2049

MASTER DRAINAGE STUDY

TOWN OF SAN LUIS

Prepared for
Town of San Luis

Department of Local Affairs
and
Colorado Water Conservation Board

Prepared by
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PREFACE

This Master Drainage Study for the Town of San Luis was prepared by WRC Engineering, Inc. of Denver, Colorado. The study was prepared for the Town of San Luis in cooperation with the Department of Local Affairs. Technical guidance was provided by the Colorado Water Conservation Board.

The technical considerations were prepared under the supervision and direction of the project manager whose seal as a licensed professional engineer is attached.

WRC Engineering, Inc.
A. S. Andrews, P.E.
Project Manager

WRC Engineering, Inc.
Dennis L. Heller, P.E.
Project Engineer

Copies of this report and the technical addendum are available for public review at the offices listed below. The technical addendum includes the basic data and engineering calculations needed to facilitate the scope of services for the study.

Town Hall
San Luis, Colorado

Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

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CHAPTER I

INTRODUCTION

A. AUTHORIZATION

This study was authorized by the Town of San Luis in cooperation with the Department of Local Affairs (DOLA) and the Colorado Water Conservation Board (CWCB). Specific tasks were performed according to the terms of the contract dated May 17, 1988, between the Town of San Luis and WRC Engineering, Inc.

The cities, incorporated towns, and counties within the study area may provide zoning regulations:

> ". . . to establish, regulate, restrict, and limit such uses on or along any storm or floodwater runoff channel or basin, as such storm or floodwater runoff channel or basin has been designated and approved by the Colorado Water Conservation Board, in order to lessen or avoid the hazards to persons and damage to property resulting from the accumulation of storm or floodwaters . . ."

as stated in Section 30-28-111 for the county governments and Section 31-23-210 for municipal governments of the Colorado Revised Statues 1973.

The Colorado Water Conservation Board has the power and duty:

> ". . . to devise and formulate methods, means and plans for bringing about the greater utilization of the waters of the state and the prevention of flood damages therefrom and to designate and approve storm or floodway runoff channels or basins, and to make such designations available to legislative bodies of cities and unincorporated towns; to county planning commissions; and to boards of adjustments of cities; incorporated towns; and counties of this state . . ."

as stated in Section 37-60-106(1)(c) of the Colorado Revised Statutes.

B. ACKNOWLEDGEMENTS

The following individuals on the staff of WRC Engineering, Inc. have contributed to the preparation and completion of this report.

- Mr. A. S. Andrews, P.E. - Project Manager
- Mr. Dennis L. Heller, P.E. - Project Engineer
- Ms. Judith Hamilton - Geologist
- Mrs. Holly Richards - Technical Drafting
- Mrs. Jo Ann Donovan - Technical Typist
- Ms. Leanne Bresnahan - Printing

We also wish to acknowledge the assistance and cooperation of other individuals, agencies, firms and organizations listed below:

Mayor Joe Espinoza, the Town Council and the Citizens of San Luis, especially Amos Bernal

Rincon Surveying, Inc., Alamosa
Mr. William Kitterman and Mr. Mike Lorton

Conejos Costilla Community Action Agency
Mr. Dave Pacheco, Ms. Cindy Espinoza and Mr. James Mondragon

Soil Conservation Service
Mr. Gus Gomez, Mr. Bill Wittwer and Mr. Glade Wilkes

The Valley Courier
Ms. Wanda Dietrich

Colorado Water Conservation Board
Mr. Larry F. Lang

C. PURPOSE AND SCOPE

The purpose of this study is to determine the extent of the surface and sub-surface drainage problems within the Town of San Luis, consider alternative solutions to the problems, select a feasible alternative and prepare a preliminary design plan for each of the following four (4) aspects of the drainage problem:

1. Groundwater flooding of basements and crawl spaces.

2. Insufficient capacity of existing Highway 159 crossing of Rito Seco.

3. Condition and level of protection provided by the U. S. Army Corps of Engineers' levee east of town.

4. Surface flooding from the North basin of the Rito Seco.

The information generated by this study will be used by the Town of San Luis and local agencies to regulate land use in the areas affected by the surface and subsurface flooding. Implementation of the recommended plans for drainage improvements will help to reduce damages to existing developed areas.

The scope of the study includes the following items:

1. Meetings with representatives of the Town of San Luis, Community Action Agency (CAA), CWCB, DOLA and other public and private agencies to obtain base information and collect data.

2. Collect available data and information required to document the history and extent of the surface and sub-surface flooding.

3. Gather information and data on the levee system located adjacent to the East Corporate Limits of the Town.

4. Conduct investigations, including physical inspection ground survey, hydrologic and hydraulic analysis to compute the hydraulic capacity of the existing and proposed structures.

5. Study alternative solutions to the different aspects of the problem.

6. Present alternatives to the Town Council at a formal meeting. Gather input for making a final alternative selection.

7. Prepare preliminary design drawings for the selected alternatives including estimated construction costs.

8. Prepare a report documenting the results of the study and providing a narrative for the preliminary design drawings.

D. ORGANIZATION OF REPORT

The report is structured so that each of the four aspects of the drainage and flooding problems are addressed in its own section. Each of these sections is subdivided into four subsections: 1. History; 2. Investigation; 3. Alternative Solutions and 4. Recommendations (including narrative of preliminary design drawings).

E. MAPPING AND SURVEYING

The Town of San Luis provided photographic contour mapping at a scale of 1" = 200' with a 4 foot contour interval. This mapping had been prepared by the U. S. Soil Conservation Service (SCS) and use for their RITO SECO WATERSHED STUDY, in 1980. Rincon Surveying, Inc. of Alamosa (under subcontract to WRC Engineering, Inc.) provided additional ground survey. CWCB also provided ground survey information for the underground investigation and floodplain analyses of the Rito Seco Basin.

F. PREVIOUS ACTION AND RELATED STUDIES

1. The Work Project Administration (WPA) during the 1930's installed a rock lined subsurface drain parallel to the east side of Highway 159, running from 4th Street to Culebra Creek upstream of the old highway bridge.

2. SCS completed a field examination of the San Luis watershed in February 1976 in conjunction with the USDA Study of the Rio Grande Basin in Colorado. The SCS report recommended that a PL-6 watershed project be considered for flood protection purposes. Planning authorization was obtained in 1978 and detailed planning activities continued until 1979.

3. Due to the possibility of flooding as a result of snow melt from the heavy snowpack in the mountains east of San Luis, the U. S. Army Corps of Engineers, acting under emergency measures, constructed a levee along the east side of San Luis in 1979.

4. Upon completion of construction of the levee, SCS abandoned the PL-6 project, as they believed that construction of the levee had accomplished the original SCS objective.

5. On August 20, 1987, CWCB published a Reconaissance Report outlining the surface and subsurface flooding problems in the Town of San Luis, outlining the history of the problem, previous actions taken and recommending that a master drainage study be prepared.

G. LIST OF FIGURES AND DRAWINGS

To assist WRC in the presentation of the study findings and recommendations, the following figures and drawings were prepared. These figures and drawings will help the reader to understand the drainage and flooding problems which presently exist in the Town of San Luis and the Rito Seco Basin.

List of Figures

List of Drawings (located in rear pocket)

H. REFERENCES

1. U. S. Army Corps of Engineers, "As built drawings and specifications for San Luis Levee", 1979.

2. U. S. Department of Agriculture, Soil Conservation Service, "Close-out Report, Rito Seco Watershed", September 1980.

3. Colorado Water Conservation Board, "Reconnaissance Report, Surface and Subsurface Flow for Town of San Luis, Colorado", August, 1987.

4. U. S. Army Corps of Engineers, Hydrologic Engineering Center, "HEC-2 Water Surface Profiles", Davis, California, 1982.

5. Colorado Department of Highways, "M & S Standards", January, 1982.

6. U. S. Department of Transportation, Federal Highway Administration, "Hydraulic Engineering Circular No. 5, Hydraulic Charts for the Selection of Highway Culverts", December, 1965.

7. Federal Emergency Management Agency "Interim Levee Policy", February, 1981.

CHAPTER II

STUDY AREA DESCRIPTION

A. LOCATION

The Town of San Luis is located in the southeastern part of the San Luis Valley, approximately 220 miles south of Denver. San Luis is the County Seat of Costilla County, and is the oldest Town in Colorado, established in 1851.

