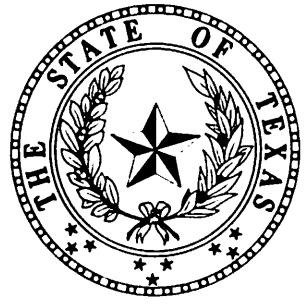
PLAN SUMMARY REPORT
for the
RED RIVER STUDY AREA
WATER QUALITY MANAGEMENT PLAN



Prepared by

RED RIVER AUTHORITY

for

TEXAS DEPARTMENT OF WATER RESOURCES

August, 1978

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EXCERPT FROM

FISCAL YEAR 1980 REVISIONS

TO THE

STATE OF TEXAS WATER QUALITY MANAGEMENT PLANS

RED RIVER STUDY AREA

Developed in accordance with Section 208
of the Federal Clean Water Act of 1977 and
Title 40 Code of Federal Regulations
Part 35, Subpart G

Compiled by

TEXAS DEPARTMENT OF WATER RESOURCES

July 1980

FISCAL YEAR 1980 REVISIONS
TO THE
STATE OF TEXAS WATER QUALITY MANAGEMENT PLANS

INTRODUCTION

Initial water quality management plans were developed in accordance with the requirements of Section 208 of the Federal Clean Water Act, Public Law 95-217, during the period of 1975-1979. Upon completion of significant plan documents, certification was made by the Governor of Texas that the completed document was prepared in accordance with the Act and applicable federal regulations and that the plan document was adopted as the State Water Quality Management Plan for the affected area. Subsequent to that initial certification, more accurate information has been developed regarding municipal facility needs, facility design information, and facility population projections.

The primary sources of the more recent data are the revised statewide population projections (by county and designated area) contained in the document "POPULATION PROJECTIONS FOR TEXAS" (certified by the Governor) and facility-specific information developed as part of the application and/or facility planning phases of the Section 201 (PL 95-217) Construction Grants Program. The information developed within the Section 201 program has been evaluated by the Texas Department of Water Resources in cooperation with the local 208 planning agency for the affected area and the results of those evaluations are summarized in this document.

The information presented in this document is intended only to revise the facility planning information for the areas listed in the following tables. Other areas for which information is presented in the initial water quality management plans are not affected by this document.

FACILITY INFORMATION

The following tables are organized by 208 planning areas, both state and designated. Within each table, facility planning information is provided in five categories:

1. AREA - City or special district for which proposed needs are identified. The physical planning boundaries for the area are established in the management agency designation for that area certified by the Governor.

2. MANAGEMENT AGENCY - The entity proposed for designation as the management agency for the collection, treatment or both for the area in accordance with Section 208(c) of the Clean Water Act. Many of the entities listed have already been designated by the Governor for the purposes shown.

3. POPULATION - Base and projected population for the area. The population projections presented herein are consistent with the statewide population projections in "POPULATION PROJECTIONS FOR TEXAS"

and the requirements of paragraph 8a of Appendix A to Title 40 Code of Federal Regulations Part 35, Subpart E (Construction Grants).

4. TREATMENT/COLLECTION NEEDS - The columns shown under the TREATMENT NEEDS heading indicate a probable need for new facilities (N), expanded facilities (E) in terms of treatment capacity (volume), and/or upgraded facilities (U), which may be required due to more stringent effluent limits or needed plant rehabilitation. The columns under the COLLECTION NEEDS heading indicate a probable need for a new collection system (N), expansion of an existing system (E), and/or rehabilitation (R) of an existing system.

5. COMMENTS - Any special conditions relative to an area's needs are indicated in this column.

UTILIZATION OF FACILITY INFORMATION

The facility information in this document is intended to be utilized in the preparation of facilities plans and the subsequent design and construction of needed facilities, primarily in the Section 201 Construction Grants Program. Design capacities of units of the treatment and collection systems shall be based upon the population projections contained in this document plus any additional needed capacity established for commercial/industrial influents and documented infiltration/inflow volumes (treatment or rehabilitation).

The probable needs shown under the TREATMENT NEEDS and/or COLLECTION NEEDS headings are preliminary findings; specific needs for an area shall be as established in the completed and certified detailed engineering studies conducted during Step 1 (facilities planning) of the Section 201 Construction Grants Program.

EFFLUENT LIMITS

Specific effluent quality for any wastewater discharges resulting from any of the facilities recommended in this document shall be in accordance with Chapter XVIII, Effluent Standards, of the Permanent Rules of the Texas Department of Water Resources in effect at the time of permit issuance for the specific facility.

RED BASIN

AREA	MANAGEMENT AGENCY (Collection/Treatment)	POPULATION				TREATMENT NEEDS			COLLECTION NEEDS			COMMENTS
		BASE (Year)	5 YEAR (Year)	10 YEAR (Year)	20 YEAR (Year)	N	E	U	N	E	R	
Canyon	City of Canyon (C/T)	11,900 (1980)		16,400 (1990)	21,600 (2000)		X				X	
DeKalb	City of DeKalb (C/T)	2,600 (1980)		3,200 (1990)	3,800 (1999)	X						
Ector	City of Ector (C/T)	615 (1980)		664 (1990)	714 (2000)		X	X				
Honey Grove	City of Honey Grove (C/T)	2,146 (1980)			1,600 (2000)			X			X	Add additional sludge bed area
Howe	City of Howe (C)	1,948 (1977)			4,300 (2000)					X		
Memphis	City of Memphis (C/T)	3,227 (1970)	3,100 (1980)	2,950 (1990)	2,950 (2000)			X			X	
Paris service area including Toco	City of Paris (C/T)	26,250 (1977)	28,400 (1983)	30,500 (1990)	33,500 (2000)		X			X		
Pottsboro	City of Pottsboro (C/T)	851 (1970)			1,900 (2000)					X		New interceptor
Reno	City of Reno (C/T)	1,100 (1980)		1,677 (1990)	2,180 (2000)	X			X			
Sherman (including Howe)	City of Sherman (C/T for Sherman) (T for Howe)	32,404 (1980)		44,850 (1990)	57,431 (2000)		X	X		X	X	
Whitesboro	City of Whitesboro (C/T)	3,286 (1980)	3,458 (1985)	3,661 (1990)	4,109 (2000)			X		X		Wastewater rehab. contingent upon SSES

PLAN SUMMARY REPORT

FOR THE

RED RIVER STUDY AREA

WATER QUALITY MANAGEMENT PLAN

Developed to Satisfy
Section 208 Requirements
of the
Federal Water Pollution Control Act
Amendments of 1972

Pursuant to
Title 40 CFR 130 and 131 and
The State of Texas Continuing Planning Process

PREPARED BY

RED RIVER AUTHORITY

FOR

TEXAS DEPARTMENT OF WATER RESOURCES

The preparation of this report was financed through planning grants from the State of Texas and the U.S. Environmental Protection Agency through the Texas Department of Water Resources.

AUGUST, 1978

Revised: March, 1980

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PREFACE

In order to estimate costs and other characteristics of sewage collection and treatment systems, it is necessary to make estimates of future service areas, treatment plant locations, lift station locations, and trunk line layouts. These locations and configurations are estimated for preliminary planning purposes and should be considered as approximate rather than specific. Accordingly, the locations and configurations presented within this report are not specific requirements of the plan. The exact location and sizing of sewer collection/treatment system elements will be determined for a given service area when a detailed engineering study is done either as part of the 201 Facility Plan or as part of a preliminary engineering study undertaken independently of the grant program. Appropriate changes in the recommendations of this report will be made at that time as necessary, to reflect actual conditions for the area.

CHAPTER A

INTRODUCTION

1. INTRODUCTION

Section 208 of the Clean Water Act of 1977 (Public Law 95-217) requires areawide wastewater treatment management planning be performed throughout the nation. The planning described in this Section of the Act consists of two types:

1) In areas with complex water quality problems the Governor designates (a) the boundaries of each such area, and (b) a local planning agency which is to be responsible for preparing a wastewater treatment management plan for that area.

2) The State is responsible for preparing a water quality management plan for the remainder of the State not designated by the Governor.

The policies and procedures established by the Environmental Protection Agency, for the accomplishment of Section 208 planning by both the State and designated areawide planning agencies, are set forth in Title 40, Code of Federal Regulations, Parts 130 and 131.

Within Texas, eight areas have been designated by the Governor as being complex water quality problem areas: Killeen-Temple, Southeast Texas, Corpus Christi, Dallas-Fort Worth, Houston, Lower Rio Grande Valley, San Antonio, and Texarkana. In order to prepare a water quality management plan for the remainder of the state, the state has been divided into fifteen planning areas. The boundaries of these fifteen areas essentially follow the hydrologic boundaries of the major river basins.

The water quality management plan being prepared for each of these state planning areas will consist of two primary documents:

1) Volume I. Basic Data Report will include information on existing wastewater treatment facilities; existing water quality; existing land use patterns; existing population; and on projections of economic growth, population, and probable land use patterns.

2) Volume II. Plan Summary Report presents the recommended plan for water quality management and the legal, financial, and institutional requirements of that plan. It also includes a description of feasible alternatives, an environmental assessment, and a summary of public participation activities conducted in the development of the plan.

The following document is the final report (Volume II. Plan Summary Report) for the Red River Study Area. It was developed through the efforts of the Red River Authority of Texas for the Texas Department of Water Resources in conformance with the State of Texas Continuing Planning Process, as amended April 1976, and the appropriate federal regulations. All plan elements as specified in Title 40, Code of Federal Regulations, Part 131 are set forth in either Volume I. Basic Data Report or Volume II. Plan Summary Report.

2. PROBLEM DEFINITION

Volume I identifies two categories of problems which are to be addressed in Volume II. The first category includes water quality problems which can be identified from an analysis of in-stream water quality data. The second category of problems includes those which are due to needs for various types of wastewater system facilities in a given community. The following problem definition chapter summarizes the specific in-stream water quality problems and facility needs which are addressed in this volume.

3. WATER QUALITY PROBLEM AREAS

The purpose of Chapter F, "Water Quality Assessment", in Volume I was to analyze existing data and make comparisons of existing water quality levels to the water quality standards in order to identify water quality problem areas. The majority of the data used to define water quality problems came from the following two sources:

1. Texas Department of Water Resources Surface Water Monitoring Network

2. United States Geological Survey Cooperative Program

The water quality problem areas are generally defined as segments within each basin that have shown violations of the Texas Water Quality Standards as established by the Texas Department of Water Resources.

Following is a summary of the problems identified in Chapter F and other in-stream water quality problems which have been identified subsequent to the preparation of Volume I. These additional problem areas have been identified as a result of public hearings, advisory committee meetings, and the review of Volume I by interested parties.

The most recurrent water quality problems in the Red River Study Area are surface water temperature violations in the Pease River and dissolved oxygen violations in the Little Wichita River and McKinney Bayou. The following discussion will present in numerical order the water quality violations exhibited by each segment.

a. Segment 0201. Segment 0201 of the Red River exhibited a pH violation on November 20, 1974. The recorded pH value on this date was 6.0, which falls below the minimum stream standard of 6.5. The segment has also exhibited three dissolved oxygen violations ranging in value from 4.0 mg/l to 4.8 mg/l. These dissolved oxygen violations occurred on Devember 6, 1972, August 6, 1972, and May 9, 1973. In each case the stream standard of 5.0 mg/l for DO was violated.

b. Segment 0202. Further upstream on the Red River, but below Lake Texoma, Segment 0202 exhibited three pH violations which occurred in October and November, 1974. The pH values ranged from 6.0 to 6.2 and were experienced at three separate monitoring stations. In May of water year 1972, monitoring station 0202.02 exhibited a dissolved oxygen violation of 4.2 mg/l. The pH violations fall outside of the stream standard range of 6.5 to 8.5 for pH, and the dissolved oxygen violation falls below the stream standard of 5.0 mg/l for DO.

c. Segment 0204. That segment of the Red River directly above Lake Texoma, extending to its confluence with the Wichita River, exhibited one noncompliant pH value for each water year from 1972 through 1974. All three pH values were greater than 9.0 and were recorded on the following dates: July 18, 1972, November 16, 1972, and on August 8, 1974. In each instance the maximum stream standard for pH of 8.5 was exceeded. In addition, several dissolved oxygen violations have been recorded.

d. Segment 0207. The single monitoring station located on the Prairie Dog Town Fork of the Red River, north of Childress, exhibited one surface water temperature violation late in water year 1975. Monitoring station 0207.01 exhibited a water temperature of 95°F (35.0°C). This value exceeded the stream standard for temperature of 93°F (33.9°C).

e. Segment 0211. The Little Wichita River has exhibited a single pH violation. This occurred on February 27, 1973, when monitoring station 0211.01 located at SH 148, northeast of Henrietta, exhibited a pH value of 9.2, which exceeded the maximum stream standard for pH of 8.5. The Little Wichita River has also exhibited extensive dissolved oxygen (DO) problems. Seven DO violations have been exhibited by this segment. The noncompliant concentrations ranged from 2.8 mg/l to 4.2 mg/l and were first exhibited in 1973. In each case, the stream standard of 5.0 mg/l for DO was violated. High fecal coliform values have also been observed.

f. Segment 0214. Segment 0214 of the Wichita River has exhibited two different water quality violations. Monitoring station 0214.02 exhibited a pH value of 8.8 on February 11, 1974; and in May, 1975 this same monitoring station exhibited a dissolved oxygen (DO) measurement of 2.8 mg/l. These respective values exceed the stream standards of 8.5 for pH, and 5.0 for dissolved oxygen.

g. Segment 0218. Monitoring station 0218.03, located on the South Fork of the Wichita River, north of Benjamin, exhibited a pH violation of 8.8 on March 28, 1975. This value exceeds the maximum stream standard for pH of 8.5. On the North Fork of the Wichita River, south of Crowell, monitoring station 0218.02 has exhibited one surface water temperature violation of 99°F (37.2°C), which occurred on July 7, 1975. This temperature value exceeds the stream standard of 93°F (33.9°C) for temperature. High fecal coliform values as well as chloride values exceeding standards have been recorded.

h. Segment 0220. Segment 0220 has exhibited stream standards violations on several occasions. These violations involve the temperature parameter and consist of instances when the stream standard of 90°F (32.2°C) was exceeded. Four such instances were recorded during water years 1972 through 1975 with temperature values ranging from 93°F (33.9°C) to 102°F (38.9°C).

i. Segment 0221. Segment 0221 of the Pease River has also exhibited temperature violations. On May 24, 1973, and on August 4, 1975, surface water temperature values of 94°F (34.4°C) and 97°F (36.1°C), respectively, were recorded. These temperatures exceeded the temperature standard of 91°F (32.8°C).

j. Segment 0222. The Salt Fork of the Red River has exhibited three noncompliant surface water temperature values for the period 1972 through 1975. Two noncompliant values,

95°F (35.0°C) and 99°F (37.2°C), were recorded on August 5, 1975 and July 8, 1975, respectively. Also, in July, 1974, a noncompliant temperature value of 95°F (35.0°C) was recorded at monitoring station 0222.01. All of these recorded values exceeded the stream standard for temperature of 93°F (33.9°C). Sulfate values exceeding the standard have also been recorded.

k. Segment 0224. The North Fork of the Red River has exhibited only one water quality violation. This occurred on July 8, 1975, when the temperature standard of 91°F (32.8°C) was exceeded by a temperature measurement of 102°F (38.9°C).

l. Segment 0225. McKinney Bayou has exhibited the most water quality violations of any segment in the Red River Study Area, and these involve the dissolved oxygen (DO) parameter. Fifteen DO violations have been exhibited by this segment; however, all but three of the DO violations were above 4.0 mg/l. These dissolved oxygen violations have been exhibited since October 27, 1971, and five of them have occurred in October and November. In each instance, the stream standard of 5.0 mg/l for DO has been violated.

A review of unpublished water quality data for water years 1976 and 1977 indicates that there are no new or different water quality problem areas in the Red River Study Area. This review indicates that pH and temperature measurements in Segments 0202, 0204, 0214, and 0220 continue to exceed the numerical values set forth in the stream standards.

4. FACILITY NEEDS

Those facilities which are discharging are either in compliance with permit standards or are actively working on improvements to meet those standards. As delineated in Table A-1, several cities are participating in the 201 facility planning process. Sixteen cities need to upgrade and expand or to replace their existing facilities. Thirteen other communities or cities will require upgrading of their septic tank systems under a septic tank control order or will require construction of a centralized collection and treatment system.

There are approximately 110 commercial permitted dischargers within the Red River Study Area. All of the feedlot operations do not discharge, and most of them are located in the western part of the Study Area. Only four of the permitted industries discharge into tributaries of the Red River. All four are currently meeting their permits.

TABLE A-1

FACILITY NEEDS IN THE RED RIVER STUDY AREA

201 Facility Plans	Expand and Upgrade Or Replace Facility	New Facility Needed	Septic Tank Ordinance
Bonham	Bellevue	Greenbelt Reservoir	Lake Diversion
DeKalb	Bells	Lake Arrowhead	Lake Kemp
Ector	Childress	Lake Tanglewood	
Henrietta	Claude	Lakeside	
Holliday	Denison	Megargel	
Honey Grove	Friona	Montague	
Lannius MUD	Hereford	Pleasant Valley	
Nocona	Matador	Ringgold	
Paris	Paducah	San Jose Community	
Reno	Panhandle	Scotland	
Savoy	Sherman		
Windthorst	Vernon		
	Wheeler		
	White Deer		
	Wichita Falls		

Of primary concern in the Red River Study Area is the degradation of water quality from non-point source pollution. Specific problems are delineated in each segment summary.

Facility needs in the Red River Study Area have been discerned during two phases of the 208 planning effort. During the basic data gathering effort, evaluation rested primarily on existing visible needs. The second phase, data evaluation, identified areas needing expansion or new systems by 1983, based on projected waste loads. Specific details concerning facility needs are found in the following chapters of this volume.

CHAPTER B

SUMMARY OF PLAN

1. WASTELOAD ALLOCATIONS

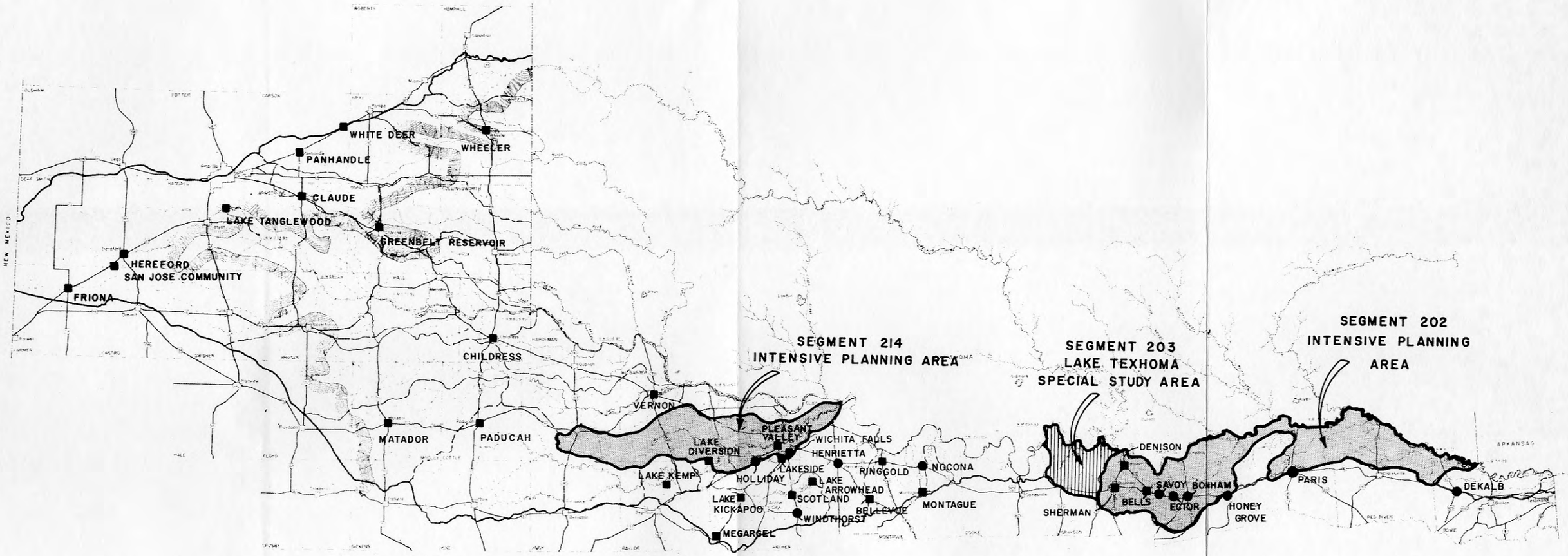
Within the Red River Study Area, as designated in Chapter A and illustrated in Figure B-1, two segments, 201 and 211, are classified as being water quality limited. In these segments "it is known that water quality does not meet applicable water quality standards and/or is not expected to meet applicable water quality standards even after the application of the effluent limitations required by Section 301(b)(1)(B) and 301 (b)(2)(A)" of PL 92-500.

a. Segment 201: Segment 201 includes approximately 47 river miles of the Red River and extends from the Arkansas State line to the Oklahoma State line. The area of study does not include the McKinney Bayou or the area south of 33°30', which is included in the Texarkana Designated Areawide Planning Area. Segment 201 drains approximately 280 square miles and is classified as a water quality segment.

