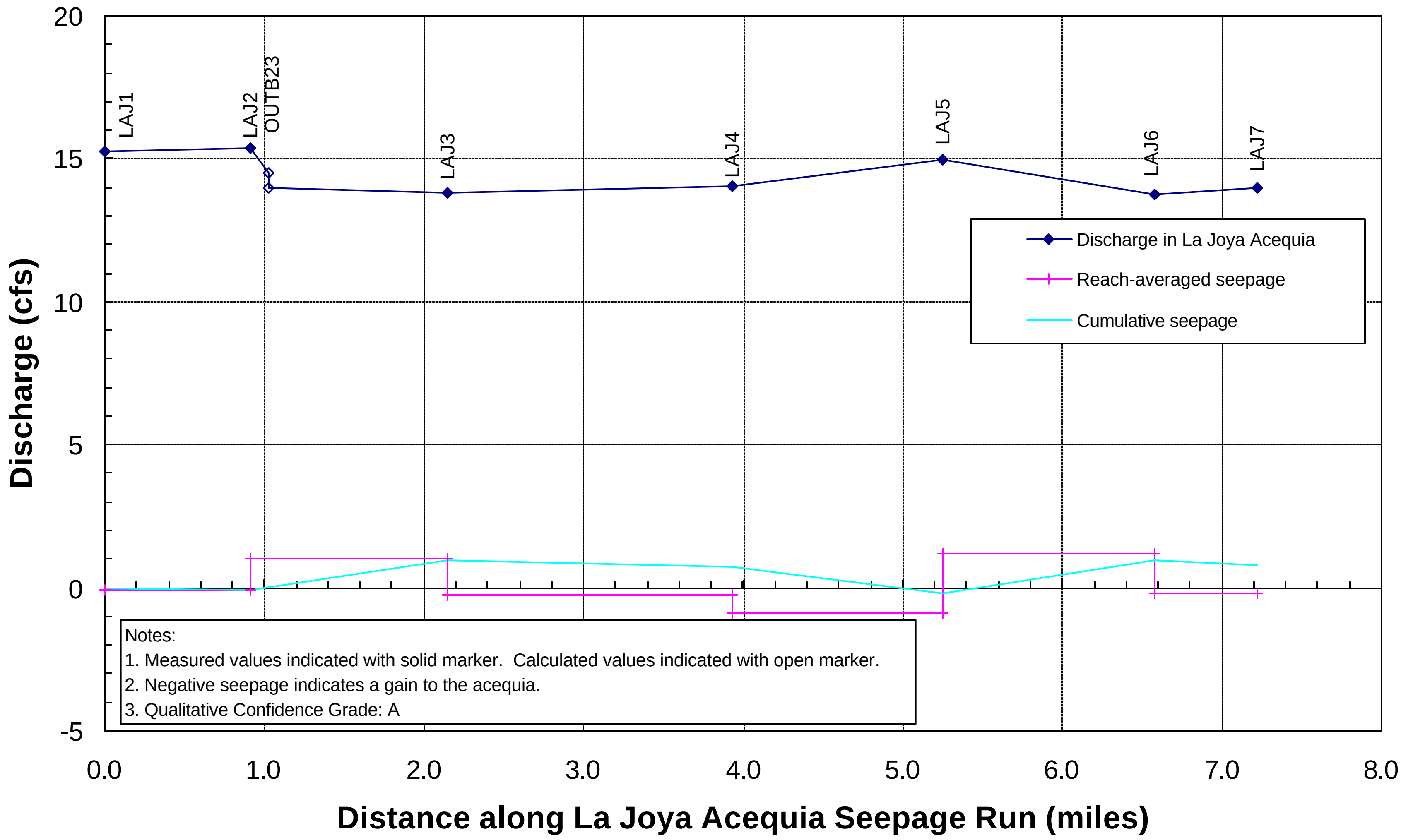
Measured Discharge and Estimated Seepage for the Rio Grande Seepage Run, Belen Division, S4-07, July 6-9, 2001



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Negative seepage indicates a gain to the river.
3. Seepage run is discontinuous. Days are calculated separately.
4. Qualitative Confidence Grade: A

Figure 27

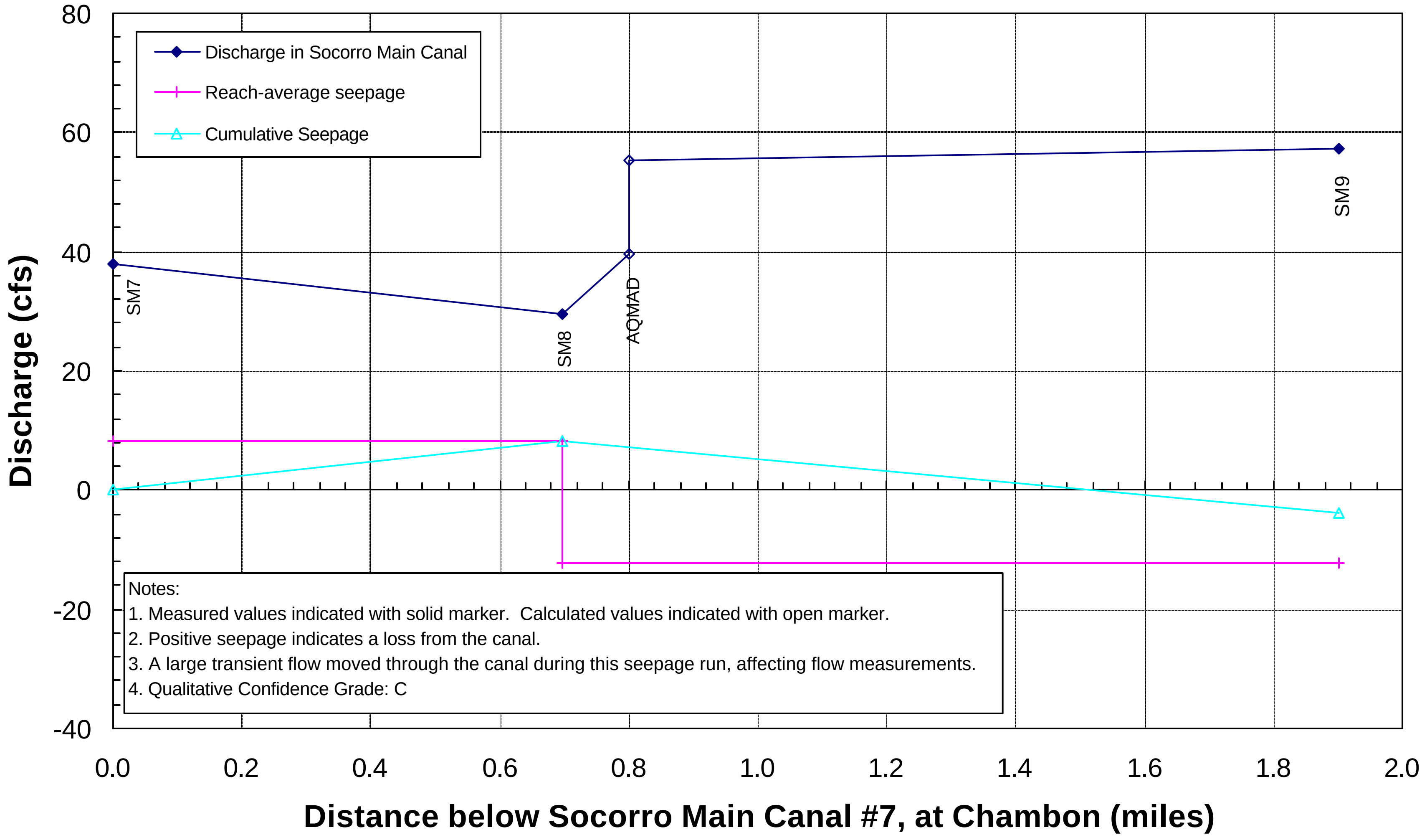
Measured Discharge and Estimated Seepage for the La Joya Acequia Seepage Run, Belen Division, S4-08, July 10, 2001



Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. Negative seepage indicates a gain to the acequia.
3. Qualitative Confidence Grade: A

Figure 28

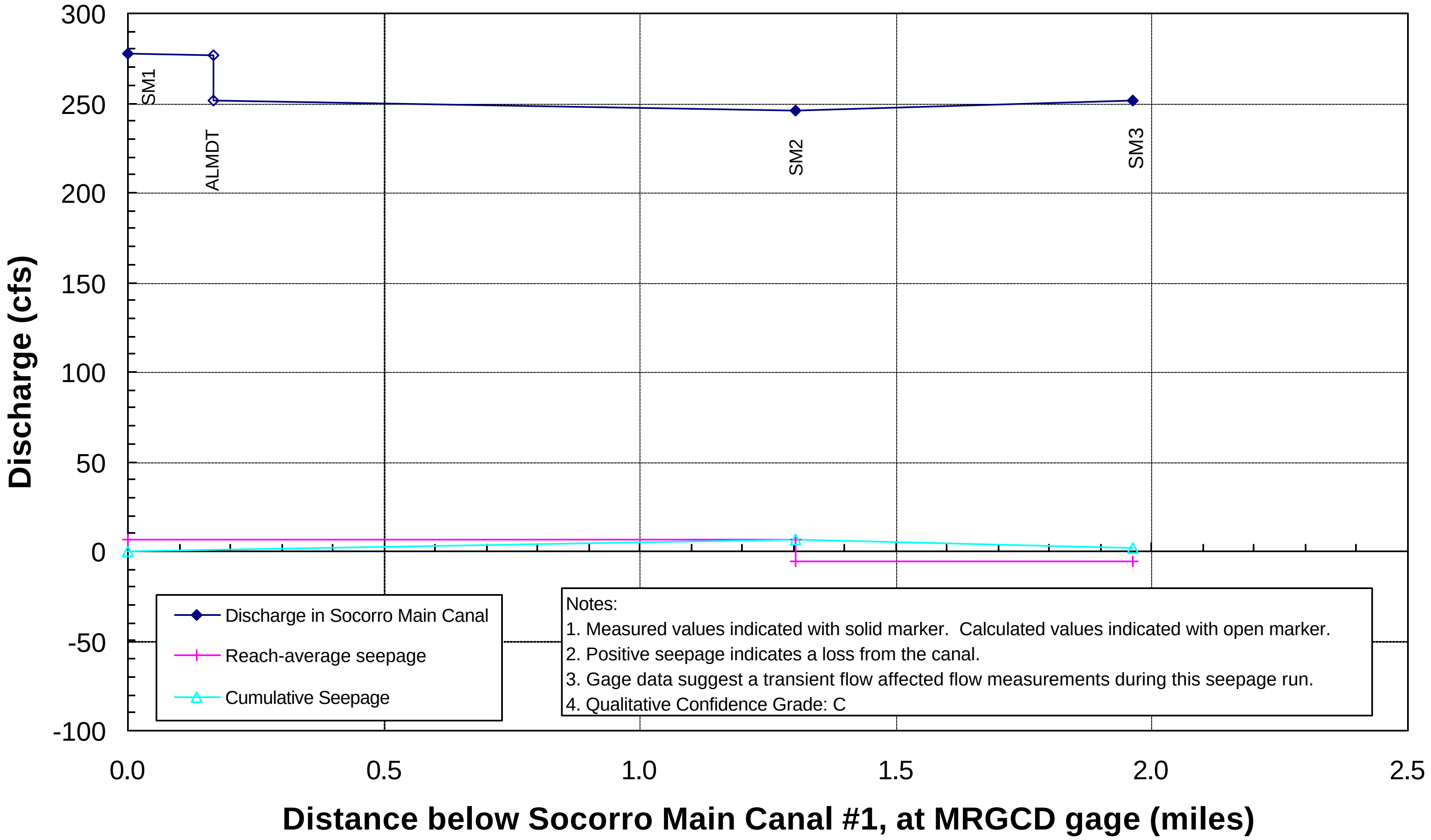
Measured Discharge and Estimated Seepage for the Socorro Main Canal Seepage Run, Socorro Division, S4-09, July 18, 2001



Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. Positive seepage indicates a loss from the canal.
3. A large transient flow moved through the canal during this seepage run, affecting flow measurements.
4. Qualitative Confidence Grade: C

Figure 29

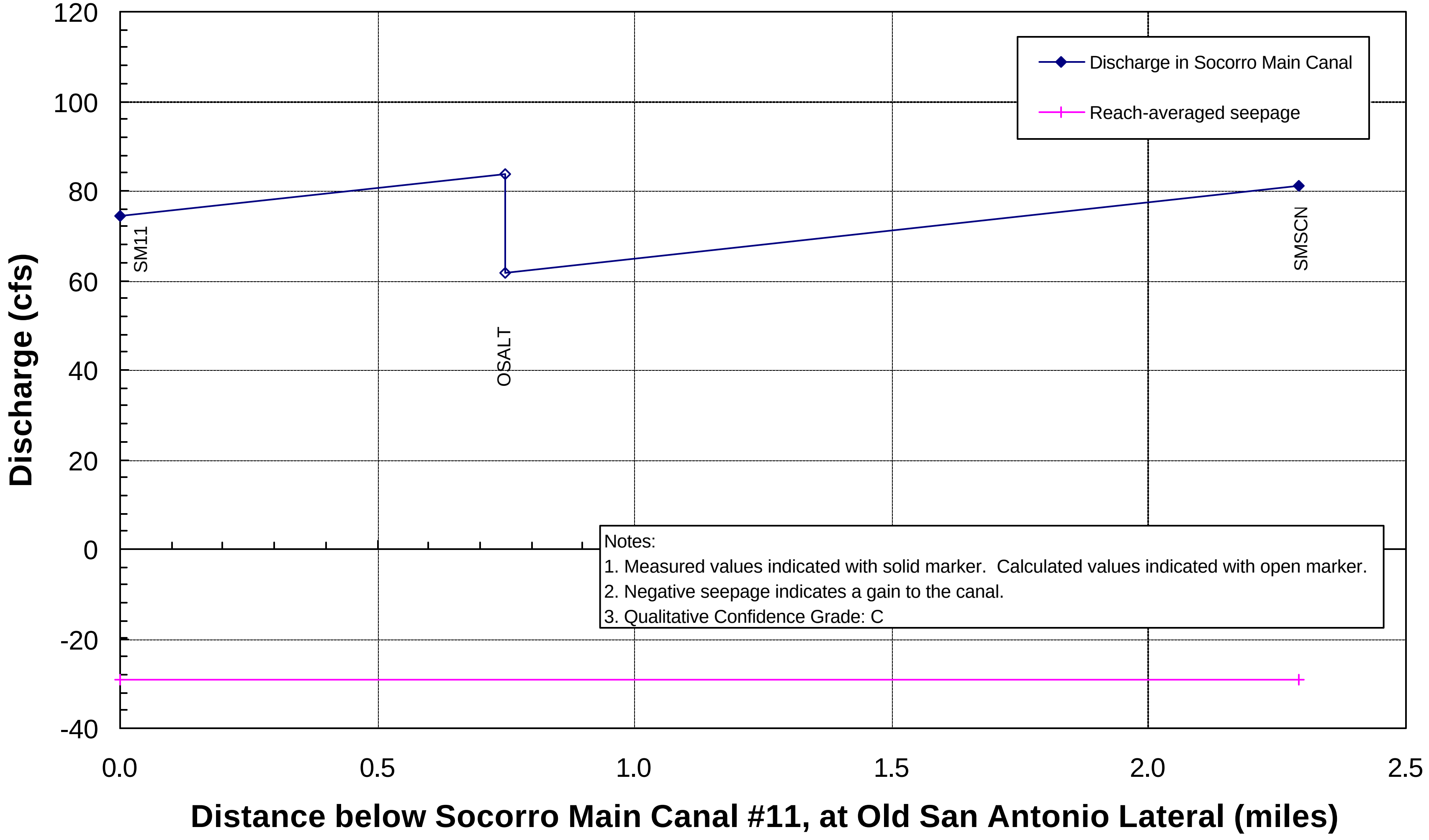
Measured Discharge and Estimated Seepage for the Socorro Main Canal Seepage Run, Socorro Division, S4-10, July 19, 2001



Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. Positive seepage indicates a loss from the canal.
3. Gage data suggest a transient flow affected flow measurements during this seepage run.
4. Qualitative Confidence Grade: C

Figure 30

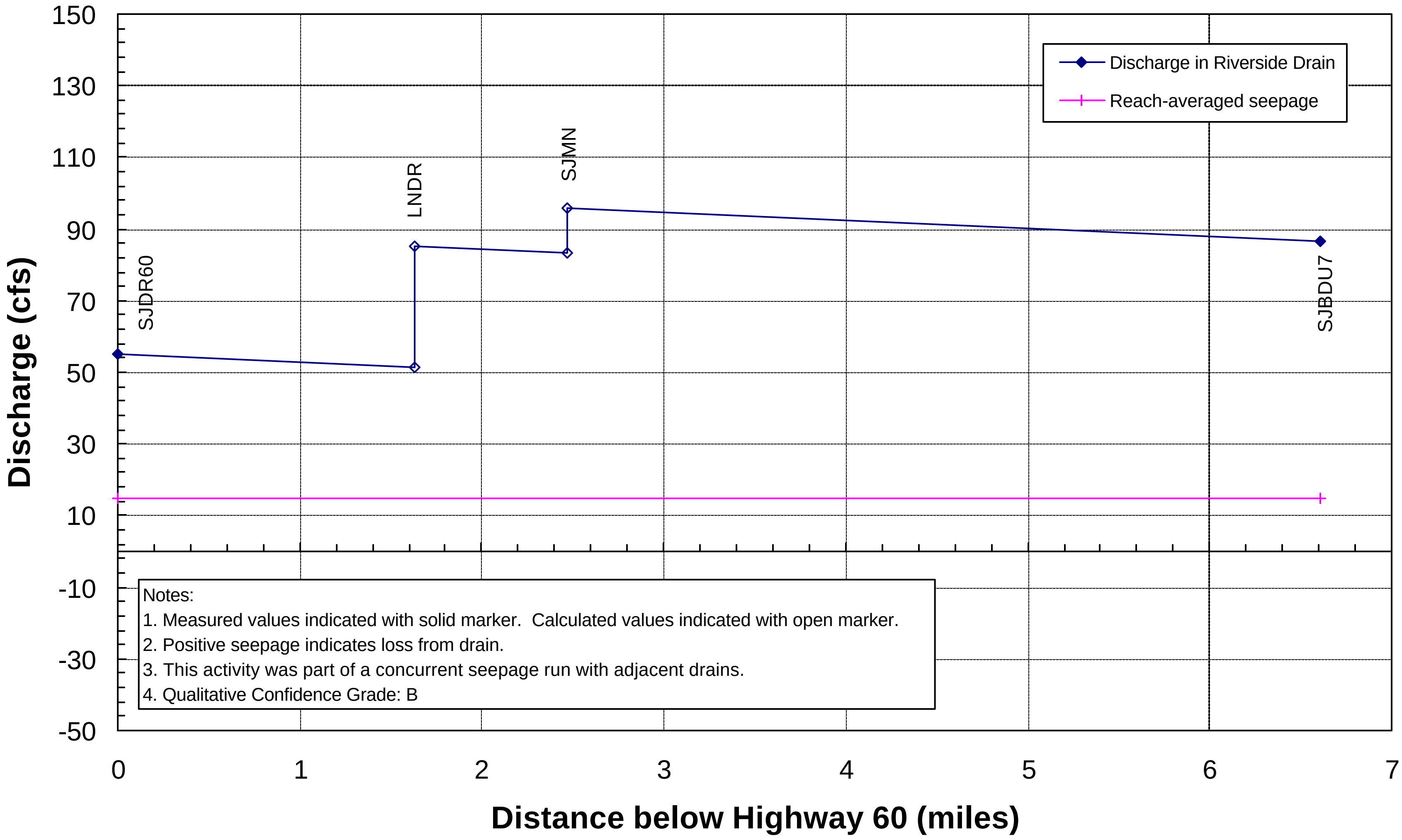
Measured Discharge and Estimated Seepage for the Socorro Main Canal Seepage Run, Socorro Division, S4-11, July 20, 2001



Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. Negative seepage indicates a gain to the canal.
3. Qualitative Confidence Grade: C

Figure 31

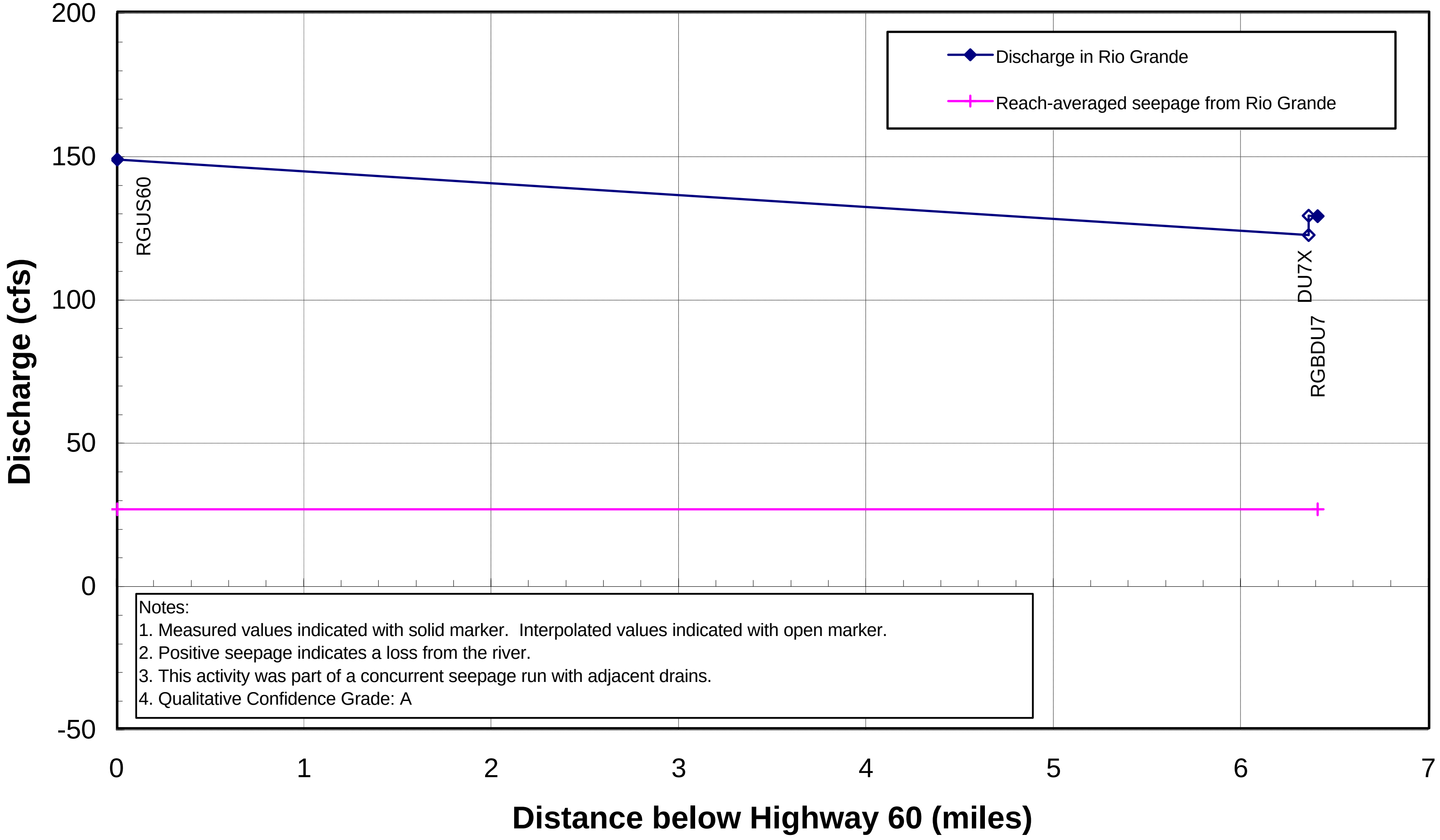
Measured Discharge and Estimated Seepage for the Lower San Juan Riverside Drain Seepage Run, Belen Division, S4-12, July 22, 2001



Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. Positive seepage indicates loss from drain.
3. This activity was part of a concurrent seepage run with adjacent drains.
4. Qualitative Confidence Grade: B

Figure 32

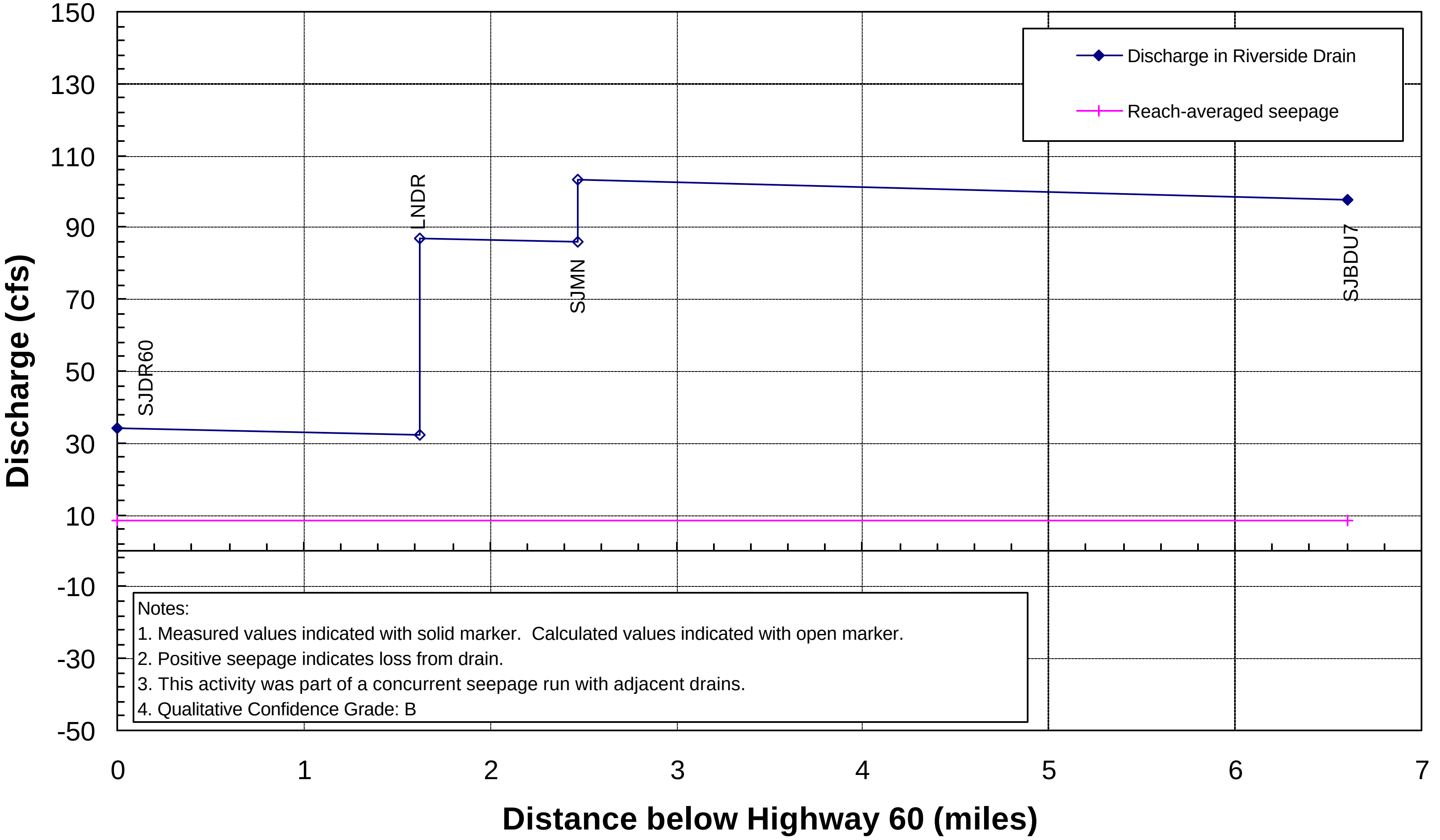
Measured Discharge and Estimated Seepage for the Belen Division Rio Grande Seepage Run, Belen Division, S4-13, July 22, 2001



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Positive seepage indicates a loss from the river.
3. This activity was part of a concurrent seepage run with adjacent drains.
4. Qualitative Confidence Grade: A

Figure 33

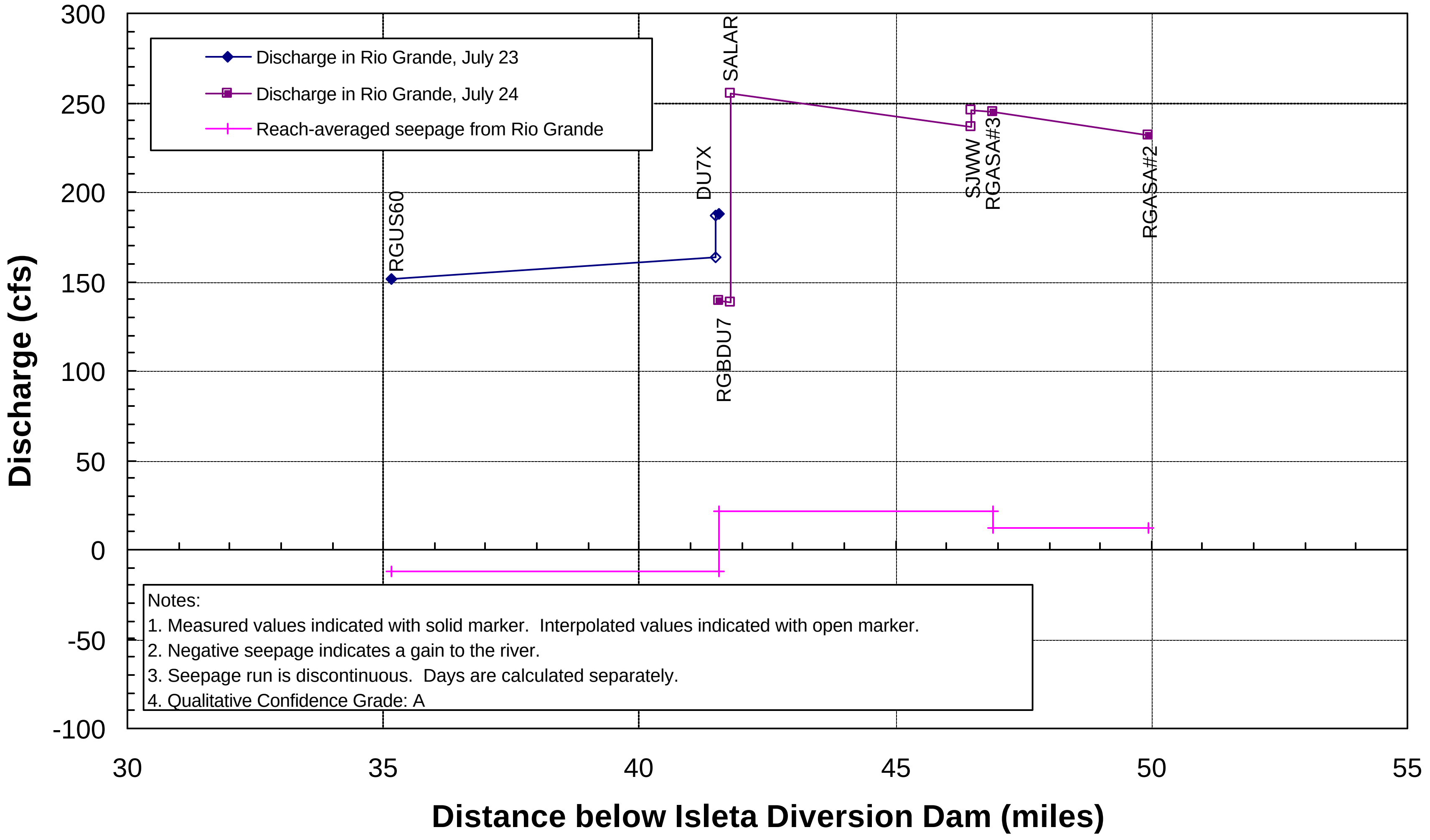
Measured Discharge and Estimated Seepage for the Lower San Juan Riverside Drain Seepage Run, Belen Division, S4-15, July 23, 2001



Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. Positive seepage indicates loss from drain.
3. This activity was part of a concurrent seepage run with adjacent drains.
4. Qualitative Confidence Grade: B

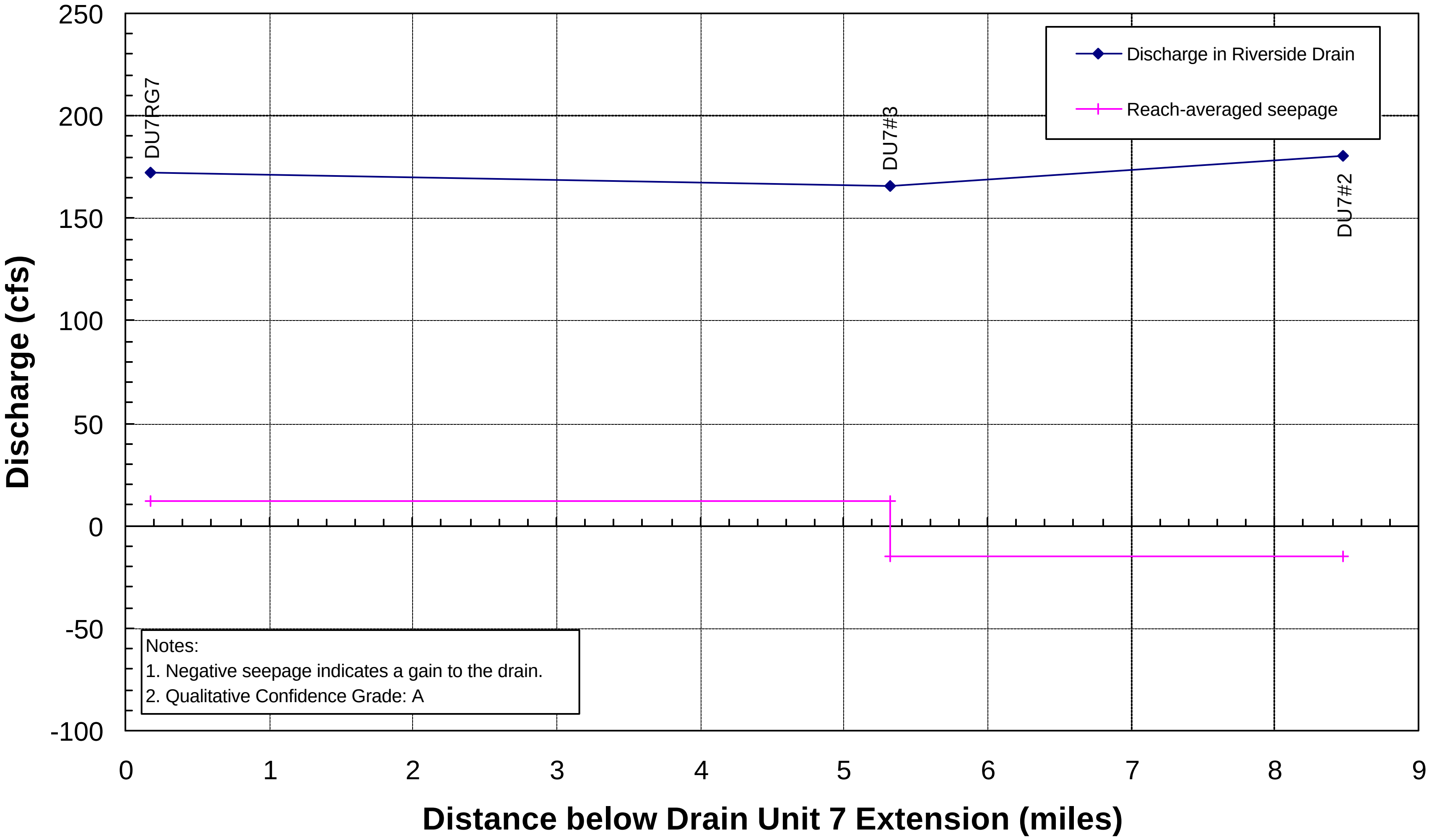
Figure 34

Measured Discharge and Estimated Seepage for the Rio Grande Seepage Run, Belen Division, S4-16, July 23-24, 2001



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Negative seepage indicates a gain to the river.
3. Seepage run is discontinuous. Days are calculated separately.
4. Qualitative Confidence Grade: A

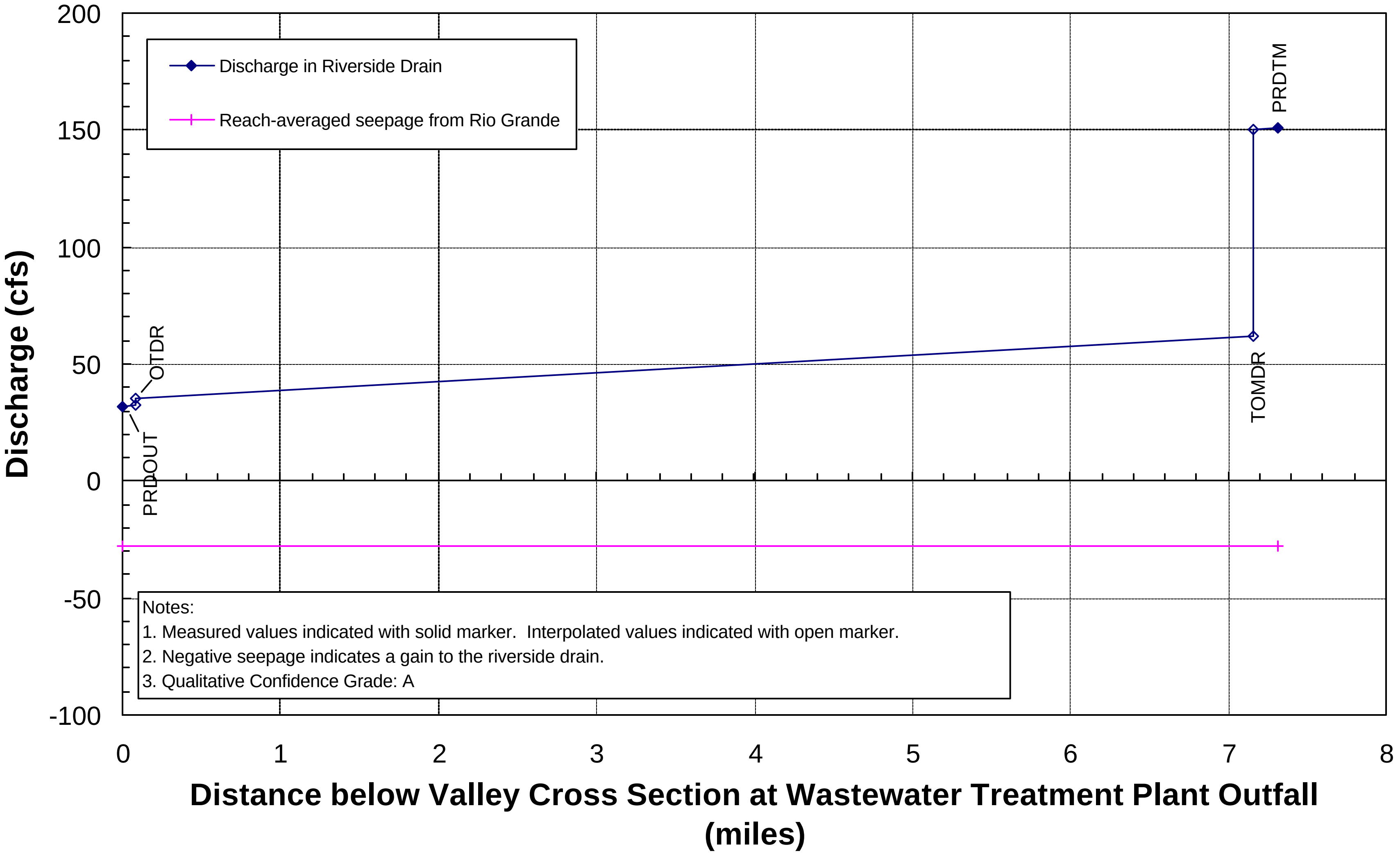
Figure 35



Notes:
1. Negative seepage indicates a gain to the drain.
2. Qualitative Confidence Grade: A

Figure 36

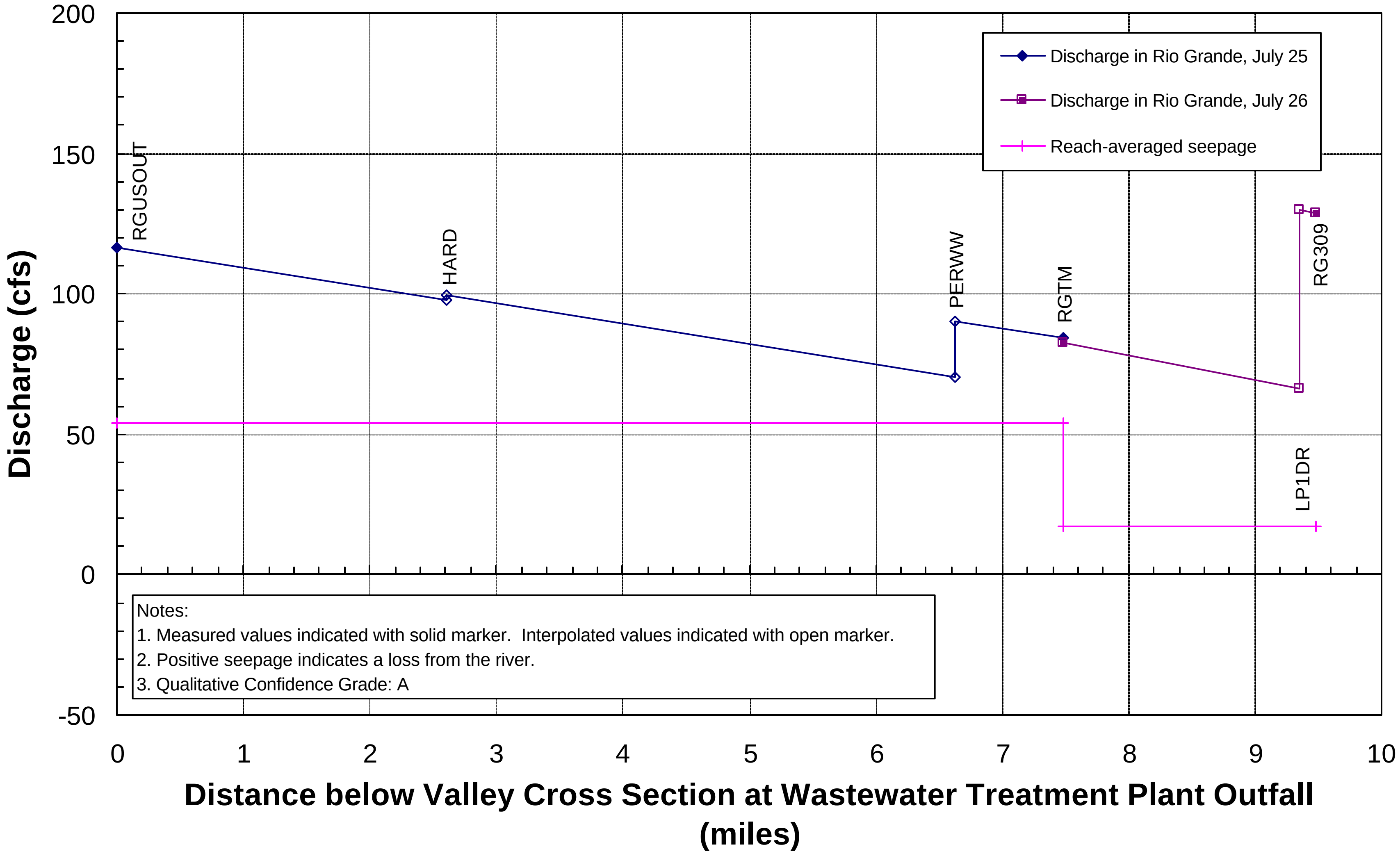
Measured Discharge and Estimated Seepage for the Peralta Riverside Drain Seepage Run, Belen Division, S4-18, July 25, 2001



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Negative seepage indicates a gain to the riverside drain.
3. Qualitative Confidence Grade: A

Figure 37

Measured Discharge and Estimated Seepage for the Rio Grande Seepage Run, Belen Division, S4-19, July 25-26, 2001



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Positive seepage indicates a loss from the river.
3. Qualitative Confidence Grade: A

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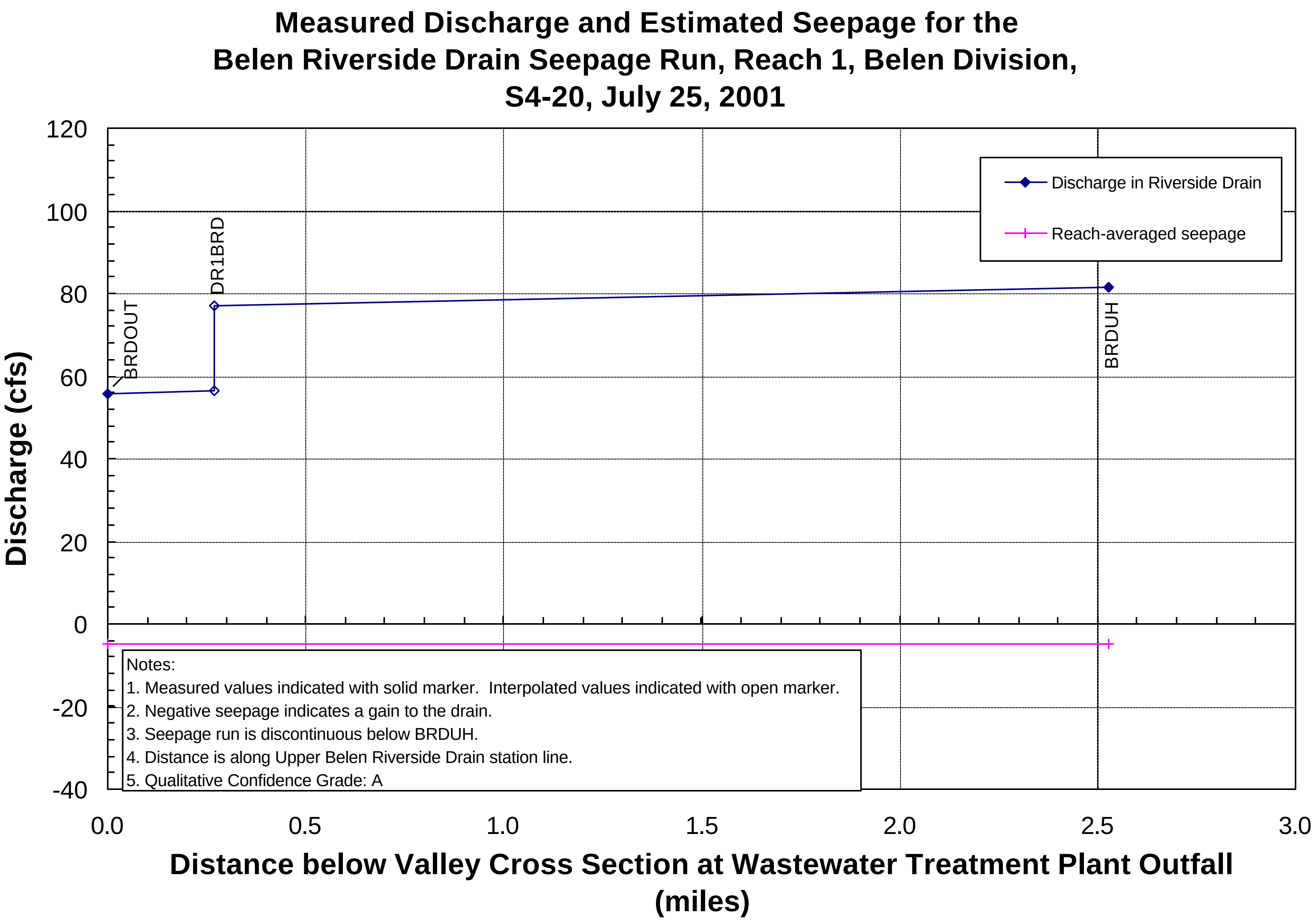
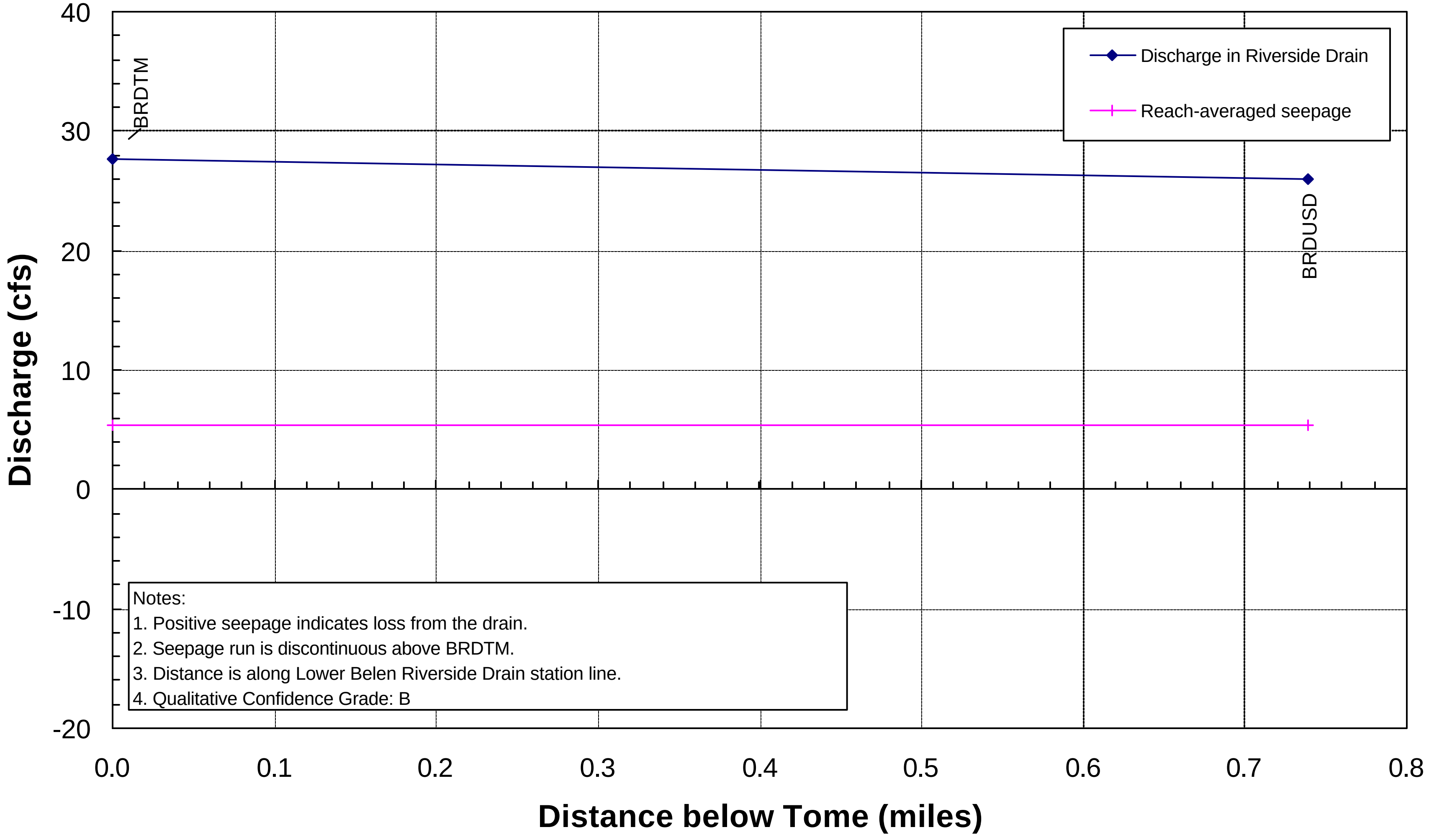
Figure 38



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Negative seepage indicates a gain to the drain.
3. Seepage run is discontinuous below BRDUH.
4. Distance is along Upper Belen Riverside Drain station line.
5. Qualitative Confidence Grade: A

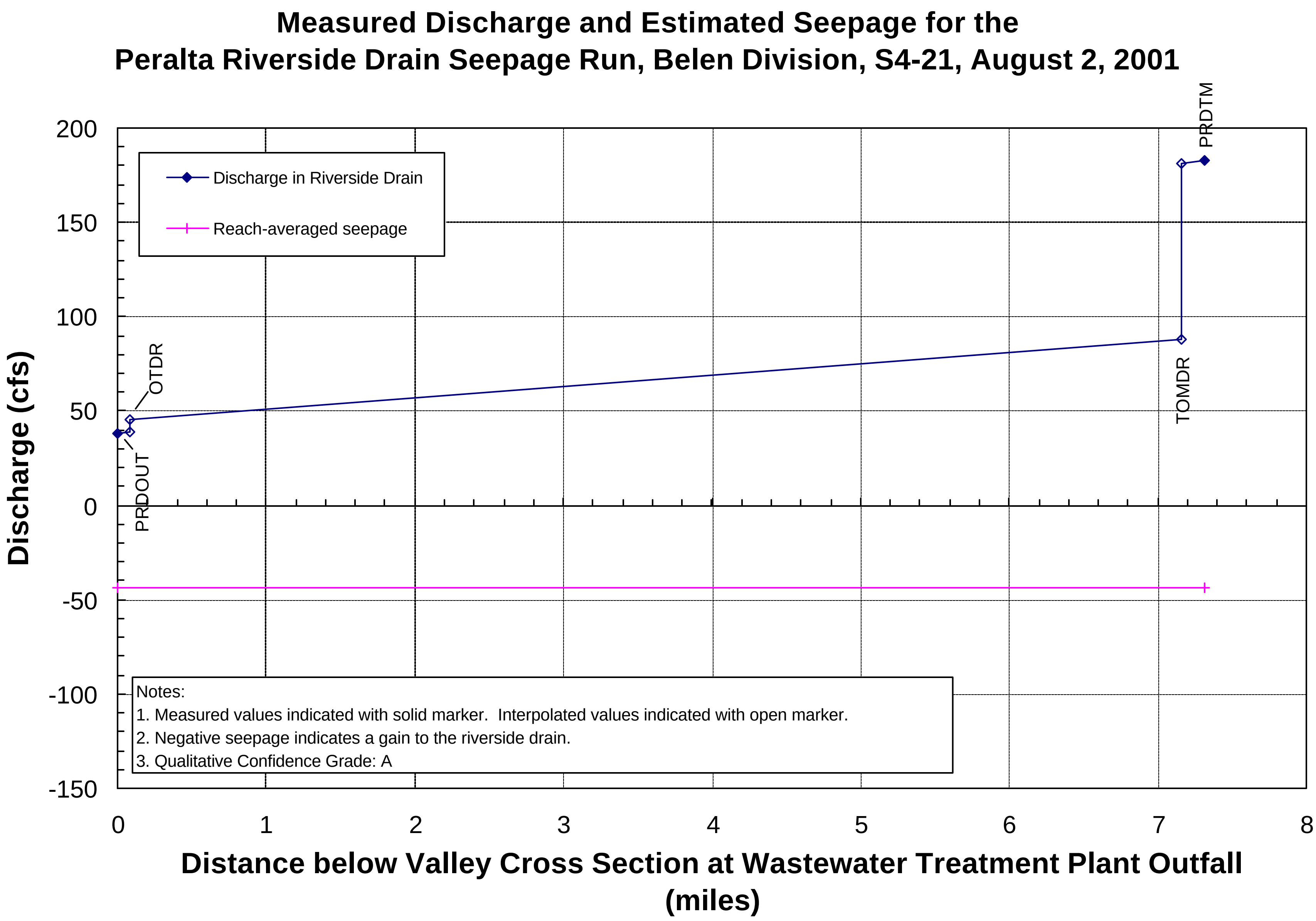
Figure 39

Measured Discharge and Estimated Seepage for the Belen Riverside Drain Seepage Run, Reach 2, Belen Division
S4-20, July 26, 2001



Notes:
1. Positive seepage indicates loss from the drain.
2. Seepage run is discontinuous above BRDTM.
3. Distance is along Lower Belen Riverside Drain station line.
4. Qualitative Confidence Grade: B

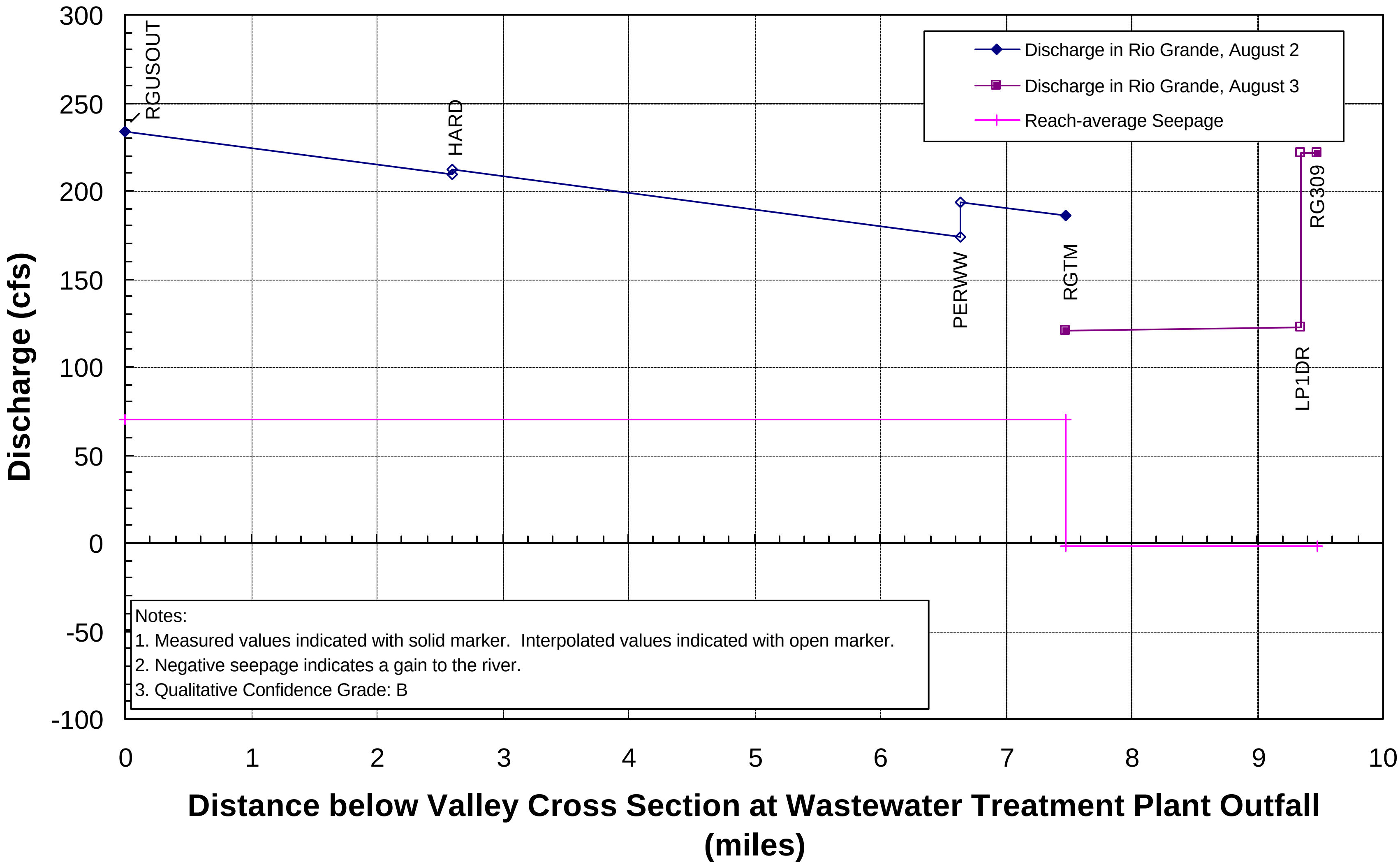
Figure 40



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Negative seepage indicates a gain to the riverside drain.
3. Qualitative Confidence Grade: A

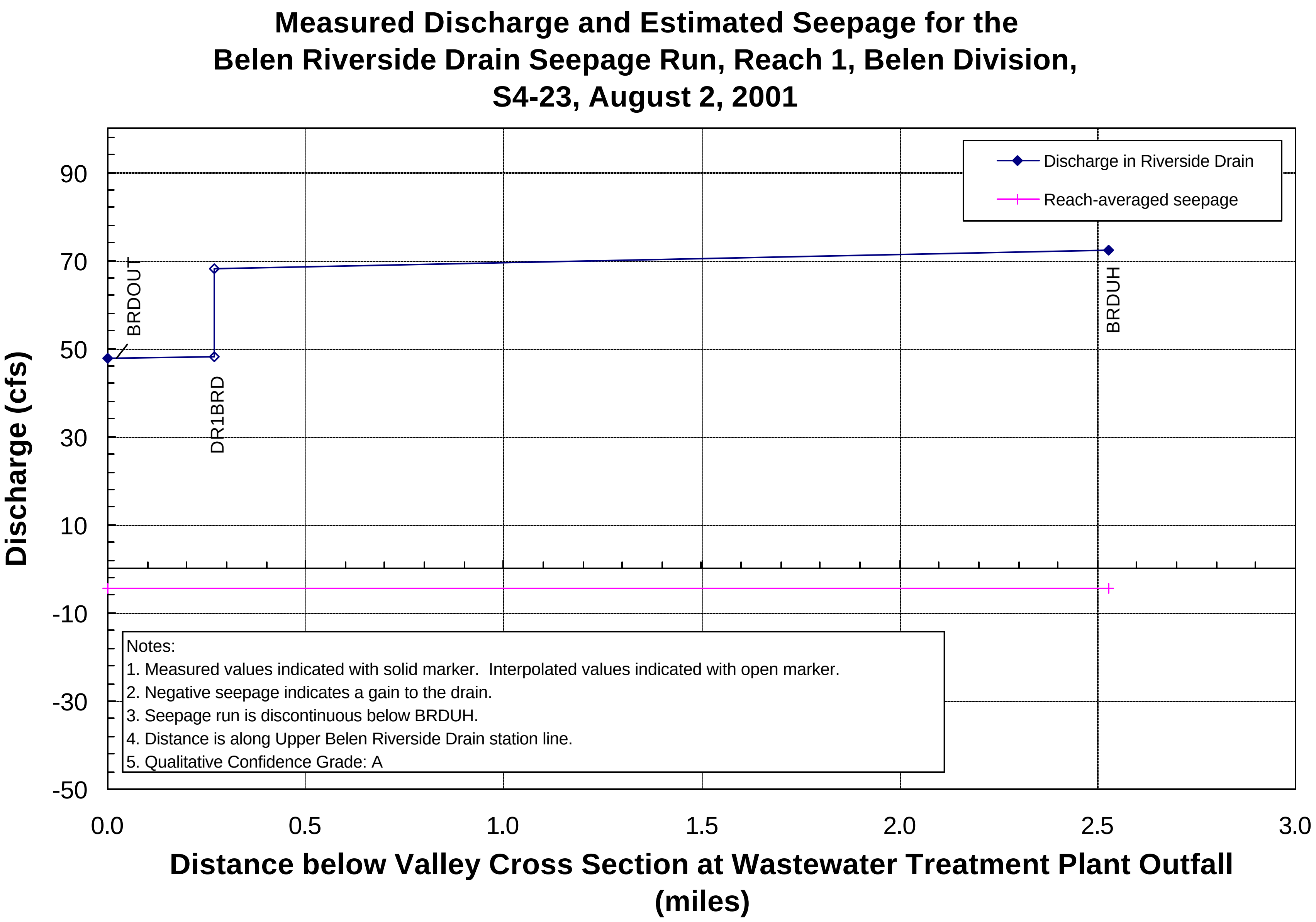
Figure 41

Measured Discharge and Estimated Seepage for the Rio Grande Seepage Run, Belen Division, S4-22, August 2-3, 2001



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Negative seepage indicates a gain to the river.
3. Qualitative Confidence Grade: B

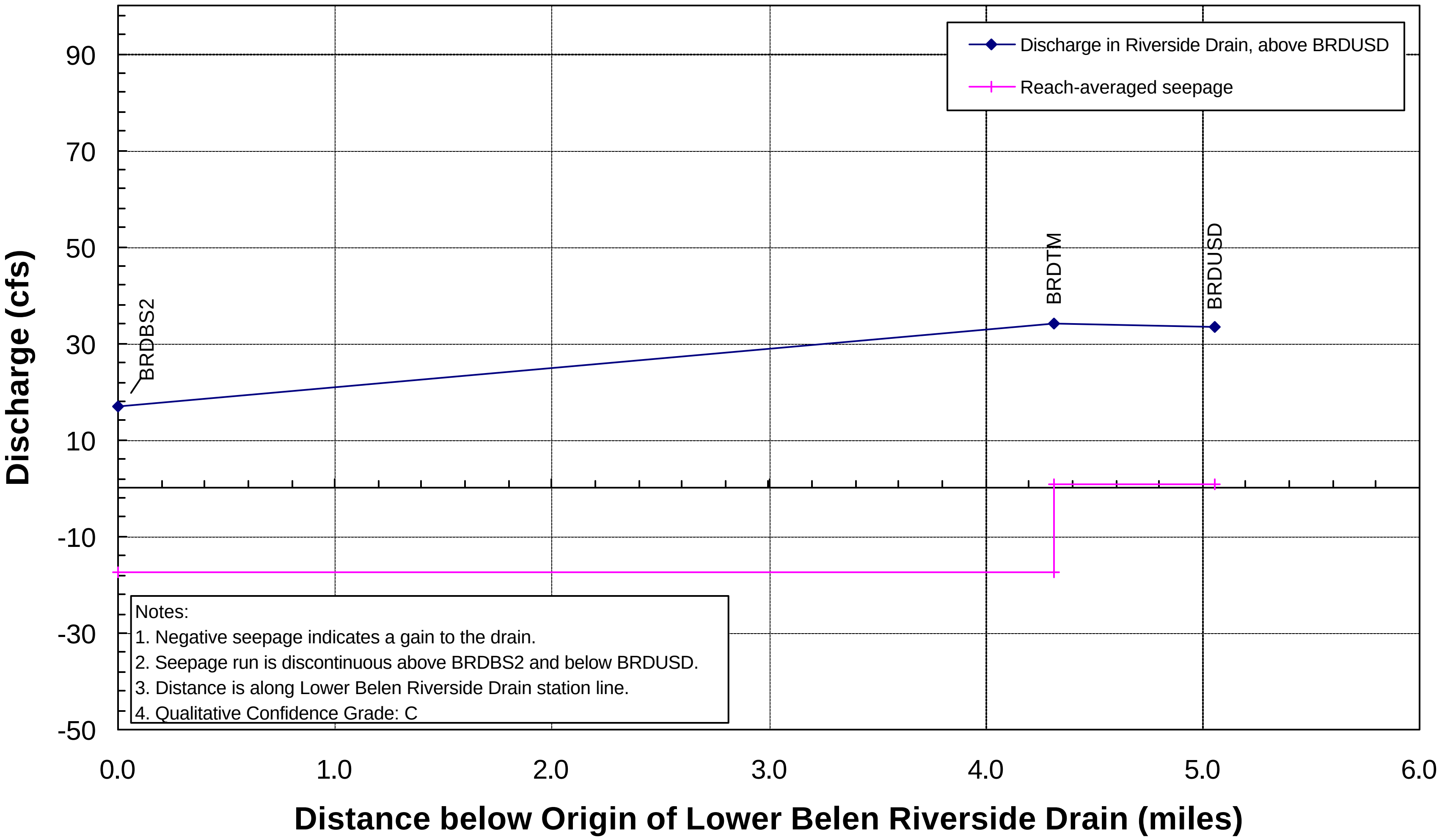
Figure 42



Notes:
1. Measured values indicated with solid marker. Interpolated values indicated with open marker.
2. Negative seepage indicates a gain to the drain.
3. Seepage run is discontinuous below BRDUH.
4. Distance is along Upper Belen Riverside Drain station line.
5. Qualitative Confidence Grade: A

Figure 43

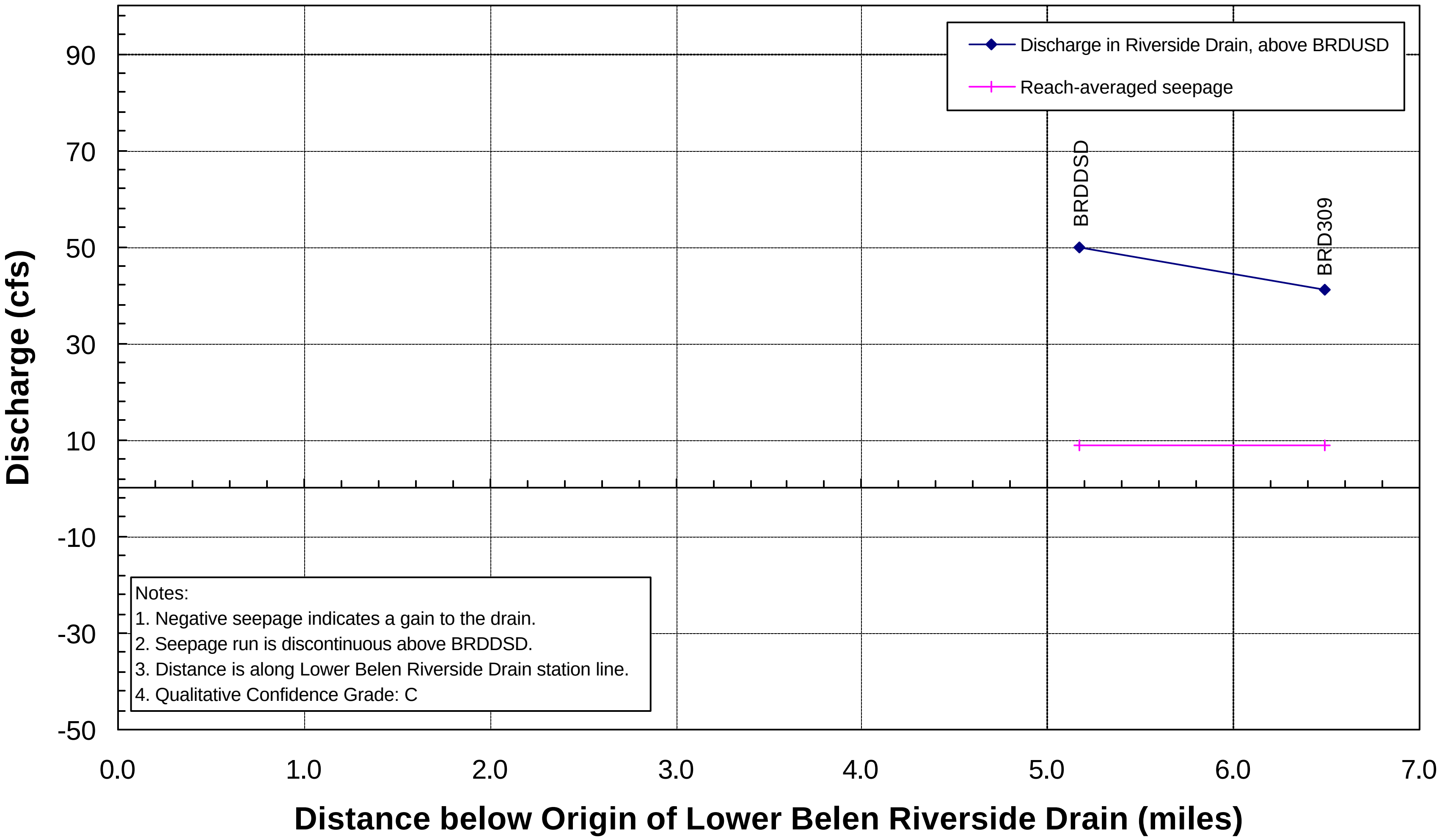
Measured Discharge and Estimated Seepage for the Belen Riverside Drain Seepage Run, Reach 2, Belen Division, S4-23, August 3, 2001



Notes:
1. Negative seepage indicates a gain to the drain.
2. Seepage run is discontinuous above BRDBS2 and below BRDUSD.
3. Distance is along Lower Belen Riverside Drain station line.
4. Qualitative Confidence Grade: C

Figure 44

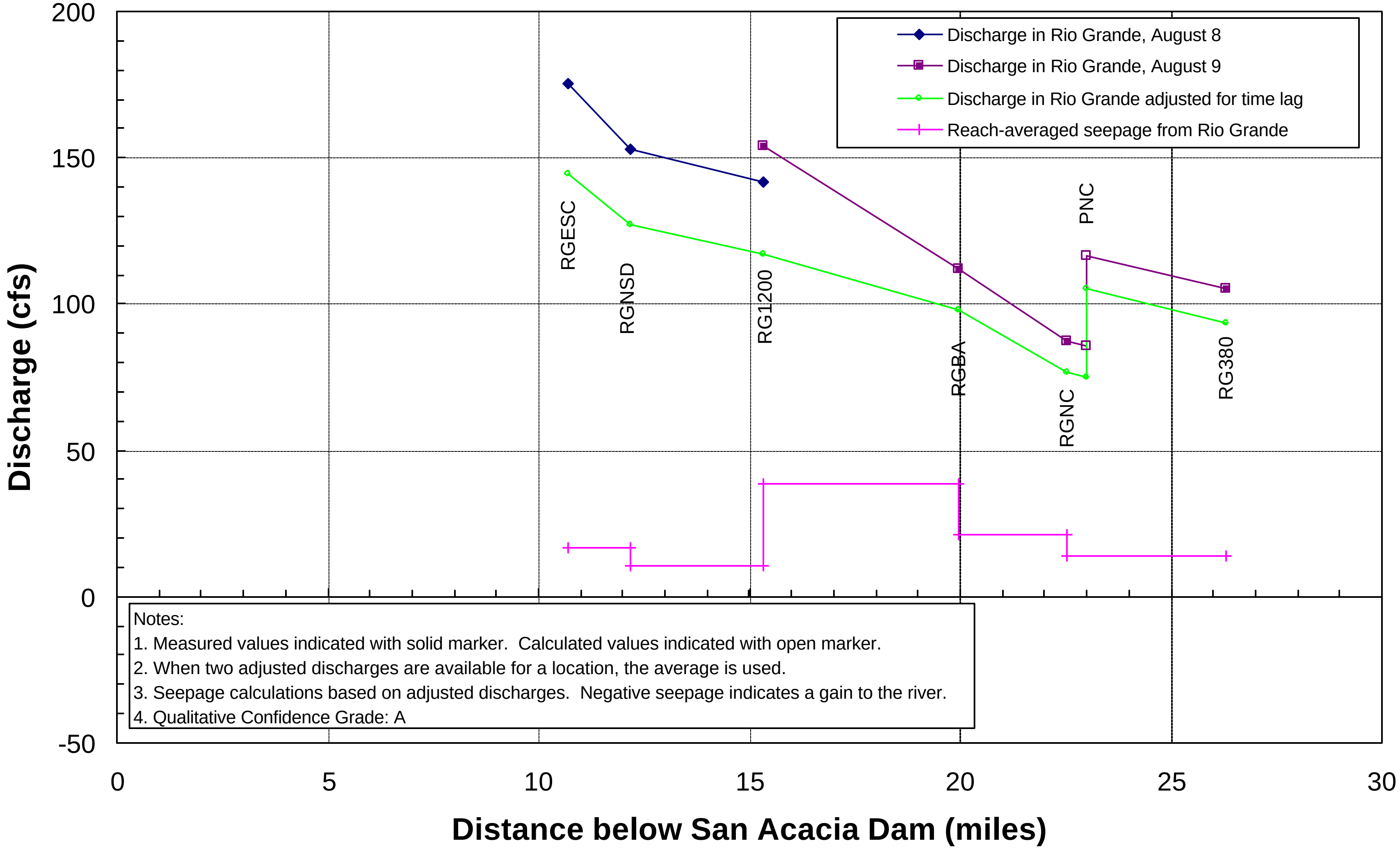
Measured Discharge and Estimated Seepage for the Belen Riverside Drain Seepage Run, Reach 3, Belen Division, S4-23, August 3, 2001