See Figure 1 - STUDY AREA LOCATION

B. DRAINAGE BASIN CHARACTERISTICS

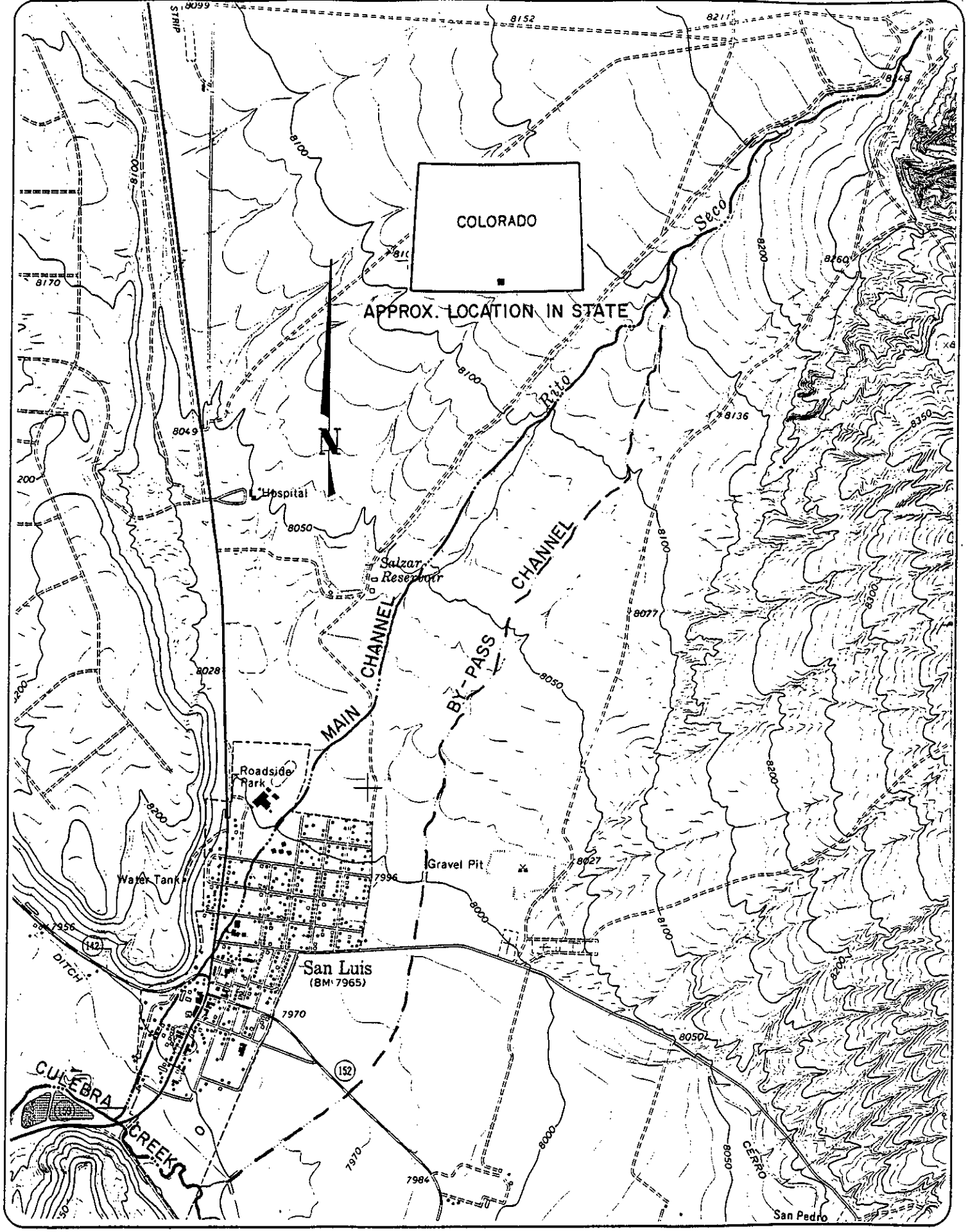
The Town of San Luis lies within the tributary area of the Rito Seco, an ephemeral stream with its headwaters in the Sangre de Cristo Mountains east of San Luis. Length of the Rito Seco is approximately 14 miles from the headwaters to its confluence with Culebra Creek at the southern edge of San Luis. Elevation of the basin varies from over 12,000 feet to 7950 feet at Culebra Creek.

With the exception of the Town of San Luis which covers approximately 280 acres and irrigated hay land covering approximately 90 acres the 42.5* square miles (27,000 + acres) is essentially undeveloped. Natural conditions consist of largely range and forest lands.

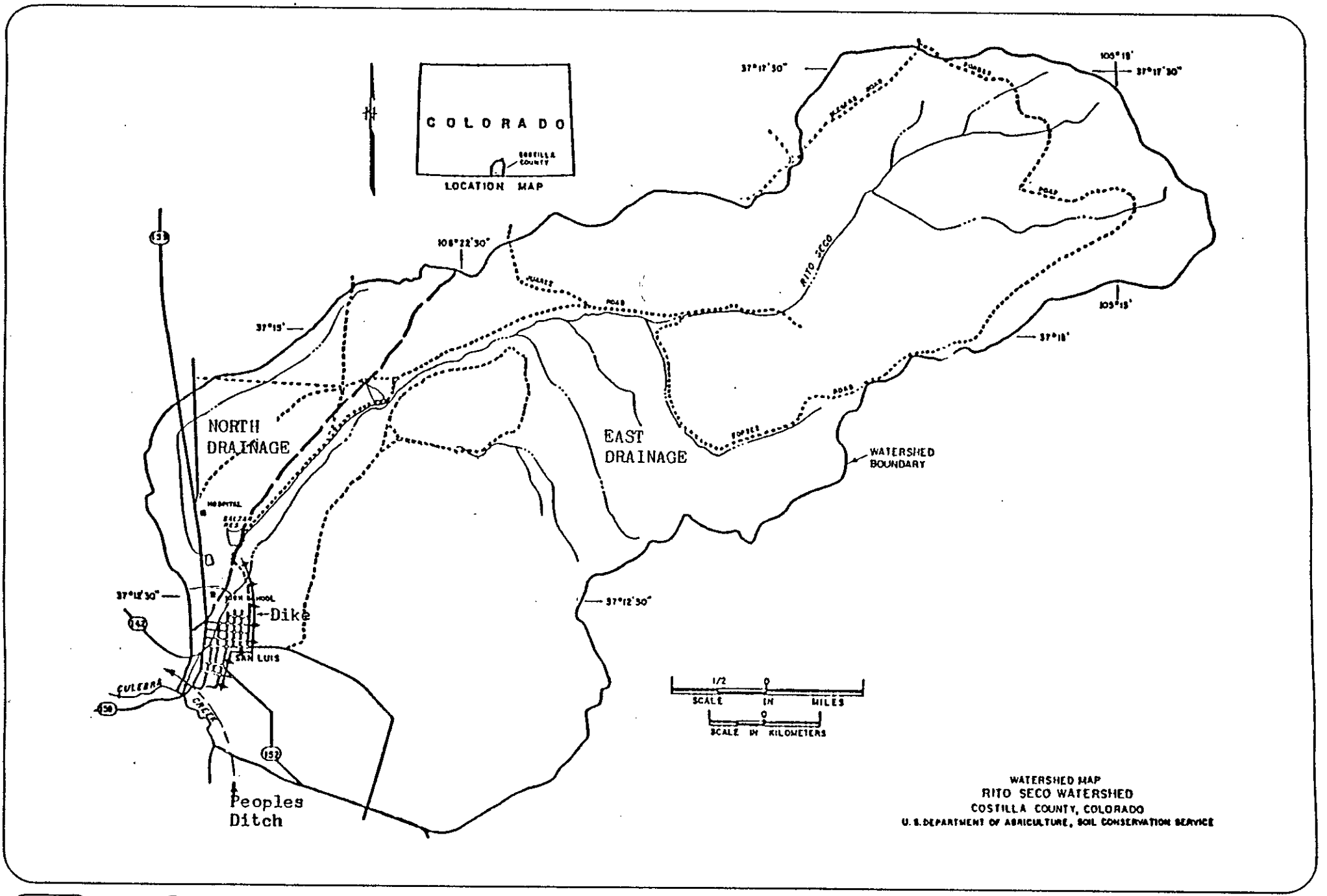
* The drainage area is essentially divided into two basins, the East Basin of 38.0 square miles and the North Basin of 4.5 square miles.

See Figure 2 - BASIN BOUNDARIES

Two irrigation reservoirs are located within the basins, Salazar No. 1, approximately 3/4 miles north of Town and Salazar No. 2, some 2 miles northeast of Salazar No. 1. As a result of a diversion structure above Salazar No. 2, and diversion ditches to the reservoirs, both are fed by flows from the Rito Seco. According to the State Engineer's records,



WRC	Job # 1667	SAN LUIS, COLORADO	STUDY AREA LOCATION	FIG. 1



WRC | Job # 1667 | SAN LUIS, COLORADO | DRAINAGE BASIN BOUNDARIES | FIG.2

Salazar No. 1 has an appropriated storage volume of 99.75 acre feet, and Salazar No. 2, 35.0 acre feet. The reservoirs are located on the Dos Hermanos Ranch and used for irrigating hay land.

Northeast of San Luis, the Rito Seco drainage is spread out into several channels, natural and man made. Diversion dikes of natural soils, however, force the runoff into the westernmost channel that runs from north to south through the Town of San Luis. Since 1979, when the Army Corps of Engineers constructed an emergency flood control levee around the east edge of Town, and installed a 24" CMP at the channel location, the flow in the channel through Town has been limited to that which will pass the 24" CMP plus the runoff from the 4.5 square mile North Basin. Although the channel has the capacity to carry the 100 year runoff from the North Basin, flooding occurs because there is no defined swale or channel to convey the runoff into the channel, and the sheet flow spreads out to cover a broad area.

The gradient of the Rito Seco between the two reservoirs is approximately 1.6% and from Salazar No. 1 to Culebra Creek 1.0% $\pm$. The walls of the channel between Highway 142 and the confluence with Culebra Creek have been lined with stone to provide a more well defined channel. Computed capacity of the channel is 300 cfs $\pm$.

Several channel crossing structures are located between Culebra Creek and the levee. Specifically a 36" CMP irrigation ditch crossing and two minor wooden bridges between Culebra Creek and Highway 142; five major bridges and a twin 24" CMP installation between Highway 142 and the levee. The twin 24" CMP installation located at Highway 159 is one of the items that will be addressed in this report.

C. GROUND WATER CHARACTERISTICS

Throughout the San Luis Valley, depth to ground water has historically been very shallow. The ground water in the Town of San Luis is no exception. Several free flowing artesian wells are located in the southern part of town where the ground water level is very near the surface. Recharging of the ground water by snow melt, stream flow and

irrigation during "wet" years has resulted in ground water levels in the north part of town that have been flooding basements and crawl spaces. Attention to this problem is one of the purposes of this study.

CHAPTER III

HYDROLOGY AND HYDRAULIC ANALYSIS

A. HYDROLOGY ANALYSIS

The hydrologic values and computations for the Rito Seco were obtained from the USDA SCS close-out report. Discharges for the North Basin (4.5 sq. mi.) were as follows:

Frequency	Flood Discharge (cfs)
10 year	118
50 year	168
100 year	189
500 year	245

For the East Drainage Basin (38.0 sq. mi.) the 100 year flood discharge used was 680 cfs.

WRC estimated the 100 year flood discharge of Culebra Creek at its confluence with the Rito Seco from a regional analysis of similar stream basins. The 100 year flood discharge was computed to be 1200 cfs. Background information and data are presented in the Technical Addendum.

B. HYDRAULIC ANALYSIS

The 100 year water surface profiles and floodplain for Culebra Creek, Rito Seco east of the levee, and Rito Seco through the Town were estimated using the U. S. Army Corps of Engineers HEC-2 Water Surface Profiles computer program.

For both Culebra Creek and Rito Seco east of the levee, cross sections were taken by field surveying. Cross section from the SCS closeout report as well as selected ground shot sections were used for the Rito Seco through Town.

Computer output and a diskette are located in the Technical Addendum.

CHAPTER IV

SPECIFIC PROBLEMS AND RECOMMENDATIONS

A. GROUND WATER

1. History

Available information indicates that the ground water table in the Town of San Luis has been relatively high since at least the 1930's when the Work Project Administration (WPA) installed a rock lined drain from Culebra Creek north to 4th Street parallel to the east side of Highway 159. Reports by long time residents indicate that the drain was very effective in solving the subsurface water problems for the southern portions of the community located adjacent to this drain.