In regard to water quality standards in Segment 201, the major compliance problems have been due to low dissolved oxygen (DO) and pH and to high fecal coliform counts. Several times in previous years, stream sampling data has been non-compliant (Table B-1).

The only discharger within the portion of Segment 201 that is in the Study Area is the City of DeKalb. The City is currently participating in the 201 construction grant program to improve its wastewater treatment facilities. The discharge from the facility is small and does not exert an appreciable effect on the segment. Consequently, any water quality problems attributable to point-source discharges are due to sources downstream of DeKalb.

After evaluating potential sources of non-point source pollution, only the sanitary landfill located north of DeKalb is considered a potential pollutant source. The expected loadings from the landfill's leachate flow, based on average containment concentrations observed in sanitary landfills, are 1,430 lbs/day of BOD, 5.5 lbs/day total phosphorus, and 50 lbs/day nitrogen.



LEGEND

■....SEWERAGE PLANNING AREAS
●....201 FACILITY PLANNING AREAS

0 30 90 150
SCALE IN MILES

RED RIVER STUDY AREA

DATE: AUGUST 1978 | FREESE AND NICHOLS, INC. | FIGURE B-1

TABLE B-1

WATER QUALITY VIOLATIONS
IN SEGMENT 201

	PARAMETER		
	Dissolved Oxygen (mg/l)	pH	Fecal Coliforms (No./100 ml)
Stream Standard	5.0	6.5-8.5	1,000
Violation Date			
07-08-69	4.0		
08-05-69	2.0		
06-08-72	4.8		
12-06-72	4.0		
05-09-73	4.2	6.4	
11-20-74		6.0	
12-11-74			1,300
03-12-75			1,200
05-27-76			2,220
09-23-76*		8.6	

* TDWR Station 0201.02 - At SH 8 North of New Boston

All Others: TDWR Station 0201.01 - Bridge on U.S. 71 at Index, Arkansas.

Since the potential for contamination from the site could have a significant effect upon the water quality of the segment, depending upon the characteristics of the water table, it is suggested that a more detailed examination of this site be made in the near future.

A waste load evaluation of Segment 201 was done by the Texas Water Quality Board and published in June of 1974. This study indicates that the "discharges from Texas Cities are small and are located on tributaries sufficiently distant from Segment 0201 in the Red River Basin to normally exert no appreciable adverse effect on this segment."

As calculated by the TDWR, the assimilation capacity of Segment 201 is 103,030 lbs/day of oxygen demanding material. Allowing for uncontrollable non-point source loading and for projected municipal and industrial growth, the segment target load is 97,800 lbs/day of oxygen demanding material.

A total waste load of about 225 lbs/day of oxygen demanding material is presently discharged in tributaries in Texas, some 10 to 15 miles from the Red River, under waste control orders. Since the Texas domestic wastewater treatment plants are located some distance from the segment, the biodegradation processes should reduce the loads in the Texas tributaries to insignificant levels.

At low flow conditions in Mud Creek, a localized problem could develop just below the City of DeKalb plant because of the poor quality of the effluent. However, these conditions should be substantially alleviated after completion of the 201 plan for the City of DeKalb.

b. Segment 211: Segment 211 is comprised of the Little Wichita River from the confluence with the Red River to Lake Arrowhead. The segment is classified as a water quality limited segment. Over past years, stream standards for DO, pH, fecal coliforms, and chloride concentrations have been violated (Table B-2).

There are only two point-source discharges in Segment 211. The largest of these is the wastewater treatment plant for the City of Henrietta. At present this facility does not meet its discharge permit, but the City is actively participating in the PL 92-500 construction grant program to upgrade and expand its facility. When the facility improvements are completed, the effluent produced should meet permit standards.

TABLE B-2

WATER QUALITY VIOLATIONS IN SEGMENT 211*

	PARAMETER			
	Dissolved Oxygen (mg/l)	pH	Fecal Coliforms (No./100 ml)	Chlorides (mg/l)
Stream Standard	5.0	6.5-8.5	200	250
Violation Date				
09-10-69	4.0			
03-12-70	3.0			
05-06-70	4.0			
09-09-70		6.2		
09-14-71	4.0			
07-18-72			1,400	
11-16-72		8.7		
01-29-73			1,400	
02-23-73		8.9		
03-27-73		9.2		
05-27-73	2.8	8.8		
06-15-73	4.0			
07-19-73	3.6			
09-10-73	4.0			
07-19-73	3.6			
09-10-73	4.0			
10-03-73	4.0			
05-01-74			6,400	
07-12-74	3.0			350
08-08-74		8.7		
11-21-74			250	
05-05-75	4.2		470	
08-04-75			550	
04-15-76			1,700	
10-08-76			3,100	

*TDWR Station 0211.01 - At SH 148 Northwest of Henrietta

The City of Petrolia operates an Imhoff tank-oxidation pond system under a "no discharge" permit. A program of irrigation has recently been implemented to correct problems of occasional discharging.

Of the non-point sources of pollution, urban runoff and disposal activities are two sources which may be contributing to water quality problems.

Evaluation of urban runoff from the City of Henrietta indicates that this runoff contributes to the eutrophication and turbidity problems in the Little Wichita River. However, these loads should have little effect on the Red River after mixing downstream.

The disposal activity of immediate concern is the sanitary landfill near Henrietta, due to its potential to produce large quantities of leachate. At present, the site produces minimal leachate. The City of Henrietta is considering the alternatives of building a levee around the portion of the site lying in a flood plain or of abandoning the site.

No waste load allocations have been done for Segment 211. However, the TDWR is actively pursuing this task and will present allocations at a future time.

2. 1983 PLAN

Included in this section are summaries of the final areawide plan recommendations for communities that require upgrading of existing facilities, implementation of waste control measures, or construction of new facilities within the next five years in order to meet State and Federal standards. For each community the optimum alternative is presented along with any requirements concerning monitoring programs, data handling systems, or revision mechanisms.

a. Bellevue. The City of Bellevue currently operates an oxidation ditch type wastewater treatment facility constructed in 1973. The design capacity is already being exceeded, and the effluent quality does not consistently meet permit requirements. The City should first do an infiltration/inflow analysis of its collection system. Should correction of the existing infiltration problems be more costly, the City should then expand the wastewater treatment facility to accommodate the larger flows.

b. Bells. The City of Bells currently operates a wastewater treatment facility consisting of an Imhoff tank-trickling filter scheme. Structurally, the plant has deteriorated, and the effluent does not consistently meet permit requirements. In addition, the plant will be moderately overloaded by 1983 and significantly overloaded by the year 2000. Therefore, the City should abandon the existing facility and construct an extended aeration plant or a land treatment facility.

c. Bonham. The City of Bonham is currently preparing a 201 Facility Plan to enlarge and upgrade their waste treatment facilities. The present facilities consist of a bar screen, a lift station, a primary clarifier, two trickling filters, a final clarifier, an anaerobic digester, chlorination facilities, and a sludge drying bed. The proposed additions are chlorination and phosphate removal facilities. The sludge drying beds will also be enlarged, and the existing mechanical bar screen will be replaced.

d. Claude. The City of Claude operates a wastewater treatment facility consisting of an Imhoff tank that discharges into a playa lake. The facility is under a "no discharge" permit, but is treating average flows (based on the Texas methodology) of almost twice its design capacity. Therefore, the plant should either be upgraded and expanded or be replaced. The existing facility should be replaced with either an extended aeration facility or a land treatment facility.

e. DeKalb. The City of DeKalb currently operates two wastewater treatment facilities. The completed 201 Facility Plan proposes to enlarge and upgrade the South plant and to divert to the South plant all the flows now treated at the North plant.

f. Denison. The City of Denison operates four wastewater treatment facilities that are within the Red River Study Area. The Airport plant, Duck Creek plant, and Paw Paw plant are all anticipated to be able to hydraulically handle their respective projected flows. However, due to the rapid growth in the Sherman-Denison area, the wasteload projections may become invalid before the end of the planning period.

The Iron Ore Creek facility will need to be expanded in order to treat the projected volume of waste loads. This plan recommends the expansion of the existing facility with an additional oxidation ditch type system.

In previous years, the facilities have had operational problems resulting from industrial wasteloads. The City should institute pretreatment regulations for industrial and commercial dischargers.

g. Ector. The City of Ector is currently participating in the 201 grant program to expand and upgrade its existing wastewater treatment facilities. The proposed treatment improvements will consist of the construction of a new Orbal-aeration ditch and of the conversion and enlargement of the existing facilities. The present manual bar screen will be used. The existing sludge beds will be used and enlarged by 50 percent. The existing pre-aeration unit will be converted to an aerobic digester by the replacement of the existing equipment with a new floating aerator. The existing Imhoff tank will be converted to a rectangular, non-mechanical final settling tank. A new chlorine contact basin will be constructed, with the gas chlorination facilities housed in an equipment building.

h. Estelline. The wastewater treatment facility for the City of Estelline is currently treating average flows in excess of its permit; however, these flows are within design capacity. Therefore, the permit requirements should be re-evaluated.

i. Friona. The City of Friona operates an Imhoff tank-oxidation pond wastewater treatment facility. The effluent is used for irrigation. The facility is currently hydraulically overloaded and will be severely overloaded by 1983. It is recommended that the City either expand and upgrade the existing facility, or abandon the existing facility and construct an oxidation ditch-type system.

j. Greenbelt Reservoir. The City of Howardwick and the Greenbelt Municipal and Industrial Authority have recently contracted with the RRA to obtain sewage collection and treatment facilities. These facilities are needed in order to prevent contamination of the Reservoir from septic tank effluent seepage and runoff. This 208 Plan recommends the construction of two facilities. One facility will serve the City of Howardwick, and the other will serve the developed areas on the southern side of the Reservoir. The facilities should be designed for a "no discharge" permit, and should consist of primary treatment followed by oxidation ponds or by land treatment.

k. Hereford. The City of Hereford operates a wastewater treatment faclity consisting of a primary clarifier, a trickling filter, oxidation ponds, an anaerobic digester, and sludge drying beds. The effluent is used for irrigation. Presently, the plant is hydraulically overloaded, and will be substantially overloaded by 1983. This plan recommends expanding the plant by adding heaters to the anaerobic digester and by constructing an additional primary clarifier and additional oxidation ponds.

l. Henrietta. The City of Henrietta currently operates two wastewater treatment facilities and is participating in the 201 construction grant program to improve its system. The North plant will be upgraded to treat the total flow of the City. The proposed plant is an Air-Aqua oxidation system, which will consist of two lagoons with aeration equipment placed within the lagoons. The South plant will be abandoned.

m. Holliday. The City of Holliday is participating in the PL 92-500 Construction Grant Program to replace its 20-year old wastewater treatment facility with an oxidation ditch type treatment facility.

n. Honey Grove. The City of Honey Grove operates a package contact stabilization plant, with drying beds and a sludge lagoon. The City needs to improve its collection system and add additional sludge drying bed area at the plant. The City has applied for 201 grant monies to assist in making these improvements.

o. Lake Arrowhead. Due to the increasing residential population around Lake Arrowhead, the area should construct a centralized collection and treatment system. A land treatment facility is recommended. Centralized wastewater treatment facilities are needed in order to maintain the water quality within the lake.

p. Lake Diversion. To maintain the water quality within Lake Diversion, the area should be placed under a strict septic tank control order. All inadequate septic tank systems and bore holes should be replaced or upgraded.

q. Lake Kemp. To maintain the water quality within Lake Kemp, the area should be placed under a strict septic tank control order. All inadequate septic tank systems and bore holes should be replaced or upgraded.

r. Lake Kickapoo. The City of Wichita Falls is currently monitoring septic tank usage within the area. The City should continue their present program and the area should be examined again during the next planning period.

s. Lake Tanglewood. The City of Lake Tanglewood presently uses individual septic tanks to treat and dispose of the wastewater. There have been numerous reports of septic tank effluents surfacing or draining into the Lake. To prevent further contamination of the Lake, the City should construct a centralized collection and wastewater treatment facility. This plan recommends the utilization of a land treatment facility.

t. Lakeside. The City of Lakeside is located on the southern shores of Lake Wichita. To prevent degradation of the water quality within the Lake, the City should construct a centalized collection system. This plan recommends treatment of the wastewater flow at a new land treatment facility, or transportation of the flows to the City of Wichita Falls system.

u. Matador. The City of Matador operates a fifty-year-old Imhoff tank-oxidation pond facility. Inspection reports indicate that the Imhoff tank structure is badly deteriorated. This plan recommends abandoning the existing facility and constructing a new contact stabilization type plant.

v. Megargel. The City of Megargel currently utilizes septic tanks for wastewater treatment. The Texas Department of Health reports that the area has many problems with the septic tank systems, including infiltration of wastewater effluent into water lines. The City should immediately construct a centalized collection and treatment system. This plan recommends the construction of a package plant.

w. Montague. The Community of Montague currently utilizes septic tanks for the diposal of wastewater. According to SCS soil surveys, soils within the area are severely limiting for use as septic tank filter fields. Present population density and projected growth indicate that the septic tanks may be a danger to ground and surface water quality. Therefore, the Community should construct a centralized collection and treatment system. This plan recommends a package plant facility.

x. Nocona. The City of Nocona is currently participating in the PL 92-500 Construction Grant Program. The City is upgrading and expanding each of its two wastewater

treatment facilities to include an oxidation ditch, final clarifier, sludge pumps, and sludge drying beds.

y. Paducah. The City of Paducah operates an older wastewater treatment facility consisting of an Imhoff tank and oxidation ponds. The effluent is used for irrigation. Inspection reports and wasteload projections indicate that the facility is hydraulically overloaded. Therefore, the City should expand and upgrade or replace the facility as soon as possible. The immediate need at the plant is the expansion of the oxidation pond area. On a long-term basis, the facility should be replaced.

z. Panhandle. The City of Panhandle operates a wastewater treatment facility consisting of an Imhoff tank, trickling filter, and sludge drying beds. The plant, although under a "no discharge" permit, is hydraulically overloaded. Wasteload projections indicate that the influent flow volume will be two times the plant's design capacity before the year 1983. The existing facility should be expanded and upgraded or replaced. This plan recommends replacement with either an oxidation ditch type system or a land treatment system.

aa. Paris. The City of Paris has a new Orbal type, activated sludge treatment system. However, major infiltration/inflow problems and heavy surges of industrial wastes occasionally upset the plant. A sewer system evaluation should be initiated to determine the feasibility of rehabilitating the sewer system. An enforced industrial wastewater ordinance is needed to adequately protect the plant and to ensure the treatment efficiency.

bb. Pleasant Valley. The City of Pleasant Valley utilizes individual septic tanks for treatment of its wastewater. Due to the low permeability of the area's soils, some problems with these septic tank systems have been reported. The City should construct a centralized collection and wastewater treatment facility. This plan recommends a land treatment facility.

cc. Reno. The City of Reno has a Step 1 grant under PL 92-500 to develop sewerage facilities. The Facility Plan will consider both the feasibility of the City building its own wastewater treatment plant or transporting its wastewater to the City of Paris.

dd. Ringgold. The community of Ringgold utilizes septic tanks for the disposal of wastewater. Because of the poor soil absorption rate, problems of septic tank overflow and of contamination of the water supply source have been reported. The area should immediately construct a centralized collection and treatment system. This plan recommends the construction of a package plant.

ee. San Jose Community. The Community of San Jose southwest of Hereford has extremely inadequate water and sewer facilities. Wastewater is either poorly treated or simply run onto the ground. Water supply contamination is frequent. The densely populated area should be sewered immediately. The wastewater flows should either be treated at a central package plant or transported to the treatment system serving the City of Hereford.

ff. Savoy. The City of Savoy has a 201 Construction Grant to improve its wastewater treatment plant. The existing plant is structurally deteriorating and does not consistently meet effluent requirements. The City is constructing a new treatment plant that is almost complete. It is a package contact stabilization plant with drying beds. One oxidation pond is being retained as an emergency holding lagoon, and the other is being abandoned.

gg. Scotland. The City of Scotland currently utilizes septic tanks to treat its wastewater. No problems have yet been reported; however, the soils in the area are generally not well suited for septic tank use, and the City is expected to grow rapidly. Drainage from the area is toward Lake Arrowhead and could endanger the water quality of the lake in the future. The City should construct centralized collection and treatment facilities. This plan recommends construction of a land treatment facility.

hh. Sherman. The City of Sherman operates a trickling filter type facility located southeast of the City on Post Oak Creek. The City is planning to upgrade the facility by converting the trickling filters into roughing filters and by adding an additional treatment system for secondary treatment.

In previous years, the facility has had operational problems that may be attributable to industrial waste flows into the system. To alleviate these problems,

the City should institute regulations requiring pre-treatment of industrial waste flows.

After renovation of the present facility and after implementation of industrial discharge regulations, the facility should adequately treat the projected waste loads.

ii. Vernon. The City of Vernon operates an upgraded wastewater treatment plant consisting of an oxidation ditch system in parallel with an Imhoff tank-trickling filter system. The plant is currently treating flows almost at its design capacity and is in need of additional sludge drying beds. The projected waste loads for the service area indicate that the plant will be overloaded by 1983. This plan recommends expansion of the facility by one of two alternative schemes.

jj. Wheeler. The City of Wheeler operates an older Imhoff tank-trickling filter facility under a "no discharge" permit. The facility is treating flows in excess of its design capacity and is in immediate need of additional oxidation pond areas. The immediate needs can be alleviated with the construction of additional ponds; however, the long-term needs can best be satisfied by replacement of the facility with a new contact stabilization plant.

kk. White Deer. The City of White Deer operates a twenty-five year old Imhoff tank-oxidation pond facility. The treated wastewater is released into a nearby playa lake. According to wasteflow projections, the plant is severely overloaded and should be expanded. This plan recommends the construction of either a new contact-stabilization facility or the implementation of a land treatment system.

ii. Wichita Falls. The City of Wichita Falls operates a trickling filter system in parallel with an activated sludge system. Wasteload projections for the planning period indicate that the facility will have sufficient capacity to meet increased flows. The facility has had problems meeting permit requirements on occasions. However, renovations are presently in progress and should alleviate the operational problems that have been experienced in the past.

mm. Windthorst. The City of Windthorst is presently participating in the PL 92-500 Construction Grant Program. The City is currently serviced by septic tanks, but is building a new wastewater treatment plant. The new plant will consist of a bar screen, a surface-aerated lagoon, polishing ponds, and chlorination facilities.

3. 1990 PLAN

This section discusses cities which will require a revised facility management plan within the next ten years due to projected increases in wasteloads or flow.

a. Canyon. The City of Canyon operates a relatively new extended aeration facility; however, wasteload projections indicate that the capacity of the plant will be exceeded by 1990. This facility should be considered in future updates of this water quality management plan.

b. Chillicothe. The City of Chillicothe operates an Imhoff tank-trickling filter-oxidation pond system. Design capacity of the facility will be sufficient throughout the planning period; however, the facility is old and structurally deteriorating. Therefore, the facility should be considered in the future revisions of the plan.

c. Memphis. The City of Memphis operates a trickling filter followed by oxidation ponds. The design capacity of the facility is 0.35 MGD and will be exceeded by 1990. Therefore, this facility should be closely studied in future updates.

d. Turkey. The City of Turkey operates a wastewater treatment system which consists of an Imhoff tank followed by oxidation ponds. The design capacity is 0.05 MGD and will be substantially exceeded by 1990. This facility should be closely examined in future updates.

e. Wellington. The City of Wellington operates a facility consisting of an Imhoff tank and oxidation ponds. The facility was upgraded in 1969 and appears to be functioning well. However, the design capacity of 0.21 MGD will be exceeded before 1990.

f. Whitesboro. The City of Whitesboro built a new extended aeration plant in 1974. However, according to the wasteload projections, the plant's design capacity will be exceeded by 1990. A detailed look at this facility is needed in future updates of this plan.

4. 2000 PLAN

This section discusses cities which will require a revised facility management plan before the end of the planning period due to projected increases in wasteloads or flow.

a. Whitewright. The City of Whitewright has a relatively new extended aeration facility. However, wasteload projections indicate the 0.25 MGD capacity will be exceeded before the year 2000.

5. SCHEDULE OF IMPLEMENTATION

a. Construction Grants Process. The implementation process consists of three steps beginning with preparation of the facility plan and the review for Step I, the preparation of design and the review for Step II, and the construction of the treatment system and the review for Step III. Table B-3 shows the estimated required time for each step and for each phase within the steps.

Table B-3

Time Sequence For Implementation of Wastewater Treatment Systems

STEP	PHASE	ESTIMATED TIME REQUIRED
I	Preparation of Facility Plan	12 mos.
	Review	6 mos.
II	Preparation of Design	6 mos.
	Review	3 mos.
III	Construction of System	12 mos.
	Review	3 mos.
		42 mos.

Prior to Step II application, submission of a request for NPDES/State permits must be made. The review phase consists of the technical review of all plans and designs by the appropriate government agencies. Figure B-2 graphically illustrates the step-by-step procedures and the initiation year necessary for a city to obtain Federal funding for construction of wastewater treatment facilities by 1983.

b. The Waste Permitting Process. The Texas Department of Water Resources (TDWR) has been designated by the Legislature as the principal authority in the State on matters relating to the quality of water. All other State agencies involved in water quality or pollution control, such as the Railroad Commission of Texas, the Parks and Wildlife Department, and the Texas Department of Health, must coordinate these activities with the TDWR. Rules of the TDWR are promulgated under the authority of Section 21.069 of Vernon's Texas Codes Annotated Water Code.