Notes:
1. Negative seepage indicates a gain to the drain.
2. Seepage run is discontinuous above BRDDSD.
3. Distance is along Lower Belen Riverside Drain station line.
4. Qualitative Confidence Grade: C

Figure 45

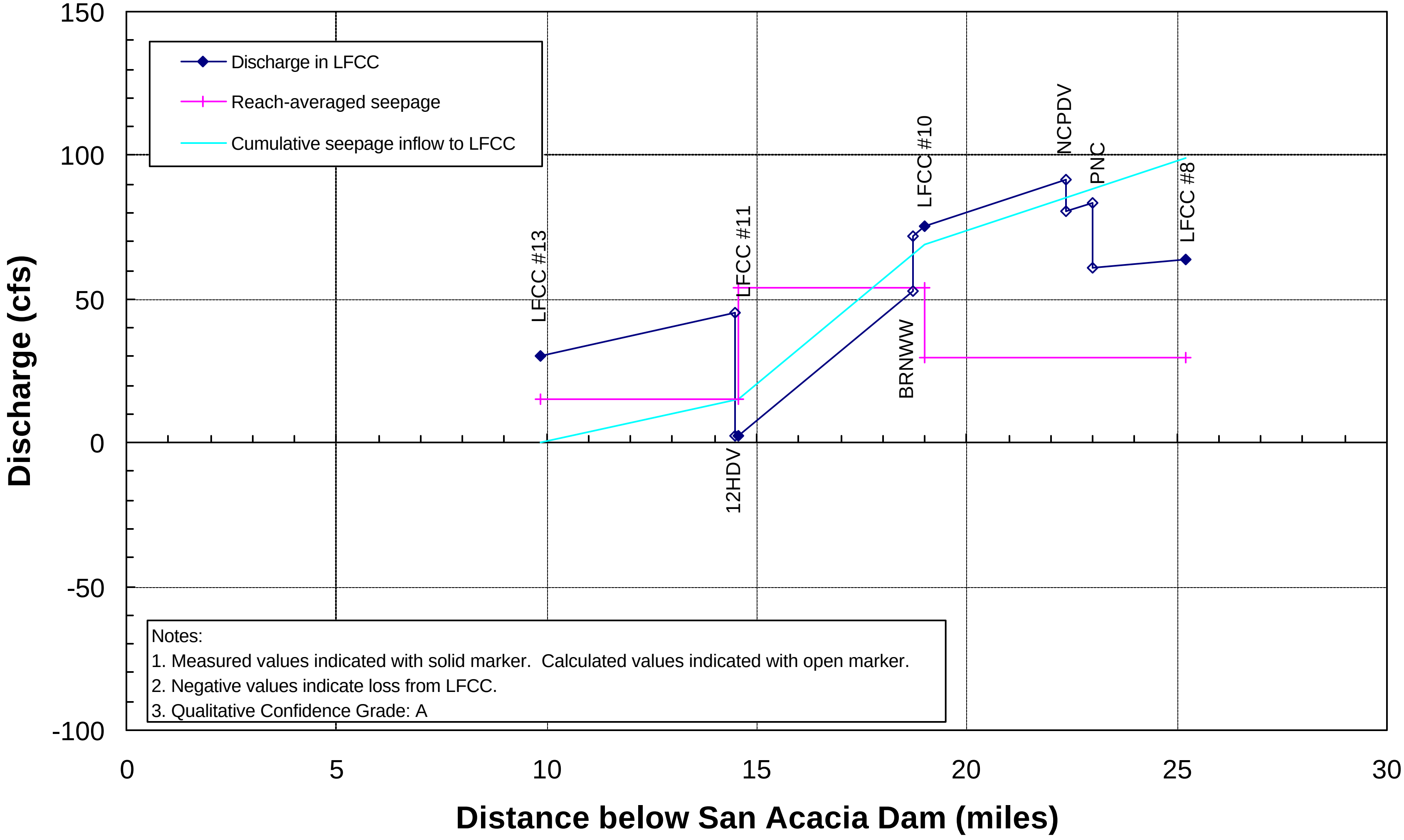
Measured Discharge, Adjusted Discharge, and Estimated Seepage for the Rio Grande Seepage Run, Socorro Division, S4-24, August 8-9, 2001



Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. When two adjusted discharges are available for a location, the average is used.
3. Seepage calculations based on adjusted discharges. Negative seepage indicates a gain to the river.
4. Qualitative Confidence Grade: A

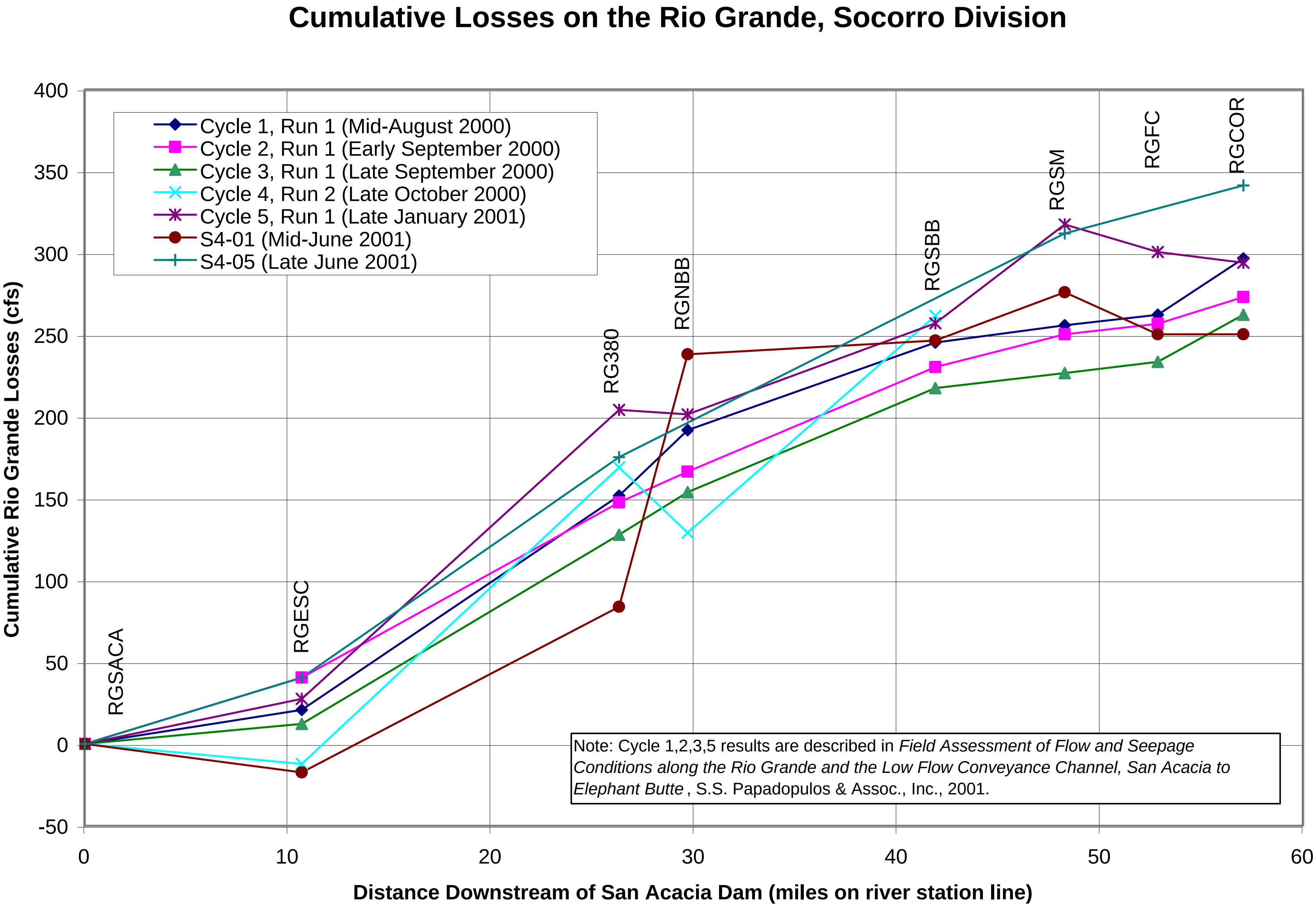
Figure 46

Measured Discharge and Estimated Seepage for the LFCC Seepage Run, Socorro Division, S4-25, August 8-9, 2001



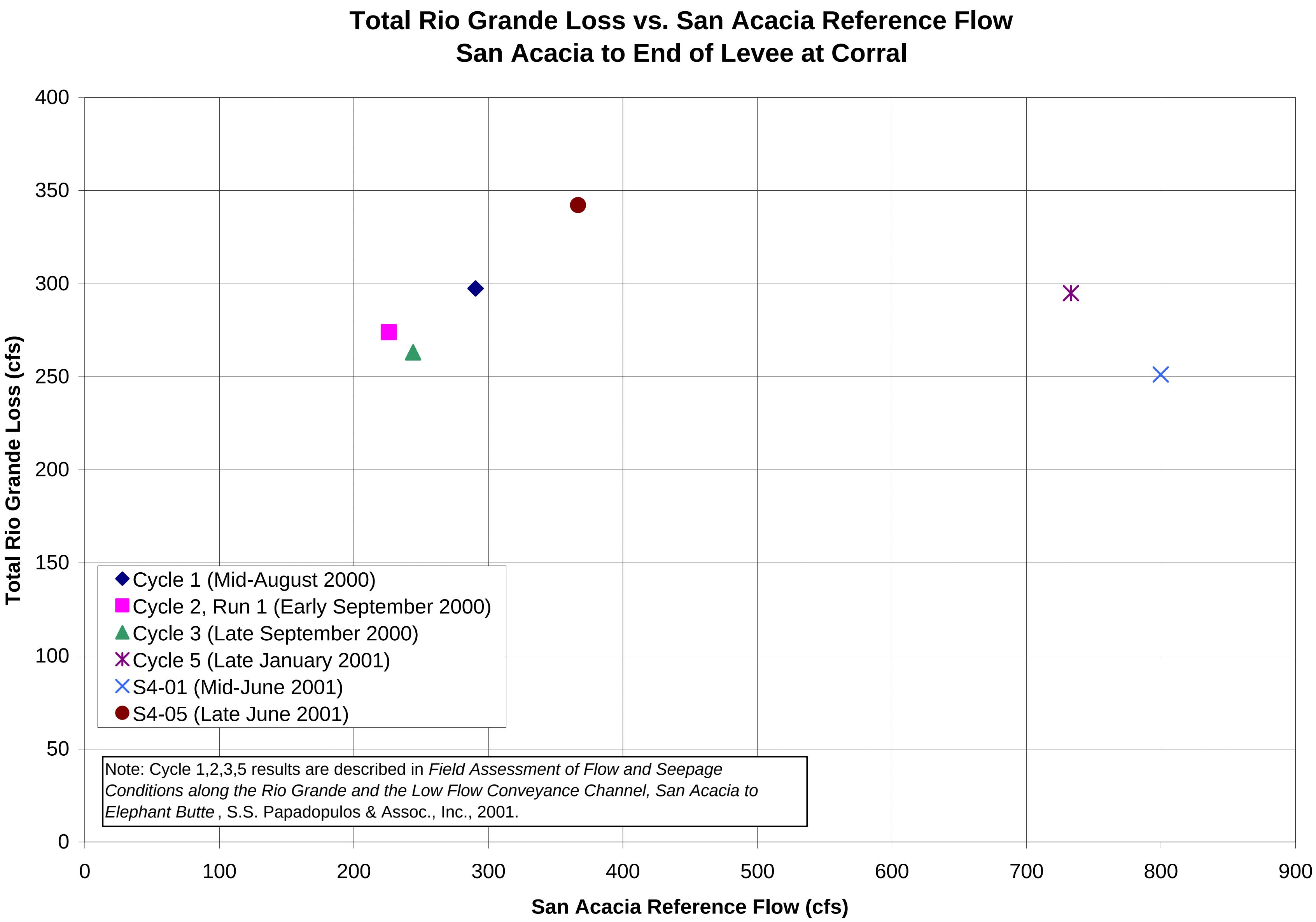
Notes:
1. Measured values indicated with solid marker. Calculated values indicated with open marker.
2. Negative values indicate loss from LFCC.
3. Qualitative Confidence Grade: A

Figure 47



Note: Cycle 1,2,3,5 results are described in *Field Assessment of Flow and Seepage Conditions along the Rio Grande and the Low Flow Conveyance Channel, San Acacia to Elephant Butte*, S.S. Papadopulos & Assoc., Inc., 2001.

Figure 48



Note: Cycle 1,2,3,5 results are described in *Field Assessment of Flow and Seepage Conditions along the Rio Grande and the Low Flow Conveyance Channel, San Acacia to Elephant Butte* , S.S. Papadopulos & Assoc., Inc., 2001.

Table 1: Measurement Location Codes

Code	Measurement Locations Name
9MO	9 Mile Outfall
ALMDT	Alamillo Ditch
AQMAD	Acequia Madre
BELDR	Belen Drain
BRD309	Belen Riverside Drain at Hwy 309
BRDBS2	Belen R/S Drain below separation 2
BRDDH	Belen Riverside Drain downstream of Harlan Drain
BRDDSD	Belen Riverside Drain downstream of Sausal Drain
BRDOUT	Belen Riverside Drain adjacent to RGUSOUT
BRDTM	Belen Riverside Drain at Tome
BRDUH	Belen Riverside Drain upstream of Harlan Drain
BRDUSD	Belen Riverside Drain upstream of Sausal Drain
BRNWW	Brown Arroyo Wasteway
DR1BRD	Drain #1 into Belen Riverside Drain
DU7#2	Drain Unit 7 #2
DU7#3	Drain Unit 7 #3
DU7G	Drain Unit 7 near MRGCD gage
DU7RG7	Drain Unit 7 adjacent to RGBDU7
DU7X	Drain Unit 7 Extension
ELMDR	Elmendorf Drain North Boundary
ELMESM	Elmendorf Drain East of Socorro Main Canal
FD3WW	Feeder Ditch #3 Wasteway
HARD	Harlan Drain
LAJ1	La Joya #1
LAJ2	La Joya #2
LAJ3	La Joya #3
LAJ4	La Joya #4
LAJ5	La Joya #5
LAJ6	La Joya #6
LAJ7	La Joya #7
LFCC #1	LFCC at Corral
LFCC #10	LFCC below Brown Arroyo
LFCC #11	LFCC #11, downstream of 1200 check structure
LFCC #13	LFCC downstream of wasteway to Rio Grande

Code	Measurement Locations Name
LFCC #18	LFCC at San Acacia
LFCC #2	LFCC at Ft. Craig
LFCC #3	LFCC at San Marcial
LFCC #5	LFCC at South Boundary of Bosque del Apache
LFCC #7	LFCC at North Boundary of Bosque del Apache
LFCC #8	LFCC downstream of Hwy 380
LNDR	Las Nutrias Drain
LP1DR	Lower Peralta Riverside Drain #1
NBLWW	New Belen Wasteway
OSALT	Old San Antonio Lateral
OTDR	Otero Drain
OUTB23	Outfall between La Joya #2 and La Joya #3
PERWW	Peralta Wasteway
PRD309	Peralta Riverside Drain at Hwy 309
PRDOUT	Peralta Riverside Drain adjacent to RGUSOUT
PRDTM	Peralta Riverside Drain at Tome
RG1200	Rio Grande at 1200 Check Structure
RG309	Rio Grande downstream of Hwy 309
RG380	Rio Grande downstream of Hwy 380
RGASA#2	Rio Grande above San Acacia #2
RGASA#3	Rio Grande above San Acacia #3
RGBA	Rio Grande at Brown Arroyo
RGBC	Rio Grande at Blue Cup
RGBDU7	Rio Grande below Drain Unit 7
RGCOR	Rio Grande North of Corral
RGESC	Rio Grande at Escondida Bridge
RGISL	Rio Grande Below Isleta Pueblo
RGNBB	Rio Grande at North Boundary of Bosque
RGNC	Rio Grande at Neil Cupp
RGNSD	Rio Grande at North Socorro Diversion
RGSACA	Rio Grande at San Acacia
RGSBB	Rio Grande at South Boundary of Bosque
RGSDR	Rio Grande upstream of Lower Sabinal drain
RGSM	Rio Grande at San Marcial
RGTM	Rio Grande at Tome
RGUS60	Rio Grande Upstream of Hwy 60

Code	Measurement Locations Name
RGUSOUT	Rio Grande Upstream of Wastewater Outfall
RIVDS1200	Riverside Drain downstream of 1200 Check Structure
RIVDSLEM	Riverside Drain downstream of Lemitar Diversion
RIVDSNC	Riverside Drain downstream of Neil Cupp Diversion
RIVUS1200	Riverside Drain upstream of 1200 Check Structure
RIVUSLEM	Riverside drain upstream of Lemitar Diversion
RIVUSNC	Riverside Drain upstream of Neil Cupp Diversion
SABDR	Sabinal Riverside Drain
SADCN	San Antonio Ditch North Boundary
SALAR	Salas Arroyo
SFBDWW	Bernardo Drain Wastewater Inflow
SFRD60	San Francisco Riverside Drain upstream of Hwy 60
SJBDU7	Lower San Juan Riverside Drain below Drain Unit 7
SJDR60	Lower San Juan Riverside Drain upstream of Hwy 60
SJFC	San Juan Feeder Canal
SJMN	San Juan Main
SJWW	San Juan Riverside Drain Wasteway
SM1	Socorro Main #1, at stop sign
SM11	Socorro Main #11
SM2	Socorro Main #2
SM3	Socorro Main # 3, upstream of Siphon
SM7	Socorro Main #7, downstream of Chambon Lateral
SM8	Socorro Main #8
SM9	Socorro Main #9, downstream of check structure
SMSA	Socorro Main at San Acacia
SMSCN	Socorro Main Canal South, North Boundary
SOCDR	Socorro Riverside Drain North Boundary
SOCWW	Socorro Riverside Drain Wasteway at Brown Arroyo
STYWW	Story Wasteway
TOMDR	Tome Drain

Table 2: Seepage Run Activity Summary Table

Activity	Date(s)	Division (B=Belen; S=Socorro)	Description	Top of Reach	Bottom of Reach
S4-01	6/9-6/12	S	Rio Grande	San Acacia	Corral
S4-02	6/10-6/13	S	LFCC, #13	LFCC #13, below 9 mile outfall	LFCC #1, end of channel
S4-03	6/23-6/24	B	Rio Grande	Hwy 309	Drain Unit 7 Extension
S4-05	6/27	S	Rio Grande	San Acacia	Corral
S4-06	6/28-6/29	B	Rio Grande	Upstream of wastewater outfall	Drain Unit 7 Extension
S4-07	7/6-7/9	B	Rio Grande	Isleta	San Acacia
S4-08	7/10	B	La Joya Acequia		
S4-09	7/18	S	Socorro Main Canal, Section 2	Downstream of Chambon	Downstream of check structure
S4-10	7/19	S	Socorro Main Canal, Section 1	Stop Sign	Siphon
S4-11	7/19	S	Socorro Main Canal, Section 3	Downstream of check structure	Upstream of Bosque del Apache
S4-12	7/22	B	Lower San Juan Riverside Drain	Upstream of Hwy 360	Drain Unit 7
S4-13	7/22	B	Rio Grande	Upstream of Hwy 60	Drain Unit 7
S4-15	7/23	B	Lower San Juan Riverside Drain	Upstream of Hwy 360	Drain Unit 7
S4-16	7/23-7/24	B	Rio Grande	Upstream of Hwy 60	San Acacia
S4-17	7/23-7/24	B	West Riverside Drains	Upstream of Hwy 60	San Acacia
S4-18	7/25	B	Peralta Riverside Drain	Adjacent to wastewater outfall on Rio Grande	Tome
S4-19	7/25-7/26	B	Rio Grande	Upstream of wastewater outfall	Hwy 309
S4-20	7/25-7/26	B	Belen Riverside Drain	Adjacent to wastewater outfall on Rio Grande	Tome
S4-21	8/2-8/3	B	Peralta Riverside Drain	Adjacent to wastewater outfall on Rio Grande	Hwy 309
S4-22	8/2-8/3	B	Rio Grande	Upstream of wastewater outfall	Hwy 309
S4-23	8/2-8/3	B	Belen Riverside Drain	Adjacent to wastewater outfall on Rio Grande	Hwy 309
S4-24	8/8-8/9	S	Rio Grande	Escondida Bridge	Neil Cupp
S4-25	8/8/-8/9	S	LFCC, #13	LFCC #13, below 9 mile outfall	LFCC #8, downstream of Hwy 380

Note: Activity S4-04 was renamed X4-01 because measurements were intended to be part of valley-cross section activity. Seepage run S4-14 was not completed.

Table 3: Valley Cross-Section and Other Activity Summary Table

Activity	Date(s)	Division (B=Belen; S=Socorro)	Description
B4-01	6/26	S	Proposed MRGCD Gage Location
B4-02	6/26	S	Proposed MRGCD Gage Location
B4-03	6/26	S	Proposed MRGCD Gage Location
B4-04	6/26	S	Proposed MRGCD Gage Location
B4-05	6/26	S	Proposed MRGCD Gage Location
B4-06	6/26	S	Proposed MRGCD Gage Locations (multiple measurements)
B4-07	6/26	S	Proposed MRGCD Gage Locations (multiple measurements)
X4-01	6/26	both	3 cross-sections on Rio Grande, Socorro Main, and Drain Unit 7
X4-02	7/9	both	3 cross-sections on Rio Grande, Socorro Main, and Drain Unit 7

Table 4
Summary of Calculated Rio Grande Seepage Rates, Belen Division

	River Loss (cfs/reach)							River Loss (cfs/mile)						
	Activity							Activity						
Rio Grande Reach	**S4-03**	**S4-06**	**S4-07**	**S4-13**	**S4-16**	**S4-19**	**S4-22**	**S4-03**	**S4-06**	**S4-07**	**S4-13**	**S4-16**	**S4-19**	**S4-22**
Rio Grande at Isleta to Upstream of Wastewater Outfall			62.2							9.4				
Sub-Reach: Upstream of Wastewater Outfall to Tome			75.7			53.9	70.4			10.1			7.2	9.4
Sub-Reach: Tome to Highway 309			-10.3			17.4	-2.0			-5.1			8.7	-1.0
Upstream of Wastewater Outfall to Hwy 309		-54.9	65.5			71.4	68.4		-5.8	6.9			7.5	7.2
Highway 309 to Blue Cup	17.2		-9.7					2.5		-1.4				
Blue Cup to Upstream of Lower Sabinal Drain			14.1							3.6				
Upstream of Lower Sabinal Drain to Hwy 60			4.8							0.9				
Hwy 309 to Below Drain Unit 7 Extension		12.4							0.6					
Hwy 60 to Below Drain Unit 7 Extension			11.3	26.4	-12.5					1.8	4.1	-1.9		
Blue Cup to Below Drain Unit 7 Extension	81.8							5.3						
Below Drain Unit 7 Extension to San Acacia #3			-31.7		21.3					-5.9		4.0		
San Acacia #3 to San Acacia #2			25.2		12.6					8.3		4.2		

Note:
Positive values indicate losses from the river; negative values indicate gains to the river.

Table 5
Summary of Calculated Rio Grande Seepage Rates, Socorro Division

	River Loss (cfs per reach)												River Loss (cfs per mile)											
	Irrigation Season 2000							Post Irrigation Season	Winter	Irrigation Season 2001			Irrigation Season 2000							Post Irrigation Season	Winter	Irrigation Season 2001		
Rio Grande Reach	**Phase I, Run 1**	**Phase I, Run 2**	**Phase II, Cycle 1, Run 1**	**Phase II, Cycle 2, Run 1**	**Phase II, Cycle 2, Run 2**	**Phase II, Cycle 3, Run 1**	**Phase II, Cycle 4, Run 1**	**Phase II, Cycle 4, Run 2**	**Phase II, Cycle 5, Run 1**	**Phase IV, S4-01**	**Phase IV, S4-05**	**Phase IV, S4-24**	**Phase I, Run 1**	**Phase I, Run 2**	**Phase II, Cycle 1, Run 1**	**Phase II, Cycle 2, Run 1**	**Phase II, Cycle 2, Run 2**	**Phase II, Cycle 3, Run 1**	**Phase II, Cycle 4, Run 1**	**Phase II, Cycle 4, Run 2**	**Phase II, Cycle 5, Run 1**	**Phase IV, S4-01**	**Phase IV, S4-05**	**Phase IV, S4-24**
Overall Seepage Run Quality Rating*	**Poor**	**Fair**	**Excellent**	**Good**	**Good**	**Fair**	**Poor**	**Fair**	**Excellent**	**Fair**	**Good**	**Good**	**Poor**	**Fair**	**Excellent**	**Good**	**Good**	**Fair**	**Poor**	**Fair**	**Excellent**	**Poor**	**Good**	**Good**
San Acacia to Escondida	-(4.2)		20.7	40.5	5.3	12.3	-70.8	-12.2	27.6	-17.4	40.6		-(0.4)		2.0	3.9	0.5	1.2	*-(6.7)*	-1.2	2.6	-1.7	3.9	
Sub-Reach: Escondida to North Socorro Diversion												*17.0*												*11.4*
Sub-Reach: North Socorro Diversion to 1200 Check Structure												*10.3*												*3.3*
Sub-Reach: Escondida to 1200 Check Structure									*93.2*	*6.1*	*42.1*										*20.1*	*1.3*	*9.1*	
Sub-Reach: 1200 Check Structure to Brown Arroyo									*-42.2*	*22.7*	*19.7*	*38.6*									*-9.1*	*4.9*	*4.3*	*8.3*
Sub-Reach: Escondida to Brown Arroyo					*96.0*	*64.0*	*56.5*	*79.7*	*51.0*								*10.4*	*(6.9)*	*(6.1)*	*(8.6)*	*5.5*			
Sub-Reach: Brown Arroyo to Neil Cupp									*53.7*	*108.8*	*60.0*	*21.4*									*21.0*	*42.5*	*24.8*	*8.4*
Sub-Reach: Neil Cupp to Highway 380									*71.8*	*-36.4*	*12.9*	*13.7*									*18.9*	*-9.6*	*3.3*	*3.6*
Sub-Reach: Brown Arroyo to Highway 380					*83.5*	*51.5*		*101.4*	*125.5*								*13.1*	*(8.1)*		*(16.0)*	*19.7*			
Escondida to Highway 380	(221.7)		131.0	107.1	179.5	115.5	--	181.1	176.5	101.2	134.6	100.9	(14.2)		8.4	6.9	11.5	7.4	--	11.6	11.3	6.6	8.9	6.5
Highway 380 to North Bosque	(74.5)		40.1	18.8	--	26.0	--	-39.8	-2.7	154.3		--	(22.1)		11.9	5.6	--	7.7	--	-11.8	-0.8	45.8		--
North Bosque to South Bosque			53.5	64.0	--	63.6	--	132.5	55.7	8.3		--			4.4	5.2	--	5.2	--	10.8	4.6	0.7		--
South Bosque to San Marcial			10.5	20.1	--	9.2	--	27.9	60.4	29.5		--			1.6	3.2	--	1.4	--	4.4	9.5	4.6		--
Highway 380 to San Marcial											136.7	--											6.2	--
San Marcial to Fort Craig	-(9.8)	16.1	6.4	6.3	--	6.8	--		-16.9			--	-(2.4)	3.9	1.6	1.6	--	1.7	--		-4.1			--
San Marcial to Corral					--		--	37.7		-25.6	29.5	--					--		--	4.3		-2.9	3.4	--
Fort Craig to Corral			34.4	16.4	--	28.9	--	--	-6.5	--	--	--			7.3	3.5	--	6.1	--		-1.4	--	--	--

Notes:

1. Seepage rates reported in italics indicate a sub reach calculation.
2. Rates reported in parentheses designate that data is incomplete for this reach and that rates may not well represent actual seepage.
3. Positive values indicate losses from the river; negative values indicate gains to the river.
4. Seepage Run Quality Rating Criteria:

Excellent: All wave discharge variations less than 10% of reference flow at San Acacia at start of run.
Good: Wave discharge variations predominatnly less than 20% of reference flow.
Fair: Wave discharge variation predominantly less than 25% of reference flow. Some points may exceed 30%.
Poor: A significant number of reaches are subject to wave discharge variations exceeding 30%

Table 6
Summary of Calculated Low Flow Conveyance Channel Seepage Rates

	LFCC Loss (cfs per reach)										LFCC Loss (cfs per mile)									
	Irrigation Season 2000					Post Irrigation Season	Winter	Irrigation Season 2001			Irrigation Season 2000					Post Irrigation Season	Winter	Irrigation Season 2001		
LFCC Reach	**Phase I, Run 1**	**Phase I, Run 2**	**Phase II, Cycle 1, Run 1**	**Phase II, Cycle 2, Run 1**	**Phase II, Cycle 3, Run 1**	**Phase II, Cycle 4, Run 1**	**Phase II, Cycle 4, Run 2**	**Phase II, Cycle 5, Run 1**	**Phase IV, S4-02**	**Phase IV, S4-25**	**Phase I, Run 1**	**Phase I, Run 2**	**Phase II, Cycle 1, Run 1**	**Phase II, Cycle 2, Run 1**	**Phase II, Cycle 3, Run 1**	**Phase II, Cycle 4, Run 1**	**Phase II, Cycle 4, Run 2**	**Phase II, Cycle 5, Run 1**	**Phase IV, S4-02**	**Phase IV, S4-25**
San Acacia to Polvadera	-9.8		-9.6	-9.3	-8.8	-10.2	-12.3				-2.0		-1.9	-1.9	-1.8	-2.1	-2.5			
Polvadera to LFCC #13	-9.8		-5.2	-13.1	-3.7	-20.6	-7.7	-3.0			-2.0		-1.1	-2.7	-0.8	-4.2	-1.6	-0.6		
LFCC #13 to 1200 Check Structure	-10.6		-21.6	-16.5	-18.9	-20.2	-25.7	-22.5	-24.3	-15.2	-2.2		-4.6	-3.5	-4.0	-4.3	-5.4	-4.8	-5.1	-3.2
1200 Check Structure to below Brown Arroyo			-54.9	-50.3	-48.6	-55.7	-50.3	-52.1	-48.4	-54.0			-12.4	-11.4	-11.0	-12.6	-11.4	-11.8	-10.9	-12.2
Below Brown Arroyo to downstream of Hwy 380			-42.4	-49.7	-49.5	--	-43.2	-38.0	-38.7	-29.7			-6.8	-8.0	-8.0	--	-7.0	-6.1	-6.2	-4.8
Downstream of Hwy 380 to North Boundary			5.1	-27.2	-11.7	--	-7.1	8.1	25.8	--			1.5	-8.2	-3.5	--	-2.2	2.4	7.8	--
North Boundary to Concrete Bridge	-36.2	-28.9	-18.4	-32.9	-32.2	--	-31.6	-38.1		--	-6.6	-5.3	-3.4	-6.0	-5.9	--	-5.8	-6.9		--
Concrete Bridge to South Boundary	-11.2	-13.4	-18.6	-4.2	-6.4	--	--	-19.8		--	-1.9	-2.3	-3.2	-0.7	-1.1	--	--	-3.4		--
North Boundary to South Boundary	-47.4	-42.3	-37.0	-37.1	-38.6	--	--	-57.9	-61.2	--	-4.2	-3.8	-3.3	-3.3	-3.4	--	--	-5.1	-5.4	--
South Boundary to San Marcial			-3.6	-8.0	-48.0	--	--	-14.6		--			-0.6	-1.3	-7.9	--	--	-2.4		--
San Marcial to Fort Craig	-22.6	3.7	-4.4	-1.0	20.3	--	--	-1.1	-22.3	--	-5.0	0.8	-1.0	-0.2	4.5	--	--	-0.2	-5.0	--
Fort Craig to Corral	--	--	2.1	4.1	-11.3	--	--	10.2	26.4	--	--	--	0.6	1.2	-3.2	--	--	2.9	7.6	--

Note:
Positive values indicate losses from the LFCC; negative values indicate gains to the LFCC.

Appendix A

Example of Summary of Field Data, Activity S4-24

Activity: S4-24

Measurement Location Code: RG1200 **Date Measured:** 08/08/01

Measurement Location Name: Rio Grande at 1200 Check Structure

Crew #1: Johnson **Crew #2:** Krueger **Crew #3:** None Listed **Crew #4:** None Listed

Equipment: Marsh-McBirney Velocimeter, Extech pH, Temperature, and Conductivity Meter

Air Temp (F): 92 **Weather:** Clear to partly cloudy, rain moving in from S.W.

pH: 8.35 **Monument Elevation (ft):** 3.72 **Water Elevation (ft)** 8.76

Water Temp (C): 25.2 **Photo:** None

Conductivity: 660 **Start Time:** 15:25 **End Time:** 16:15

LEW (ft): 89 **REW (ft):** 4.5 **Channel Width (ft):** 84.5

Remarks: 200 yards upstram of monument because of sandbar exposure at normal cross section

Distance (ft)	Width (ft	Depth (ft	Area (ft^2)	60% or 20% Velocity (ft/s)	80% Velocity (ft/s)	Average Velocity (ft/s)	Calculated Discharg (cfs)
83.5	2	1	0	1.47	-999.9	1.47	2.94
74	1	2	0	1.89	-999.9	1.89	3.78
69	3	1.3	0	1.71	-999.9	1.71	6.67
71	1	1.8	0	1.72	-999.9	1.72	3.10
72	1	2.15	0	1.79	-999.9	1.79	3.85
73	1	2.05	0	1.98	-999.9	1.98	4.06
66.5	2	1.7	0	1.81	-999.9	1.81	6.15
75	1	1.85	0	1.85	-999.9	1.85	3.42
76	1	1.75	0	1.95	-999.9	1.95	3.41
77.5	2	1.65	0	1.9	-999.9	1.9	6.27
6	3	1.7	0	0	-999.9	0	0.00
81.5	2	1.2	0	1.7	-999.9	1.7	4.08
46.75	2.5	1	0	1.45	-999.9	1.45	3.63
85.5	2	0.8	0	1.07	-999.9	1.07	1.71
87.8	2.5	0.3	0	0.63	-999.9	0.63	0.47
79.5	2	1.4	0	1.81	-999.9	1.81	5.07
33	5	0.85	0	1.4	-999.9	1.4	5.95
53	5	0.9	0	1.41	-999.9	1.41	6.34
49.25	2.5	1.1	0	1.52	-999.9	1.52	4.18
15	3	1.3	0	1.21	-999.9	1.21	4.72
18	3	1.2	0	1.21	-999.9	1.21	4.36
21.5	4	1	0	1.37	-999.9	1.37	5.48
9	3	1.7	0	1	-999.9	1	5.10
28.5	4	0.8	0	1.39	-999.9	1.39	4.45
64.5	2	1.7	0	1.8	-999.9	1.8	6.12
38	5	0.8	0	1.57	-999.9	1.57	6.28
43	5	0.85	0	1.44	-999.9	1.44	6.12
12	3	1.5	0	1.13	-999.9	1.13	5.09
57.5	4	1.1	0	1.49	-999.9	1.49	6.56
61.5	4	1.2	0	1.43	-999.9	1.43	6.86
24.5	4	0.9	0	1.51	-999.9	1.51	5.44
						Total Discharge (cf	141.6

Distance (ft)	Width (ft	Depth (ft	Area (ft^2)	60% or 20% Velocity (ft/s)	80% Velocity (ft/s)	Average Velocity (ft/s)	Calculated Discharg (cfs)
84	8	0.6	0	1.19	-999.9	1.19	5.71
96	4	0.9	0	1.53	-999.9	1.53	5.51
5	10	0.25	0	0.42	-999.9	0.42	1.05
120	2	1.1	0	1.82	-999.9	1.82	4.00
118	2	1.1	0	2.01	-999.9	2.01	4.42
116	2	1.15	0	1.64	-999.9	1.64	3.77
114	2	1	0	1.91	-999.9	1.91	3.82
111.5	3	1.3	0	1.86	-999.9	1.86	7.25
108	4	1.05	0	1.73	-999.9	1.73	7.27
124	2	1.1	0	2.01	-999.9	2.01	4.42
100	4	0.95	0	1.64	-999.9	1.64	6.23
126	2	1.2	0	2.01	-999.9	2.01	4.82
91	6	0.8	0	1.35	-999.9	1.35	6.48
75	10	0.35	0	0.83	-999.9	0.83	2.90
55	10	0.6	0	0.58	-999.9	0.58	3.48
45	10	0.5	0	0.52	-999.9	0.52	2.60
35	10	0.3	0	0.51	-999.9	0.51	1.53
25	10	0.25	0	0.38	-999.9	0.38	0.95
15	10	0.45	0	0.46	-999.9	0.46	2.07
104	4	0.9	0	1.68	-999.9	1.68	6.05
144.5	3	0.9	0	0.58	-999.9	0.58	1.57
64.5	11	0.2	0	0.18	-999.9	0.18	0.40
54	10	0.4	0	0.59	-999.9	0.59	2.36
44	10	0.4	0	0.62	-999.9	0.62	2.48
35.5	7	0.6	0	0.64	-999.9	0.64	2.69
28.5	7	0.4	0	0.9	-999.9	0.9	2.52
65	10	0.6	0	0.72	-999.9	0.72	4.32
17.5	5	0.4	0	1.35	-999.9	1.35	2.70
122	2	1.1	0	1.82	-999.9	1.82	4.00
2.5	5	0.65	0	1.45	-999.9	1.45	4.71
12.5	5	0.5	0	1.25	-999.9	1.25	3.13
141.5	3	1.1	0	1.29	-999.9	1.29	4.26
138.5	3	1.1	0	1.53	-999.9	1.53	5.05
136	2	1.35	0	1.64	-999.9	1.64	4.43
134	2	1.4	0	1.83	-999.9	1.83	5.12
132	2	1.3	0	1.96	-999.9	1.96	5.10
130	2	1.25	0	1.6	-999.9	1.6	4.00
128	2	1.25	0	1.8	-999.9	1.8	4.50
7.5	5	0.5	0	1.69	-999.9	1.69	4.23
22.5	5	0.4	0	1.18	-999.9	1.18	2.36
					Total Discharge (cf		154.3

Measurement Location Code: RG380 **Date Measured:** 08/09/01

Measurement Location Name: Rio Grande downstream of Hwy 380

Crew #1: Johnson **Crew #2:** Krueger **Crew #3:** None Listed **Crew #4:** None Listed

Equipment: Marsh-McBirney Velocimeter, Extech pH, Temperature, and Conductivity Meter

Air Temp (F): 86 **Weather:** sunny, dark clouds to the west

pH: 8.27 **Monument Elevation (ft):** 3.24 **Water Elevation (ft)** 8.86

Water Temp (C): 25.8 **Photo:** nm

Conductivity: nm **Start Time:** 14:35 **End Time:** 15:30

LEW (ft): 131.5 **REW (ft):** 4.5 **Channel Width (ft):** 127

Remarks: Water level stayed the same. Cross section was north of 380 Hwy.

Distance (ft)	Width (ft	Depth (ft	Area (ft^2)	60% or 20% Velocity (ft/s)	80% Velocity (ft/s)	Average Velocity (ft/s)	Calculated Discharg (cfs)
15	1	1.2	0	2.06	-999.9	2.06	2.47
12.5	2	1.15	0	1.93	-999.9	1.93	4.44
14	1	1.15	0	2.07	-999.9	2.07	2.38
19	1	1.1	0	1.77	-999.9	1.77	1.95
18	1	1.15	0	1.9	-999.9	1.9	2.18
20	1	1.1	0	1.76	-999.9	1.76	1.94
16	1	1.2	0	2.1	-999.9	2.1	2.52
17	1	1.15	0	1.87	-999.9	1.87	2.15
79	5	0.35	0	1.25	-999.9	1.25	2.19
23	3	1	0	1.68	-999.9	1.68	5.04
26	3	1	0	1.7	-999.9	1.7	5.10
29	3	0.9	0	1.48	-999.9	1.48	4.00
32	3	0.75	0	1.4	-999.9	1.4	3.15
35	3	0.6	0	1.14	-999.9	1.14	2.05
39	5	0.6	0	1	-999.9	1	3.00
44	5	0.8	0	0.73	-999.9	0.73	2.92
49	5	0.7	0	0.57	-999.9	0.57	2.00
54	5	0.7	0	0.5	-999.9	0.5	1.75
61.5	10	0.55	0	0.63	-999.9	0.63	3.46
21	1	1	0	1.65	-999.9	1.65	1.65
74	5	0.6	0	0.88	-999.9	0.88	2.64
122.5	4	0.7	0	1.54	-999.9	1.54	4.31
84	5	0.4	0	1.3	-999.9	1.3	2.60
89	5	0.4	0	1.28	-999.9	1.28	2.56
94	5	0.4	0	1.17	-999.9	1.17	2.34
99	5	0.5	0	1.12	-999.9	1.12	2.80
104	5	0.45	0	1.27	-999.9	1.27	2.86
109	5	0.6	0	1.36	-999.9	1.36	4.08
114	5	0.6	0	1.32	-999.9	1.32	3.96
118.5	4	0.7	0	1.5	-999.9	1.5	4.20
126.5	4	0.8	0	1.59	-999.9	1.59	5.09
69	5	0.6	0	0.76	-999.9	0.76	2.28
8.5	2	1.1	0	1.71	-999.9	1.71	3.76
6	3	0.7	0	0.17	-999.9	0.17	0.36
130	3	0.5	0	0.68	-999.9	0.68	1.02
10.5	2	1.2	0	1.78	-999.9	1.78	4.27
						Total Discharge (cf	105.5

Measurement Location Code: RGBA **Date Measured:** 08/09/01

Measurement Location Name: Rio Grande at Brown Arroyo

Crew #1: Scholle **Crew #2:** Karen **Crew #3:** None Listed **Crew #4:** None Listed

Equipment: Marsh-McBirney Velocimeter, Extech pH, Temperature, and Conductivity Meter

Air Temp (F): -999 **Weather:** Overcast, low barometric pressure

pH: 8.47 **Monument Elevation (ft):** 5.885 **Water Elevation (ft)** 9.835

Water Temp (C): 21.7 **Photo:** None

Conductivity: 650 **Start Time:** 10:30 **End Time:** 11:20

LEW (ft): 34.5 **REW (ft):** 192.8 **Channel Width (ft):** 158.3

Remarks: No appreciable change in water level

Distance (ft)	Width (ft	Depth (ft	Area (ft^2)	60% or 20% Velocity (ft/s)	80% Velocity (ft/s)	Average Velocity (ft/s)	Calculated Discharg (cfs)
79.5	10	0.45	0	0.96	-999.9	0.96	4.32
118	5	0.6	0	1.5	-999.9	1.5	4.50
114	3	0.75	0	1.48	-999.9	1.48	3.33
111.5	2	1	0	1.62	-999.9	1.62	3.24
109.5	2	1	0	1.72	-999.9	1.72	3.44
107.5	2	1	0	1.85	-999.9	1.85	3.70
105.5	2	1.05	0	1.82	-999.9	1.82	3.82
103.5	2	0.95	0	1.72	-999.9	1.72	3.27
123	5	0.5	0	1.04	-999.9	1.04	2.60
89.5	10	0.3	0	1.25	-999.9	1.25	3.75
147	11	0.25	0	0.92	-999.9	0.92	2.53
69.5	10	0.4	0	0.98	-999.9	0.98	3.92
59.5	10	0.55	0	0.98	-999.9	0.98	5.39
49.5	10	0.5	0	1.16	-999.9	1.16	5.80
39.5	10	0.4	0	1.2	-999.9	1.2	4.80
98.5	8	0.4	0	1.63	-999.9	1.63	5.22
180	3	0.7	0	1.67	-999.9	1.67	3.51
129	7	0.45	0	1.21	-999.9	1.21	3.81
183	3	0.9	0	1.73	-999.9	1.73	4.67
189.5	2	1.2	0	1.79	-999.9	1.79	4.30
177	3	0.65	0	1.58	-999.9	1.58	3.08
173	5	0.5	0	1.92	-999.9	1.92	4.80
167	7	0.4	0	1.75	-999.9	1.75	4.90
158	11	0.3	0	1.43	-999.9	1.43	4.72
187.5	2	1.05	0	1.92	-999.9	1.92	4.03
191.65	2.3	0.8	0	1.53	-999.9	1.53	2.82
137	9	0.35	0	1.25	-999.9	1.25	3.94
185.5	2	1	0	1.83	-999.9	1.83	3.66
						Total Discharge (cf	111.9

Measurement Location Code: RGESC **Date Measured:** 08/08/01

Measurement Location Name: Rio Grande at Escondida Bridge

Crew #1: Johnson **Crew #2:** Krueger **Crew #3:** None Listed **Crew #4:** None Listed

Equipment: Marsh-McBirney Velocimeter, Extech pH, Temperature, and Conductivity Meter

Air Temp (F): 76 **Weather:** cloudy, slightly raining

pH: 8.32 **Monument Elevation (ft):** 2.09 **Water Elevation (ft)** 12.82

Water Temp (C): 22.2 **Photo:** None

Conductivity: 650 **Start Time:** 10:40 **End Time:** 11:50

LEW (ft): 111 **REW (ft):** 7 **Channel Width (ft):** 104

Remarks: water dropped ~ a couple of cm

Distance (ft)	Width (ft	Depth (ft	Area (ft^2)	60% or 20% Velocity (ft/s)	80% Velocity (ft/s)	Average Velocity (ft/s)	Calculated Discharg (cfs)
43.5	5	1	0	0	-999.9	0	0.00
38.5	5	1.15	0	0	-999.9	0	0.00
33.5	5	1.45	0	0.07	-999.9	0.07	0.51
109.75	2.5	1	0	0.21	-999.9	0.21	0.52
26.5	3	2	0	0.47	-999.9	0.47	2.82
20.5	3	1.1	0	1.72	-999.9	1.72	5.68
17.5	3	1.2	0	1.82	-999.9	1.82	6.55
89.5	1	2.1	0	2.38	-999.9	2.38	5.00
48.5	5	1	0	0.06	-999.9	0.06	0.30
96.5	1	2.35	0	1.97	-999.9	1.97	4.63
95.5	1	2.3	0	1.9	-999.9	1.9	4.37
94.5	1	2.1	0	2.22	-999.9	2.22	4.66
93.5	1	1.9	0	2.39	-999.9	2.39	4.54
92.5	1	2	0	2.2	-999.9	2.2	4.40
98.5	1	2	0	1.74	-999.9	1.74	3.48
90.5	1	1.85	0	2.26	-999.9	2.26	4.18
99.5	1	2.05	0	1.89	-999.9	1.89	3.87
88.5	1	2.1	0	2.12	-999.9	2.12	4.45
87.5	1	2	0	2.21	-999.9	2.21	4.42
86.5	1	1.9	0	2.15	-999.9	2.15	4.09
85.5	1	1.8	0	2.05	-999.9	2.05	3.69
84.5	1	1.95	0	2.11	-999.9	2.11	4.11
83.5	1	2	0	2.1	-999.9	2.1	4.20
91.5	1	1.85	0	1.92	-999.9	1.92	3.55
82.5	1	2	0	2.19	-999.9	2.19	4.38
58.5	5	1.2	0	0.85	-999.9	0.85	5.10
63.5	5	1.35	0	0.87	-999.9	0.87	5.87
67.5	3	1.5	0	0.98	-999.9	0.98	4.41
70.5	3	1.6	0	0.99	-999.9	0.99	4.75
73.5	3	1.7	0	1.3	-999.9	1.3	6.63
76	2	1.75	0	1.3	-999.9	1.3	4.55
97.5	1	2.1	0	1.96	-999.9	1.96	4.12
81.5	1	1.95	0	1.95	-999.9	1.95	3.80
53.5	5	1.05	0	0.44	-999.9	0.44	2.31
15.25	1.5	1.85	0	0.99	-999.9	0.99	2.75
107	2	1.25	0	0.56	-999.9	0.56	1.40
23.5	3	1.8	0	0.65	-999.9	0.65	3.51
105	2	1.65	0	1.27	-999.9	1.27	4.19
103	2	1.9	0	1.62	-999.9	1.62	6.16
101	2	2.1	0	1.9	-999.9	1.9	7.98
78	2	1.9	0	1.57	-999.9	1.57	5.97
7.5	1	0.65	0	0	-999.9	0	0.00
13.75	1.5	2.5	0	1.76	0.64	1.2	4.50
8.5	1	1.2	0	0	-999.9	0	0.00
9.5	1	1	0	0.14	-999.9	0.14	0.14
10.5	1	1.9	0	0.77	-999.9	0.77	1.46
29.5	3	1.9	0	0.19	-999.9	0.19	1.08

11.5	1	2.2	0	1.23	-999.9	1.23	2.71
12.5	1	2.8	0	1.76	0.88	1.32	3.70
					Total Discharge (cf		175.5

Measurement Location Code: RGNC **Date Measured:** 08/09/01

Measurement Location Name: Rio Grande at Neil Cupp

Crew #1: Scholle **Crew #2:** Karen **Crew #3:** None Listed **Crew #4:** None Listed

Equipment: Marsh-McBirney Velocimeter, Extech pH, Temperature, and Conductivity Meter

Air Temp (F): -999 **Weather:** Partly cloudy

pH: 8.44 **Monument Elevation (ft):** 2.945 **Water Elevation (ft)** 6.455

Water Temp (C): 26.7 **Photo:** None

Conductivity: 630 **Start Time:** 14:20 **End Time:** 15:13

LEW (ft): 3.8 **REW (ft):** 98.6 **Channel Width (ft):** 94.8

Remarks: None

Distance (ft)	Width (ft	Depth (ft	Area (ft^2)	60% or 20% Velocity (ft/s)	80% Velocity (ft/s)	Average Velocity (ft/s)	Calculated Discharg (cfs)
65.6	1.2	1.3	0	1.75	-999.9	1.75	2.73
72.9	1.4	1.25	0	1.56	-999.9	1.56	2.73
80.4	1.6	1.05	0	2.03	-999.9	2.03	3.41
78.8	1.6	0.9	0	2.02	-999.9	2.02	2.91
77.2	1.6	1.2	0	1.74	-999.9	1.74	3.34
75.7	1.4	1.15	0	1.76	-999.9	1.76	2.83
74.3	1.4	1.2	0	1.69	-999.9	1.69	2.84
82.1	1.8	1.1	0	1.71	-999.9	1.71	3.39
71.6	1.2	1.2	0	1.63	-999.9	1.63	2.35
70.4	1.2	1.3	0	1.64	-999.9	1.64	2.56
69.2	1.2	1.25	0	1.64	-999.9	1.64	2.46
83.9	1.8	1	0	1.9	-999.9	1.9	3.42
66.8	1.2	1.35	0	1.6	-999.9	1.6	2.59
63.3	1	1.2	0	1.94	-999.9	1.94	2.33
64.4	1.2	1.25	0	1.94	-999.9	1.94	2.91
62.3	1	1.2	0	1.91	-999.9	1.91	2.29
68	1.2	1.3	0	1.64	-999.9	1.64	2.56
46.8	6	0.6	0	1.19	-999.9	1.19	4.28
85.8	2	0.9	0	1.71	-999.9	1.71	3.08
61.3	1	1.2	0	1.93	-999.9	1.93	2.32
13.8	20	0.1	0	0.16	-999.9	0.16	0.32
28.8	10	0.3	0	0.7	-999.9	0.7	2.10
38.8	10	0.35	0	1.12	-999.9	1.12	3.92
51.3	3	0.8	0	1.23	-999.9	1.23	2.95
54.05	2.5	0.9	0	1.46	-999.9	1.46	3.29
92.5	3	1.05	0	0.39	-999.9	0.39	1.23
87.8	2	0.85	0	1.58	-999.9	1.58	2.69
89.9	2.2	0.9	0	0.97	-999.9	0.97	1.92
56.55	2.5	1.05	0	1.61	-999.9	1.61	4.23
96.3	4.6	0.8	0	0.23	-999.9	0.23	0.85
60.3	1	1.2	0	1.91	-999.9	1.91	2.29
59.3	1	1.2	0	1.86	-999.9	1.86	2.23
58.3	1	1.15	0	1.83	-999.9	1.83	2.10
						Total Discharge (cf	87.4

Measurement Location Code: RGNSD **Date Measured:** 08/08/01

Measurement Location Name: Rio Grande at North Socorro Diversion

Crew #1: Johnson **Crew #2:** Krueger **Crew #3:** None Listed **Crew #4:** None Listed

Equipment: Marsh-McBirney Velocimeter, Extech pH, Temperature, and Conductivity Meter

Air Temp (F): 82 **Weather:** Cloudy

pH: 8.42 **Monument Elevation (ft):** 3.76 **Water Elevation (ft)** 10.25

Water Temp (C): 23.1 **Photo:** None

Conductivity: 600 **Start Time:** 13:00 **End Time:** 14:03

LEW (ft): 14.5 **REW (ft):** 125 **Channel Width (ft):** 110.5

Remarks: Split flow. Left channel looking down stream LEW-4.3 REW-38.5 Channel width-34.2
Right channel LEW-14.5 REW-125 Channel width-110.5

Distance (ft)	Width (ft)	Depth (ft	Area (ft^2)	60% or 20% Velocity (ft/s)	80% Velocity (ft/s)	Average Velocity (ft/s)	Calculated Discharg (cfs)
46	3	1.3	0	0.57	-999.9	0.57	2.22
58	3	1.4	0	0.95	-999.9	0.95	3.99
73	3	1.5	0	1.34	-999.9	1.34	6.03
31	3	1.1	0	0.62	-999.9	0.62	2.05
34	3	1.3	0	0.52	-999.9	0.52	2.03
37	3	1.4	0	0.43	-999.9	0.43	1.81
40	3	1.3	0	0.49	-999.9	0.49	1.91
43	3	1.3	0	0.47	-999.9	0.47	1.83
70	3	1.55	0	1.2	-999.9	1.2	5.58
49	3	1.3	0	0.64	-999.9	0.64	2.50
52	3	1.3	0	0.71	-999.9	0.71	2.77
16	3	0.7	0	0.51	-999.9	0.51	1.07
19	3	1.6	0	0.52	-999.9	0.52	2.50
22	3	1.7	0	0.46	-999.9	0.46	2.35
25	3	1.5	0	0.54	-999.9	0.54	2.43
76	3	1.45	0	1.32	-999.9	1.32	5.74
55	3	1.3	0	1.08	-999.9	1.08	4.21
61	3	1.4	0	1.4	-999.9	1.4	5.88
64	3	1.4	0	1.28	-999.9	1.28	5.38
28	3	1.1	0	0.61	-999.9	0.61	2.01
106	3	1.2	0	1.23	-999.9	1.23	4.43
19.8	7	0.5	0	0.76	-999.9	0.76	2.66
67	3	1.45	0	1.31	-999.9	1.31	5.70
6.8	5	0.7	0	0.8	-999.9	0.8	2.80
0	0	0	0	0	0	0	0.00
122.5	5.5	1.1	0	0.6	-999.9	0.6	3.63
118	3	1	0	0.95	-999.9	0.95	2.85
115	3	1	0	1.19	-999.9	1.19	3.57
97	3	1.25	0	1.45	-999.9	1.45	5.44
109	3	1.15	0	1.28	-999.9	1.28	4.42
79	3	1.3	0	1.29	-999.9	1.29	5.03
103	3	1.2	0	1.42	-999.9	1.42	5.11
30.9	15.2	0.3	0	0.16	-999.9	0.16	0.73
100	3	1.3	0	1.44	-999.9	1.44	5.62
12.8	7	0.7	0	1.01	-999.9	1.01	4.95
94	3	1.3	0	1.27	-999.9	1.27	4.95
91	3	1.3	0	1.44	-999.9	1.44	5.62
88	3	1.3	0	1.33	-999.9	1.33	5.19
85	3	1.4	0	1.44	-999.9	1.44	6.05
82	3	1.4	0	1.34	-999.9	1.34	5.63
112	3	1.1	0	1.24	-999.9	1.24	4.09
						Total Discharge (cf	152.7

Appendix B
Summary of Discharge Data by Seepage Run Activity

Table B-1
Measured Discharge
Rio Grande Seepage Run, Socorro Division, S4-01, June 9-12, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande at San Acacia	RGSACA	6/9/01 11:37 AM	780.8	Reach Endpoint
9 Mile Outfall	9MO	6/9/01 12:22 PM	284.9	Inflow
Rio Grande at Escondida Bridge	RGESC	6/9/01 2:15 PM	1157.6	Mid-Reach Flow
Rio Grande at 1200 Check Structure	RG1200	6/9/01 4:40 PM	1012.6	Mid-Reach Flow
Rio Grande at 1200 Check Structure	RG1200	6/10/01 9:07 AM	1020.2	Mid-Reach Flow
Rio Grande at Brown Arroyo	RGBA	6/10/01 11:57 AM	928.9	Mid-Reach Flow
Rio Grande at Neil Cupp	RGNC	6/10/01 2:45 PM	841.3	Mid-Reach Flow
Rio Grande downstream of Hwy 380	RG380	6/10/01 5:00 PM	856.7	Mid-Reach Flow
Rio Grande downstream of Hwy 380	RG380	6/11/01 10:22 AM	816.9	Mid-Reach Flow
Rio Grande at North Boundary of Bosque	RGNBB	6/11/01 12:22 PM	672.2	Mid-Reach Flow
Rio Grande at South Boundary of Bosque	RGSBB	6/11/01 3:15 PM	785.4	Mid-Reach Flow
Rio Grande at San Marcial	RGSM	6/11/01 4:55 PM	768.7	Mid-Reach Flow
Rio Grande at San Marcial	RGSM	6/12/01 10:30 AM	583.5	Mid-Reach Flow
Rio Grande North of corral	RGCOR	6/12/01 12:50 PM	561.3	Reach Endpoint

Table B-2.1
Measured Discharge
North LFCC Seepage Run, Socorro Division, S4-02, June 10-12, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
LFCC downstream of wasteway to Rio Grande	LFCC #13	6/10/01 10:37 AM	24.6	Reach Endpoint
Diversion at 1200 check structure	12HDV	6/10/01 2:15 PM	27.3	Outflow Calculated*
LFCC #11, downstream of 1200 check structure	LFCC #11	6/11/01 10:42 AM	21.6	Mid-Reach Flow
Brown Arroyo Wasteway	BRNWW	6/11/01 1:05 PM	5.4	Inflow
LFCC below Brown Arroyo	LFCC #10	6/11/01 3:42 PM	75.3	Mid-Reach Flow
Diversion at Neil Cupp	NCPDV	6/12/01 10:26 AM	2.0	Outflow Calculated*
LFCC downstream of Hwy 380	LFCC #8	6/12/01 1:32 PM	112.1	Reach Endpoint

*These discharges are calculated outflows from the LFCC. The flows are calculated based on measurements taken upstream and downstream of the diversions. See Appendix C for measured flows.

Table B-2.2
Measured Discharge
South LFCC Seepage Run, Socorro Division, S4-02, June 12-13, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
LFCC downstream of Hwy 380	LFCC #8	6/12/01 1:32 PM	112.1	Reach Endpoint
LFCC at North Boundary of Bosque del Apache	LFCC #7	6/12/01 3:20 PM	86.3	Mid-Reach Flow
LFCC at South Boundary of Bosque del Apache	LFCC #5	6/12/01 3:45 PM	147.5	Mid-Reach Flow
LFCC at San Marcial	LFCC #3	6/12/01 4:09 PM	262.0	Mid-Reach Flow
LFCC at Ft. Craig	LFCC #2	6/13/01 3:35 PM	284.3	Mid-Reach Flow
LFCC at corral	LFCC #1	6/13/01 1:10 PM	257.9	Reach Endpoint

Table B-3
Measured Discharge
Rio Grande Seepage Run, Belen Division, S4-03, June 23-24, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande downstream of Hwy 309	RG309	6/23/01 11:00 AM	226.0	Reach Endpoint
Belen Drain	BELDR	6/23/01 1:17 PM	0.9	Inflow
New Belen Wasteway	NBLWW	6/23/01 11:25 AM	2.6	Inflow
San Juan Feeder Canal	SJFC	6/23/01 2:25 PM	4.6	Inflow
Rio Grande at Blue Cup	RGBC	6/23/01 4:12 PM	216.9	Mid-Reach Flow
Rio Grande at Blue Cup	RGBC	6/24/01 10:37 AM	326.8	Mid-Reach Flow
Drain Unit 7 Extension	DU7X	6/24/01 1:22 PM	1.0	Inflow
Rio Grande below Drain Unit 7	RGBDU7	6/24/01 1:05 PM	246.0	Reach Endpoint

Note: Seepage run is discontinuous. First and second days are calculated separately.

Table B-4
Measured Discharge
Rio Grande Seepage Run, Socorro Division, S4-05, June 27, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande at San Acacia	RGSACA	6/27/01 10:57 AM	380.6	Reach Endpoint
Rio Grande at Escondida Bridge	RGESC	6/27/01 11:20 AM	331.7	Mid-Reach Flow
Rio Grande at 1200 Check Structure	RG1200	6/27/01 10:52 AM	284.9	Mid-Reach Flow
Rio Grande at Brown Arroyo	RGBRN	6/27/01 1:58 PM	266.1	Mid-Reach Flow
Rio Grande at Neil Cupp	RGNC	6/27/01 1:07 PM	205.8	Mid-Reach Flow
Rio Grande downstream of Hwy 380	RG380	6/27/01 2:02 PM	241.4	Mid-Reach Flow
Rio Grande at San Marcial	RGSM	6/27/01 4:55 PM	111.5	Mid-Reach Flow
Rio Grande North of Corral	RGCOR	6/27/01 5:07 PM	76.0	Reach Endpoint

Table B-5
Measured Discharge
Rio Grande Seepage Run, Belen Division, S4-06, June 28-29, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	6/28/01 1:40 PM	329.3	Reach Endpoint
Harlan Drain	HARD	6/28/01 3:52 PM	1.8	Inflow
Peralta Wasteway	PERWW	6/28/01 1:22 PM	92.6	Inflow
Lower Peralta Riverside Drain #1	LP1DR	6/28/01 3:30 PM	105.0	Inflow
Rio Grande downstream of Hwy 309	RG309	6/28/01 6:08 PM	583.7	Mid-Reach Flow
Rio Grande downstream of Hwy 309	RG309	6/29/01 10:55 AM	369.6	Mid-Reach Flow
Belen Drain	BELDR	6/29/01 10:55 AM	10.3	Inflow
New Belen Wasteway	NBLWW	6/29/01 1:59 PM	1.5	Inflow
San Juan Feeder Canal	SJFC	6/29/01 1:47 PM	4.1	Inflow
Feeder Ditch #3 Wasteway	FD3WW	6/29/01 2:27 PM	18.8	Inflow
Sabinal Riverside Drain	SABDR	6/29/01 4:24 PM	3.0	Inflow
Drain Unit 7 Extension	DU7X	6/29/01 5:00 PM	9.5	Inflow
Rio Grande below Drain Unit 7	RGBDU7	6/29/01 5:05 PM	404.5	Reach Endpoint

Note: No flow was observed at Story Wasteway inflow point.

Table B-6.1
Measured Discharge
Rio Grande Seepage Run, Section 1
Belen Division, S4-07, July 6-7, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande Below Isleta Pueblo	RGISL	7/6/01 12:27 PM	190.5	Reach Endpoint
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	7/6/01 12:52 PM	128.3	Mid-Reach Flow
Harlan Drain	HARD	7/6/01 3:40 PM	0.2	Inflow
Peralta Wasteway	PERWW	7/6/01 4:32 PM	68.1	Inflow
Rio Grande at Tome	RGTM	7/6/01 5:47 PM	121.0	Mid-Reach Flow
Lower Peralta Riverside Drain #1	LP1DR	7/6/01 7:02 PM	81.8	Inflow
Rio Grande downstream of Hwy 309	RG309	7/6/01 7:37 PM	213.0	Reach Endpoint
Rio Grande downstream of Hwy 309	RG309	7/7/01 10:26 AM	204.9	Reach Endpoint
Belen Drain	BELDR	7/7/01 10:35 AM	7.9	Inflow
New Belen Wasteway	NBLWW	7/7/01 1:12 PM	0.7	Inflow
San Juan Feeder Canal	SJFC	7/7/01 1:17 PM	4.7	Inflow
Feeder Ditch #3 Wasteway	FD3WW	7/7/01 3:20 PM	8.9	Inflow
Rio Grande at Blue Cup	RGBC	7/7/01 3:30 PM	236.7	Reach Endpoint

Note: Seepage runs are discontinuous. First and second days are calculated separately.

Table B-6.2
Measured Discharge
Rio Grande Seepage Run, Section 2
Belen Division, S4-07, July 8, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande at Blue Cup	RGBC	7/8/01 10:46 AM	212.6	Reach Endpoint
Rio Grande upstream of Lower Sabinal drain	RGSDR	7/8/01 11:50 AM	198.5	Mid-Reach Flow
Sabinal Riverside Drain	SABDR	7/8/01 3:30 PM	2.8	Inflow
Rio Grande Upstream of Hwy 60	RGUS60	7/8/01 2:37 PM	196.5	Mid-Reach Flow
Drain Unit 7 Extension	DU7X	7/8/01 5:17 PM	2.8	Inflow
Rio Grande below Drain Unit 7	RGBDU7	7/8/01 4:39 PM	188.0	Reach Endpoint

Table B-6.3
Measured Discharge
Rio Grande Seepage Run, Section 3
Belen Division, S4-07, July 9, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande below Drain Unit 7	RGBDU7	7/9/01 11:20 AM	171.8	Reach Endpoint
Salas Arroyo	SALAR	7/9/01 12:35 PM	127.5	Inflow
Rio Grande above San Acacia #3	RGASA#3	7/9/01 11:10 AM	331.0	Mid-Reach Flow
Rio Grande above San Acacia #2	RGASA#2	7/9/01 2:10 PM	305.8	Mid-Reach Flow
Rio Grande at San Acacia	RGSACA	7/9/01 5:30 PM	216.0	Reach Endpoint

Table B-7
Measured Discharge
La Joya Acequia Seepage Run, Belen Division, S4-08, July 10, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
La Joya #1	LAJ1	7/10/01 10:55 AM	15.3	Reach Endpoint
La Joya #2	LAJ2	7/10/01 11:16 AM	15.3	Mid-Reach Flow
Outfall between La Joya #2 and La Joya #3	OUTB23	7/10/01 12:17 PM	0.5	Outflow
La Joya #3	LAJ3	7/10/01 12:36 PM	13.8	Mid-Reach Flow
La Joya #4	LAJ4	7/10/01 2:02 PM	14.0	Mid-Reach Flow
La Joya #5	LAJ5	7/10/01 2:50 PM	14.9	Mid-Reach Flow
La Joya #6	LAJ6	7/10/01 3:55 PM	13.8	Mid-Reach Flow
La Joya #7	LAJ7	7/10/01 5:00 PM	14.0	Reach Endpoint

Table B-8.1
Measured Discharge
Socorro Main Canal Seepage Run, Section 1, S4-10
July 19, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Socorro Main #1, at stop sign	SM1	7/19/01 12:25 PM	277.3	Reach Endpoint
Alamillo Ditch	ALMDT	7/19/01 1:05 PM	24.6	Outflow
Socorro Main #2	SM2	7/19/01 4:41 PM	245.8	Mid-Reach Flow
Socorro Main # 3, upstream of Siphon	SM3	7/19/01 4:02 PM	251.2	Reach Endpoint

Table B-8.2
Measured Discharge
Socorro Main Canal Seepage Run, Section 2, S4-09
July 18, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Socorro Main #7, downstream of Chambon Lateral	SM7	7/18/01 1:36 PM	37.9	Reach Endpoint
Socorro Main #8	SM8	7/18/01 2:17 PM	29.7	Mid-Reach Flow
Acequia Madre	AQMAD	7/18/01 5:35 PM	15.6	Inflow
Socorro Main #9, downstream of check structure	SM9	7/18/01 5:34 PM	57.4	Reach Endpoint

Table B-8.3
Measured Discharge
Socorro Main Canal Seepage Run, Section 3, S4-11
July 20, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Socorro Main #11	SM11	7/20/01 12:52 PM	74.4	Reach Endpoint
Old San Antonio Lateral	OSALT	7/20/01 2:18 PM	22.3	Outflow
Socorro Main Canal South, North Boundary	SMSCN	7/20/01 6:17 PM	81.1	Reach Endpoint

Table B-9
Measured Discharge
Lower San Juan Drain Seepage Run, Belen Division, S4-12, July 22, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Lower San Juan Riverside Drain upstream of Hwy 60	SJDR60	7/22/01 11:31 AM	55.1	Reach Endpoint
Las Nutrias Drain	LNDR	7/22/01 1:33 PM	33.6	Inflow
San Juan Main	SJMN	7/22/01 3:40 PM	12.4	Inflow
Lower San Juan Riverside Drain below Drain Unit 7	SJBDU7	7/22/01 5:42 PM	86.6	Reach Endpoint

Table B-10
Measured Discharge
Rio Grande Seepage Run, Belen Division, S4-13, July 22, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande Upstream of Hwy 60	RGUS60	7/22/01 11:40 AM	148.3	Reach Endpoint
Drain Unit 7 Extension	DU7X	7/22/01 1:45 PM	6.8	Inflow
Rio Grande below Drain Unit 7	RGBDU7	7/22/01 3:28 PM	128.7	Reach Endpoint

Table B-11
Measured Discharge
Lower San Juan Drain Seepage Run, Belen Division, S4-15, July 23, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Lower San Juan Riverside Drain upstream of Hwy 60	SJDR60	7/23/01 1:15 PM	34.1	Reach Endpoint
Las Nutrias Drain	LNDR	7/23/01 3:11 PM	55.0	Inflow
San Juan Main	SJMN	7/23/01 4:59 PM	17.3	Inflow
Lower San Juan Riverside Drain below Drain Unit 7	SJBDU7	7/23/01 6:10 PM	97.9	Reach Endpoint

Table B-12
Measured Discharge
Rio Grande Seepage Run, Belen Division, S4-16, July 23-24, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande Upstream of Hwy 60	RGUS60	7/23/01 1:02 PM	151.4	Reach Endpoint
Drain Unit 7 Extension	DU7X	7/23/01 3:10 PM	23.5	Inflow
Rio Grande below Drain Unit 7	RGBDU7	7/23/01 4:15 PM	187.4	Reach Endpoint
Rio Grande below Drain Unit 7	RGBDU7	7/24/01 10:42 AM	139.4	Reach Endpoint
Salas Arroyo	SALAR	7/24/01 10:47 AM	116.9	Inflow
San Juan Riverside Drain Wasteway	SJWW	7/24/01 12:50 PM	9.5	Inflow
Rio Grande above San Acacia #3	RGASA#3	7/24/01 2:03 PM	244.5	Mid-Reach Flow
Rio Grande above San Acacia #2	RGASA#2	7/24/01 3:55 PM	231.9	Mid-Reach Flow
Rio Grande at San Acacia	RGSACA	7/24/01 4:52 PM	159.6	Reach Endpoint

Note: Seepage run is discontinuous. First and second days are calculated separately.

Table B-13
Measured Discharge
West Riverside Drains Seepage Run, Belen Division, S4-17, July 23-24, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
San Francisco Riverside Drain upstream of Hwy 60	SFRD60	7/23/01 12:27 PM	48.8	Reach Endpoint
Bernardo Drain Wastewater Inflow	SFBDWW	7/23/01 2:04 PM	122.9	Inflow
Drain Unit 7 Extension	DU7X	7/23/01 3:10 PM	23.5	Outflow
Drain Unit 7 adjacent to RGBDU7	DU7RG7	7/23/01 4:10 PM	172.4	Reach Endpoint
Drain Unit 7 adjacent to RGBDU7	DU7RG7	7/24/01 11:17 AM	172.4	Reach Endpoint
Drain Unit 7 #3	DU7#3	7/24/01 2:44 PM	165.4	Mid-Reach Flow
Drain Unit 7 #2	DU7#2	7/24/01 3:27 PM	180.4	Reach Endpoint

Note: Seepage run is discontinuous. First and second days are calculated seperately.

Table B-14
Measured Discharge
Peralta Riverside Drain Seepage Run, Belen Division, S4-18, July 25, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Peralta Riverside Drain adjacent to RGUSOUT	PRDOUT	7/25/01 12:25 PM	32.1	Reach Endpoint
Otero Drain	OTDR	7/25/01 3:19 PM	2.6	Inflow
Tome Drain	TOMDR	7/25/01 6:25 PM	88.3	Inflow
Peralta Riverside Drain at Tome	PRDTM	7/25/01 5:52 PM	150.7	Reach Endpoint

Table B-15
Measured Discharge
Rio Grande Seepage Run, Belen Division, S4-19, July 25-26, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	7/25/01 11:22 AM	116.6	Reach Endpoint
Harlan Drain	HARD	7/25/01 1:12 PM	1.7	Inflow
Peralta Wasteway	PERWW	7/25/01 3:32 PM	19.7	Inflow
Rio Grande at Tome	RGTM	7/25/01 5:12 PM	84.1	Mid-Reach Flow
Rio Grande at Tome	RGTM	7/26/01 11:29 AM	82.5	Mid-Reach Flow
Lower Peralta Riverside Drain #1	LP1DR	7/26/01 1:53 PM	63.7	Inflow
Rio Grande downstream of Hwy 309	RG309	7/26/01 4:20 PM	128.7	Reach Endpoint

Table B-16
Measured Discharge
Belen Riverside Drain Seepage Run, Belen Division, S4-20, July 25-26, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Measurement Description
Belen Riverside Drain adjacent to RGUSOUT	BRDOUT	7/25/01 11:00 AM	55.8	Reach Endpoint
Drain #1 into Belen Riverside Drain	DR1BRD	7/25/01 12:37 PM	20.9	Inflow
Belen Riverside Drain upstream of Harlan Drain	BRDUH	7/25/01 2:10 PM	81.6	Reach Endpoint
Belen Riverside Drain downstream of Harlan Drain	BRDDH	7/25/01 3:07 PM	66.0	*see notes
Belen Riverside Drain at Tome	BRDTM	7/25/01 4:22 PM	27.6	*see notes
Belen Riverside Drain at Tome	BRDTM	7/26/01 12:29 PM	31.3	Reach Endpoint
Belen Riverside Drain upstream of Sausal Drain	BRDUSD	7/26/01 1:45 PM	26.0	Reach Endpoint
Belen Riverside Drain downstream of Sausal Drain	BRDDSD	7/26/01 3:25 PM	49.1	*see notes

Notes:

1. After the measurement activity was completed, the measurements at BRDDH and BRDDSD were determined to be inappropriate for use in seepage calculation.
2. Seepage run is discontinuous between BRDUH and BRDTM. Below BRDOUT is designated as the upper Belen Riverside Drain. Below BRDTM is the lower Belen Riverside Drain.