Early homes in San Luis were built without basements or crawl spaces and were not affected by the high water table. In the early 1960's public water and sewer service was made available in San Luis and many homes were retrofitted with crawl spaces to accommodate indoor plumbing. Also, many homes built in the northeast area of Town included basements. For several years, these homes were not bothered by ground water. Then in 1985 and 1986 during a "wet cycle", residents, particularly those in the northeast area of town, started experiencing water in their basements and crawl spaces. In order to dry out the basements, residents have been discharging their sump pumps into the sanitary sewer system, resulting in overloading the sewage treatment facility. (See following newspaper articles.)

In 1986 and 1987, the Soil Conservation Service (SCS) conducted a preliminary subsurface water investigation and recommended that a subsurface drain be installed to lower the water table. SCS made an initial cost estimate for installing the drain and began design of the line, however, the design was not completed due to lack of study authorization and funding.

DELORES ARELLANO shows how high the water was in her basement in San Luis on Tuesday, June 23. She has three pumps in her basement to try to control her flooding problem.
(Courier photo by Wanda Dietrich)

Water complaints flood council

By WANDA DIETRICH
Courier Correspondent

SAN LUIS — The San Luis Town Council heard a flood of complaints Thursday night from residents upset about water in their basements.

According to a June 15 Soil Conservation Service report, the cause of the high water is probably the irrigation of a hay field north of town and San Luis' own irrigation system.

The report suggests solving the problem by replacing the hay field's recently-dug trench with a shallow surface ditch and tile drain, and by replacing the town's irrigation system with a concrete ditch or pipe.

After visiting a number of homes with flooded basements, including one home whose adobe walls were crumbling from the moisture, the council agreed something must be done to lower the water table in the northeast part of town.

The council decided to contact the representative of the Dos Hermanos Ranch, where the hayfield is located, to see if the ditch could be replaced.

The council also conferred with the Costilla County Commissioners to determine priorities for spending incoming CDBG grants money. Councilors were asked to decide whether a new fire truck or a town drainage study was more important for the community.

While the council felt both were important, both the council and the commissioners decided if only one project could be funded, it should be the drainage study.

The council and commission also worked together to create a Costilla County Airport Authority, which would oversee the creation of the proposed Costilla County Airport.

The Airport Authority will consist of seven members, four appointed by the commissioners and three by the council. The county agreed to try to appoint its members from the county area, and the city to pick only town residents if possible.

The council decided not to grant special liquor licenses for the three days of the Santa Ana Festival. County Sheriff Pete Espinoza said his goal was to clean up the festival and make it a more enjoyable occasion for those attending.

Espinoza also thanked the council for lending his department a town car. He said the car was in better condition than the county cars used by his department.

The council also decided to publicize again its job opening for town clerk, treasurer and judge, as there had been some misunderstandings about the position.

Persons applying for the job need not be residents of the city, as some had believed, but only of the county.

Tuesday

VALLEY COURIER

35¢

SERVING ALAMOSA, CONEJOS, COSTILLA, MINERAL, RIO GRANDE AND SAGUACHE COUNTIES

TUESDAY, August 11, 1987 Alamosa, Colorado 81101 VOLUME 61 NO. 157

Sewage flooding creek

State tells San Luis to stop contamination

By WANDA DIETRICH
Courier Corresondent

SAN LUIS — The Costilla County Commissioners found themselves again confronted with this town's water problems Wednesday, when San Luis Mayor Joe Espinoza reported that a State of Emergency as been declared for San Luis by the Town Council because of excess water.

Water being pumped into the town's sewage system from resident's attempts to keep their basements dry has overloaded the sewage lagoons. Because the lagoons are overloaded, they are spilling almost twice the flow permitted, and 26 times the bacterial content allowed, into Culebra Creek. The Colorado State Health Department has notified the town that it must immediately either stop the excess water from entering the system, or construct a new $750,000 sewage lagoon.

A tile drain system running along the north and west borders of San Luis eventually draining into Culebra Creek was proposed by the Soil Conservation Service to intercept ground water before it can enter basements, especially those

State tells San Luis to stop contamination.....

(Continued from page 1)

n the northern part of town. If there is less water in people's basements, there will e less water pumped into the sewage system. Espinoza asked the Commissioners or in-kind help installing this system.

In answer to questions about the cost of the tile drainage system, Espinoza informed the commissioners it would cost about $100,000 for the complete system. Ernest Chavez asked if the town had any money for the project.

"No," replied Espinoza.

Chavez said he didn't think the county could legally give the town help, but that hey might be able to lease equipment to the town for the project.

County Administrator Maclovio Gallegos said the county has legal restrictions nd paperwork that is necessary for the county to give such help. He said he would ook into it.

Community Action Agency Director Dave Pacheco reported that the town hopes o receive grant money to fund a massive drainage study that will cover the entire own of San Luis and make recommendations for solutions. Without proper study, e added, applications for grants are not likely to receive much consideration, but ithout outside funding, San Luis will not be able to solve its water problem.

Several area ranchers asked the commissioners to mediate some disagreements ney have concerning land leased from the county. The dispute concerns the anchers' ability to control the cattle on the leased land.

County Attorney Bob Pastore said he would be willing to mediate the dispute, earning that the county would no longer be interested in leasing the land if it auses problems.

Alphonso Gallegos asked the commissioners' help in solving access problems he is having. His son bought land, with a verbal easement agreement, but now he is unable to get to his land to work in the field.

Pastore explained that it is not the county's job to provide access to the property, but that is a dispute between the two parties involved. He offered to sit down with them and help them find a fair agreement.

Chavez agreed, saying that the county doesn't care who leases the land, but it doesn't want problems.

The commissioners opened bids that they had received for a new grader. John Burris of MacDonald Equipment Co. questioned why bids that did not include the demonstration requested by the commissioners were still eligible for consideration and his was not, even though it was late. He pointed out that his grader was priced $7,746 less than the nearest competitor.

Gallegos informed him that the commissioners could reject any bid, for any reason, and that to bend the rules in this way would set a bad precedent. He stated that the only way to legally accept MacDonald's offer would be to reopen the bidding process.

Pastore agreed, adding that a demonstration was not a condition, while the deadline was.

No action was taken on the matter.

Duke White of the Mesita Development Committee requested county help and support in reincorporating the town. He explained that development is moving up from Taos, and they would like Mesita to be an entity again. No action was taken.

White also asked why the library in San Luis has so little money. He had ordered books through the library, but the library had no money to pay the postage. White questioned why the library's hours had been reduced.

Gallegos explained that the library is funded by a separate bond issue. Last year it overspent its budget, and must cut back this year. He stated that the library has received $1,300 from the state, so next year the library will be in better shape.

Prax Ortega reported that the County Emergency Medical Technicians have a good performance rating, and with a recent good report, that rating is being maintained. Community Education Classes have started in the EMT building, a will continue.

Ortega suggested that the sidewalk in front of the EMT building be completed a soon as possible. Fred Sanchez suggested that the landscaping suggested by the Colorado University Team that visited earlier be considered. Chavez questioned the expense. He was informed that the biggest expense would be for the fence, and that the labor would come from the county.

Ortega questioned what he should do about those people who do not pay their ambulance bills. He was told to keep sending them a monthly bill.

Sitting on the Board of Health, the commissioners approved a 18 percent increase in the salary of the director of Costilla County Nursing Services to $19,500 and appointed Crystal Brandt to that position.

Audrey Martinez requested that the house that her mother, Nadine Rascon had owned be declared a health hazard. The house had caught fire before Rascon passed away, and the plastic sewage lines were burned through. Since the fire, the house has begun to smell from the sewage and the fact that water has not been pumped away.

The commissioners decided to have the house inspected to see if it is a health hazard, and will decide at the next meeting what to do.

The commissioners sold 106 lots in the Lago Costilla Ranches to a client of Ghet Coleman for three years of back taxes, prior to the county taking over the land.

The El Rito Cemetery near San Francisco has run out of space. The owner of the property evidently is willing to sell lots adjecent to the cemetery. A request was made to the commissionrs to help pay for the property to claim tax deductions.

The commissioners appointed Dave Pacheco, Amos Bernal, Tom Valdez and Maclovio Gallegos to the Airport Board.

The commissioners replied to a request for a job, by stating that one half of the county workers will be laid off for four months, until November. This is to be able to hire during the winter, when agricultural jobs are scarce.

Residents and experts study San Luis seepage problems

By WANDA DIETRICH
Courier Correspondent

SAN LUIS — In an attempt to "pull the plug" on flooding problems facing their town, citizens here met recently with experts from the Army Corps of Engineers, the State Highway Department and the Soil Conservation Service.

Residents who were having problems with seepage were invited to speak, and several did so, saying in many cases that their homes are in jeopardy and that the water problem has become much worse in the past three to five years.

Some residents continued to blame the problem on irrigation of the hay field north of town. A survey taken earlier revealed that 66 of the 100 houses polled had seepage problems.

Elmer Valdez of Dos Hermanos Ranch disputed that the hay field was responsible for the problem, however.

He said the ranch dug the ditch in the hay field at the request of town residents, and even dug it much deeper than Dos Hermanos felt was necessary, in an attempt to help control the seepage.

Now that the ditch itself has been blamed for the seepage, the ranch has been filling it back up and packing it to keep its irrigation water out of the water table.

Gus Gomez of the Soil Conservation Service then explained that the ditch had been dug deeply enough to uncover old gravel bars deposited many years ago by the Rito Seco, thus changing the water table.

He suggested that one way to control the seepage on the north side of town was to lay a 10-inch drainage pipe from the north side, along the hay field, then down the east perimeter to a point where the excess water could drain into the river.

He also suggested a more managed approach to irrigating the hay field, such as only watering until the root zone is saturated with water.

He offered the help of the SCS in laying out and grading a new ditch to drain into Rito Seco, which he indicated would prevent water from standing and soaking into the ground.

Valdez said the field is only flooded 21 days out of the year.

Frank Collins of the Army Corps of Engineers said that since about 1979 the climate of the area has been getting wetter, so that now there is more water to control. He asked if there had been any change in water use or management lately that might have made some difference in the water table.

Valdez said that Dos Hermanos Ranch has watered the same way for the 21 years that he has worked on the land. He added, however, that the water used to irrigate the field has only been available for the past several years.