Rule 130.01.03.005(a) General Prohibition Against Unauthorized Waste Disposal: "Except as enumerated in paragraph (b) of this rule, no person may discharge, deposit or inject, or otherwise dispose of any defined waste unless the disposal is authorized by and conducted in compliance with a Waste Control Order (WCO), a registration duly entered in the official records of the Board, or an order of the Executive Director as authorized by the Board, or these rules."

In general, a waste control order authorizes:

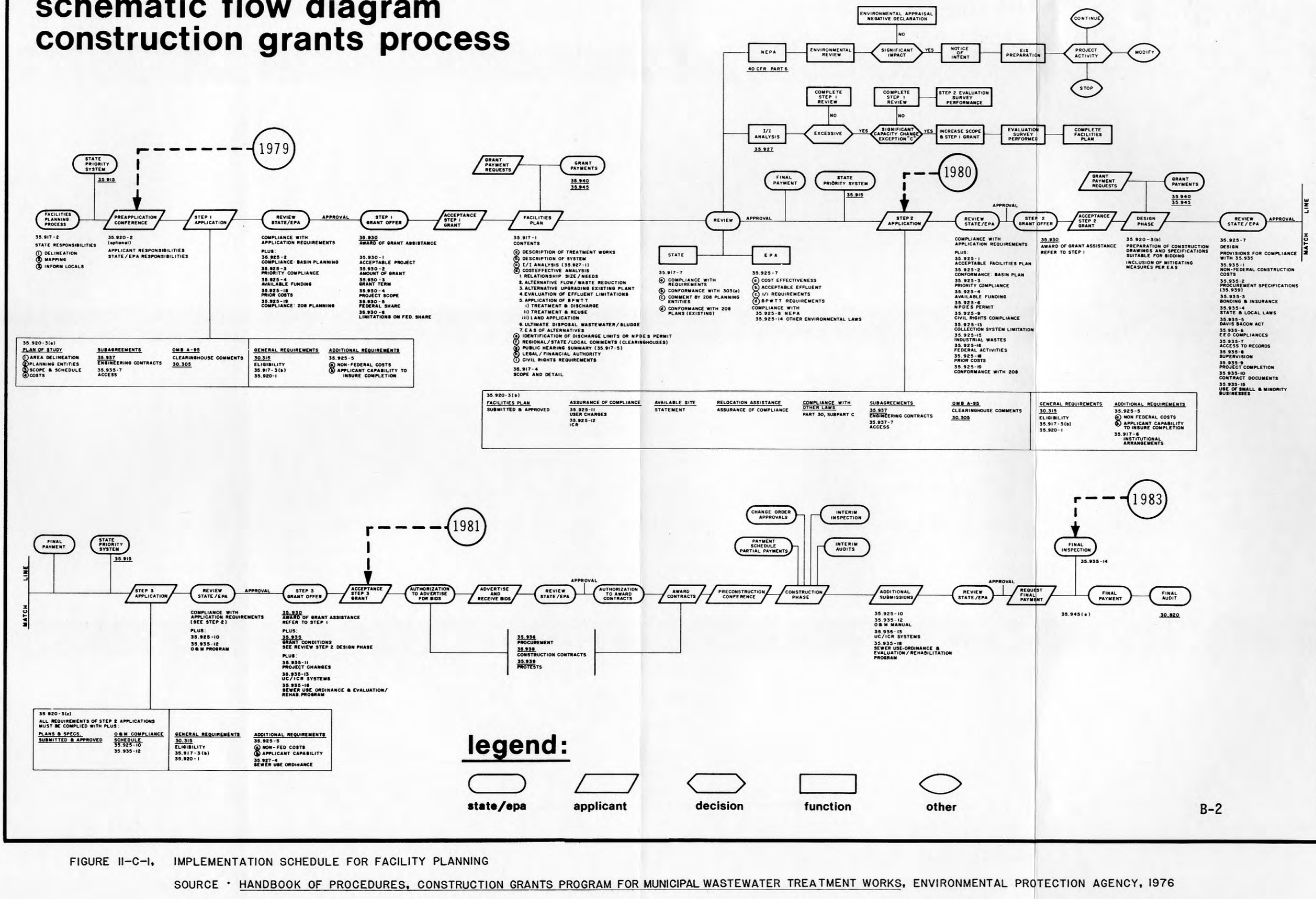
(1) the disposal of a defined waste into or adjacent to a water in the State,

(2) the disposal of a defined waste by disposal well, and

(3) the disposal of any industrial solid waste except as provided in Section 4(f) of the Solid Waste Disposal Act.

c. Application and Information Requirements. The application forms for a WCO or an amendment to a WCO can be obtained from the Texas Department of Water Resources in Austin, Texas. To procure a regular WCO particularly suited to a specific waste treatment project or system, it is necessary to complete a general application. From the information contained in this application, the

schematic flow diagram construction grants process



B-2

FIGURE II-C-1, IMPLEMENTATION SCHEDULE FOR FACILITY PLANNING

SOURCE · HANDBOOK OF PROCEDURES, CONSTRUCTION GRANTS PROGRAM FOR MUNICIPAL WASTEWATER TREATMENT WORKS, ENVIRONMENTAL PROTECTION AGENCY, 1976

TDWR is able to determine which regular waste control order should be issued to the applicant and to advise the applicant of the procedural information necessary for obtaining the permit (WCO).

d. NPDES Permits. If an application for a State permit is for the discharge of a wastewater into a watercourse, the person, entity, or firm seeking a State permit must also file an application for an NPDES (National Pollution Discharge Examination System) Permit with the Environmental Protection Agency. It will help expedite processing of the State application if a copy of the NPDES application is submitted to the TDWR. Application forms may be obtained from Environmental Protection Agency Permits Branch, Region VI, Dallas, Texas.

Section 401(a)(1) of the Federal Water Pollution Control Act Amendments of 1972 requires any applicant for a Federal permit to conduct any activity which may result in any discharge into the navigable waters to obtain from the State, in which the discharge originates, a certification that the discharge will comply with applicable provisions of Sections 301, 302, 306, and 307 of the Federal Act before the EPA issues the NPDES permit. Therefore, an applicant who wants to discharge waste into the waters of the State is required to obtain a State permit (WCO), a Federal permit (NPDES Permit), and State certification for the Federal permit. A memorandum of understanding between the EPA and TDWR prevents some of the duplication of effort in maintaining two separate systems. It allows the TDWR to do the drafting of the NPDES permit. However, since actual "delegation" has not occurred, the EPA continues to be responsible for the actual issuance of NPDES permits.

6. INSTITUTIONAL AND LEGAL REQUIREMENTS

a. Introduction. There are several water quality improvement programs under development in the Red River Study Area. The majority of the programs are being accomplished under joint funding arrangements by Federal and local agencies. A listing of institutions which participate in water quality related programs by making loans and/or grants for qualifying programs are discussed in detail in Appendix B of this report.

b. Existing Water Quality Planning Programs in The Red River Study Area.

(1) EPA Grants: A number of facility plans in the Red River Study Area are being developed under Section 201

of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500). The scopes of these projects range from planning for basic collection system installations or improvements to planning for complete wastewater systems. The 201 facility plan is intended to document the need for collection and/or treatment facilities, to define the area to be served, to address the available alternatives for meeting the defined needs, and to recommend that alternative which is most cost-effective and feasible for the affected community. This type of plan is often referred to as a "Step 1 Plan" under the EPA Construction Grants Program and is a prerequisite to obtaining funding for subsequent construction under that program.

The Texas Department of Water Resources publishes a "Municipal Facilities Construction Grant Priority List" under Public Law 92-500 as approved by the Board. This list is in order of rank and is divided into two classes based on population; Class I - entities with more than 2,500 people and Class II - entities with 2,500 or fewer people. Each class is divided into a first and second ranking group. Projects in the first ranking group are those that have received a Step 2 grant. All other projects are in the second ranking group. Grants are contingent on funds being appropriated by the United States Congress.

(2) Related Planning Programs.

(a) Soil Conservation Service

(1) Watershed Treatment Programs. The soil conservation service (SCS) administers the planning and implementation of protective measures, primarily in the form of small dams, to control runoff which would otherwise cause flooding, increase erosion, and increase sediment loads to major waterways. Other services provided under this program include cleaning out of sediment-choked channels and providing water for municipal or industrial purposes.

As of October 1, 1977, the Soil Conservation Service inventory shows 262 water retarding structures planned or built in the Red River Study Area. These are delineated in Appendix B.

(2) Great Plains Conservation Program. The Great Plains Conservation Program was initiated in 1958. The primary objective of the program is to institute measures to insure permanent soil and water conservation practices. An additional high priority objective is agriculture related pollution abatement. As indicated on Plate 3(B), Volume 1, Basic Data Report (Draft), all of the Red River Study Area west of Cooke County, is included in this program.

Programs which have been implemented to date include planting grasses and reseeding depleted rangelands, thus reducing the amount of erosion by wind and water. As a result of revegetation, a reduction in sediment loads to major waterways is being achieved.

(3) Resource Conservation and Development. This program is another program administered by the Soil Conservation Service, which has as its goals the conservation of natural resources, including waters and soils. There are no known water related projects under way in the Study Area at this time under the program.

(b) The Economic Development Administration. This agency makes grants of 50% of the cost of approved project costs to municipalities which qualify under one of their categories. Economically depressed areas, counties of declining population, and growth centers are included in the program. While there are no known current EDA sponsored projects in progress, the Counties of Armstrong, Dickens, Floyd, and Motley, which are included in the Study Area, are designated as counties which are eligible for EDA assistance. An area one mile on either side of Interstate Highway 27 between Amarillo and Canyon, Texas, is eligible for grant consideration since the area has been designated a potential rapid growth center and may require water and sewage services.

(c) Corps of Engineers. The Corps of Engineers, Tulsa District, has done extensive planning for chloride control of waters in the upper Red River Basin. As a result, much material which concerns the various feasible alternatives for solving the water quality problems of the Red River have evolved for the various areas of concern. "A Statement of Findings", which embodies a discussion of area alternatives and sets forth a selected plan and the reasons for its selection, was published by the Corps in May, 1977.

Another project of the Corps of Engineers is Big Pine Lake located in Lamar and Red River Counties on Big Pine Creek. The Damsite is located approximately one mile southeast of Kanawa, Texas, in Red River County. The lake is a multi-purpose project for flood control, water supply, and recreational purposes. The lake is described as one unit of a system of multi-purpose lakes in tributaries of the Red River between Denison Dam and Fulton, Arkansas.

c. Financial and Managerial Agencies for Sewerage Planning Areas. As part of the areawide water quality managment plan, a management agency or management system is to be selected to implement the plan.

The management agency or management system must possess the authority to:

* Carry out appropriate portions of an areawide waste treatment plan.

* Manage effectively waste treatment works and related facilities in conformance with the areawide plan.

* Directly or by contract, design and construct new treatment works, and operate and maintain new and existing works required by the areawide plan.

* Accept and utilize grants, or other funds from any source, for waste treatment purposes.

* Raise revenues, including the assessment of waste treatment charges.

* Incur short and long term indebtedness.

* Assure, in the implementation of a plan, that each participating community pays its proportionate share of treatment costs.

* Refuse to receive wastes from any municipality or subdivision that does not conform to any provisions of the approved plan, and

* Accept industrial wastes for treatment.

No one agency need meet all the criteria but the total system needs to meet these requirements.

After an agency has been designated in an approved plan, the EPA cannot grant 201 construction funds to anyone except those designated agencies which conform to the approved plan.

Managerial agencies directly affecting the individual sewerage planning areas are summarized in the following.

(1) Bellevue: The City of Bellevue is located in southeastern Clay County. The City is incorporated and is governed by a Mayor and five Councilmen. The municipality is located within the geographical boundaries of the Nortex Regional Planning Commission.

Municipal water is supplied by two city-owned wells and is distributed by the City. The City owns and operates a wastewater treatment facility which was constructed about 1973-74. It is recommended that the City of Bellevue be designated as the official managerial agency for sewerage planning purposes.

(2) Bells: The City of Bells is located in Grayson County, about 13 miles east of Sherman. The City is incorporated as a General Law city and is governed by a Mayor and five Councilmen. The municipality is a member of the Texoma Regional Planning Commission.

The City owns the municipal water system and operates its wastewater treatment facility. A district is being formed which would assume the responsibilities for sewerage planning within the entire Sherman-Denison Area; however, until the district has been established, the City of Bells should be designated as the management agency for its own sewerage planning.

(3) Childress: The City of Childress, which is the county seat of Childress County, is an incorporated "Home Rule" City and is governed by a Manager-Council form of administration. The City is a member of Nortex Regional Planning Commission.

The Greenbelt Municipal and Industrial Water Authority supplies treated water to the City for distribution to the populace.

The City operates a wastewater treatment facility which was constructed about 1922, with a rated capacity of 0.45 MGD. Childress has two projects rated on the TDWR Municipal Facilities Construction Grant Priority List. One project is for upgrading or replacement of the present wastewater plant, and another is for a small plant in the vicinity of the airport.

It is recommended that the City of Childress be designated as the managerial agency for sewerage planning for the entity.

(4) Claude: The City of Claude, which is the county seat of Armstrong County, is an incorporated General Law City. The City is governed by a Mayor and five Councilmen, and is a member of the Panhandle Regional Planning Commission.

Municipal water is produced from three wells located about two miles from town and distributed to its customers by the City. The City owns and operates a wastewater treatment plant which serves most of the City. However, there are a few septic tanks still in service within the City.

It is recommended that the City of Claude be designated as the managerial agency for sewerage planning.

(5) Denison: The City of Denison presently owns and operates its four wastewater treatment facilities. A district is being formed which would assume the responsibilities for sewerage planning within the entire Sherman-Denison Area; however, until the district has been established, the City of Denison should be designated as the management agency for its own sewerage planning.

(6) Friona: The City of Friona is an incorporated General Law City and is located in north central Parmer County. It is governed by a Mayor-Council

form of government and administered by a City Manager. The City is a member of Panhandle Regional Planning Commission.

Municipal water is pumped from seven City-owned deep wells and distributed by the City to its customers. The City operates a wastewater treatment facility reported to be sufficient for a population of 5,000. The City made an application for an EPA grant in 1975 to make improvements to the present plant. It is recommended that the City of Friona be designated as the managerial agency for sewerage planning for the area.

(7) Greenbelt Reservoir: Greenbelt Reservoir, which is located in Donley County about five miles north of Clarendon, is owned by the Greenbelt Municipal and Industrial Water Authority and the Texas Department of Water Resources.

The City of Howardwick, which is located on the northern shores of the lake, is incorporated and governed by a Mayor and five Aldermen. Howardwick is a member of the Panhandle Regional Planning Commission.

Lots on the southern shores may be leased from the Greenbelt Authority (not purchased). By count in January 1978, there were 295 dwellings of all types on the northern shore and 74 on the southern shore. Seasonal population varies greatly and may reach a peak of 1,500 in the area on summer weekends.

Wastewater disposal is accomplished by means of individual septic tanks. It is recommended that the Red River Authority be designated as the managerial agency for sewage planning in the area.

(8) Hereford: The City of Hereford, which is the county seat of Deaf Smith County, is incorporated as a "Home Rule" City. The City is governed by a Council-Manager form of government, and lies within the geographical boundaries of the Panhandle Regional Planning Commission.

Municipal water is pumped from twenty-seven City-owned wells and is distributed by the City to its customers. The City owns and operates a wastewater treatment facility under a "no discharge" waste control order. Plant effluent is used to irrigate a 3,000 acre City-owned farm which produces corn, wheat, milo, and other agricultural products.

The City has recently made application for an EPA grant to expand the wastewater treatment plant and to improve the collection system. It is recommended that the City of Hereford be designated as the managerial agency for sewage planning.

(9) Lake Arrowhead: Lake Arrowhead is located on the Little Wichita River in Clay County about 13 miles southeast of Wichita Falls. It is owned by the City of Wichita Falls and is a source of municipal water for the City.

There is extensive real estate development around the shores of the Lake. Wastewater disposal resulting from area housing is by means of individual septic tanks. In order to minimize the potential for contamination of the lake water, the City issues permits for septic tank construction and performs inspections to assure compliance with standards.

Since the RRA has recently contracted with the City of Wichita Falls to provide water distribution and to eventually provide wastewater treatment (when deemed necessary), the RRA should be designated as the managerial agency for Lake Arrowhead.

(10) Lake Diversion: Lake Diversion is located in Archer and Baylor Counties on the Wichita River. It is owned jointly by the City of Wichita Falls and the Wichita County Water Control and Improvement District No. 2. The Lake was constructed for the purposes of irrigation and to serve as a source of municipal water for Wichita Falls.

Lakes Kemp and Diversion are operated and maintained by Wichita County WCID#2 under a contractual agreement with Wichita Falls.

Disposal of wastewater resulting from real estate developments on the lake shores is by means of individual septic tanks or other means. In order to minimize the potential for contamination of the lake water, it is recommended that wastewater

be disposed of by means of permitted and approved septic tank systems. It is further recommended that the Wichita County WCID#2 be designated as the managerial agency for administering the plan and for enforcing its provisions.

(11) Lake Kemp: Lake Kemp is located in Baylor County on the Wichita River. It is owned jointly by the City of Wichita Falls and the Wichita County Water Control and Improvement District No. 2. The Lake was constructed for the purpose of irrigation and to serve as a source of municipal water for Wichita Falls.

Lakes Kemp and Diversion are operated and maintained by Wichita County WCID#2 under a contractual agreement with Wichita Falls.

Disposal of wastewater resulting from real estate development on the lake shores is by means of individual septic tanks or other means. In order to minimize the potential for contamination of the lake water, it is recommended that wastewater be disposed of by means of permitted and approved septic tank systems. It is further recommended that the Wichita County WCID#2 be designated as the managerial agency for administering the plan and for enforcing its provisions.

(12) Lake Kickapoo: Lake Kickapoo is located in Archer County on the North Fork of the Little Wichita River. It is owned by the City of Wichita Falls and is a source of municipal water for the City.

There is extensive real estate development surrounding the Lake. Wastewater disposal resulting from the area development is by means of individual septic tanks. In order to minimize the potential for contamination of the lake water, the City issues permits for construction of septic tanks and performs inspections to assure compliance with standards. It is recommended that the City and the County Health Department join in a cooperative effort to enforce compliance with regulations, including soil percolation tests, during construction and during subsequent operation of the individual systems.

It is further recommended that the Wichita County Water Control and Improvement District No. 2 be designated as the managerial agency for sewerage planning for the area.

(13) Lake Tanglewood: The Village of Lake Tanglewood is located in northeast Randall County and is incorporated. The area lies within the geographical boundaries of the Panhandle Regional Planning Commission.

Municipal water is supplied by wells. Wastewater disposal is accomplished by means of individual septic tanks. It is recommended that the Village of Lake Tanglewood be designated as the managerial agency for sewerage planning.

(14) Lakeside: Lakeside City, which is located in northeastern Archer County and south of the City of Wichita Falls, is an incorporated General Law City. The City is governed by a Mayor and five Aldermen. Lakeside lies within the geographical boundaries of Nortex Regional Planning Commission.

Municipal water (treated surface water) is purchased from the Wichita Falls Municipal System, and is distributed by Lakeside City to its customers.

Wastewater disposal is accomplished by individual septic tanks. The location of the City, in close proximity to Lake Wichita, poses a potential threat of contamination of the lake water. It is recommended that the City of Lakeside be designated as the managerial agency for sewage planning. It is further recommended that the City develop a plan for a wastewater collection system and contract with the City of Wichita Falls to accept wastewater from Lakeside, or build its own wastewater treatment facilities.

(15) Matador: The City of Matador, which is the county seat of Motley County, is an incorporated General Law City and is governed by a Mayor and five Councilmen. The City is a member of the South Plains Association of Governments.

Municipal water is supplied by five wells located in the City and by two new wells located about three miles east of Roaring Springs. Water supply improvements, pipelines, and wells were financed

under a matching funds grant from HUD. SPAG is working with the City in order to obtain additional funds to improve some inadequate water mains and to extend sewage collection lines.

The City operates a wastewater treatment facility. However, some areas of the City must depend on septic tanks since sewerage collection mains do not serve the entire City. It is recommended that the City of Matador be designated as the managerial agency for sewerage planning purposes.

(16) Megargel: The City of Megargel is located in southwestern Archer County. The City is an incorporated General Law City and is governed by a Mayor and five Councilmen. The City is a member of the Nortex Regional Planning Commission.

Domestic water is obtained from two City-owned lakes and is treated and distributed by the City. Wastewater disposal is by individual septic tank or cesspool. It is recommended that the City of Megargel be designated as the managerial agency for sewerage planning. The City is working with Nortex for a collection system and wastewater treatment facility.

(17) Montague: The Community of Montague, county seat of Montague County, is unincorporated. It is within the geographical boundaries of Nortex Regional Planning Commission. The residents pay a school tax to the Montague Community School District.