Table B-17
Measured Discharge
Peralta Riverside Drain Seepage Run, Belen Division, S4-21, August 2, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Measurement Description
Peralta Riverside Drain adjacent to RGUSOUT	PRDOUT	8/2/01 10:18 AM	38.4	Reach Endpoint
Otero Drain	OTDR	8/2/01 11:35 AM	6.7	Inflow
Tome Drain	TOMDR	8/2/01 2:07 PM	93.3	Inflow
Peralta Riverside Drain at Tome	PRDTM	8/2/01 3:38 PM	182.5	Reach Endpoint

Table B-18
Measured Discharge
Rio Grande Seepage Run, Belen Division, S4-22, August 2-3, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Measurement Description
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	8/2/01 10:08 AM	234.1	Reach Endpoint
Harlan Drain	HARD	8/2/01 12:24 PM	2.2	Inflow
Peralta Wasteway	PERWW	8/2/01 1:53 PM	19.9	Inflow
Rio Grande at Tome	RGTM	8/2/01 3:37 PM	185.8	Reach Endpoint
Rio Grande at Tome	RGTM	8/3/01 9:55 AM	120.7	Reach Endpoint
Lower Peralta Riverside Drain #1	LP1DR	8/3/01 12:08 PM	99.0	Inflow
Rio Grande downstream of Hwy 309	RG309	8/3/01 2:40 PM	221.8	Reach Endpoint

Note: Seepage runs are discontinuous. First and second days are calculated separately.

Table B-19
Measured Discharge
Belen Riverside Drain Seepage Run, Belen Division, S4-23, August 2-3, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Measurement Description
Belen Riverside Drain adjacent to RGUSOUT	BRDOUT	8/2/01 10:15 AM	47.7	Reach Endpoint
Drain #1 into Belen Riverside Drain	DR1BRD	8/2/01 12:36 PM	20.1	Inflow
Belen Riverside Drain upstream of Harlan Drain	BRDUH	8/2/01 3:05 PM	72.2	Reach Endpoint
Belen Riverside Drain downstream of Harlan Drain	BRDDH	8/2/01 4:48 PM	63.9	*see note
Belen R/S Drain below separation 2	BRDBS2	8/3/01 10:50 AM	17.0	Reach Endpoint
Belen Riverside Drain at Tome	BRDTM	8/3/01 10:20 AM	34.3	Mid-Reach Flow
Belen Riverside Drain upstream of Sausal Drain	BRDUSD	8/3/01 12:37 PM	33.3	Reach Endpoint
Belen Riverside Drain downstream of Sausal Drain	BRDDSD	8/3/01 2:22 PM	49.9	Reach Endpoint
Belen Riverside Drain at Hwy 309	BRD309	8/3/01 1:45 PM	41.0	Reach Endpoint

Notes:

1. After the measurement activity was completed, the measurement at BRDDH was determined to be inappropriate for use in seepage calculation.
2. This activity consists of three discontinuous seepage runs, each calculated separately.

Table B-20
Measured Discharge
Rio Grande Seepage Run, Socorro Division, S4-24, August 8-9, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande at Escondida Bridge	RGESC	8/8/01 11:15 AM	175.5	Reach Endpoint
Rio Grande at North Socorro Diversion	RGNSD	8/8/01 1:31 PM	152.7	Mid-Reach Flow
Rio Grande at 1200 Check Structure	RG1200	8/8/01 3:50 PM	141.6	Mid-Reach Flow
Rio Grande at 1200 Check Structure	RG1200	8/9/01 9:30 AM	154.3	Mid-Reach Flow
Rio Grande at Brown Arroyo	RGBA	8/9/01 10:55 AM	111.9	Mid-Reach Flow
Rio Grande at Neil Cupp	RGNC	8/9/01 2:46 PM	87.4	Mid-Reach Flow
Rio Grande downstream of Hwy 380	RG380	8/9/01 3:02 PM	105.5	Reach Endpoint

Table B-21
Measured Discharge
North LFCC Seepage Run, Socorro Division, S4-25, August 8-9, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
LFCC downstream of wasteway to Rio Grande	LFCC #13	8/8/01 11:25 AM	30.3	Reach Endpoint
Diversion at 1200 check structure	12HDV	8/8/01 1:46 PM	42.9	*see note
LFCC #11, downstream of 1200 check structure	LFCC #11	8/8/01 3:55 PM	2.6	Mid-Reach Flow
Brown Arroyo Wasteway	BRNWW	8/9/01 11:15 AM	18.9	Inflow
LFCC below Brown Arroyo	LFCC #10	8/9/01 12:55 PM	75.4	Mid-Reach Flow
Diversion at Neal Cupp	NCPDV	8/9/01 1:09 PM	10.8	*see note
LFCC downstream of Hwy 380	LFCC #8	8/9/01 4:17 PM	64.0	Reach Endpoint

Note:
These discharges are calculated outflows from the LFCC. The flows are calculated based on measurements taken upstream and downstream of the diversions. See Appendix C for measured flows.

Appendix C
Calculated Flows by Activity

Table C-1
Calculated Flow
North LFCC Seepage Run, Socorro Division, S4-02, June 10-12, 2001

Location	Designation	Measurement Date/Time	Discharge (cfs)
Riverside Drain upstream of 1200 Check Structure	RIVUS1200	6/10/01 12:57 PM	29.3
Riverside Drain downstream of 1200 Check Structure	RIVDS1200	6/10/01 3:32 PM	56.5
Diversion at 1200 check structure	**12HDV**	**Calculated**	**27.3**
Riverside Drain upstream of Neil Cupp Diversion	RIVUSNC	6/12/01 10:07 AM	12.8
Riverside Drain downstream of Neil Cupp Diversion	RIVDSNC	6/12/01 10:45 AM	14.8
Diversion at Neil Cupp	**NCPDV**	**Calculated**	**2.0**

Table C-2
Calculated Flow
North LFCC Seepage Run, Socorro Division, S4-25, August 8-9, 2001

Location	Designation	Measurement Date/Time	Discharge (cfs)
Riverside Drain upstream of 1200 Check Structure	RIVUS1200	8/8/01 1:07 PM	24.1
Riverside Drain downstream of 1200 Check Structure	RIVDS1200	8/8/01 2:26 PM	67.0
Diversion at 1200 check structure	**12HDV**	**Calculated**	**42.9**
Riverside Drain upstream of Neil Cupp Diversion	RIVUSNC	8/9/01 1:00 PM	8.2
Riverside Drain downstream of Neil Cupp Diversion	RIVDSNC	8/9/01 1:18 PM	19.0
Diversion at Neil Cupp	**NCPDV**	**Calculated**	**10.8**

Appendix D
Rio Grande Flow Measurement Adjustments to Incorporate Lag Time

Table D-1
Flow Measurement Adjustments to Incorporate Lag Time
Rio Grande Seepage Run, Socorro Division, S4-01, June 9-12, 2001

Time Lag from San Acacia to San Marcial (hrs)	26.84

Location	Designation	Distance Below San Acacia Dam (miles)	Measurement Date/Time	Measured Discharge (cfs)	Lag (hrs)	Wave Time at San Acacia	Rounded Wave Time at San Acacia	Wave Q at San Acacia (cfs)	Wave Q Variation from Reference Q at San Acacia *	Adjusted Q at Measurement Location (cfs)
Rio Grande at San Acacia	RGSACA	0.19	6/9/01 11:37 AM	780.8	0.0	6/9/01 11:37 AM	6/9/01 11:30 AM	799.0	0.0%	780.8
Rio Grande at Escondida Bridge	RGESC	10.69	6/9/01 2:15 PM	1157.6	5.9	6/9/01 8:23 AM	6/9/01 8:30 AM	854.0	6.9%	1083.1
Rio Grande at 1200 Check Structure	RG1200	15.33	6/9/01 4:40 PM	1012.6	8.5	6/9/01 8:12 AM	6/9/01 8:15 AM	807.0	1.0%	1002.6
Rio Grande at 1200 Check Structure	RG1200	15.33	6/10/01 9:07 AM	1020.2	8.5	6/10/01 12:40 AM	6/10/01 12:45 AM	708.0	-11.4%	1151.4
Rio Grande at Brown Arroyo	RGBA	19.95	6/10/01 11:57 AM	928.9	11.0	6/10/01 12:55 AM	6/10/01 1:00 AM	704.0	-11.9%	1054.3
Rio Grande at Neil Cupp	RGNC	22.51	6/10/01 2:45 PM	841.3	12.5	6/10/01 2:17 AM	6/10/01 2:15 AM	711.0	-11.0%	945.4
Rio Grande downstream of Hwy 380	RG380	26.31	6/10/01 5:00 PM	856.7	14.6	6/10/01 2:25 AM	6/10/01 2:30 AM	711.0	-11.0%	962.7
Rio Grande downstream of Hwy 380	RG380	26.31	6/11/01 10:22 AM	816.9	14.6	6/10/01 7:47 PM	6/10/01 7:45 PM	652.0	-18.4%	1001.0
Rio Grande at North Boundary of Bosque	RGNBB	29.68	6/11/01 12:22 PM	672.2	16.5	6/10/01 7:54 PM	6/10/01 8:00 PM	649.0	-18.8%	827.6
Rio Grande at South Boundary of Bosque	RGSBB	41.89	6/11/01 3:15 PM	785.4	23.3	6/10/01 3:58 PM	6/10/01 4:00 PM	766.0	-4.1%	819.3
Rio Grande at San Marcial	RGSM	48.26	6/11/01 4:55 PM	768.7	26.8	6/10/01 2:04 PM	6/10/01 2:00 PM	811.0	1.5%	757.3
Rio Grande at San Marcial	RGSM	48.26	6/12/01 10:30 AM	583.5	26.8	6/11/01 7:39 AM	6/11/01 7:45 AM	567.0	-29.0%	822.2
Rio Grande North of corral	RGCOR	57.05	6/12/01 12:50 PM	561.3	31.7	6/11/01 5:05 AM	6/11/01 5:00 AM	550.0	-31.2%	815.4

* Note: Reference Q is defined as flow at the USGS gage at San Acacia at the start of the seepage run (averaged over two hours surrounding the rounded wave time at San Acacia).

Table D-2
Flow Measurement Adjustments to Incorporate Lag Time
Rio Grande Seepage Run, Socorro Division, S4-05, June 27, 2001

Time Lag from San Acacia to San Marcial (hrs)	32.65

Location	Location Code	Distance Below San Acacia Dam (miles)	Measurement Date/Time	Measured Discharge (cfs)	Lag (hrs)	Wave Time at San Acacia	Rounded Wave Time at San Acacia	Wave Q at San Acacia (cfs)	Wave Q Variation from Reference Q at San Acacia *	Adjusted Q at Measurement Location (cfs)
Rio Grande at San Acacia	RGSACA	0.19	6/27/01 10:57 AM	380.6	0.00	6/27/01 10:57 AM	6/27/01 11:00 AM	366.0	0.0%	380.6
Rio Grande at Escondida Bridge	RGESC	10.69	6/27/01 11:20 AM	331.7	7.14	6/27/01 4:11 AM	6/27/01 4:15 AM	357.0	-2.5%	340.0
Rio Grande at 1200 Check Structure	RG1200	15.33	6/27/01 10:52 AM	284.9	10.29	6/27/01 12:35 AM	6/27/01 12:30 AM	350.0	-4.4%	298.0
Rio Grande at Brown Arroyo	RGBRN	19.95	6/27/01 1:58 PM	266.1	13.42	6/27/01 12:33 AM	6/27/01 12:30 AM	350.0	-4.4%	278.3
Rio Grande at Neil Cupp	RGNC	22.36	6/27/01 1:07 PM	205.8	15.06	6/26/01 10:03 PM	6/26/01 10:00 PM	345.0	-5.7%	218.3
Rio Grande downstream of Hwy 380	RG380	26.31	6/27/01 2:02 PM	241.4	17.74	6/26/01 8:18 PM	6/26/01 8:15 PM	338.0	-7.7%	261.4
Rio Grande at San Marcial	RGSM	48.26	6/27/01 4:55 PM	111.5	32.65	6/26/01 8:16 AM	6/26/01 8:15 AM	327.0	-10.7%	124.8
Rio Grande North of Corral	RGCOR	57.05	6/27/01 5:07 PM	76.0	38.62	6/26/01 2:30 AM	6/26/01 2:30 AM	292.0	-20.2%	95.3

* Note: Reference Q is defined as flow at the USGS gage at San Acacia at the start of the seepage run (averaged over two hours surrounding the rounded wave time at San Acacia).

Table D-3
Flow Measurement Adjustments to Incorporate Lag Time
Rio Grande Seepage Run, Socorro Division, S4-24, August 8-9, 2001

Time Lag from San Acacia to San Marcial (hrs)	40.3

Location	Designation	Distance Below San Acacia Dam (miles)	Measurement Date/Time	Measured Discharge (cfs)	Lag (hrs)	Wave Time at San Acacia	Rounded Wave Time at San Acacia	Wave Q at San Acacia (cfs)	Wave Q Variation from Reference Q at San Acacia *	Adjusted Q at Measurement Location (cfs)
Rio Grande at San Acacia	RGSACA, USGS Gaged Flow	0.19	8/8/01 11:15 AM	180	0.0	8/8/01 11:15 AM	8/8/01 11:15 AM	180	0.0%	180
Rio Grande at Escondida Bridge	RGESC	10.69	8/8/01 11:15 AM	175.5	8.8	8/8/01 2:26 AM	8/8/01 2:30 AM	219	21.7%	144
Rio Grande at North Socorro Diversion	RGNSD	12.18	8/8/01 1:31 PM	152.7	10.1	8/8/01 3:27 AM	8/8/01 3:30 AM	216	20.0%	127
Rio Grande at 1200 Check Structure	RG1200	15.33	8/8/01 3:50 PM	141.6	12.7	8/8/01 3:07 AM	8/8/01 3:15 AM	218	21.1%	117
Rio Grande at 1200 Check Structure	RG1200	15.33	8/9/01 9:30 AM	154.3	12.7	8/8/01 8:47 PM	8/8/01 8:45 PM	203	12.8%	137
Rio Grande at Brown Arroyo	RGBA	19.95	8/9/01 10:55 AM	111.9	16.6	8/8/01 6:20 PM	8/8/01 6:15 PM	205	13.9%	98
Rio Grande at Neil Cupp	RGNC	22.51	8/9/01 2:46 PM	87.4	18.7	8/8/01 8:02 PM	8/8/01 8:00 PM	205	13.9%	77
Rio Grande downstream of Hwy 380	RG380	26.31	8/9/01 3:02 PM	105.5	21.9	8/8/01 5:07 PM	8/8/01 5:00 PM	203	12.8%	94

* Note: Reference Q is defined as flow at the USGS gage at San Acacia at the start of the seepage run (averaged over two hours surrounding the rounded wave time at San Acacia).

Appendix E
Belen Division Seepage Calculations

Table E-1
Seepage Calculation
Rio Grande Seepage Run, Belen Division, S4-03, June 23-24, 2001

Discharge					Seepage Calculation			
Location	**Location Code**	**Distance Below Isleta Diversion Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande downstream of Hwy 309	RG309	19.3	226.0					
Belen Drain	BELDR	20.9		0.9				
New Belen Wasteway	NBLWW	21.5		2.6				
San Juan Feeder Canal	SJFC	23.8		4.6				
Rio Grande at Blue Cup	RGBC	26.1	216.9		Hwy 309 to Blue Cup	6.8	17.2	2.5
Rio Grande at Blue Cup	RGBC	26.1	326.8					
Drain Unit 7 Extension	DU7X	41.5		1.0				
Rio Grande below Drain Unit 7	RGBDU7	41.6	246.0		Blue Cup to below Drain Unit 7 Extension	15.5	81.8	5.3

Note: Seepage run is discontinous. First and second days are calculated separately.

Table E-2
Seepage Calculation
Rio Grande Seepage Run, Belen Division, S4-06, June 28 - 29, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below Isleta Diversion Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	9.8	329.3					
Harlan Drain	HARD	12.4		1.8				
Peralta Wasteway	PERWW	16.4		92.6				
Lower Peralta Riverside Drain #1	LP1DR	19.1		105.0				
Rio Grande downstream of Hwy 309	RG309	19.3	583.7		Rio Grande upstream of outflow to Rio Grande at Hwy 309	9.48	-54.9	-5.8
Rio Grande downstream of Hwy 309	RG309	19.3	369.6					
Belen Drain	BELDR	20.9		10.3				
New Belen Wasteway	NBLWW	21.5		1.5				
San Juan Feeder Canal	SJFC	23.8		4.1				
Feeder Ditch #3 Wasteway	FD3WW	25.8		18.8				
Sabinal Riverside Drain	SABDR	30.5		3.0				
Drain Unit 7 Extension	DU7X	41.5		9.5				
Rio Grande below Drain Unit 7	RGBDU7	41.6	404.5		Rio Grande at Hwy 309 to Rio Grande below DU7X	22.3	12.4	0.6

Notes:
Seepage run is discontinuous. First and second days are calculated separately.

Table E-3.1
Seepage Calculation
Rio Grande Seepage Run, Belen Division, Section 1, S4-07
July 6-7, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below Isleta Diversion Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande Below Isleta Pueblo	RGISL	3.2	190.5					
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	9.8	128.3		Isleta Pueblo to Upstream of Wastewater	6.6	62.2	9.4
Harlan Drain	HARD	12.4		0.2				
Peralta Wasteway	PERWW	16.4		68.1				
Rio Grande at Tome	RGTM	17.3	121.0		Upstream of Wastewater Outfall to Tome	7.5	75.7	10.1
Lower Peralta Riverside Drain #1	LP1DR	19.1		81.8				
Rio Grande downstream of Hwy 309	RG309	19.3	213.0		Tome to Hwy. 309	2.0	-10.3	-5.1
Rio Grande downstream of Hwy 309	RG309	19.3	204.9					
Belen Drain	BELDR	20.9		7.9				
New Belen Wasteway	NBLWW	21.5		0.7				
San Juan Feeder Canal	SJFC	23.8		4.7				
Feeder Ditch #3 Wasteway	FD3WW	25.8		8.9				
Rio Grande at Blue Cup	RGBC	26.1	236.7		Hwy. 309 to Blue Cup	6.8	-9.7	-1.4

Note: Seepage runs are discontinuous. First and second days are calculated separately.

Table E-3.2
Seepage Calculation
Rio Grande Seepage Run, Belen Division, Section 2, S4-07
July 8, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below Isleta Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande at Blue Cup	RGBC	26.1	212.6					
Rio Grande upstream of Lower Sabinal drain	RGSDR	30.0	198.5		Blue Cup to Upstream of Lower Sabinal Drain	3.9	14.1	3.6
Sabinal Riverside Drain	SABDR	30.5		2.8				
Rio Grande Upstream of Hwy 60	RGUS60	35.1	196.5		Upstream of Lower Sabinal Drain to Upstream of US Hwy 60	5.1	4.8	0.9
Drain Unit 7 Extension	DU7X	41.5		2.8				
Rio Grande below Drain Unit 7	RGBDU7	41.6	188.0		Upstream of US Hwy 60 to Below DU7X	6.4	11.3	1.8

Note: Distance to RGSDR is approximate.

Table E-3.3
Seepage Calculation
Rio Grande Seepage Run, Belen Division, Section 3, S4-07
July 9, 2001

Discharge					Seepage Calculation			
Location	**Location Code**	**Distance Below Isleta Diversion Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande below Drain Unit 7	RGBDU7	41.6	171.8					
Salas Arroyo	SALAR	41.8		127.5				
Rio Grande above San Acacia #3	RGASA#3	46.9	331.0		Below DU7X to above San Acacia #3	5.4	-31.7	-5.9
Rio Grande above San Acacia #2	RGASA#2	49.9	305.8		Above San Acacia #3 to above San Acaacia #2	3.0	25.2	8.3

Table E-4
Seepage Calculation
La Joya Acequia Seepage Run, Belen Division, S4-08, July 10, 2001

Discharge						**Seepage Calculation**			
Location	**Designation**	**Distance Below LAJ1 (mi)**	**InChannel Discharge (cfs)**	**Inflow (cfs)**	**Outflow (cfs)**	**LFCC Reach**	**Reach Length (miles)**	**LFCC Loss (cfs per reach)**	**LFCC Loss (cfs per mile)**
La Joya #1	LAJ1	0.00	15.3						
La Joya #2	LAJ2	0.91	15.3			La Joya Acequia #1 to #2	0.9	-0.1	-0.1
Outfall between La Joya #2 and La Joya #3	OUTB23	1.03			0.5				
La Joya #3	LAJ3	2.15	13.8			La Joya Acequia #2 to #3	1.2	1.0	0.8
La Joya #4	LAJ4	3.94	14.0			La Joya Acequia #3 to #4	1.8	-0.2	-0.1
La Joya #5	LAJ5	5.26	14.9			La Joya Acequia #4 to #5	1.3	-0.9	-0.7
La Joya #6	LAJ6	6.58	13.8			La Joya Acequia #5 to #6	1.3	1.2	0.9
La Joya #7	LAJ7	7.22	14.0			La Joya Acequia #6 to #7	0.6	-0.2	-0.3

Table E-5
Seepage Calculation
Lower San Juan Drain Seepage Run, Belen Division, S4-12, July 22, 2001

Discharge					Seepage Calculation			
Location	**Location Code**	**Distance Below SJDR60 (miles)**	**Adjusted InChannel Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Lower San Juan Riverside Drain upstream of Hwy 60	SJDR60	0.00	55.1					
Las Nutrias Drain	LNDR	1.63		33.6				
San Juan Main	SJMN	2.47		12.4				
Lower San Juan Riverside Drain below Drain Unit 7	SJBDU7	6.60	86.6		Lower San Juan Riverside Drain from upstream of Hwy 60 to below Drain Unit 7	6.60	14.6	2.2

Table E-6
Seepage Calculation
Rio Grande Seepage Run, Belen Division, S4-13, July 22, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below Isleta Diversion Dam (miles)**	**Adjusted InChannel Discharge (cfs)**	**Inflow (cfs)**	**River Reach**	**Reach Length (miles)**	**River Loss (cfs per reach)**	**River Loss (cfs per mile)**
Rio Grande Upstream of Hwy 60	RGUS60	35.1	148.3					
Drain Unit 7 Extension	DU7X	41.5		6.8				
Rio Grande below Drain Unit 7	RGBDU7	41.6	128.7		Rio Grange upstream of Hwy 60 to below Drain Unit 7 extension	6.40	26.4	4.1

Table E-7
Seepage Calculation
Lower San Juan Drain Seepage Run, Belen Division, S4-15, July 23, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below SJDR60 (miles)**	**Measured Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**River Loss (cfs per reach)**	**River Loss (cfs per mile)**
Lower San Juan Riverside Drain upstream of Hwy 60	SJDR60	0.0	34.1					
Las Nutrias Drain	LNDR	1.6		55.0				
San Juan Main	SJMN	2.5		17.3				
Lower San Juan Riverside Drain below Drain Unit 7	SJBDU7	6.6	97.9		Upstream of Hwy 60 to below Drain Unit 7	6.6	8.6	1.3

Table E-8
Seepage Calculation
Rio Grande Seepage Run, Belen Division, S4-16, July 23-24, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below Isleta Diversion Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande Upstream of Hwy 60	RGUS60	35.1	151.4					
Drain Unit 7 Extension	DU7X	41.5		23.5				
Rio Grande below Drain Unit 7	RGBDU7	41.6	187.4		Upstream of Hwy 60 to below Drain Unit 7	6.40	-12.5	-1.9
Rio Grande below Drain Unit 7	RGBDU7	41.6	139.4					
Salas Arroyo	SALAR	41.8		116.9				
San Juan Riverside Drain Wasteway	SJWW	46.5		9.5				
Rio Grande above San Acacia #3	RGASA#3	46.9	244.5		Below Drain Unit 7 to above San Acacia #3	5.4	21.3	4.0
Rio Grande above San Acacia #2	RGASA#2	49.9	231.9		Above San Acacia #3 to above San Acacia #2	3.0	12.6	4.2

Notes:
Seepage runs are discontinuous. First and second days are calculated separately.

Table E-9
Seepage Calculation
West Riverside Drains Seepage Run, Belen Division, S4-17, July 23-24, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below DU7X (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Drain Unit 7 adjacent to RGBDU7	DU7RG7	0.2	177.2					
Drain Unit 7 #3	DU7#3	5.3	165.4		Drain Unit 7 at RGBDU7 cross-section to Drain Unit 7 #3	5.1	11.8	2.3
Drain Unit 7 #2	DU7#2	8.5	180.4		Drain Unit 7 #3 to Drain Unit 7 #2	3.1	-15.0	-4.8

Notes:
Due to discontinuities in the station line, seepage was not calculated for the first day's seepage run.

Table E-10
Seepage Calculation
Peralta Riverside Drain Seepage Run, Belen Division, S4-18, July 25, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below PRDOUT (miles)**	**Adjusted InChannel Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**River Loss (cfs per reach)**	**River Loss (cfs per mile)**
Peralta Riverside Drain adjacent to RGUSOUT	PRDOUT	0.0	32.1					
Otero Drain	OTDR	0.1		2.6				
Tome Drain	TOMDR	7.2		88.3				
Peralta Riverside Drain at Tome	PRDTM	7.3	150.7		Peralta Riverside Drain adjacent to RGUSOUT to Tome	7.3	-27.7	-3.8

Table E-11
Seepage Calculation
Rio Grande Seepage Run, Belen Division, S4-19, July 25-26, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below RGUSOUT (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**River Loss (cfs per reach)**	**River Loss (cfs per mile)**
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	0.0	116.6					
Harlan Drain	HARD	2.6		1.7				
Peralta Wasteway	PERWW	6.6		19.7				
Rio Grande at Tome	RGTM	7.5	84.1		Upstream of wastewater outfall to Tome	7.5	53.9	7.2
Rio Grande at Tome	RGTM	7.5	82.5					
Lower Peralta Riverside Drain #1	LP1DR	9.4		63.7				
Rio Grande downstream of Hwy 309	RG309	9.5	128.7		Tome to downstream of Hwy 309	2.0	17.4	8.7

Notes:
Seepage run is discontinuous. First and second days are calculated separately.

Table E-12
Seepage Calculation
Belen Riverside Drain Seepage Run, S4-20, July 25-26, 2001

Discharge					Seepage Calculation			
Location	**Location Code**	**Distance Below BRDOUT or BRDTM (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Belen Riverside Drain adjacent to RGUSOUT	BRDOUT	0.0	55.8					
Drain #1 into Belen Riverside Drain	DR1BRD	0.3		20.9				
Belen Riverside Drain upstream of Harlan Drain	BRDUH	2.5	81.6		Belen Riverside Drain adjacent to RGUSOUT to upstream of Harlan Drain	2.5	-4.9	-1.9
Belen Riverside Drain at Tome	BRDTM	0.0	31.3					
Belen Riverside Drain upstream of Sausal Drain	BRDUSD	0.7	26.0		Upstream of Tome to upstream of Sausal Drain	0.7	5.4	7.3

Notes:

1. Discharge at RGTM represents July 26 measurement.
2. Seepage run is discontinuous between BRDUH and BRDTM. Below BRDOUT is designated as the upper Belen Riverside Drain. Below BRDTM is the lower Belen Riverside Drain.

Table E-13
Seepage Calculation
Peralta Riverside Drain Seepage Run, S4-21, August 2, 2001

Discharge					Seepage Calculation			
Location	**Location Code**	**Distance Below PRDOUT (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**River Loss (cfs per mile)**
Peralta Riverside Drain adjacent to RGUSOUT	PRDOUT	0.0	38.4					
Otero Drain	OTDR	0.1		6.7				
Tome Drain	TOMDR	7.2		93.3				
Peralta Riverside Drain at Tome	PRDTM	7.3	182.5		Peralta Riverside Drain adjacent to RGUSOUT to Tome	7.3	-44.0	-6.0

Table E-14
Seepage Calculation
Rio Grande Seepage Run, Belen Division, S4-22, August 2-3, 2001

Discharge					Seepage Calculation			
Location	**Location Code**	**Distance Below Isleta Diversion Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	6.6	234.1					
Harlan Drain	HARD	9.2		2.2				
Peralta Wasteway	PERWW	13.3		19.9				
Rio Grande at Tome	RGTM	14.1	185.8		Upstream of Wastewater Outfall to Tome	7.5	70.4	9.4
Rio Grande at Tome	RGTM	14.1	120.7					
Lower Peralta Riverside Drain #1	LP1DR	16.0		99.0				
Rio Grande downstream of Hwy 309	RG309	16.1	221.8		Tome to Hwy 309	2.0	-2.0	-1.0

Note:
Seepage runs are discontinuous. First and second days are calculated separately.

Table E-15
Seepage Calculation
Belen Riverside Drain Seepage Run, S4-23, August 2-3, 2001

Discharge					Seepage Calculation			
Location	**Location Code**	**Distance Below BRDOUT (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Belen Riverside Drain adjacent to RGUSOUT	BRDOUT	0.0	47.7					
Drain #1 into Belen Riverside Drain	DR1BRD	0.3		20.1				
Belen Riverside Drain upstream of Harlan Drain	BRDUH	2.5	72.2		Belen Riverside Drain adjacent to RGUSOUT to upstream of Harlan Drain	2.5	-4.5	-1.8
Belen R/S Drain below separation 2	BRDBS2	0.0	17.0					
Belen Riverside Drain at Tome	BRDTM	4.3	34.3		Belen Riverside Drain below separation 2 to Tome	4.3	-17.3	-4.0
Belen Riverside Drain upstream of Sausal Drain	BRDUSD	5.1	33.3		Tome to upstream of Sausal Drain	0.7	1.0	1.3
Belen Riverside Drain downstream of Sausal Drain	BRDDSD	5.2	49.9					
Belen Riverside Drain at Hwy 309	BRD309	6.5	41.0		Downstream of Sausal Drain to Hwy 309	1.3	8.9	6.7

Note:
Seepage run is discontinuous between BRDUH and BRDBS2 and between BRDUSD and BRDDSD

Appendix F
Socorro Division Seepage Calculations

Table F-1
Seepage Calculation
Rio Grande Seepage Run, Socorro Division, S4-01, June 9-12, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below San Acacia Dam (miles)**	**Adjusted Discharge (cfs)**	**Inflow (cfs)**	**River Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande at San Acacia	RGSACA	0.19	780.8					
9 Mile Outfall	9MO	10.60		284.9				
Rio Grande at Escondida Bridge	RGESC	10.69	1083.1		San Acacia to Escondida Bridge	10.50	-17.4	-1.7
Rio Grande at 1200 Check Structure	RG1200	15.33	1077.0		Escondida to 1200 Check Structure	4.64	6.1	1.3
Rio Grande at Brown Arroyo	RGBA	19.95	1054.3		1200 Check Structure to Brown Arroyo	4.62	22.7	4.9
Rio Grande at Neil Cupp	RGNC	22.51	945.4		Brown Arroyo to Neil Cupp	2.56	108.8	42.5
Rio Grande downstream of Hwy 380	RG380	26.31	981.9		Neil Cupp to Hwy 380	3.80	-36.4	-9.6
Rio Grande at North Boundary of Bosque	RGNBB	29.68	827.6		Hwy 380 to North Boundary of Bosque	3.37	154.3	45.8
Rio Grande at South Boundary of Bosque	RGSBB	41.89	819.3		North Boundary of Bosque to South	12.21	8.3	0.7
Rio Grande at San Marcial	RGSM	48.26	789.8		South Boundary of Bosque to San Marcial	6.37	29.5	4.6
Rio Grande North of corral	RGCOR	57.05	815.4		San Marcial to Corral	8.79	-25.6	-2.9

Notes:
Duplicate measurements at the same station are averaged when computing seepage.
No pumping was reported by USBR for these dates.

Table F-2.1
Seepage Calculation
North LFCC Seepage Run, Socorro Division, S4-02, June 10-12, 2001

Discharge						**Seepage Calculation**			
Location	**Location Code**	**Distance Below San Acacia Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Outflow (cfs)**	**LFCC Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
LFCC downstream of wasteway to Rio Grande	LFCC #13	9.85	24.6						
Diversion at 1200 check structure	12HDV	14.50			27.3				
LFCC #11, downstream of 1200 check structure	LFCC #11	14.58	21.6			LFCC #13 to 1200 Check Structure	4.7	-24.3	-5.1
Brown Arroyo Wasteway	BRNWW	18.72		5.4					
LFCC below Brown Arroyo	LFCC #10	19.00	75.3			1200 Check Structure to below Brown Arroyo	4.4	-48.4	-10.9
Diversion at Neil Cupp	NCPDV	22.36			2.0				
LFCC downstream of Hwy 380	LFCC #8	25.22	112.1			Below Brown Arroyo to downstream of Hwy 380	6.2	-38.7	-6.2

Note:
No pumping was reported by USBR for this date.

Table F-2.2
Seepage Calculation
South LFCC Seepage Run, Socorro Division, S4-02, June 12-13, 2001

Discharge						**Seepage Calculation**			
Location	**Designation**	**Distance Below San Acacia Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Outflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
LFCC downstream of Hwy 380	LFCC #8	25.22	112.1						
LFCC at North Boundary of Bosque del Apache	LFCC #7	28.54	86.3			Downstream of Hwy 380 to North Boundary	3.3	25.8	7.8
LFCC at South Boundary of Bosque del Apache	LFCC #5	39.78	147.5			North Boundary to South Boundary	11.2	-61.2	-5.4
LFCC at San Marcial	LFCC #3	45.82	262.0						
LFCC at Ft. Craig	LFCC #2	50.32	284.3			San Marcial to Fort Craig	4.5	-22.3	-5.0
LFCC at corral	LFCC #1	53.80	257.9			Fort Craig to Corral	3.5	26.4	7.6

Note:
Seepage run is discontinuous. Inflow from Elemendorf Drain was not measured during this activity.
No pumping was reported by USBR for this date.

Table F-3
Seepage Calculation
Rio Grande Seepage Run, Socorro Division, S4-05, June 27, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below San Acacia Dam (miles)**	**Adjusted Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande at San Acacia	RGSACA	0.2	380.6					
Rio Grande at Escondida Bridge	RGESC	10.7	340.0		San Acacia to Escondida Bridge	10.5	40.6	3.9
Rio Grande at 1200 Check Structure	RG1200	15.3	298.0		Escondida to 1200 Check Structure	4.6	42.1	9.1
Rio Grande at Brown Arroyo	RGBRN	20.0	278.3		1200 Check Structure to Brown Arroyo	4.6	19.7	4.3
Rio Grande at Neil Cupp	RGNC	22.4	218.3		Brown Arroyo to Neil Cupp	2.4	60.0	24.8
Pumps at Neil Cupp	PNC	23.0		56.0				
Rio Grande downstream of Hwy 380	RG380	26.3	261.4		Neil Cupp to Hwy 380 Bridge	3.9	12.9	3.3
Rio Grande at San Marcial	RGSM	48.3	124.8		Hwy 380 Bridge to San Marcial	22.0	136.7	6.2
Rio Grande North of Corral	RGCOR	57.0	95.3		San Marcial to Corral	8.8	29.5	3.4

Notes:
Distance to pumps at Neil Cupp is approximate.

Table F-4.1
Seepage Calculation
Socorro Main Canal Seepage Run, Section 1, S4-10
July 19, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below Socorro Main #1 (miles)**	**Discharge (cfs)**	**Outflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Socorro Main #1, at stop sign	SM1	0.0	277.3					
Alamillo Ditch	ALMDT	0.2		24.6				
Socorro Main #2	SM2	1.3	245.8		Socorro Main #1 to #2	1.3	7.0	5.4
Socorro Main # 3, upstream of Siphon	SM3	2.0	251.2		Socorro Main #2 to #3	0.7	-5.4	-8.2

Note: The distance below Socorro Main #1 is calculated along the Socorro Main Canal station line.

Table F-4.2
Seepage Calculation
Socorro Main Canal Seepage Run, Section 2, S4-09
July 18, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below Socorro Main #7 (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Socorro Main #7, downstream of Chambon Lateral	SM7	0.0	37.9					
Socorro Main #8	SM8	0.7	29.7		Socorro Main #7 to #8	0.7	8.2	11.8
Acequia Madre	AQMAD	0.8		15.6				
Socorro Main #9, downstream of check structure	SM9	1.9	57.4		Socorro Main #8 to #9	1.2	-12.1	-10.1

Note: The distance below Socorro Main #7 is calculated along the Socorro Main Canal station line.

Table F-4.3
Seepage Calculation
Socorro Main Canal Seepage Run, Section 3, S4-11
July 19, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below Socorro Main #11 (miles)**	**Discharge (cfs)**	**Outflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Socorro Main #11	SM11	0.0	74.4					
Old San Antonio Lateral	OSALT	0.8		22.3				
Socorro Main Canal South, North Boundary	SMSCN	2.3	81.1		Socorro Main #11 to Socorro Main Canal South, North Boundary	2.3	-29.0	-12.7

Note: The distance below Socorro Main #11 is calculated along the Socorro Main Canal South station line.

Table F-5
Seepage Calculation
Rio Grande Seepage Run, Socorro Division, S4-24, August 8-9, 2001

Discharge					**Seepage Calculation**			
Location	**Location Code**	**Distance Below San Acacia Dam (miles)**	**Adjusted Discharge (cfs)**	**Inflow (cfs)**	**Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
Rio Grande at Escondida Bridge	RGESC	10.7	144.2					
Rio Grande at North Socorro Diversion	RGNSD	12.2	127.3		Escondida Bridge to North Socorro Diversion	1.5	17.0	11.4
Rio Grande at 1200 Check Structure	RG1200	15.3	117.0		North Socorro Diversion to 1200 Check Structure	3.1	10.3	3.3
Rio Grande at 1200 Check Structure	RG1200	15.3	136.8					
Rio Grande at Brown Arroyo	RGBA	20.0	98.2		1200 Check Structure to Brown Arroyo	4.6	38.6	8.3
Rio Grande at Neil Cupp	RGNC	22.5	76.8		Brown Arroyo to Neil Cupp	2.6	21.4	8.4
Pumps at Neil Cupp	PNC	23.0		30.4				
Rio Grande downstream of Hwy 380	RG380	26.3	93.5		Neil Cupp to Hwy 380	3.8	13.7	3.6

Note:
Seepage Run is discontinuous. First and second days calculated separately.
Distance to pumps at Neil Cupp is approximate.

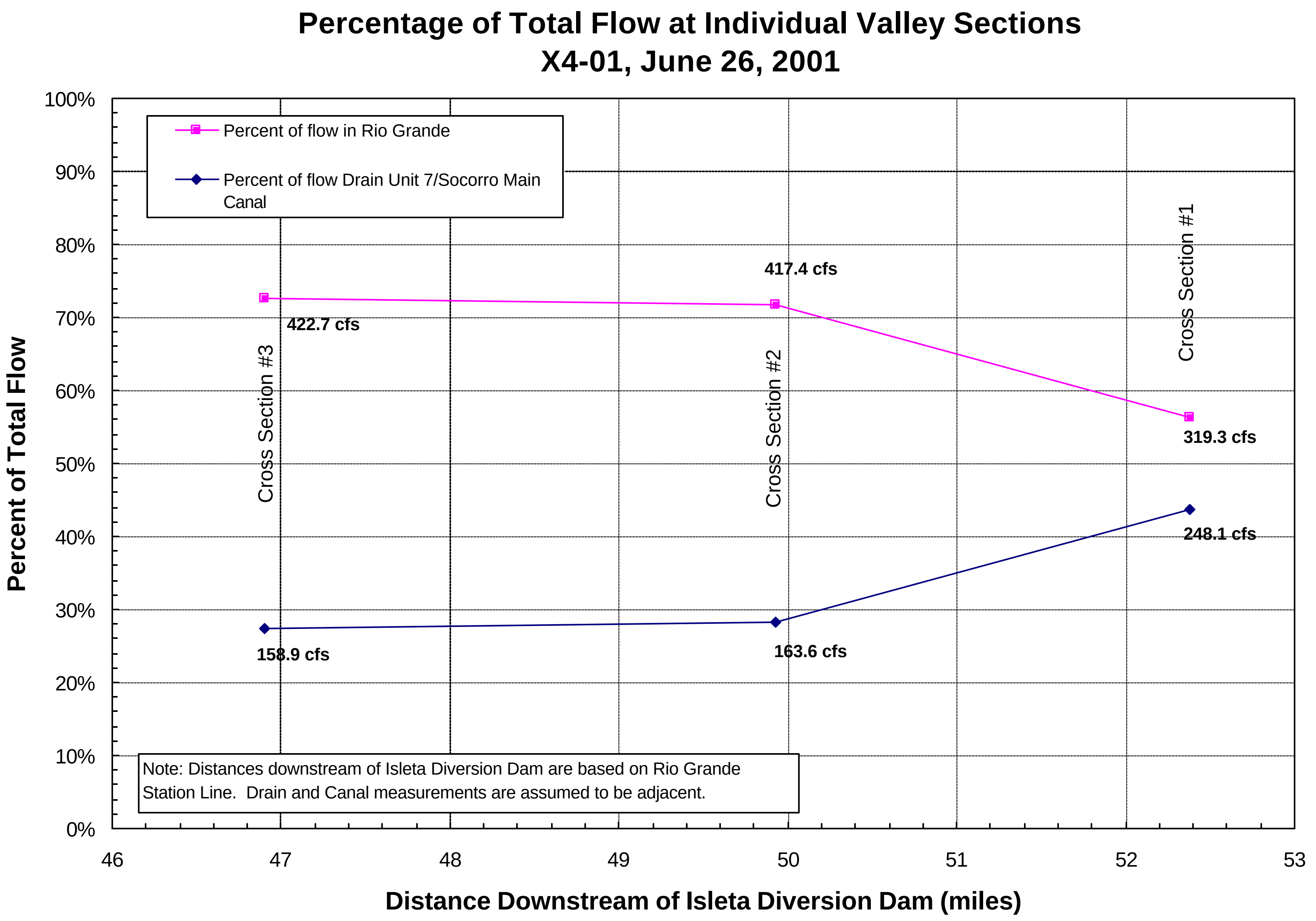
Table F-6
Seepage Calculation
North LFCC Seepage Run, Socorro Division, S4-25, August 8-9, 2001

Discharge						**Seepage Calculation**			
Location	**Location Code**	**Distance Below San Acacia Dam (miles)**	**Discharge (cfs)**	**Inflow (cfs)**	**Outflow (cfs)**	**LFCC Reach**	**Reach Length (miles)**	**Loss (cfs per reach)**	**Loss (cfs per mile)**
LFCC downstream of wasteway to Rio Grande	LFCC #13	9.9	30.3						
Diversion at 1200 Check Structure	12HDV	14.5			42.9				
LFCC #11, downstream of 1200 check structure	LFCC #11	14.6	2.6			LFCC #13 to 1200 Check Structure	4.7	-15.2	-3.2
Brown Arroyo Wasteway	BRNWW	18.7		18.9					
LFCC below Brown Arroyo	LFCC #10	19.0	75.4			1200 Check Structure to below Brown Arroyo	4.4	-54.0	-12.2
Diversion at Neil Cupp	NCPDV	22.4			10.8				
Pumps at Neil Cupp	PNC	23.0			30.4				
LFCC downstream of Hwy 380	LFCC #8	25.2	64.0			Below Brown Arroyo to downstream of Hwy 380	6.2	-29.7	-4.8

Note:
Distance to Pumps at Neil Cupp is approximate.

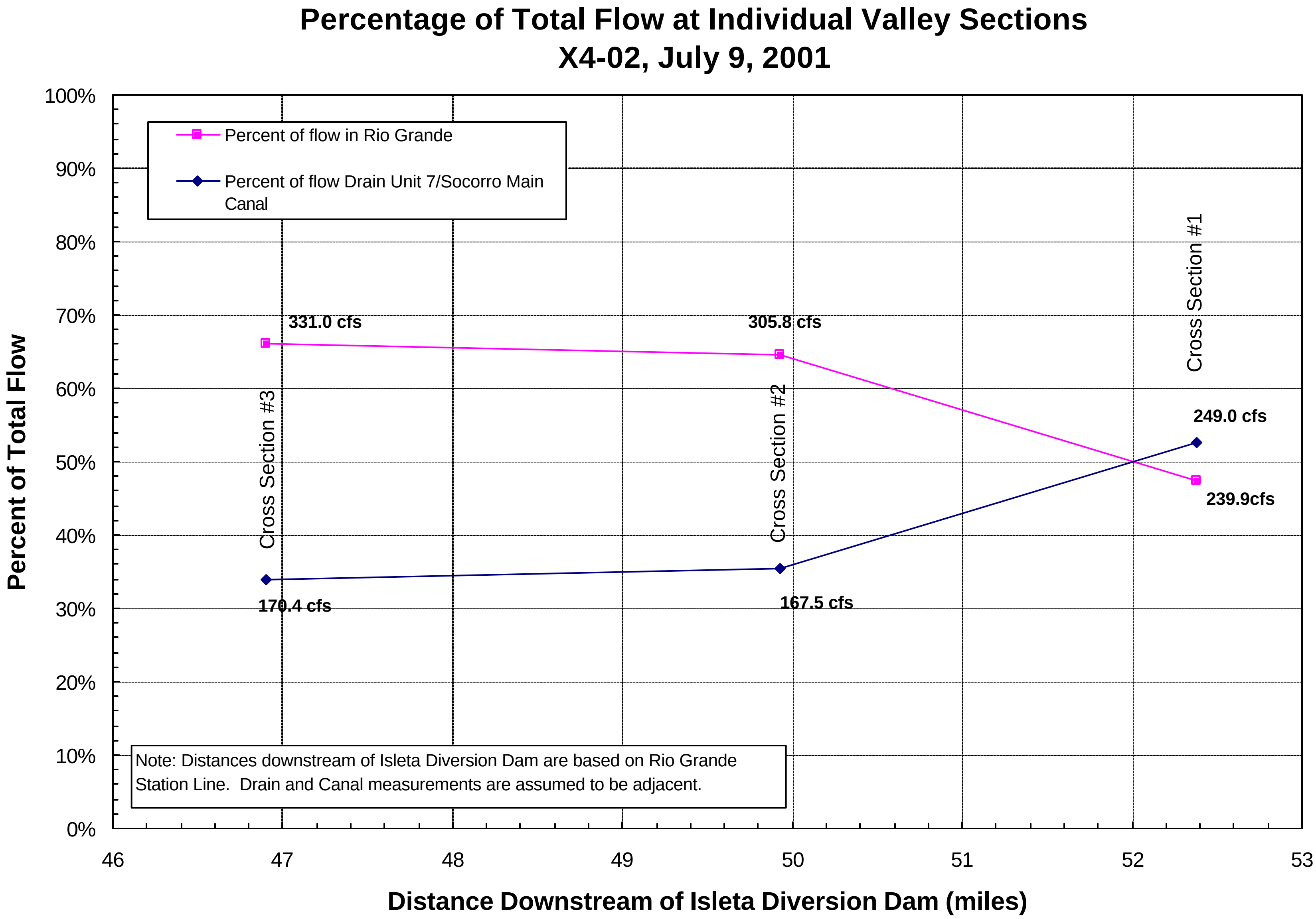
Appendix G
Valley Cross-Section Calculations

Figure G-1



Note: Distances downstream of Isleta Diversion Dam are based on Rio Grande Station Line. Drain and Canal measurements are assumed to be adjacent.

Figure G-2



Note: Distances downstream of Isleta Diversion Dam are based on Rio Grande Station Line. Drain and Canal measurements are assumed to be adjacent.

Table G-1
Measured Discharge
Valley Cross Section, X4-01, June 26, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande above San Acacia #3	RGASA#3	6/26/01 12:39 PM	422.7	Cross-Section #3
Drain Unit 7 #3	DU7#3	6/26/01 12:07 PM	158.9	Cross-Section #3
Rio Grande above San Acacia #2	RGASA#2	6/26/01 2:52 PM	417.4	Cross-Section #2
Drain Unit 7 #2	DU7#2	6/26/01 3:00 PM	163.6	Cross-Section #2
Rio Grande at San Acacia	RGSACA	6/26/01 5:00 PM	319.3	Cross-Section #1
Socorro Main at San Acacia	SMSA	6/26/01 5:10 PM	248.1	Cross-Section #1

Table G-2
Measured Discharge
Valley Cross Section, X4-02, July 9, 2001

Location	Location Code	Date/Time	Discharge (cfs)	Station Type
Rio Grande above San Acacia #3	RGASA#3	7/9/01 11:10 AM	331.0	Cross-Section #3
Drain Unit 7 #3	DU7#3	7/9/01 12:52 PM	170.4	Cross-Section #3
Rio Grande above San Acacia #2	RGASA#2	7/9/01 2:10 PM	305.8	Cross-Section #2
Drain Unit 7 #2	DU7#2	7/9/01 3:19 PM	167.5	Cross-Section #2
Rio Grande at San Acacia	RGSACA	7/9/01 5:30 PM	216.0	Cross-Section #1
Socorro Main at San Acacia	SMSA	7/9/01 5:43 PM	239.9	Cross-Section #1

Appendix H
Monument and Water Elevation Data

Table H-1: Rio Grande Water Level Elevations

Measurement Location Code	**Activity Code**	**Measurement Date**	**Monument Elevation (ft)**	**Monument Type**	**Monument, Relative Elevation (ft)**	**Water Surface, Relative Elevation (ft)**	**Water Level Elevation (ft)**
RG1200	S4-01	6/9/2001	4595.4	Mon	3.6	7.3	4591.7
RG1200	S4-01	6/10/2001	4595.4	Mon	3.7	7.5	4591.6
RG1200	S4-05	6/27/2001	4595.4	Mon	4.1	8.9	4590.6
RG1200	S4-24	8/8/2001	4595.4	Mon	3.7	8.8	4590.4
RG1200	S4-24	8/9/2001	4595.4	Mon	3.7	8.8	4590.3
RG309	S4-19	7/26/2001	4802.6	RTP	3.8	9.0	4797.4
RG309	S4-22	8/3/2001	4802.6	RTP	2.6	7.7	4797.6
RG380	S4-01	6/10/2001	*4551*	Mon	2.3	8.0	*4546*
RG380	S4-01	6/11/2001	*4551*	Mon	2.3	8.0	*4546*
RG380	S4-05	6/27/2001	*4551*	Mon	0.9	5.8	*4546*
RG380	S4-24	8/9/2001	*4551*	Mon	3.2	8.9	*4546*
RGASA2	S4-16	7/24/2001	4683.2	RTP	2.8	6.5	4679.5
RGASA3	S4-16	7/24/2001	4690.3	Temp Mon	4.3	6.3	4688.4
RGBA	S4-01	6/10/2001	4575.0	Mon	6.7	8.9	4572.8
RGBA	S4-05	6/27/2001	4575.0	Mon	5.8	12.0	4568.7
RGBA	S4-24	8/9/2001	4575.0	Mon	5.9	9.8	4571.0
RGBDU7	S4-03	6/24/2001	4708.9	RTP	4.3	6.7	4706.4
RGBDU7	S4-07	7/8/2001	4708.9	RTP	3.7	6.5	4706.1
RGBDU7	S4-07	7/9/2001	4708.9	RTP	3.4	6.3	4706.0
RGBDU7	S4-13	7/22/2001	4708.9	RTP	3.4	6.4	4705.9
RGBDU7	S4-16	7/23/2001	4708.9	RTP	2.6	5.4	4706.0
RGBDU7	S4-16	7/24/2001	4708.9	RTP	3.4	6.3	4706.0
RGCOR	S4-01	6/12/2001	4456.4	Mon	8.6	11.3	4453.7
RGCOR	S4-05	6/27/2001	4456.4	Mon	7.0	11.0	4452.3
RGESC	S4-01	6/9/2001	4618.8	Mon	2.7	11.1	4610.4
RGESC	S4-05	6/27/2001	4618.8	Mon	4.0	14.5	4608.3
RGESC	S4-24	8/8/2001	4618.8	Mon	2.1	12.8	4608.1
RGNC	S4-01	6/10/2001	*4565*	Mon	3.3	5.5	*4563*
RGNC	S4-05	6/27/2001	*4565*	Mon	3.9	7.0	*4562*
RGNC	S4-24	8/9/2001	*4565*	Mon	2.9	6.5	*4561*

Measurement Location Code	**Activity Code**	**Measurement Date**	**Monument Elevation (ft)**	**Monument Type**	**Monument, Relative Elevation (ft)**	**Water Surface, Relative Elevation (ft)**	**Water Level Elevation (ft)**
RGNSD	S4-24	8/8/2001	*4610*	RTP	3.8	10.3	*4604*
RGSACA	B4-07	7/17/2001	*4663*	Mon	4.2	14.4	*4653*
RGSACA	S4-01	6/9/2001	*4663*	Mon	2.6	10.7	*4655*
RGSACA	S4-04	6/26/2001	*4663*	Mon	2.4	11.8	*4654*
RGSACA	S4-05	6/27/2001	*4663*	Mon	5.0	14.3	*4654*
RGSACA	S4-07	7/9/2001	*4663*	Mon	2.1	12.0	*4654*
RGSACA	S4-16	7/24/2001	*4663*	Mon	4.9	15.1	*4653*
RGSBB	S4-01	6/11/2001	4496.6	Mon	5.2	7.4	4494.4
RGSM	S4-01	6/11/2001	4479.7	Mon	4.3	6.4	4477.5
RGSM	S4-01	6/12/2001	4479.7	Mon	5.5	8.0	4477.2
RGSM	S4-05	6/27/2001	4479.7	Mon	1.9	5.9	4475.7
RGTM	S4-19	7/26/2001	4809.7	RTP	1.0	4.3	4806.4
RGTM	S4-22	8/2/2001	4809.7	RTP	2.0	5.0	4806.6
RGUS60	S4-07	7/8/2001	4737.4	RTP	6.3	8.4	4735.3
RGUS60	S4-13	7/22/2001	4737.4	RTP	5.8	8.1	4735.1
RGUS60	S4-16	7/23/2001	4737.4	RTP	5.6	8.0	4735.0
RGUSOUT	S4-19	7/25/2001	4842.7	RTP	3.9	6.7	4839.9
RGUSOUT	S4-22	8/2/2001	4842.7	RTP	3.8	6.5	4840.0

Notes:

1. Vertical accuracy of monument elevation measurements is estimated at 0.1 ft for high accuracy and 1 ft for low accuracy. Low accuracy measurements are identified in italics. Level of accuracy is influenced by atmospheric conditions.
2. Relative elevations measured with surveyor's level and survey rod. The survey rod is calibrated from bottom to top, therefore a lower elevation will yield a higher reading on the rod. Estimated accuracy of these measurements is 0.1 ft.
3. Monument types are defined as follows:
   Mon : Monument permanently installed
   RTP: Top of temporary "pin" of rebar, right side of river
   Temp Mon: Other temporary monument
4. RG380 monument reported is Mon#1 of two used as a pair to improve accuracy of measurement.
5. RGESC monument reported is the one located on the east side of the river.

Table H-2: LFCC Water Level Elevations

Measurement Location Code	Activity Code	Measurement Date	Monument Elevation (ft)	Monument Type	Monument, Relative Elevation (ft)	Water Surface, Relative Elevation (ft)	Water Level Elevation (ft)
LFCC #13	S4-02	6/10/2001	4620.5	Mon	1.6	7.4	4614.7
LFCC #13	S4-25	8/8/2001	4620.5	Mon	0.9	16.0	4605.4
LFCC #11	S4-02	6/11/2001	4591.9	Mon	3.6	15.6	4579.9
LFCC #11	S4-25	8/8/2001	4591.9	Mon	1.7	14.6	4579.0
LFCC #11	S4-25	8/9/2001	4591.9	Mon	2.7	15.2	4579.4
LFCC #10	S4-02	6/11/2001	4575.0	Mon	3.4	5.9	4572.6
LFCC #10	S4-25	8/9/2001	4575.0	Mon	0.2	16.1	4559.1
LFCC #8			4546.8	Mon			
LFCC #8	S4-02	6/12/2001		LTP	8.0	12.5	
LFCC #8	B4-07	7/17/2001	4546.8	Mon	2.7	6.5	4542.9
LFCC #8	S4-25	8/9/2001	4546.8	Mon	2.5	16.3	4533.0
LFCC #7	S4-02	6/12/2001		Rebar	1.6	4.6	
LFCC #5			4489.7				
LFCC #5	S4-02	6/12/2001		Rebar	3.8	6.7	
LFCC #3	S4-02	6/12/2001	4469.8	Mon	4.2	9.8	4464.2
LFCC #2			4458.3				
LFCC #2	S4-02	6/13/2001		Rebar	5.6	7.7	
LFCC #1			4459.6				
LFCC #1	S4-02	6/13/2001		Rebar	6.1	7.8	

Notes:

1. Vertical accuracy of monument elevation measurements is estimated at 0.1 ft for high accuracy measurements. All LFCC measurements were high accuracy.
2. Relative elevations measured with surveyor's level and survey rod. The survey rod is calibrated from bottom to top, therefore a lower elevation will yield a higher reading on the rod. Estimated accuracy of these measurements is 0.1 ft.
3. Monument types are defined as follows:

Mon :	Monument permanently installed
LTP:	Top of temporary "pin" of rebar, left side of river
Rebar:	Other temporary rebar

4. Monument elevation measurements at LFCC #1, #2, #5, and #8, in Activity S4-02, do not correspond to relative elevation measurements.

Table H-3: Water Level Elevations, Other Channels

Measurement Location Code	Activity Code	Measurement Date	Monument Elevation (ft)	Monument Type	Monument, Relative Elevation (ft)	Water Surface, Relative Elevation (ft)	Water Level Elevation (ft)
ALMDT	S4-10	7/19/2001	4671.2	LTP	3.7	6.2	4668.7
AQMAD	S4-09	7/18/2001	4630.6	RTP	3.7	7.0	4627.2
BRD309	S4-23	8/3/2001	4802.6	LTP	4.0	9.0	4797.6
BRDOUT	S4-20	7/25/2001	4841.1	LTP	3.1	8.8	4835.3
BRDOUT	S4-23	8/2/2001	4841.1	LTP	3.8	9.8	4835.2
BRDTM	S4-20	7/25/2001	4809.4	LTP	3.6	8.5	4804.5
BRDTM	S4-23	8/2/2001	4809.4	LTP	4.4	9.0	4804.8
BRDTM	S4-23	8/3/2001	4809.4	LTP	4.4	9.1	4804.7
BRNWW	S4-02	6/11/2001	4572.0	Mon	8.0	12.0	4568.0
BRNWW	S4-25	8/9/2001	4572.0	Mon	4.3	8.0	4568.3
DU7#2	S4-17	7/24/2001	4686.4	n/a	2.6	10.0	4679.1
DU7#3	S4-17	7/24/2001	4697.5	n/a	3.1	9.9	4690.7
DU7G	S4-17	7/24/2001	4677.7	n/a	3.6	8.8	4672.5
DU7RG7	S4-14	7/22/2001	*4719*	Upper RTP	1.2	11.2	*4709*
DU7RG7	S4-17	7/23/2001	*4719*	Upper RTP	3.2	12.5	*4710*
DU7RG7	S4-17	7/24/2001	*4719*	Upper RTP	3.2	12.4	*4710*
DU7X	S4-03	6/24/2001	*4710*	n/a	4.8	8.2	*4707*
DU7X	S4-06	6/29/2001	*4710*	LTP	4.6	7.8	*4707*
DU7X	S4-07	7/8/2001	*4710*	LTP	5.1	8.9	*4706*
DU7X	S4-13	7/22/2001	*4710*	LTP	2.2	6.1	*4706*
DU7X	S4-16	7/23/2001	*4710*	LTP	4.2	7.9	*4707*
HARD	S4-19	7/25/2001	4834.8	RTP	2.3	9.9	4827.2
HARD	S4-22	8/2/2001	4834.8	RTP	2.1	8.5	4828.4
LNDR	S4-12	7/22/2001	*4733*	RTP	9.1	14.2	*4728*
LNDR	S4-15	7/23/2001	*4733*	RTP	3.2	8.0	*4728*
OTDR	S4-18	7/25/2001	*4834*	RTP	9.0	12.3	*4831*
OTDR	S4-18	7/25/2001	*4834*	LTP	8.8	12.3	*4831*
OTDR	S4-21	8/2/2001		RTP	7.3	10.4	
OTDR	S4-21	8/2/2001		LTP	7.1	10.4	
OTDR	S4-21	8/6/2001	*4839*	Temp Mon	2.9	10.4	*4831*
PRD309	S4-21	8/3/2001	4808.6	RTP	2.6	11.4	4799.8
PRDOUT	S4-18	7/25/2001	*4838*	Lower RTP	7.3	12.8	*4832*
PRDOUT	S4-21	8/2/2001	*4841*	Upper RTP	3.3	11.8	*4832*
PRDOUT	S4-21	8/2/2001	*4838*	Lower RTP	6.7	11.8	*4832*
PRDTM	S4-18	7/25/2001	4811.2	RTP	2.6	7.9	4805.8
PRDTM	S4-21	8/2/2001	4811.2	RTP	2.3	7.8	4805.7
PRDTM	S4-21	8/3/2001	4811.2	RTP	3.6	8.2	4806.6
RIVDS1200	B4-07	7/17/2001	4590.5	Mon	4.4	8.9	4586.0
RIVDS1200	S4-02	6/10/2001	4590.5	Mon	3.2	7.3	4586.4
RIVDS1200	S4-25	8/8/2001	4590.5	Mon	3.2	7.7	4586.0
RIVDSLEM	B4-07	7/17/2001	*4630*	Mon	4.1	14.0	*4620*
RIVDSNC	B4-07	7/17/2001	*4558*	Mon	3.9	15.1	*4546*

Measurement Location Code	Activity Code	Measurement Date	Monument Elevation (ft)	Monument Type	Monument, Relative Elevation (ft)	Water Surface, Relative Elevation (ft)	Water Level Elevation (ft)
RIVDSNC	S4-02	6/12/2001		Rebar	11.1	14.0	
RIVDSNC	S4-25	8/9/2001	*4558*	Mon	4.2	15.4	*4546*
RIVUS1200	B4-07	7/17/2001	4590.7	Mon	4.2	8.8	4586.1
RIVUS1200	S4-02	6/10/2001	4590.7	Mon	3.1	7.2	4586.6
RIVUS1200	S4-25	8/8/2001	4590.7	Mon	2.8	11.3	4582.2
RIVUSLEM	B4-07	7/17/2001	4632.4	Mon	4.3	16.3	4620.4
RIVUSNC	B4-07	7/17/2001	4557.0	Mon	4.0	15.9	4545.1
RIVUSNC	S4-25	8/9/2001	4557.0	Mon	6.6	17.5	4546.1
SFBDWW	S4-14	7/22/2001	4724.6	Upper RTP	4.3	8.7	4720.2
SFBDWW	S4-17	7/23/2001	4724.6	Upper RTP	3.2	7.6	4720.3
SFRD60	S4-14	7/22/2001	4736.9	LTP	7.3	11.7	4732.5
SFRD60	S4-17	7/23/2001	4736.9	LTP	4.8	9.3	4732.5
SJBDU7	S4-12	7/22/2001	4719.0	RTP	11.6	15.0	4715.5
SJBDU7	S4-15	7/23/2001	4719.0	RTP	5.5	12.4	4712.1
SJDR60	S4-12	7/22/2001	4737.0	RTP	4.6	9.3	4732.3
SJDR60	S4-15	7/23/2001	4737.0	RTP	3.0	7.9	4732.0
SJMN	S4-12	7/22/2001	*4730*	RTP	6.3	8.3	*4728*
SJMN	S4-15	7/23/2001	*4730*	RTP	6.5	8.2	*4728*
SM1	S4-10	7/19/2001	4671.8	LTP	4.6	7.7	4668.7
SM1DR	S4-10	7/19/2001	4671.8	LTP	2.4	15.4	4658.9
SM2	S4-10	7/19/2001	4666.9	RTP	3.9	6.9	4663.9
SM3	S4-10	7/19/2001	4668.5	LTP	3.8	7.7	4664.5
SM7	S4-09	7/18/2001	4631.4	RTP	3.6	8.0	4627.0
SM7DR	S4-09	7/18/2001	4621.6	LTP	12.0	15.5	4618.1
SM8	S4-09	7/18/2001	4629.7	LTP	3.9	6.9	4626.6
SM8DR	S4-09	7/18/2001	4625.7	RTP	4.4	15.2	4615.0
SM9	S4-09	7/18/2001	4625.8	LTP	2.5	7.2	4621.1
SMSA	S4-17	7/24/2001	4672.4	RTP	1.9	6.2	4668.1
TOMDR	S4-21	8/2/2001	4810.1	Temp Mon	4.9	9.1	4805.8

Notes:

1. Vertical accuracy of monument elevation measurements is estimated at 0.1 ft for high accuracy and 1 ft for low accuracy. Low accuracy measurements are identified in italics. Level of accuracy is influenced by atmospheric conditions.

2. Relative elevations measured with surveyor's level and survey rod. The survey rod is calibrated from bottom to top, therefore a lower elevation will yield a higher reading on the rod. Estimated accuracy of these measurements is 0.1 ft.

3. Monument types are defined as follows:

Mon : Monument permanently installed
RTP: Top of temporary "pin" of rebar, right side of river
Temp Mon: Other temporary monument

4. SM1DR and SM1 share the same monument.

Table H-4: Permanent Monument Location Coordinates

Measurement Location Name	Measurement Location Code	Measurement Date	Latitude (NAD83)	Longitude (NAD83)
Alamillo Ditch	ALMDT	7/19/2001	34.25741657	-106.8933444
Acequia Madre	AQMAD	7/18/2001	34.14972252	-106.8921347
Belen Riverside Drain at Hwy 309	BRD309	8/3/2001	34.65143127	-106.7401127
Belen Riverside Drain adjacent to RGUSOUT	BRDOUT	8/2/2001	34.78298503	-106.7331356
Belen Riverside Drain at Tome	BRDTM	8/7/2001	34.6783266	-106.7462716
Brown Arroyo Wasteway	BRNWW	6/11/2001	34.00568549	-106.873103
Drain Unit 7 #2	DU7#2	7/24/2001	34.2733452	-106.8653683
Drain Unit 7 #3	DU7#3	7/24/2001	34.30293455	-106.8506733
Drain Unit 7 near MRGCD gage	DU7G	7/24/2001	34.2654386	-106.8774132
Drain Unit 7 adjacent to RGBDU7	DU7RG7	7/22/2001	*34.37235827*	*-106.8451736*
Drain Unit 7 Extension	DU7X	7/22/2001	*34.37402915*	*-106.8405451*
Harlan Drain	HARD	8/2/2001	34.7448902	-106.7450117
LFCC at Corral	LFCC1	na	33.59595523	-107.0427401
LFCC below Brown Arroyo	LFCC10	6/11/2001	34.00157731	-106.8720743
LFCC #11, downstream of 1200 check structure	LFCC11	6/11/2001	34.06057155	-106.8766058
LFCC downstream of wasteway to Rio Grande	LFCC13	6/10/2001	34.12554845	-106.8886348
LFCC at Ft. Craig	LFCC2	na	33.63075279	-107.0032271
LFCC at San Marcial	LFCC3	6/12/2001	33.68603905	-106.9954346
LFCC at South Boundary of Bosque del Apache	LFCC5	na	33.72478929	-106.9142396
LFCC downstream of Hwy 380	LFCC8	na	33.9169848	-106.855809
Las Nutrias Drain	LNDR	7/23/2001	*34.42858122*	*-106.7957351*
Otero Drain	OTDR	8/6/2001	*34.77687304*	*-106.7274792*
Peralta Riverside Drain at Hwy 309	PRD309	8/3/2001	34.65190682	-106.7366341
Peralta Riverside Drain adjacent to RGUSOUT	PRDOUT	8/6/2001	*34.77823417*	*-106.7273127*
Peralta Riverside Drain at Tome	PRDTM	8/3/2001	34.67933286	-106.7395356
Rio Grande at 1200 Check Structure	RG1200	6/9/2001	34.06089102	-106.8754234
Rio Grande downstream of Hwy 309	RG309	8/7/2001	34.65191168	-106.7379386
Rio Grande downstream of Hwy 380	RG380	6/10/2001	*33.91785149*	*-106.8509489*
offset needed to improve accuracy	RG380-OffSet	na	33.9178023	-106.8506939
Rio Grande above San Acacia #2	RGASA2	7/24/2001	34.27182221	-106.8585832
Rio Grande above San Acacia #3	RGASA3	7/24/2001	34.30339176	-106.8491877
Rio Grande at Brown Arroyo	RGBA	6/10/2001	34.00214751	-106.8710135
Rio Grande below Drain Unit 7	RGBDU7	7/22/2001	34.37273252	-106.8412712
Rio Grande North of Corral	RGCOR	6/12/2001	33.58793165	-107.0540327
Rio Grande at Escondida Bridge	RGESC	6/9/2001	34.12132243	-106.8868589
Rio Grande at Neil Cupp	RGNC	6/10/2001	*33.96833264*	*-106.8594685*
Rio Grande at North Socorro Diversion	RGNSD	8/8/2001	*34.10074533*	*-106.880769*
Rio Grande at San Acacia	RGSACA	6/9/2001	*34.25637101*	*-106.8920579*
Rio Grande at South Boundary of Bosque	RGSBB	6/11/2001	33.72185191	-106.9121046
Rio Grande at San Marcial	RGSM	6/11/2001	33.67902726	-106.9972442
Rio Grande at Tome	RGTM	8/7/2001	34.67837118	-106.7432691
Rio Grande Upstream of Hwy 60	RGUS60	7/22/2001	34.45235992	-106.8024673
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	8/2/2001	34.78002358	-106.7299225
Riverside Drain downstream of 1200 Check Structure	RIVDS1200	6/10/2001	34.06174206	-106.877467
Riverside Drain downstream of Lemitar Diversion	RIVDSLEM	7/17/2001	*34.15012311*	*-106.8839563*
Riverside Drain downstream of Neil Cupp Diversion	RIVDSNC	na	*33.95696132*	*-106.8541457*
Riverside Drain upstream of 1200 Check Structure	RIVUS1200	6/10/2001	34.06213177	-106.8774806
Riverside drain upstream of Lemitar Diversion	RIVUSLEM	7/17/2001	34.15080166	-106.8845929

Measurement Location Name	Measurement Location Code	Measurement Date	Latitude (NAD83)	Longitude (NAD83)
Riverside Drain upstream of Neil Cupp Diversion	RIVUSNC	na	33.957691	-106.8546469
Bernardo Drain Wastewater Inflow	SFBDWW	7/22/2001	34.39919687	-106.8272112
San Francisco Riverside Drain upstream of Hwy 60	SFRD60	7/22/2001	34.45366386	-106.8052776
Lower San Juan Riverside Drain below Drain Unit 7	SJBDU7	7/23/2001	34.371164	-106.8378043
Lower San Juan Riverside Drain upstream of Hwy 60	SJDR60	7/22/2001	34.45092902	-106.7985851
San Juan Main	SJMN	7/23/2001	*34.41639529*	*-106.7944823*
Socorro Main #1, at stop sign	SM1	7/19/2001	34.25712489	-106.8902914
Socorro Main #2	SM2	7/19/2001	34.24404278	-106.9050356
Socorro Main # 3, upstream of Siphon	SM3	7/19/2001	34.23612226	-106.9111309
Socorro Main #7, downstream of Chambon Lateral	SM7	7/18/2001	34.15811785	-106.8997645
Socorro Main #8	SM8	7/18/2001	34.15125221	-106.8919297
Socorro Main #9, downstream of check structure	SM9	7/18/2001	34.13383084	-106.8940911
Socorro Main at San Acacia	SMSA	7/24/2001	34.25722689	-106.8925957
Tome Drain	TOMDR	8/2/2001	34.68153474	-106.7386354

Notes:

1.Horizontal accuracy of GPS measurements is estimated at 0.1 ft for high accuracy and 1 ft for low accuracy. Low accuracy measurements are identified in italics. Level of accuracy is influenced by atmospheric conditions.