Collins clarified his role as representative of the Corps, saying that while the Corps has limited authority to do work, it can provide a lot of technical assistance.

It was brought out by city employees that the sewage lagoons are being swamped with fresh water that people are pumping out of their basements and into the sewage system. Because the system was not designed to handle this much water, the state may require the town to build another lagoon to handle the extra water.

Those present also said they were concerned that the two 24-inch culverts installed several years ago on the Rito Seco to replace a condemned highway bridge would not be sufficient to carry away water in the event of a big flood.

It was agreed that it doesn't take much, "just a couple of tumbleweeds," to plug a culvert and render it useless.

Collins said that, as badly overgrown as the Rito Seco is now, it cannot carry much more water than the culverts could handle, anyway.

He suggested that a good first step, both to help control potential floods and to get help to replace the culverts, would be to clear the river channel.

Valdez said that Dos Hermanos has been keeping the channel clean where it goes through the ranch.

The experts also said that, if it was improved a bit, the emergency dike erected by the Corps during a flood in 1979 would be able to control a 100-year flood.

Most of the needed improvements would involve getting rid of the cuts in the dike, such as those where roads go through it instead of over it.

The dike is not considered to be a permanent structure, however, and would need to be certified in order to be considered permanent. The experts felt this would not be a problem.

People at the meeting were warned that the process of studying the town's problems and coming up with solutions would take awhile, and that there is no guarantee that money will be available for either studies or projects.

Someone pointed out, however, that $25,000 for a drainage study is a small amount compared to the proposed cost of the Denver Convention Center.

TUESDAY, July 21, 1987

Adobe basements crumbling in San Luis

By WANDA DIETRICH
Courier Correspondent

SAN LUIS — Friends have told Dolores Arellano her house in north San Luis looks like Paradise. It is a nice house, with trees and colorful flowers greeting visitors and an idyllic view of a hay field to the north.

There is trouble in that Paradise, though, and Arellano blames it on the hayfield. The trouble is water, lots of water, in her basement.

She is not alone. Five other houses in San Luis have the same problem, and all five of them are near the same hay field. In a way, Arellano is luckier than her neighbors, because she has pumps to keep the water in her basement under control.

Some of the others don't.

Delores Alire measured 31 inches of water in her basement on July 13. She had to bail the water out by hand through the trap door in her kitchen.

Maurice Cordova found the walls in his adobe basement crumbling and falling in because of the high water.

Arellano and her neighbors blame their problems on the irrigation of the hay field. She says her basement water gets higher every time the field is flooded. A Soil Conservation Service engineering study dated June 15 also suggests the irrigation is the cause of the problem.

The city and county have conducted studies on the problem, but Arellano says they haven't gotten rid of the water in her basement.

"Now they are just going to do another study," she said. "We've already had a study. What good will another one do?"

A deep ditch dug earlier this year has been filled in by the county, but Arellano said water still runs there.

"It looks like a river," she said. Filling the ditch with loose dirt didn't seem to help any, she added.

The Town of San Luis and Costilla County are working to find a solution to what has proved to be a difficult problem. In the meantime, asks Arellano, "How am I going to pay my electric bills for the pumps?"

Alamosa, Colorado Tuesday, Octobe

San Luis receives $20,000 water gra

By WANDA DIETRICH
Courier Correspondent

AN LUIS — Water was again at the of the agenda at the San Luis ncil meeting, held Wednesday. The ncil heard from Dave Pacheco that proposal the town made to the state fund a $20,000 comprehensive inage study was successful, and that entire $20,000 will be made ilable to the town from the state.

Pacheco reported that although the ney will be made available, it is not ilable to the town yet. Before the n can put the work out for bids, they first receive and sign a contract ... ne state, detailing all obligations. e contract should arrive in about ee weeks to a month.

Pacheco further announced that the lorado Water Conservation Board ll provide technical assistance to the wn. In a letter Pacheco read to the uncil, Larry Lang of the Conrvation Board offered the assistance his board and advised that the town t take any action until the contract is gned.

Mayor Joe Espinoza asked if that eant that the council is to do nothing r a while, until the state contract is ceived and signed. Pacheco agreed, ying that "none of us are experts" in ese matters, and that they should ait until the experts get here, to do it ght.

Pacheco advised that when the study s completed, money to act on the roposals may be available from the mpact Assistance Fund, or the Community Development Block rants. If the study is completed by the part of January, Pacheco advised council to make a bid for some CDBG money.

Espinoza advised representatives of wo engineering firms, Armstrong Engineering and Agro Engineering, who were attending the meeting that although the council was not going to do anything until the time was right, they leave their literature, and tell they can do.

"That's about all we can do tonight," he said.

In a related matter, Pacheco reported that the town's request for emergency funding to install a drainage system around the town has not been acted upon by the governor. Normally, the town would be considered for funding of this nature, but the recent disaster on Berthoud Pass, where a boulder crushed a bus and used the entire budget for that fund, there is none available for the drainage system, or anything else, for a while.

Chris Maes of the Water and Sanitation District asked the board about the legality of cesspools, and if there are laws regulationg the dumping of raw sewage inside the town. He stated that "There are people in town using cesspools," and worried that they could be health and safety hazards.

"It's not right," he said.

The council agreed that they should help deal with the problem. After some discussion, it was decided that the town should try to do away with cesspools completely. They decided to start by writing those people who have cesspools letters quoting the ordinance against them, and requesting that they be removed.

In other business, Espinoza announced that a group of disabled veterans from Denver will be in San Luis to replace the flags that were stolen from the front of the Town Hall. He stated that there will be a parade for which he hopes to get a band, then a flag raising ceremony. He suggested that the town feed the participants lunch.

The council voted to feed them lunch.

Discussing the town's building that they have been considering renting, City Attorney David Graham gave the opinion that the town could not legally rent the building to a private entity. It was decided to rent it to the new Chamber of Commerce.

The signs that are to be put up on either side of town were not published by the local paper. They will be published this month, and the bids opened at the next meeting. Laura Vigil suggested that it be published in the Alamosa paper also, as more people receive this paper. The council decided to publish the signs in both papers.

Ernest Duran reported to the council that the new town trash pickup has been pruchased and is in service. He suggested that it might be nice to paint "San Luis" on the side.

On the subject of trash pick-ups, Ernest Quintana questioned the legality of having the city pick up only business trash, and supply the cans. The council stated that the painted trash cans are supposed to be for people's litter. After discussing the problem, the council decided to take the cans away from the local businesses, and have them get their own cans.

Espinoza cautioned that the cans will have to be removed from all businesses, with no exceptions.

Espinoza informed the council that Fr. Pat Valdez had approached him about the town buying the first of the Stations of the Cross for the new Stations of the Cross Park that the church is working on. Loyola Taylor questioned if it would be a violation of separation of church and state laws. The council decided to contact its attorney for an opinion on the matter.

The council requested to William Martinez that he come up with the price for making Christmas decorations for the town entrances. He promised to have them by the next meeting, October 21.

San Luis to apply for grant to remedy drainage woes

By SYLVIA LOBATO
Courier Staff Writer

SAN LUIS — If drainage problems here are not remedied soon, it may cost the taxpayers some $750,000 to build an additional sewage lagoon, but Mayor Joe Espinoza said the town is already taking steps to find a solution and has applied for a $25,000 grant to develop a drainage plan.

In addition, he said, the U.S. Soil Conservation Service has committed engineering, inspection and other work at no cost to the town, Williamson Ranch has offered an in-kind contribution of labor and equipment and Costilla County has also offered in-kind contributions.

Espinoza said the SCS area engineer has recommended a tile drainage system to alleviate problems in the northeast section of town, where most of the flooding is taking place, and the total cost of that system is about $78,980 — a great deal less than the price of a new lagoon.

Seasonal flooding has been a problem in northeastern San Luis for some time, and, while residents agree it is difficult to live with, they haven't been able to agree on the source of the water.

Some residents blame their flooded basements on irrigation and a nearby gravel pit, while others have suggested that the town irrigation system and the waters of the Rito Seco are the source of the problem.

Espinoza said the town is serious about finding the cause of the flooding and seeking a way to end it through an improved drainage plan.

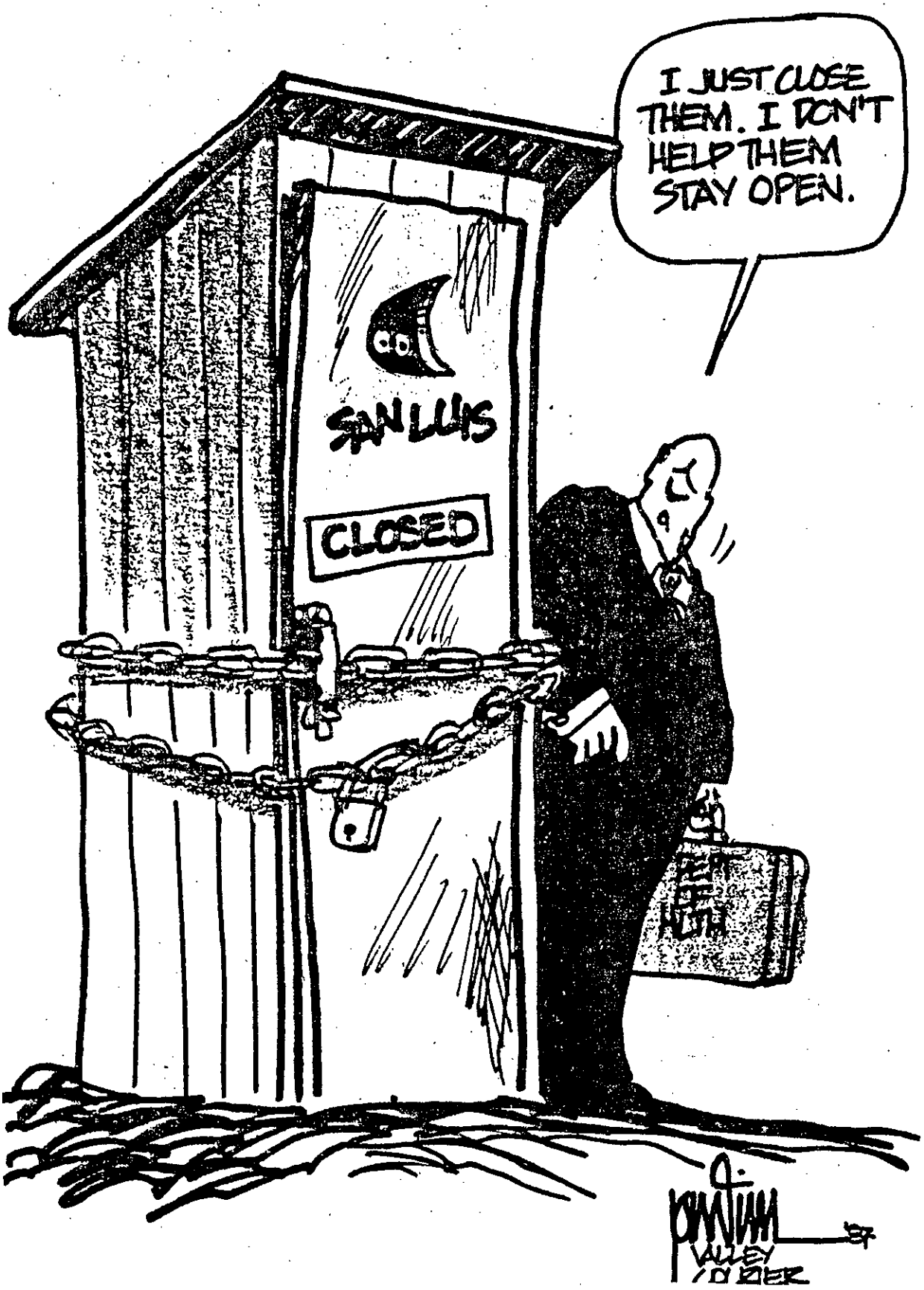
If nothing is done, he said, the problem could become even more costly to the taxpayers.