Domestic water is supplied by a private water company and by numerous private wells. Wastewater disposal is by individual septic tank. It is recommended that the Red River Authority be designated as the managerial agency for sewerage planning purposes for this community.

(18) Paducah: The City of Paducah, which is the county seat of Cottle County, is an incorporated General Law City. The City is governed by a Mayor and five Councilmen and is a member of Nortex Regional Planning Commission.

Municipal water is produced from eleven wells located in a field north of town. A twelfth well is currently being drilled. Water is distributed to its customers by the City. A wastewater treatment facility, which operates on a "no discharge"

waste control order, serves the City. Plant effluent is retained in holding ponds and used for irrigation of crops. It is recommended that the City of Paducah be designated as the managerial agency for sewerage planning.

(19) Panhandle: The City of Panhandle, which is the county seat of Carson County, is an incorporated General Law City. The City is governed by a Mayor and five Councilmen. A City Manager administers the City's affairs. Panhandle is a member of the Panhandle Regional Planning Commission.

Municipal water is supplied by three wells pumping from the Ogallala formation. Another well is proposed within the next two years. The City owns and operates a wastewater treatment facility under a "no discharge" waste control order. It is recommended that the City of Panhandle be designated as the managerial agency for sewerage planning purposes.

(20) Pleasant Valley: The City of Pleasant Valley is located in Wichita County northwest of Wichita Falls. The City is incorporated as a General Law City and is governed by a Mayor and five Councilmen. Pleasant Valley is situated within the geographical boundaries of Nortex Regional Planning Commission.

Municipal water is purchased in bulk from the Wichita Falls Municipal Water System and distributed to its customers by the City.

Wastewater disposal is by means of individual septic tanks. The City is presently experiencing rapid growth. It is recommended that the City of Pleasant Valley be designated as the managerial agency for sewerage planning purposes.

(21) Ringgold: Ringgold is an unincorporated entity located in northwestern Montague County. No city tax is levied or collected. However, inhabitants pay school taxes to Gold Burg Independent School District. Ringgold is located within the jurisdictional boundaries of Nortex Regional Planning Commission.

Domestic water is supplied from Community-owned wells and distribution system. Construction was financed by a loan from FHA. Wastewater is presently disposed of by individual septic tank or cesspool.

Since the entity is unincorporated, it is recommended that the Red River Authority be designated as the managerial agency for sewage planning for the locality.

(22) San Jose Community: This Community is located southwest of the City of Hereford (outside the City Limits) in Deaf Smith County. The area is within the geographical boundaries of the Panhandle Regional Planning Commission.

Domestic water is supplied by a private source. Wastewater disposal is on an individual basis - by cesspool, septic tank, or other basis.

An application for a grant from HUD to provide a water system has been made through the efforts of the County. It is recommended that Deaf Smith County be designated as the managerial agency for sewerage planning for the area.

(23) Scotland: The City of Scotland is located in east central Archer County, and is an incorporated General Law City. The City is governed by a Mayor and five Councilmen. Scotland is included within the geographical boundaries of Nortex Regional Planning Commission.

Municipal water is purchased from the City of Wichita Falls. Wastewater disposal is by means of individual septic tanks. It is recommended that the City of Scotland be designated as the managerial agency for sewerage planning functions.

(24) Sherman: The City of Sherman currently owns and operates its wastewater treatment facility. A district is being formed which would assume the responsibilities for sewerage planning within the entire Sherman-Denison Area; however, until the district has been established, the City of Sherman should be designated as the management agency for its own sewerage planning.

(25) Vernon: The City of Vernon, which is the county seat of Wilbarger County, is an incorporated "home rule" City and is administered by a Commission-Manager form of government. The City is located within the geographical boundaries of the Nortex Regional Planning Commission.

Municipal water is supplied by numerous wells which are located both in the City and in a well field located approximately two miles north of town.

About five years ago the existing wastewater treatment facility was renovated, and an oxidation ditch type treatment plant was added. Extensions and improvements were financed by an EPA grant and a bond issue.

Currently, the City of Vernon has an application for an EPA construction grant for wastewater treatment plant improvements and land disposal facilities. It is recommended that the City of Vernon be designated as the managerial agency for sewerage planning purposes.

(26) Wheeler: The City of Wheeler, which is the county seat of Wheeler County, is an incorporated General Law City. The City is governed by a Mayor and five Councilmen. Wheeler is a member of the Panhandle Regional Planning Commission.

Domestic water is supplied by three City-owned wells and by two privately-owned wells from which the City purchases bulk water for distribution to its customers. The City operates a wastewater treatment facility consisting of an Imhoff tank, four oxidation ponds, and a sludge drying bed. The plant operates under a "no discharge" waste control order. It is recommended that the City of Wheeler be designated as the managerial agency for sewerage planning purposes.

(27) White Deer: The City of White Deer, which is located in east central Carson County, is an incorporated General Law City. The City is governed by a Mayor and five Councilmen and is a member of Panhandle Regional Planning Commission.

Municipal water is produced from three City-owned wells and distributed to its customers by the City. The City owns and operates a "no discharge" wastewater treatment facility, which serves about 95% of the City. Most of the effluent is held in oxidation ponds. Some is retained in a playa lake. It is recommended that the City of White Deer be designated as the managerial agency for sewerage planning.

(28) Wichita Falls: The City of Wichita Falls, which is the county seat of Wichita County, is an incorporated "home rule" City. It is governed by a Council-Manager type of administration. The City

is a member of Nortex Regional Planning Commission. Wichita Falls is the principal City of a Standard Metropolitan Statistical Area that includes Wichita and Clay Counties.

The City treats and sells municipal water to customers within the city limits and to neighboring areas such as Sheppard Air Force Base, Pleasant Valley, Lakeside City, Scotland, Holliday, Iowa Park, and others. The City of Wichita Falls operates two municipal water treatment plants. Raw water currently comes from Lake Arrowhead and Lake Kickapoo.

The City operates a wastewater treatment facility. A continuing program is underway to construct a new wastewater treatment plant and to modify and upgrade the collection system. It is recommended that the City of Wichita Falls be designated as the management agency having the necessary managerial and financial capabilities for sewerage planning.

7. FINANCIAL REQUIREMENTS

A number of sources and programs are necessary to meet financial requirements for study, planning, and construction of collection systems and wastewater treatment plants. Financing arrangements include loans, grants, taxation, revenue bonds, tax supported bonds, and in some instances, funds derived from revenue sharing. A plan of user charges is usually developed to support the operation and maintenance of the wastewater system.

Federal agencies which support water quality oriented programs by providing grants and/or loans are the Environmental Protection Agency, The Farmers Home Administration, The Department of Housing and Urban Development, and The Economic Development Administration. The Corps of Engineers and the Soil Conservation Service are other Federal Agencies which participate directly or indirectly in water management programs.

On the State level, the Texas Water Development Board has the authority to provide financial assistance for water-quality enhancement purposes through the purchase by the Board of bonds issued by the borrowing entity. It is the policy of the Board to make loans to construct treatment works only to political subdivisions that cannot obtain financial assistance at reasonable rates from the commercial market.

"Special Districts" are other sources of financing water quality management programs. These districts, since they are political bodies under the constitution of the State, give a flexibility for accomplishing specific programs. They may, with voter approval, issue bonds, assess taxes, and enter into joint projects with other political bodies in the accomplishment of their functions.

On the local level, county and city governments provide sources of financial assistance, since they possess the legal authority to assess and collect taxes, fees, and user charges. However, the Constitution of the State places limitations on tax rates for these government entities and on the amount of debt a city or county may assume.

A detailed discussion of financial arrangements available for water quality management programs is presented in Appendix B of this report.

8. INFORMATIONAL REQUIREMENTS FOR UPDATES

a. Point Sources. Several areas in the Red River Study Area are growing rapidly. Sewerage planning for facilities in some of these areas is presented in this plan and are based on wasteload projections using the available data. However, sewerage needs in the future may vary substantially from the assessment presented in this plan. A visual inspection of these facilities and a reassessment of monitoring data will be necessary in order to update this plan.

Several lakes - Lakes Diversion, Kemp, and Kickapoo, specifically - have been designated in this plan as areas for which a septic tank control order is needed. At this time, such an order should effectively control point source pollution entering the lakes. However, the continued use of septic tanks for individual wastewater disposal is contingent on the minimal population growth expected for areas around the lakes and on the strict adherence to septic tank standards for installation, operation, and maintenance.

After the intensive study on Lake Texoma is completed, the effect of concentrated septic tank areas and their subsequent discharges on the quality of lake water should be more clearly defined. These results can be used to help evaluate the continued use of septic tanks around other lakes in the Red River Study Area.

b. Non-Point Source. During preliminary examination, two segments within the Red River Study Area, 202 and 214, seem to contribute considerable non-point pollution loadings to tributaries of the Red River. In these areas, the urban runoff from Sherman and Denison and from Wichita Falls may be contributing significant coliforms, sediment, BOD_5, and nutrients. Segment 202 encompasses extensive areas from which agricultural runoff may contribute excessive sediment loadings, pesticide, and nutrients, to tributaries of the Red River. Therefore, an effective sampling program should be conducted in Segments 202 and 214.

This study should be conducted over a two-year period. Samples should be taken at least eight times in order to get indicative seasonal variations.

The urban samples should be flow weighted and analyzed for:

BOD_{20}
BOD_{20} (Nitrogen suppressed)
TDS
TSS
Nitrogen Series (Nitrates, nitrites, ammonia N, and total Kjeldahl).
Total and ortho phosphates
Chlorides
Sulfates
Heavy metals (lead, mercury, copper, chromium, cadmium, and arsenic)

In addition, samples should be collected individually for total and fecal coliforms, fecal streptococci, oil, and grease.

The agricultural/silvicultural samples should be flow weighted and analyzed for:

BOD_{20}
Nitrates
Phosphates
Pesticides
TSS
TDS

In addition, the following data should be taken at each sampling site:

Stream depth and velocity
Dissolved oxygen concentration
Temperature (both air and water)
Precipitation (intensity and duration)
Conductivity
pH

An effective non-point source study will require that samples be taken at intervals over at least a two-year period. Consequently, an effective, sufficient study will cost approximately $200,000 to $500,000.

In addition to urban runoff and agricultural runoff, several sanitary landfills in the Study Area may be contributing substantial non-point source pollutant loads. Several of these sites are operated as "Grandfather sites" using temporary permits. These sites should be immediately inspected, and leachate samples and ground water samples should be taken, where necessary, to help define possible problems and to provide data for the reassessment of the permits.

CHAPTER C

SEGMENT 201

1. SEGMENT SUMMARY

(a) General: Segment 201 includes approximately 47 river miles of the Red River and extends from the Arkansas State line to the Oklahoma State line. This area does not include the McKinney Bayou or the area south of 33°30' which is included in the Texarkana Designated Areawide Planning Area. Segment 201 drains approximately 280 square miles and is classified as a water quality segment. A water quality segment is defined as any segment where it is known that water quality does not meet applicable water quality standards and/or is not expected to meet applicable water quality standards even after the application of the effluent limitations required by PL 92-500. The stream standards for this segment limit the fecal coliforms/100 ml to 1,000, which is relatively high, and contact recreation is not considered to be a desirable water use.

The Cities of DeKalb and Hooks operate the only municipal treatment facilities within this segment, and both have treatment schemes which discharge effluent into tributaries of the Red River. The City of Hooks is located within the Texarkana Designated Planning Area and will not be discussed in this report.

(b) Non-Point Source Assessment: Land use in the portion of Segment 201 which is included in the Study Area consists primarily of dry cropland and forestland. The primary problem in this category IV segment has been chronic dissolved oxygen deficits during periods of low flow. It is believed that the problem may be due to either point source pollution, stream hydraulic characteristics which inhibit reaeration, or non-point source pollution from the heavily wooded areas. An examination of the different categories of non-point pollutant sources indicates that pollution from mining, construction, hydrographic modification, and agricultural activities are not significant and alone should not create nor greatly contribute to water quality problems. Mining activity in this segment is minimal, with most of the production in Bowie County which is outside the Study Area. Construction activity in the area is minor in nature and, with proper sediment control techniques,

should produce no measurable pollutant load to the streams of the area. There are no hydrographic modification projects underway or planned, and there are no major impoundments located within this segment. Although agriculture is a primary activity, sediment loading for this segment is not indicative of potential problem areas according to the methodology prepared for the analysis of these activities. Contamination from natural salts is not a problem in this segment, since most of the chloride flow from upstream portions of the Red River is diluted at Lake Texoma.

Other possible sources of non-point contamination are urban runoff, silviculture, and disposal activities. DeKalb is the only major urban area within this segment. Every year approximately 300 acre-feet of urban runoff containing 9,400 pounds of BOD and 570,000 pounds of suspended solids discharges into Mud Creek. Since the Red River at DeKalb has a flow of more than 10 million acre-feet per year, the dilution factor for this runoff is greater than 30,000. The runoff from DeKalb will have a very minor impact once it reaches the Red River. The impact of this flow upon Mud Creek cannot be evaluated since there are no data available for this receiving water.

Segment 201 is the only region having significant forestland within the Red River Study Area. Loblolly, longleaf pines, and shortleaf pines are the principal softwoods; and oaks, hickory, magnolia, and sweet and black gum are the principal hardwoods in this segment. Undisturbed forests are generally recognized as primary sources of good quality water runoff. The water quality is chiefly influenced by man's activities. The major activities causing pollution in the forestlands include the construction of access systems, harvesting, intensive site preparation, planting, and prescribed firing. Sediment, nutrients, and temperature are generally considered the primary water pollutants from forestlands. Forest practices that reduce sediment loss will usually reduce nutrient loss and water temperature increase as well.

The control of pollutants generated by silvicultural activities is achieved through source management. At the present, data do not indicate an excessive pollution problem from silvicultural sources in this segment; therefore, the existing management program should be adequate for pollution control.

A survey of disposal activities indicate that no septic tank concentration areas or land application sites currently exist within the portion of Segment 201 which is included in the Study Area. The only area within this segment where disposal activities are a potential source for non-point contamination is the sanitary landfill located north of DeKalb. At present only 30 percent of this 10 acre site is filled. The remaining portion of the fill should serve the City of DeKalb for five additional years. On the basis of the simplified, water-balance computations suggested for use by the methodology, "Disposal Related Non-point Source Analysis," it is estimated that leachate from the landfill could first begin to flow from the landfill within three years. The landfill has been in operation for several years; however, no leachate has been reported to date. It is estimated that the fill could possibly produce as much as 10,200 gpd of leachate after the fill is completed. The expected loadings from this flow, based upon average containment concentrations observed in sanitary landfills, are 1,430 lbs/day of BOD, 5.5 lbs/day total phosphorus, and 50 lbs/day of nitrogen.

The degree to which these waste loads would be attenuated is a function of the thickness of soil through which the wastes flow before reaching ground or surface waters. Information obtained from a local well driller indicates that the sanitary landfill is located very near the top of the water-bearing sands of the area. Since these waste flows would not be greatly reduced in strength when entering the water table, the potential for contamination from the disposal site could be great. These wastes could flow through this groundwater to wells used as a water supply or become part of the base flow of a stream, thereby affecting the quality of surface waters. Because there is not a sufficient amount of data available on these receiving waters, the impacts cannot properly be evaluated. The waste load from this landfill is quite significant, and adverse impacts appear to be probable if these wasteloads are not adequately attenuated. If the water table drops and these wastes pass through the underlying soils, the loads will be reduced. According to the methodology, flow through 14 feet of soil would effectively reduce the organic loading by over 50 percent of its original loading.

Since the potential contamination from this site could have a significant effect upon the water quality of the segment, depending upon the characteristics of

the water table, it is suggested that a more detailed examination of this site be made in the near future. This study should consider the seasonal variations of the water table at this site and any geological features which would affect the flow of these waters. In addition, the production of leachate should be examined on a seasonal basis as well since the production is greatest during the wetter seasons of the year. The City has applied for a permit for this landfill site, and a thorough investigation should be completed as part of the permitting procedure. Since this site was in operation prior to November, 1970 (Grandfather site), its permit requirements were given a low priority by the Texas Department of Health while the Department worked to insure that new sites were adequately designed to prevent problems in the future. Current site inspection reports in the files of the Texas Department of Health indicate that the site is well operated and that no conditions indicating water quality problems have been observed. Because there is a potential for contamination from the site in the future, it is recommended that the permitting procedure for this site be given a higher priority rating so that the site may be fully investigated and any contamination may be curtailed.

Because of this landfill's potential to contaminate not only the groundwater of the surrounding area, but the adjoining surface waters as well, several control strategies should be examined. Control strategies consist of either stopping the infiltration of water into the landfill area, and thus eliminating the production of leachate, or of intercepting and treating the contaminated groundwater. The alternative of intercepting and treating the contaminated groundwater is the most costly strategy; and the effectiveness of this strategy is debateable, because the treatment method will generate quantities of solid waste that would ultimately require disposal. The probability of collecting all the contaminated ground water is slight, and a continuous monitoring program will be required.

Control strategies which will stop or greatly reduce the quantity of leachate produced are the closing of the site or the modification of the existing operation procedures. Simply closing the landfill will not eliminate the pollution problem unless certain abandonment procedures are also initiated to stop leachate generation. Percolation into the landfill must be eliminated by constructing an impermeable layer of material over the landfill and by modifying the drainage patterns in the surrounding areas to prevent runoff from entering the landfill and to prevent erosion of the impermeable top layer. Once

these items are accomplished, the leachate generation will abate; and the direct impacts on the water resources will cease. Unless proper techniques are used to prevent percolation from entering the landfill, the landfill could continue to pollute for many years after the last solid waste is deposited. Because this is the only landfill in the area, the social impact of closing the facility without an alternative site available will be adverse.

Another control strategy which should be considered is the modification of existing operational practices to reduce or eliminate the pollution generated from the landfill. Modification of the solid waste compaction technique may be used to increase the density of the solid wastes in the landfill, thereby increasing the field capacity of the landfill. Thicker soil covering between lifts and as final cover will increase the field capacity of the landfill and may reduce the quantity of leachate generated to an acceptable level. Both modifications are relatively inexpensive; however, they are limited in effectiveness. Another technique that may be used is the planting of a dense vegetative cover on the landfill site to promote maximum evapotranspiration. This inexpensive measure can minimize the quantity of leachate generated and, therefore, reduce the pollution from the existing landfill. The effectiveness of these control measures is greatly dependent on the characteristics of the landfill, and a specific study would be required to determine if this strategy would provide adequate pollution control.

2. DEKALB

The City of DeKalb currently has two wastewater treatment plants. The North Plant consists of an Imhoff tank, a trickling filter, an oxidation pond, and sludge drying beds. The South Plant utilizes a bar screen, an Imhoff tank, two oxidation ponds, and sludge drying beds. Both systems suffer from excessive infiltration and inflow problems that result in the bypassing of waste flows during and following heavy rainfall. The total suspended solids concentration regularly exceeds the permitted levels due to the algal accumulations in the oxidation ponds.

The City has applied for a Construction Grant under PL-92-500, and Step 1 has been funded. The project includes replacing

the North Plant with a new interceptor, lift station, and force main in order to divert the wastewater to the South Plant. The South Plant will be enlarged and upgraded to meet the City's effluent limitations.

CHAPTER D

SEGMENT 202

1. SEGMENT SUMMARY

(a) General:

Segment 202 extends from the Oklahoma State line to Lake Texoma and encompasses an approximate area of 1,740 square miles. This segment drainage area includes parts of Bowie, Red River, Lamar, Fannin, and Grayson Counties. This segment has relatively good water quality; however, the pH standard is not met approximately 20 percent of the time. On a few occasions, the fecal coliform, dissolved oxygen, and chloride standards have also been exceeded. This segment has been designated by the Texas Department of Water Resources as an intensive planning area since preliminary data indicates the possibility of problems resulting from runoff from areas of urbanization, silviculture, and agriculture.

Located within the segment drainage area are a large number of treatment facilities both municipal and industrial. A summary of these facilities are as follows:

Description	No. of Dischargers	No. of Non-Dischargers
Municipal WWTP	14	0
Non-Municipal WWTP	4	0
Municipal WTP	2	0
Industrial Operations	2	6
Feedlot Operations	0	1

These facilities, as well as areas currently not being served by treatment facilities, were investigated; and their needs within the next five years have been presented in the following sections.

The Lannius MUD has made application to obtain 201 grant funds to construct a new sewage collection system and treatment plant. No funds have yet been designated.

(b) Non-Point Source Assessment

Segment 202 has been designated as the Sherman-Denison Intensive Planning Area. Land use in this area consists

primarily of dry cropland and forest land with a significant amount of urban area in Sherman and Denison. It is believed that potential water quality problems may be the result of runoff from areas of urbanization, silviculture, and agriculture. Other possible sources of non-point contamination which need to be examined include mining, natural salts, construction, disposal, and hydrographic modifications. There are no areas of natural salt deposits within the segment, and most of the chloride flow from the upstream portion of the Red River is diluted at Lake Texoma. Mining activity in this segment consists primarily of petroleum production in Grayson County and sand and gravel production in Grayson and Fannin Counties. There are no areas within the segment where water quality problems have been attributed to the mining activity of the segment.