2. "na" indicates that the data is not available

3. Permanent monuments were not installed at all measurement locations.

Appendix I
Water Quality Data

List of Figures

List of Tables

Figure I-1.1
Water Temperature for Rio Grande Seepage Run, Socorro Division, S4-01, June 9-12, 2001

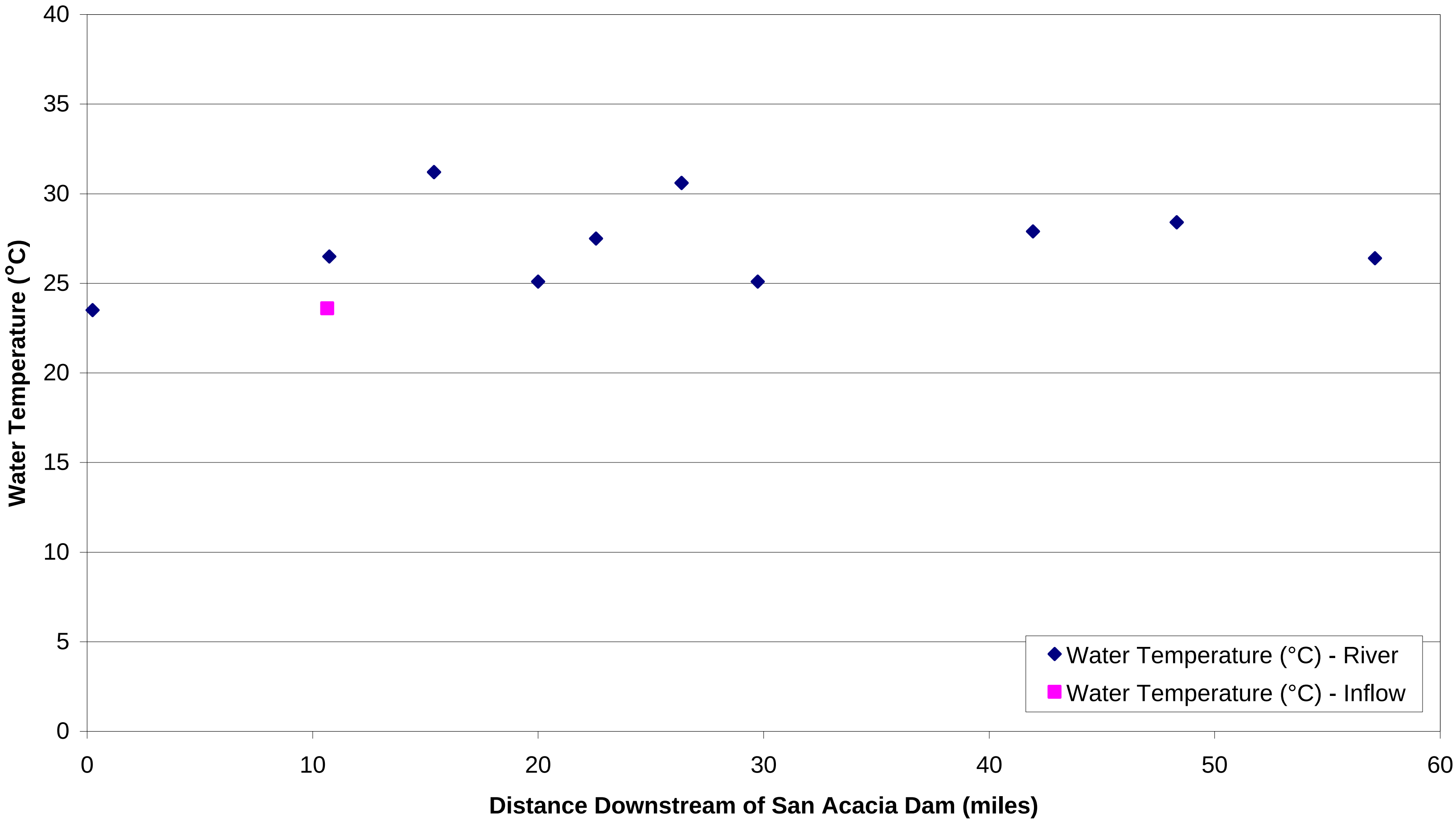


Figure I-1.2

pH for Rio Grande Seepage Run, Socorro Division, S4-01, June 9-12, 2001

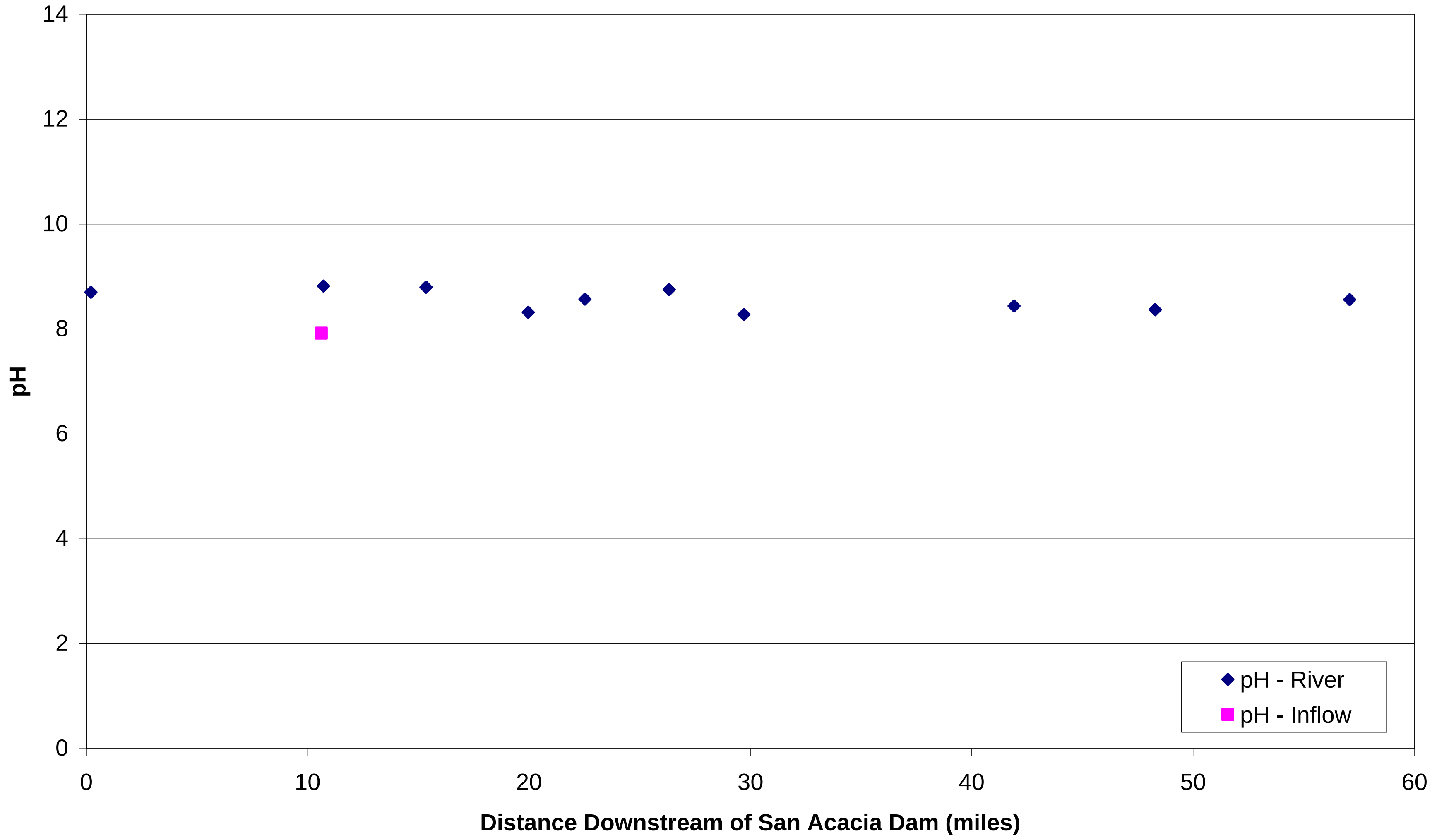


Figure I-1.3
Conductivity for Rio Grande Seepage Run, Socorro Division, S4-01, June 9-12, 2001

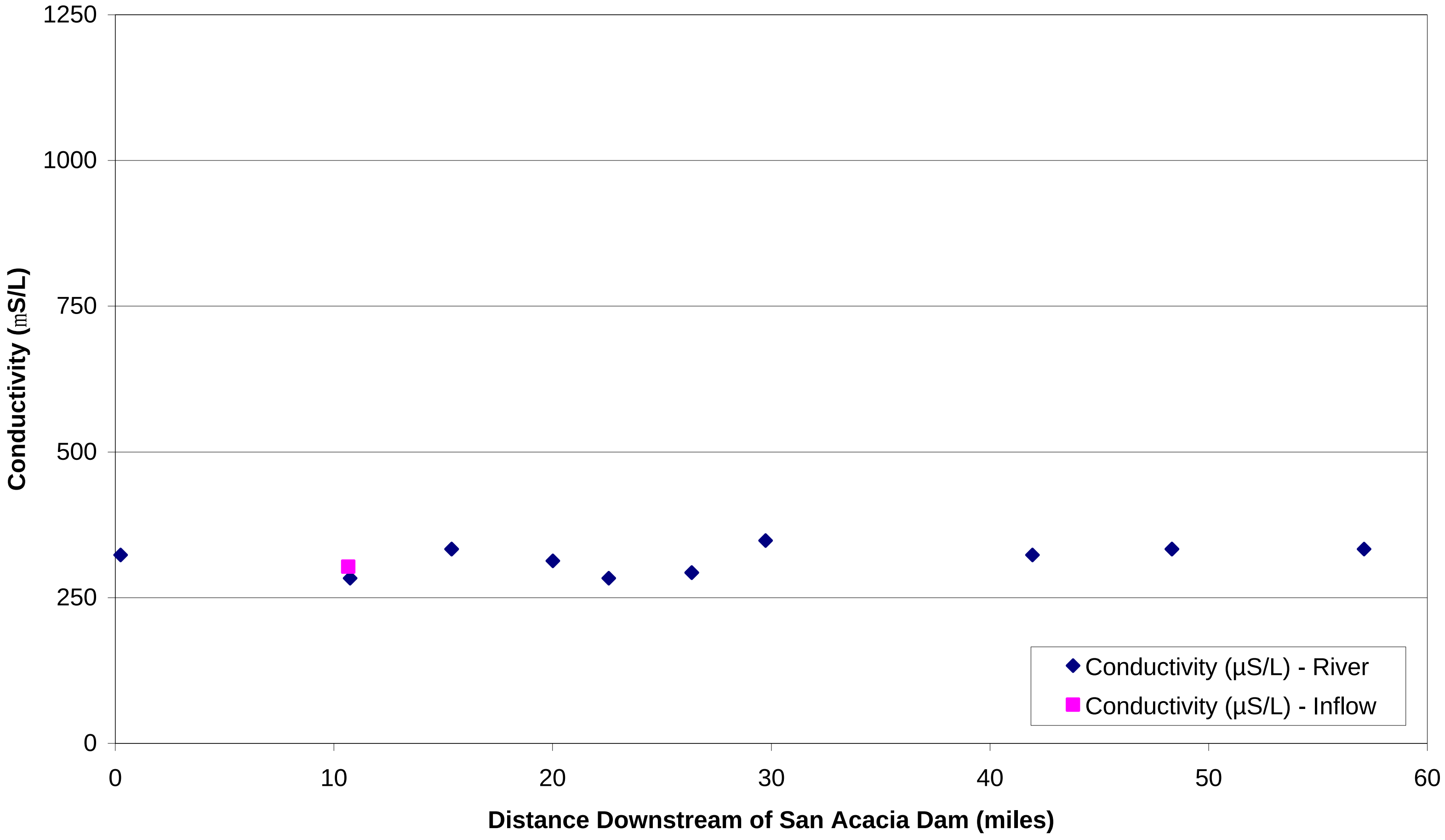


Figure I-2.1a
Water Temperature for North LFCC Seepage Run, Socorro Division, S4-02, June 10-12, 2001

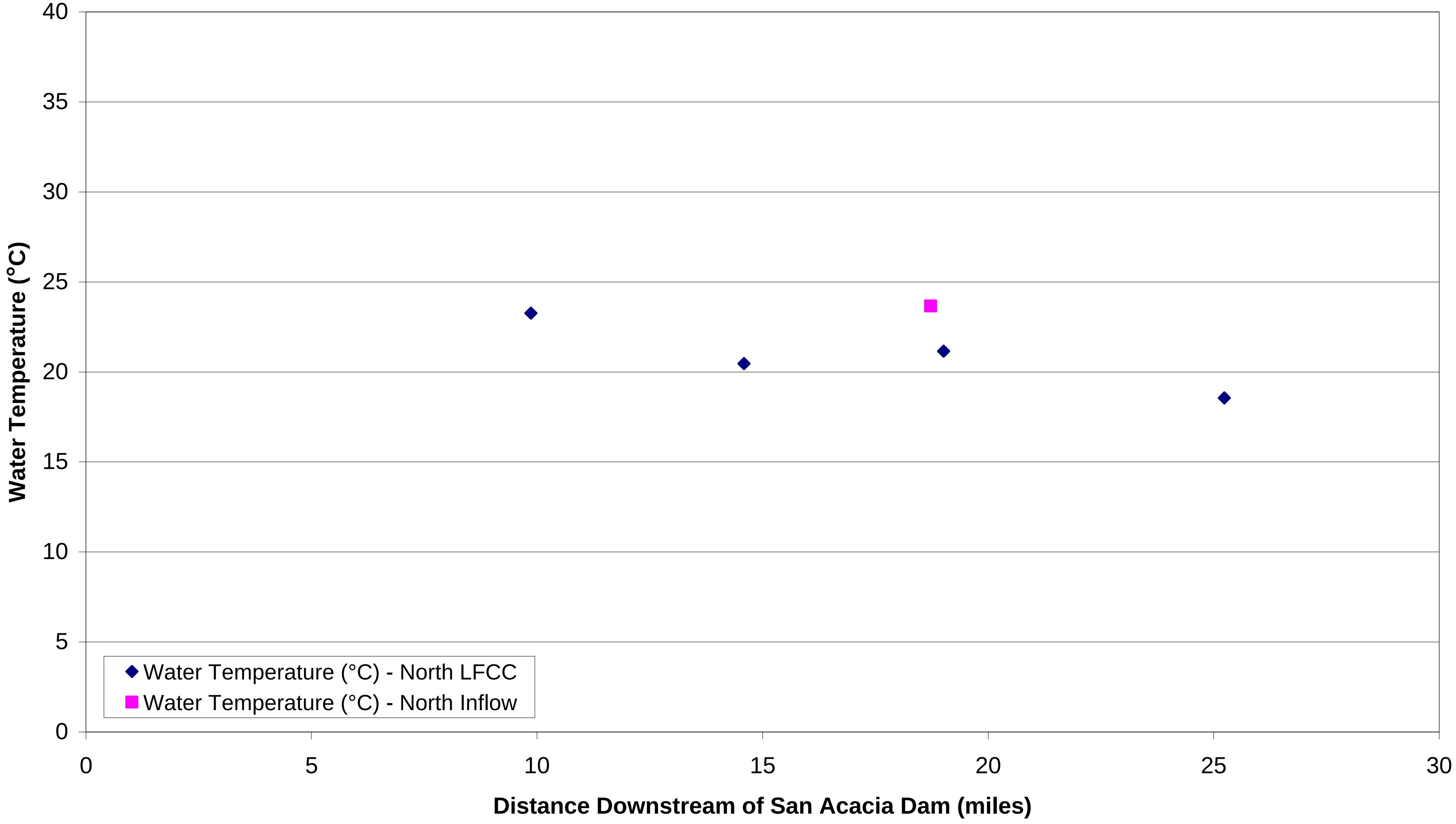


Figure I-2.2a
pH for North LFCC Seepage Run, Socorro Division, S4-02, June 10-12, 2001

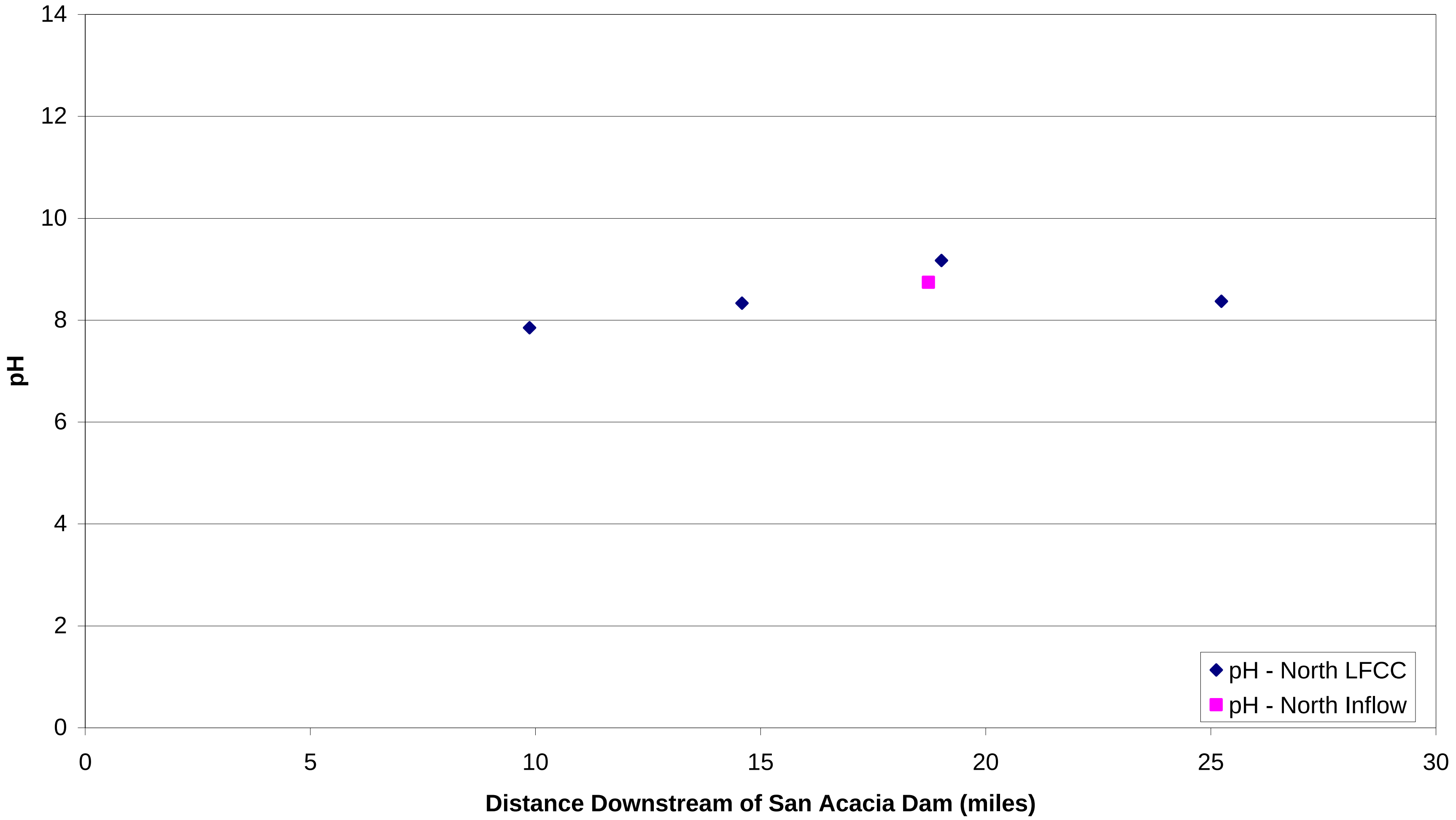


Figure I-2.3a
Conductivity for North LFCC Seepage Run, Socorro Division, S4-02, June 10-12, 2001

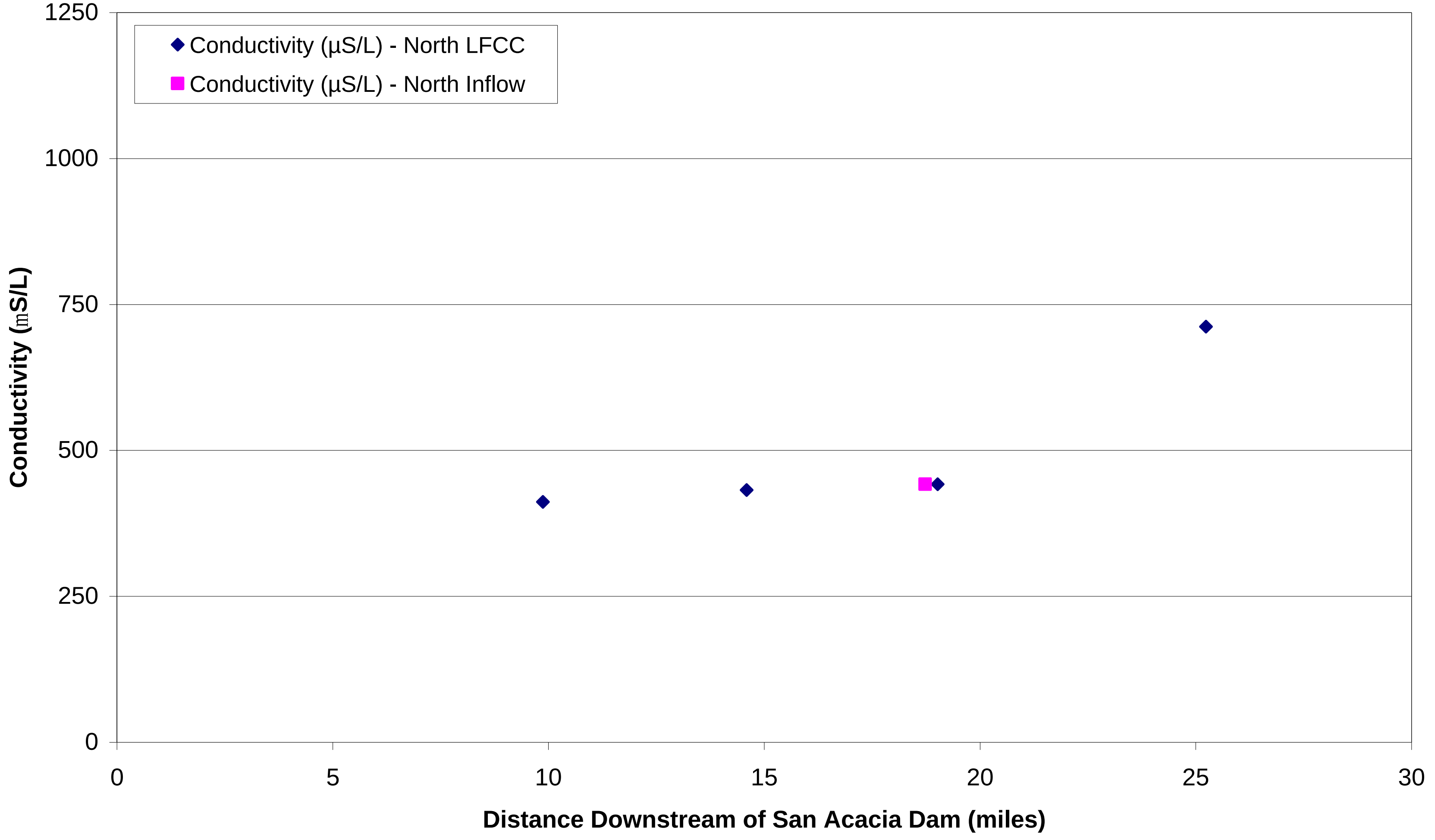


Figure I-2.1b
Water Temperature for South LFCC Seepage Run, Socorro Division, S4-02, June 12-13, 2001

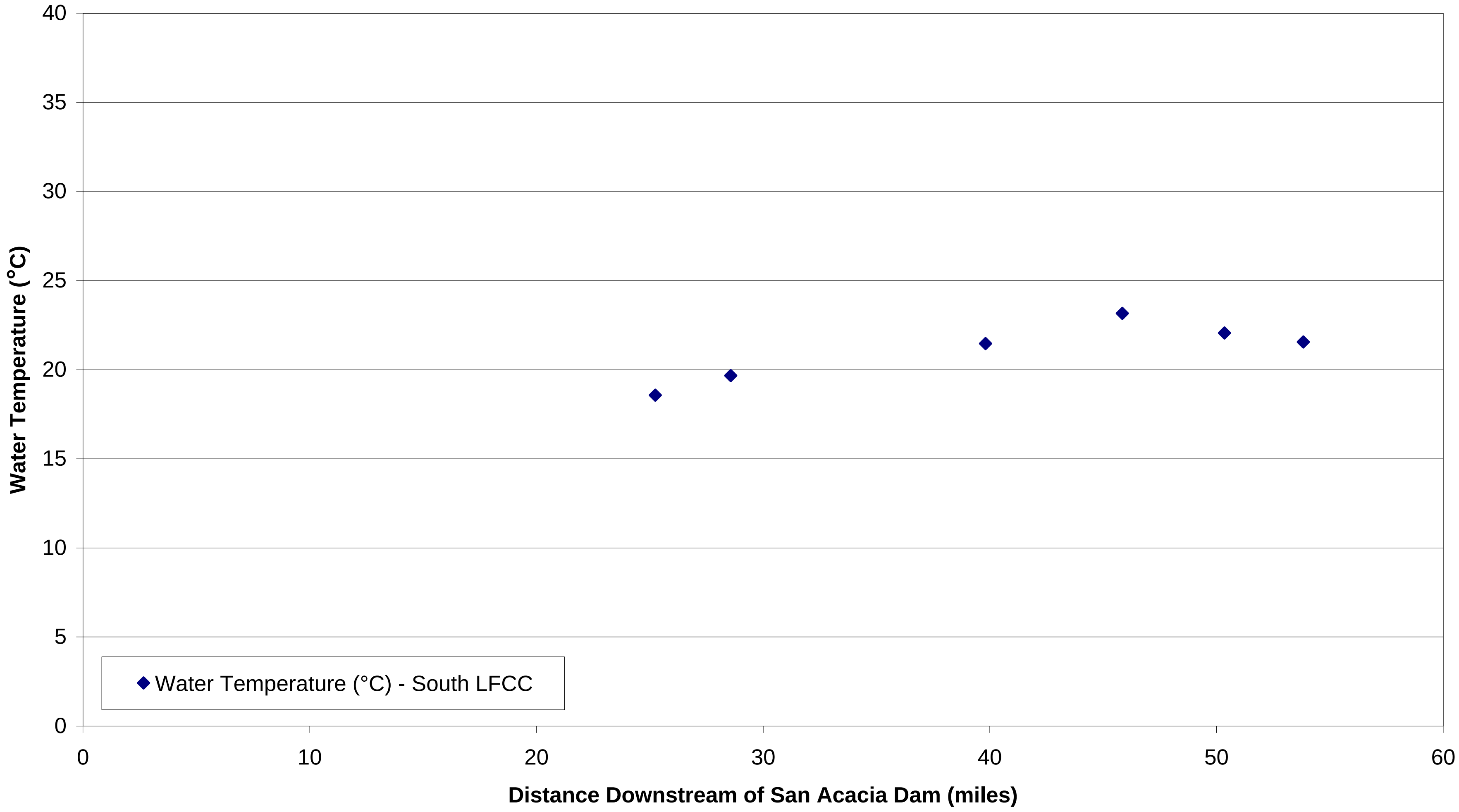


Figure I-2.2b
pH for South LFCC Seepage Run, Socorro Division, S4-02, June 12-13, 2001

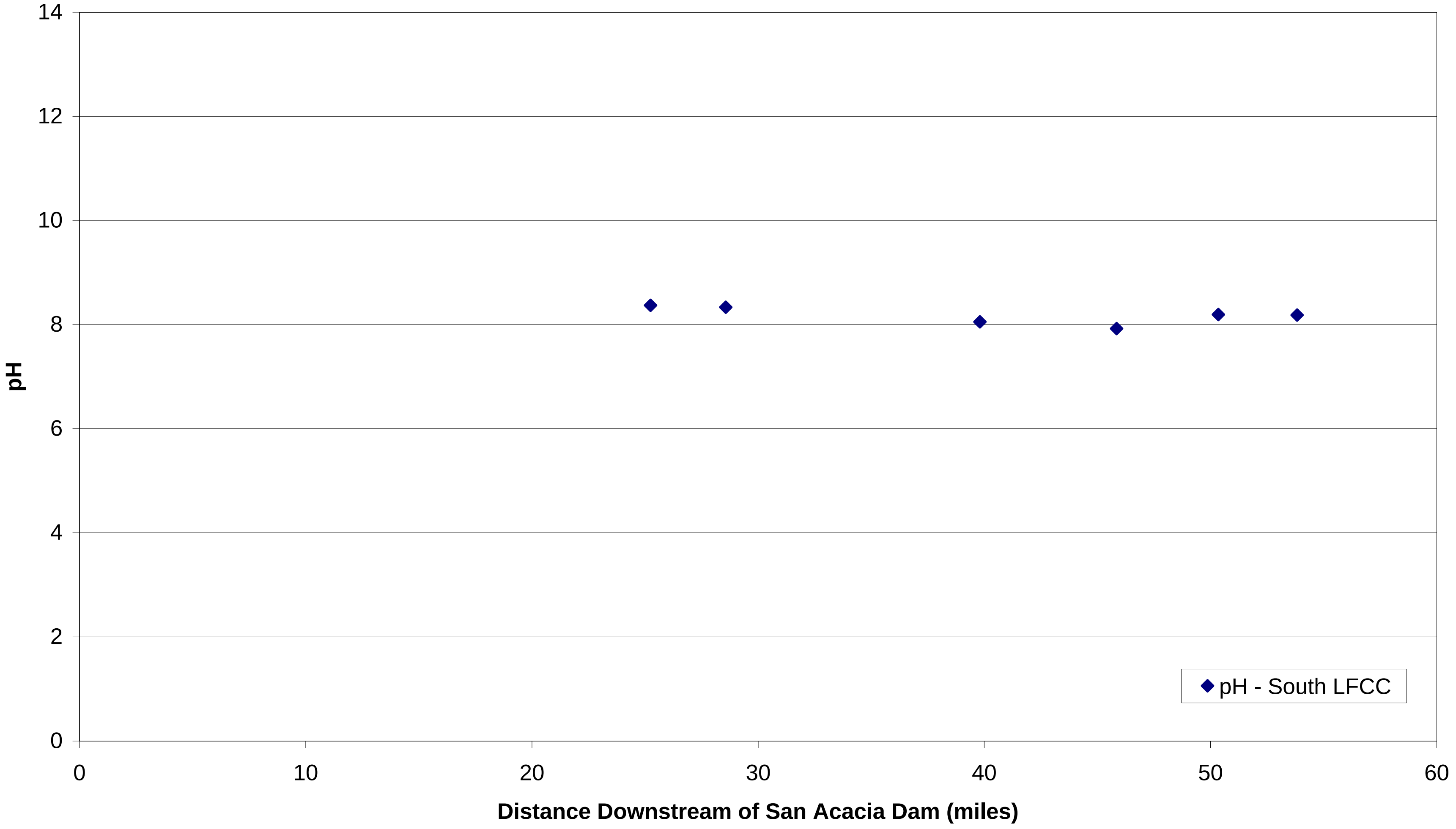


Figure I-2.3b
Conductivity for South LFCC Seepage Run, Socorro Division, S4-02, June 12-13, 2001

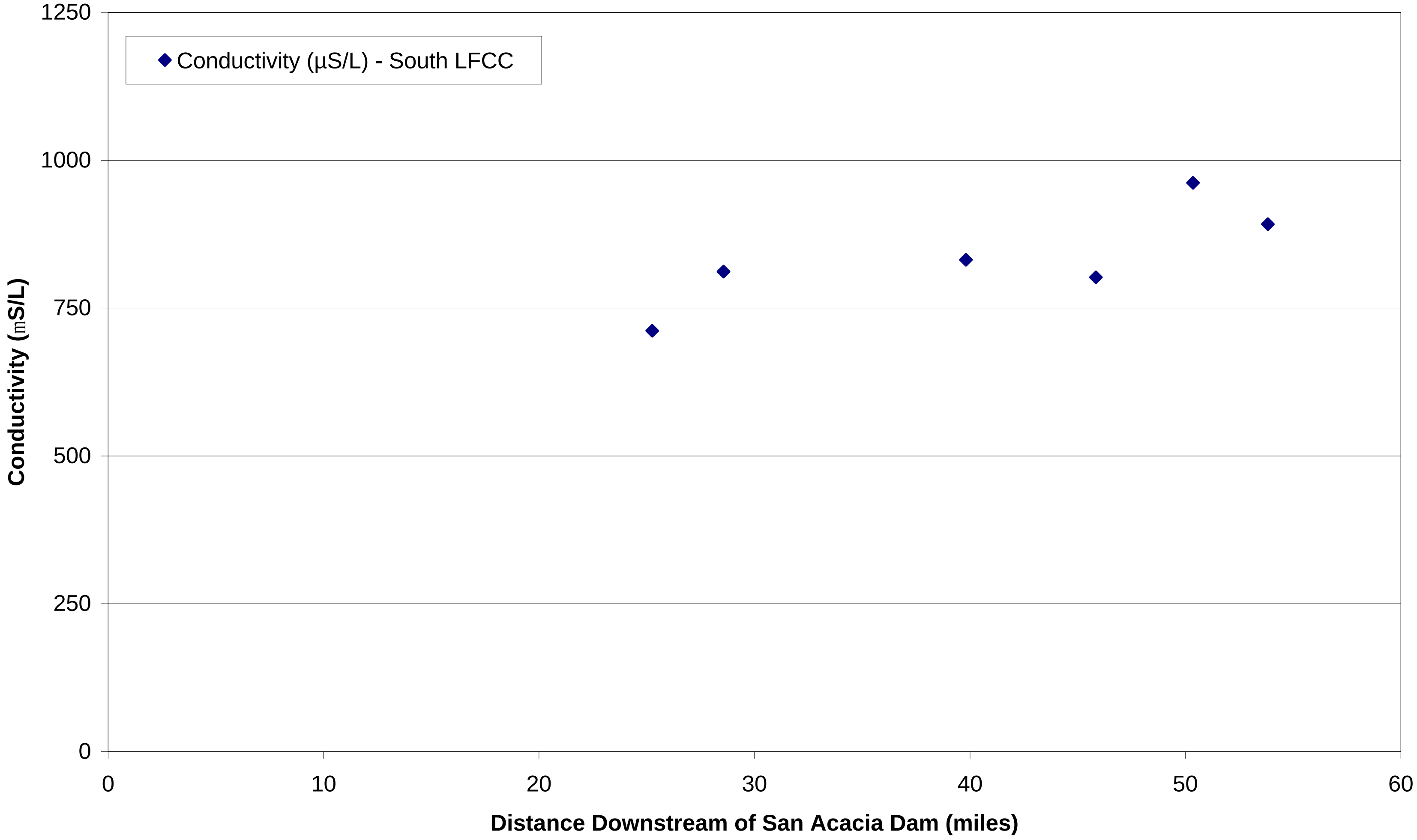


Figure I-3.1
Water Temperature for Rio Grande Seepage Run, Belen Division, S4-03, June 23-24, 2001

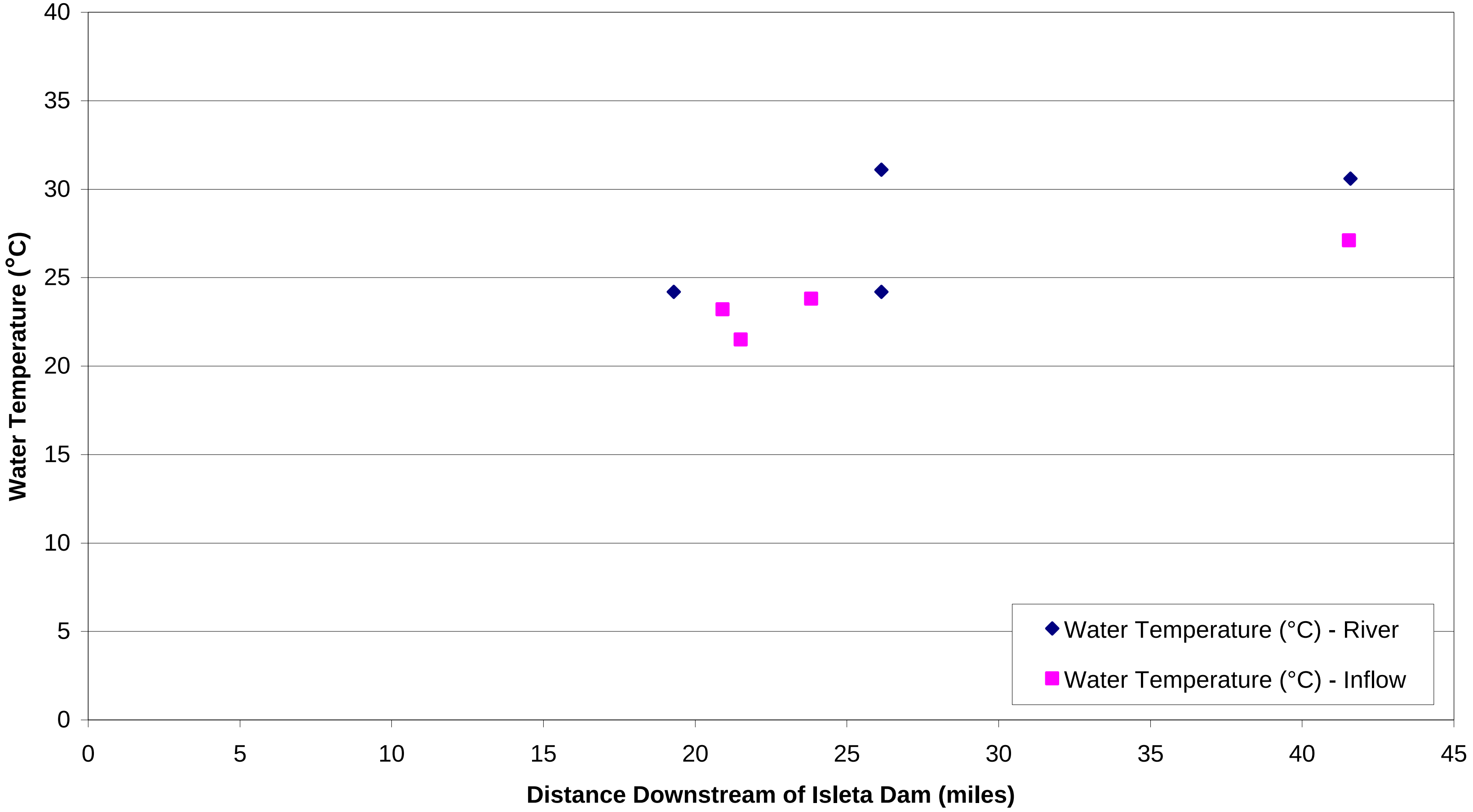


Figure I-3.2
pH for Rio Grande Seepage Run, Belen Division, S4-03, June 23-24, 2001

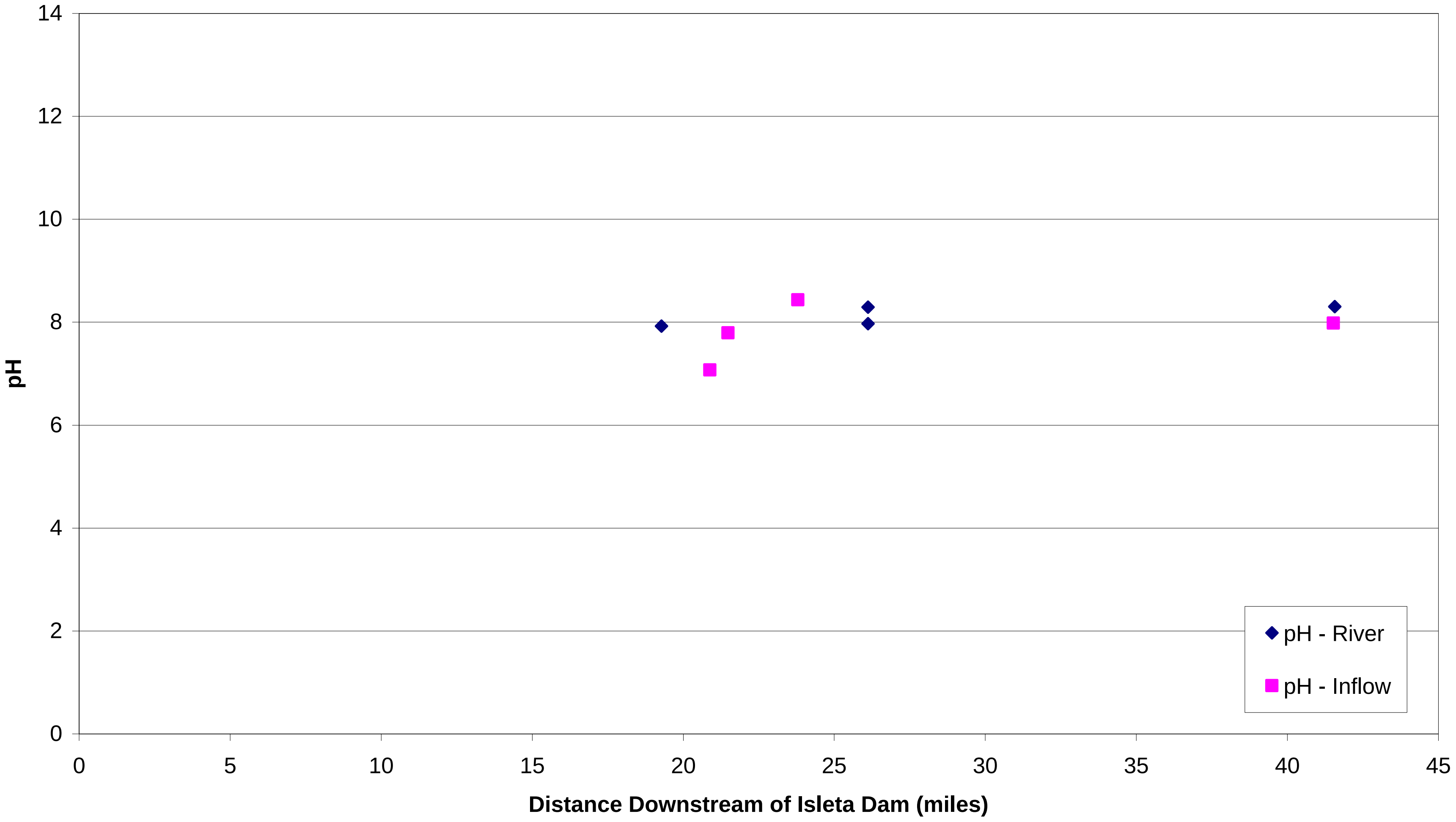


Figure I-3.3
Conductivity for Rio Grande Seepage Run, Belen Division, S4-03, June 23-24, 2001

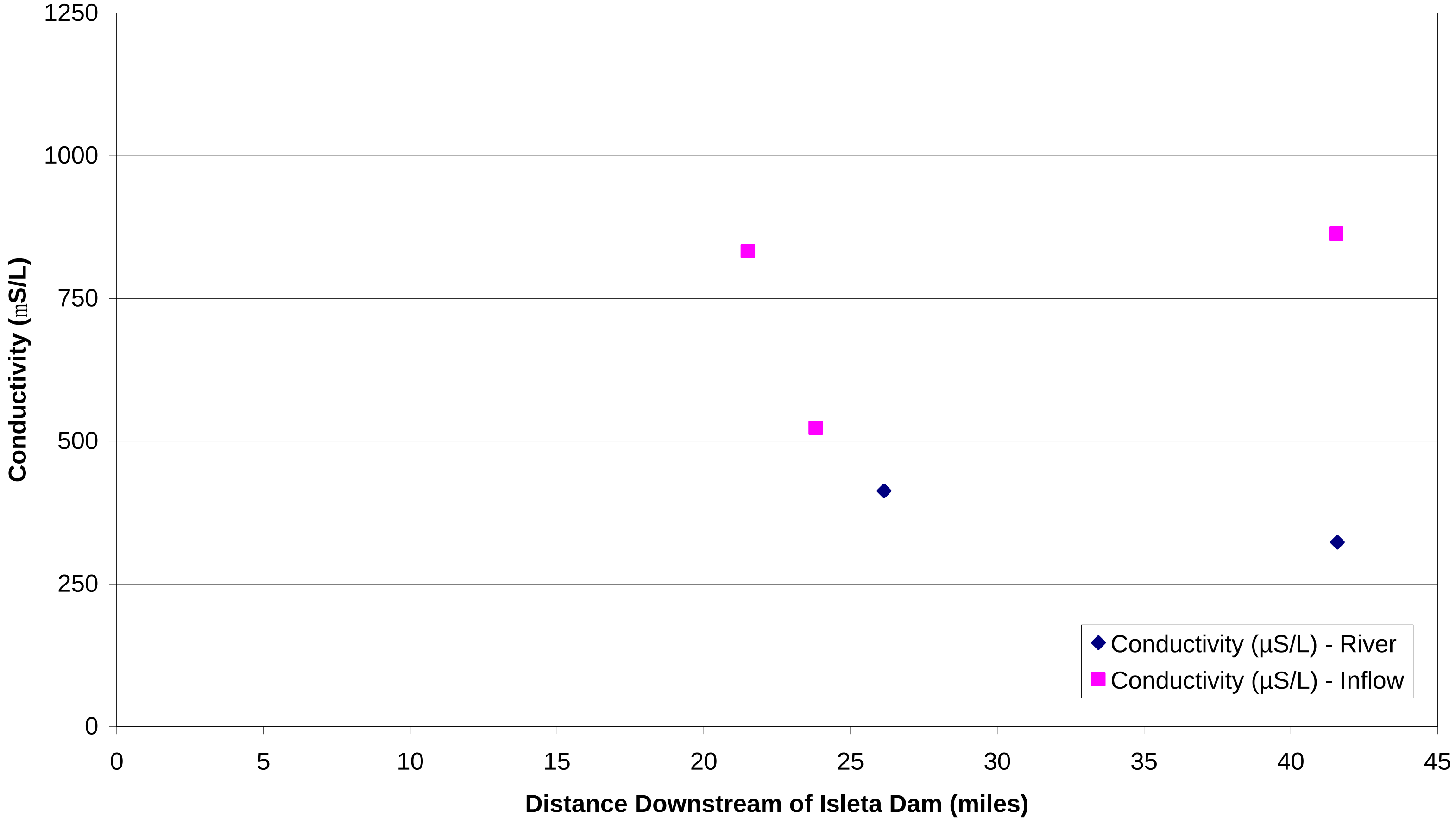


Figure I-4.1
Water Temperature for Rio Grande Seepage Run, Socorro Division, S4-05, June 27, 2001

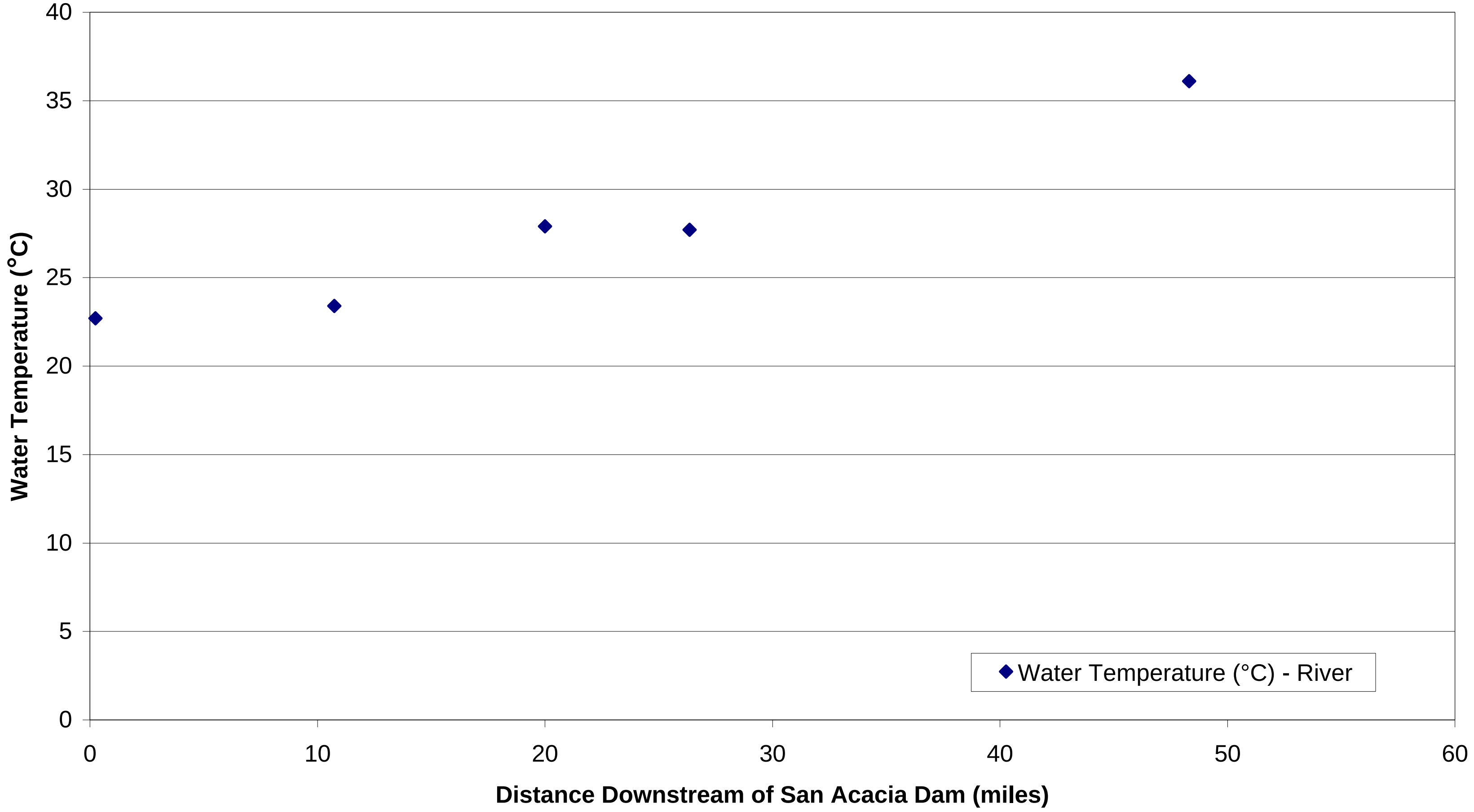


Figure I-4.2

pH for Rio Grande Seepage Run, Socorro Division, S4-05, June 27, 2001

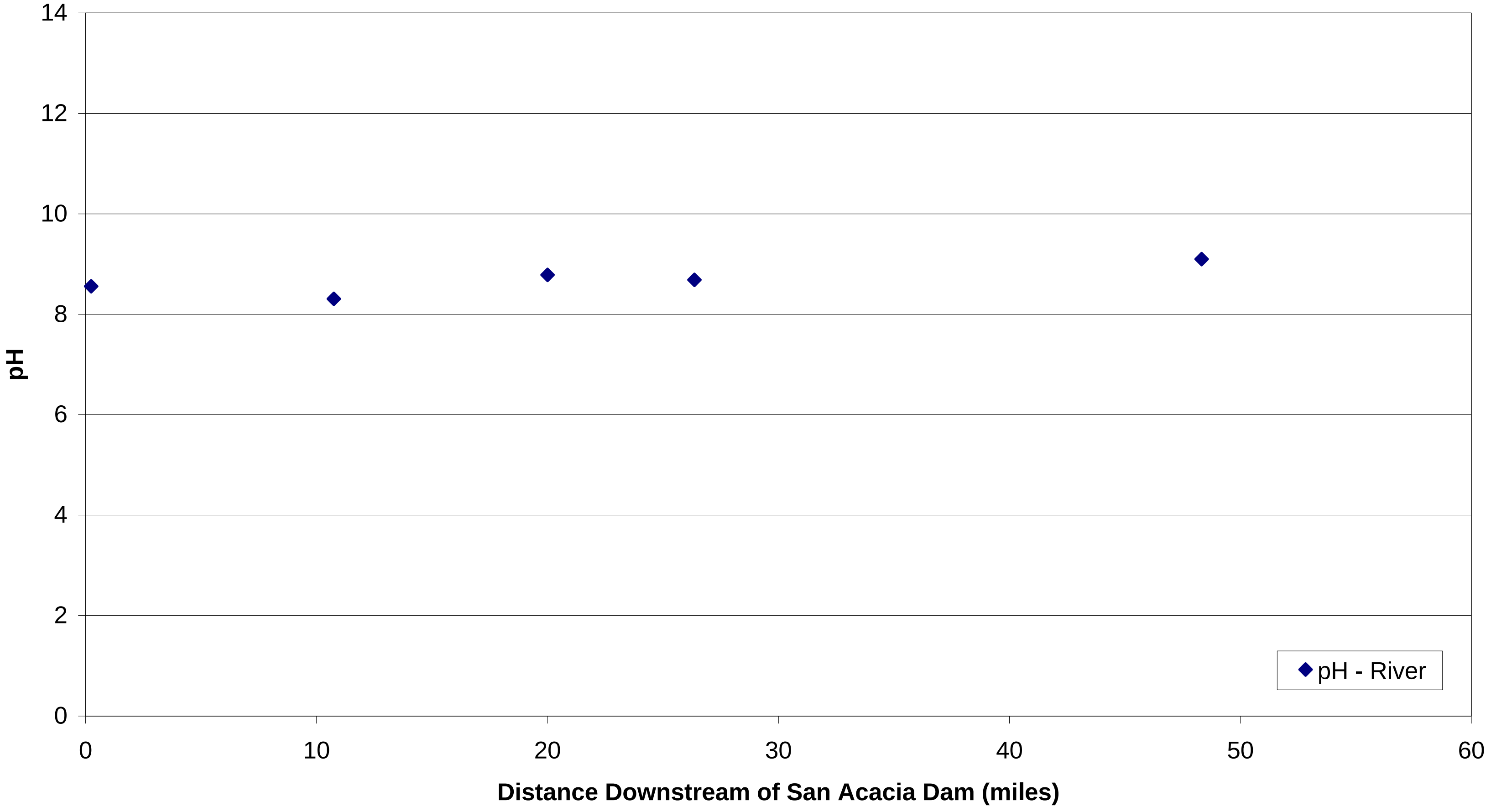


Figure I-4.3

Conductivity for Rio Grande Seepage Run, Socorro Division, S4-05, June 27, 2001

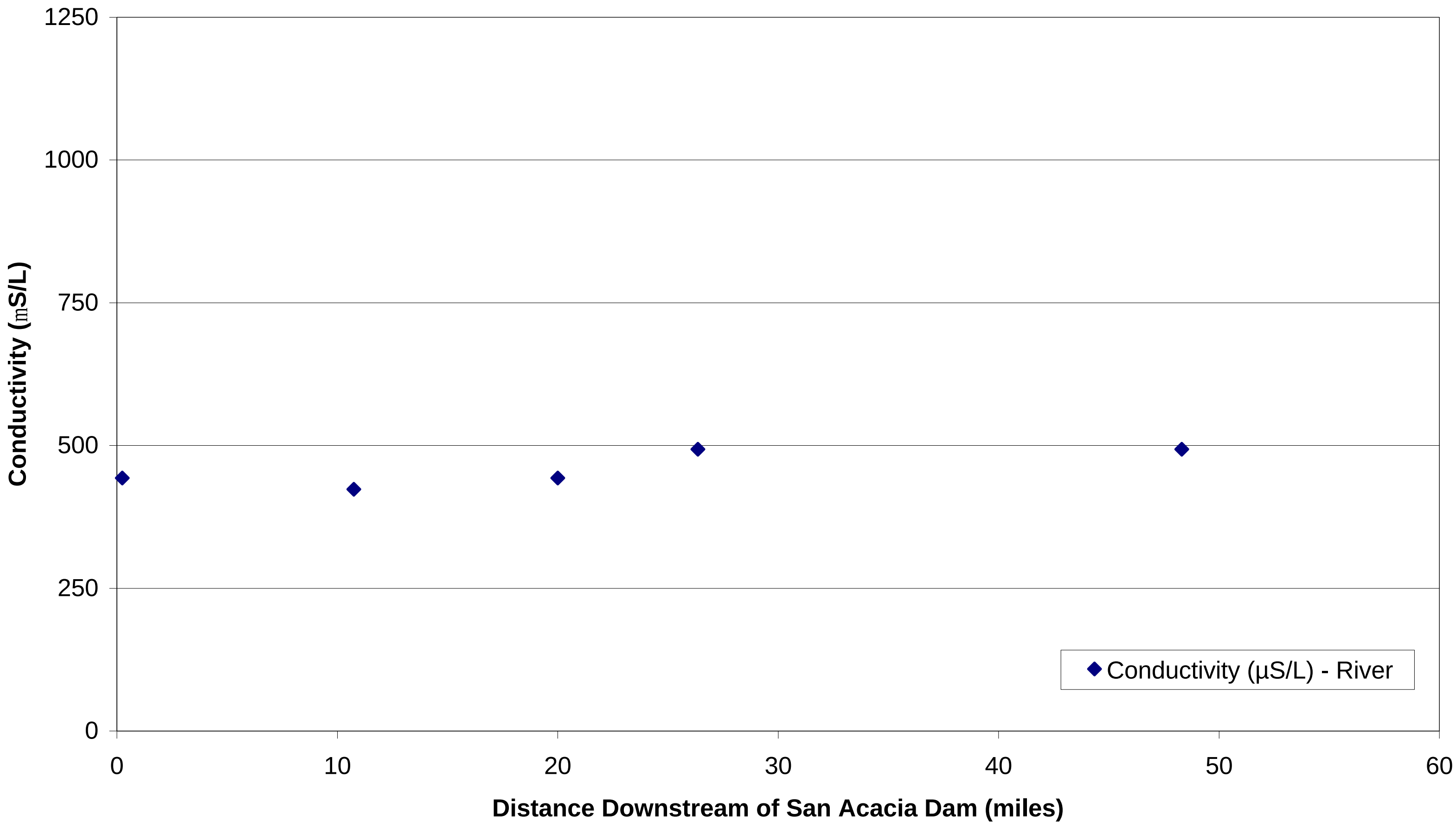


Figure I-5.1

Water Temperature for Rio Grande Seepage Run, Belen Division, S4-06, June 28-29, 2001

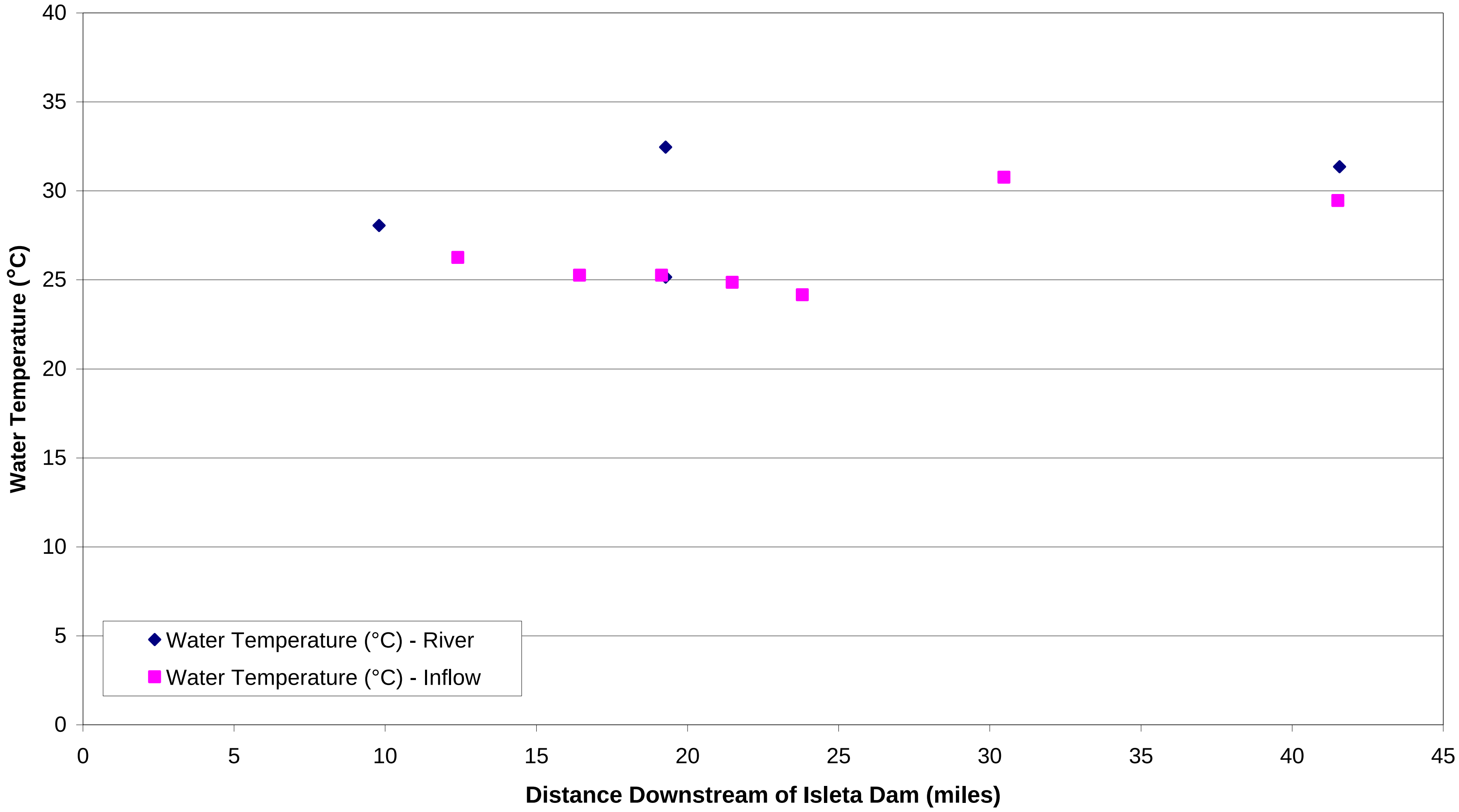


Figure I-5.2

pH for Rio Grande Seepage Run, Belen Division, S4-06, June 28-29, 2001

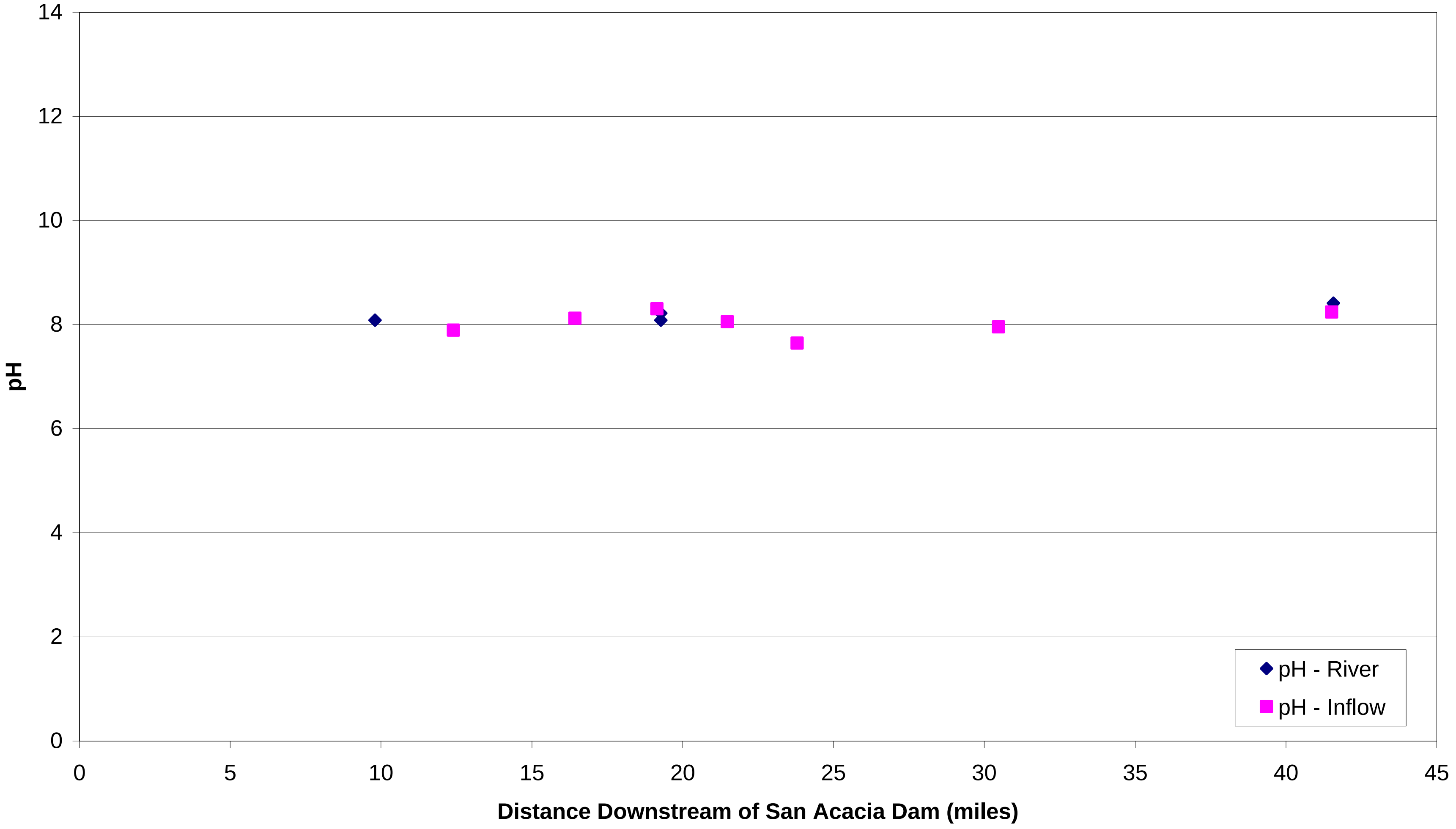


Figure I-5.3

Conductivity for Rio Grande Seepage Run, Belen Division, S4-06, June 28-29, 2001

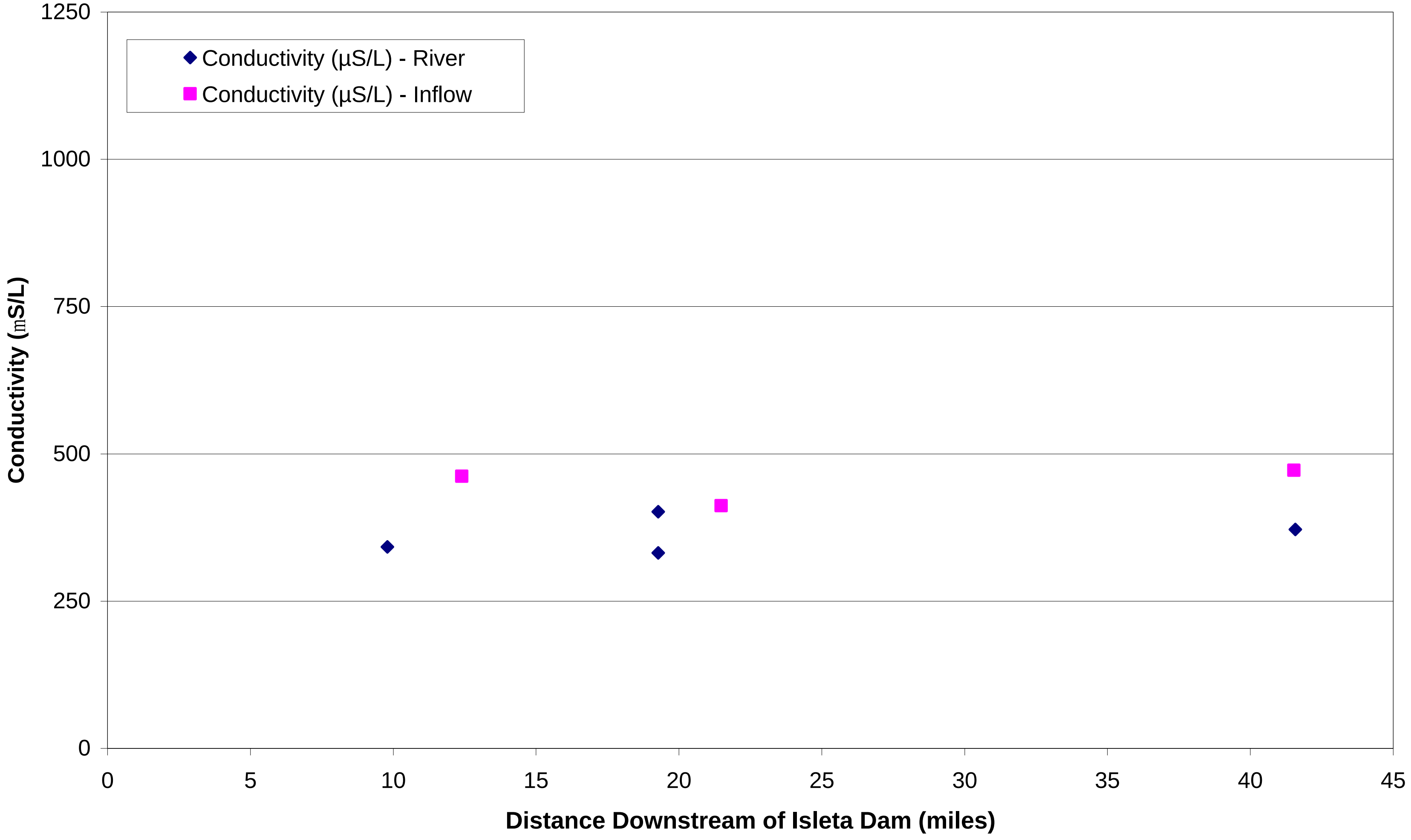


Figure I-6.1a

Water Temperature for Rio Grande Seepage Run, Belen Division, Section 1, S4-07, July 6-7, 2001

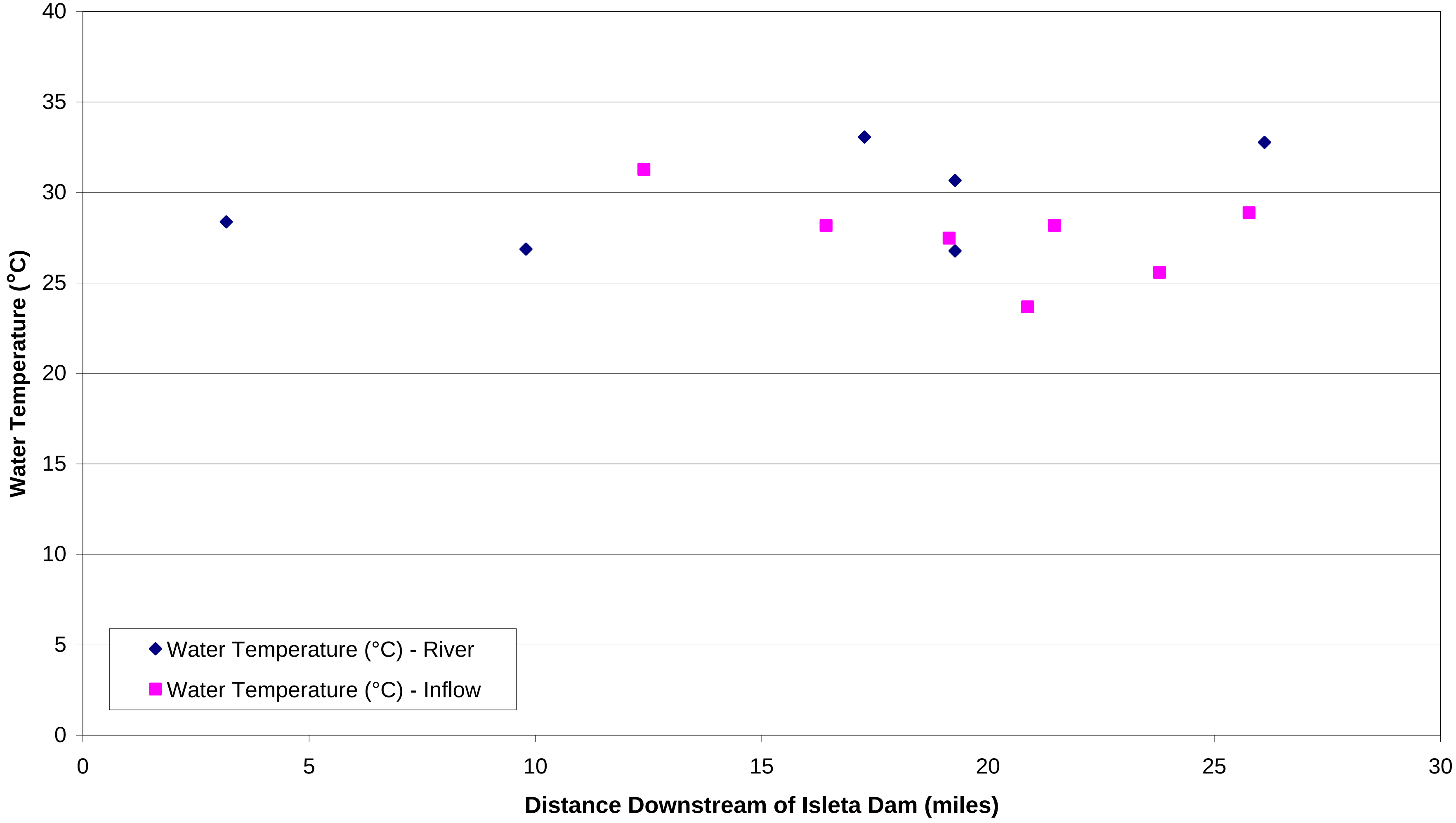


Figure I-6.2a
pH for Rio Grande Seepage Run, Belen Division, Section 1, S4-07, July 6-7, 2001

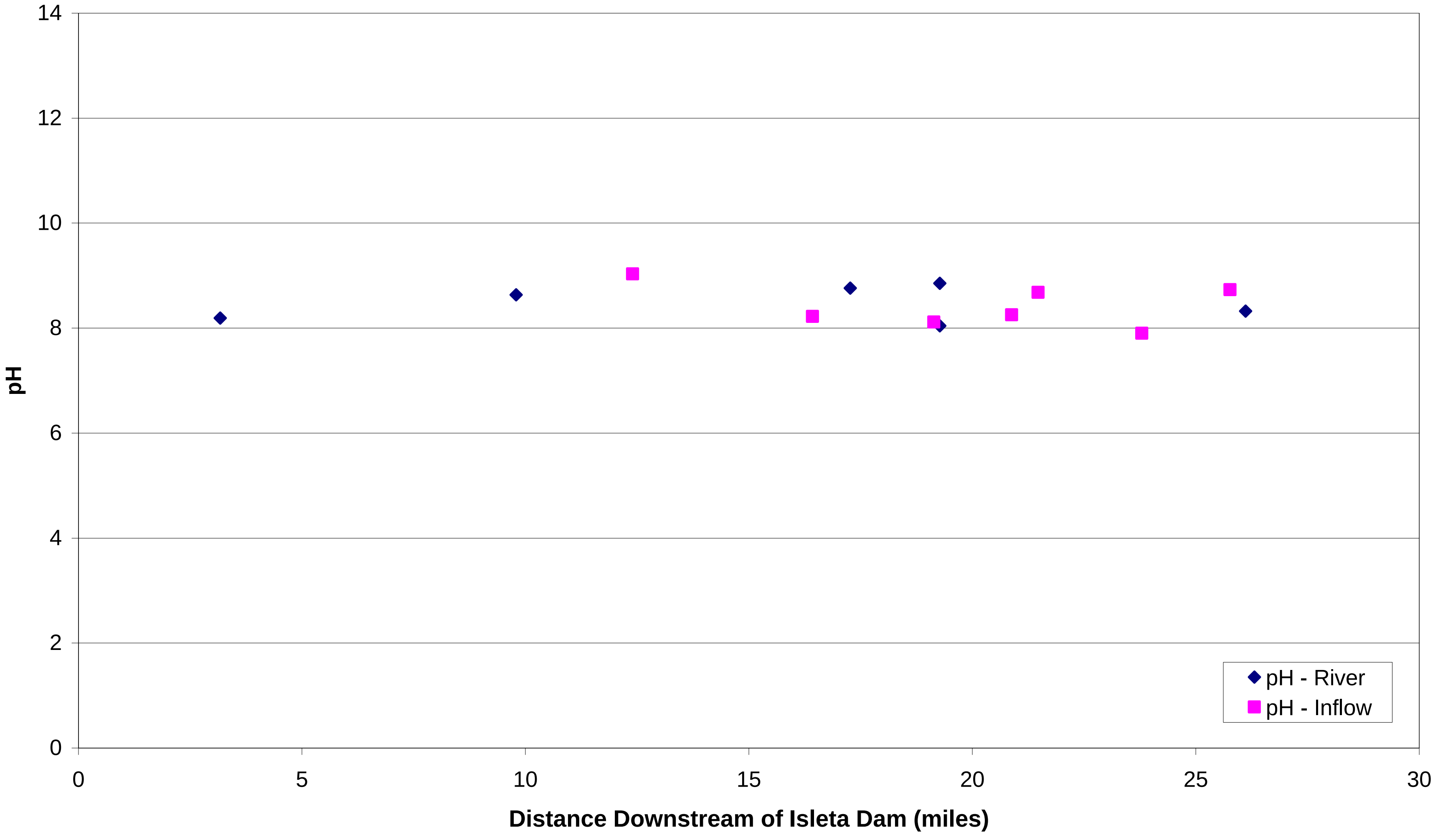


Figure I-6.3a
Conductivity for Rio Grande Seepage Run, Belen Division, Section 1, S4-07, July 6-7, 2001