The Costilla County Water and Sanitation Department has been notified by the Colorado Department of Public Health that, if work isn't done to remedy the situation, construction must begin on a third sewage lagoon.

Espinoza said the warning stems from the fact that residents in northeastern San Luis have been pumping water from their flooded basements into the sewer, causing the existing lagoons to overflow and dump effluent into Culebra Creek.

David G. Pacheco, executive director of the Conejos-Costilla Community Action Agency, will direct the new project, Espinoza said, adding that he and Pacheco will attend a conference in Gunnison Aug. 20 and submit the town's application for the $25,000 planning grant.

STATE, NATION AND WORLD



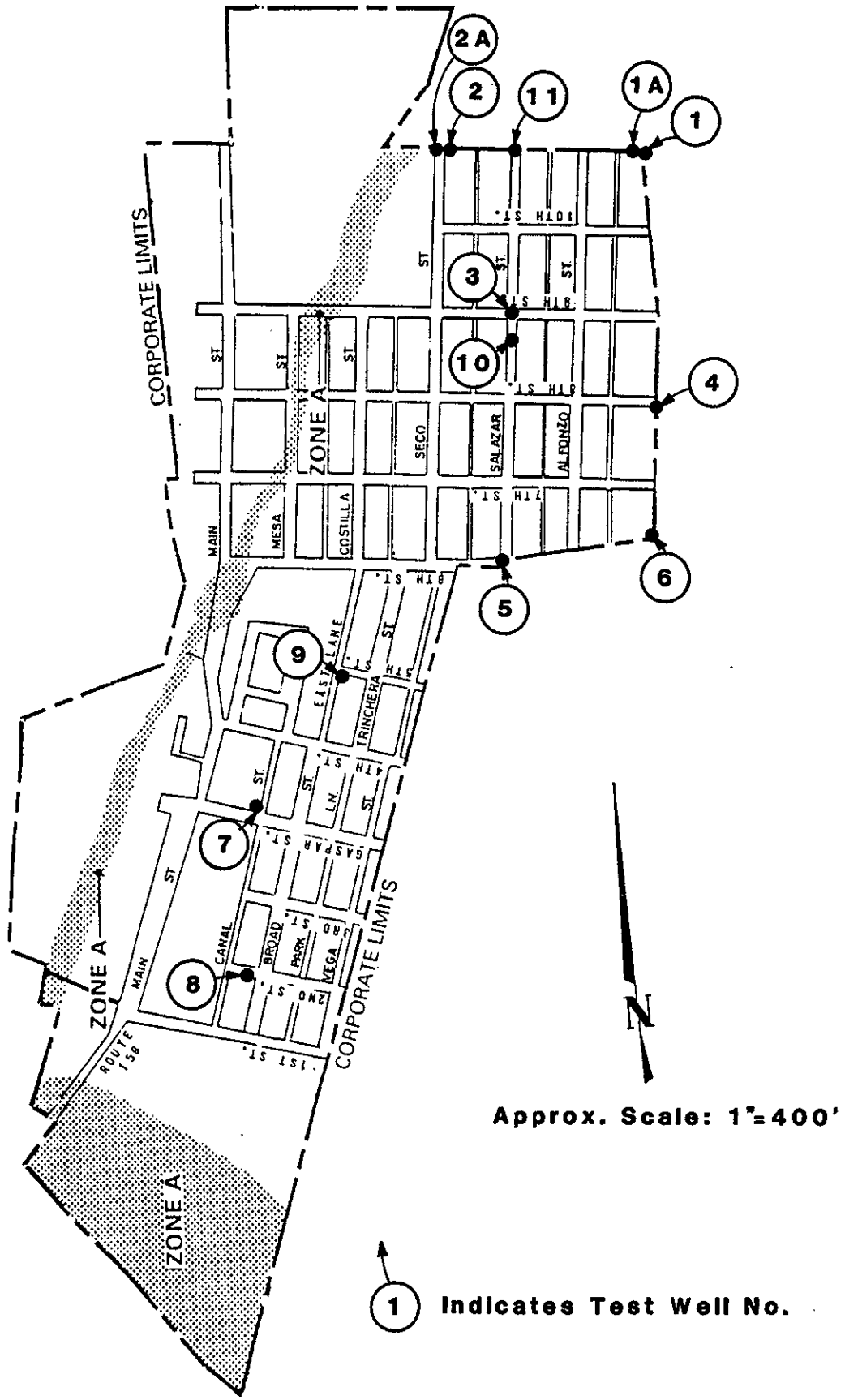
During SCS investigation, the exact cause of the high water table was not determined although irrigation to the north of town was believed to be a heavy contributor along with the high spring snow melt runoff.

2. Investigation

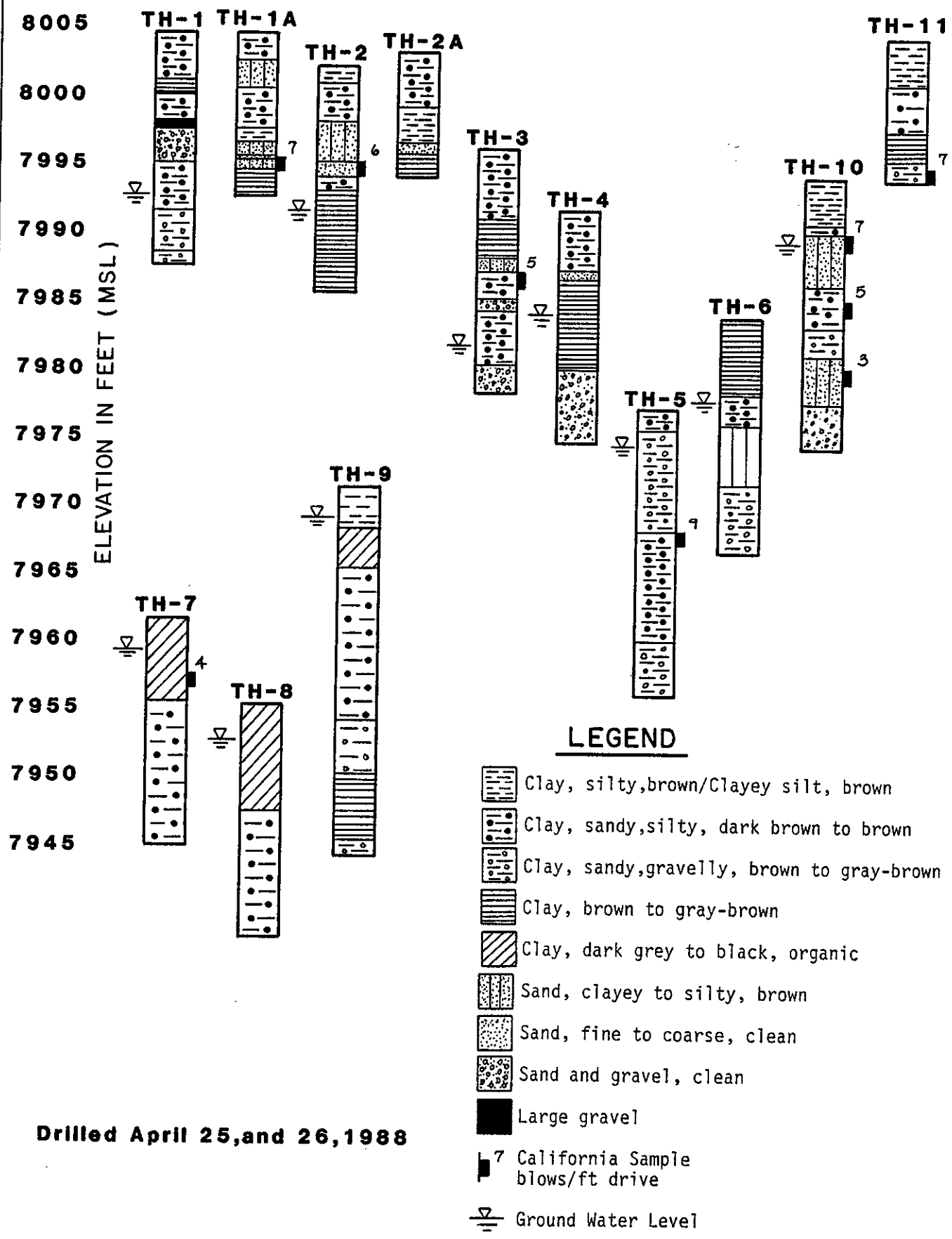
On April 25 and 26, 1988, under the supervision of WRC, Custom Auger Drilling Company of Denver drilled 13 monitoring wells at various locations throughout the Town of San Luis. These wells were installed to gather base data for analyzing the community's groundwater problems.