Highway construction is the major construction concern within this segment. Approximately 90 miles of highway are either planned or under construction outside of the urban areas. All of these construction projects will use sediment control techniques which should greatly reduce any possible sediment loads in runoff. If control methods are properly used, no adverse environmental impacts from the construction are foreseen.

Segment 202 is the only area within Red River Study Area with possible sediment problems due to agricultural runoff. For an in-depth evaluation of the problem, Segment 202 was divided into 92 subwatersheds, and the Modified Universal Soil Loss Equation was employed to determine the sediment yield. The soil loss due to a 12-hour storm having a 5-year return frequency was calculated, and the results are shown in Figure D-1. Group IV areas, areas 59, 60, 63-67, and 69, have the highest soil loss range (8-10 tons/day/sq. mi.) and are identified in Figure D-1. Table D-1 lists the soil loss due to a 12-hour, 5-year frequency storm for each area.

FIGURE D-1. SOIL LOSS AREAS

Table D-1

Soil Loss Due to 12-hr, 5-Yr. Frequency Storm and Allowable Level

Area Number	Storm Soil Loss Tons/day/sq.mi.
59	8.60
60	9.48
63	8.62
64	8.91
65	8.61
66	8.53
67	8.21
69	9.18

Except for area 59, these areas have a soil loss greater than the allowable level. Therefore, for these areas a good soil management and conservation program may help to control the sediment problem.

Because of the many variables which influence sediment yield and the variable characteristics of site conditions, no stereotype pattern of sediment control can be established. The primary cause of sediment production is sheet erosion. Land treatment measures provide an effective and economical means of reducing sheet erosion and sediment yield. Various types of soil conservation measures for erosion reduction have been developed for specific soil, cover, slope, and rainfall complexes. These measures include soil improvement, proper tillage methods, strip cropping, terracing, and crop rotation. Of all the conservation measures available, cover control is perhaps the most effective and easiest. Even with only 20 percent of the ground covered, the soil loss will be reduced by 42 percent if the covering material is weed or undecayed residue, and 52 percent if the covering material is grass or decaying, compacted duff of substantial depth. Conversion of farming practices to include terracing of row crops where needed and planting of fallow land with small grains, meadow grasses, or other cover crops should effectively reduce the soil loss to allowable levels.

Silviculture was also examined as a possible pollutant source in this segment. The major areas of forestland in Segment 202 are located in Red River County. The activities of man have the greatest influence on the quality of runoff from the forest watershed. The activities causing pollution include the construction of access systems, harvesting, intensive site preparation, planting and prescribed firing. Silvicultural operations are unique in two ways: (1) rotation occurs over a long period of time, during which many of the activities occur only for short time intervals; and (2) during any one time interval, only a portion of the total forested area is subject to the activities. These facts tend to mitigate pollutant loads; and, together with a good forest management program, no water quality problem is expected in this area due to the silvicultural activities.

Paris, Bonham, Sherman, Denison, and Whitesboro are the major urban areas within this segment. Every year, approximately 29,400 acre-feet of urban runoff containing 800,000 pounds BOD and 49 million pounds of suspended

solids discharges into the receiving waterway. Sherman and Denison contribute 85 percent of the total runoff. The Red River at Denison has a discharge of approximately 3.5 million acre-feet per year. Therefore, after considering the dilution effect, the urban runoff will add 0.08 mg/l BOD, 5.1 mg/l suspended solids, 0.02 mg/l total nitrogen, 0.004 mg/l total phosphorus, and 2500 coliforms/100 ml to the receiving water. From the criteria stated in the "methodology," the high coliform count is the only potential pollutant that may cause the receiving water to be considered unsuitable for swimming or raw water supply.

A high-rate disinfection system, which would remove 98 percent or more of the coliforms, could be utilized for the treatment of this urban runoff. The system should have the capacity of treating runoff caused by a 5-year frequency, 12-hour storm. The system should consist of 10 high-rate disinfection plants, each with 98 MGD design flow, for Sherman and of 10 plants, each with 90.4 MGD design flow, for Denison. The total capital cost for this system will be $2,688,000, and the annual Operation and Maintenance cost will be $400,000.

The methodology used to evaluate the impacts of urban runoff has several limitations and allows for only a preliminary analysis of the impacts that urban runoff may cause. The quantities of runoff, and thus the loads, are based upon average urban runoff characteristics and not on those characteristics peculiar to the Sherman-Denison urban area. It is also uncertain that this runoff could be collected (for treatment) at a central point. The stream impact would depend upon the water quality in the receiving waters, and this also has not been determined to date. Because of the relatively high cost involved and the uncertainties associated with the evaluation method, it is recommended that more data be gathered before a control strategy is decided upon. In addition, the economic impact of such control strategy should also be considered.

Disposal activities in Segment 202 include septic tank concentration areas, sanitary landfills, and areas for the land application of wastewater. The septic tank concentration areas are located in Lamar County near the Red River and have all been reviewed for their contamination potential. Projection of unattenuated wasteloads from the septic tanks (Table D-2) indicate total loads of less than 18 lbs/day BOD_5 and less than 9 lbs/day TSS. These loadings would be greatly reduced by passage through infiltration fields and have a potential for contamination only if the

Table D-2

Wasteloads from Septic Tank Concentration Areas in Segment 202

City	Population	Flow MGD)	Wasteloads (lbs/day)					
			TSS	BOD_5	Phosphates	Organic N.	NH_3	Coliforms
Arthur City	200	0.02	8.84	17.8	3.34	1.84	3.34	70
Powderly	185	0.02	8.18	16.5	3.09	1.70	3.09	65
Chicota	125	0.01	5.53	11.1	2.08	1.15	2.09	44

systems fail to operate properly and if the effluent flows to the surface. For the quantity of effluent anticipated from these areas, this failure would be more a hazard to public health than a threat to water quality.

Sanitary landfills in this segment are located near the larger cities of Sherman, Denison, Bonham, and Paris. With the exception of a commercial landfill site near Bonham, these landfills are all larger than 100 acres in size and have a potential to produce a significant amount of leachate if the landfills are not properly operated. Table D-3 presents the quantity of leachate that could be produced annually by the completed landfill after the leachate first appears. The time of first appearance of leachate, given in the table, is relative to the completion of the landfill. Because some channeling of water will occur, some leachate may appear before the landfill has reached its field capacity; however, these quantities of leachate should not be great and may be assumed to be negligible. The unattenuated wasteloads from these landfill sites have been estimated by assuming an average value for landfill leachate and are presented in Table D-4. These loads are quite large; therefore, unless the loads are greatly attenuated before reaching the receiving water, negative water quality impacts would be probable.

The degree to which these wasteloads would be attenuated is a function of the thickness of the soil through which the wastes flow before reaching ground or surface waters. At the City of Paris landfill site, the water table has been reported to be approximately 13 feet below the landfill area. According to the methodology, passage of leachate through this soil would reduce the organic load of the contaminant by approximately 50 percent so that the estimated BOD_5 loading would be 10,200 pounds per day. This load would not be greatly reduced once the water table is reached, and the impact of the load could be significant. Before the impact of this loading can be assessed, more data on the receiving waters is required.

Since the potential for contamination from this site could have a significant effect upon the water quality of the segment, depending upon the characteristics of the water table, it is suggested that a more detailed examination of the Paris site be made in the near future. This study should consider the seasonal variations of the water table at the site and any geological features which would

Table D-3

Leachate Production in Sanitary Landfills in Segment 202

City	Permit Number	Est. Annual Percolation Into Landfill (Inches)	Time of First Appearance (Years)	Annual Leachate Quantit (Gallons/Day)
Paris	00144	12	3	143,000
Bonham	00475	11	2	94,300
Bonham	00201	11	1.5	24,600
Lee Truck. (Sherman)	00523	11	4	92,200
Sherman	00648	11	3.5	96,300
Denison	00440	11	6	79,900

Table D-4

Wasteloads From Sanitary Landfills
In Segment 202

City	Permit Number	LOADINGS (lbs/day) BOD_5	Total Solids	Total P	NH_4-N
Paris	00144	19,900	35,300	78	692
Bonham	00475	13,200	23,300	51	456
Bonham	00201	3,400	6,100	13	119
Lee Trucking (Sherman)	00523	12,900	22,800	50	446
Sherman	00648	13,400	23,800	52	466
Denison	00440	11,100	19,700	43	386

affect the flow of these waters. The production of leachate should be examined on a seasonal basis since leachate production is greatest during the wetter seasons of the year. This landfill site has been permitted, and there is a possibility that an adequate investigation has already been made. The landfill is a grandfather site (site in existence prior to November, 1970) and is over 80 percent complete. If subsequent investigations verify that the potential for groundwater contamination exists, as does this preliminary assessment, steps should be considered to curtail leachate production from the landfill.

Because of this landfill's potential to contaminate not only the groundwater of the surrounding area but the adjoining surface waters as well, several control strategies should be examined. Control strategies consist of either stopping the infiltration of water into the landfill area, and thus eliminating the production of leachate, or of intercepting and treating the contaminated groundwater. The alternative of intercepting and treating the contaminated groundwater is the most costly strategy;. The effectiveness of this strategy is also debatable, because the treatment method selected will generate quantities of solid waste that will ultimately require disposal. The probability of collecting all the contaminated ground water will be slight, and a continuous monitoring program will be required.

Control strategies which reduce the quantity of leachate produced include closing the site and modifying the existing operations procedures. Simply closing the landfill will not eliminate the pollution problem unless certain abandonment procedures are initiated to stop leachate generation. Percolation into the landfill must be eliminated by constructing an impermeable layer of material over the landfill and by modifying the drainage patterns in the surrounding areas to prevent runoff from entering the landfill and to prevent erosion of the impermeable top layer. Once these items are accomplished, the leachate generation will abate; and the direct impacts on the water resources will cease. Unless proper techniques are used to prevent percolation from entering the landfill, the landfill could continue to pollute for many years after the last solid waste is deposited. Because this is the only landfill in the area, the social impact of closing the facility without an alternative site available will be adverse.

Another control strategy which should be considered is the modification of existing operational practices to reduce or eliminate the pollution generated from the landfill. Modification of the solid waste compaction technique may be used to increase the density of the solid waste in the landfill, thereby increasing the field capacity of the landfill. Also, thicker soil covering between lifts and as final cover will increase the field capacity of the landfill and may reduce the quantity of leachate generated. Both modifications are relatively inexpensive; however, they are limited in effectiveness. Another technique that may be used is the planting of a dense vegetative cover on the landfill site to promote maximum evapotranspiration. This inexpensive measure can have a significant effect on the quantity of leachate generated and, therefore, can reduce the pollution from the existing landfill. The effectiveness of these control measures is greatly dependent on the characteristics of the landfill, and a specific study will be required to determine if this strategy will provide adequate pollution control.

The water table is approximately 50 feet below the sanitary landfills near Bonham. The passage of leachate through the soils will reduce the organic land by approximately 92 percent. The estimated BOD_5 loading which will reach the water table below the Hale Landfill is 1,000 pounds per day, while that for the smaller H&H Wrecking site is estimated to be approximately 250 pounds per day. This removal is comparable to that which can be achieved if the leachate is collected and treated before being discharged into a surface water. The impact of even the greatly reduced load, however, depends upon the characteristics of the receiving water. Unless these waters are used as a drinking water supply, it is not believed that the impacts will be significant.

The three other landfills located in the Segment are at Sherman and Denison. The City of Sherman has a relatively new disposal site (less than 20 percent complete) which encompass over 100 acres. The Lee Trucking Company also has a sanitary landfill near Sherman. At present, the site is having problems complying with its permit and is utilizing available space in the City of Sherman landfill. The Denison site encompasses over 100 acres and is approximately 70 percent complete. The water table at these sites is reportedly over 100 feet below the bottom of the fill area. It is estimated that passage of the leachate through the soil to the water table would effectively remove over 99 percent of the

pollutants. Because of this attenuation, no adverse water quality impacts are foreseen for ground waters of the area.

There are two facilities, located north of the City of Paris, which dispose of their waste by land application. The facility operated by C&S Market treats process water and wash water from its slaughterhouse and meat processing operations. Treatment facilities include a grease trap, two holding ponds in series, and three septic tanks, with a combined capacity of 2000 gallons. All wastewater effluent from these facilities is collected in two lagoons where it is disposed of by evaporation and irrigation. Although there are 13 acres of coastal bermuda grass available for irrigation, inventory data indicates that all wastewater has been evaporated in the past. Unless the capacity of this facility is greatly increased, no problems are forseen.

Campbell Soup operates the only overland flow system within the State of Texas. This system treats only grease and vegetable wastewaters which are collected from the plant by two separate systems. Sanitary sewage is collected and discharged into the City of Paris' sanitary sewage system. The grease is removed by a gravity grease separator and sold to a local rendering company. After the grease is removed, the water is combined with the vegetable wastewater stream and screened. This screened flow is applied to the land by a sprinkler irrigation system. This irrigation flows over approximately 250 feet of terraced grassland and is then collected and discharged to an outlet waterway. This flow is monitored at a discharge point at the end of the facility. The facility has an eleven-year history of BOD reduction in excess of 99 percent, and an examination of recent discharge data indicates that a monthly BOD average of 10 mg/l has not been exceeded.

Concern for pollution problems arises during storm events in which the runoff detention time, upon which this type system relies, is drastically reduced. At best, this stormwater will dilute the normal effluent and reduce the normal effluent pollutant concentration. The worst condition will result if there is no treatment of this wastewater as it flows across the treatment area, and the wastewater strength is reduced only by dilution. At the present, there is not enough data available to indicate which of these conditions is more likely to occur. These conditions will vary as

a function of rainfall intensity which also varies greatly. No impact can be assessed for either Smith Creek or Pine Creek, receiving waters for the two land application facilities, since no data are available for either of these receiving waters. These waste will become more dilute as stormwaters from these creeks increased with rainfall, and the probability of adverse impacts will be greatly reduced. Without the necessary data to examine flooding conditions, it is not possible to properly evaluate the facility, although, under normal rainfall conditions the facility will be adequate throughout the study period.

2. BELLS

(a) General: The community of Bells is located in Grayson County on U. S. Highway 82, twelve miles east of Sherman. The City has a population of approximately 830 persons. The Sherman-Denison area is projected to grow rapidly during the next two decades, and thus, Bells is also projected to grow rapidly. The land use in Bells consists primarily of residential housing with only a few commercial establishments. The City is shown in Figure D-2. The topography of the area slopes to the north and northwest, with drainage into Corneliason Creek. The soils of the area are of three types - Houston Black-Austin clays, Ellis-Crockett soils, and Wilson-Crockett clay loams - none of which are well-suited for septic tank drainage.

The City currently operates a wastewater treatment plant consisting of an Imhoff tank-trickling filter scheme and having a design capacity of 0.09 MGD. The system was built in 1953 and is showing deterioration. The effluent produced cannot consistently meet effluent requirements. In addition, the plant will be moderately overloaded by 1983 and severely overloaded by the year 2000. Consequently, the existing plant should be abandoned, and a new plant should be constructed to serve the needs of the community. Two alternatives are presented.

In order to determine the size and costs of alternative waste treatment schemes, raw wastewater loadings were projected using the statewide Municipal Waste Treatment Needs Assessment Methodology for the present, 1983, 1990, and the year 2000. These projections were based on population projections and assumed per capita waste loadings and flow variations. The results of these wasteload projections are presented in Figure D-3. The design criteria are based on wasteloads projected for the year 2000.

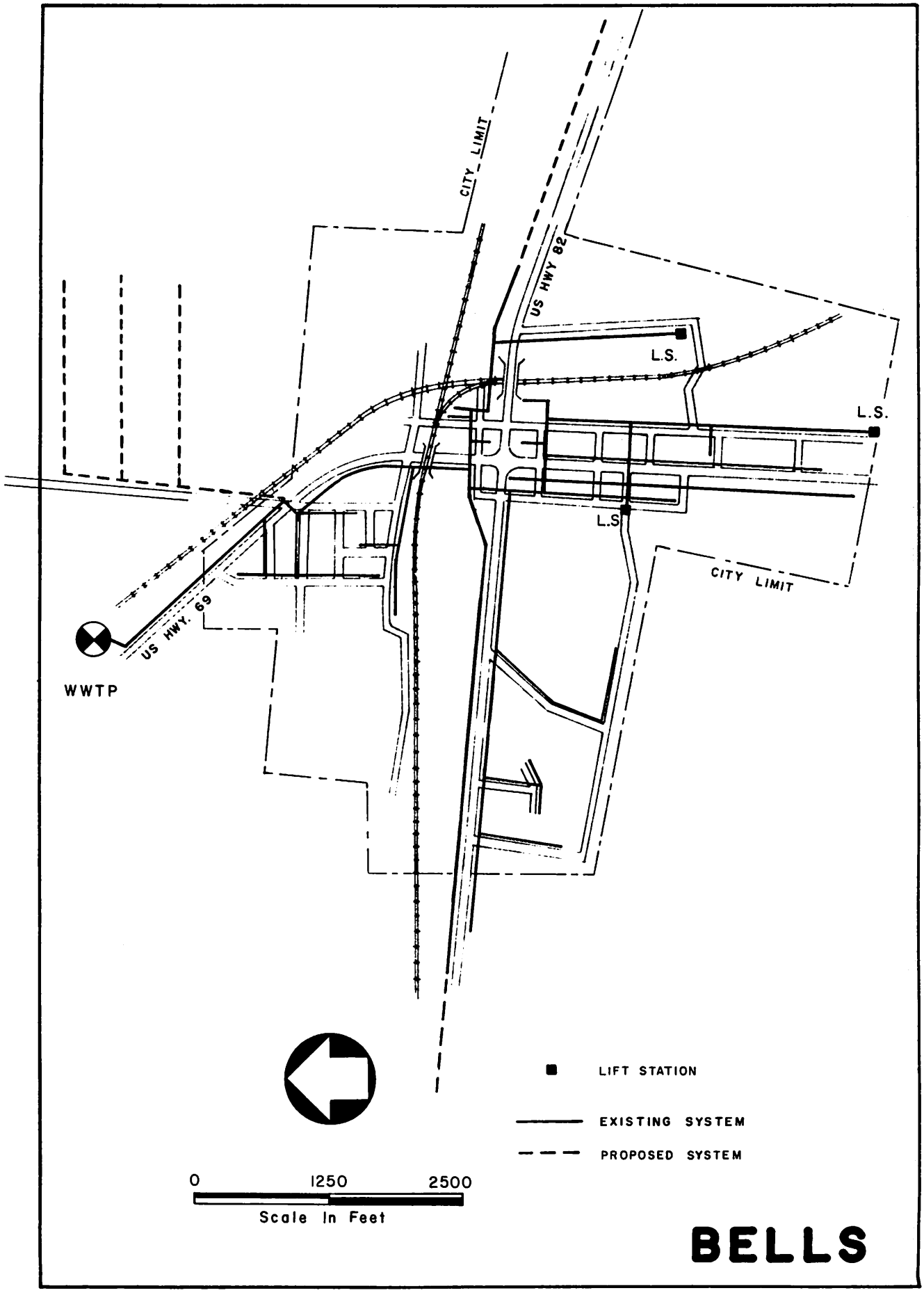
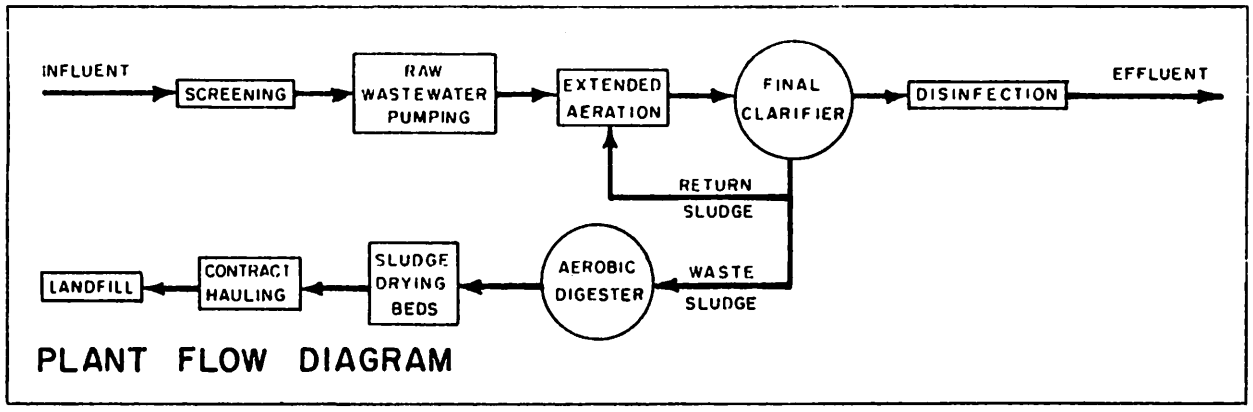
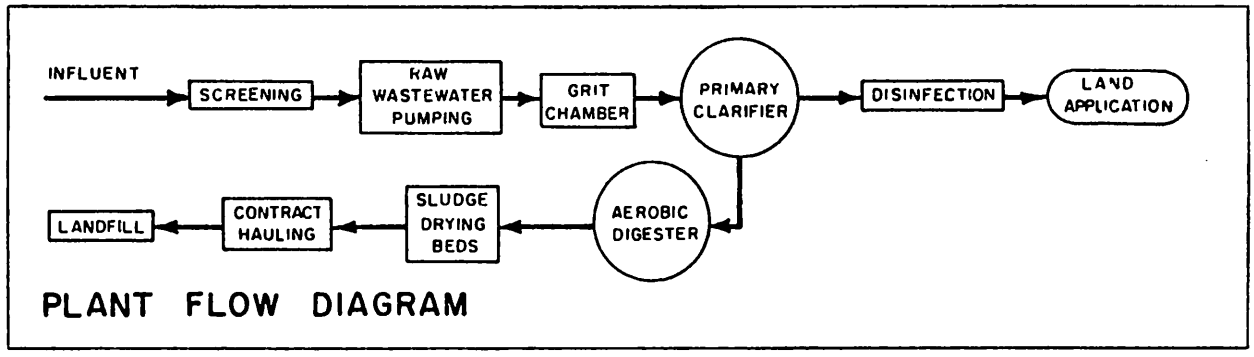


Figure D-2: Existing and Proposed Collection System For the City of Bells

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF BELLS



Alternative 1. Abandon existing facility - construct extended aeration plant.