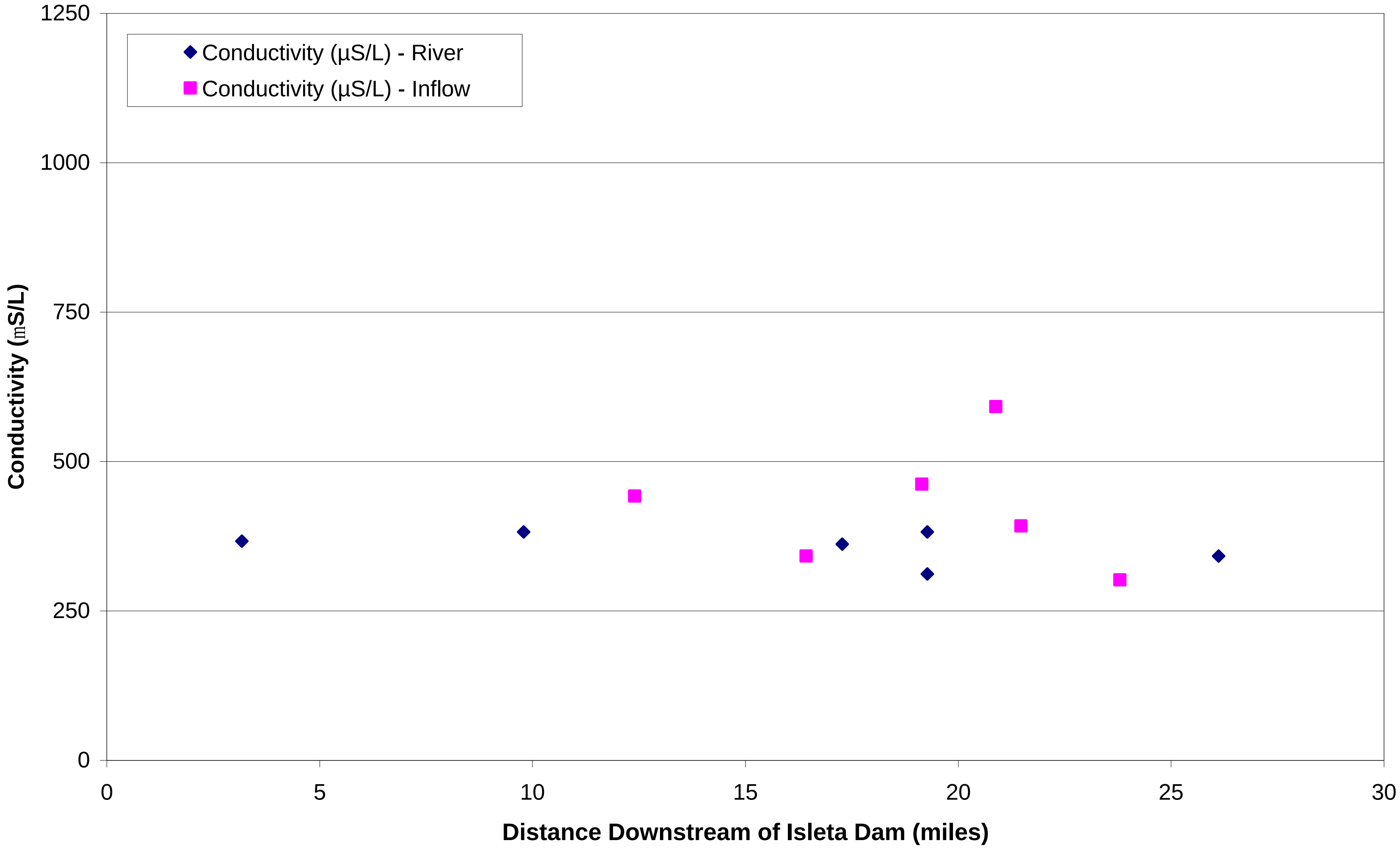


Figure I-6.1b

Water Temperature for Rio Grande Seepage Run, Belen Division, Section 2, S4-07, July 8, 2001

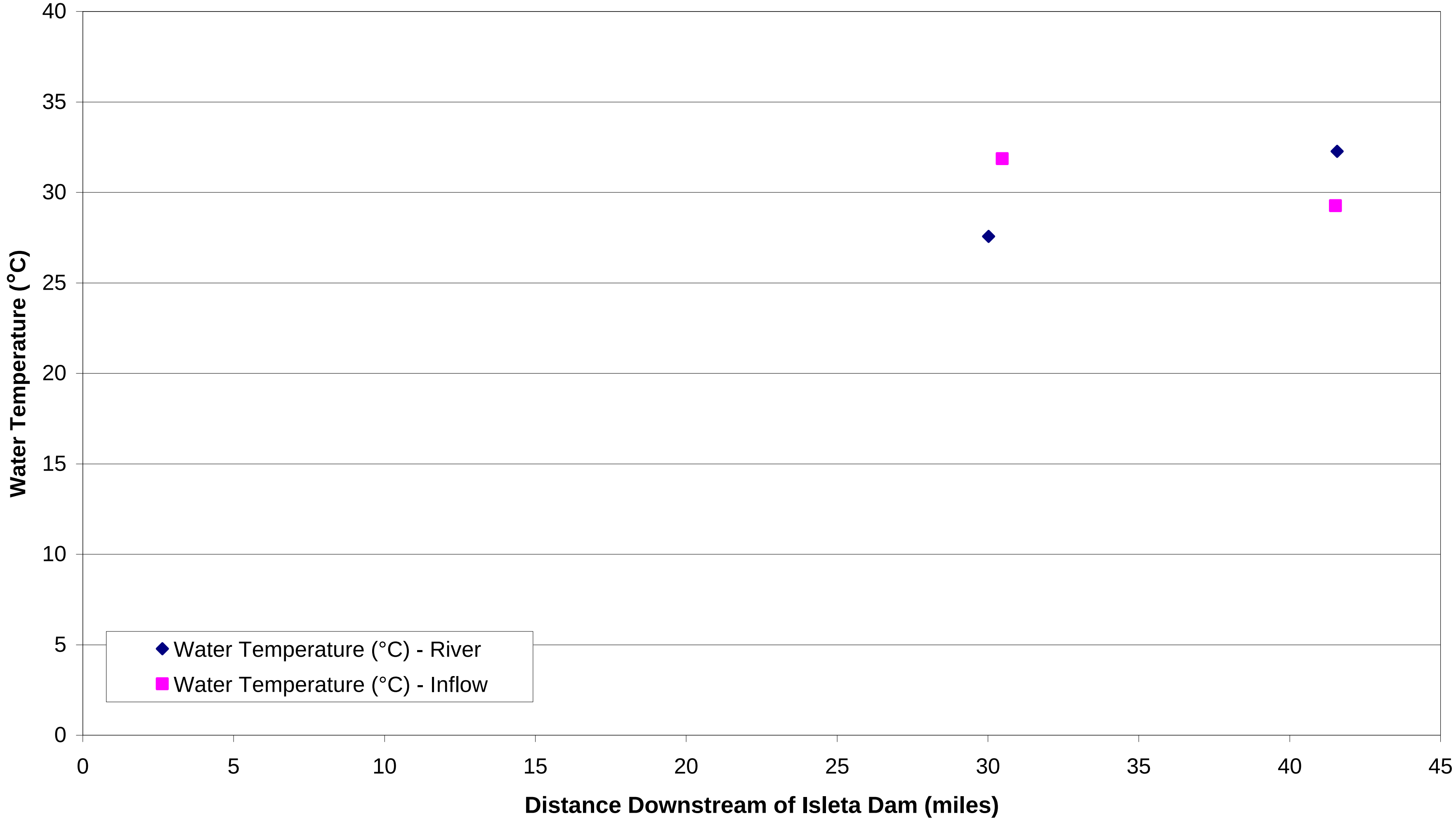


Figure I-6.2b
pH for Rio Grande Seepage Run, Belen Division, Section 2, S4-07, July 8, 2001

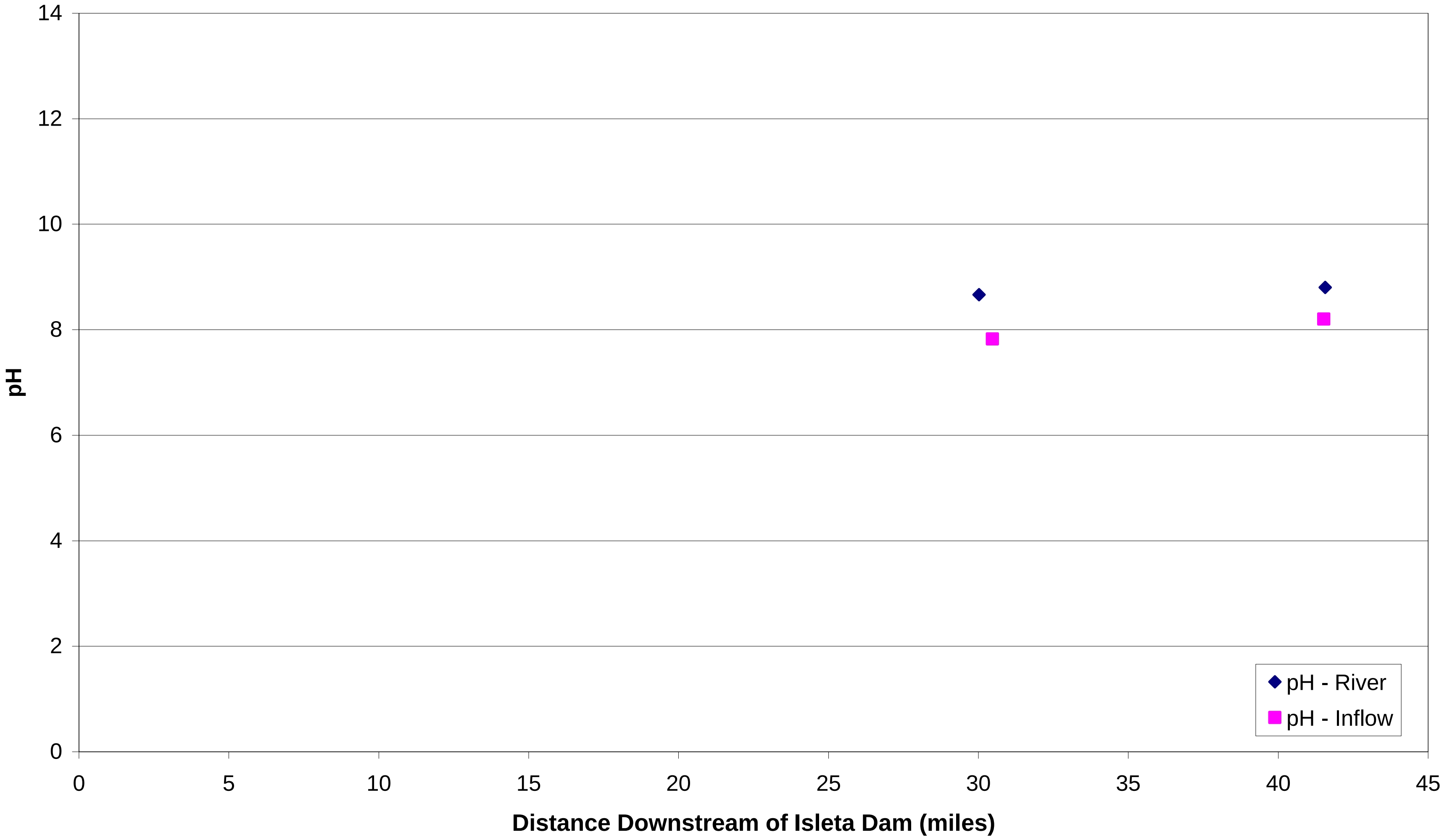


Figure I-6.3b
Conductivity for Rio Grande Seepage Run, Belen Division, Section 2, S4-07, July 8, 2001

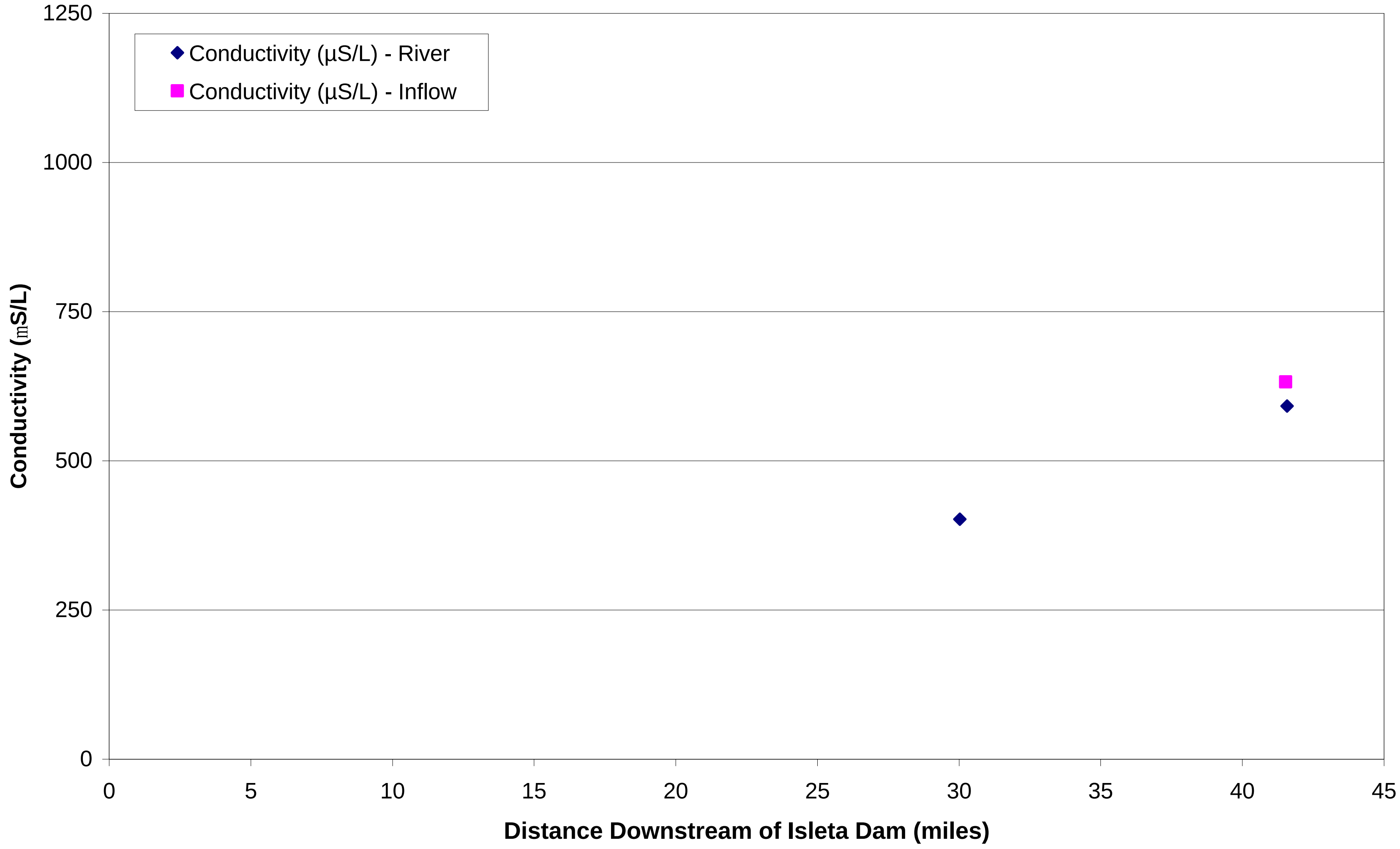


Figure I-6.1c
Water Temperature for Rio Grande Seepage Run, Belen Division, Section 3, S4-07, July 9, 2001

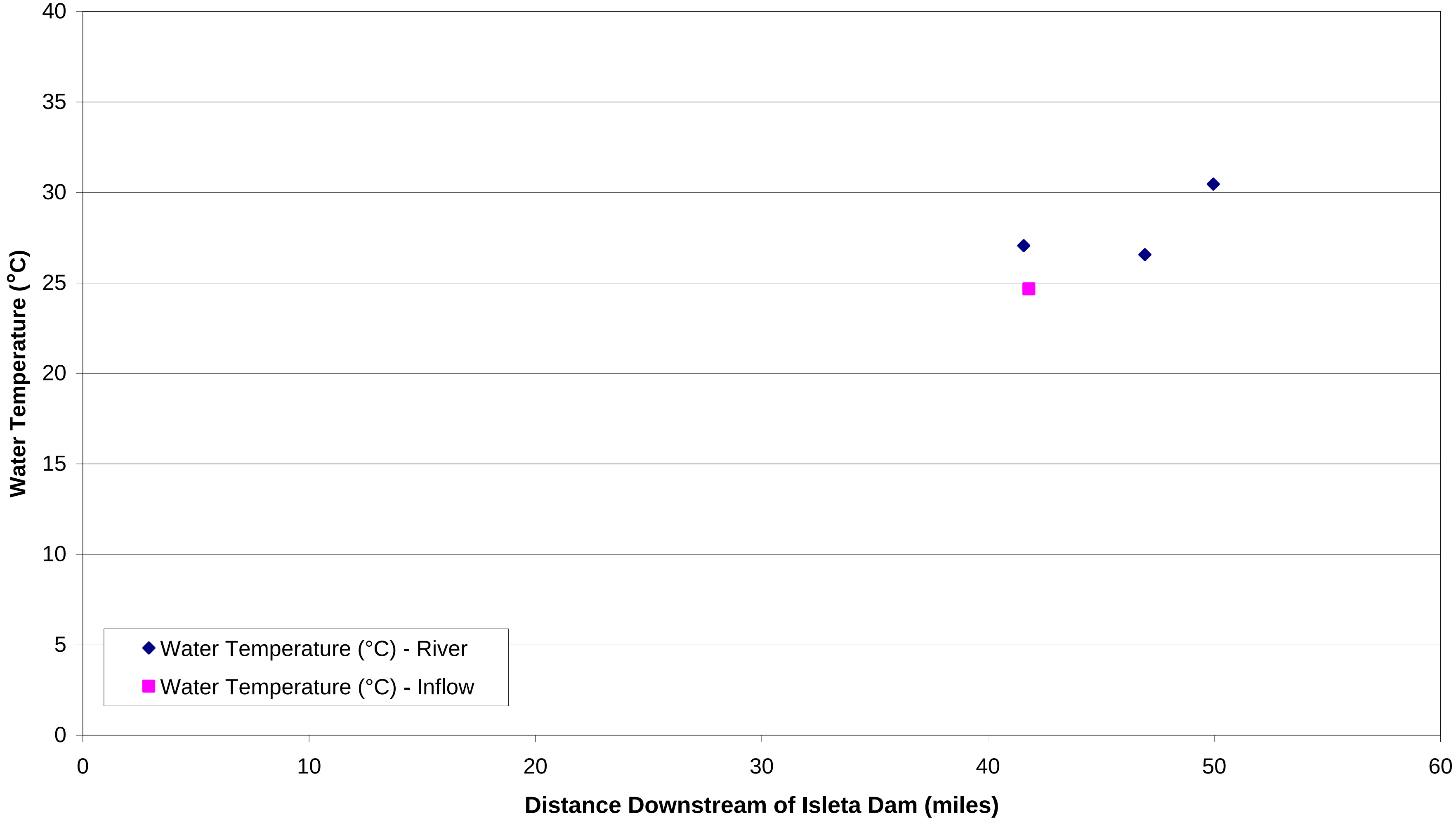


Figure I-6.2c

pH for Rio Grande Seepage Run, Belen Division, Section 3, S4-07, July 9, 2001

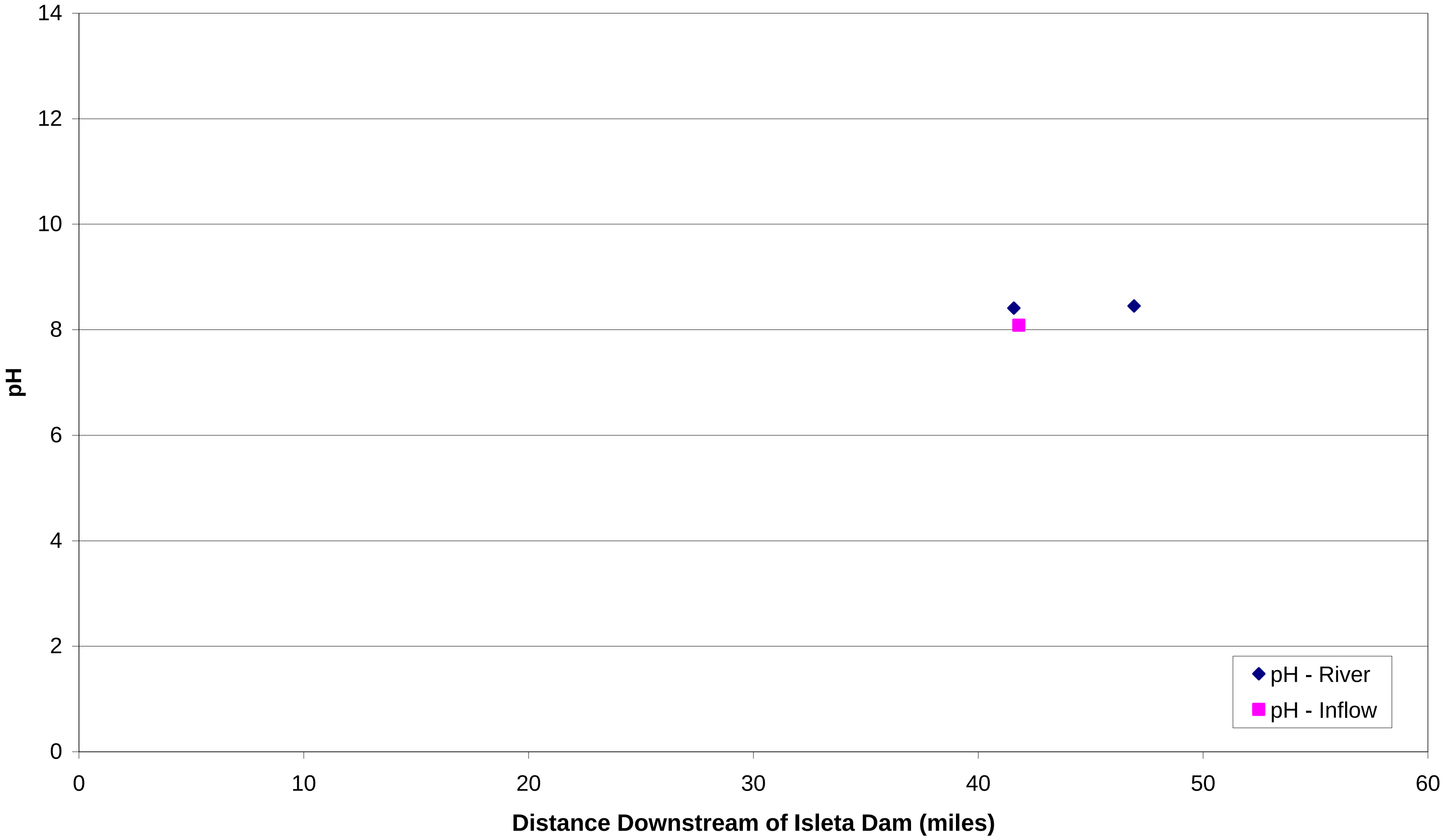


Figure I-6.3c
Conductivity for Rio Grande Seepage Run, Belen Division, Section 3, S4-07, July 9, 2001

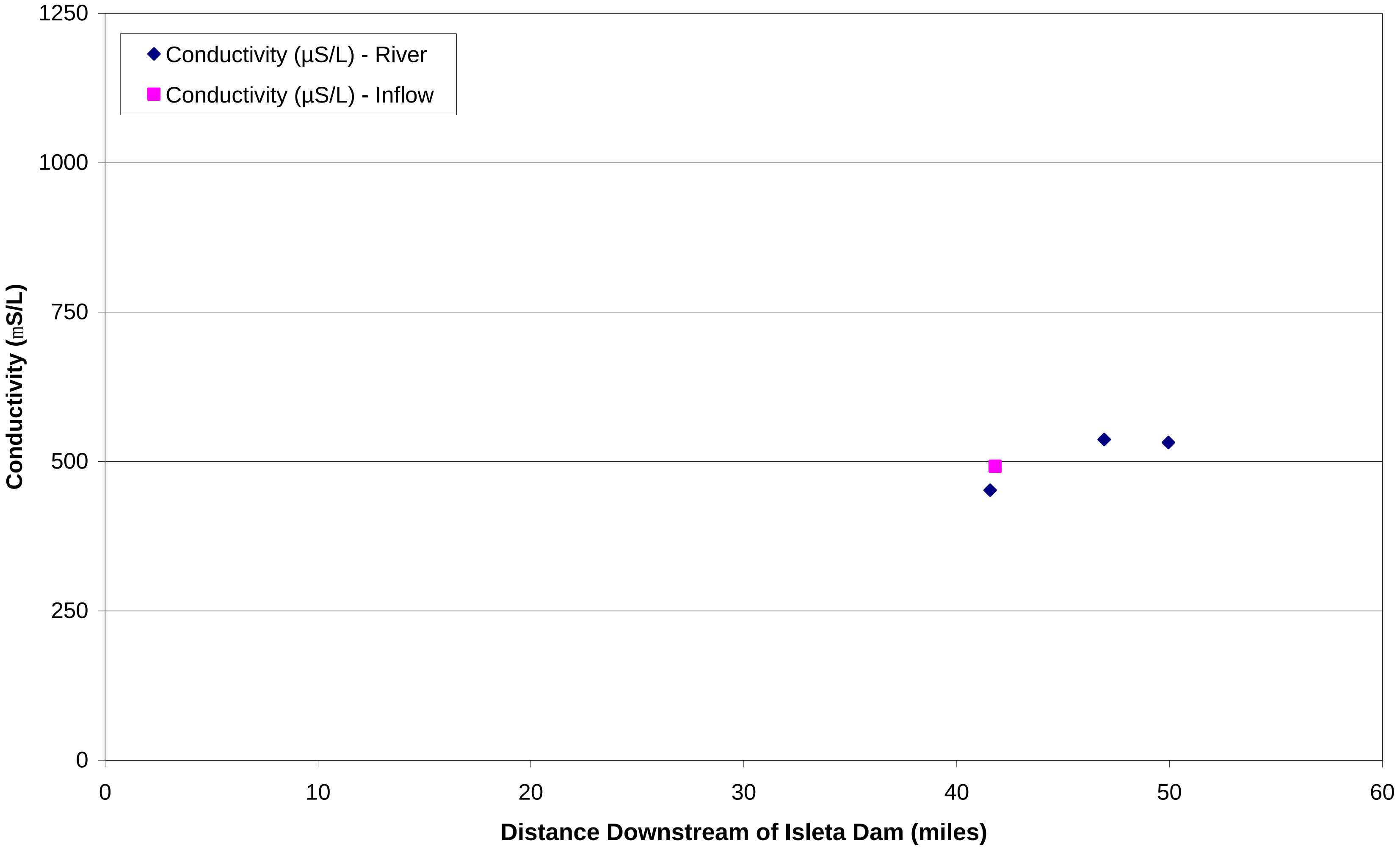


Figure I-7.1
Water Temperature for La Joya Acequia Seepage Run, Belen Division, S4-08, July 10, 2001

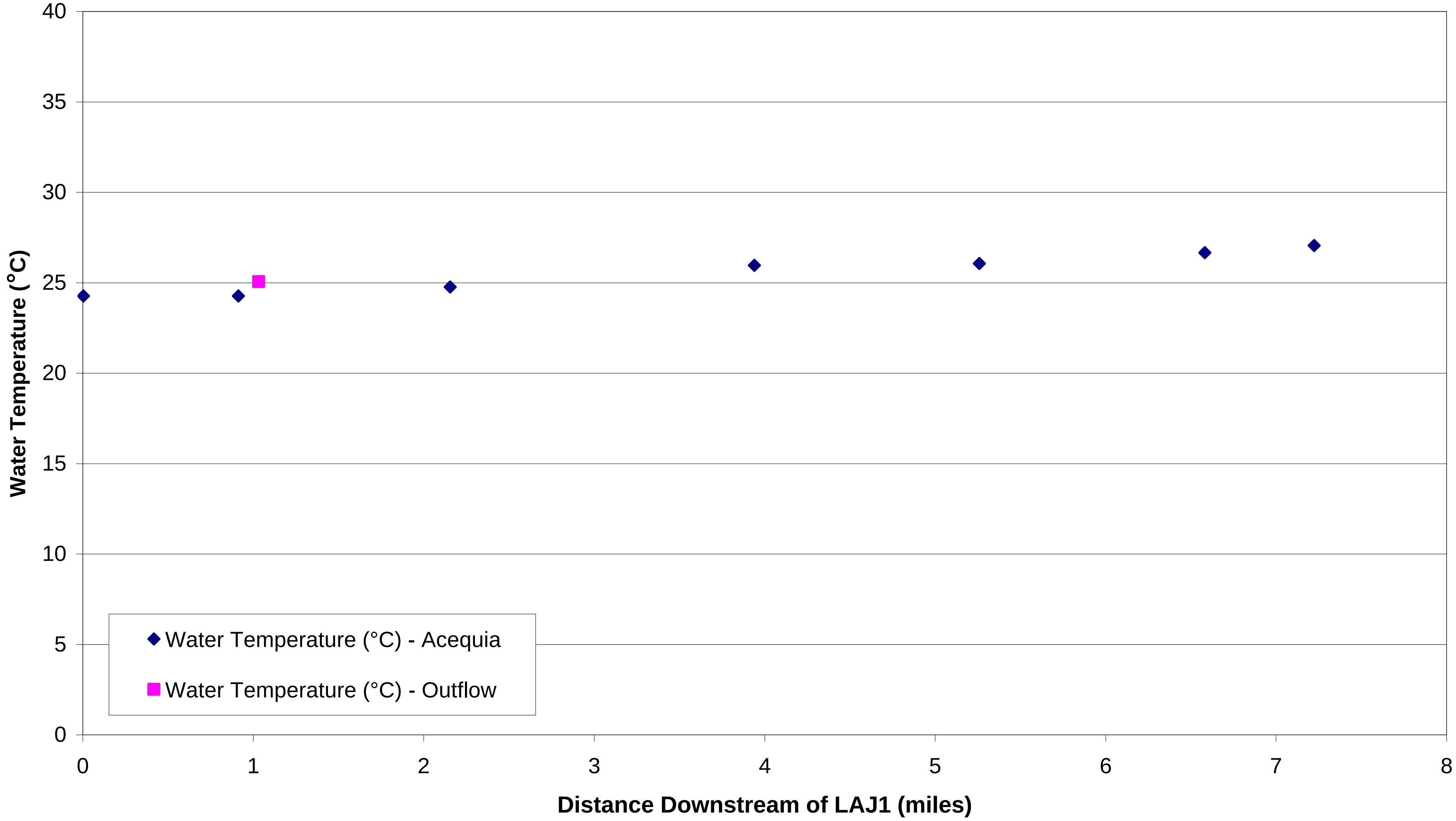


Figure I-7.2
pH for La Joya Acequia Seepage Run, Belen Division, S4-08, July 10, 2001

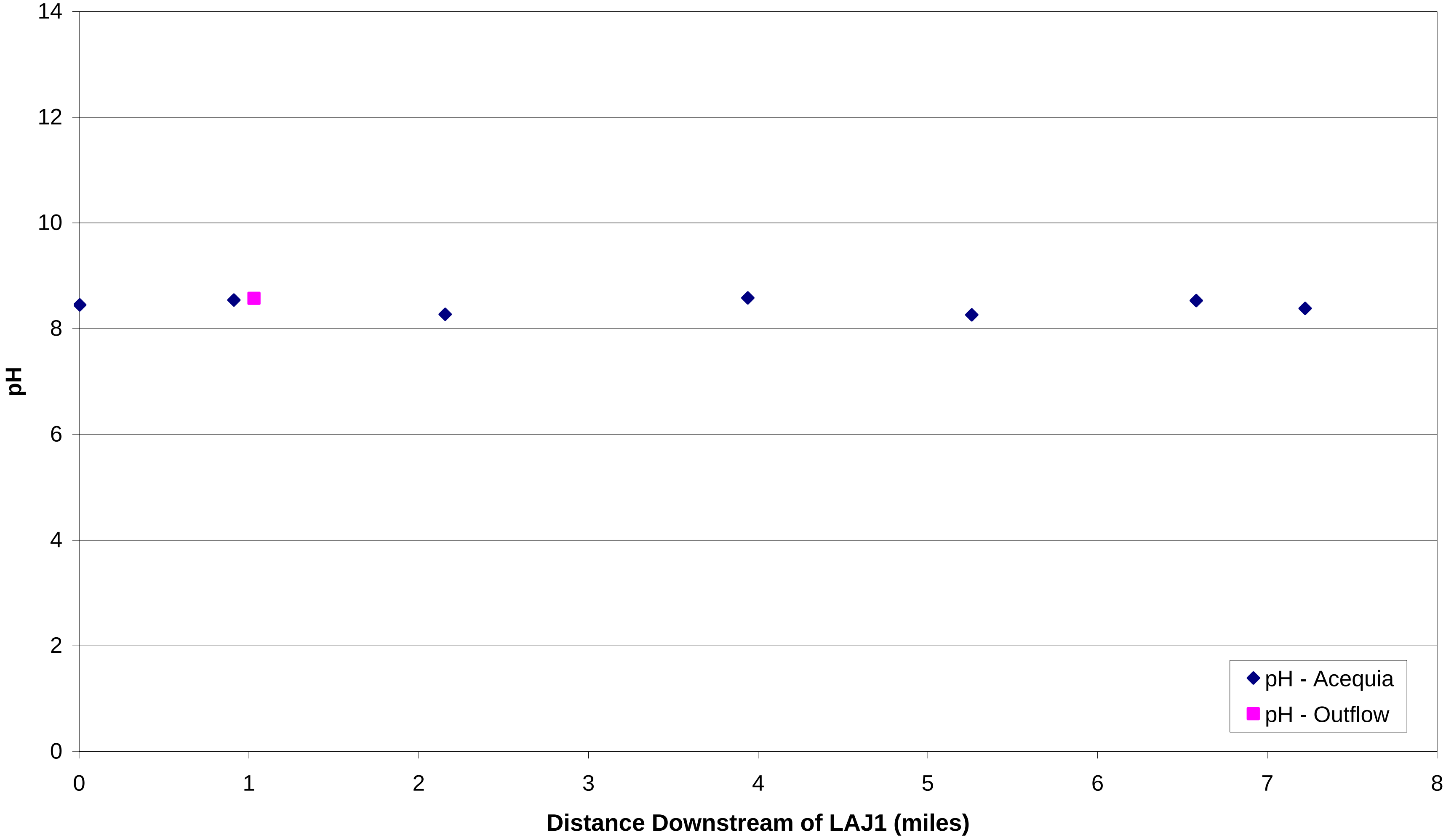


Figure I-7.3
Conductivity for La Joya Acequia Seepage Run, Belen Division, S4-08, July 10, 2001

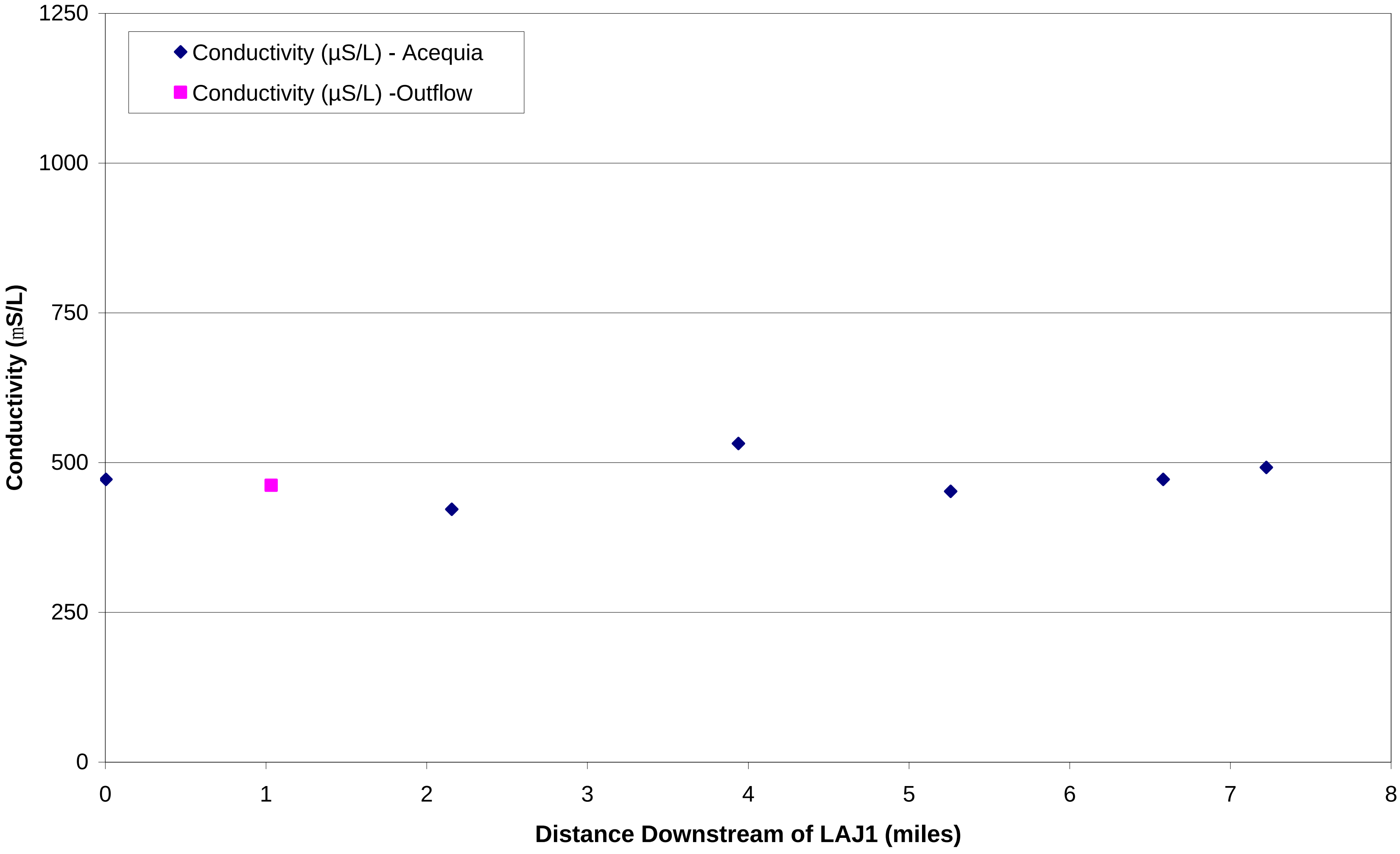


Figure I-8.1a
Water Temperature for Socorro Main Canal Seepage Run, Section 2, Socorro Division, S4-09, July 18, 2001

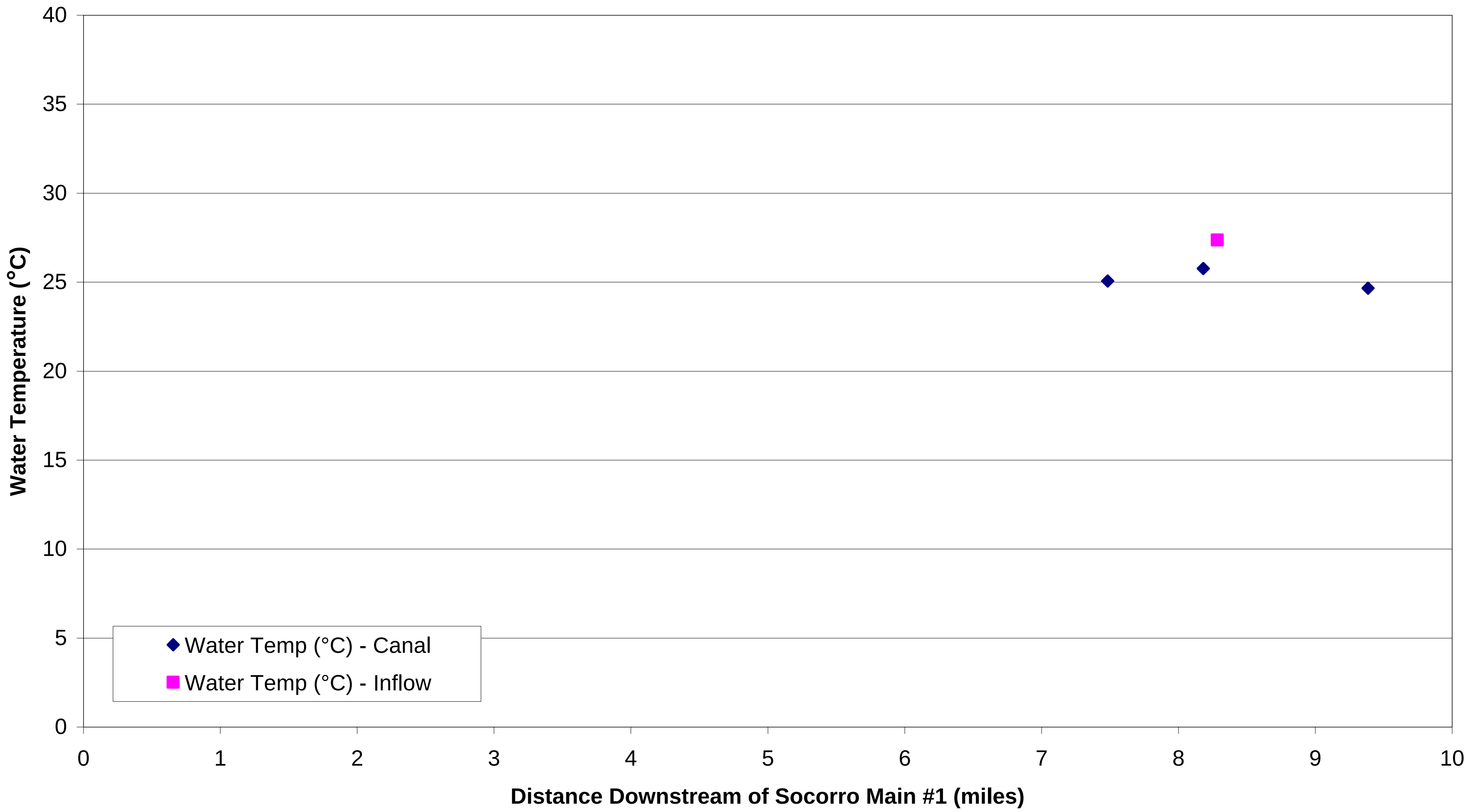


Figure I-8.2a
pH for Socorro Main Canal Seepage Run, Section 2, Socorro Division, S4-09, July 18, 2001

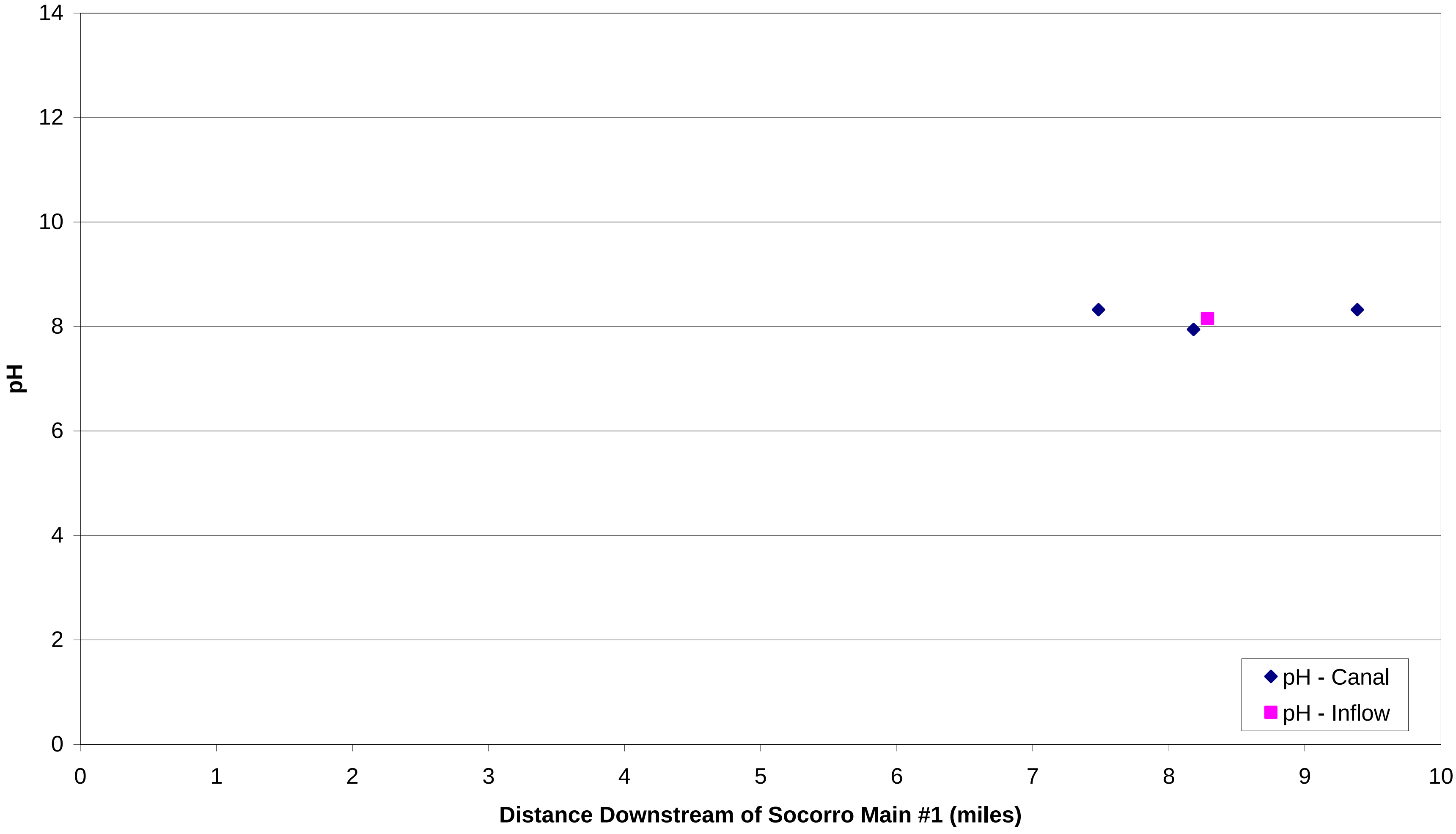


Figure I-8.3a

Conductivity for Socorro Main Canal Seepage Run, Section 2, Socorro Division, S4-09, July 18, 2001

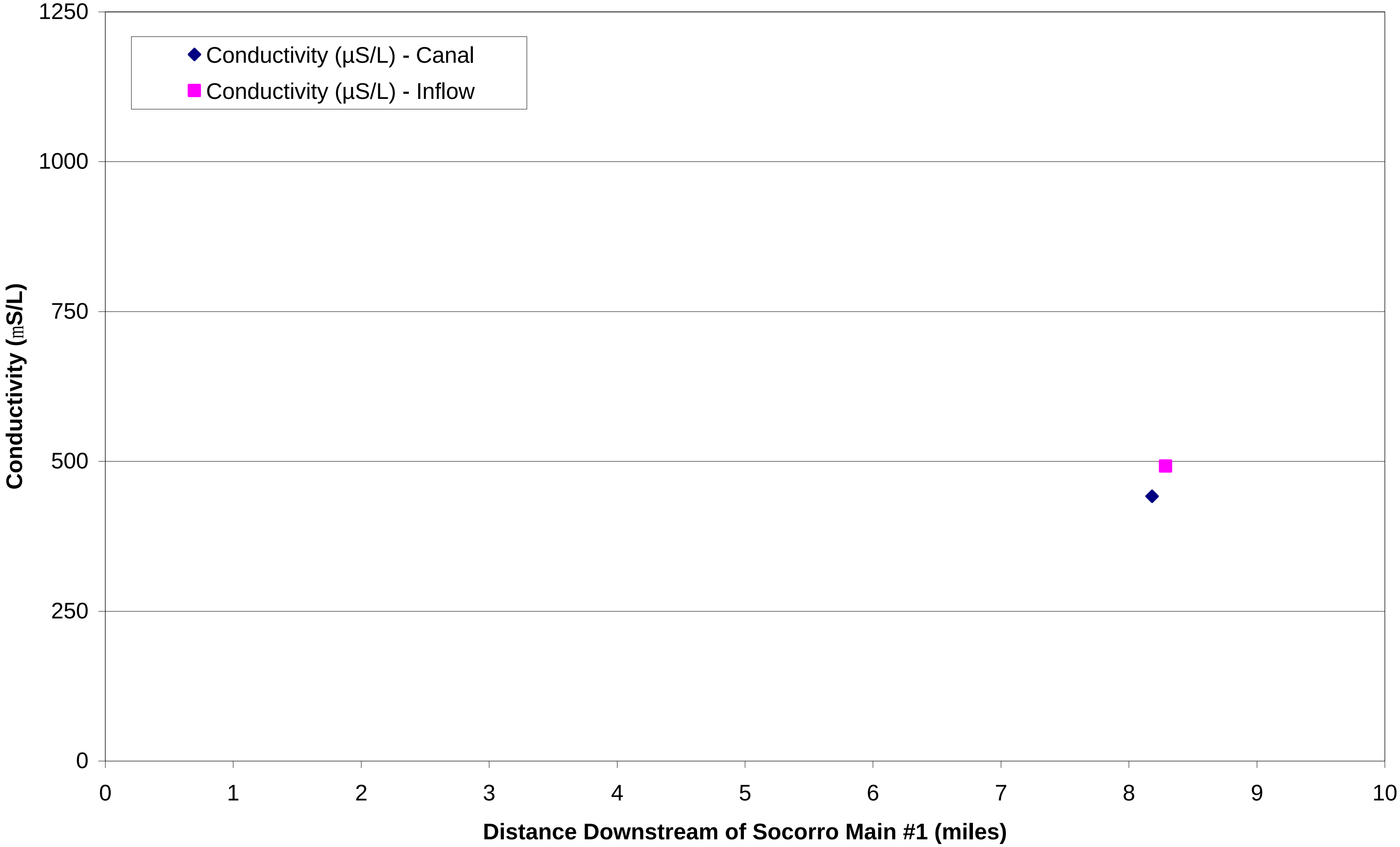


Figure I-8.1b
Water Temperature for Socorro Main Canal Seepage Run, Section 1, Socorro Division, S4-10, July 19, 2001

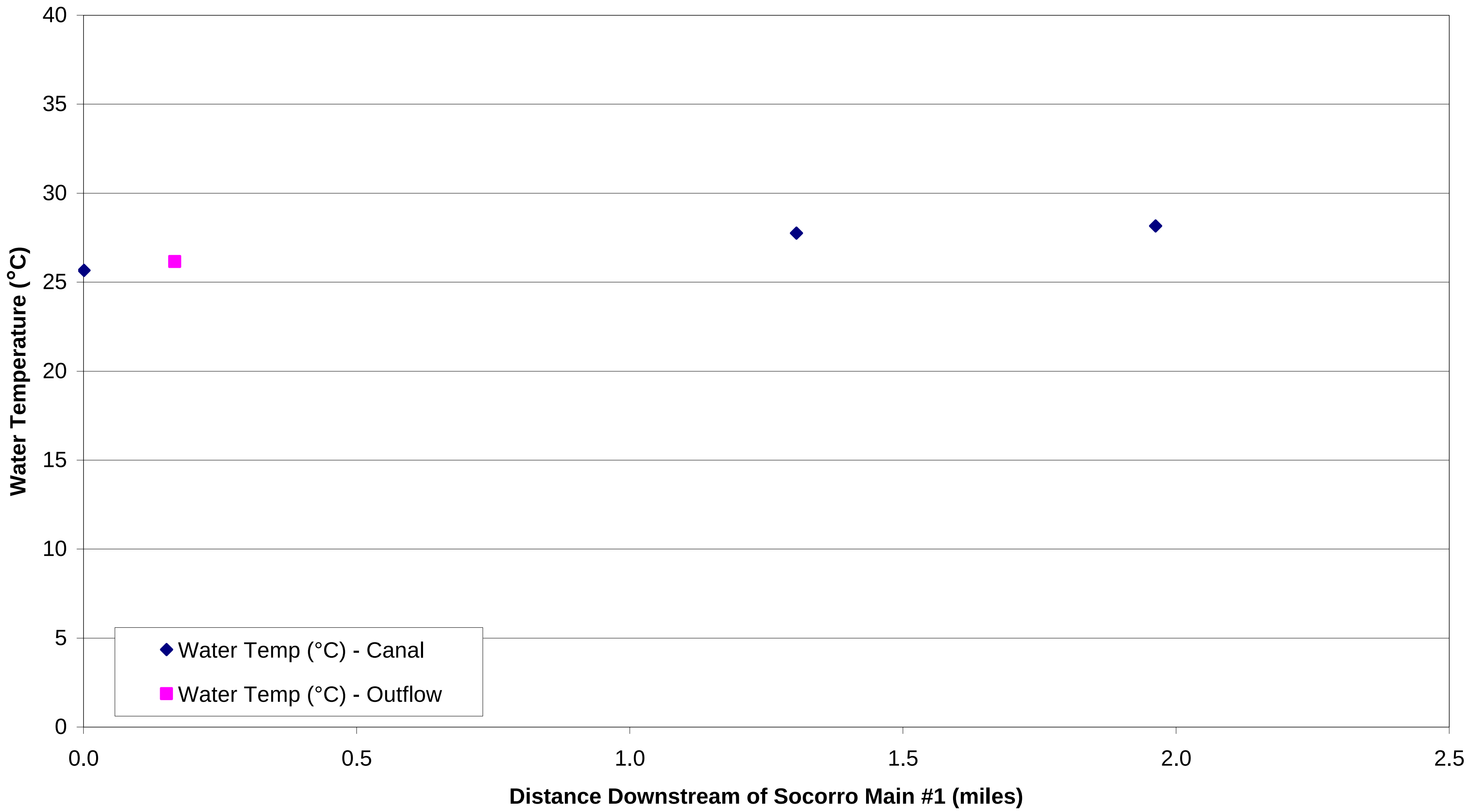


Figure I-8.2b
pH for Socorro Main Canal Seepage Run, Section 1, Socorro Division, S4-10, July 19, 2001

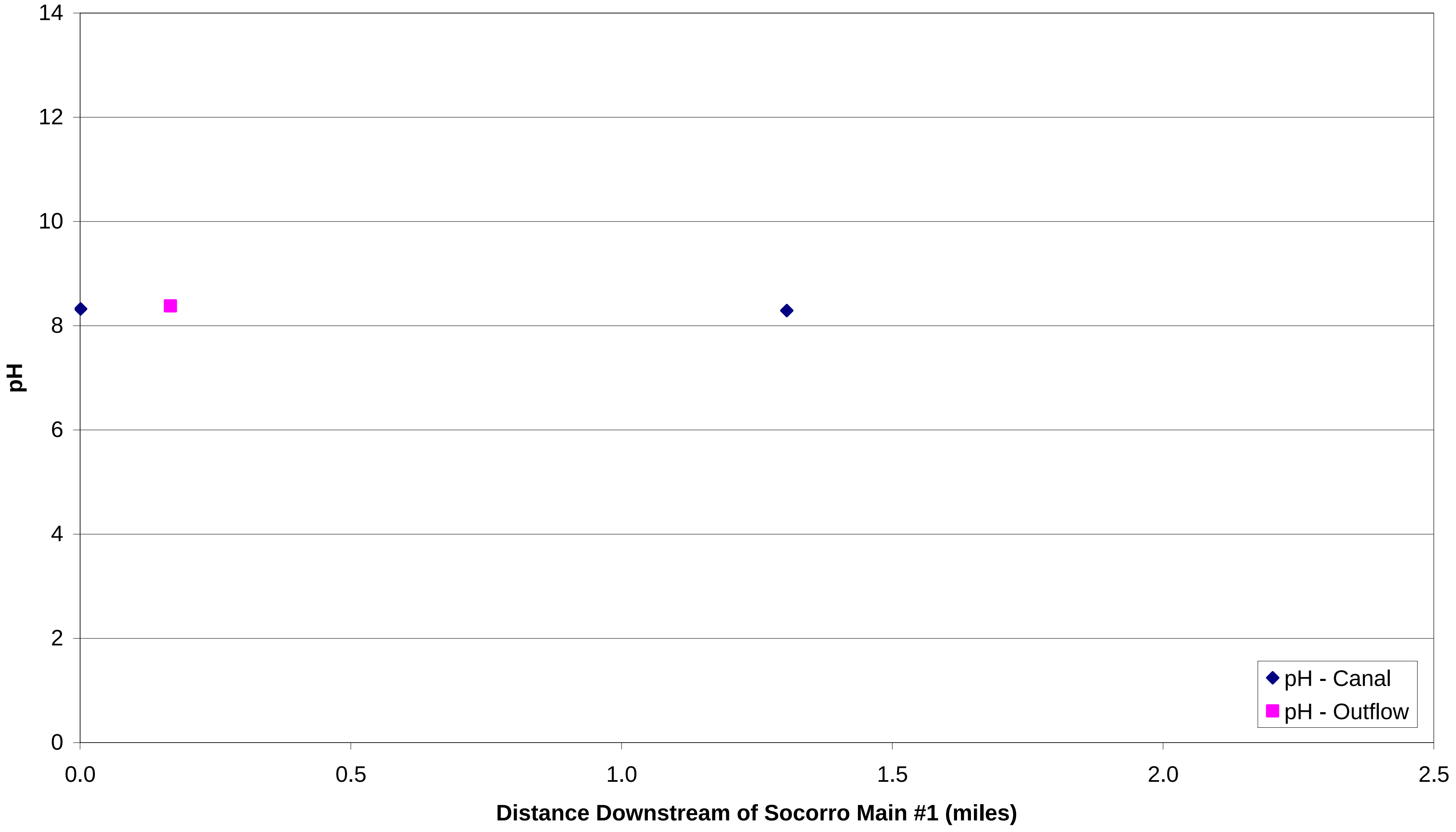


Figure I-8.3b

Conductivity for Socorro Main Canal Seepage Run, Section 1, Socorro Division, S4-10, July 19, 2001

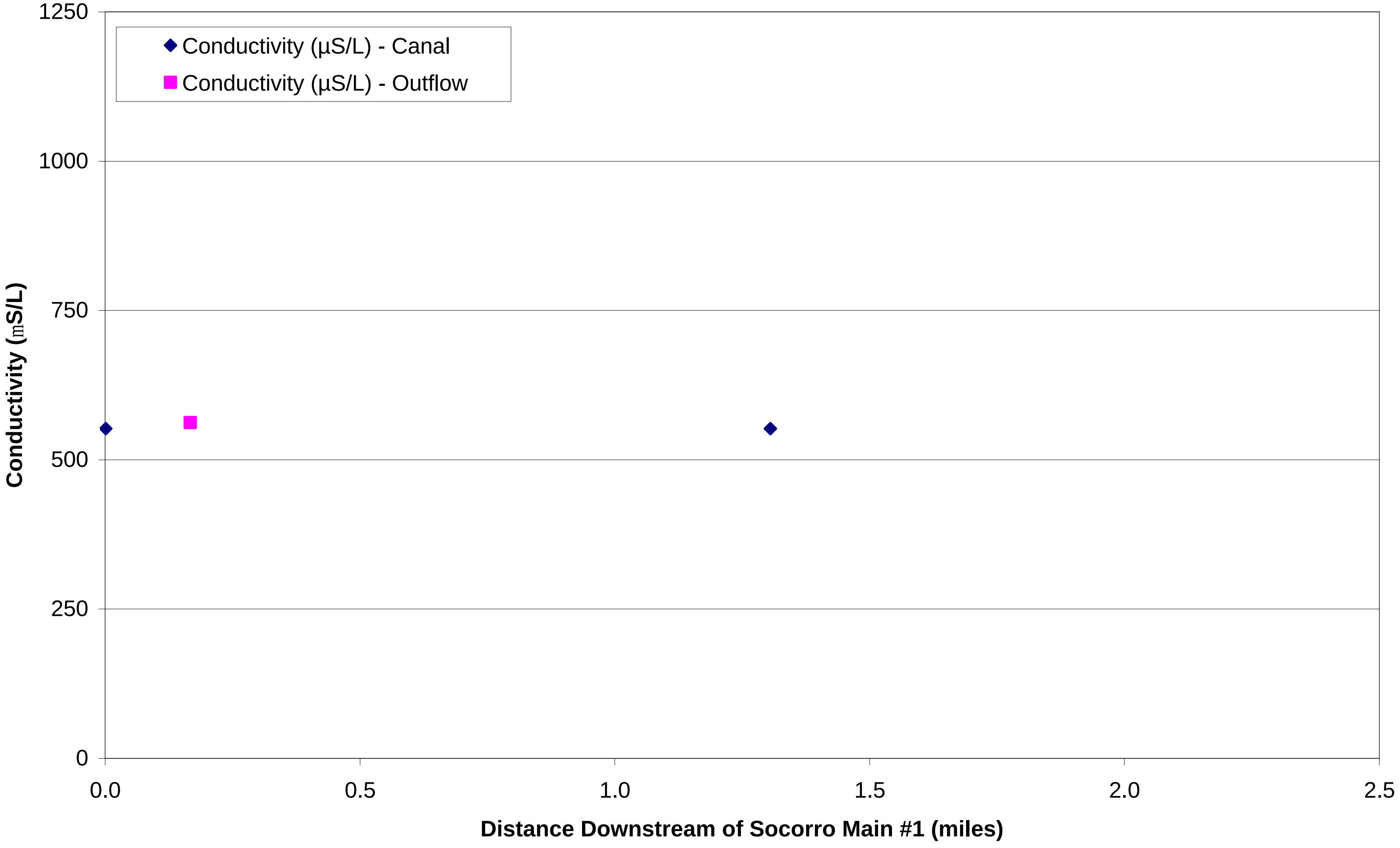


Figure I-8.1c

Water Temperature for Socorro Main Canal Seepage Run, Section 3, Socorro Division, S4-11, July 19, 2001

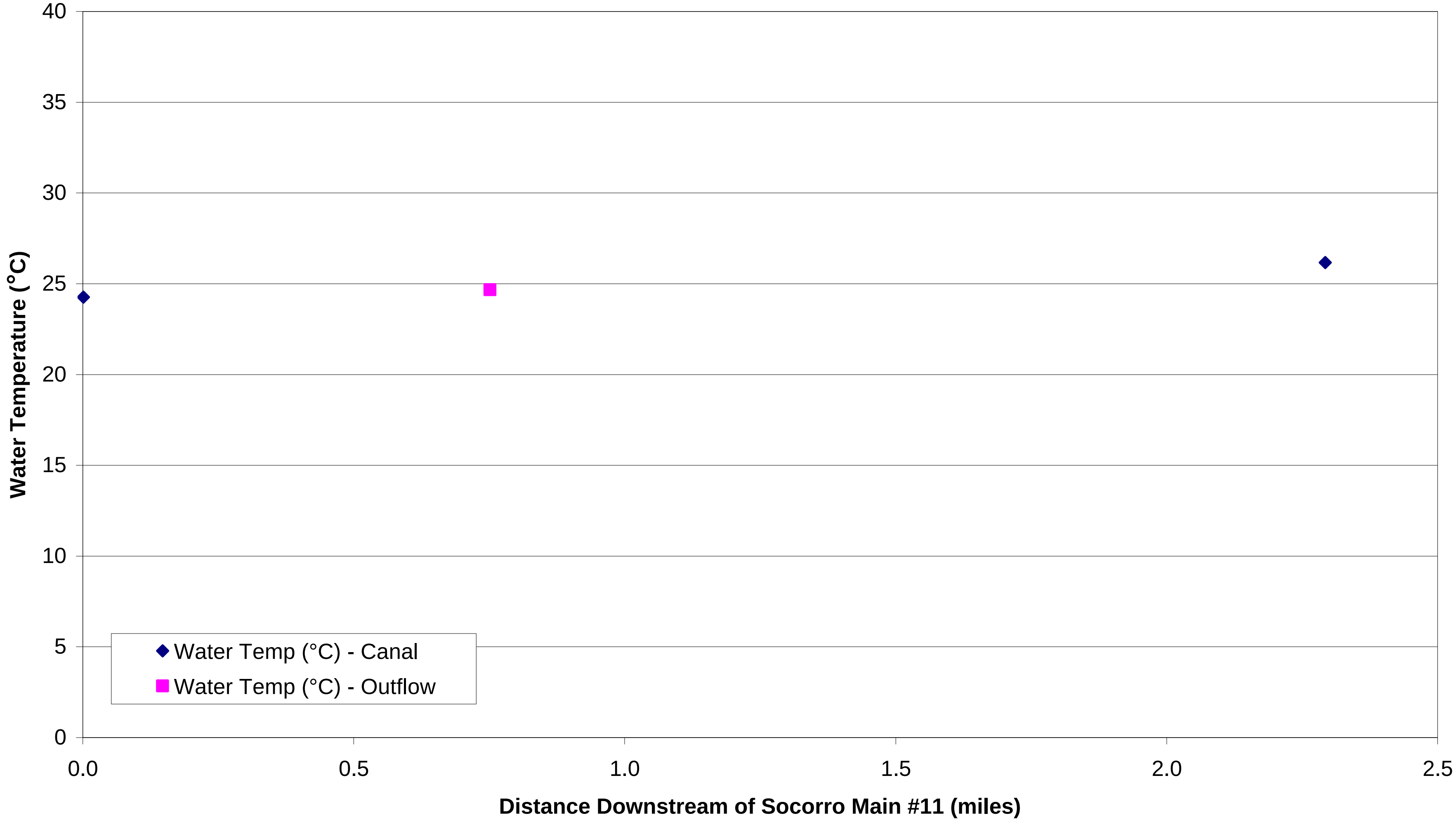


Figure I-8.2c
pH for Socorro Main Canal Seepage Run, Section 3, Socorro Division, S4-11, July 19, 2001

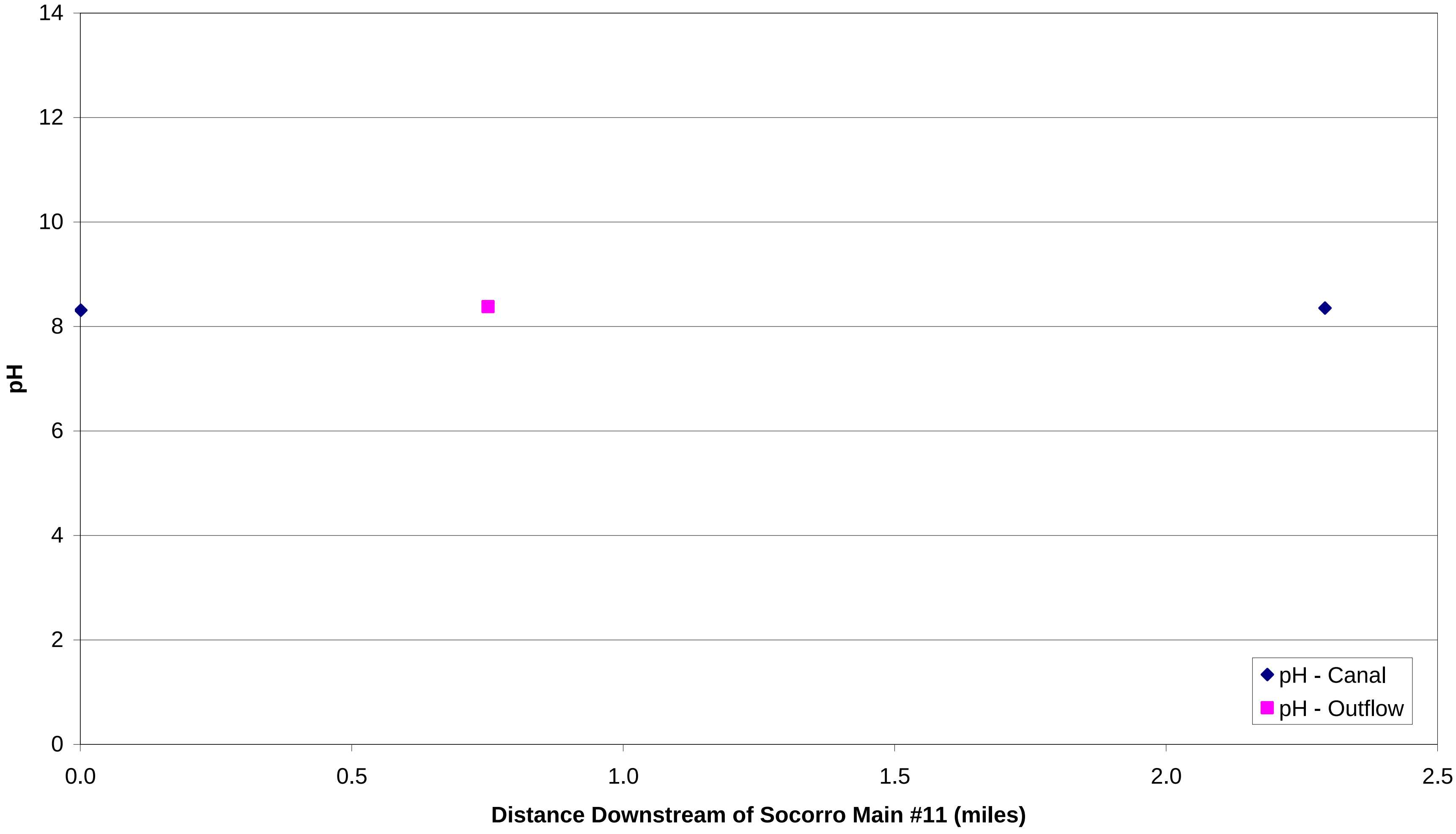


Figure I-8.3c
Conductivity for Socorro Main Canal Seepage Run, Section 3, Socorro Division, S4-11, July 19, 2001

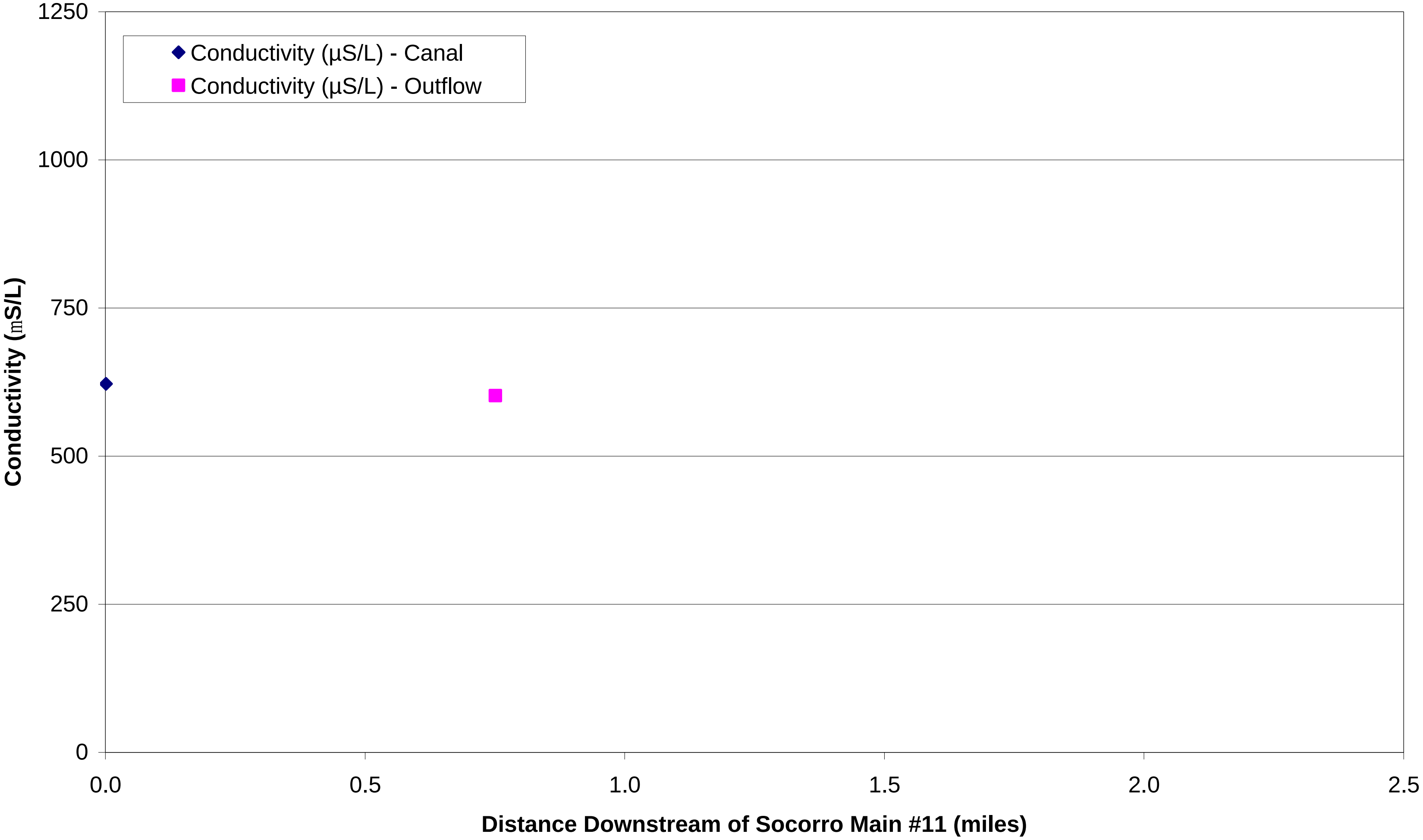


Figure I-9.1
Water Temperature for Rio Grande Seepage Run, Belen Division, S4-13, July 22, 2001