See Figure 3 - LOCATION OF MONITORING WELLS

The wells were drilled to depths of from 10 feet to 27 feet. Soil logs and depths to ground water at the time of drilling are shown on Figure 4 - LOGS OF MONITORING WELLS. At the time of drilling ground water was present in all but three of the wells at depths of from 3 feet to 17 feet below the surface. The three wells that were dry initially were drilled to a shallower depth then the other to determine if the irrigation along the north end of town would create a "perched" water table. Staff of the Costilla Conejos County Community Action Agency were instructed on procedures for reading the test wells and did so on a daily basis from the week of drilling through the end of July, 1988. After August 1, readings were taken on a weekly basis until the end of September, at which time they were discontinued. The readings were mailed on a weekly basis to WRC Engineering in Denver. Results of the readings are shown on Figure 5A-5C - "DEPTH TO GROUND WATER - MONITORING WELLS". Twelve of the wells were cased with 2" PVC with the length of the perforated portions of the pipe varying from between 5 feet and 12 feet depending on the depth of the well. In order to perform a pumping test to determine the characteristics and properties of the aquifer, Well No. 10 was cased with 20 feet of 4" PVC 10' slotted and 10' solid. All wells were cemented near the surface and capped with threaded caps. The soil logs indicated that the subsoils north

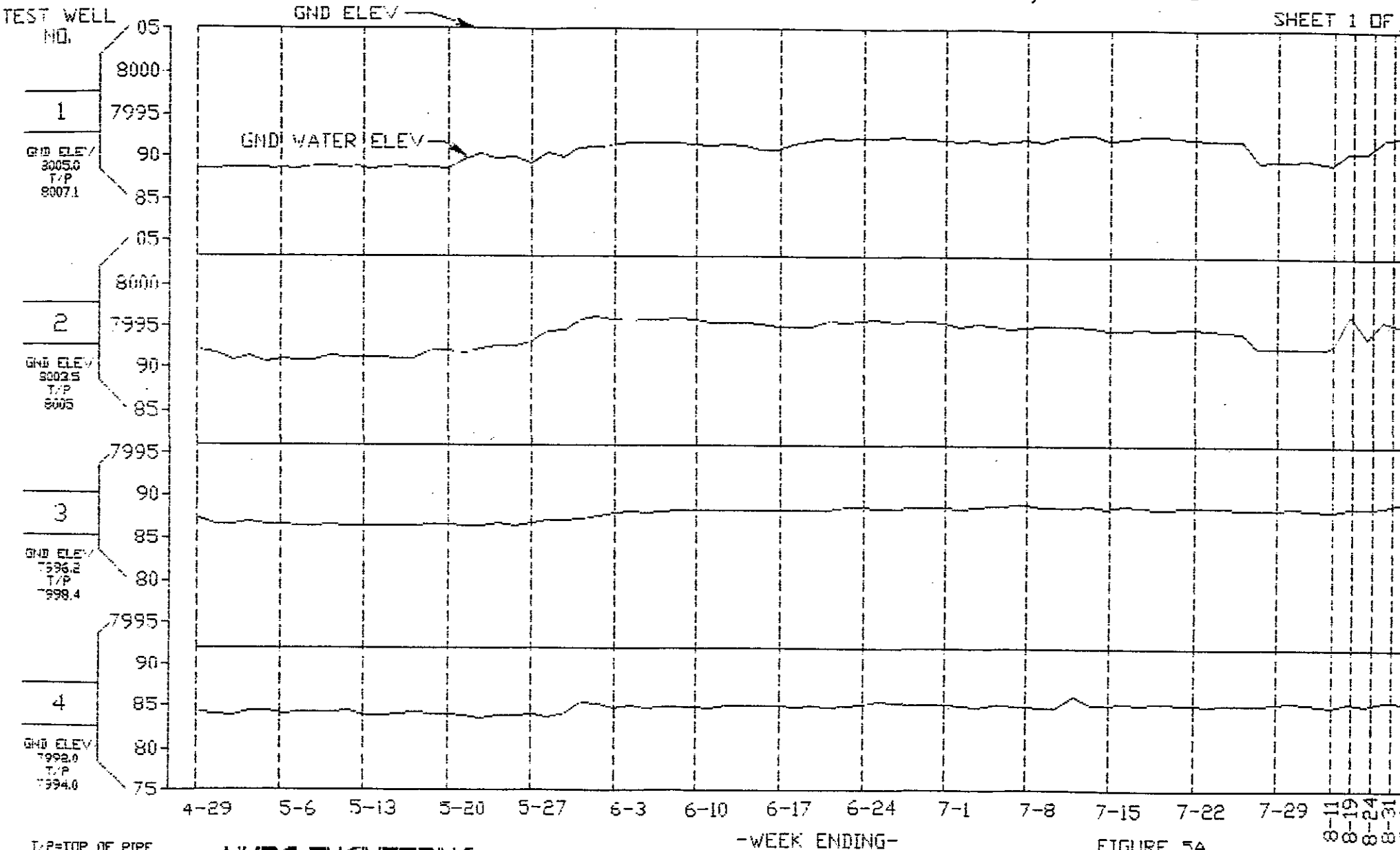


WRC	Job # 1667	SAN LUIS, COLORADO	LOCATION OF MONITORING WELLS	FIG. 3



WRC	Job # 1667	SAN LUIS, COLORADO	LOGS OF MONITORING WELLS	FIG.4

1988 GROUND WATER ELEVATIONS—SAN LUIS, COLORADO

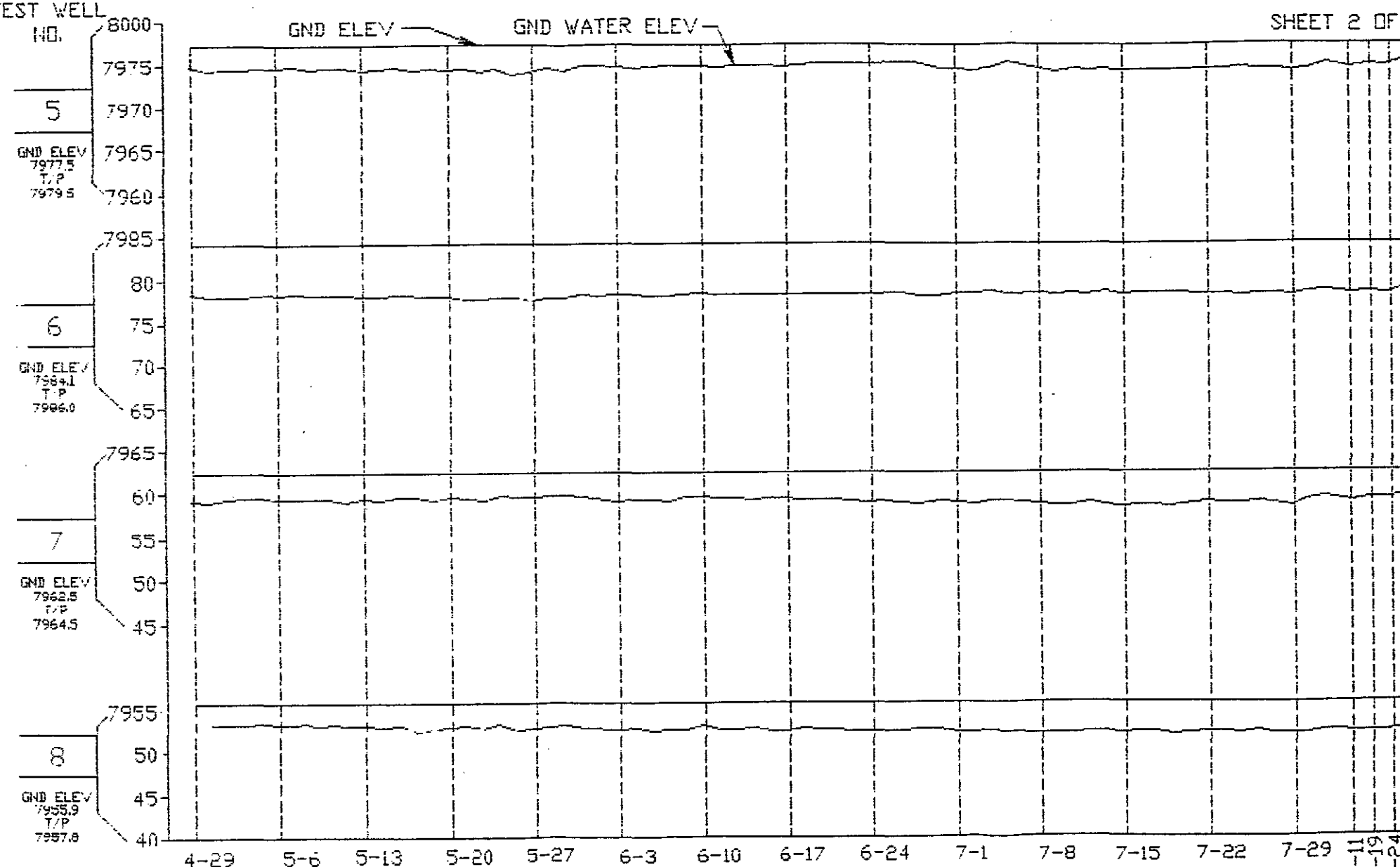


T/P=TOP OF PIPE

WRC ENGINEERING, INC.