Alternative 2. Abandon existing facility - implement land treatment.

Design Population: 1,100
Design Flow:
Average - 0.12 MGD
Peak - 0.28 MGD

Effluent Requirements: (Alt. 1)
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Corneliason Creek (Alt. 1)

Wasteload Projections for the City of Bells

Planning Year	Population	Flow (MGD) Average	Peak
1975	825	0.07	0.07
1983	890	0.09	0.22
1990	980	0.10	0.25
2000	1,100	0.12	0.28

EXISTING PLANT CAPACITY: 0.09 MGD

Figure D-3

The waste flows indicated for 1975 are based on self reporting data and indicate that infiltration and inflow may play an important part in overloading the existing wastewater treatment plant. A detailed infiltration and inflow study should be conducted if 201 facility planning is initiated.

(b) Technical Alternative 1:

(1) Technical Plan: As a first alternative, the City of Bells should abandon its existing wastewater treatment facilities and construct an extended aeration facility. The plant flow diagram of such a facility is illustrated in Figure D-3. Substantial growth is expected on the northern and eastern perimeter of the City, and collection lines should be extended to these areas in accordance with growth patterns (Figure D-2).

(2) Financial and Managerial Considerations: If the treatment plant is constructed, the total capital cost of this alternative is estimated to be $477,400 as illustrated in Table D-5.

Its present worth and total annual cost will be $704,000 and $64,600, respectively, based on 6-5/8 percent interest for twenty years. The monthly charge per connection would be $14.70 based on three persons per connection. If Federal funding is available through PL 92-500, the monthly charge per connection would be $8.40.

The City of Bells presently operates the existing wastewater treatment facility; and, since significant new service areas outside of the City's jurisdiction are not proposed, the City should continue to manage the plant on the local level.

(3) Impacts: There are no long-term adverse environmental impacts associated with the construction of an extended aeration type plant at the site of the existing facility. In contrast, a new efficient plant would improve the water quality downstream from the discharge point since the existing plant effluent does not consistently meet effluent requirements. There should be no significant social impact since the City currently has a central collection and treatment system.

With the help of Federal funds, the economic impact should not be adverse. As the City grows and collection lines are extended, the revenue

Table D-5

Estimated Alternative Costs For The Community of Bells

	Technical Alternative 1 Replace Existing Facility With Extended Aeration Pond	Technical Alternative 2 Replace Existing Facility With Land Treatment
Collection Cost		
Capital Cost	$201,000	$ 201,000
O&M Cost	1,400	1,400
Treatment Plant		
Total Labor Cost	14,200	16,000
Total Energy Cost	2,300	1,500
Total Chemical Cost	300	600
Construction Cost	275,000	*840,600
Land Acquisition Cost	1,400	1,400
O&M Cost	19,400	22,300
Capital Cost	276,400	842,000
Total Capital Cost	477,400	1,043,000
Present Worth	704,000	1,281,000
Total Annual Cost	64,600	117,500
Monthly Charge per Connection	14.70	26.70
WITH FEDERAL GRANT IN AID:	(75 PERCENT)	(85 PERCENT)
Total Capital Cost	176,000	176,500
Present Worth	401,700	430,500
Total Annual Cost	37,000	40,200
Monthly Charge per Connection	8.40	9.10

*Purchase of land used for irrigation is included in construction cost.

from additional user fees should help pay the expenses of the new facility.

(c) Technical Alternative 2:

(1) Technical Plan: Alternative 2 also proposes to abandon the existing facility. A land treatment system should be constructed to treat the City's wastewater. Such a facility is also illustrated in Figure D-3.

(2) Financial and Managerial Considerations: If a land treatment type plant is constructed, the total capital cost of the system is estimated to be $1,043,000. This cost includes the construction of facilities for primary treatment, purchase of the land area needed for land application, and the distribution system, pumps and piping, to spread the primary treated water over the land area. Since the City must have control of the land used in land treatment, it is assumed that this land is not currently available and will need to be purchased. This cost estimate does not, however, place a value on the water used for irrigation or on the benefits incurred from its use. Considering these assumptions, the monthly charge per connection will be $26.70, based on a 20-year amortization at 6-5/8 percent interest. With 85 percent funding from PL 92-500, the monthly charge per connection will be $9.10. Should the City be able to obtain a long term lease on the land needed for irrigation, costs of this alternative will be substantially reduced, since the land need not be purchased.

The City is currently managing the existing plant, and this appears to be a very satisfactory arrangement.

(3) Impacts: A negative aspect of this alternative is that in implementing land treatment, the effluent that is now discharged to Corneliason Creek will no longer be discharged, and this will reduce the flow in the Creek. In the detailed facility plan, the water rights downstream of the facility should be assessed. In addition, the land area used must be capable of receiving effluent on a continual basis. During times of excessive rainfall or, in the case of irrigated crop land, when irrigation is not desirable, the effluent must be held in holding ponds until the wastewater can again be applied to the land area. Positively, the land

treatment scheme can utilize the effluent for irrigation where an alternate supply of water may be difficult or costly to obtain.

Socially, land treatment may raise objections from nearby residents if the system is not properly maintained and supervised. Since the effluent is disinfected prior to application, land treatment should not impose a health hazard, although disinfection must be monitored and supervised to prevent odor problems.

3. BONHAM

The City of Bonham has a wastewater treatment system consisting of a bar screen, a lift station, a primary clarifier, two dual-stage trickling filters, a final clarifier, an anaerobic digester, and a sludge drying bed.

The City is currently participating in the PL 92-500 construction grant program to improve its system. The plans propose to upgrade the plant with chlorination and phosphate removal facilities. The sludge drying beds will be enlarged, and the mechanical bar screen will be replaced. In addition, three new interceptors will be constructed. These improvements will enlarge and upgrade the system to handle the waste flow for 10,000 persons.

4. ECTOR

The City of Ector has a wastewater treatment system composed of a manually cleaned bar screen, a pre-aeration tank, an Imhoff tank, a chlorine contact chamber with a hypochlorate generator, and dual sludge drying beds. Operating difficulties have been experienced in the motor life of the pre-aeration unit. The plant does not treat the existing flow adequately, nor can it provide secondary treatment.

Ector is participating in the PL 92-500 Construction Grant program. The proposed treatment improvements will consist of construction of a new Orbal aeration ditch and of conversion and enlargement of the existing facilities. The present manual bar screen will be reused. The sludge beds will be reused and enlarged by 50 percent. The existing pre-aeration unit will be converted to an aerobic digester by the replacement of the existing equipment with a new floating aerator. A new three-channel orbal ditch with rotary aeration disc will be constructed to provide the activated sludge process treatment. The existing Imhoff tank will be converted to a rectangular, non-mechanical final settling tank by removing a septum wall, installing an overflow weir on one long wall with the influent piping on the opposite

wall, and providing concrete fill in the bottom to form a hopper section with 3:1 side slopes. The existing chlorine chamber will be abandoned, and a new chlorine chamber will be constructed with gas chlorination facilities housed in an equipment building.

5. HONEY GROVE

The City of Honey Grove has applied for 201 grant funds to improve its collection system and add additional sludge bed area to its relatively new plant. The existing facility is an activated sludge package plant, built in 1968, followed by oxidation ponds added in 1978. Self reporting data indicate that the existing plant is performing well. Based on this data and on wasteload projections, the plant should be adequate throughout the planning period.

6. PARIS

The City of Paris has a new Orbal type activated sludge treatment system including a comminutor, a bar screen, an aerated grit chamber, two final clarifiers, gas chlorination with a chlorine contact tank, and sludge drying beds. The treatment facility is capable of producing an acceptable effluent with normal dry weather sewage flows.

The City has a major infiltration and inflow problem. Each time a rain of any significance occurs, the plant is subject to a washing-out effect, and a great portion of the solids are washed into the receiving stream. This causes the plant to lose most of its biological action and decreases the treatment efficiency of the plant. A sewer system evaluation should be carried out for the facility to determine the feasibility of rehabilitating the sewer system.

Heavy surges of industrial wastes occasionally upset the plant and cause high BOD and TSS in the effluent. Ten major industrial dischargers with flow in excess of 50,000 gpd contribute to this problem. An enforced industrial wastewater ordinance is needed to adequately protect the plant facility and to insure the treatment efficiency.

7. RENO

The City of Reno currently has a Step 1 grant to develop sewage facilities. The plans will consider both the feasibility of the City building its own wastewater treatment plant or of transporting its wastewater to the City of Paris.

8. SAVOY

The City of Savoy has a 201 construction grant to improve its wastewater treatment plant. The existing plant consists of a bar screen, an Imhoff tank, two oxidation ponds, and sludge drying beds. The plant is structurally deteriorating and does not consistently meet effluent requirements.

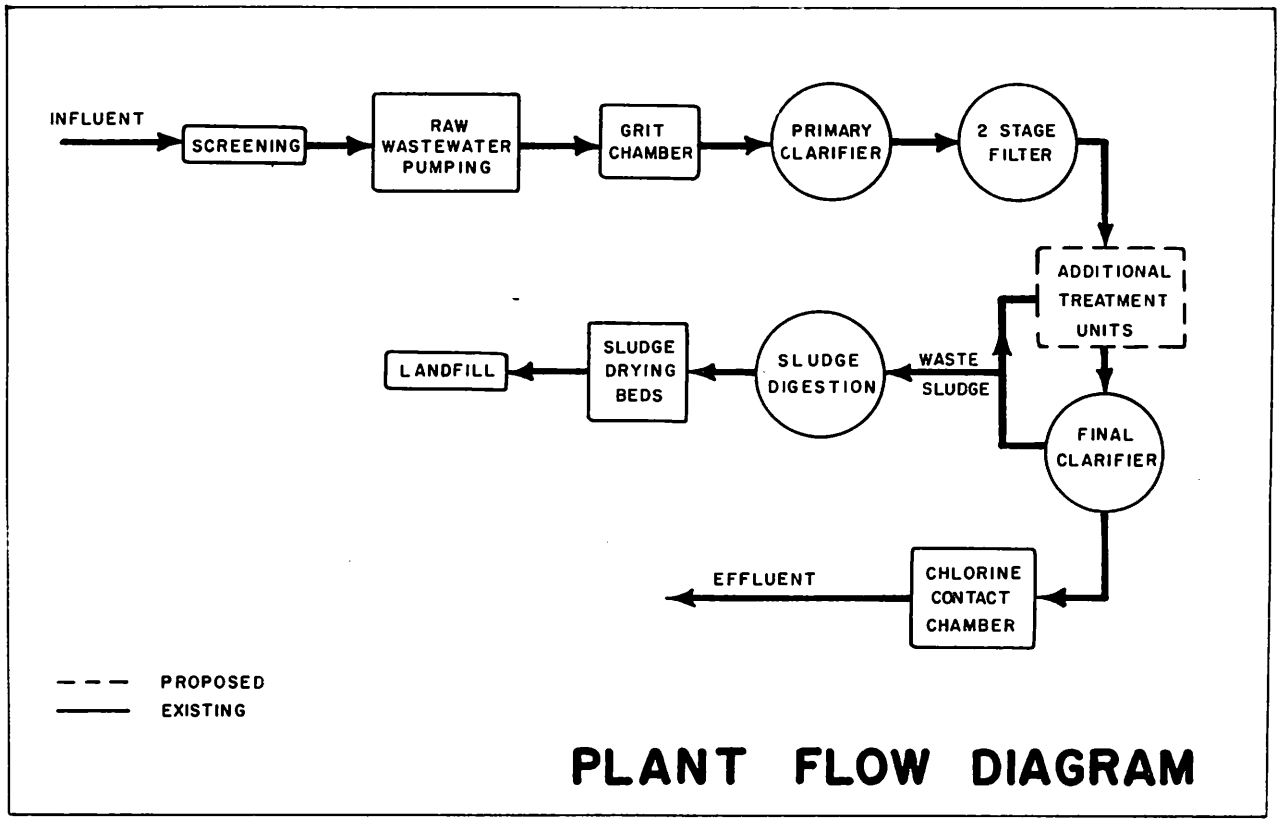
The plan to upgrade the plant proposes to inactivate the Imhoff tank and sludge drying beds and construct an oxidation ditch. The Imhoff tank and drying beds would remain on a standby or emergency basis. The oxidation ponds will remain in use to further treat the waste flows leaving the oxidation ditch.

9. SHERMAN-DENISON INTENSIVE PLANNING AREA

(a) Sherman: The City of Sherman has a present population of over 30,000 and is expected to grow to over 42,500 by the year 2000. The City's wastewater disposal needs are currently being served by a trickling filter type plant located southeast of the City on Post Oak Creek. The current wastewater treatment facility consists of two parallel trickling filter type systems. The older portion of the plant has a 3 MGD capacity while the new portion of the plant has a 6 MGD capacity. Wasteload evaluations, shown in Figure D-4, indicate that the plant has adequate capacity to handle hydraulic loads throughout the planning period. However, the addition of several large industries could invalidate these wasteload projections because of the large quantities of waste which some industries produce. The City of Sherman has a good atmosphere for industrial growth, and the addition of new industries within the study period is probable. The City has experienced some problems with reducing the effluent BOD_5 to its permitted level. These problems may be attributable to high industrial organic loadings to the system. These industrial loadings elevate the influend BOD_5 loadings above those of domestic wastewater thus making treatment more difficult. It is believed that enforcement of existing industrial waste and ordinances will control these problems.

Sherman is currently conducting a two-phased study to determine the size and significance of industrial contributions to the facility. Phase I involves a complete inventory of major industries and the monitoring of effluent quantity and quality. Phase II involves an

WASTEWATER TREATMENT PLANT DATA FOR CITY OF SHERMAN



Alternative: Upgrade existing facility.

Design Population: 45,400
Design Flow:
Average - 9.0 MGD
Peak - 14.00 MGD

Effluent Requirements:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Post Oak Creek

Wasteload Projections for the City of Sherman
(including Howe which is served by the City of Sherman)

Planning Year	Population (Sherman & Howe	Flow (MGD) Average	Peak
1975	27,600	5.85	7.15
1983	36,000	7.37	11.67
1990	39,000	8.24	12.93
2000	45,400	9.06	13.97

EXISTING PLANT CAPACITY: 9.0 MGD

Figure D-4

inventory of the smaller commercial and industrial facilities. Based on the results of these studies, industries are being encouraged to install pretreatment facilities as needed to reduce the overall loading to the facility. Currently, industry is responding to the problem very favorably.

According to wasteload projections, the facility has sufficient hydraulic capacity throughout the planning period. Preliminary engineering designs needed to upgrade the facility are being formulated and reviewed. These include the possible addition of trickling filters or an aeration basin. The upgraded facility will be designed to reduce the organic overloading problems.

At present, all residents of the City are served by the collection system. Major extensions of the lines to many of the outlying areas of the City are projected (Figure D-5). These lines will serve new industrial and residential growth. Figure D-6 illustrated the existing and projected land use for the City of Sherman.

(b) Howe: The City of Howe collects its wastewaters and pipes them to the City of Sherman facility for treatment. The City is projected to grow at a healthy rate; however, these increased flows can easily be handled by the City of Sherman facility, with no expansion required. The City is currently making additions to its collection system and plans to continue contracting with Sherman for treatment of its waste.

(c) Denison: The City of Denison presently has a population of over 25,000 persons and is served by three wastewater treatment plants within Segment 202. The population served by each facility is shown in Table D-6 and in the appropriate facility data sheets.

(1) Iron Ore Plant: The Iron Ore Plant is a new oxidation ditch plant that has apparently suffered from operational difficulties in the past; however, a site visit indicates that these problems are being corrected, and the plant seems to be operating efficiently. The plant does not receive waste from any major industry but is projected to have the greatest increase in flow since most of

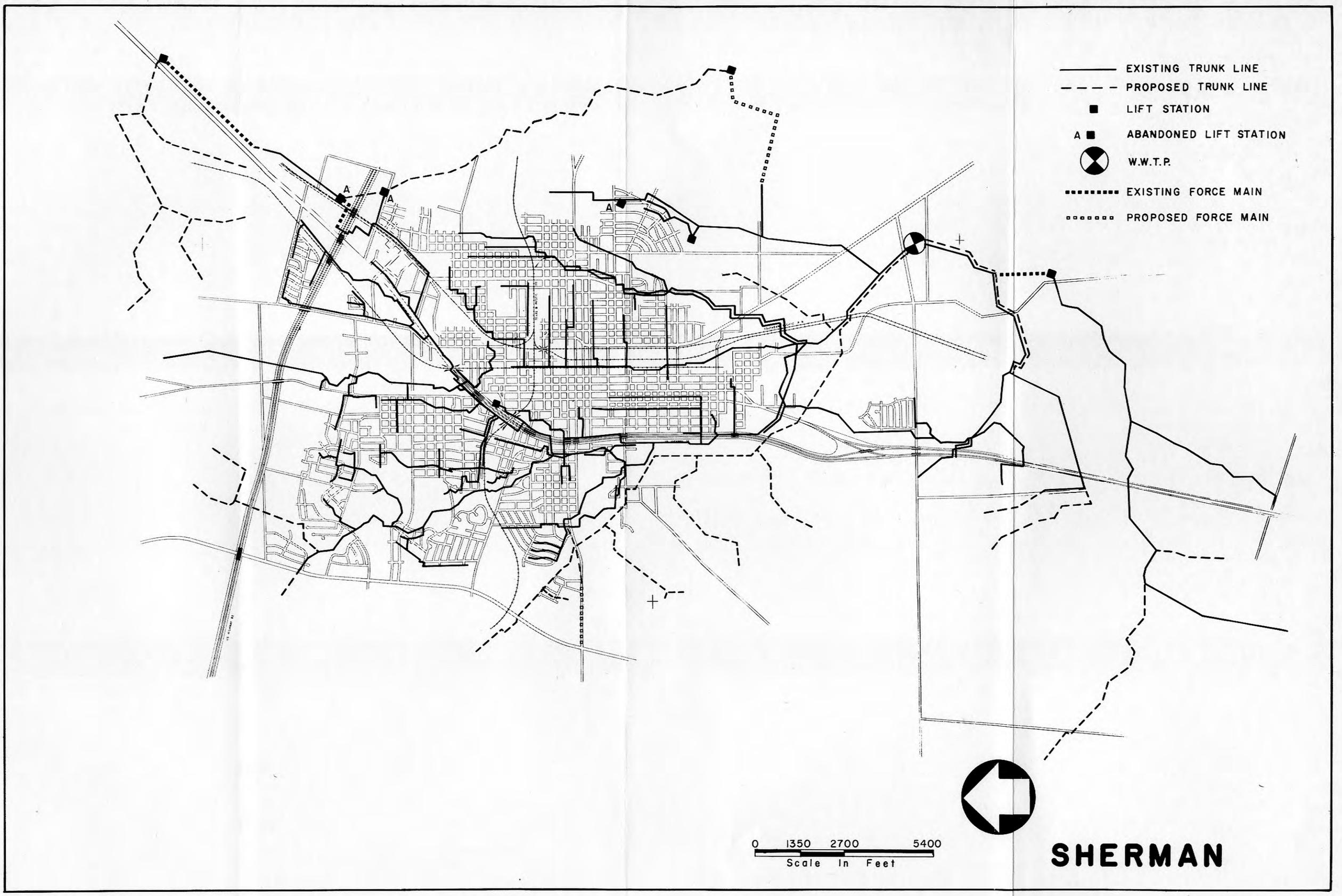

EXISTING TRUNK LINE
PROPOSED TRUNK LINE
LIFT STATION
A ABANDONED LIFT STATION
W.W.T.P.
EXISTING FORCE MAIN
PROPOSED FORCE MAIN
A
A
A
0 1350 2700 5400
Scale In Feet
SHERMAN

Figure D-5

Table D-6

Population Projections for the City of Denison

Service Area	% Pop. Served	1975	1983	1990	2000
Denison	100	25,103	26,000	27,500	29,650
Iron Ore Plant	34	8,535	9,300	10,600	12,400
Paw Paw Plant	40	10,041	10,200	10,400	10,700
Duck Creek Plant	24.5	6,150	6,150	6,150	6,150
Airport Plant	1.5	377	400	400	400

the projected residential growth in the City will be served by this facility. Wasteload projections for the facility (Figure D-7) indicate that the capacity of the plant will need to be increased by 0.6 MGD to serve the 12,400 people expected for this service area by 2000.