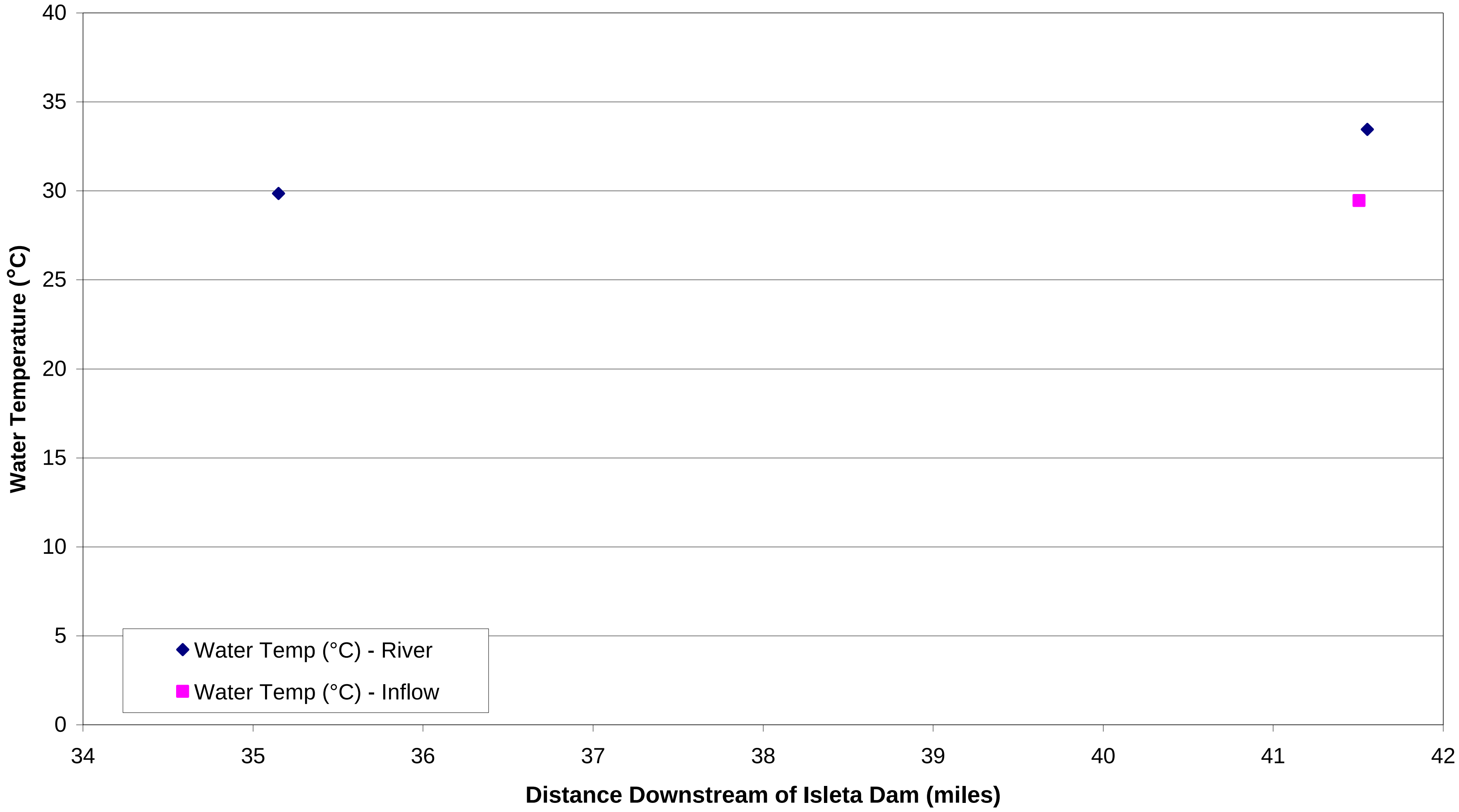


Figure I-9.2
pH for Rio Grande Seepage Run, Belen Division, S4-13, July 22, 2001

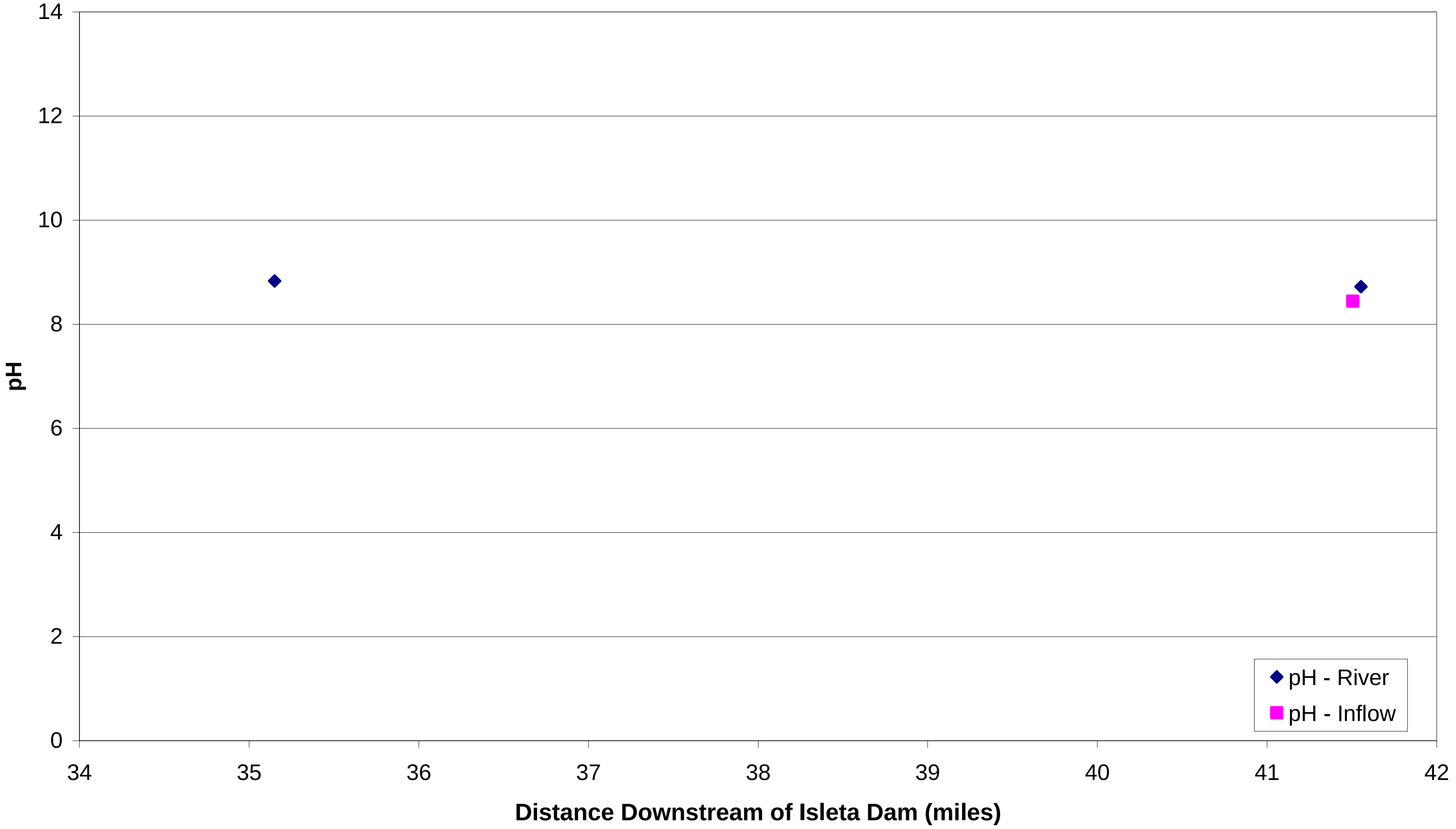


Figure I-9.3

Conductivity for Rio Grande Seepage Run, Belen Division, S4-13, July 22, 2001

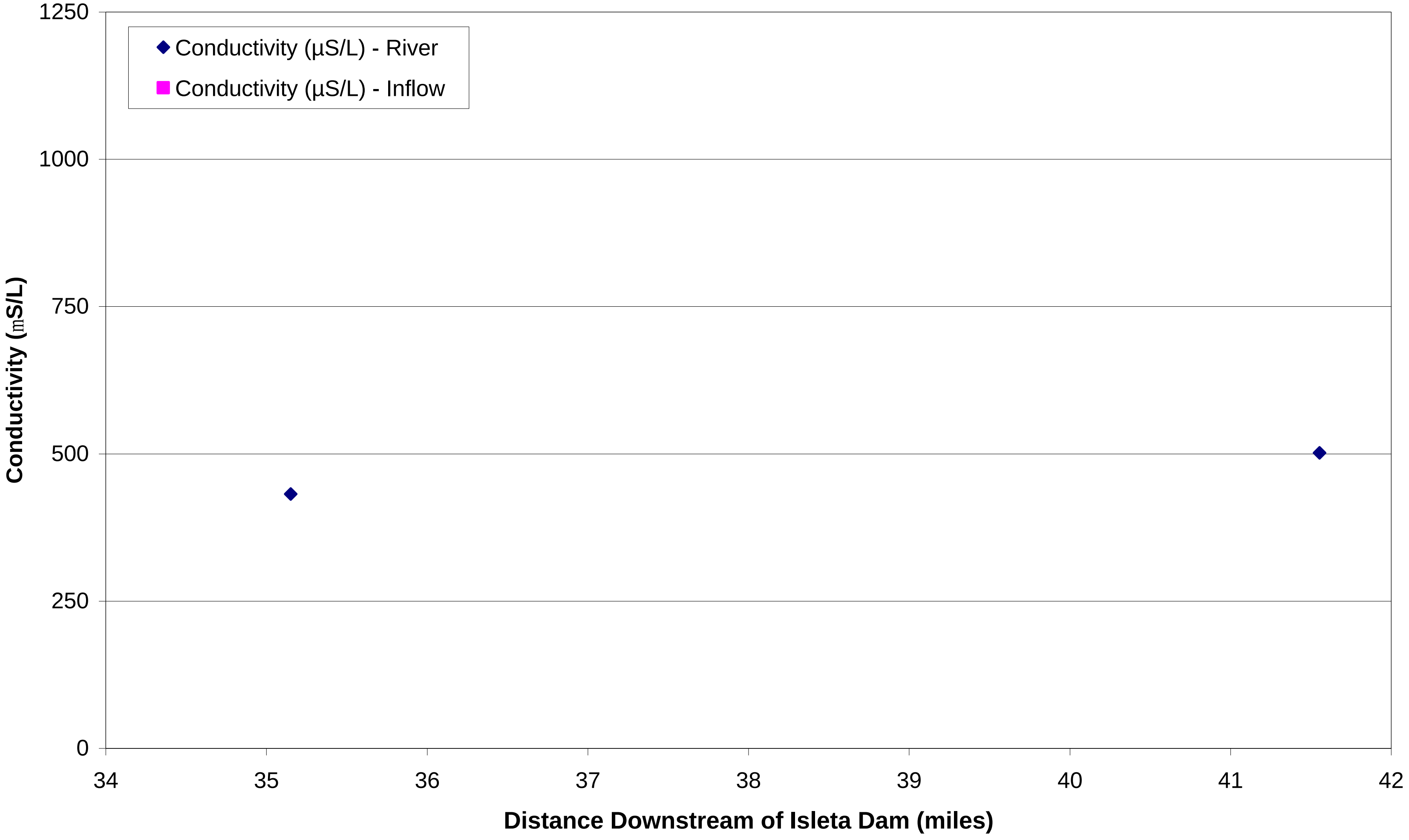


Figure I-10.1a
Water Temperature for West Riverside Drains Seepage Run, Belen Division, S4-14, July 22, 2001

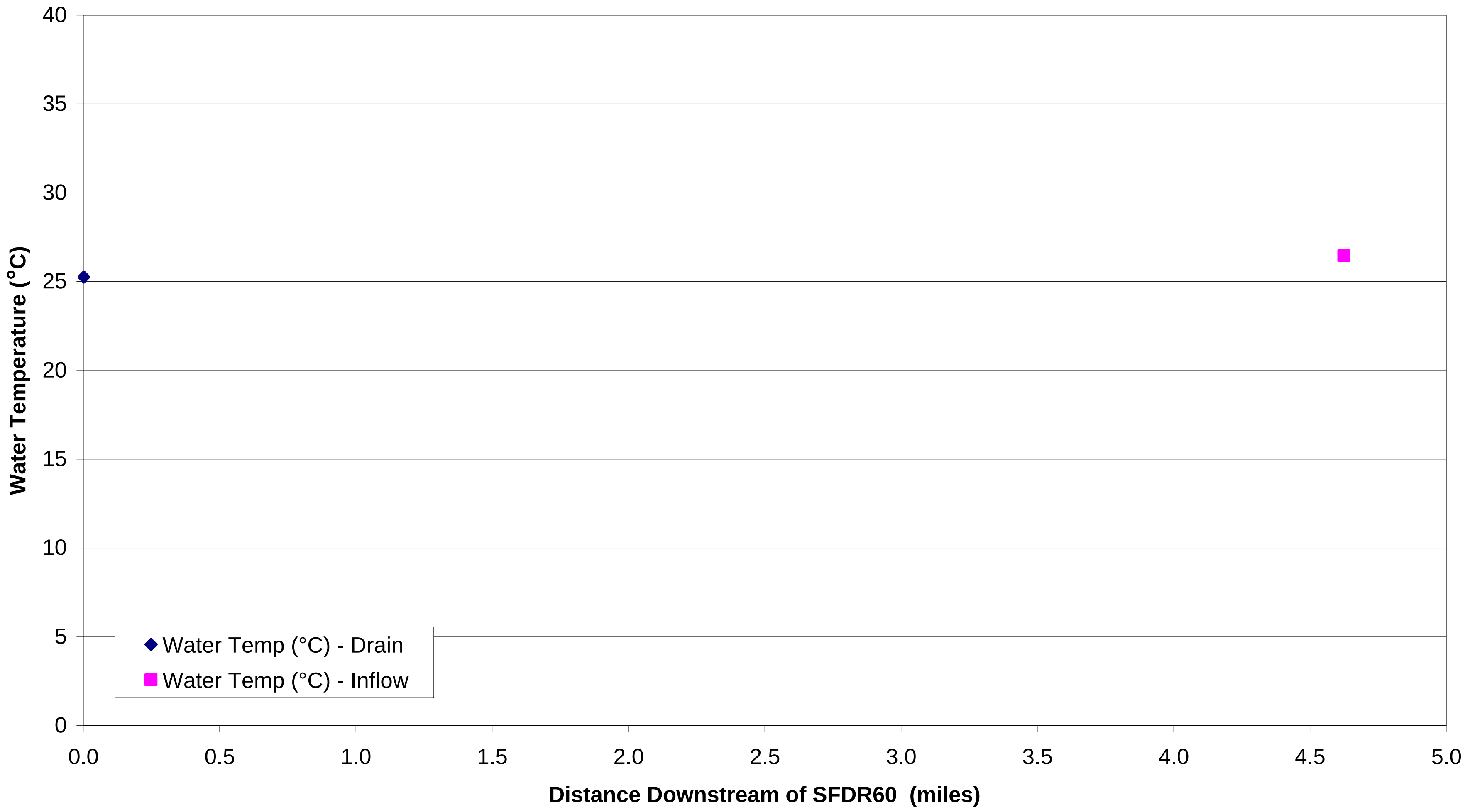


Figure I-10.2a
pH for West Riverside Drains Seepage Run, Belen Division, S4-14, July 22, 2001

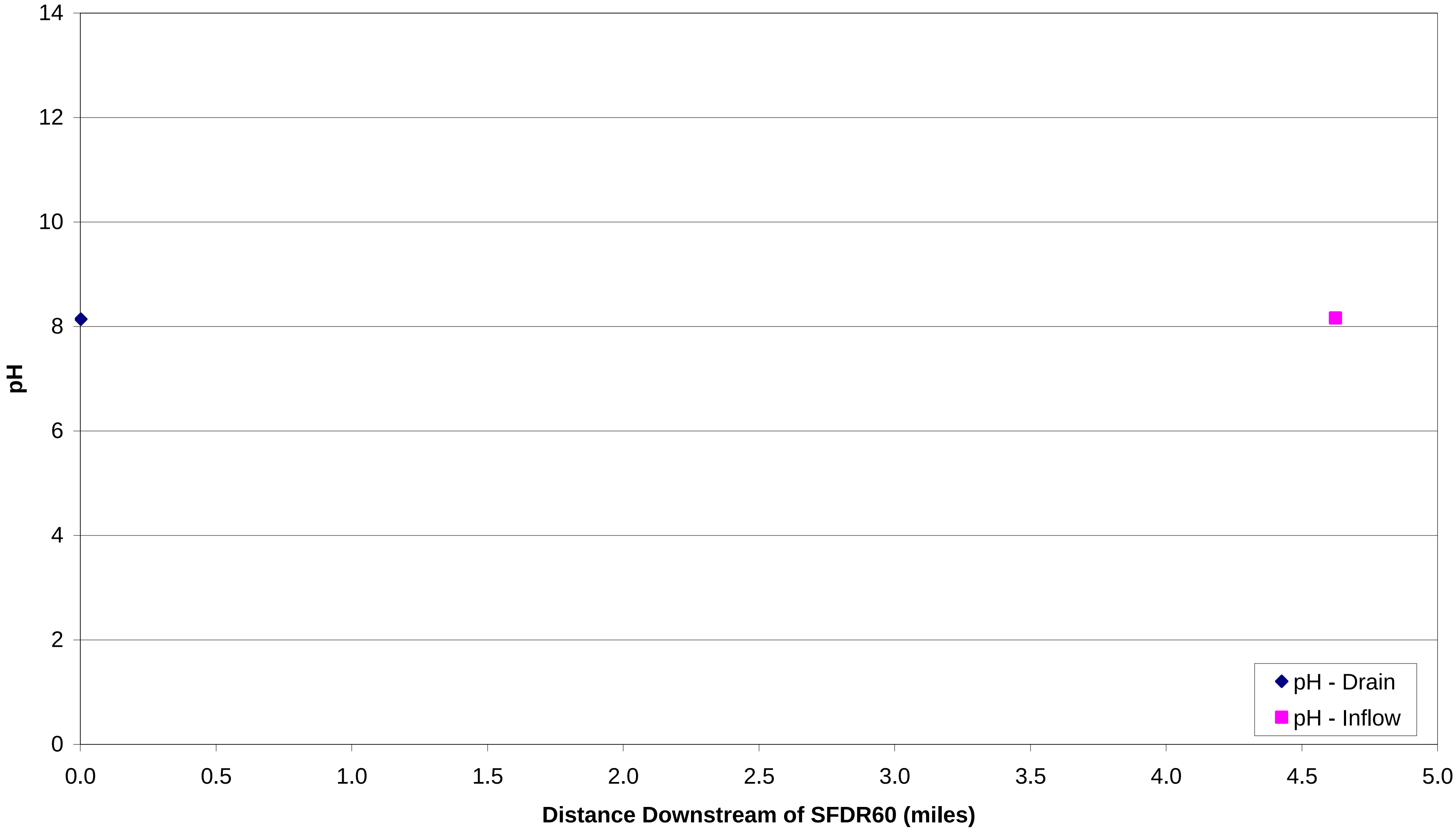


Figure I-10.3a

Conductivity for West Riverside Drains Seepage Run, Belen Division, S4-14, July 22, 2001

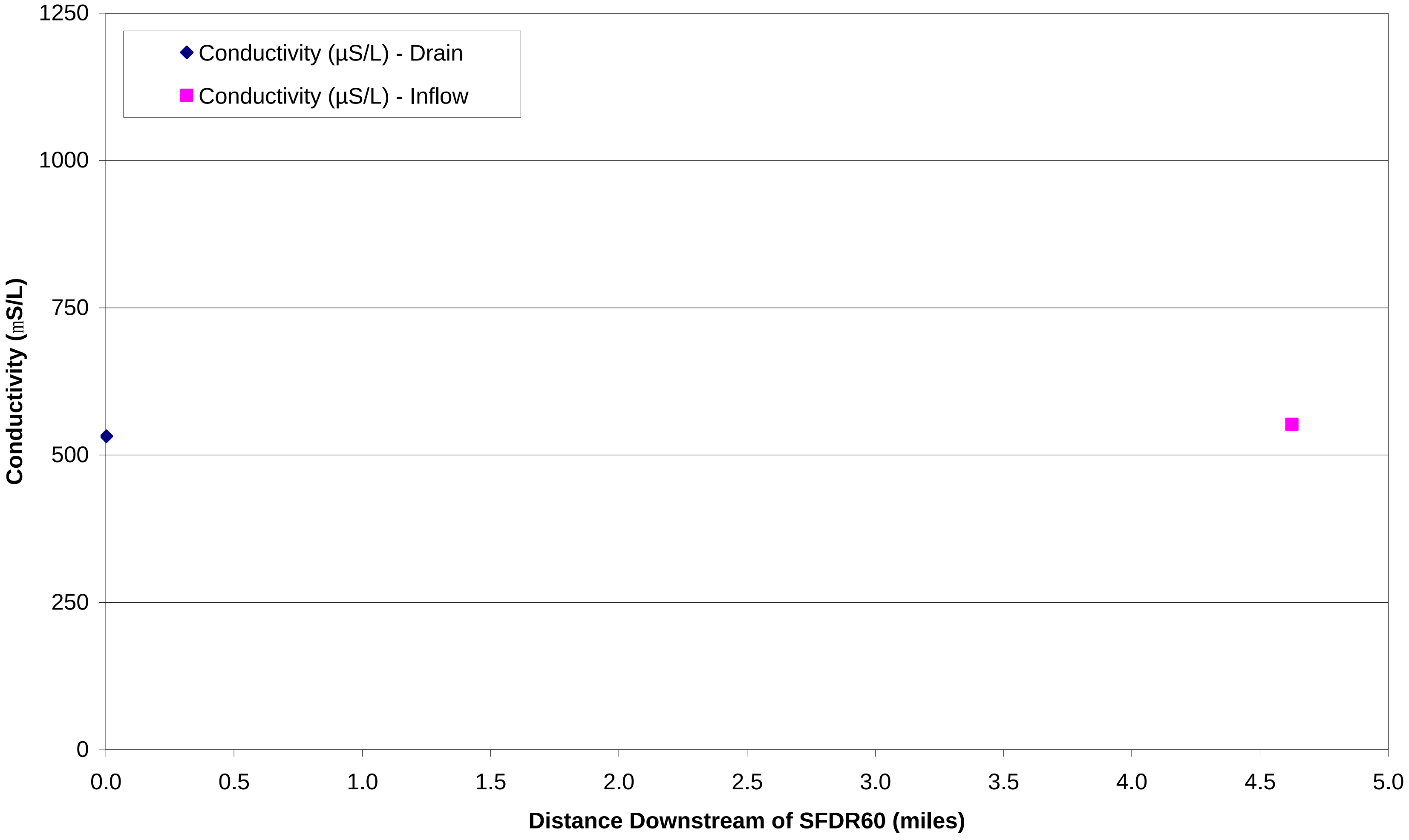


Figure I-10.1b
Water Temperature for West Riverside Drains
Seepage Run, Belen Division, S4-14, July 22, 2001

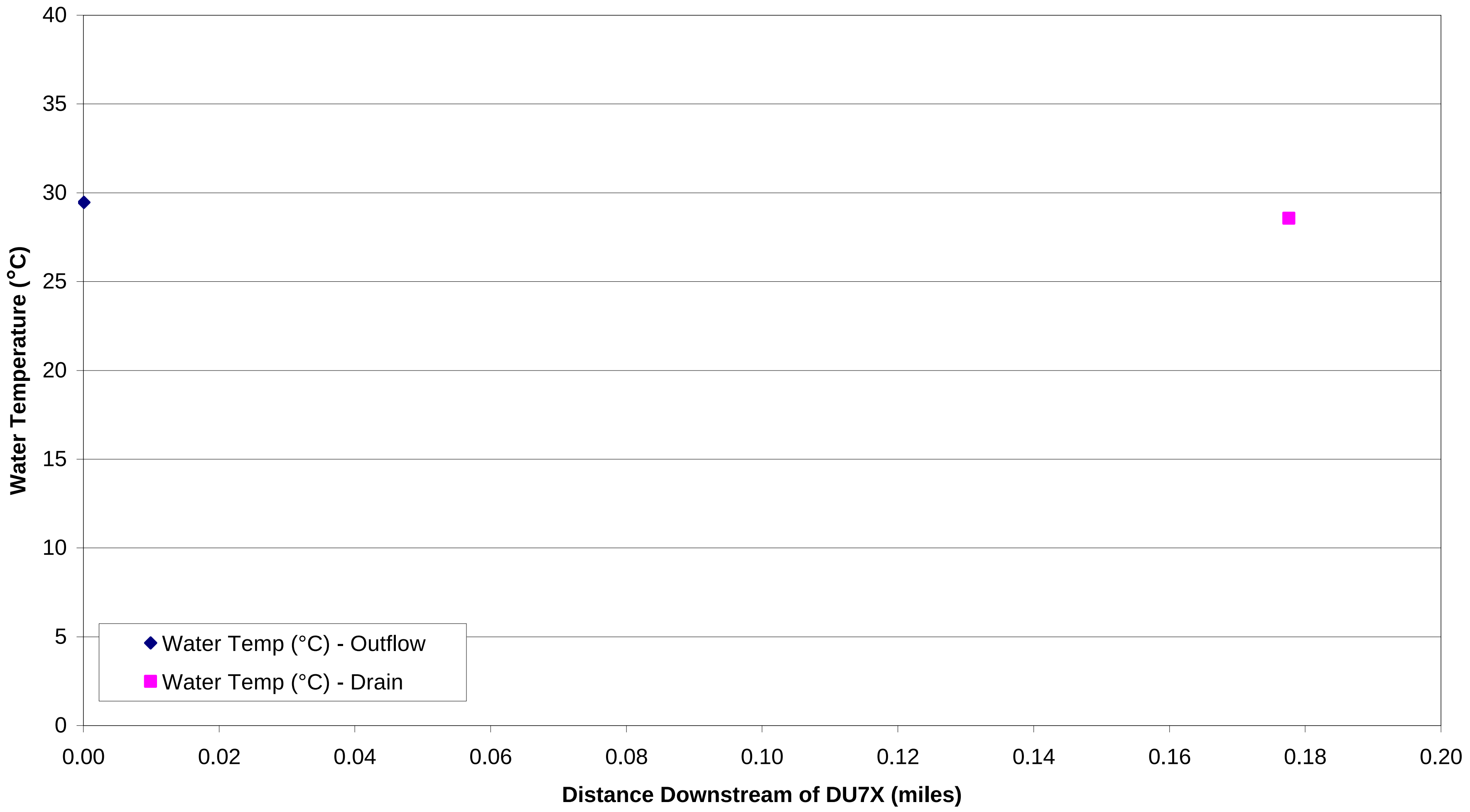


Figure I-10.2b
pH for West Riverside Drains Seepage Run, Belen Division, S4-14, July 22, 2001

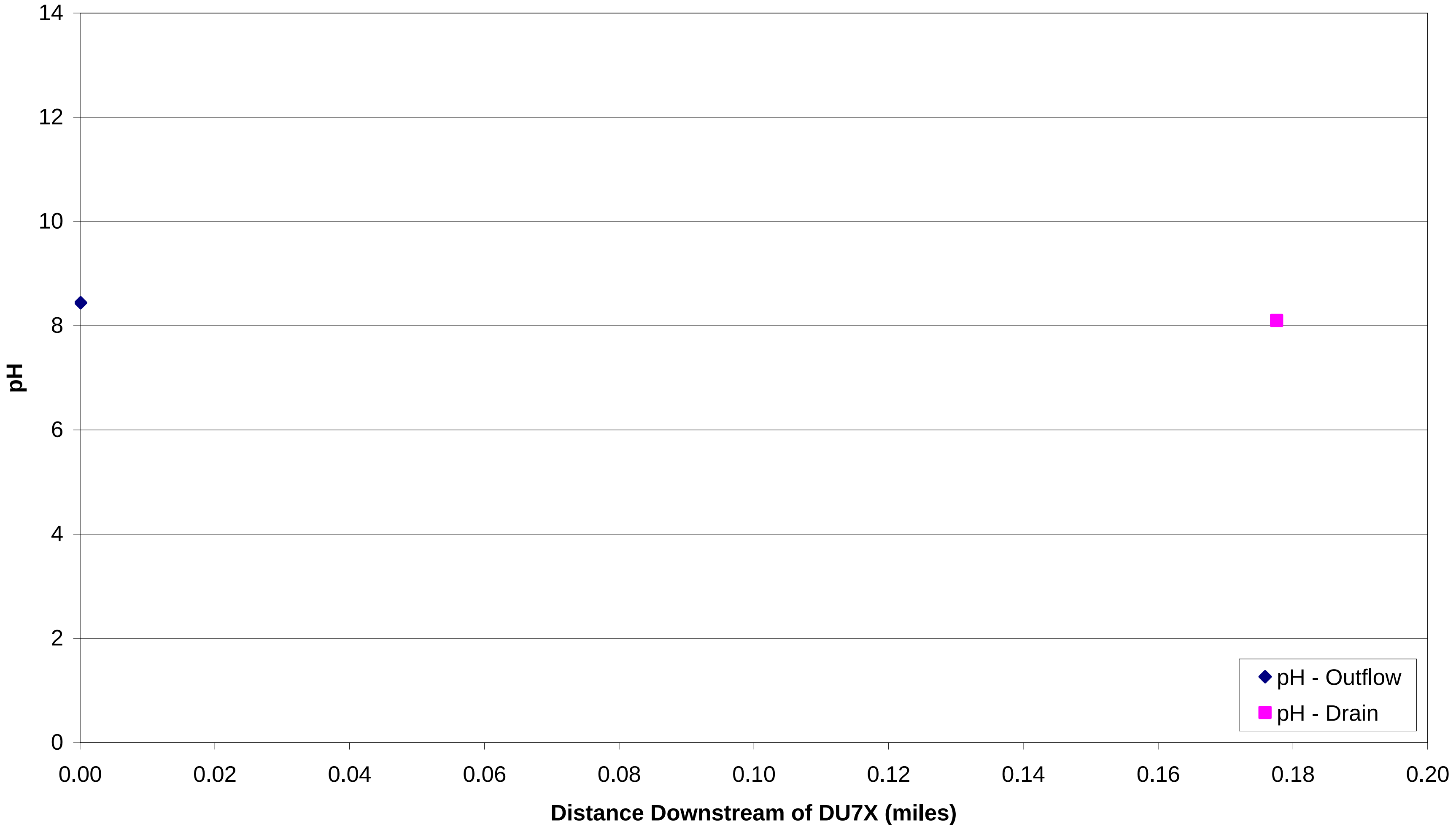


Figure I-10.3b

Conductivity for West Riverside Drains Seepage Run, Belen Division, S4-14, July 22, 2001

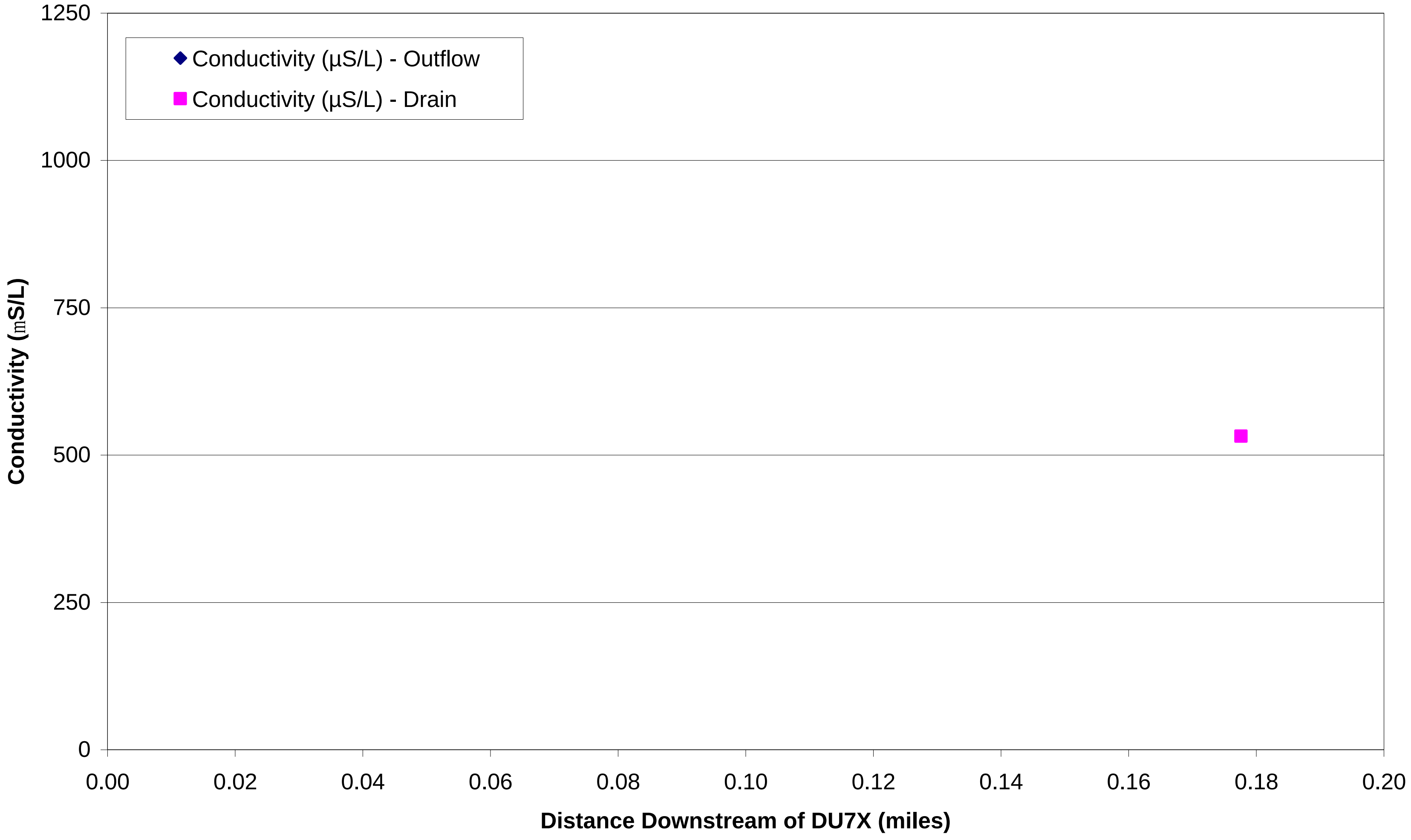


Figure I-11.1
Water Temperature for Lower San Juan Drain Seepage Run, Belen Division, S4-15, July 23, 2001

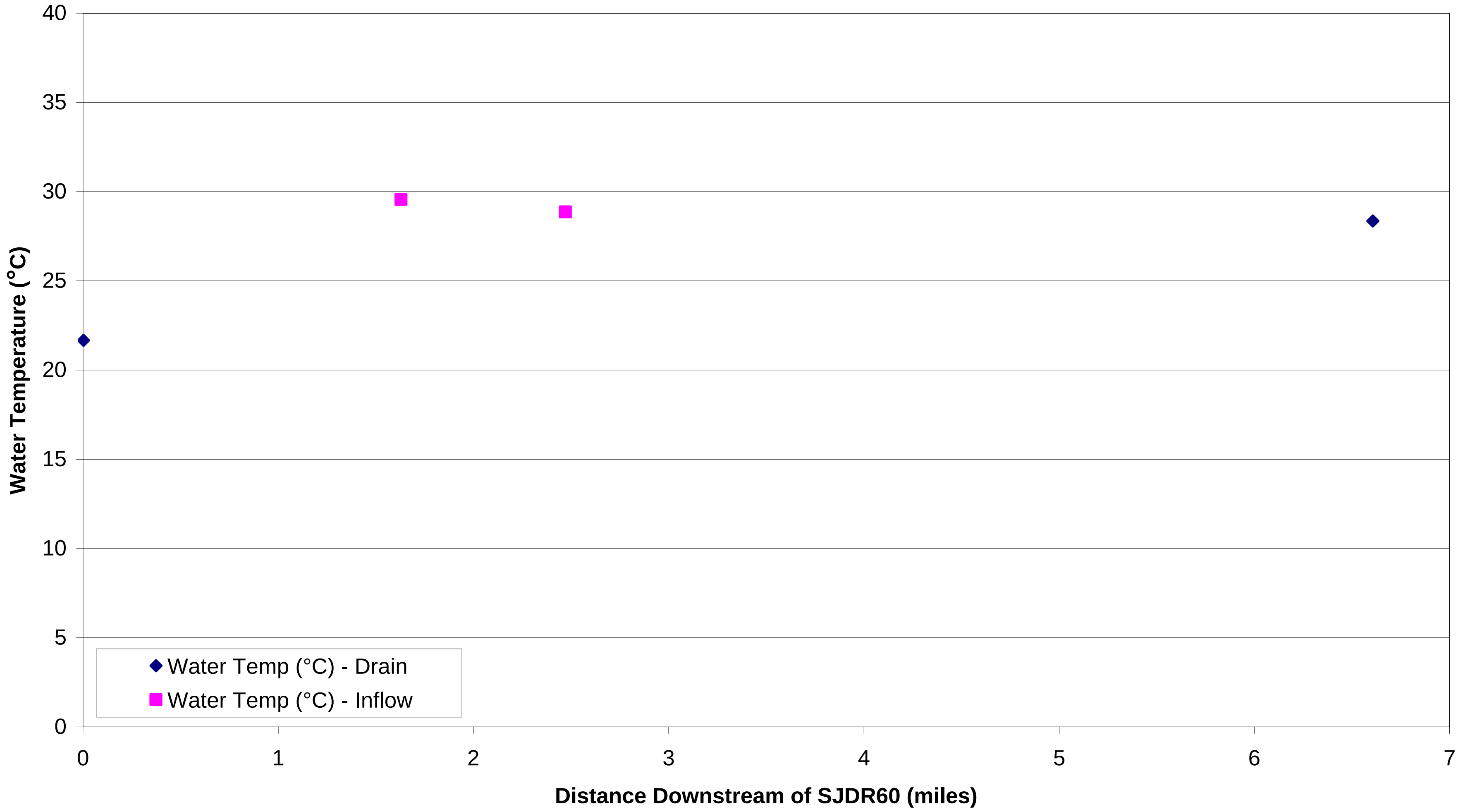


Figure I-11.2

pH for San Juan Riverside Drain Seepage Run, Belen Division, S4-15, July 23, 2001

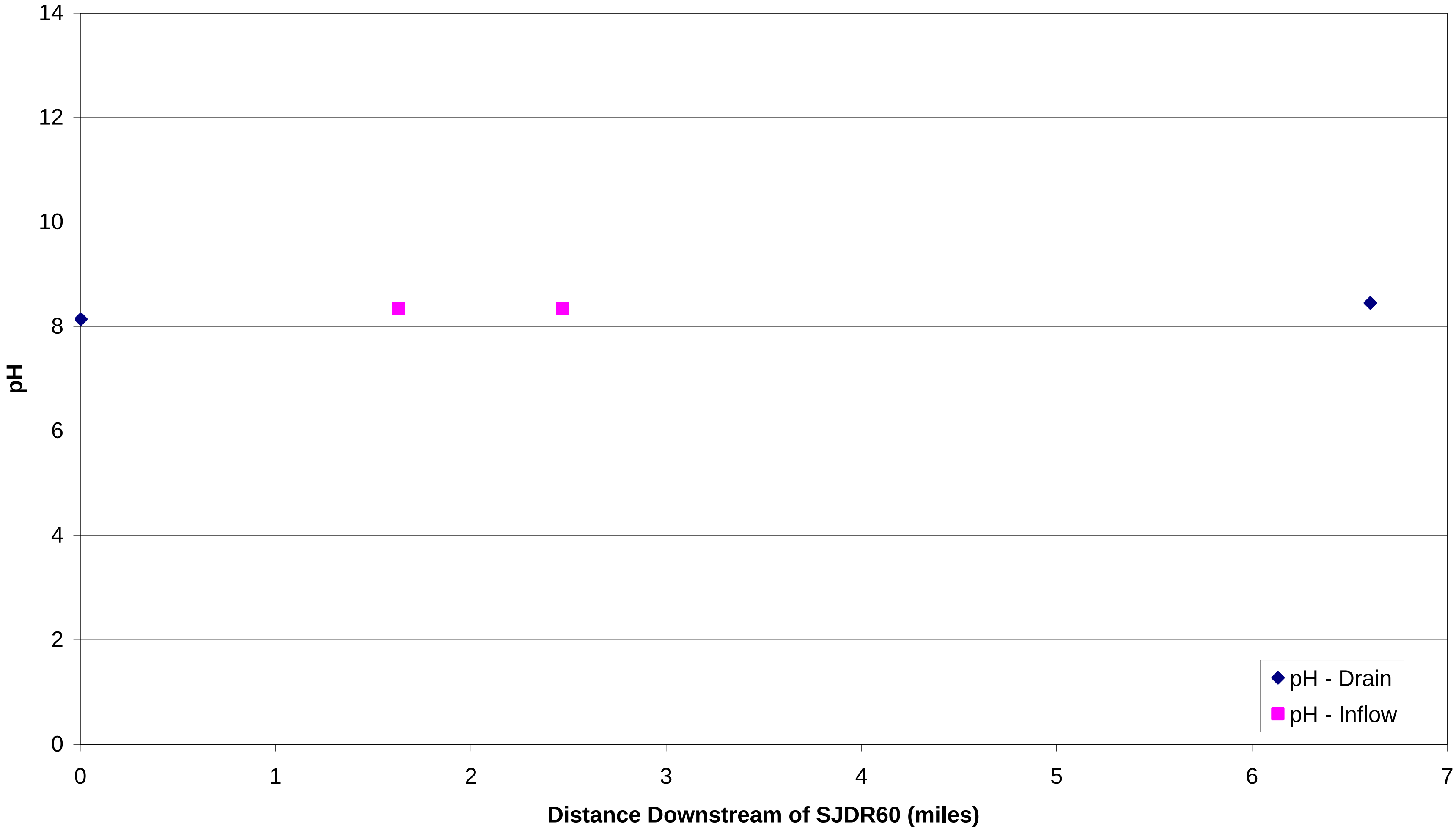


Figure I-11.3

Conductivity for San Juan Riverside Drain Seepage Run, Belen Division, S4-15, July 23, 2001

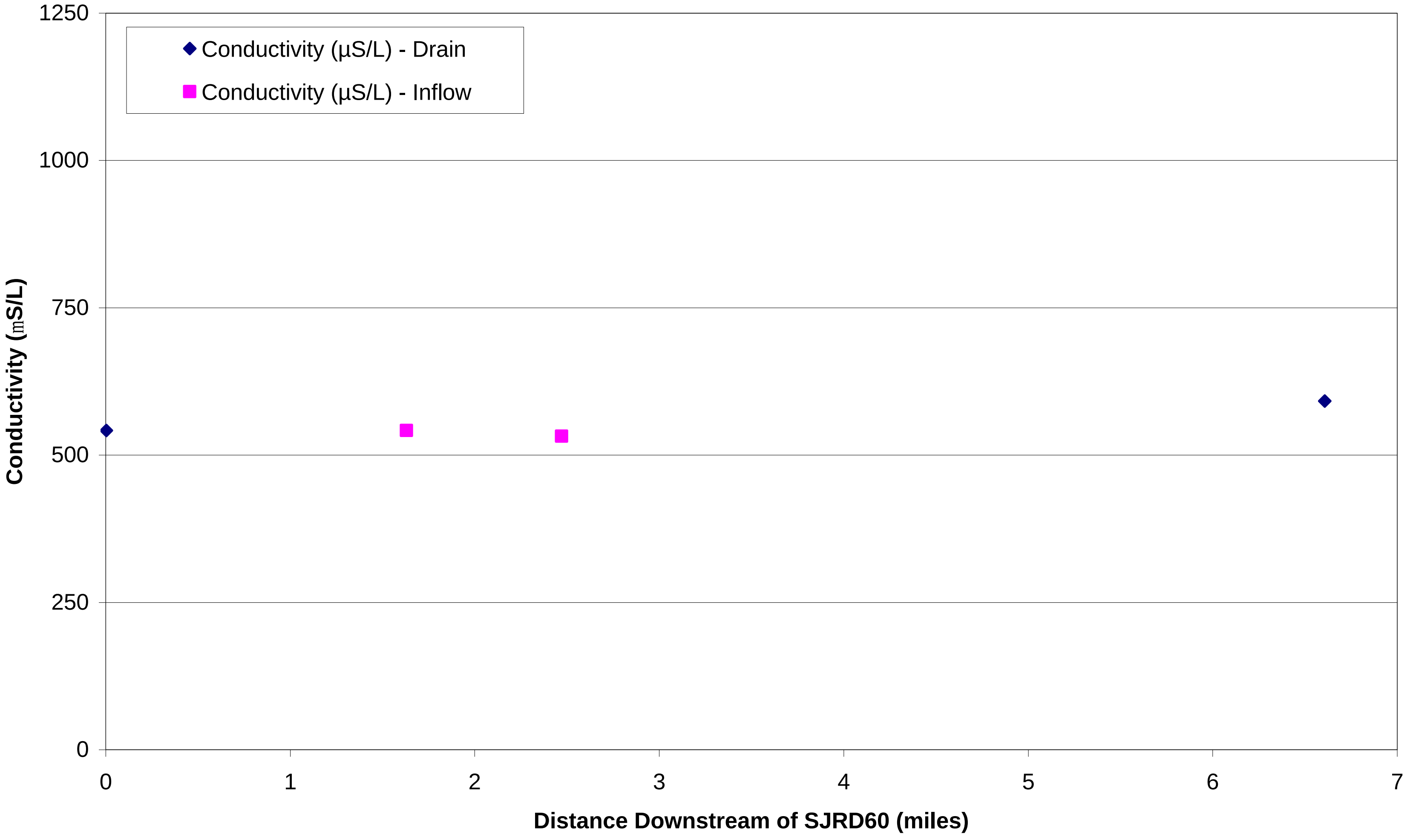


Figure I-12.1

Water Temperature for Rio Grande Seepage Run, Belen Division, S4-16, July 23-24, 2001

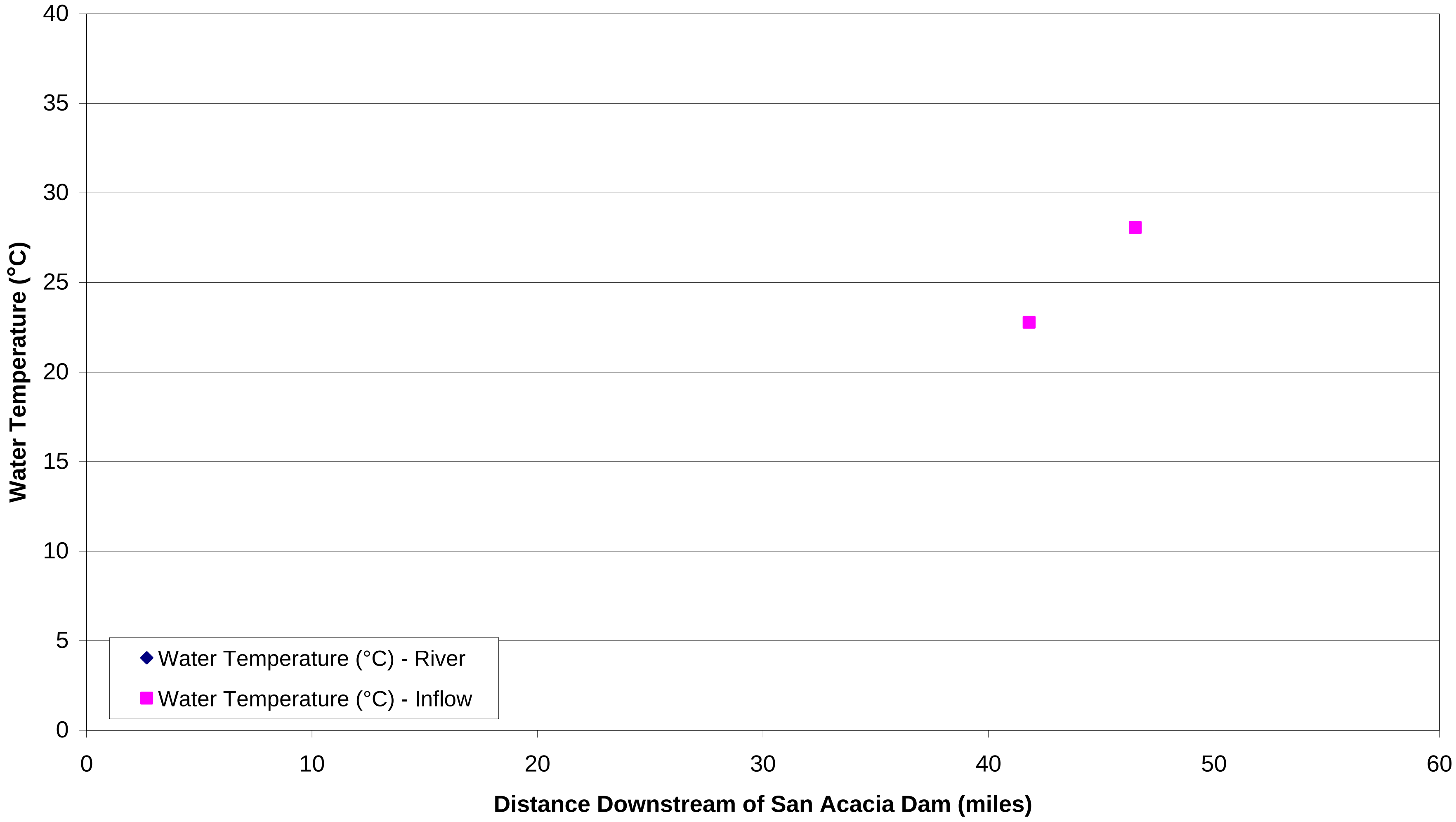


Figure I-12.2
pH for Rio Grande Seepage Run, Belen Division, S4-16, July 23-24, 2001

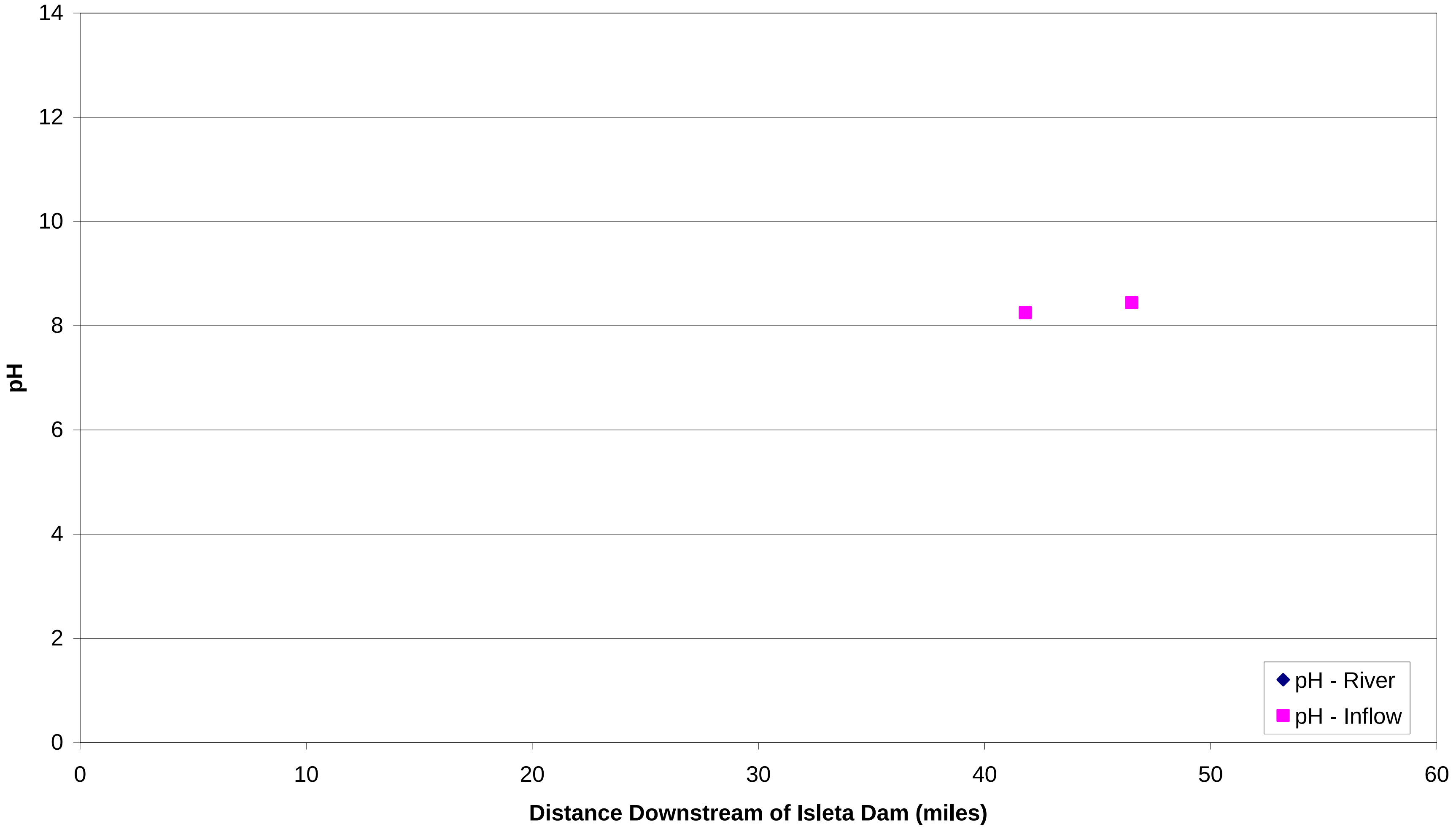


Figure I-12.3
Conductivity for Rio Grande Seepage Run, Belen Division, S4-16, July 23-24, 2001

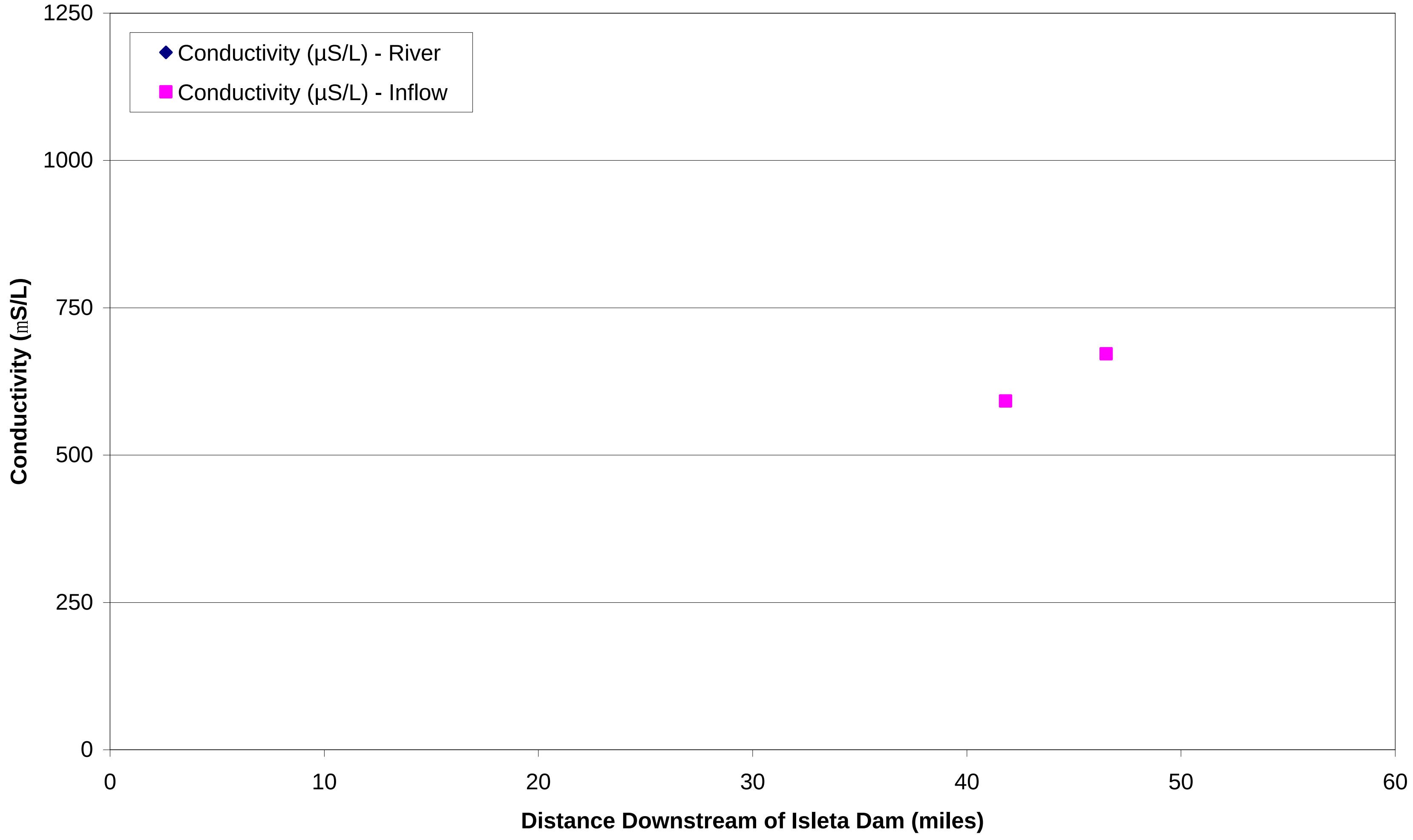


Figure I-13.1
Water Temperature for West Riverside Drain Seepage Run, Belen Division, S4-17, July 23-24, 2001

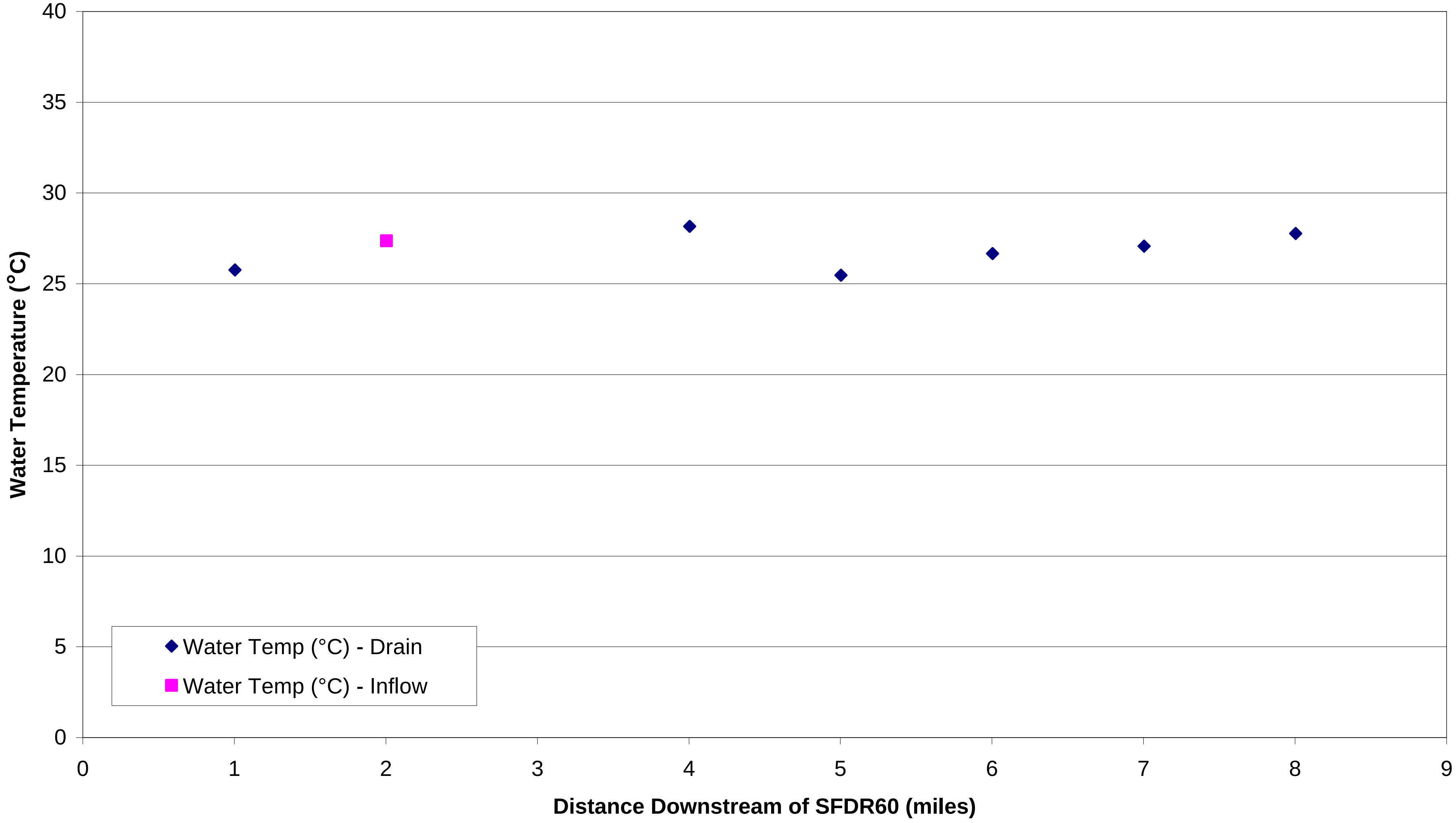


Figure I-13.2

pH for West Riverside Drains Seepage Run, Belen Division, S4-17, July 23-24, 2001

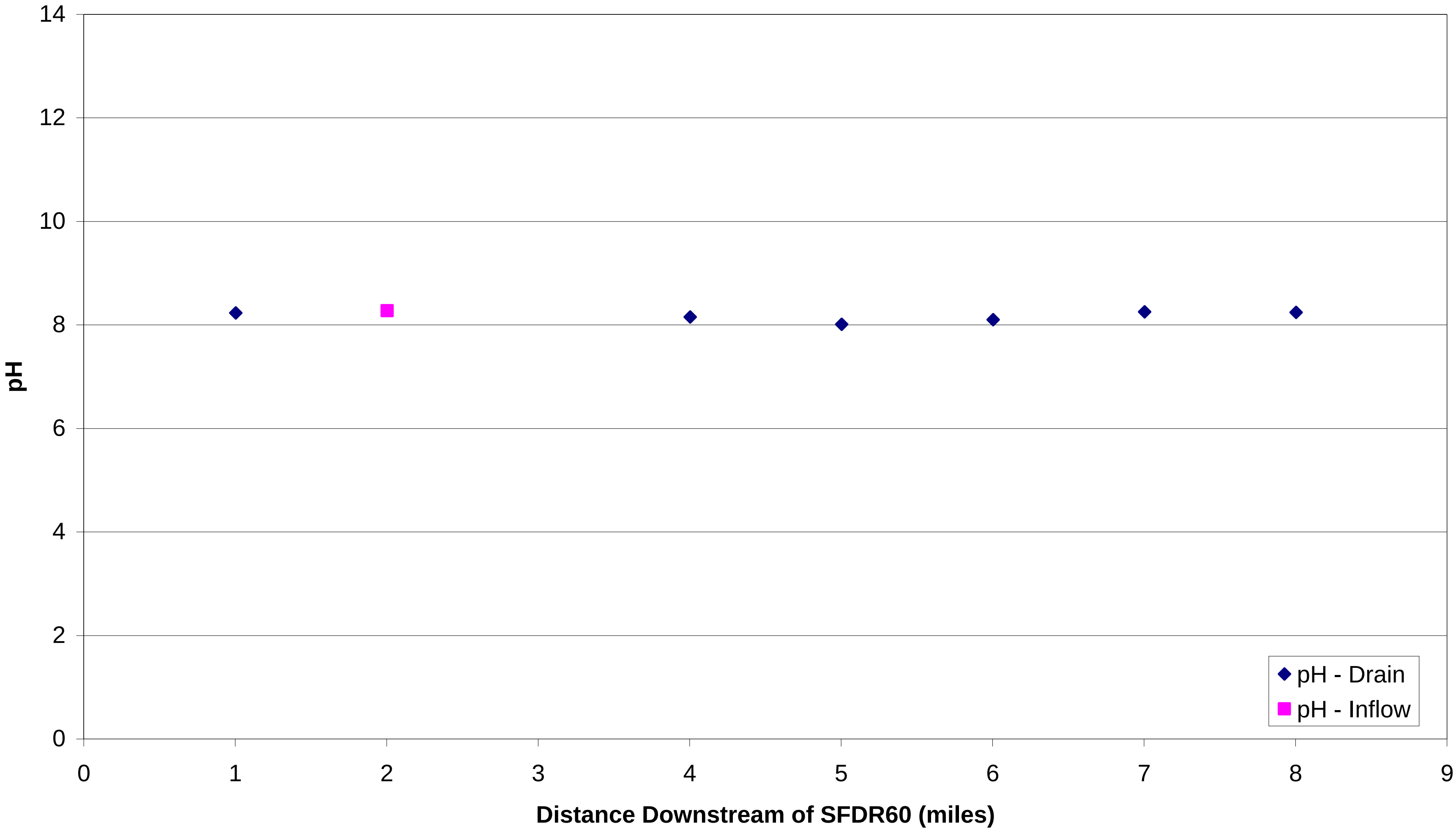


Figure I-13.3
Conductivity for West Riverside Drain Seepage Run, Belen Division, S4-17, July 23-24, 2001

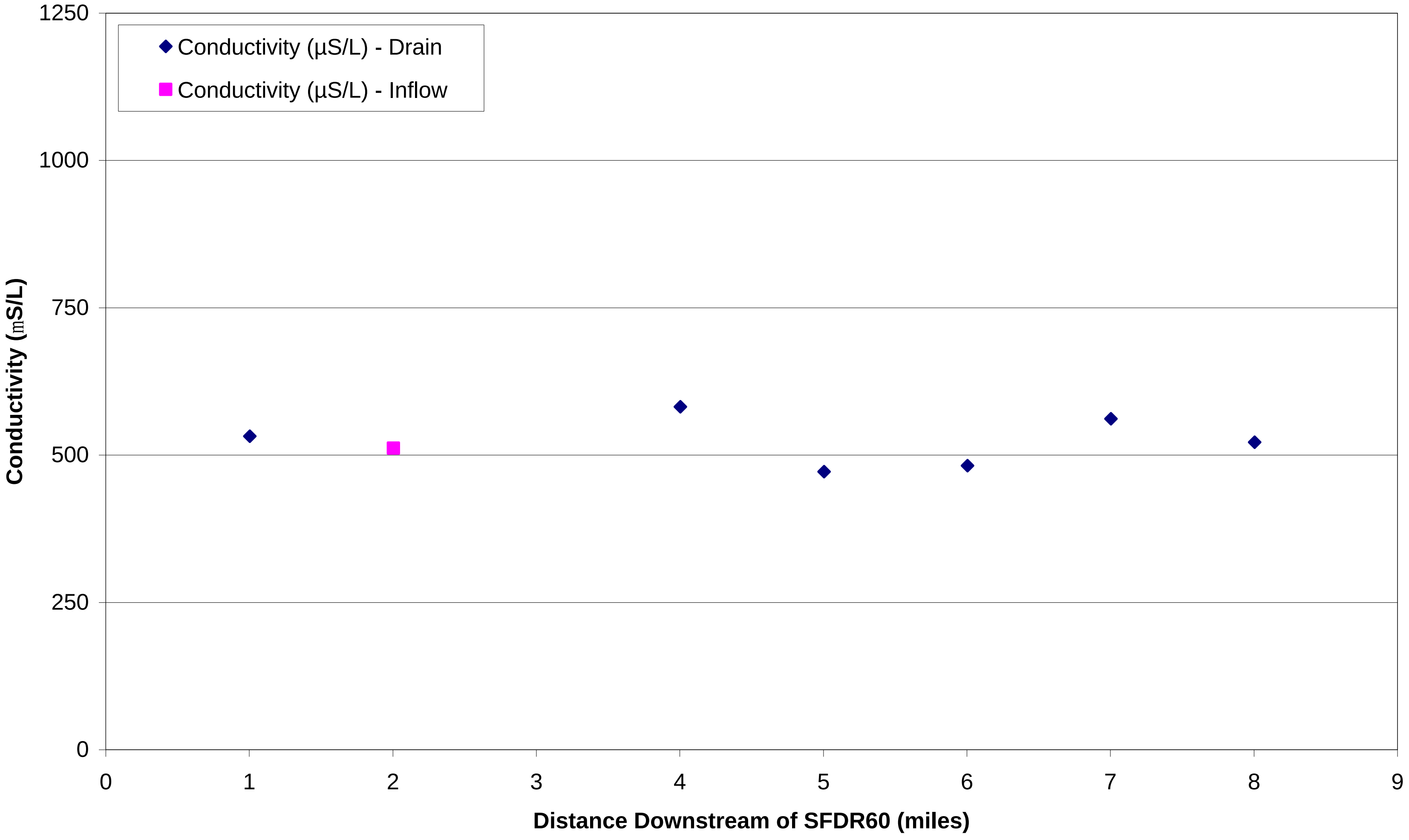


Figure I-14.1
Water Temperature for Peralta Riverside Drain Seepage Run, Belen Division, S4-18, July 25, 2001

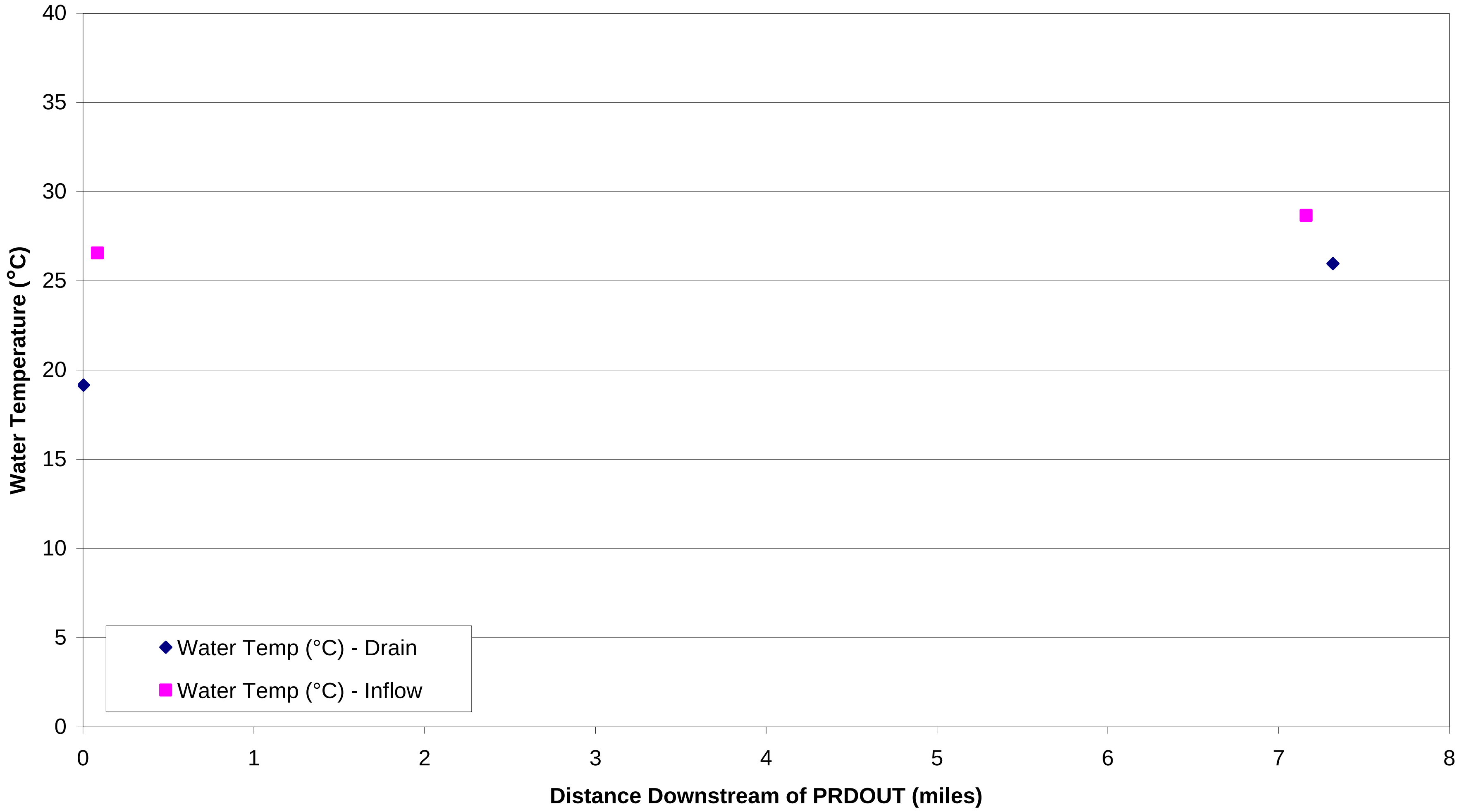


Figure I-14.2

pH for Peralta Riverside Drain Seepage Run, Belen Division, S4-18, July 25, 2001

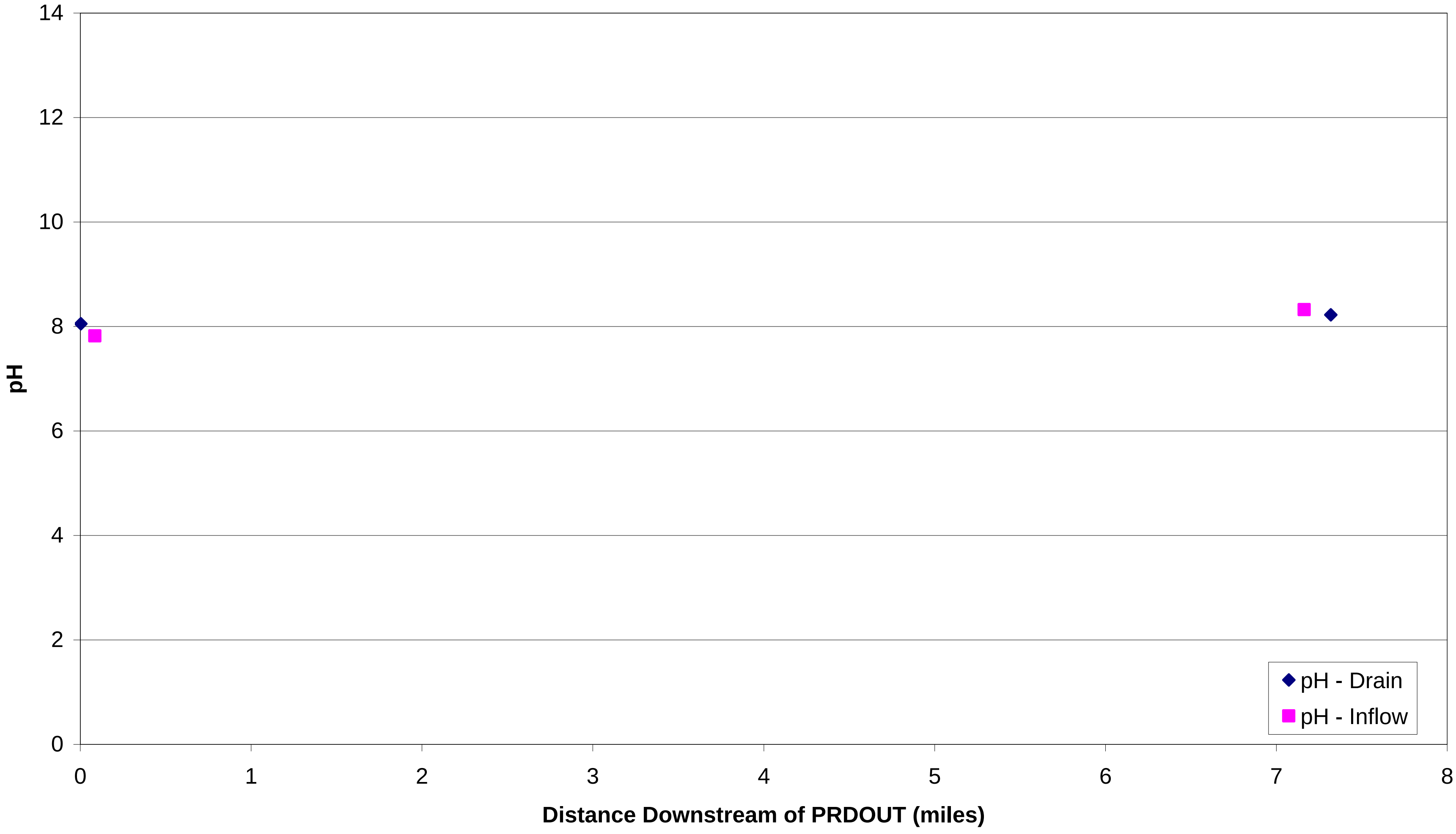


Figure I-14.3

Conductivity for Peralta Riverside Drain Seepage Run, Belen Division, S4-18, July 25, 2001