FIGURE 5A
-DEPTH TO GROUND WATER-
MONITORING WELLS

1988 GROUND WATER ELEVATIONS—SAN LUIS, COLORADO

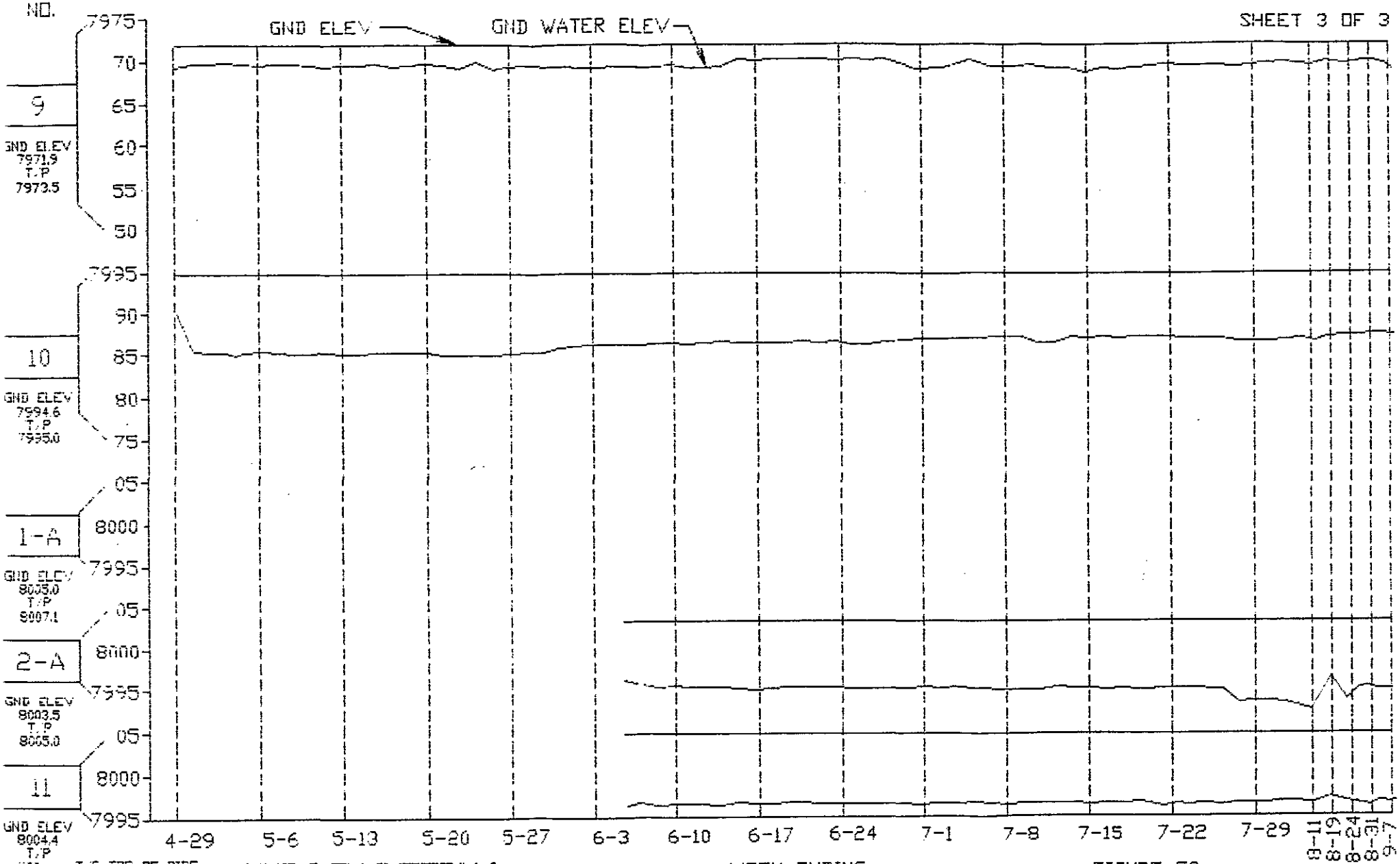


T/P=TOP OF PIPE

WRC ENGINEERING, INC.

FIGURE 5B
-DEPTH TO GROUND WATER
MONITORING WELLS

1988 GROUND WATER ELEVATIONS–SAN LUIS, COLORADO



WRC ENGINEERING, INC

FIGURE 5C
-DEPTH TO GROUND WATER-
MONITORING WELLS

of 6th Street consist of interlayed and intermixed sand, silt, clay and some sand/gravel mixtures. The log of existing Well No. 29389 shows similar soil profile.

In the southern part of Town, the presence of organic clay at and near the surface indicates that swampy conditions have likely existed there for a long period of time. The number of artesian wells south of Gaspar Street are probably contributing factors to the swampy conditions.

Initially and throughout the duration of the study, there were no reports of water in basements or crawl spaces. Our readings indicate that the depth to water in the northeast area varied from 2' to 12.5' with the shallowest depths occurring in mid July for most wells. Through interviews with local residents and the SCS, we project that the groundwater levels in 1986 and 1987 were approximately 3 to 4 feet higher than the 1988 levels.

The project Scope of Work called for a pumping test to be performed to determine the transmissivity and the storage coefficient for the water bearing strata. Well No. 10 was cased with a 4" PVC pipe so that it could be pump tested. However, upon insertion of a submersible pump the well was pumped dry within three minutes. WRC concluded that the well would need to be developed (a considerable expense) before a successful pumping test could be performed. WRC made arrangements with Valley Pump of Monte Vista to test Well No. 29389 on Amos Bernal's property at 907 Salazar Street as an alternative.

On July 18, 1988, Valley Pump installed a pump approximately 43 feet below surface in the 55 foot deep, 6" cased well. After adjusting pump, meter and discharge hose, testing began at approximately 8:30 a.m. Test Wells No. 3 (265' south of well) and No. 10 (450' south of well) were used as monitoring wells. After 8 minutes of pumping at 12 gpm both test wells were drawn down 0.2 feet. No additional drawdown was present after one hour of pumping. WRC checked test Well No. 2 (700' NW of well) for 15 minutes and observed no

difference in the water level. Valley Pump increased the pumping rate to 22 gpm and the test wells were monitored again for 15 minutes with no change in the water level. At this point WRC determined that the pumping test was not yielding conclusive results, so pumping was discontinued.

Due to the failure of the pumping test to yield positive results, it was necessary to estimate the properties of the aquifer by other methods. Sieve analysis was performed on soil samples from 4 of the test wells and an average permeability of 106 gpd/ft^2 was determined. Based on a length of 1200 feet (the maximum width of the three block area in the northeast part of town) and lowering the water table by a maximum of 4 feet, the interception rate required would be 0.73 cfs. This is the minimum rate that the dewatering system will be based on.

3. Alternative Solutions

Two different means of lowering the water table were investigated: a) system of well points and b) subdrain perforated pipe system. The investigation considered the engineering and construction concepts as well as installation plus operation and maintenance costs in developing the project recommendation.

a. Well Points

WRC determined that in order to drop the water table a depth of two feet using well points would require approximately 60 well points along (spaced at 20' along a 1200' line). The initial cost of this system is estimated to be from $50,000 to $70,000. O&M costs per year were estimated at $50,000 a year, including pump rental and normal maintenance.

b. Subdrain system (gravity flow)

A gravity subdrain system consisting of three parallel east-west perforated pipes connected to a solid north-south

collection pipe discharging into the Vega south of 6th Street was considered. Estimated costs for the system are between $100,000 and 150,000 depending on the difficulty of construction.

4. Recommendations

Based on review of preliminary costs as well as the ability for the system to function with a minimum of human intervention, WRC recommends that a gravity flow subdrain system be installed in the northeast section of the Town of San Luis. Preliminary Design for the recommended system is shown on Sheet 1 of 4 of the drawings and is described as follows:

Three 10" PVC perforated pipes will be placed between Pedro Street and Casa Verde Street at the following locations - the north edge of town, along 9th Street and along 7th Street. These three lines will drain to a solid PVC collection line (10" to 12" diameter) which will run the length of Salazar Street and will be extended south to discharge into the Vega.

At the junction of the perforated pipes and the solid pipes in Salazar Street, 4' I.D. manholes will be installed. At each of the upper ends of the perforated pipes, PVC cleanouts will be installed. In addition three cleanouts will be installed in the Salazar Line at 10th, 8th and 6th Streets. Depths of the North Line and 9th Street Line will be a minimum of 8 feet with the minimum depth of the 7th Street Line being approximately 4 feet. Each leg of the parallel lines will have the ability to carry 0.7 cfs. The main line in Salazar Street will have a capacity of from 1.7 cfs to 2.6 cfs and will discharge some 300' south of 6th Street into the Vega. Details of trench excavation and backfill are shown on Sheet 1 of 4 of the drawings.

B. HIGHWAY 159 CROSSING OF RITO SECO

1. History

In 1985, the Colorado Department of Highways replaced a dangerous bridge at the location of the State Highway 159 crossing over the Rito Seco. The old highway bridge at this location was estimated to be a 20 foot span with a 4 foot vertical opening or 80 square foot of conveyance area. The Highway Department replaced the bridge with two 24 inch corrugated metal pipe culverts with a conveyance area of 6.3 square feet. The Highway Department believed that only the flow from the Rito Seco Basin which would be released by the 24 inch culvert through the levee crossing location would enter the two 24 inch CMP's at the highway location. However, during heavy rains and flooding conditions, the flow from the North and East Drainage Basins is choked off by the culverts. The stormwater runoff will overflow the highway culverts and run southerly down Main Street. The North Drainage Basin of 4.5 square miles should have been included in the sizing of the new culverts at the Rito Seco and Highway 159 location. In addition, the Corps' Emergency Levee System does not meet FEMA Levee standards.

2. Investigation

WRC performed an inventory of the hydraulic structures along the Rito Seco to determine the hydraulic capacity of the existing structures. Based on this inventory, channel cross sections surveyed by Rincon, and the 100 year storm flow hydrology developed by SCS, WRC was able to explore alternate structures capable of passing the 100 year flow beneath Highway 159.

3. Alternative Solutions

Based on the fact that the Corps of Engineers' Emergency Levee has restricted the flow into the Rito Seco from the East Drainage Basin and that the SCS hydrology indicates that the 100 year flow from the North Drainage Basin is approximately 180 cfs, the proposed crossing

structure at Highway 159 will not require the capacity of the bridges upstream and downstream (approximately 300 cfs). Therefore, the need for a larger single or double span bridge was eliminated. The alternatives considered were single or multiple culvert installations. Due to the limited amount of depth available between the crown of the highway and the channel bottom, selections were further limited to multiple culvert installation, specifically a double 6' x 3' reinforced concrete box culvert and double 57" x 38" corrugated steel pipe and with concrete headwalls.

4. Recommendations

WRC recommends that a double 6' x 3' reinforced concrete box culvert with headwall and wingwalls be installed in the Rito Seco beneath Highway 159. In addition, the downstream channel from Highway 159 to Highway 142, including the portion under the Highway 142 bridge will need to be graded to provide positive slope and reduce the backwater downstream from Highway 159. The concrete structure will provide approximately 2.0 feet of freeboard during the 100 year storm as opposed to approximately 0.5' for the corrugated steel structure. The concrete structure would provide the business area with additional flood and drainage protection.

See Sheet 2 of 4 of Drawings.