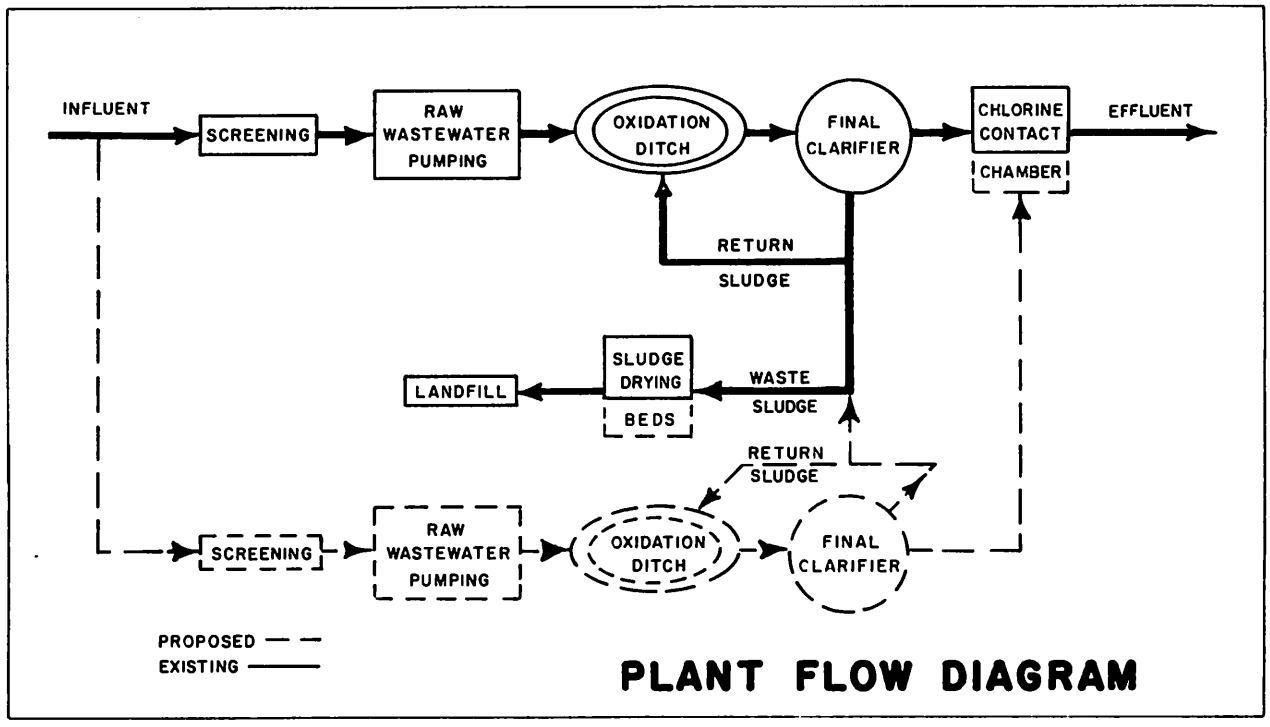
a. Technical Alternative: The City of Denison should expand its Iron Ore wastewater treatment facility to accommodate projected flows. Figure D-7 shows a possible expansion scheme for the facility.

b. Financial and Managerial Considerations: The total capital cost of expanding the facility by 0.6 MGD will be approximately $780,800 (Table D-8). With 75 percent Federal funding under PL 92-500, the total capital cost will be $195,200, resulting in an additional monthly charge per connection, assuming three persons per connection, of $1.30. These costs do not include the necessary head work and piping changes necessary for implementation.

c. Impacts: The expansion of the facility should allow the facility to produce an effluent that can meet permit requirements.

(2) Paw Paw Plant: The Paw Paw Plant is an older trickling filter type system and serves the central area of the City. This plant has suffered from maintenance problems, but its primary difficulties appear to be caused by organic overloading from industrial users of the system. The more stringent industrial pretreatment requirements which have been instituted should help to alleviate this situation. Even with this problem, the facility is operating within its permitted limitations. A recent site visit indicated that the plant is now well maintained. The Paw Paw Plant, which currently serves approximately 40 percent of the population, is expected to receive an additional 0.4 MGD by 2000. This increased load should easily be handled by the existing 2.5 MGD plant, which is depicted in Figure D-8. This plant is quite old, and the City has developed so that the plant is close to residential areas.

WASTEWATER TREATMENT PLANT DATA FOR CITY OF DENISON
(IRON ORE PLANT)



Alternative: Expand existing facility

Design Population: 12,400
Design Flow
Average - 1.60 MGD
Peak - 2.70 MGD

Effluent Requirements:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Iron Ore Creek

WASTELOAD PROJECTIONS FOR CITY OF DENISON
(IRON ORE CREEK)

Planning Year	Population	Flow (MGD) Average	Peak
1975	8,535	1.04	1.74
1983	9,300	1.16	2.13
1990	10,600	1.31	2.37
2000	12,400	1.52	2.71

EXISTING PLANT CAPACITY: 1.0 MGD

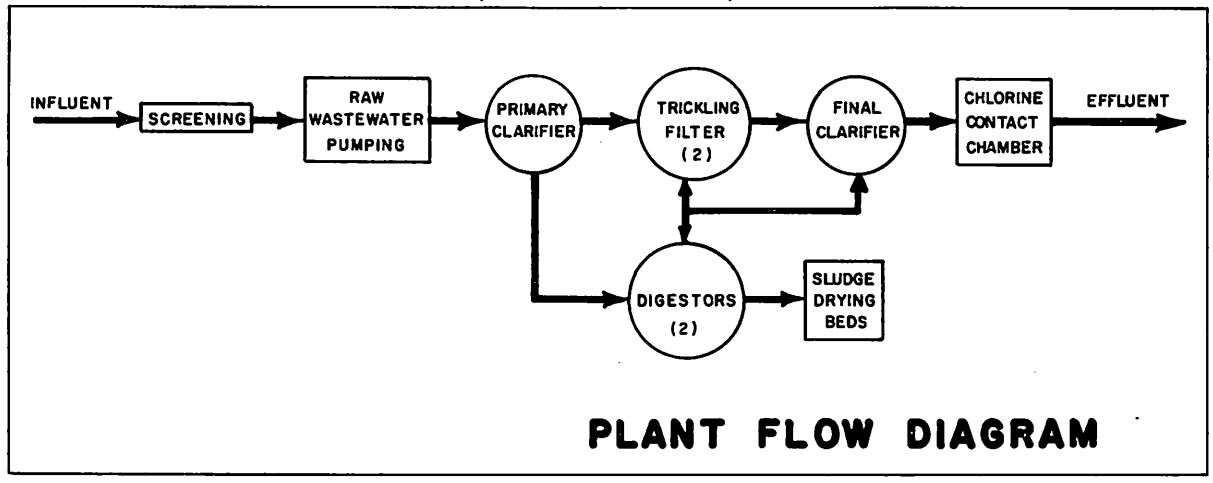
Figure D-7

Table D-7

Estimated Alternative Costs For
The City of Denison (Iron Ore Plant)

	Technical Alternative Expand Exisitng Facilities
Collection System	
Capital Cost	No Additions
O&M Cost	Proposed
Treatment Plant	
Total Labor Cost	$ 29,200
Total Energy Cost	13,800
Total Chemical Cost	1,300
Construction Cost	774,400
Land Acquisition Cost	6,400
O&M Cost	47,400
Capital Cost	780,800
Total Capital Cost	780,800
Present Worth	1,300,000
Total Annual Cost	118,800
Additional Monthly Charge per Connection	2.40
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	195,200
Present Worth	703,600
Total Annual Cost	64,700
Additional Monthly Charge per Connection	1.30

WASTEWATER TREATMENT PLANT DATA FOR CITY OF DENISON
(PAW PAW PLANT)



Design Population: 10,700
Design Flow
Average - 1.53 MGD
Peak - 2.78 MGD

Effluent Requirements:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Paw Paw Creek

WASTELOAD PROJECTIONS FOR CITY OF DENISON
(PAW PAW CREEK)

Planning Year	Population	Flow (MGD) Average	Peak
1975	10,041	1.41	2.18
1983	10,200	1.46	2.65
1990	10,400	1.49	2.70
2000	10,700	1.53	2.78

EXISTING PLANT CAPACITY: 2.50 MGD

Figure D-8

This may have created an undesirable situation which will require action in the future. The City may wish to examine the possibility of abandoning this facility and of constructing a newer facility at a greater distance from the City.

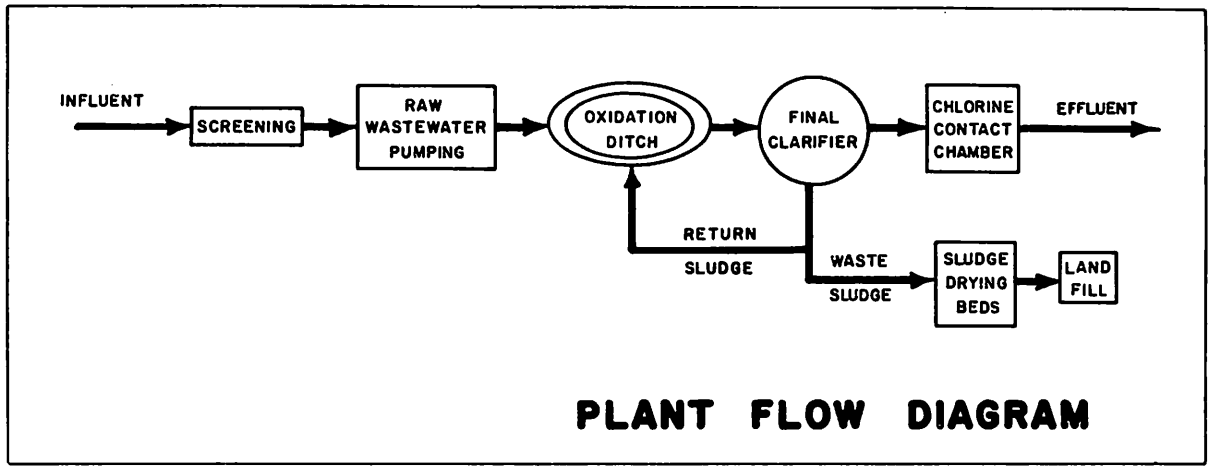
(3) Duck Creek Plant: The Duck Creek facility is a new oxidation ditch plant which services the northern side of the City. Problems have been encountered in the past with heavy industrial discharges; however, the City is attempting to control these discharges. The discharges in the past have contained high levels of detergents which have caused the solids to be floated through the plant and into the polishing pond. The increased solids content has caused the pond to silt up, thus reducing its effectiveness as a polishing pond. As a result, the City has been considering measures to correct the problem. More stringent industrial pretreatment requirements have been instituted in order to control future discharges to the municipal systems. The portion of the City served by this facility is not projected to receive any significant residential growth, and all increased flows are expected to result from industrial contributors. The existing facility, depicted in Figure D-9, has the capacity to handle all projected loads for its service area, and no expansion of this facility is required.

At the present all residents of the City are served by the City's collection system, which is shown in Figure D-10, and no major extensions of the lines are projected. Figure D-11 illustrates the existing and proposed land use for the City of Denison.

(4) Airport Plant: The Grayson County Airport plant is in Segment 203 and will be more closely scrutinized in the special study for that segment. However, preliminary examination indicates that the plant has sufficient capacity to serve its existing area throughout the planning period.

(d) Regional Plan: Within the Grayson County area there are numerous wastewater treatment facilities. Many of these facilities have problems either relating to operation and maintenance or relating to hydraulic or organic overloading. In addition, several of the smaller facilities are run on a minimal budget due to

WASTEWATER TREATMENT PLANT DATA FOR CITY OF DENISON
(DUCK CREEK PLANT)



Design Population: 6,150
Design Flow
Average - 0.7 MGD
Peak - 1.3 MGD

Effluent Requirements:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Duck Creek

Wasteload Projections for City of Denison
(Duck Creek)

Planning Year	Population	Flow (MGD) Average	Peak
1975	6,150	0.62	1.12
1983	6,150	0.65	1.25
1990	6,150	0.66	1.27
2000	6,150	0.67	1.29

EXISTING PLANT CAPACITY: 1.00 MGD

Figure D-9

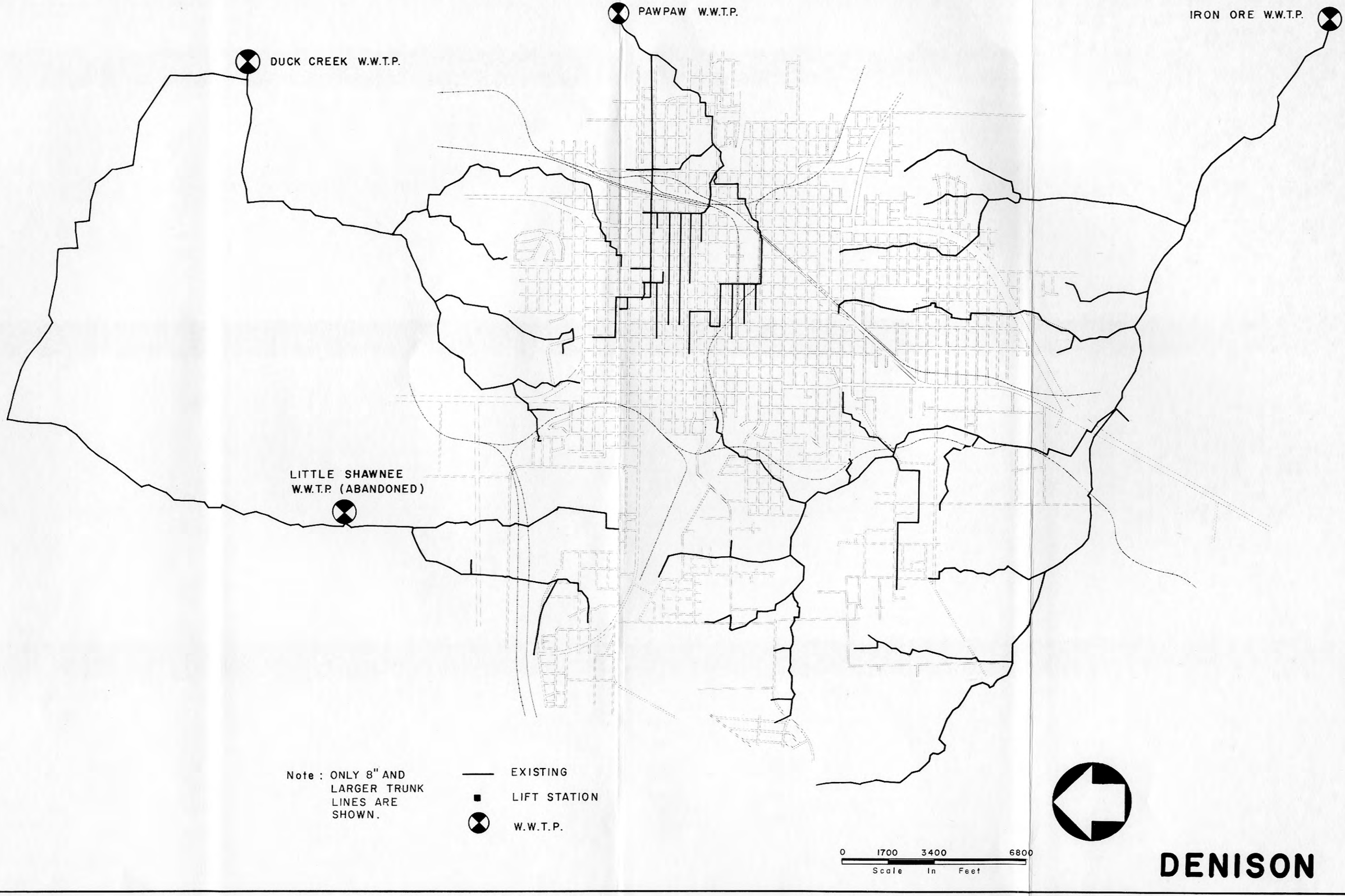
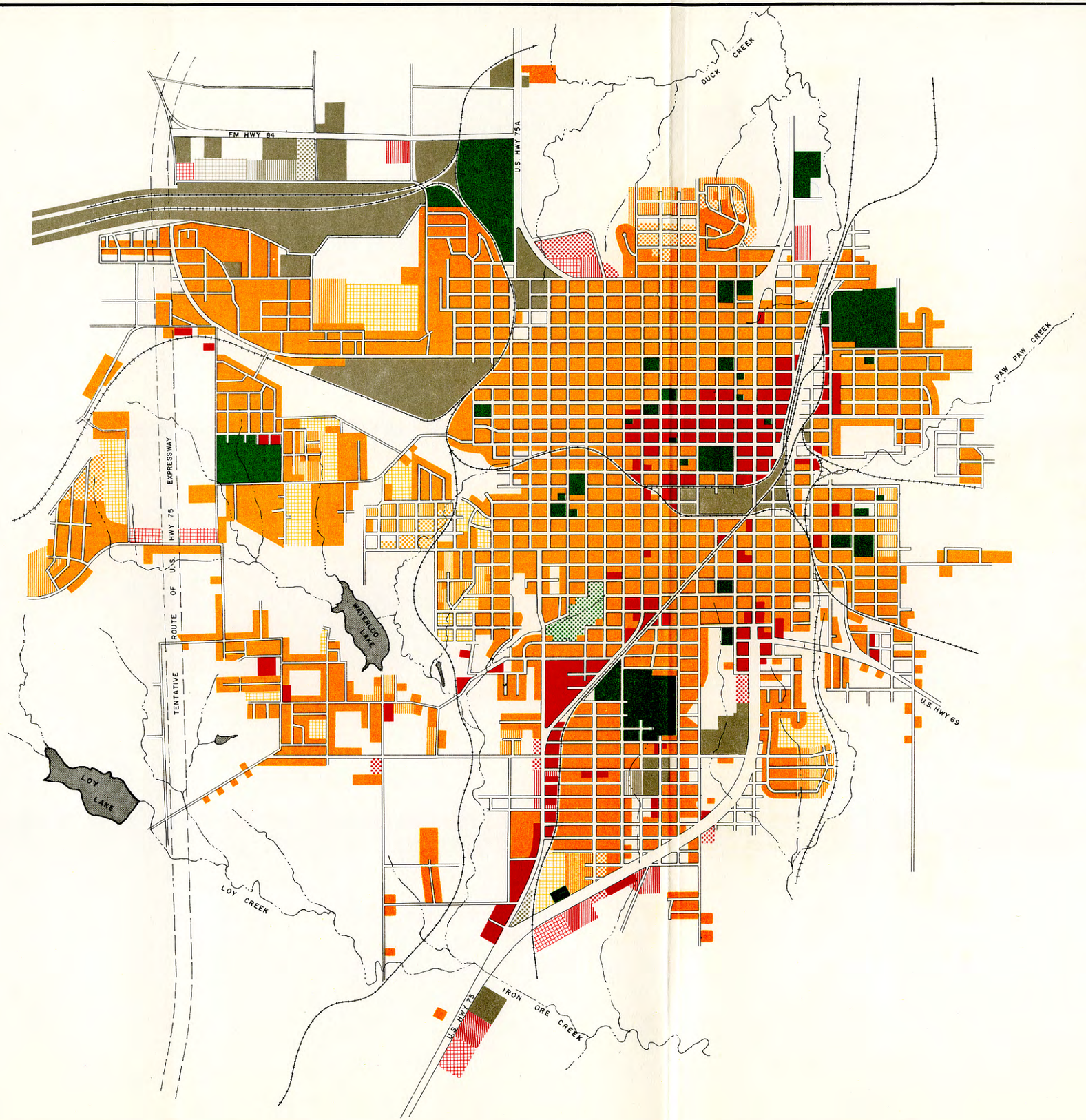

PAWPAW W.W.T.P.
IRON ORE W.W.T.P.
DUCK CREEK W.W.T.P.
LITTLE SHAWNEE
W.W.T.P. (ABANDONED)
Note : ONLY 8" AND LARGER TRUNK LINES ARE SHOWN.
EXISTING
LIFT STATION
W.W.T.P.
0 1700 3400 6800
Scale In Feet
DENISON

Figure D-10



LEGEND

	1975	1983	1990	2000
RESIDENTIAL				
COMMERCIAL				
INDUSTRIAL				
PUBLIC				

PROPOSED TRANSPORTATION ==========

0 1000 2000 3000 6000

SCALE IN FEET

DENISON TEXAS

lack of City revenue and, therefore, are operated by inexperienced personnel. In some cases, the plants are improperly operated and, thus, do not meet the effluent quality for which they were designed.

The Cities of Sherman and Denison are also concerned about the problems of growth in the Twin Cities area as related to providing economical utilities to the citizens now and in the future.

One means of dealing with such problems would be to place the responsibility for wastewater planning under one management agency which then would be responsible for management of wastewater utilities throughout the county.