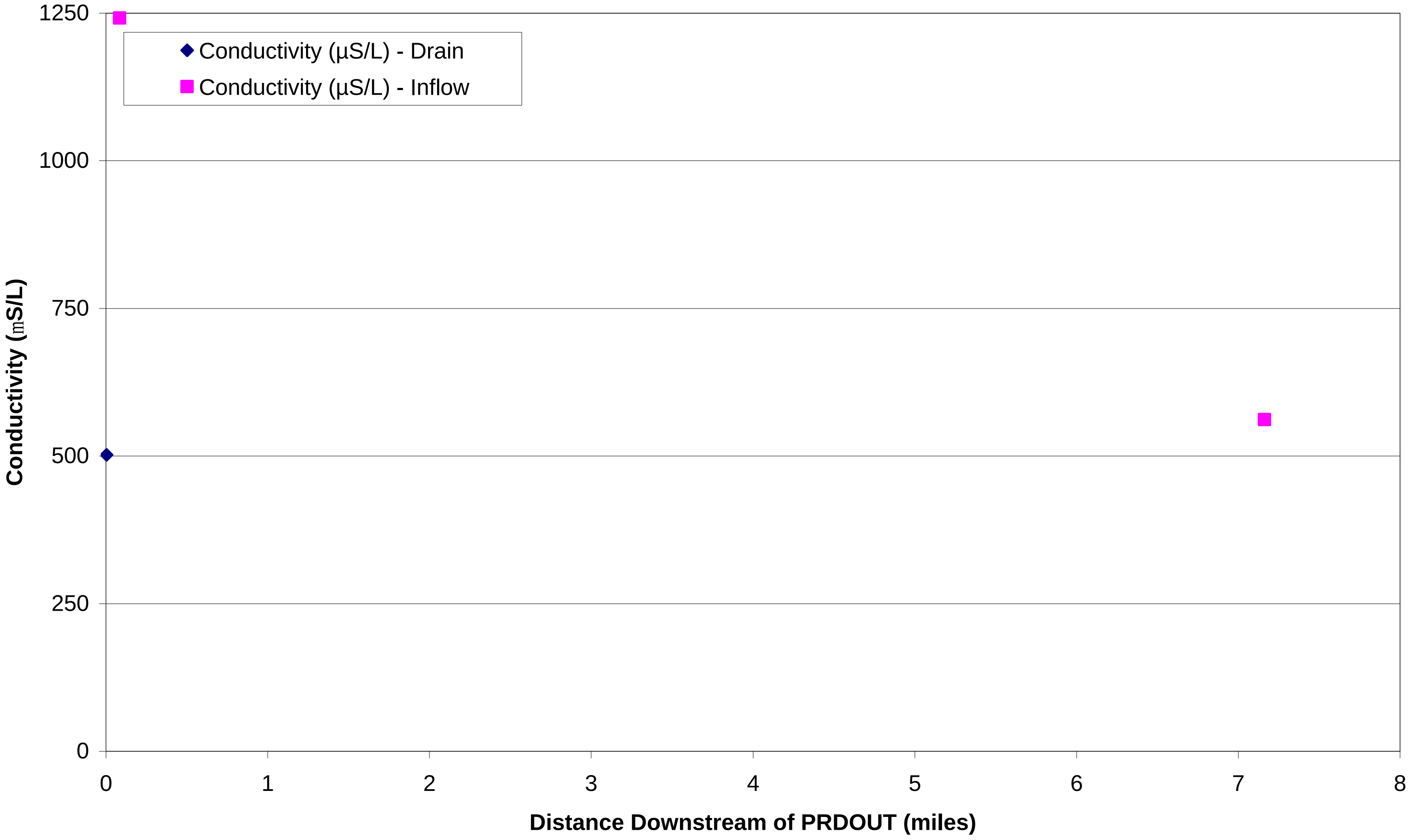


Figure I-15.1

Water Temperature for Rio Grande Seepage Run, Belen Division, S4-19, July 25-26, 2001

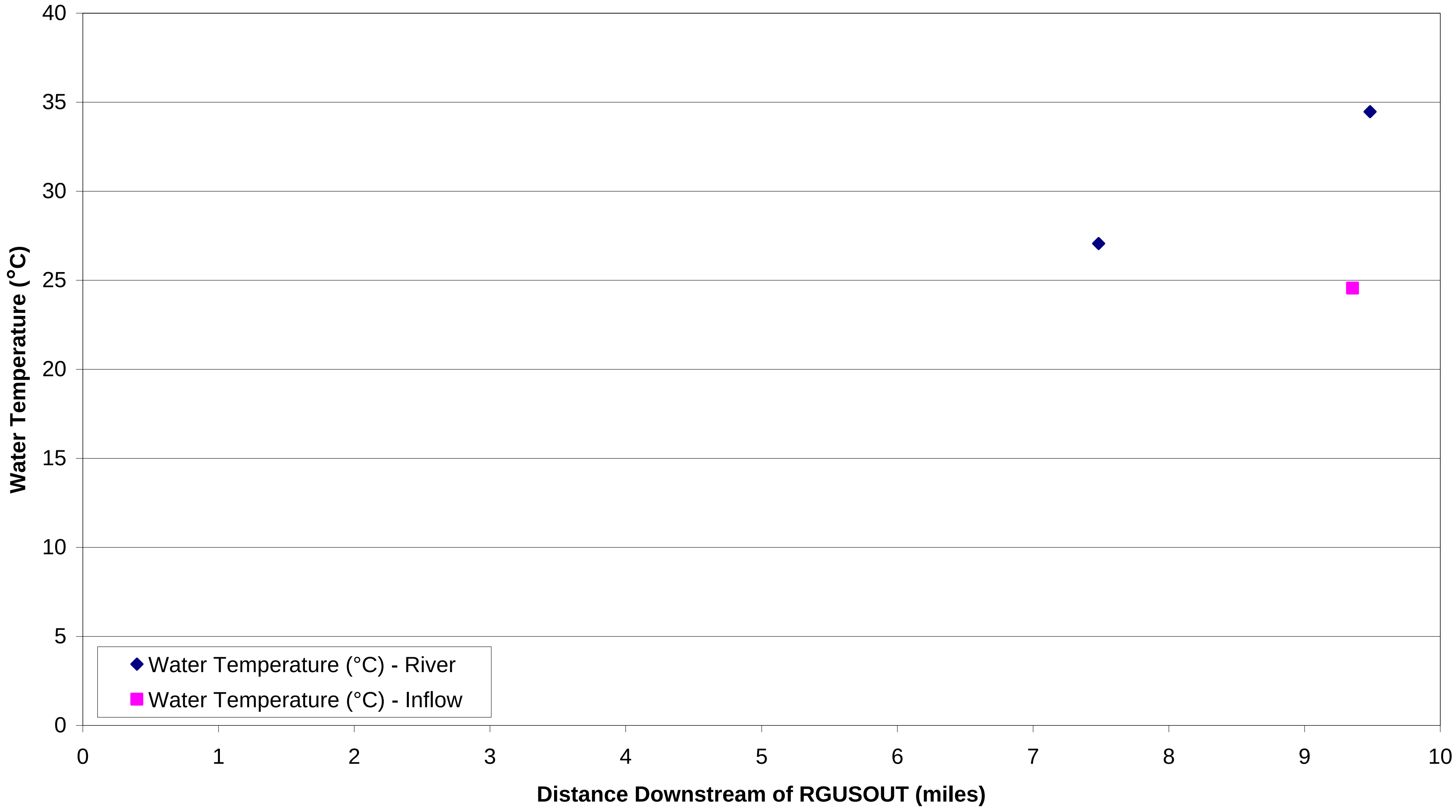


Figure I-15.2
pH for Rio Grande Seepage Run, Belen Division, S4-19, July 25-26, 2001

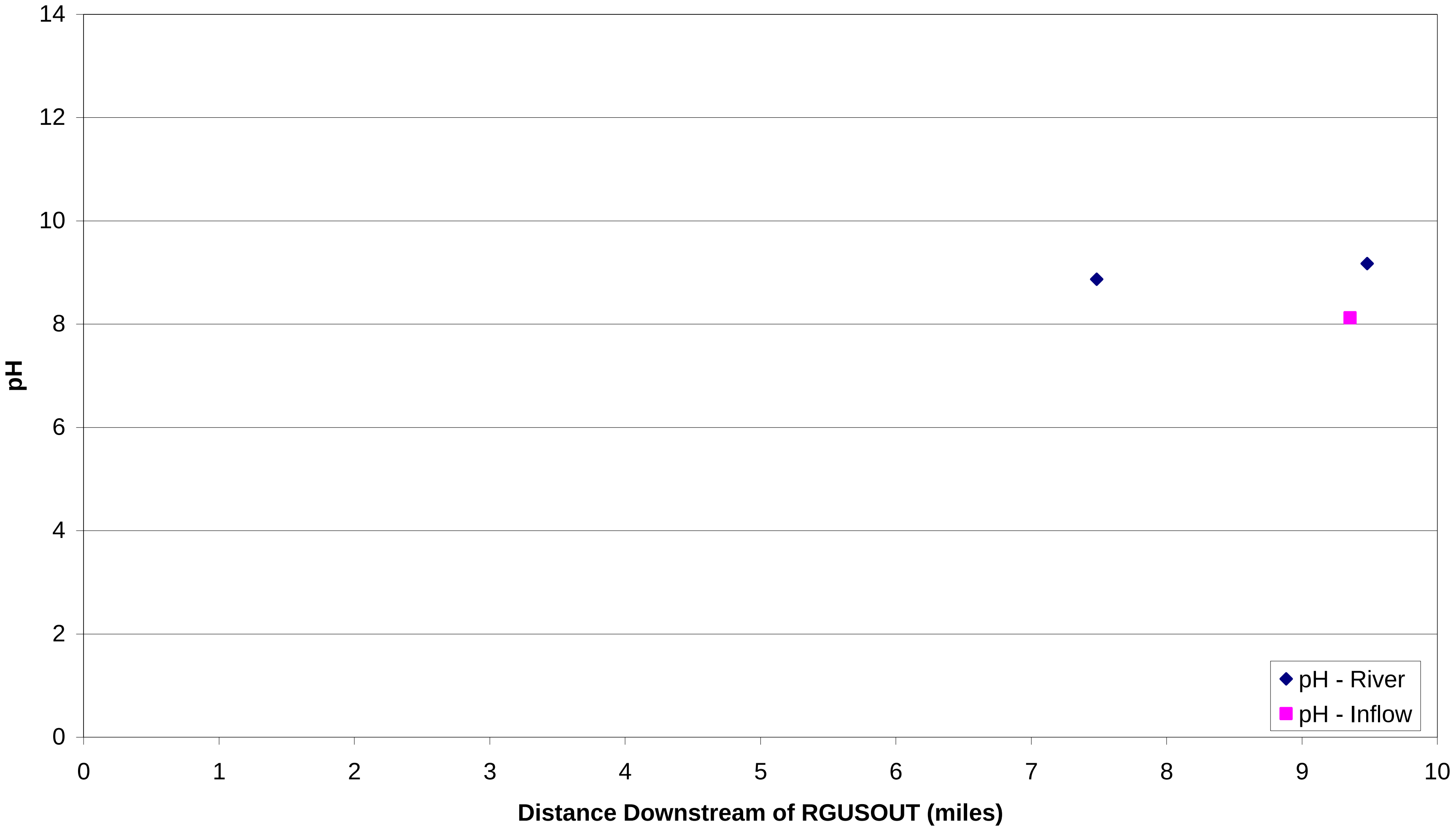


Figure I-15.3

Conductivity for Rio Grande Seepage Run, Belen Division, S4-19, July 25-26, 2001

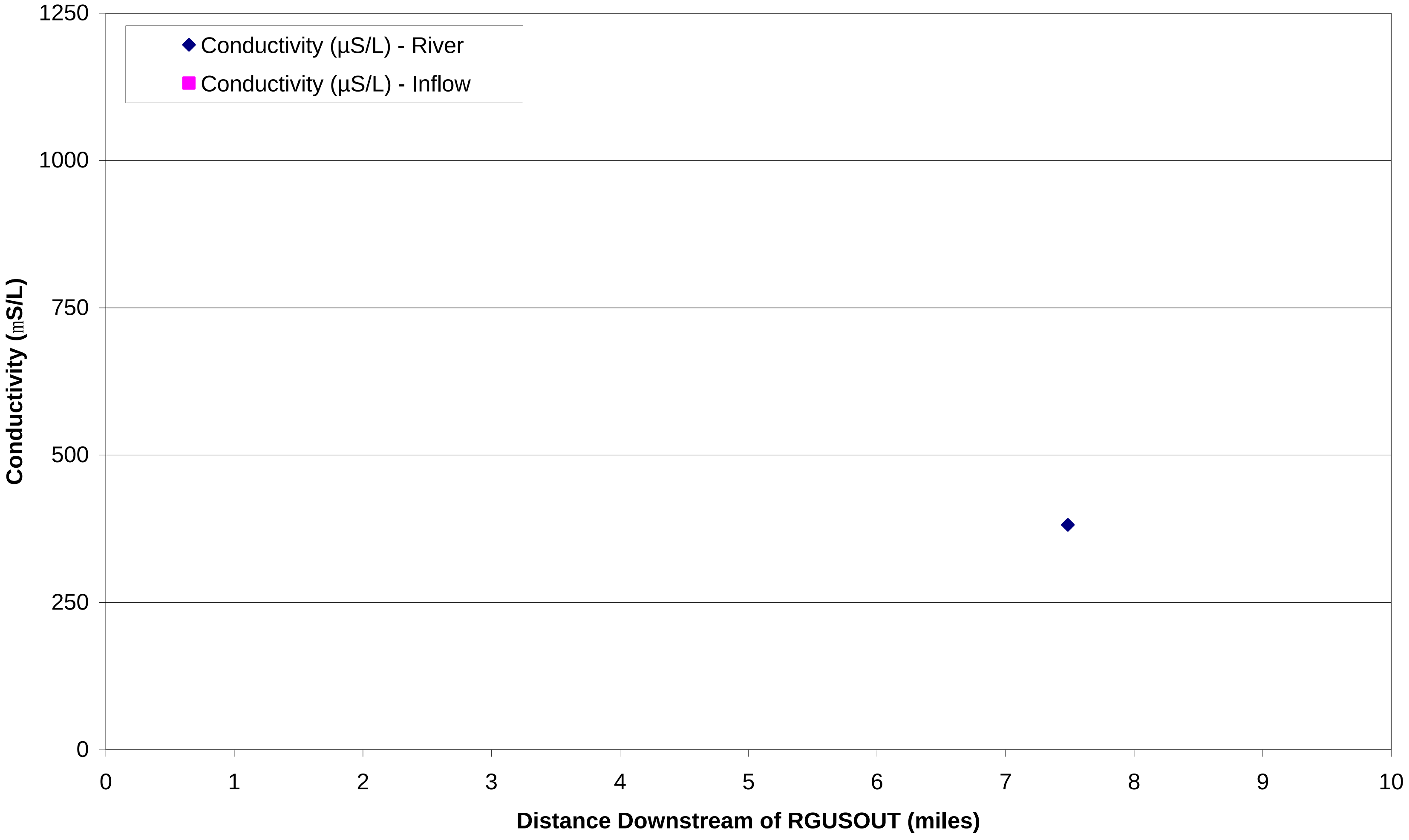


Figure I-16.1a
Water Temperature for Belen Riverside Drain Seepage Run, Belen Division, S4-20, July 25-26, 2001

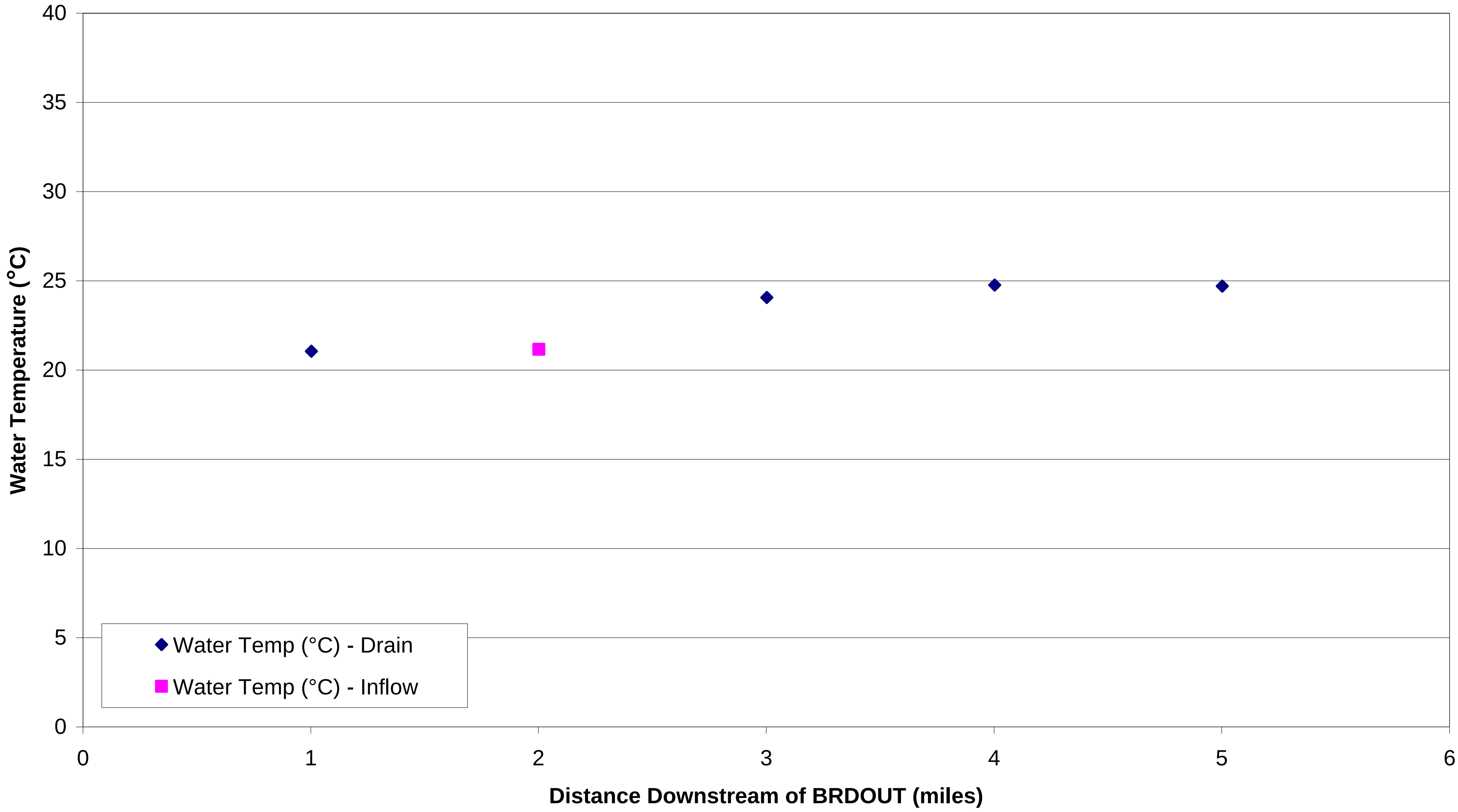


Figure I-16.2a
pH for Belen Riverside Drain Seepage Run, Belen Division, S4-20, July 25-26, 2001

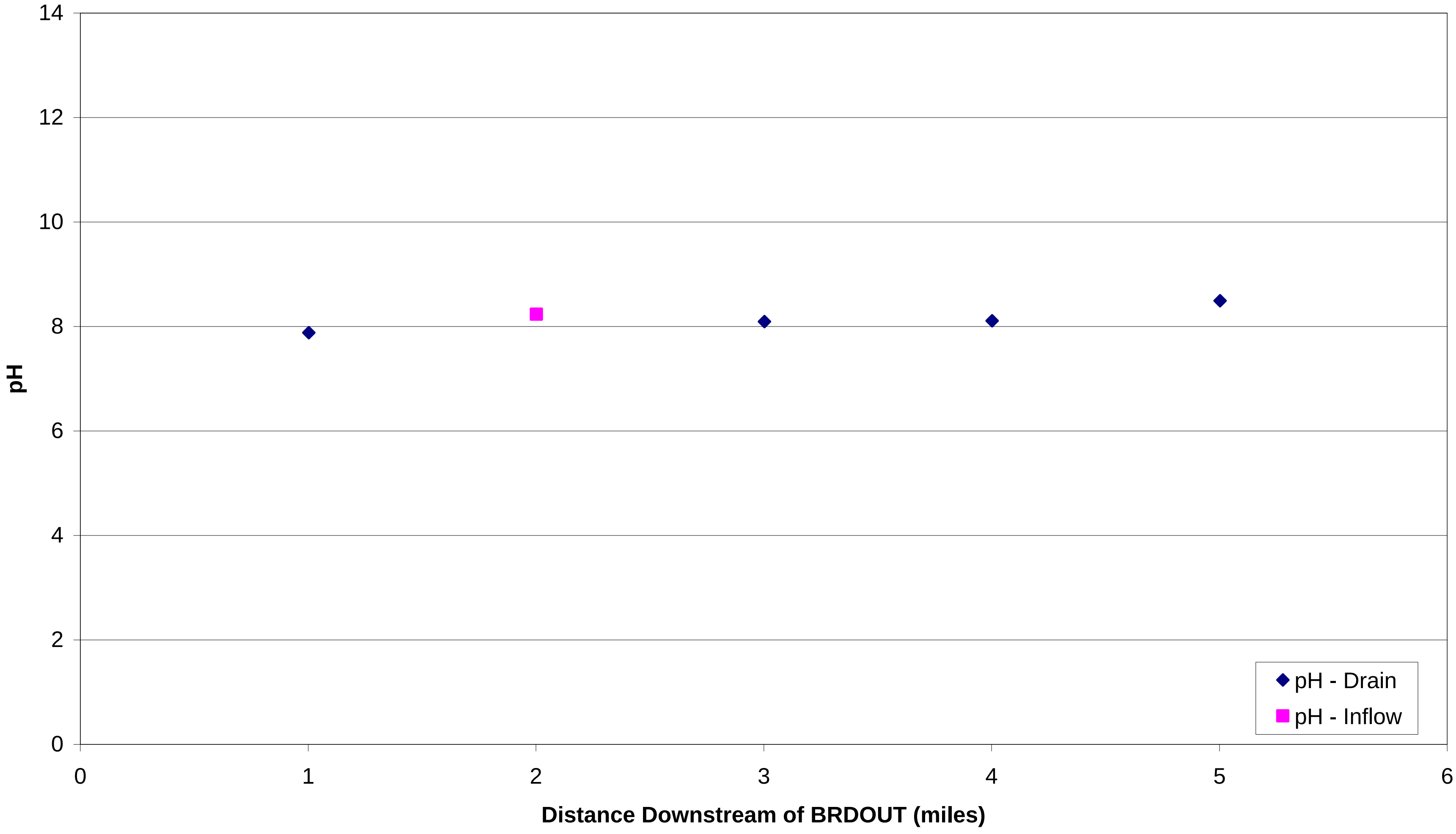


Figure I-16.3a
Conductivity for Belen Riverside Drain Seepage Run, Belen Division, S4-20, July 25-26, 2001

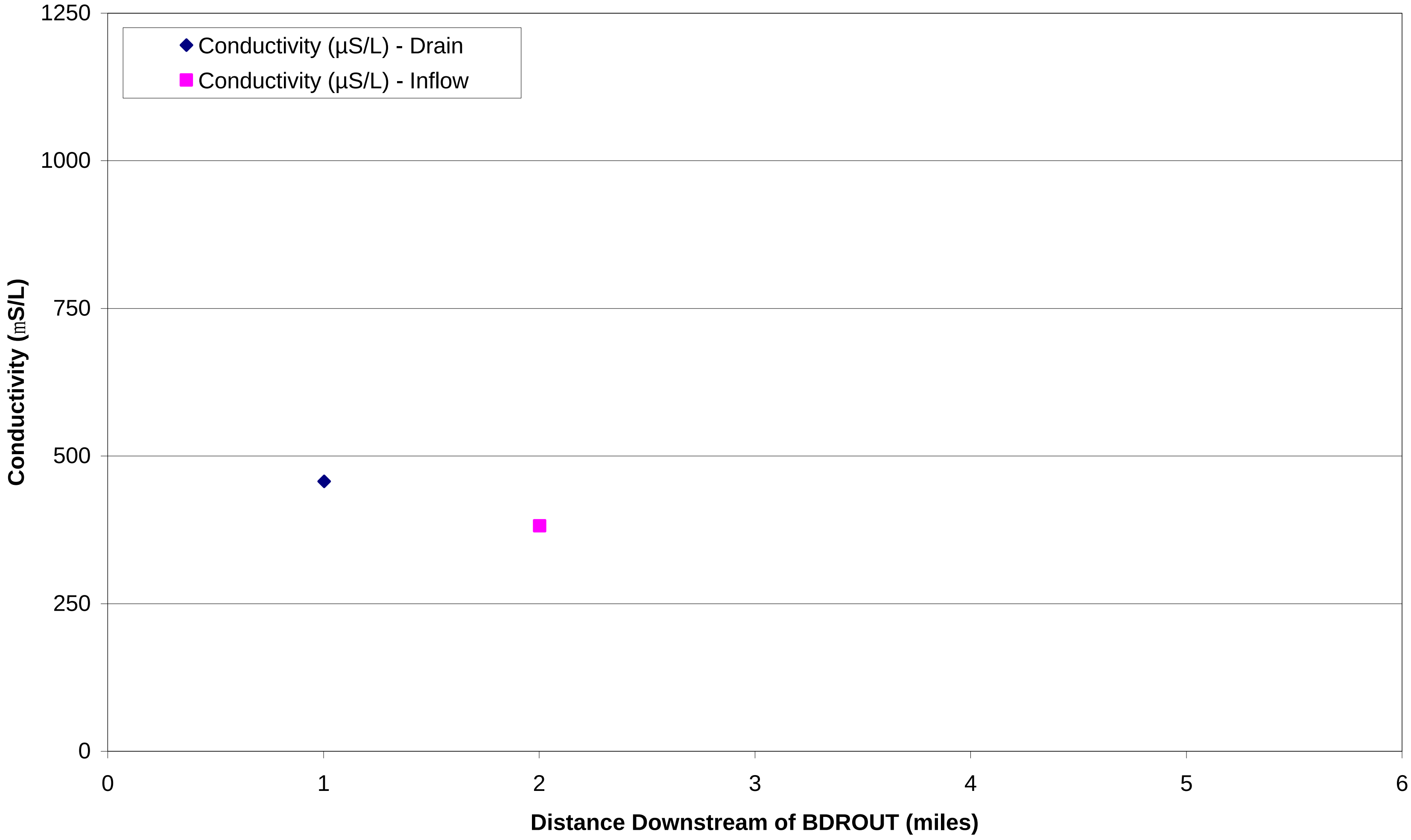


Figure I-16.1b
Water Temperature for Belen Riverside Drain Seepage Run, Belen Division, S4-20, July 25-26, 2001

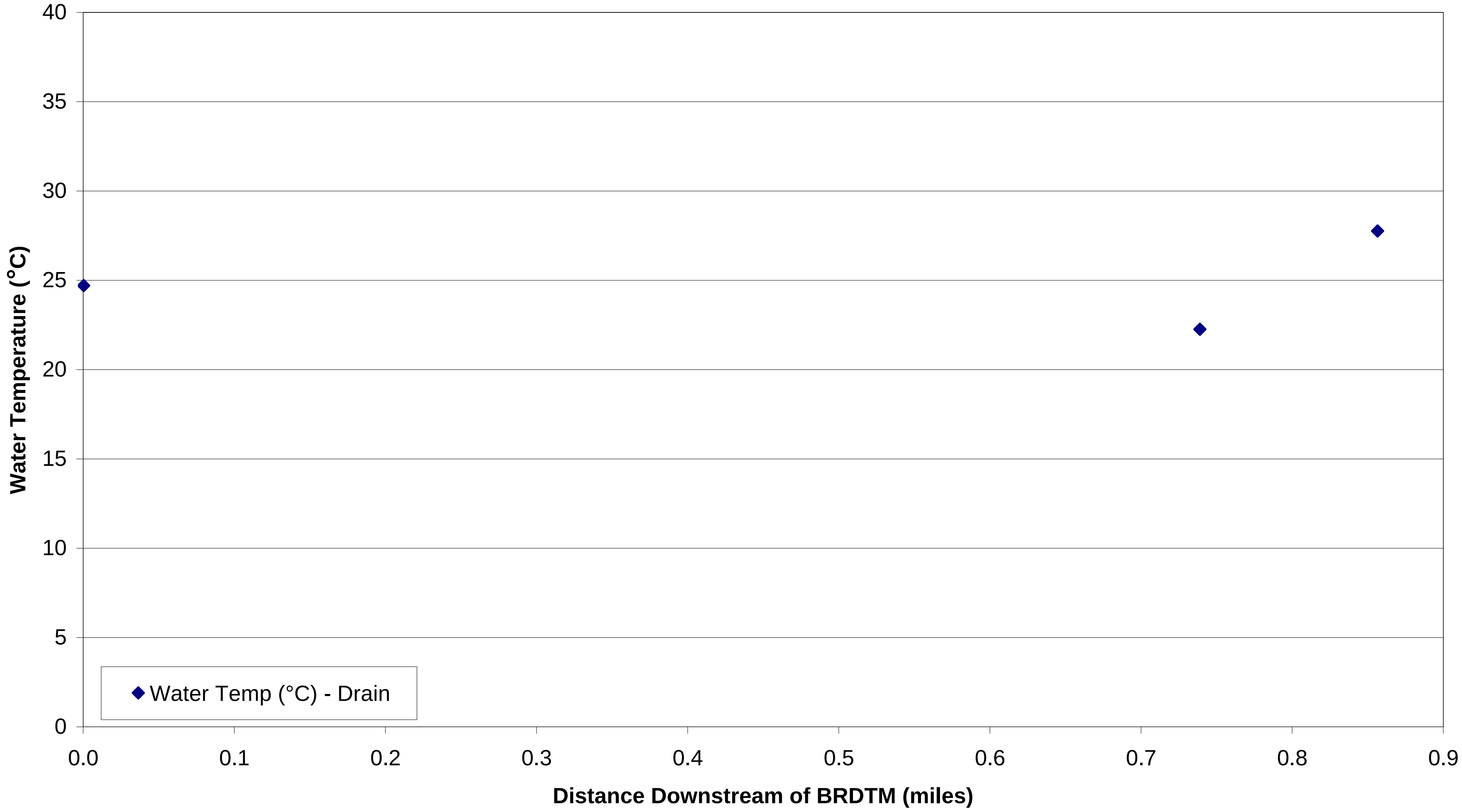


Figure I-16.2b
pH for Belen Riverside Drain Seepage Run, Belen Division, S4-20, July 25-26, 2001

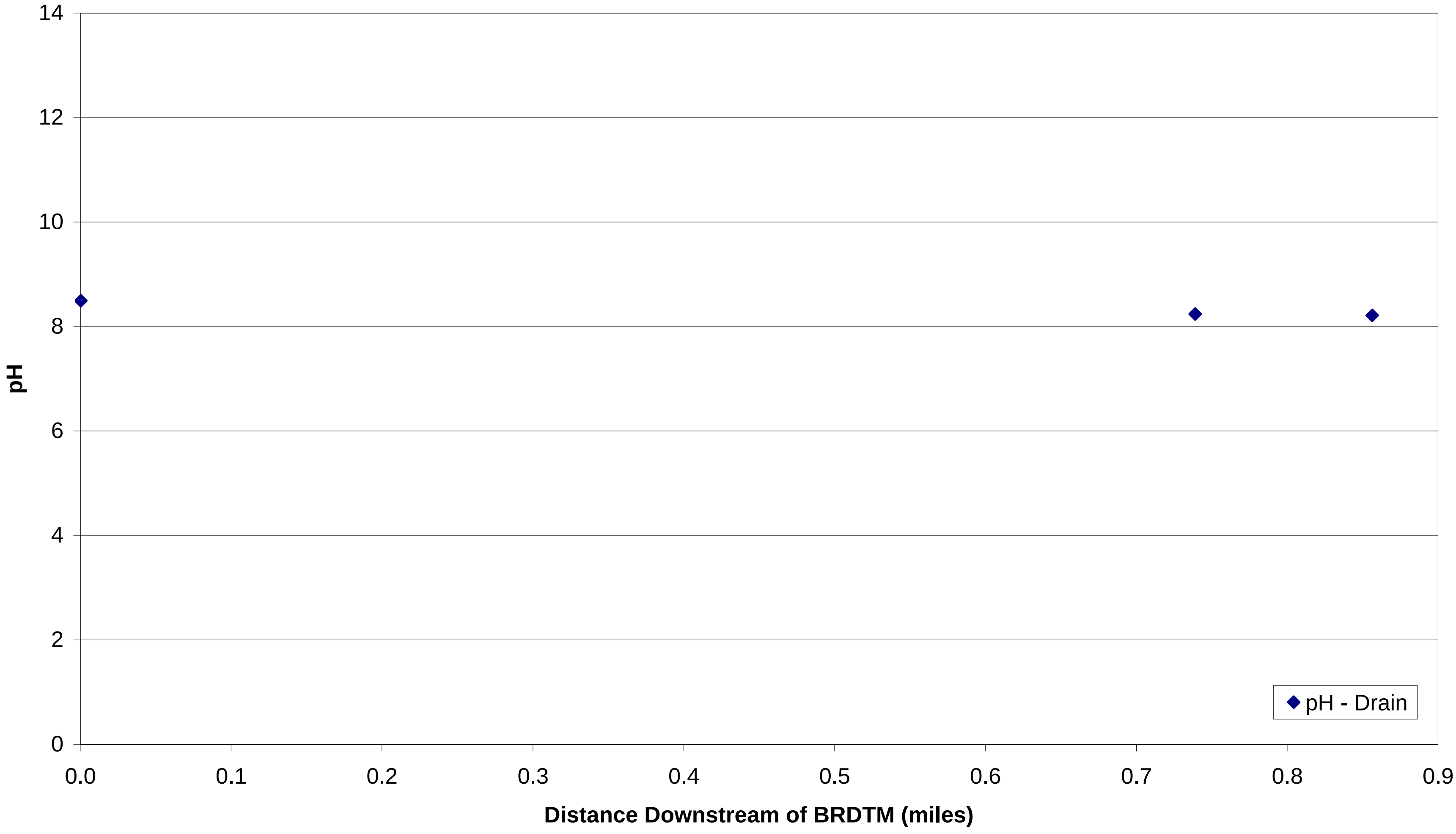


Figure I-16.3b
Conductivity for Belen Riverside Drain Seepage Run, Belen Division, S4-20, July 25-26, 2001

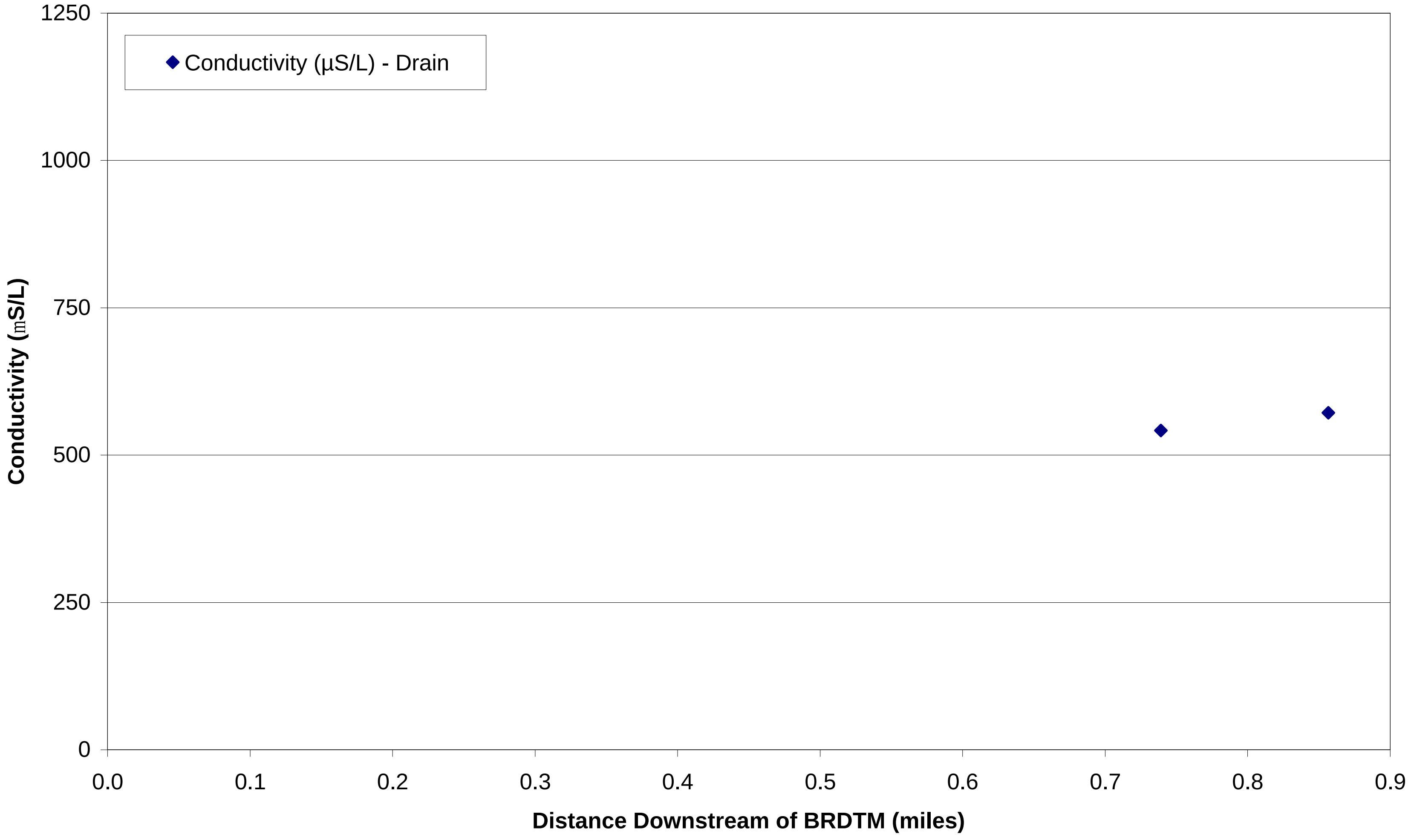


Figure I-17.1

Water Temperature for Peralta Riverside Drain Seepage Run, Belen Division, S4-21, August 2-3, 2001

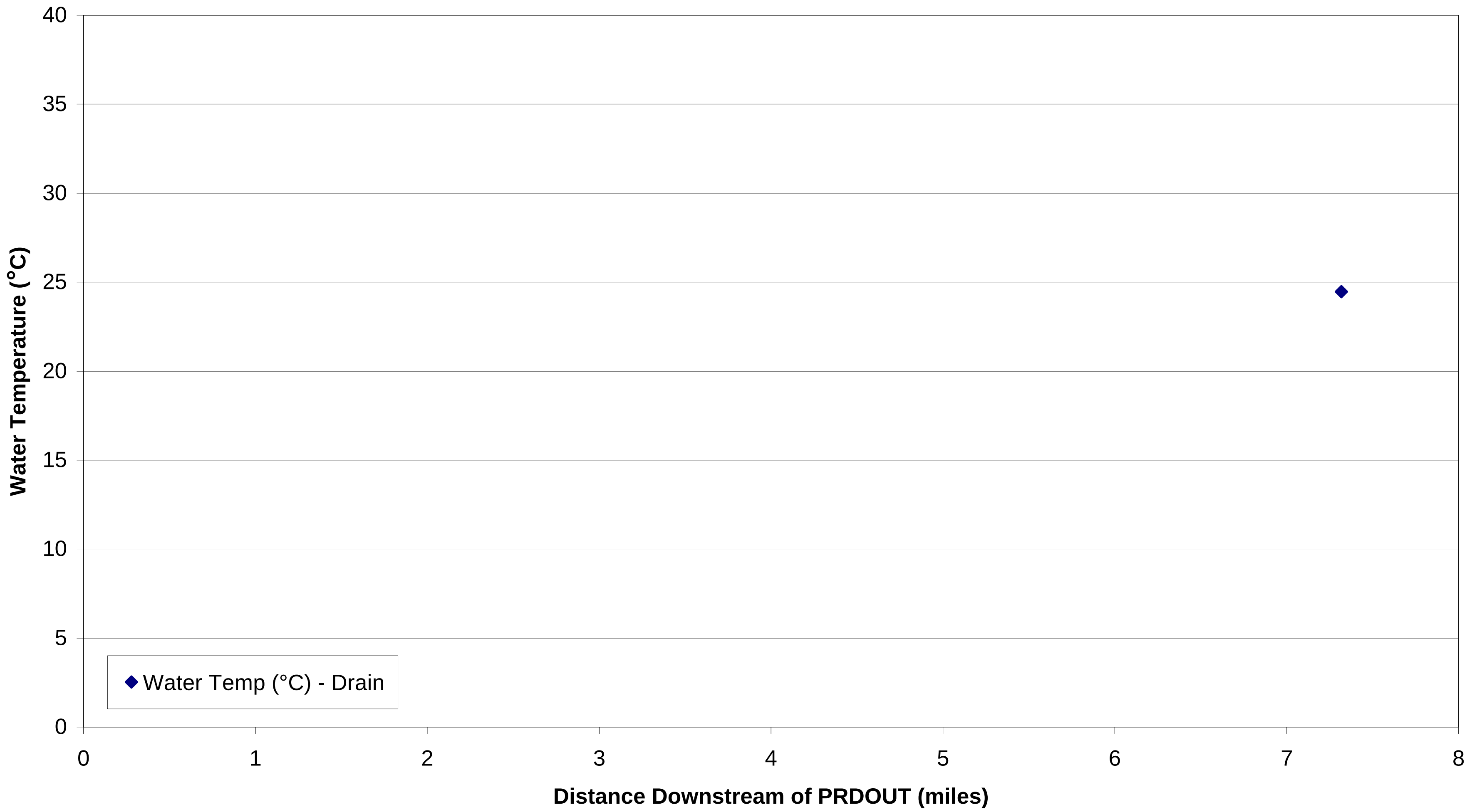


Figure I-17.2
pH for Peralta Riverside Drain Seepage Run, Belen Division, S4-21, August 2-3, 2001

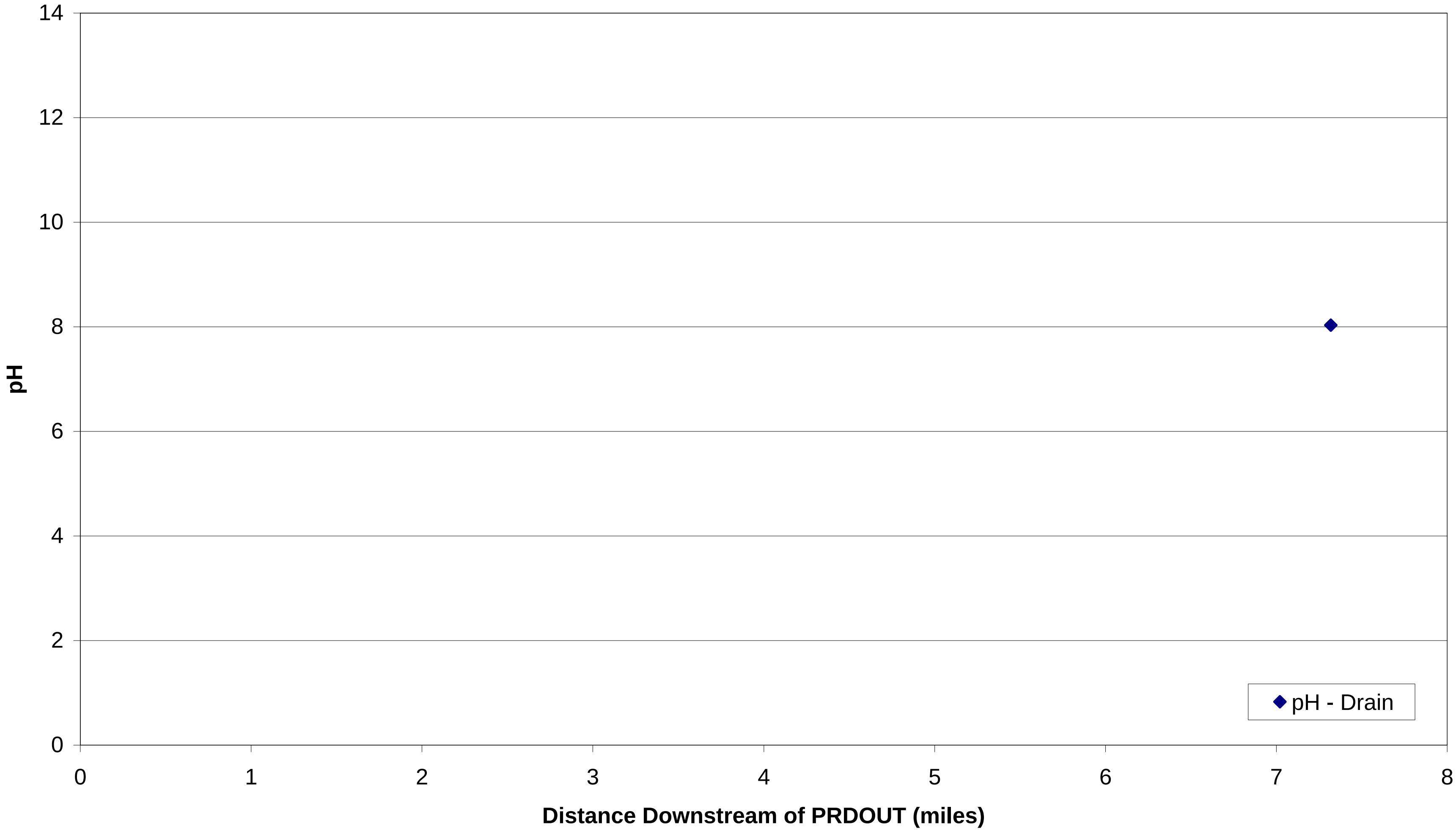


Figure I-17.3
Conductivity for Peralta Riverside Drain Seepage Run, Belen Division, S4-21, August 2-3, 2001

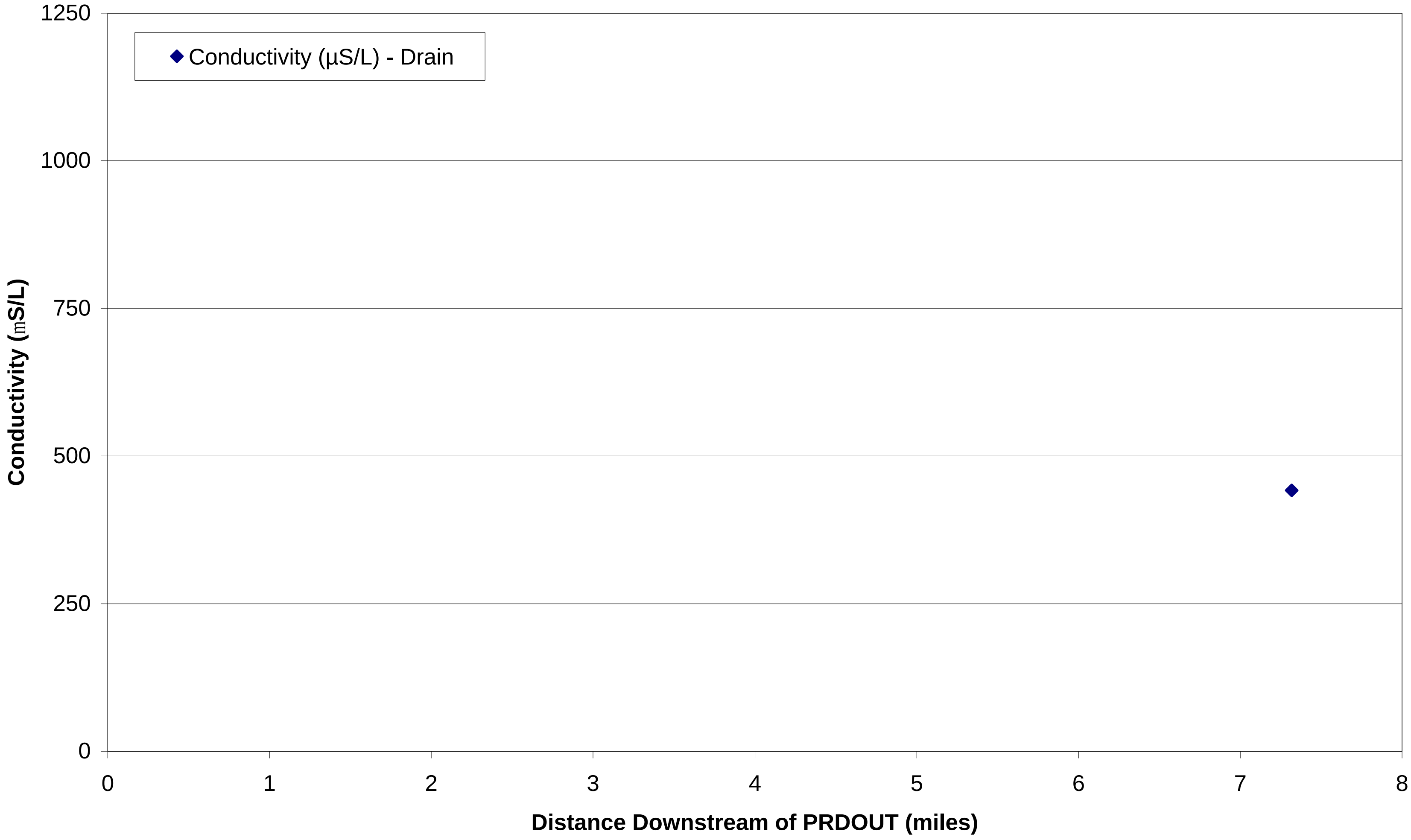


Figure I-18.1

Water Temperature for Rio Grande Seepage Run, Belen Division, S4-22, August 2-3, 2001

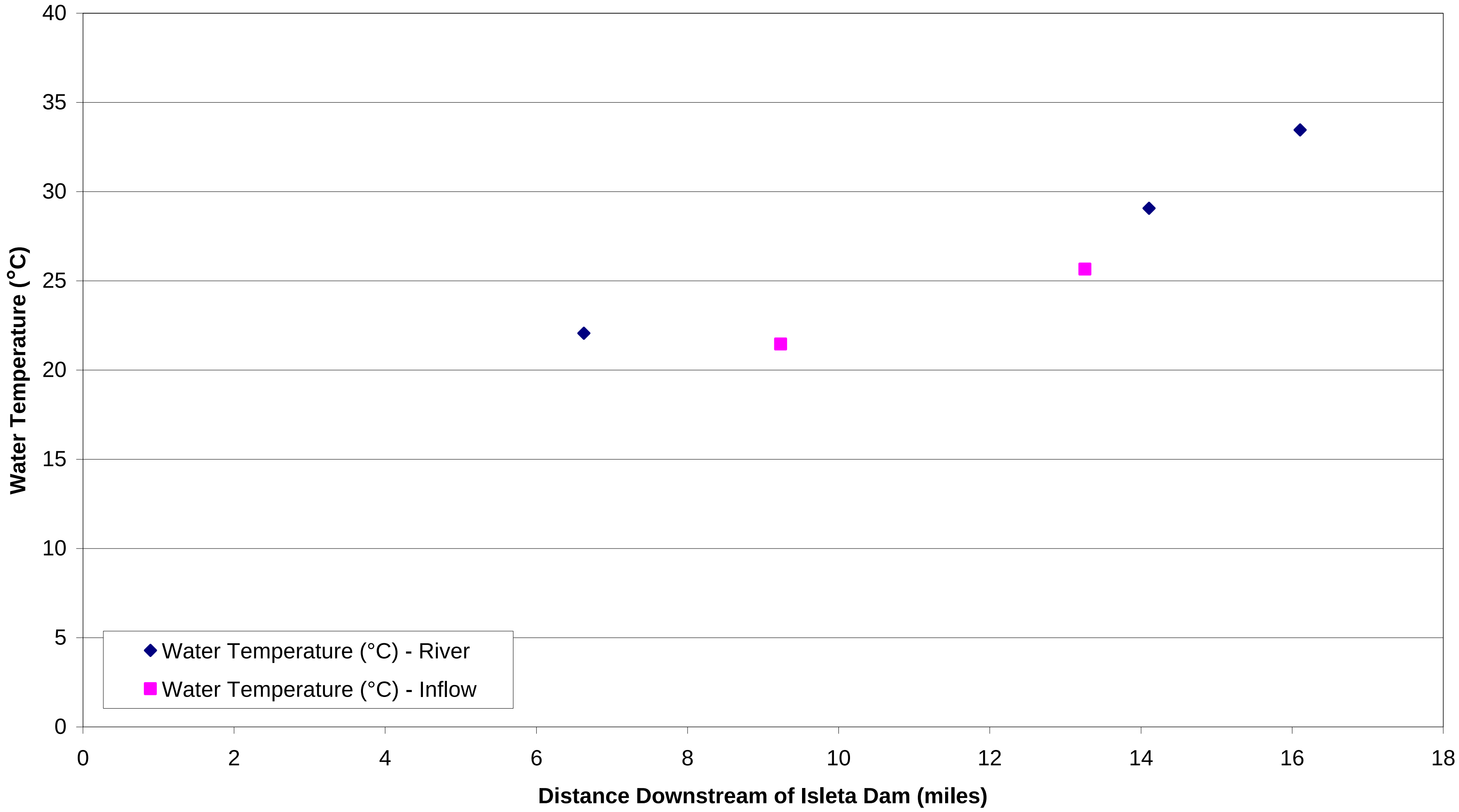


Figure I-18.2
pH for Rio Grande Seepage Run, Belen Division, S4-22, August 2-3, 2001

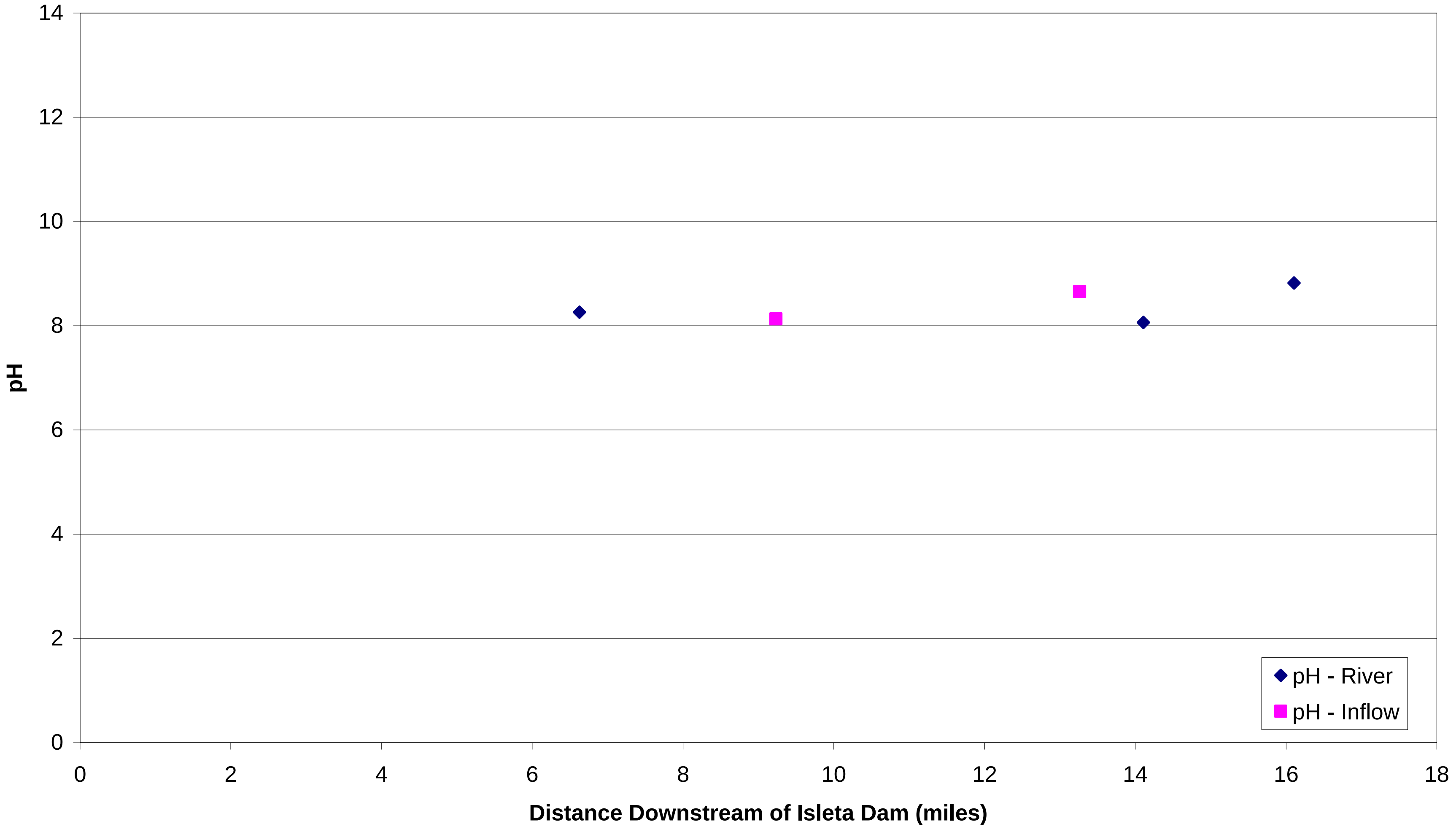


Figure I-19.1a
Water Temperature for Belen Riverside Drain Seepage Run, Belen Division, S4-23, August 2-3, 2001

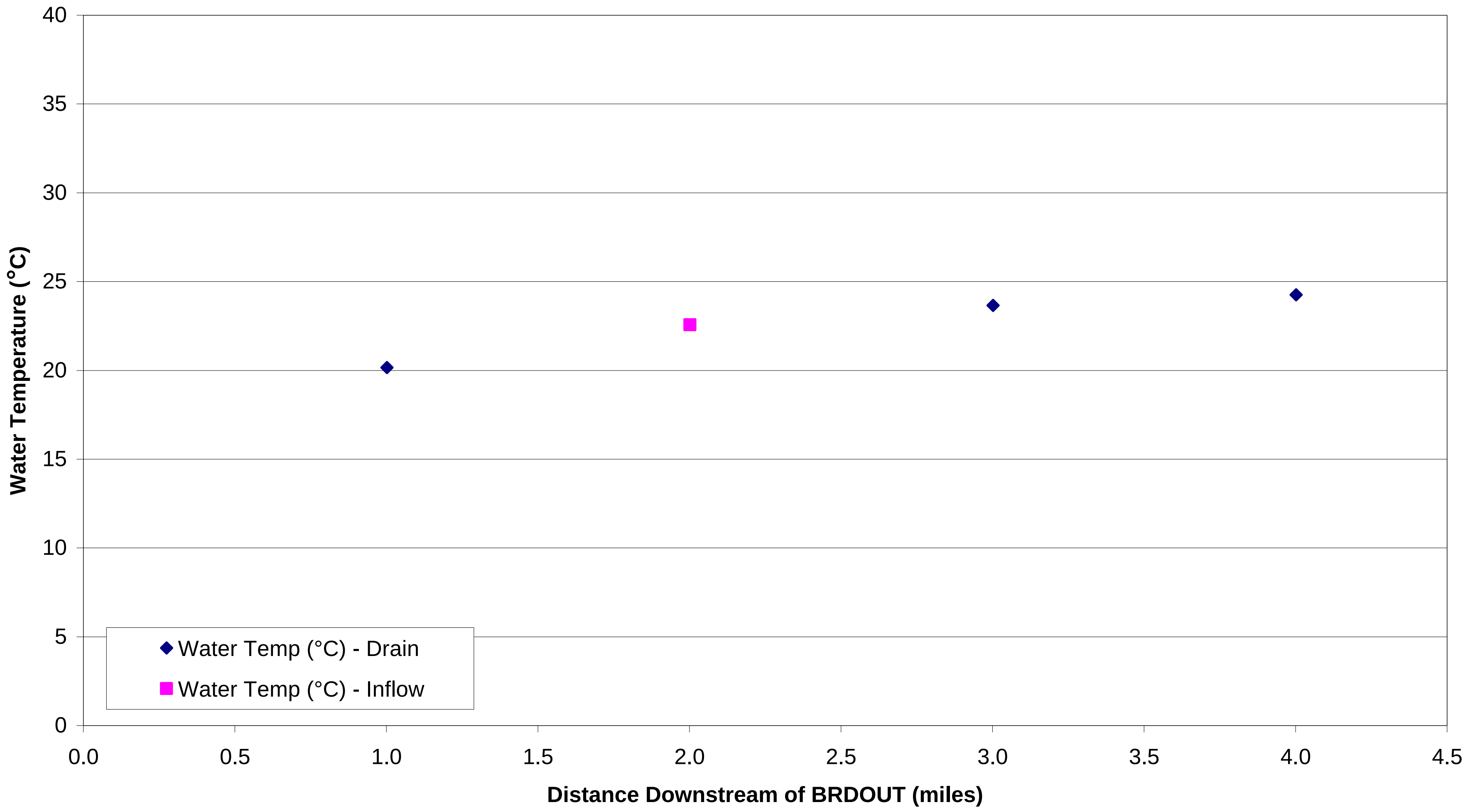


Figure I-19.2a
pH for Belen Riverside Drain Seepage Run, Belen Division, S4-23, August 2-3, 2001

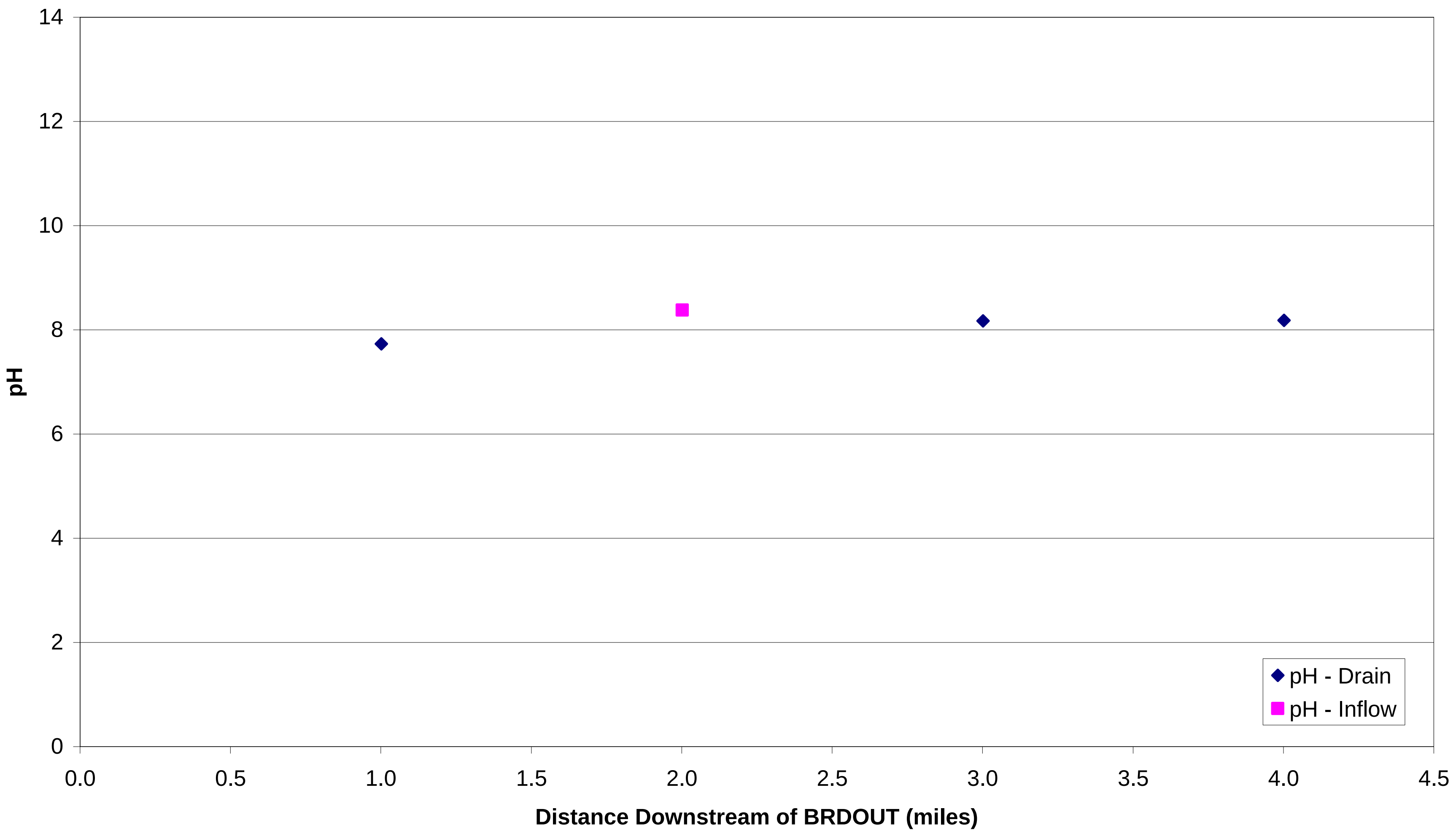


Figure I-19.3a

Conductivity for Belen Riverside Drain Seepage Run, Belen Division, S4-23, August 2-3, 2001

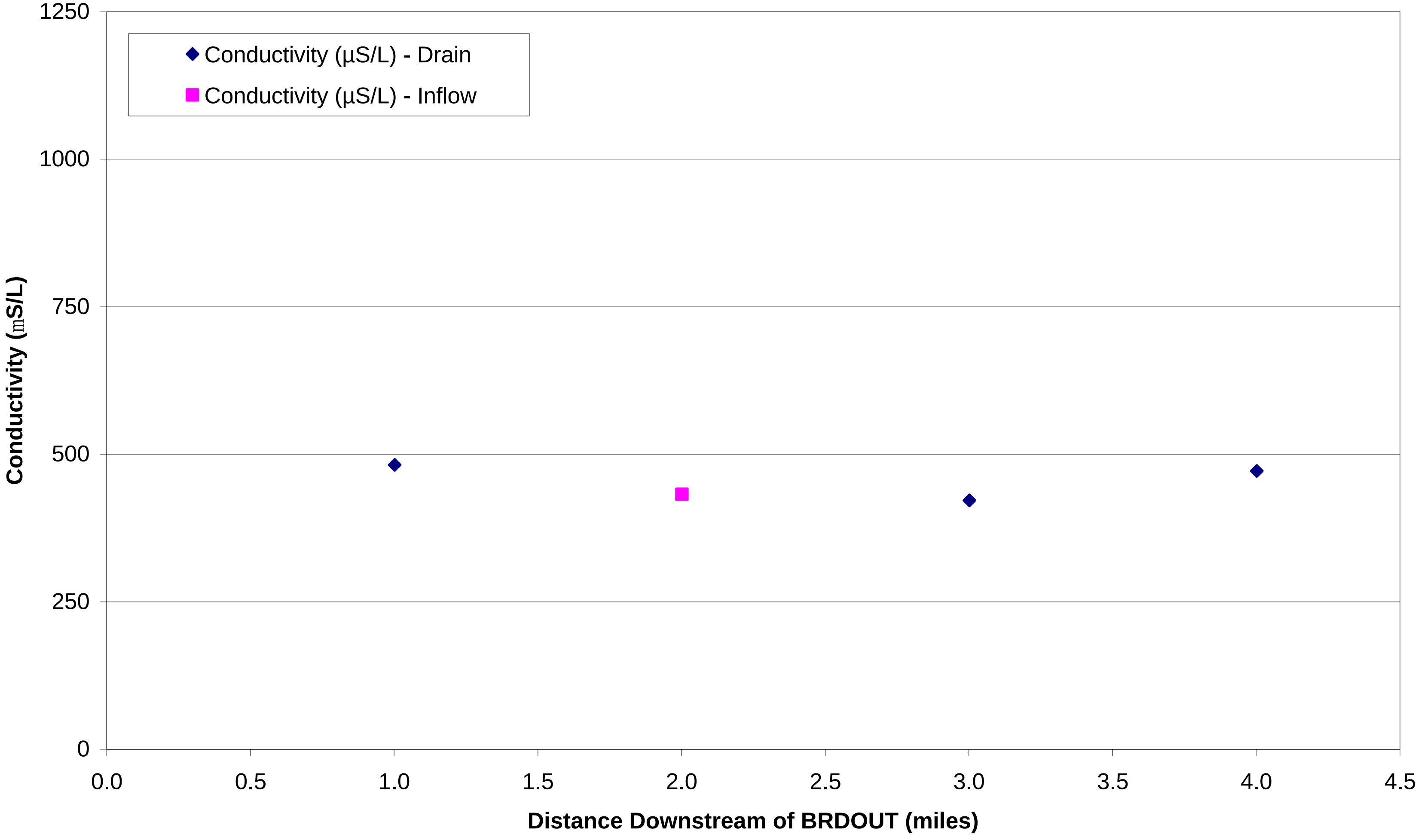


Figure I-19.1b
Water Temperature for Belen Riverside Drain Seepage Run, Belen Division, S4-23, August 2-3, 2001

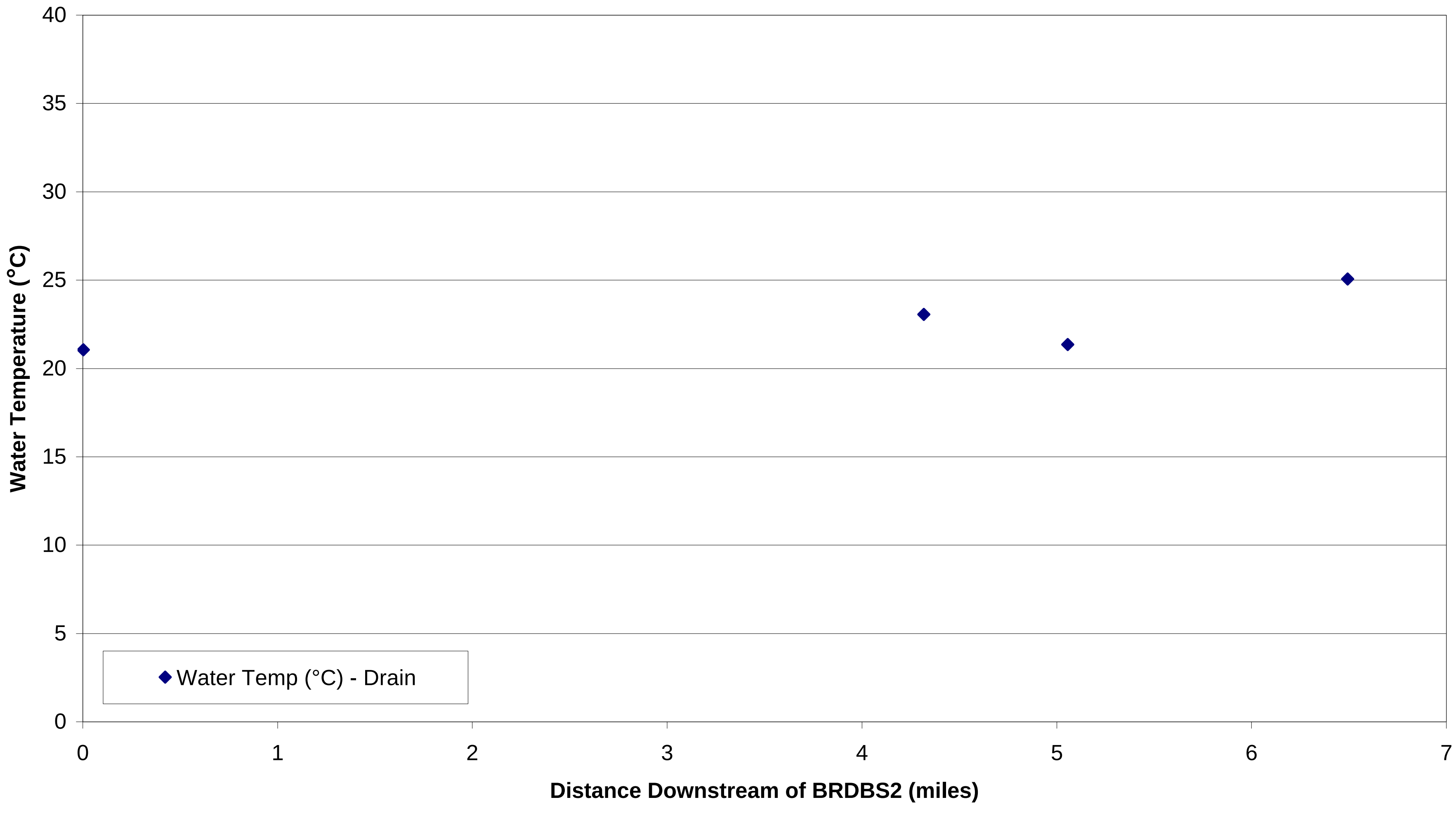


Figure I-19.2b
pH for Belen Riverside Drain Seepage Run, Belen Division, S4-23, August 2-3, 2001