C. PROTECTION PROVIDED BY LEVEE

1. History

At the request of the local governments, the Albuquerque District, Corps of Engineers became involved with the community of San Luis during January of 1979. During the winter of 1978-79, abnormal snowpacks were building in the mountains above San Luis and the potential for spring flooding was evident. The Corps of Engineers, under emergency measures, constructed a levee along the east edge of town to divert possible floodwater coming from the East Drainage of the Rito Seco. The 1979 levee construction divided the East Drainage and North Drainage and has provided flood protection to the town. The levee is an engineered structure and was constructed under Corps of Engineers standard of excellence. The as-built plans and specifications for the levee project are available at the Corps of Engineers Office in Albuquerque, New Mexico.

In its present condition the levee will not meet Federal Emergency Management Agency (FEMA) levee certification requirements for flood control protection. A part of this study was to determine what measures would be required to bring the levee up the the FEMA standards and provide 100 year flood protection for the community.

2. Investigation

WRC obtained the FEMA Regulations for levees. The requirements for protection from the 100 year flood are that:

- The levee provide 3.0 feet of freeboard above the 100 year water surface elevation.
- All openings must be provided with closure devices.
- Levee embankments must be protected from erosion.
- Levee embankments stability must be evaluated.
- The interior drainage system must be evaluated.
- An operation and maintenance plan must be implemented for the levee system.

We also reviewed the as-built drawings of the levee provided to WRC by the CWCB. In addition to this information field survey data including profile and cross sections of the levee and the floodplain area to the east. Based on a limited number of field shot cross sections, WRC established an approximate 100 year water surface profile for the area adjacent to the levee. This profile and corresponding floodplain are shown on Sheet 4 of 4 of the drawings. Based on this data generated by the HEC-2 water surface profile computer program, an estimate of the levee profile required to provide 3.0 feet of freeboard could be established. That profile is also shown on Sheet 4 of 4. The profile indicates that the elevation at the top of the levee needs to be increased and average of 1.5 feet from the southern and to approximately 600 feet north of 6th Street.

Two soil borings were drilled in the levee to determine the soil type and approximate stability of the levee. Levee material consists of medium dense, silty, sandy, gravel and the underlying base of organic clay. The levee is generally sparsely covered with vegetation that contributes to its stability. Based on WRC's HEC-2 profile, the 100 year depth at the levee does not exceed 2.0 feet, the structural integrity of the levee should not be threatened.

It should be noted that the level of accuracy of this profile may be limited by the distance between cross sections (up to 2000 feet in some locations) and WRC recommends that prior to preparing construction drawings for levee improvements, additional cross sections at no greater than 500 foot intervals be taken and the HEC-2 run refined accordingly.

3. Alternative Solutions

In order to provide the required 3.0 feet of freeboard, approximately 4700 lineal ft. of the levee will have to be raised by an average of 1.5 feet. Within this stretch three openings in the levee exist for the purpose of providing access in and out of Town, namely Gaspar Street, 4th Street and 6th Street. The following

alternative solutions were investigated in order to choose a means of providing the 3.0' freeboard at the street crossings:

a) Increasing the grade of the street crossings to match the grade of the new top of the levee, resulting in a fill of 3.7 to 4.6 feet at the crossings.

b) Increasing the street grade to match the elevation of the 100 year water surface, providing a closure structure consisting of concrete retaining walls and wooden stop logs 3.0 feet in height.

c) Increasing the street grade to 1.0 feet above the 100 year water surface elevation, providing a closure structure consisting of concrete refraining walls and wooden stop logs 2.0 feet in height.

4. Recommendations

WRC recommends that alternative b) be used for the street crossings. In addition, the levee in the vicinity of 6th Street will be relocated approximately 100 feet east of its present location so as to not interfere with the grading of adjacent private property driveways. The preliminary details of this option are shown on Sheet 1 of 4.

This alternative will result in the least disturbance to the sight distance and minimize the street reconstruction.

As previously mentioned, a more refined profile HEC-2 run will be required prior to preparing construction plans for the rehabilitation of the levee system. Significant changes may lead to more economical designs.

D. NORTH BASIN OF RITO SECO

1. History

The north basin of the Rito Seco consists of 4.5 square miles that drains into the Rito Seco mainly via overland flow. The drainage concentrates in a broad swale on the high school property. Historically, and as shown by the SCS floodplain delineation in their Close-out Report, September, 1980, flow from major storms crosses 9th Street in the vicinity of State Highway 159 divides and flows overland until it reaches the Rito Seco Channel, a portion at 8th Street and the remainder near 6th Street and Highway 159. Portions of the developed part of Town are located in the floodplain, including the future post office site at 9th Street and Highway 159.

2. Investigation

On June 8, 1988 WRC conducted an on site inventory of the hydraulic structures along the Rito Seco commencing at the 24" CMP through the levee northeast of Town to its confluence with Culebra Creek south of Town. The inventory consisted of photographing and measuring all structures within this reach. A ground survey was conducted to check elevations with those shown on the topographic mapping provided by the Town. WRC also reviewed the water surface profile study (WSP-2) done by SCS and modified the input to be used for a HEC-2 run on the proposed improved conditions. Using the surveyed information, measurements from the inventory and the topographic mapping, WRC confirmed that the crux of the problem was that the runoff from the North Drainage Basin does not have a defined channel to carry the flow to the Rito Seco. In order to reduce this overland flooding condition into the developed portions of Town, a flood control measure must be devised to carry the flow into the Rito Seco Channel.

3. Alternative Solutions

Three main alternatives were investigated to provide a means to concentrate the 100 year flow through the high school property and convey it to the Rito Seco north of 9th Street.

a) an open diversion channel with a 35 foot top width, an 8 foot bottom width at a 100 year depth of 2.5 ± feet

b) a storm sewer system to carry the 100 year flow from the school property

c) a combination of a low flow storm sewer system, an open channel and broad grassed swale

4. Recommendations

WRC recommends that the flow from the North Drainage Basin be concentrated downstream of the school entrance from Highway 159. In order to accomplish this a concrete low flow ford dropping into an open channel of grouted riprap will be required (see Sheet 2 of 4 of drawings). From the open channel the low flow will be collected by a drop inlet and directed into a 24" storm sewer just upstream from the school entrance from 9th Street. The higher flows will pass over a concrete overflow structure and be carried to the Rito Seco in a broad grass-lined swale through the playground. This will minimize reshaping of the area south of the school and should not affect playground activities in the area except during construction, and flood conditions. The flood depths and velocities will not be hazardous to human activities in the area.

See Sheet 2 of 4

COST ESTIMATE FOR SUB DRAIN *

	ITEM	QUANTITY	UNIT	UNIT COST	EXTENSION
1.	10" PERF PVC	3,500	L.F.	$ 12.00	$ 42,000.00
2.	10" SOLID PVC	1,750	L.F.	11.00	19,250.00
3.	12" SOLID PVC	750	L.F.	12.00	9,000.00
4.	4' DIA. M. H'S	3	EA.	1,000.00	3,000.00
5.	CLEANOUTS	9	EA.	300.00	2,700.00
6.	SEWER LINE ENCASEMENT	60	L.F.	20.00	1,200.00
7.	LOWER 4" W.L.	1	EA.	400.00	400.00
8.	SAND-GRAVEL D50 = 5MM	2,750	TONS	8.00	22,000.00
9.	CONCRETE CUTOFF WALLS	6	EA.	100.00	600.00
10.	ASPHALT PAVEMENT 3" THICK	2,600	S.Y.	7.00	18,200.00
					$118,350.00
			15% CONTINGENCY		17,650.00
			SUB TOTAL I		$136,000.00

COST ESTIMATE FOR HIGHWAY 159 CROSSING *

60 L.F. 2 - 6 X 3 - RCBC @ $260.00/L.F. =	$ 15,600.00
WINGWALLS & APRON	2,900.00
CHANNEL GRADING 500 L.F. L.S. =	2,000.00
TRAFFIC CONTROL L.S. =	20,000.00
	$ 40,500.00
15% CONTINGENCY	6,000.00
SUB TOTAL II	$ 46,500.00

* THESE COSTS SHOULD BE CONSIDERED AS PRELIMINARY SUBJECT TO CHANGE DURING THE FINAL DESIGN PHASE.

PRELIMINARY COST ESTIMATE FOR LEVEE IMPROVEMENTS *

	ITEM	QUANTITY	UNIT	UNIT COST	EXTENSION
1.	LEVEE EMBANKMENT	11,000	C.Y	$ 3.00	$33,000.00
2.	CONCRETE RETAINING WALL	28	C.Y.	250.00	7,000.00
3.	SALT TREATED FIR STOP LOGS (2" X 12")	252	L.F.	6.00	1,512.00
4.	STREET CONSTRUCTION				
	a) EMBANKMENT	1,400	C.Y.	5.00	7,000.00
	b) PAVEMENT REMOVAL AND REPLACEMENT	2,500	S.Y.	12.00	30,000.00
					$78,512.00
		15% CONTINGENCY			11,488.00
					$90,000.00

* THESE COSTS SHOULD BE CONSIDERED AS PRELIMINARY SUBJECT TO CHANGE DURING FINAL DESIGN PHASE.

COST ESTIMATE FOR NORTH RITO SECO BASIN *

	ITEM	QUANTITY	UNIT	UNIT COST	EXTENSION
1.	24" RCP	785	L.F.	$ 30.00	$23,550.00
2.	4' I.D. MH	1	EA.	1,000.00	1,000.00
3.	CONCRETE FLAT WORK (6" THICK)	700	S.Y.	20.00	14,000.00
4.	RIPRAP CHANNEL	100	L.F.	100.00	10,000.00
5.	TYPE C INLET (DOUBLE)	1	EA.	1,200.00	1,200.00
6.	RIPRAP CHANNEL PROTECTION	150	TONS	30.00	4,500.00
7.	BEDDING	80	TONS	20.00	1,600.00
8.	EXCAVATION	1,000	C.Y.	3.00	3,000.00
9.	REVEGETATION	5	AC	1,250.00	6,250.00
					$65,100.00
	CONTINGENCY @ 25% * *				16,300.00
	SUB TOTAL IV				$81,400.00

SUMMARY

I	$136,000
II	46,500
III	90,000
IV	81,400
TOTAL	$353,900

* THESE COSTS SHOULD BE CONSIDERED AS PRELIMINARY SUBJECT TO CHANGE DURING FINAL DESIGN PHASE.

** CONTINGENCY IS HIGHER DUE TO POSSIBLE REGRADING OF SCHOOL PARKING LOT AREA.