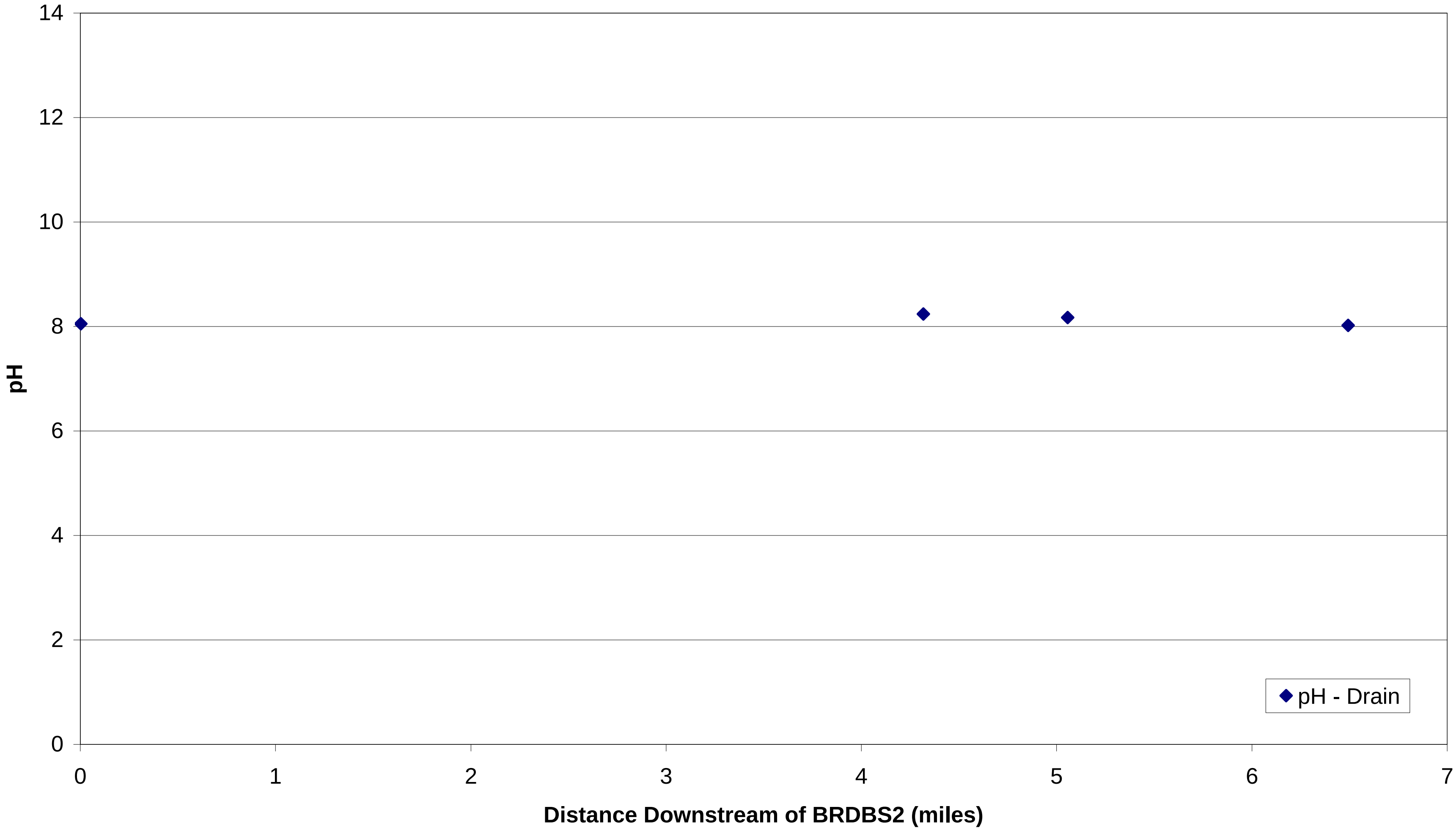


Figure I-19.3b

Conductivity for Belen Riverside Drain Seepage Run, Belen Division, S4-23, August 2-3, 2001

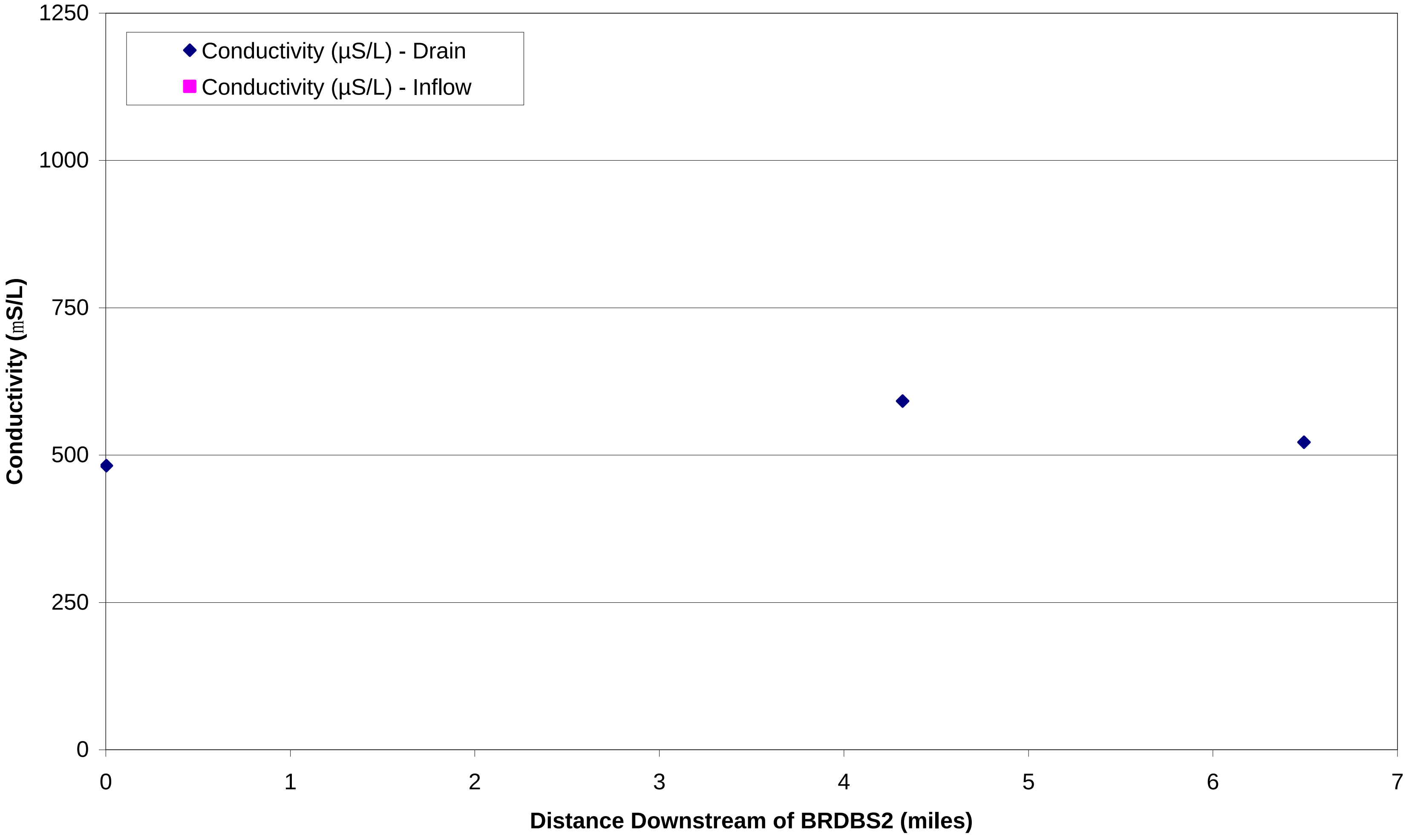


Figure I-20.1

Water Temperature for Rio Grande Seepage Run, Socorro Division, S4-24, August 8-9, 2001

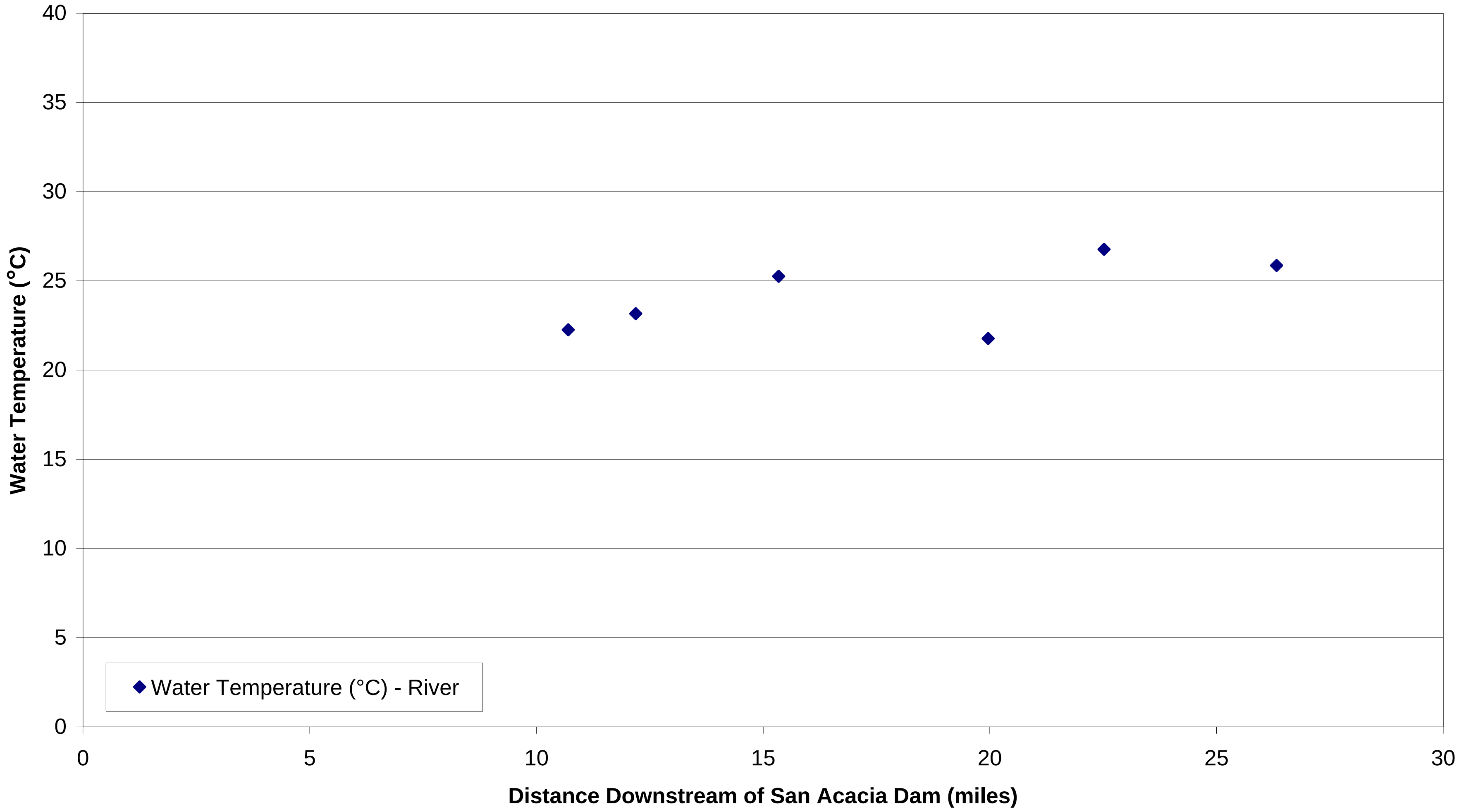


Figure I-20.2

pH for Rio Grande Seepage Run, Socorro Division, S4-24, August 8-9, 2001

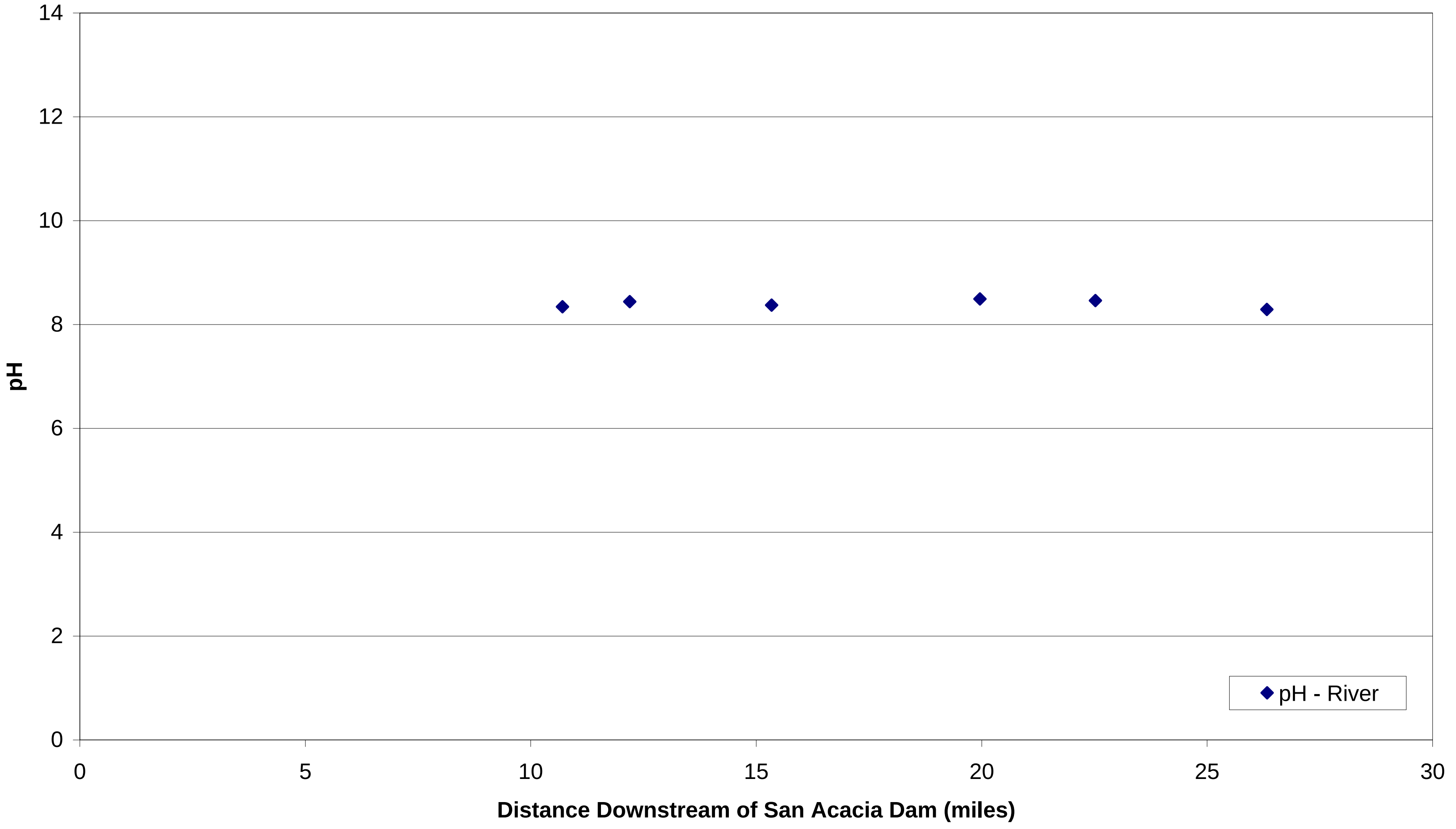


Figure I-20.3
Conductivity for Rio Grande Seepage Run, Socorro Division, S4-24, August 8-9, 2001

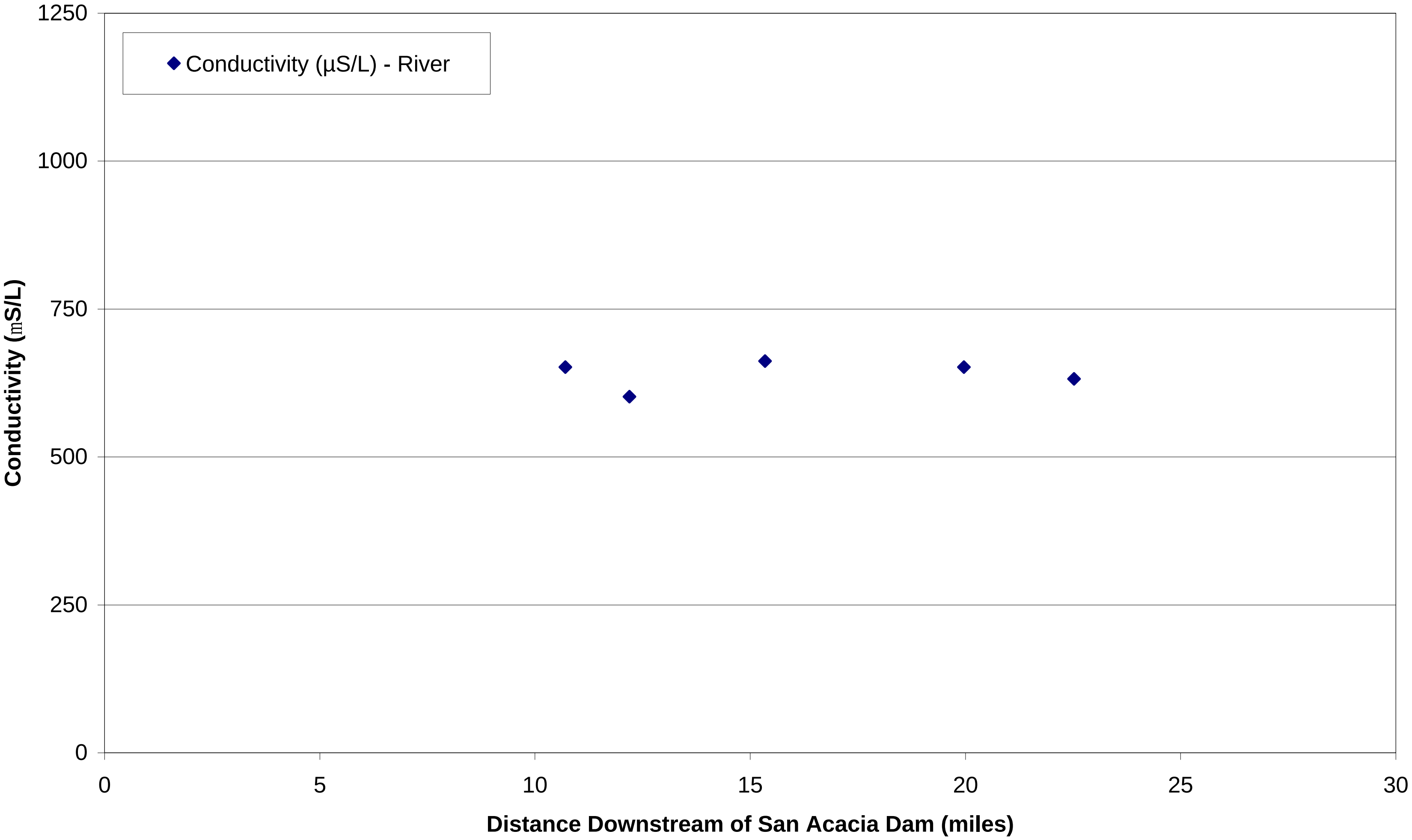


Figure I-21.1
Water Temperature for North LFCC Seepage Run, Socorro Division, S4-25, August 8-9, 2001

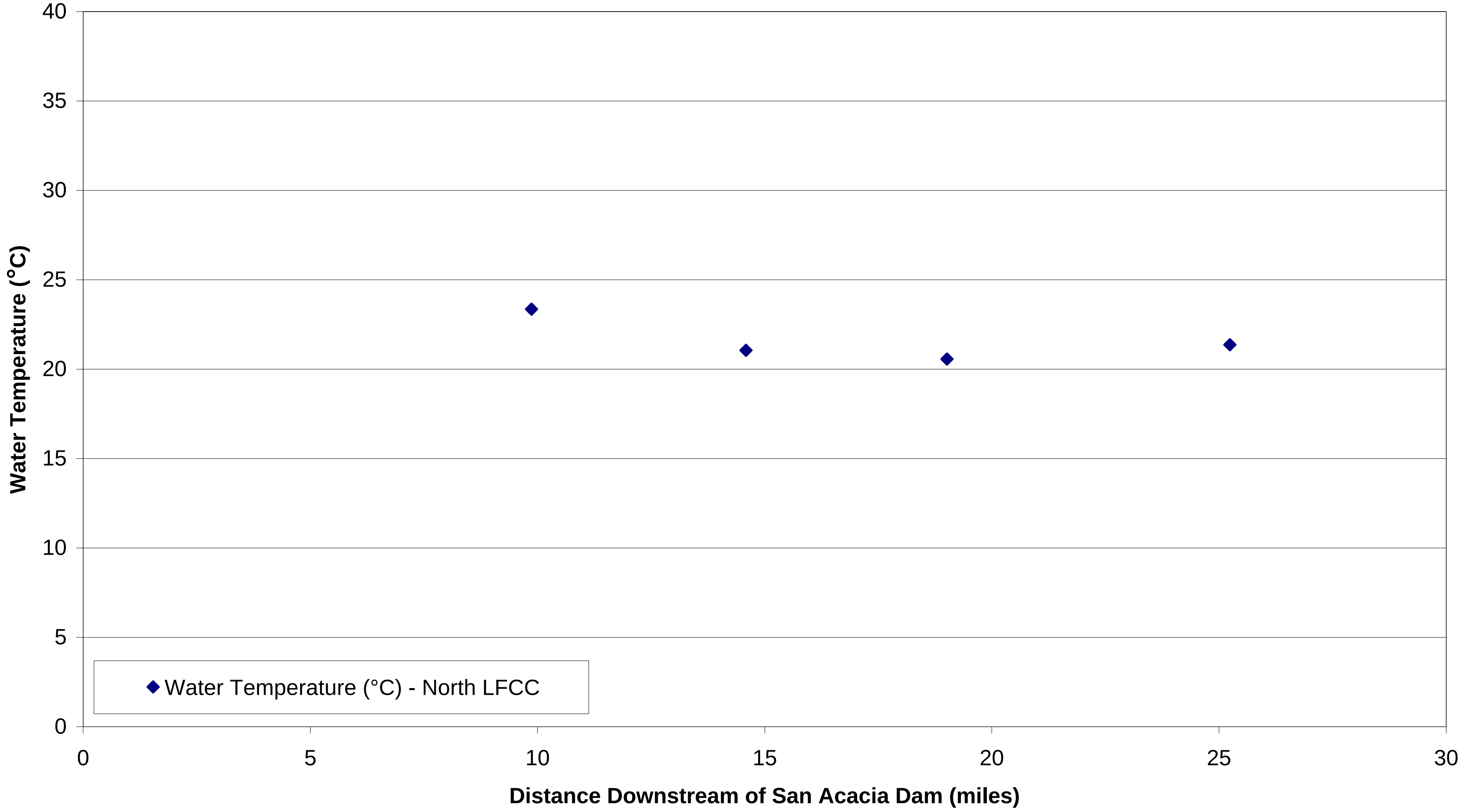


Figure I-21.2

pH for North LFCC Seepage Run, Socorro Division, S4-25, August 8-9, 2001

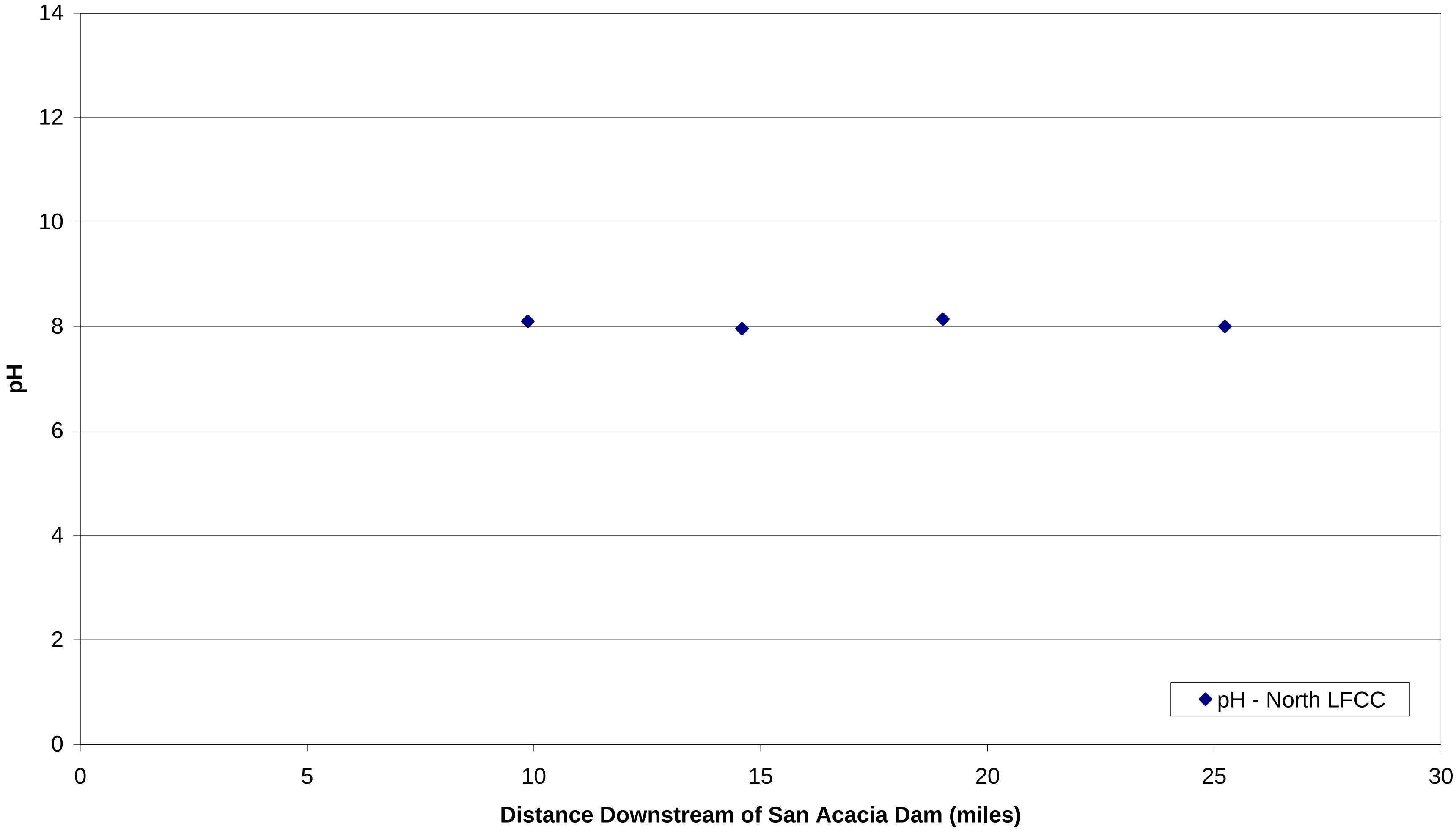


Figure I-21.3

Conductivity for North LFCC Seepage Run, Socorro Division, S4-25, August 8-9, 2001

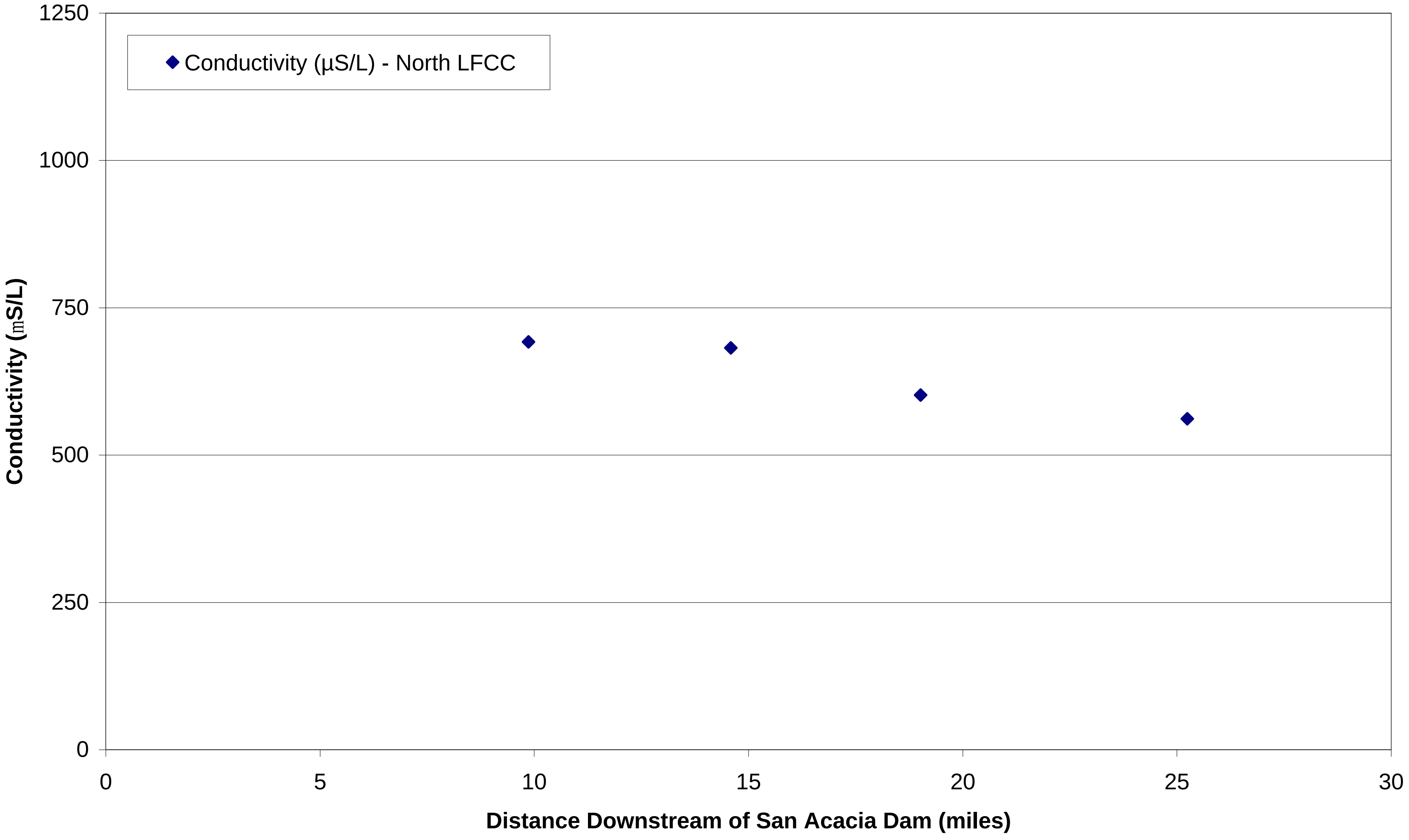


Table I-1
Water Quality
Rio Grande Seepage Run,
Socorro Division, S4-01, June 9-12, 2001

Location	Location Code	Distance Below San Acacia Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Rio Grande at San Acacia	RGSACA	0.19	River	6/9/01 11:37 AM	23.4	8.68	320
9 Mile Outfall	9MO	10.60	Inflow	6/9/01 12:22 PM	23.5	7.90	300
Rio Grande at Escondida Bridge	RGESC	10.69	River	6/9/01 2:15 PM	26.4	8.80	280
Rio Grande at 1200 Check Structure	RG1200	15.33	River	6/9/01 4:40 PM	31.1	8.78	330
Rio Grande at 1200 Check Structure	RG1200	15.33	River	6/10/01 9:07 AM	23.3	8.33	295
Rio Grande at Brown Arroyo	RGBA	19.95	River	6/10/01 11:57 AM	25.0	8.30	310
Rio Grande at Neil Cupp	RGNC	22.51	River	6/10/01 2:45 PM	27.4	8.55	280
Rio Grande downstream of Hwy 380	RG380	26.31	River	6/10/01 5:00 PM	30.5	8.73	290
Rio Grande downstream of Hwy 380	RG380	26.31	River	6/11/01 10:22 AM	23.1	8.26	390
Rio Grande at North Boundary of Bosque	RGNBB	29.68	River	6/11/01 12:22 PM	25.0	8.26	345
Rio Grande at South Boundary of Bosque	RGSBB	41.89	River	6/11/01 3:15 PM	27.8	8.42	320
Rio Grande at San Marcial	RGSM	48.26	River	6/11/01 4:55 PM	28.3	8.35	330
Rio Grande at San Marcial	RGSM	48.26	River	6/12/01 10:30 AM	24.6	8.51	330
Rio Grande North of corral	RGCOR	57.05	River	6/12/01 12:50 PM	26.3	8.54	330

Table I-2.1a
Water Quality
North LFCC Seepage Run (LFCC), Socorro Division, S4-02, June 10-12, 2001

Location	Location Code	Distance Below San Acacia Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
LFCC downstream of wasteway to Rio Grande	LFCC #13	9.85	LFCC	6/10/01 10:37 AM	23.2	7.83	410
LFCC #11, downstream of 1200 check structure	LFCC #11	14.58	LFCC	6/11/01 10:42 AM	20.4	8.31	430
Brown Arroyo Wasteway	BRNWW	18.72	Inflow	6/11/01 1:05 PM	23.6	8.72	440
LFCC below Brown Arroyo	LFCC #10	19.00	LFCC	6/11/01 3:42 PM	21.1	9.15	440
LFCC downstream of Hwy 380	LFCC #8	25.22	LFCC	6/12/01 1:32 PM	18.5	8.35	710

Table I-2.2a
Water Quality
North LFCC Seepage Run (Riverside Drain), Socorro Division, S4-02, June 10-12, 2001

Location	Location Code	Distance Below San Acacia Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Riverside Drain upstream of 1200 Check Structure	RIVUS1200	na	Drain	6/10/01 12:57 PM	23.6	7.76	530
Riverside Drain downstream of 1200 Check Structure	RIVDS1200	na	Drain	6/10/01 3:32 PM	24.6	7.75	650
Riverside Drain upstream of Neil Cupp Diversion	RIVUSNC	na	Drain	6/12/01 10:07 AM	18.4	7.84	1470
Diversion at Neil Cupp	RIVDSNC	na	Drain	6/12/01 10:45 AM	17.6	7.80	1200

"na" indicates not applicable

Table I-2b
Water Quality
South LFCC Seepage Run,
Socorro Division, S4-02, June 12-13, 2001

Location	**Location Code**	**Distance Below San Acacia Dam (miles)**	**Station Type**	**Date/Time**	**Water Temp (°C)**	**pH**	**Conductivity (µS/L)**
LFCC downstream of Hwy 380	LFCC #8	25.22	LFCC	6/12/01 1:32 PM	18.5	8.35	710
LFCC at North Boundary of Bosque del Apache	LFCC #7	28.54	LFCC	6/12/01 3:20 PM	19.6	8.31	810
LFCC at South Boundary of Bosque del Apache	LFCC #5	39.78	LFCC	6/12/01 3:45 PM	21.4	8.03	830
LFCC at San Marcial	LFCC #3	45.82	LFCC	6/12/01 4:09 PM	23.1	7.90	800
LFCC at Ft. Craig	LFCC #2	50.32	LFCC	6/13/01 3:35 PM	22.0	8.17	960
LFCC at corral	LFCC #1	53.80	LFCC	6/13/01 1:10 PM	21.5	8.16	890

Table I-3
Water Quality
Rio Grande Seepage Run,
Belen Division, S4-03, June 23-24, 2001

Location	Location Code	Distance Below Isleta Diversion Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Rio Grande downstream of Hwy 309	RG309	19.26	River	6/23/01 11:00 AM	24.1	7.90	nm
Belen Drain	BELDR	20.86	Inflow	6/23/01 1:17 PM	23.1	7.05	nm
New Belen Wasteway	NBLWW	21.46	Inflow	6/23/01 11:25 AM	21.4	7.77	830
San Juan Feeder Canal	SJFC	23.78	Inflow	6/23/01 2:25 PM	23.7	8.41	520
Rio Grande at Blue Cup	RGBC	26.10	River	6/23/01 4:12 PM	31.0	7.95	410
Rio Grande at Blue Cup	RGBC	26.10	River	6/24/01 10:37 AM	24.1	8.27	390
Drain Unit 7 Extension	DU7X	41.50	Inflow	6/24/01 1:22 PM	27.0	7.96	860
Rio Grande below Drain Unit 7	RGBDU7	41.55	River	6/24/01 1:05 PM	30.5	8.28	320

Table I-4
Water Quality
Rio Grande Seepage Run,
Socorro Division, S4-05, June 27, 2001

Location	Location Code	Distance Below San Acacia Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (μS/L)
Rio Grande at San Acacia	RGSACA	0.19	River	6/27/01 10:57 AM	22.6	8.52	440
Rio Grande at Escondida Bridge	RGESC	10.69	River	6/27/01 11:20 AM	23.3	8.27	420
Rio Grande at 1200 Check Structure	RG1200	15.33	River	6/27/01 10:52 AM	nm	nm	nm
Rio Grande at Brown Arroyo	RGBRN	19.95	River	6/27/01 1:58 PM	27.8	8.75	440
Rio Grande at Neil Cupp	RGNC	22.36	River	6/27/01 1:07 PM	nm	nm	nm
Rio Grande downstream of Hwy 380	RG380	26.31	River	6/27/01 2:02 PM	27.6	8.65	490
Rio Grande at San Marcial	RGSM	48.26	River	6/27/01 4:55 PM	36	9.06	490
Rio Grande North of Corral	RGCOR	57.05	River	6/27/01 5:07 PM	nm	nm	nm

"nm" indicates no measurement

Table I-5
Water Quality
Rio Grande Seepage Run,
Belen Division, S4-06, June 28-29, 2001

Location	Location Code	Distance Below Isleta Diversion Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (μS/L)
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	9.78	River	6/28/01 1:40 PM	28	8.06	340
Harlan Drain	HARD	12.39	Inflow	6/28/01 3:52 PM	26.2	7.87	460
Peralta Wasteway	PERWW	16.41	Inflow	6/28/01 1:22 PM	25.2	8.1	nm
Lower Peralta Riverside Drain #1	LP1DR	19.13	Inflow	6/28/01 3:30 PM	25.2	8.28	nm
Rio Grande downstream of Hwy 309	RG309	19.26	River	6/28/01 6:08 PM	32.4	8.2	400
Rio Grande downstream of Hwy 309	RG309	19.26	River	6/29/01 10:55 AM	25.1	8.06	330
Belen Drain	BELDR	20.86	Inflow	6/29/01 10:55 AM	nm	nm	nm
New Belen Wasteway	NBLWW	21.46	Inflow	6/29/01 1:59 PM	24.8	8.03	410
San Juan Feeder Canal	SJFC	23.78	Inflow	6/29/01 1:47 PM	24.1	7.62	nm
Feeder Ditch #3 Wasteway	FD3WW	25.76	Inflow	6/29/01 2:27 PM	nm	nm	nm
Sabinal Riverside Drain	SABDR	30.45	Inflow	6/29/01 4:24 PM	30.7	7.93	nm
Drain Unit 7 Extension	DU7X	41.50	Inflow	6/29/01 5:00 PM	29.4	8.22	470
Rio Grande below Drain Unit 7	RGBDU7	41.55	River	6/29/01 5:05 PM	31.3	8.39	370

"nm" indicates no measurement

Table I-6a
Water Quality
Rio Grande Seepage Run,
Belen Division, Section 1, S4-07, July 6-7, 2001

Location	**Location Code**	**Distance Below Isleta Dam (miles)**	**Station Type**	**Date/Time**	**Water Temp (°C)**	**pH**	**Conductivity (µS/L)**
Rio Grande Below Isleta Pueblo	RGISL	3.16	River	7/6/01 12:27 PM	28.3	8.17	365
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	9.78	River	7/6/01 12:52 PM	26.8	8.61	380
Harlan Drain	HARD	12.39	Inflow	7/6/01 3:40 PM	31.2	9.01	440
Peralta Wasteway	PERWW	16.41	Inflow	7/6/01 4:32 PM	28.1	8.20	340
Rio Grande at Tome	RGTM	17.26	River	7/6/01 5:47 PM	33	8.74	360
Lower Peralta Riverside Drain #1	LP1DR	19.13	Inflow	7/6/01 7:02 PM	27.4	8.09	460
Rio Grande downstream of Hwy 309	RG309	19.26	River	7/6/01 7:37 PM	30.6	8.83	380
Rio Grande downstream of Hwy 309	RG309	19.26	River	7/7/01 10:26 AM	26.7	8.02	310
Belen Drain	BELDR	20.86	Inflow	7/7/01 10:35 AM	23.6	8.23	590
New Belen Wasteway	NBLWW	21.46	Inflow	7/7/01 1:12 PM	28.1	8.66	390
San Juan Feeder Canal	SJFC	23.78	Inflow	7/7/01 1:17 PM	25.5	7.88	300
Feeder Ditch #3 Wasteway	FD3WW	25.76	Inflow	7/7/01 3:20 PM	28.8	8.71	nm
Rio Grande at Blue Cup	RGBC	26.10	River	7/7/01 3:30 PM	32.7	8.3	340

"nm" indicates no measurement

Table I-6b
Water Quality
Rio Grande Seepage Run,
Belen Division, Section 2, S4-07, July 8, 2001

Location	Location Code	Distance Below Isleta Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Rio Grande at Blue Cup	RGBC	26.10	River	7/8/01 10:46 AM	nm	nm	nm
Rio Grande upstream of Lower Sabinal drain	RGSDR	30.00	River	7/8/01 11:50 AM	27.5	8.64	400
Sabinal Riverside Drain	SABDR	30.45	Inflow	7/8/01 3:30 PM	31.8	7.8	nm
Rio Grande Upstream of Hwy 60	RGUS60	35.15	River	7/8/01 2:37 PM	nm	nm	nm
Drain Unit 7 Extension	DU7X	41.50	Inflow	7/8/01 5:17 PM	29.2	8.18	630
Rio Grande below Drain Unit 7	RGBDU7	41.55	River	7/8/01 4:39 PM	32.2	8.78	590

"nm" indicates no measurement

Table I-6c
Water Quality
Rio Grande Seepage Run,
Belen Division, Section 3, S4-07, July 9, 2001

Location	Location Code	Distance Below Isleta Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Rio Grande below Drain Unit 7	RGBDU7	41.55	River	7/9/01 11:20 AM	27.0	8.39	450
Salas Arroyo	SALAR	41.78	Inflow	7/9/01 12:35 PM	24.6	8.06	490
Rio Grande above San Acacia #3	RGASA#3	46.90	River	7/9/01 11:10 AM	26.5	8.43	535
Rio Grande above San Acacia #2	RGASA#2	49.93	River	7/9/01 2:10 PM	30.4	nm	530
Rio Grande at San Acacia	RGSACA	#N/A	River	7/9/01 5:30 PM	27.8	8.66	590

"nm" indicates no measurement

Table I-7
Water Quality
La Joya Acequia Seepage Run,
Belen Division, S4-08, July 10, 2001

Location	Location Code	Distance Below LAJ1 (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
La Joya #1	LAJ1	0.00	Acequia	7/10/01 10:55 AM	24.2	8.43	470
La Joya #2	LAJ2	0.91	Acequia	7/10/01 11:16 AM	24.2	8.52	nm
Outfall between La Joya #2 and La Joya #3	OUTB23	1.03	Outflow	7/10/01 12:17 PM	25	8.55	460
La Joya #3	LAJ3	2.15	Acequia	7/10/01 12:36 PM	24.7	8.25	420
La Joya #4	LAJ4	3.94	Acequia	7/10/01 2:02 PM	25.9	8.56	530
La Joya #5	LAJ5	5.26	Acequia	7/10/01 2:50 PM	26	8.24	450
La Joya #6	LAJ6	6.58	Acequia	7/10/01 3:55 PM	26.6	8.51	470
La Joya #7	LAJ7	7.22	Acequia	7/10/01 5:00 PM	27	8.36	490

"nm" indicates no measurement

Table I-8a
Water Quality
Socorro Main Canal Seepage Run, Section 2, S4-09,
July 18, 2001

Location	Location Code	Distance Below Socorro Main #1 (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Socorro Main #7, downstream of Chambon Lateral	SM7	7.5	Canal	7/18/01 1:36 PM	25	8.3	nm
Socorro Main #8	SM8	8.2	Canal	7/18/01 2:17 PM	25.7	7.92	440
Acequia Madre	AQMAD	8.3	Inflow	7/18/01 5:35 PM	27.3	8.13	490
Socorro Main #9, downstream of check structure	SM9	9.4	Canal	7/18/01 5:34 PM	24.6	8.30	nm

Table I-8b
Water Quality
Socorro Main Canal Seepage Run, Section 1, S4-10
July 19, 2001

Location	Location Code	Distance Below Socorro Main #1 (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Socorro Main #1, at stop sign	SM1	0.0	Canal	7/19/01 12:25 PM	25.6	8.3	550
Alamillo Ditch	ALMDT	0.2	Outflow	7/19/01 1:05 PM	26.1	8.36	560
Socorro Main #2	SM2	1.3	Canal	7/19/01 4:41 PM	27.7	8.27	550
Socorro Main # 3, upstream of Siphon	SM3	2.0	Canal	7/19/01 4:02 PM	28.1	nm	nm

Table I-8c
Measured Discharge
Socorro Main Canal Seepage Run, Section 3, S4-11
July 19, 2001

Location	Location Code	Distance Below Socorro Main #11 (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (μS/L)
Socorro Main #11	SM11	0.0	Canal	7/20/01 12:52 PM	24.2	8.29	620
Old San Antonio Lateral	OSALT	0.8	Outflow	7/20/01 2:18 PM	24.6	8.36	600
Socorro Main Canal South, North Boundary	SMSCN	2.3	Canal	7/20/01 6:17 PM	26.1	8.33	nm

Table I-9
Water Quality
Rio Grande Seepage Run,
Belen Division, S4-13, July 22, 2001

Location	Location Code	Distance Below Isleta Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Rio Grande Upstream of Hwy 60	RGUS60	35.15	River	7/22/01 11:40 AM	29.8	8.81	430
Drain Unit 7 Extension	DU7X	41.50	Inflow	7/22/01 1:45 PM	29.4	8.42	nm
Rio Grande below Drain Unit 7	RGBDU7	41.55	River	7/22/01 3:28 PM	33.4	8.7	500

"nm" indicates no measurement

Table I-10
Water Quality
West Riverside Drains Seepage Run, Belen Division, S4-14, July 22, 2001

NOTE: This seepage run was not completed.

Location	Location Code	Distance below SFRD60 or DU7X	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
San Francisco Riverside Drain upstream of Hwy 60	SFRD60	0.0	Drain	7/22/01 11:40 AM	25.2	8.12	530
Bernardo Drain Wastewater Inflow	SFBDWW	4.6	Inflow	7/22/01 3:35 PM	26.4	8.14	550
Drain Unit 7 Extension	DU7X	0.0	Outflow	7/22/01 1:45 PM	29.4	8.42	nm
Drain Unit 7 adjacent to RGBDU7	DU7RG7	0.2	Drain	7/22/01 6:32 PM	28.5	8.08	530

Notes:
"nm" indicates no measurement
Measurements span two station lines: San Francisco Riverside Drain and Drain Unit 7

Table I-11
Water Quality
Lower San Juan Drain Seepage Run,
Belen Division, S4-15, July 23, 2001

Location	Location Code	Distance Below SJDR60 (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Lower San Juan Riverside Drain upstream of Hwy 60	SJDR60	0.00	Drain	7/23/01 1:15 PM	21.6	8.12	540
Las Nutrias Drain	LNDR	1.63	Inflow	7/23/01 3:11 PM	29.5	8.32	540
San Juan Main	SJMN	2.47	Inflow	7/23/01 4:59 PM	28.8	8.32	530
Lower San Juan Riverside Drain below Drain Unit 7	SJBDU7	6.60	Drain	7/23/01 6:10 PM	28.3	8.43	590

"nm" indicates no measurement

Table I-12
Water Quality
Rio Grande Seepage Run,
Belen Division, S4-16, July 23-24, 2001

Location	Location Code	Distance Below Isleta Diversion Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Rio Grande Upstream of Hwy 60	RGUS60	35.15	River	7/23/01 1:02 PM	nm	nm	nm
Drain Unit 7 Extension	DU7X	41.50	Inflow	7/23/01 3:10 PM	nm	nm	nm
Rio Grande below Drain Unit 7	RGBDU7	41.55	River	7/23/01 4:15 PM	nm	nm	nm
Rio Grande below Drain Unit 7	RGBDU7	41.55	River	7/24/01 10:42 AM	nm	nm	nm
Salas Arroyo	SALAR	41.78	Inflow	7/24/01 10:47 AM	22.7	8.23	590
San Juan Riverside Drain Wasteway	SJWW	46.49	Inflow	7/24/01 12:50 PM	28	8.42	670
Rio Grande above San Acacia #3	RGASA#3	46.90	River	7/24/01 2:03 PM	nm	nm	nm
Rio Grande above San Acacia #2	RGASA#2	49.93	River	7/24/01 3:55 PM	nm	nm	nm
Rio Grande at San Acacia	RGSACA	#N/A	River	7/24/01 4:52 PM	27.7	8.53	630

"nm" indicates no measurement

Table I-13
Water Quality
West Riverside Drains Seepage Run, Belen Division, S4-17, July 23-24, 2001

Location	Location Code	Distance Below SFRD60 (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
San Francisco Riverside Drain upstream of Hwy 60	SFRD60	0.0	Drain	7/23/01 12:27 PM	25.7	8.21	530
Bernardo Drain Wastewater Inflow	SFBDWW	4.6	Inflow	7/23/01 2:04 PM	27.3	8.25	510
Drain Unit 7 Extension	DU7X	0.0	Inflow	7/23/01 3:10 PM	nm	nm	nm
Drain Unit 7 adjacent to RGBDU7	DU7RG7	0.2	Drain	7/23/01 4:10 PM	28.1	8.13	580
Drain Unit 7 adjacent to RGBDU7	DU7RG7	0.2	Drain	7/24/01 11:17 AM	25.4	7.99	470
Drain Unit 7 #3	DU7#3	5.3	Drain	7/24/01 2:44 PM	26.6	8.08	480
Drain Unit 7 #2	DU7#2	8.5	Drain	7/24/01 3:27 PM	27	8.23	560
Socorro Main at San Acacia	SMSA	*see note	Drain	7/24/01 6:25 PM	27.7	8.22	520

Notes:
"nm" indicates no measurement

Measurements above DU7X and below DU7#2 not located on the Drain Unit 7 station line.
*The station for SMSA was not determined.

Table I-14
Water Quality
Peralta Riverside Drain Seepage Run, Belen Division, S4-18, July 25, 2001

Location	Location Code	Distance Below PRDOUT (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Peralta Riverside Drain adjacent to RGUSOUT	PRDOUT	0.00	Drain	7/25/01 12:25 PM	19.1	8.03	500
Otero Drain	OTDR	0.08	Inflow	7/25/01 3:19 PM	26.5	7.8	1240
Tome Drain	TOMDR	7.16	Inflow	7/25/01 6:25 PM	28.6	8.30	560
Peralta Riverside Drain at Tome	PRDTM	7.31	Drain	7/25/01 5:52 PM	25.9	8.20	nm

"nm" indicates no measurement

Table I-15
Water Quality
Rio Grande Seepage Run,
Belen Division, S4-19, July 25-26, 2001

Location	Location Code	Distance Below RGUSOUT (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	0.00	River	7/25/01 11:22 AM	nm	nm	nm
Harlan Drain	HARD	2.61	Inflow	7/25/01 1:12 PM	nm	nm	nm
Peralta Wasteway	PERWW	6.63	Inflow	7/25/01 3:32 PM	nm	nm	nm
Rio Grande at Tome	RGTM	7.48	River	7/25/01 5:12 PM	nm	nm	nm
Rio Grande at Tome	RGTM	7.48	River	7/26/01 11:29 AM	27	8.85	380
Lower Peralta Riverside Drain #1	LP1DR	9.35	Inflow	7/26/01 1:53 PM	24.5	8.10	nm
Rio Grande downstream of Hwy 309	RG309	9.48	River	7/26/01 4:20 PM	34.4	9.15	nm

"nm" indicates no measurement

Table I-16
Water Quality
Belen Riverside Drain Seepage Run, Belen Division, S4-20, July 25-26, 2001

Location	Location Code	Distance Below BRDOUT or BRDTM (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (μS/L)
Belen Riverside Drain adjacent to RGUSOUT	BRDOUT	0.0	Drain	7/25/01 11:00 AM	21.0	7.86	455
Drain #1 into Belen Riverside Drain	DR1BRD	0.3	Inflow	7/25/01 12:37 PM	21.1	8.21	380
Belen Riverside Drain upstream of Harlan Drain	BRDUH	2.5	Drain	7/25/01 2:10 PM	24.0	8.07	nm
Belen Riverside Drain downstream of Harlan Drain	BRDDH	* see note	Drain	7/25/01 3:07 PM	24.7	8.09	nm
Belen Riverside Drain at Tome	BRDTM	0.0	Drain	7/25/01 4:22 PM	24.65	8.47	nm
Belen Riverside Drain at Tome	BRDTM	0.0	Drain	7/26/01 12:29 PM	20.9	7.99	nm
Belen Riverside Drain upstream of Sausal Drain	BRDUSD	0.7	Drain	7/26/01 1:45 PM	22.2	8.22	540
Belen Riverside Drain downstream of Sausal Drain	BRDDSD	0.9	Drain	7/26/01 3:25 PM	27.7	8.19	570

Notes:

Belen Riverside Drain measurements span two station lines, designated as upper and lower.
The station for BRDDH was not determined because it was not necessary for seepage calculations.

Table I-17
Water Quality
Peralta Riverside Drain, Belen Division, S4-21, August 2-3, 2001

Location	Location Code	Distance Below PRDOUT (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Peralta Riverside Drain adjacent to RGUSOUT	PRDOUT	0.0	Drain	8/2/01 10:18 AM	nm	nm	nm
Otero Drain	OTDR	0.1	Inflow	8/2/01 11:35 AM	nm	nm	nm
Tome Drain	TOMDR	7.2	Inflow	8/2/01 2:07 PM	nm	nm	nm
Peralta Riverside Drain at Tome	PRDTM	7.3	Drain	8/2/01 3:38 PM	nm	nm	nm
Peralta Riverside Drain at Tome	PRDTM	7.3	Drain	8/3/01 12:00 PM	24.4	8.01	440

Table I-18
Water Quality
Rio Grande Seepage Run, Belen Division, S4-22, August 2-3, 2001

Location	Location Code	Distance Below Isleta Diversion Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Rio Grande Upstream of Wastewater Outfall	RGUSOUT	6.6	River	8/2/01 10:08 AM	22	8.24	nm
Harlan Drain	HARD	9.2	Inflow	8/2/01 12:24 PM	21.4	8.11	nm
Peralta Wasteway	PERWW	13.3	Inflow	8/2/01 1:53 PM	25.6	8.63	nm
Rio Grande at Tome	RGTM	14.1	River	8/2/01 3:37 PM	29	8.04	nm
Rio Grande at Tome	RGTM	14.1	River	8/3/01 9:55 AM	nm	nm	nm
Lower Peralta Riverside Drain #1	LP1DR	16.0	Inflow	8/3/01 12:08 PM	nm	nm	nm
Rio Grande downstream of Hwy 309	RG309	16.1	River	8/3/01 2:40 PM	33.4	8.8	nm

Table I-19
Water Quality
Belen Riverside Drain, Belen Division, S4-23, August 2-3, 2001

Location	Location Code	Distance Below BRDOUT or BRDBS2 (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Belen Riverside Drain adjacent to RGUSOUT	BRDOUT	0.00	Drain	8/2/01 10:15 AM	20.1	7.71	480
Drain #1 into Belen Riverside Drain	DR1BRD	0.27	Inflow	8/2/01 12:36 PM	22.5	8.36	430
Belen Riverside Drain upstream of Harlan Drain	BRDUH	2.53	Drain	8/2/01 3:05 PM	23.6	8.15	420
Belen Riverside Drain downstream of Harlan Drain	BRDDH	* see note	Drain	8/2/01 4:48 PM	24.2	8.16	470
Belen R/S Drain below separation 2	BRDBS2	0.00	Drain	8/3/01 10:50 AM	21.0	8.03	480
Belen Riverside Drain at Tome	BRDTM	4.31	Drain	8/3/01 10:20 AM	23	8.22	590
Belen Riverside Drain upstream of Sausal Drain	BRDUSD	5.05	Drain	8/3/01 12:37 PM	21.3	8.15	nm
Belen Riverside Drain downstream of Sausal Drain	BRDDSD	5.17	Drain	8/3/01 2:22 PM	nm	nm	nm
Belen Riverside Drain at Hwy 309	BRD309	6.49	Drain	8/3/01 1:45 PM	25	8.00	520

Notes:

Belen Riverside Drain measurements span two station lines, designated as upper and lower.
The station for BRDDH was not determined because it was not necessary for seepage calculations.

Table I-20
Water Quality
Rio Grande Seepage Run, Socorro Division, S4-24, August 8-9, 2001

Location	Location Code	Distance Below San Acacia Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Rio Grande at Escondida Bridge	RGESC	10.69	River	8/8/01 11:15 AM	22.2	8.32	650
Rio Grande at North Socorro Diversion	RGNSD	12.18	River	8/8/01 1:31 PM	23.1	8.42	600
Rio Grande at 1200 Check Structure	RG1200	15.33	River	8/8/01 3:50 PM	25.2	8.35	660
Rio Grande at 1200 Check Structure	RG1200	15.33	River	8/9/01 9:30 AM	nm	nm	nm
Rio Grande at Brown Arroyo	RGBA	19.95	River	8/9/01 10:55 AM	21.7	8.47	650
Rio Grande at Neil Cupp	RGNC	22.51	River	8/9/01 2:46 PM	26.7	8.44	630
Rio Grande downstream of Hwy 380	RG380	26.31	River	8/9/01 3:02 PM	25.8	8.27	nm

Table I-21a
Water Quality
North LFCC Seepage Run (LFCC), Socorro Division, S4-25, August 8-9, 2001

Location	Location Code	Distance Below San Acacia Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
LFCC downstream of wasteway to Rio Grande	LFCC #13	9.85	LFCC	8/8/01 11:25 AM	23.3	8.08	690
LFCC #11, downstream of 1200 check structure	LFCC #11	14.58	LFCC	8/8/01 3:55 PM	21	7.94	680
Brown Arroyo Wasteway	BRNWW	18.72	Inflow	8/9/01 11:15 AM	nm	nm	nm
LFCC below Brown Arroyo	LFCC #10	19.00	LFCC	8/9/01 12:55 PM	20.5	8.12	600
LFCC downstream of Hwy 380	LFCC #8	25.22	LFCC	8/9/01 4:17 PM	21.3	7.98	560

Table I-21b
Water Quality
North LFCC Seepage Run (Riverside Drain), Socorro Division, S4-25, August 8-9, 2001

Location	Location Code	Distance Below San Acacia Dam (miles)	Station Type	Date/Time	Water Temp (°C)	pH	Conductivity (µS/L)
Riverside Drain upstream of 1200 Check Structure	RIVUS1200	na	Drain	8/8/01 1:07 PM	21.6	7.98	1020
Riverside Drain downstream of 1200 Check Structure	RIVDS1200	na	Drain	8/8/01 2:26 PM	21.7	7.97	800
Riverside Drain upstream of Neil Cupp Diversion	RIVUSNC	na	Drain	8/9/01 1:00 PM	nm	nm	nm
Diversion at Neal Cupp	RIVDSNC	na	Drain	8/9/01 1:18 PM	19.9	7.68	nm

"na" indicates not applicable

Appendix J
Flow Measurements for B-Activities

Table J-1
Measured Discharge
Measurements at Proposed MRGCD Gage Locations
Activities B4-01 through B4-05

Location	Location Code	Date/Time	Discharge (cfs)	Activity
San Antonio Ditch N. Boundary	SADCN	6/20/01 11:15 AM	3.0	B4-01
Socorro Main Canal South, North Boundary	SMSCN	6/20/01 1:50 PM	27.3	B4-02
Elmendorf Drain, N Boundary Bosque	ELMDR	6/21/01 12:29 PM	6.8	B4-03
Socorro Riverside Drain N. Boundary	SOCDR	6/21/01 3:02 PM	34.0	B4-04
Socorro Wasteway	SOCWW	6/22/01 12:25 PM	0.4	B4-05

Table J-2
Measured Discharge
Measurements at Proposed MRGCD Gage Locations
Activity B4-06

Location	Location Code	Date/Time	Discharge (cfs)	Activity
Socorro Wasteway	SOCWW	7/5/01 1:32 PM	15.0	B4-06
San Antonio Ditch N. Boundary	SADCN	7/5/01 3:06 PM	20.7	B4-06
Elmendorf Drain, N Boundary Bosque	ELMDR	7/5/01 5:39 PM	13.3	B4-06
Socorro Main Canal South, North Boundary	SMSCN	7/11/01 1:00 PM	47.7	B4-06
Socorro Riverside Drain N. Boundary	SOCDR	7/11/01 3:35 PM	39.9	B4-06
Brown Arroyo Wasteway	BRNWW	7/11/01 6:00 PM	0.7	B4-06

Table J-3
Measured Discharge
Snapshot of MRGCD Operations
Activity B4-07

Location	Location Code	Date/Time	Discharge (cfs)	Activity
Rio Grande downstream of Hwy 380	RG380	7/17/01 10:45 AM	46.2	B4-07
Rio Grande at San Acacia	RGSACA	7/17/01 10:57 AM	121.8	B4-07
Riverside Drain upstream of 1200 Check Structure	RIVUS1200	7/17/01 10:55 AM	25.1	B4-07
LFCC #8 (D/S of Hwy 380)	LFCC #8	7/17/01 11:55 AM	48.1	B4-07
Riverside Drain downstream of 1200	RIVDS1200	7/17/01 12:17 PM	65.1	B4-07
San Antonio Ditch N. Boundary	SADCN	7/17/01 2:35 PM	2.6	B4-07
Riverside drain upstream of Lemitar Diversion	RIVUSLEM	7/17/01 3:35 PM	64.0	B4-07
Riverside Drain upstream of Neil Cupp Diversion	RIVUSNC	7/17/01 3:30 PM	6.8	B4-07
Socorro Main Canal South, North Boundary	SMSCN	7/17/01 3:30 PM	30.3	B4-07
Elmendorf Drain, N Boundary Bosque	ELMDR	7/17/01 4:52 PM	22.6	B4-07
Riverside Drain downstream of Lemitar Diversion	RIVDSLEM	7/17/01 5:05 PM	62.7	B4-07
Riverside Drain downstream of Neil Cupp	RIVDSNC	7/17/01 5:03 PM	19.3	B4-07
Socorro Riverside Drain N. Boundary	SOCDR	7/17/01 6:22 PM	42.2	B4-07
LFCC at San Acacia	LFCC #18	7/18/01 12:00 AM	0.0	B4-07

APPENDIX K
Standard Operating Procedure for Flow Measurement

Cross Section Layout

The ideal location for stream gaging is in a uniform cross section with straight and parallel streamlines. The cross section should also be in a location that contains the entire discharge without any divided flow areas. It is important to try and choose a cross section that is free of any flow impediments such as debris or encroaching vegetation and one that will provide a suitable gaging location under a range of discharges. Cross sections should always be aligned orthogonal to the direction of flow.

For purposes of this project, cross section end points will be monumented with rebar (along canals and at various diversions and wasteways) or with fence posts (along the Rio Grande). The placement of the rebar and fence posts should be low enough along the bank to facilitate being able to read the "tagline" yet high enough along the bank to maintain accessibility at greater discharges and water surface elevations. In addition, due to the flow on some of the Rio Grande cross sections in which one bank could actually become part of the channel bed at higher flows, rebar should only be used on a temporary basis to prevent it from becoming a hazard at the higher discharges.

If a cross section that is to be gaged is already monumented, verify that the location and alignment is still suitable for gaging at the current discharge. If necessary, adjust the cross section so that it meets the above requirements.

Field Notes Form

A form for all field notes and data was generated to help eliminate the chance of any measurements or information being forgotten. The form is shown in Figure 2.

Temperature, Conductivity, and pH Measurement

The Extech "Oyster" temperature, conductivity, and pH meter is the instrument currently being used. The calibration of both the pH and conductivity meter is performed at the beginning of each workday. Actual calibration procedures are described in the Extech operating instructions.

*Do not use the small plastic bottles found in the case to extract and measure the samples. The volume of water is small enough to be affected by the temperature of the measurement probes when placed into the bottle. Instead, either use a larger container to extract a sample or measure directly in the stream.

*Do not use the pH probe with the temperature and conductivity probes also plugged in. The pH readings have been found to fluctuate significantly when all three probes are connected to the meter.

In addition to water temperature, conductivity, and pH, the ambient temperature should also be measured with the pen-sized mercury thermometer.

Stream Gaging

The first step is to tie a "tagline" taut between the cross section endpoints. Once that is done, determine the reading on the tagline (Distance) of the left edge of water (LEW) and right edge of water (REW). The left and right orientation is determined facing the downstream direction.

According to USGS guidelines, each incremental discharge should be less than 5% of the total discharge. Therefore, take time to examine the flow and try to estimate an incremental width that will keep the incremental discharge less than 5% of the total.

Recommendations:

- If the flow is very uniform across the channel with only slight depth and velocity decreases near the banks, multiplying the entire width (LEW to REW) by ~2.5% - ~3.0% often provides a reasonable estimation of the necessary incremental width.
- If the flow is concentrated in a particular part of the channel, the increments in that location will need to be smaller. Multiplying the width of the concentrated flow by 5% can also aid in the determination of the increment.
- If the cross section of interest has been previously gaged, reviewing the field notes will probably provide the best estimate of the incremental width (as long as the cross section configuration has not changed).

After the incremental width is determined, depths and velocities can be recorded. Always place the velocimeter at the center of each incremental width. For example: If the left edge of water (LEW) is at the distance (tagline reading) of 12.0' and the necessary increment is 1.0', then the first location in which velocities will be recorded will be at the distance of 12.5' (see Figure 2 and Figure 3). Be careful that when incremental distances are altered along the cross section that the velocities are always measured at the center of each increment and that there is no overlap or gap between each incremental width.

This technique differs slightly from the procedure described in the USGS protocol for discharge measurements (Techniques of Water-Resources Investigations of the United States Geologic Survey: Discharge Measurements at Gaging Stations; Book 3, Chapter A8). However, the procedure described in the USGS protocol has been simplified. As shown in the diagram below as Method A, measurements are not made at the center of the measurement interval at locations where the measurement interval widths are changed. This may lead to slight inaccuracies in the determination of the discharge through that cell, since the best estimate of discharge would be obtained from the average flow rate at the center of the cell. However, this inaccuracy is generally not significant if the change in measurement interval is not large, and the USGS method uses this approach.

The method specified in this SOP varies slightly from the USGS Method (Method A), and incorporates a method for reducing the error discussed above. Shown in the attached diagram as Method B, the locations are chosen so that the measurement location is always at the center of the cell being measured.

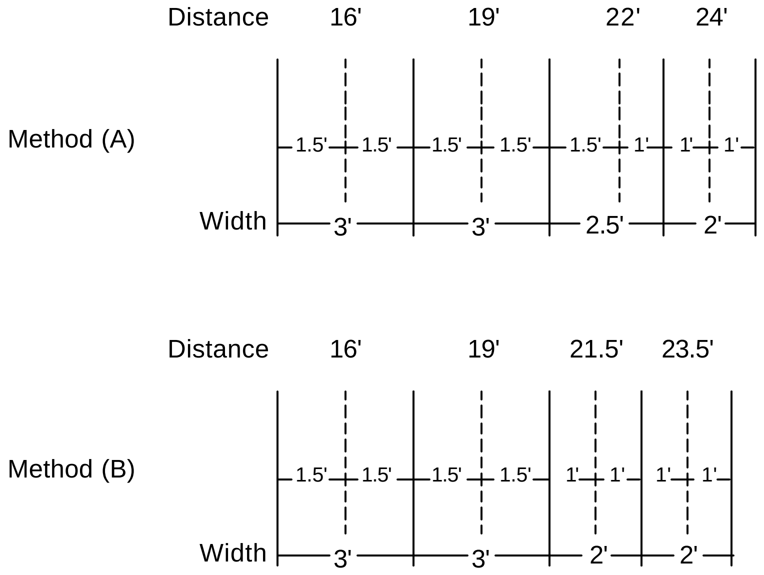


Figure 1. Example of width change from 3 feet to 2 feet during a typical gaging procedure. Method (A) is the method described in the USGS protocol.

Both of these measurement methods allow a check at the end of the measurement event that the intervals have been selected and recorded properly. Teams will typically add up all of the cell widths and make sure that the total is equal to the total width of the river.

Use of Velocimeter and wading rod:

- For this project, the meter used is the Marsh-McBirney velocimeter. The rounded probe of the Marsh-McBirney must be placed on the front of the cylindrical bracket that spans both vertical rods on the wading rod. Be sure that the set screw is aligned vertically upward. The rounded end of the probe must face in the upstream direction with the individual standing on the downstream side in order to not disrupt the flow.
- At each appropriate location along the cross section, place the base of the wading rod on the bed of the channel. The depth of flow can be read using the graduated marks on the vertical hexagonal portion of the wading rod. Single marks represent 0.1 feet, double marks represent 0.5 feet, and triple marks represent 1 foot.
- If the depth of flow is less than 2.5 feet, one velocity taken at 60% of the depth (down from the water surface) is sufficient. To do so, align the increments on the vertical round portion of the wading rod with the increments on the handle so that the reading equals the

flow depth (numbers on the round rod represent feet and the numbers on the handle represent 1/10 of a foot).

- If the depth of flow is greater than or equal to 2.5 feet, two velocities must be recorded. One velocity is at 20% of the depth and the other is at 80% of the depth. The average of these values will be used in the discharge calculation. To measure the velocity at 20% of the depth, adjust the vertical round rod to "twice" the actual depth. To measure the velocity at 80% of the depth, adjust the vertical round rod to "half" the actual depth.
- The Marsh-McBirney operates on a cycle of 30 seconds in which an average discharge is displayed at the end of that time period. Make sure that the recorded velocity measurement corresponds to an average velocity of a full cycle in which the probe was not adjusted or disturbed.

An example of the discharge calculations is shown in Figure 2. Multiply the width (which will not correspond to the difference in distances at locations in which the incremental width is changed) and the depth to determine each incremental area. Multiply the area and the velocity (average of the 20% and 80% velocities if appropriate) to calculate each incremental discharge. Sum all incremental discharges to determine the total discharge.

Compare each incremental discharge to 5% of the total discharge. If any incremental discharge is greater than 5% of the total, it may be necessary to re-gage that particular location at a smaller incremental width.

Remarks

Document all pertinent observations or changes at the measurement site.

Photos

At new locations, take photos across the cross section from each bank as well as looking upstream and downstream at the cross section. At previously photographed sections, photos are only necessary to document any pertinent changes.

Sketch of Cross Section

At new locations, sketch the cross section (in the downstream direction) including channel bed type, banks, rebar locations, vegetation type, roadways, etc. At previously sketched sections, additional sketches are only necessary to document any pertinent changes.

Summer 2001 Seepage Run Date: 5/31/01

LEW: 12.0 REW: 31.4 Channel Width: 19.4

Distance (ft)	Width (ft)	Depth (ft)	Velocity (ft/sec)	Area (ft2)	Discharge (cfs)
12.0	0.0	0.0	0.00	0.00	0.00
12.5	1.0	0.1	0.85	0.10	0.09
13.5	1.0	0.4	1.22	0.40	0.49
14.5	1.0	1.0	1.33	1.00	1.33
15.5	1.0	2.5	0.2: 1.33	2.50	3.35
			0.8: 1.35		
16.5	1.0	2.7	0.2: 1.37	2.70	3.73
			0.8: 1.39		
17.5	1.0	2.4	1.33	2.40	3.19
18.5	1.0	2.4	1.34	2.40	3.22
19.5	1.0	2.3	1.30	2.30	2.99
20.5	1.0	2.4	1.20	2.40	2.88
21.5	1.0	2.4	1.22	2.40	2.93
22.3	0.6	2.4	1.26	1.44	1.81
22.9	0.6	2.3	1.35	1.38	1.86
23.5	0.6	2.3	1.31	1.38	1.81
24.1	0.6	2.3	1.29	1.38	1.78
24.7	0.6	2.2	1.38	1.32	1.82
25.3	0.6	2.0	1.31	1.20	1.57
26.1	1.0	2.0	1.33	2.00	2.66
27.1	1.0	1.8	1.33	1.80	2.39
28.1	1.0	1.5	1.33	1.50	2.00
29.1	1.0	1.0	1.33	1.00	1.33
30.1	1.0	0.8	1.33	0.80	1.06
31.0	0.8	0.5	0.99	0.40	0.40
31.4	0.0	0.0	0.00	0.00	0.00
					sumQ: 44.7 cfs

Figure 2. Example of field entry form.

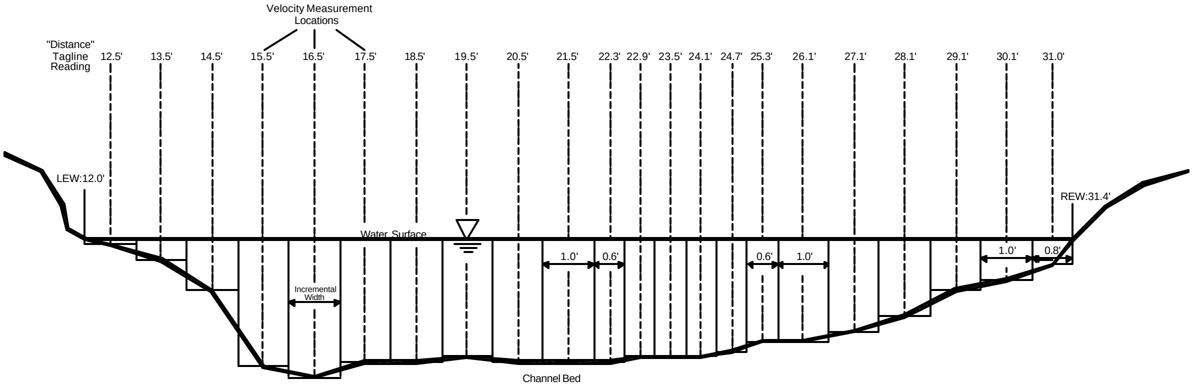


Figure 3. Example of velocity measurement and discharge calculation locations.