CHAPTER E

SEGMENT 203

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 203 encompasses Lake Texoma and its immediate drainage area of approximately 350 square miles. Within this drainage area the following dischargers are found:

Description	No. of Dischargers	No. of Non-Dischargers
Municipal WWTP	3	1
Non-Municipal WWTP	7	0
Municipal WTP	0	0
Industrial Operations	2	0
Feedlot Operations	0	0

The City of Pottsboro, included in this segment, has filed for federal grant funds to extend sewer service into areas within the City that are not presently served. These extensions will be discussed more fully in the Intensive Plan for Segment 203.

The City of Southmayd has been previously designated as a sewerage planning area. Alternative planning for the area will also be included in the Intensive Plan for Segment 203.

(b) Non-Point Source Assessment: Non-point contributions of pollutant loadings from septic tank concentrations located around Lake Texoma pose a potential danger to the water quality of the Lake. Because these loadings are considered to be quite significant, this segment has been selected for a more detailed study to be carried out at a later date.

CHAPTER F

SEGMENT 204

1. SEGMENT SUMMARY

(a) General: Segment 204 encompasses approximately 784 square miles of drainage area and extends from the headwaters of Lake Texoma to the confluence of the Wichita River. Located within the segment drainage area are only four permitted dischargers. Three of these dischargers are wastewater treatment plants while the fourth is a water treatment plant. Segment 204 has relatively good water quality; however, in historical data, several DO values have been below the standard of 5.0 mg/l, and the pH has been outside the 6.5 to 8.5 range approximately 30 percent of the time.

The City of Byers has applied for federal funds to upgrade its wastewater treatment plant and portions of its sewage collection system. No funds have yet been allocated.

(b) Non-Point Source Assessment: Over one-half of the land in Segment 204 is used as dry cropland, with one-fourth of the remaining land used as rangeland. The water quality of this segment is good; however, the salinity, which is due to upstream sources, prohibits the use of the water as a domestic raw water supply. The stream has been classified as a Category II segment. This classification is attributable to the discharges from the Cities of Bellevue and Nocona, whose wastewater treatment plant effluent qualities do not meet the allowable limits. The problems of these facilities are discussed in greater detail in this chapter. The two areas of septic tank concentrations have been designated as sewerage planning areas and are also examined in greater detail. The non-point contributions are not considered to be significant in this segment; and with the improvement of the effluent from the dischargers in this segment and the reduction of the salt loads from upstream sources, the water quality of the segment should be greatly improved.

2. BELLEVUE

(a) General: The community of Bellevue is located in Clay County 36 miles southeast of Wichita Falls, on U. S. Highway 287. The areas surrounding the City are used

primarily as rangeland and dry cropland. The soils in the area are Renfrow-Kirkland soils which have severe limitations as septic tank filter fields according to the SCS Soil Survey. The topography in the area slopes to the northwest. The City of Bellevue presently has a population of 300 persons and is not expected to grow significantly within the next 20-year planning period.

Bellevue presently operates a wastewater treatment plant consisting of a bar screen, a grit chamber, an oxidation ditch, and two oxidation ponds. Currently, the plant is treating flows exceeding its design capacity of 30,000 gallons per day and cannot consistently meet its effluent requirements. The present permit requires an effluent that contains a maximum of 30 mg/l BOD and 30 mg/l TSS. Self reporting data indicates that the effluent quality averages 33/128. In addition, the projected waste flows for the City indicate the design capacity of the plant will be exceeded by 20,000 gallons per day by the year 1983. Reports also indicate that the sewer system has some infiltration and inflow problems which would contribute to the excessive average flows.

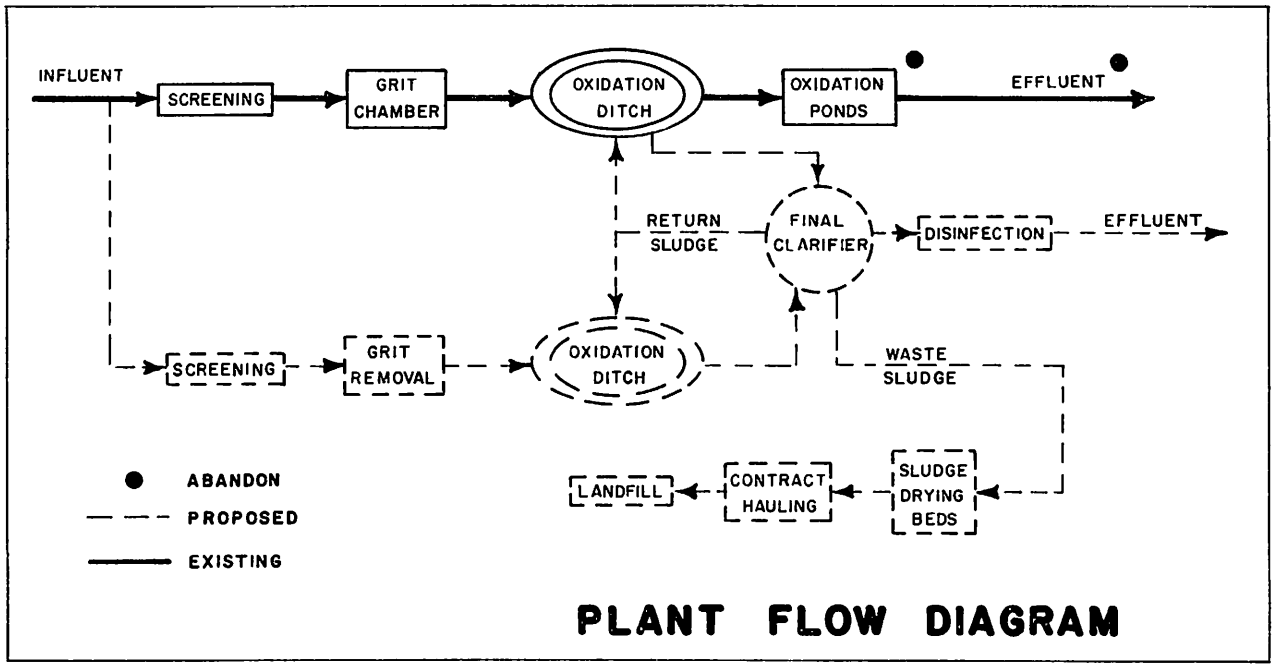
The plant was built in 1973 and should consistently produce an effluent meeting permit standards if the hydraulic overloading is corrected.

One of two projects should be implemented to alleviate the problems at the existing facility. First, a detailed analysis of the collection system should be initiated to determine where problems exist. Corrections of these problems could eliminate the need to expand the existing facility. If not, the plant should be expanded in order to treat the excessive flows and produce an effluent of consistent quality.

(b) Technical Alternative:

(1) Technical Plan: This preliminary plan proposes to abandon the existing oxidation ponds and construct an additional oxidation ditch (Figure F-1). Thus, the facility will be expanded in capacity, and the TSS problems associated with the algae growth in the ponds will be eliminated. This alternative proposes to continue discharging the treated effluent. Since the City is not projected to grow significantly in population, no additions to the present collection system are proposed.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF BELLEVUE



Alternative: Expand plant and continue to discharge.

Design Population: 310

Design Flow
- Average - 0.05 MGD
- Peak - 0.15 MGD

Effluent Requirement:
- BOD_5 (mg/l) - 20
- TSS (mg/l) - 20

Receiving Water: Unnamed Creek

Wasteload Projections for the City of Bellevue

Planning Year	Population	Flow (MGD) Average	Peak
1975	295	0.04	0.05
1983	310	0.05	0.14
1990	310	0.05	0.14
2000	310	0.05	0.15

EXISTING PLANT CAPACITY: 0.03 MGD

Figure F-1

(2) Financial and Managerial Consideration: If the Bellevue plant is expanded as proposed in this Alternative, the total capital cost of the project is expected to be $199,700 (Table F-1). The present worth and total annual cost will be $350,000 and $32,100, respectively. The additional monthly charge per connection will be $25.40, assuming three persons per connection. If 75 percent grant monies are available from PL 92-500, the total capital cost is estimated to be $49,900 with a present worth of $199,600 and a total annual cost of $18,400. Accordingly, the additional monthly charge per connection will be $14.80.

Since the City of Bellevue currently manages the existing wastewater treatment plant, the new facility should continue to be managed by the City.

(3) Impacts: No significant social impacts should be encountered after expansion of the existing facility since Bellevue has treated its wastewater in this manner for years.

Financially, the expansion of the wastewater treatment plant will be adverse. The monthly charge per connection, $25.90, will be added to the existing charges. This addition will make the system extremely expensive. With a 75 percent grant, the additional expense is estimated to be $14.80.

Of all the expansion alterations considered, expansion of the plant as described was found to be the least costly. Nevertheless, without additional grant monies in excess of a 75 percent grant, expansion of the City's wastewater treatment facility will place an excessive financial burden on the City.

3. MONTAGUE

(a) General: Montague, which is the County Seat of Montague County, is a community of approximately 400 residents located in the center of the County, 9 miles south of Nocona and 10 miles northeast of Bowie on State Highway 59 and State Highway 175. Development is mainly along the north-south highway.

Table F-1

Estimated Alternative Costs
For The City of Bellevue

	Technical Alternative Expand Plant and Continue To Discharge
Collection System	No Additions
Capital Cost	Proposed
O&M Cost	
Treatment Plant	
Total Labor Cost	$ 11,200
Total Energy Cost	1,000
Total Chemical Cost	100
Construction Cost	198,600
Land Acquisition Cost	1,100
O&M Cost	13,800
Capital Cost	199,700
Total Capital Cost	199,700
Present Worth	350,000
Total Annual Cost	32,100
Additional Monthly Charge per Connection	25.90
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	49,900
Present Worth	199,600
Total Annual Cost	18,400
Additional Monthly Charge per Connection	14.80

The area has moderate topographic relief and slopes from the south to the north with a drop of about 20 feet. The general direction of drainage is toward the north to Salt Creek and then to the Red River. The area is underlain by Stephenville-Nimrod type soils which have low permeabilities and, thus, have severe limitations on the use of septic tanks.

The population of the area is projected to increase to 500 by the year 2000. The area encompasses approximately 500 acres. Projected growth is expected to occur along the southern side of the area and in presently vacant sites within the developed area. Land usage is primarily residential with commercial usage in the central business district. The economic resource base is primarily dependent on agriculture and farm related activities with no existing or anticipated industrial contribution.

The residents of Montague do not have access to a central wastewater facility, and currently, septic tanks are used for the disposal of wastewater. Because the soils have severe limitations for the use of septic tanks, an effort should be made to prevent surface and groundwater contamination.

The population and waste load projections are shown in Figure F-2. These waste loads are from domestic and infiltration inflow only since there is currently no significant industry in the area which would discharge into the system.

In selecting a wastewater treatment method, several alternatives were considered. These alternatives include:

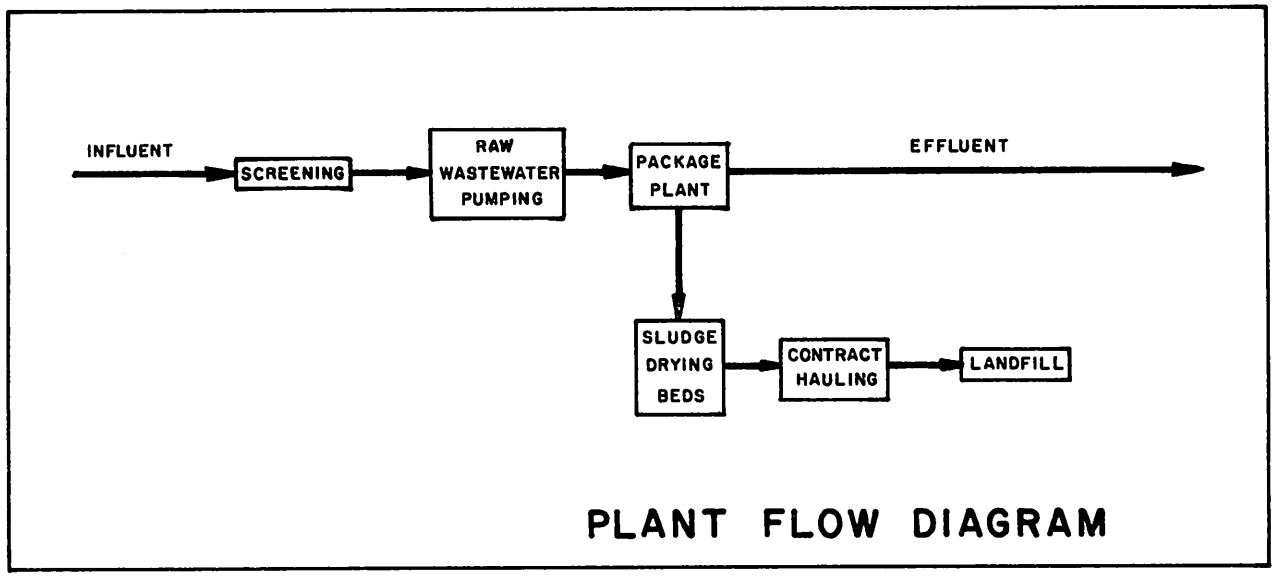
1) Continuing the use of septic tanks under a strictly enforced waste control order,

2) Employing a "no discharge" method of wastewater treatment by land application of the wastewater following primary treatment,

3) Constructing the treatment facilities required to meet the effluent standards and which will best maintain the existing receiving water quality,

4) Taking no action and continuing the use of septic tanks for wastewater disposal.

WASTEWATER TREATMENT PLANT DIAGRAM AND DESIGN DATA FOR MONTAGUE



Alternative: Construct Package Plant

Design Population: 50
Design Flow:
Average - 0.05 MGD
Peak - 0.14 MGD

Effluent Requirements:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Salt Creek

Wasteload Projection for Montague

Planning Year	Population	Flow (MGD) Average	Peak
1975	400	-	-
1983	400	0.04	0.11
1990	450	0.05	0.13
2000	500	0.05	0.14

NO EXISTING FACILITY

Figure F-2

(b) Technical Alternative 1

(1) Technical Plan: In order for septic tanks to be considered as a viable alternative, it will be necessary to institute a stringent septic tank control ordinance. Due to the severe limitations on septic tanks as expressed in the SCS Soil Survey, septic tanks appear to be a potential health problem. To date, however, there have been no reported problems and, if septic tanks are properly maintained, they could perform satisfactorily despite the limitation on filter fields.

(2) Financial and Managerial Consideration: The cost of a septic tank control ordinance will be in fulfilling the legal and institutional requirements required to pass and enforce the ordinance. Funds will be required for qualified personnel to inspect these systems during construction and while in operation and for the clerical work involved with this process. If many of the existing systems were found to be inadequate, the owners of these unsuitable systems can be faced with the cost of installing new septic tank absorption field systems to replace the systems they are now using.

The community of Montague is not an incorporated municipality and it, therefore, has no mechanism for carrying out the management of this alternative. Several options are open to the residents of the area and these include the following:

1) The area can establish a Utilities District to handle all the management requirements. This will require, however, the hiring of personnel to carry out the administrative responsibilities.

2) The County can be designated as a management agency; however, they again do not presently maintain adequate staff to manage the sewerage planning.

3) The Red River Authority (RRA) of Texas can be designated as the management agency for this area. One advantage to this arrangement is that the RRA currently operates several facilities in the study area, and they have established personnel who are

experienced in managing facilities. The RRA also has an established revenue base for initiating such plans.

The Red River Authority will be the most likely agency for management. The Texas Department of Water Resources should be the enforcement agency.

(3) Impacts: This alternative will have fairly significant impacts on the area even though septic tanks will be maintained as a means of treatment. In order to achieve the minimum required treatment level, it will be necessary to inact a strictly enforced control order. This order might possibly allow the area to maintain stream quality; however, with available data this is difficult to determine. This order on the other hand could have a significant economic impact, as evaluation of existing systems will be necessary, and residents may need to replace or upgrade their existing tanks or filter fields.

Economic impacts will also be encountered in the management and enforcement of the septic tank control order. The cost of this activity is difficult to determine; however, for an area without prior experience and personnel, these costs can be considerable (refer to Appendix F).

(c) Technical Alternative 2:

(1) Technical Plan: This alternative would employ a collection system and a package plant to treat the wastewater of Montague. The recommended wastewater collection system as shown in Figure F-3 consists of 26,000 feet of sewer line. This is a gravity system without any lift stations or force main.

A contact-stabilization type package plant is recommended for the wastewater treatment. This is a system combining clarifier, contact tank, stabilization tank, and digester in a small, self contained unit. Chlorination is also performed in the plant.

A schematic diagram of this treatment plant system is shown in Figure F-2. The effluent of the plant would discharge to Salt Creek.

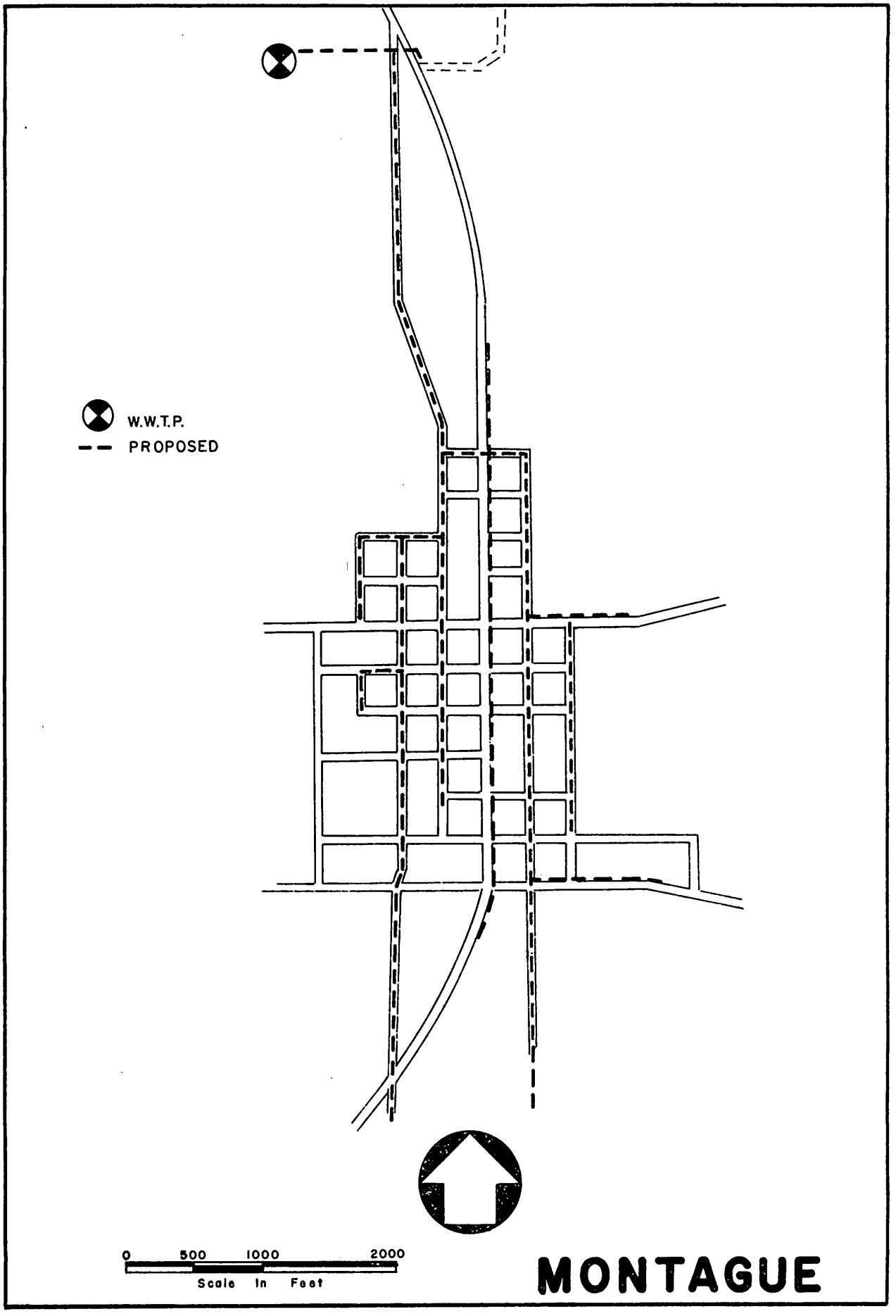


Figure F-3. Proposed Collection System for Montague.

(2) Financial and Managerial Considerations: The estimated capital cost for the treatment plant will be $145,400 and for the collection system will be $356,500. The total capital cost of this alternative will be $501,900. Its present worth and total annual cost willbe $661,800 and $61,800, respectively, based on 6-5/8 percent interest rate for twenty years. The average monthly charge per connection will be $31.00. If 75 percent Federal funding is available through PL 92-500, the monthly charage would be $13.30 per connection. These costs are presented in Table F-2.

Management options for this alternative are the same as Alternative 1.

(3) Impacts: The most direct benefit of having a central wastewater treatment facility is the abatement of pollution sources, thus improving the existing water quality. The local economy should be stimulated through the construction of a collection and treatment system. Also a wastewater treatment facility tends to improve the environment so that residents as well as business establishments are attracted, thus increasing the growth potential.

The customer charge for this facility is substantial and probably excessive for the average household to handle. Without additional funding in excess of a 75 percent grant, the customer charge would have a drastic, negative economic impact on a community the size of Montague.

The adverse environmental impacts of constructing a plant would be temporary and should not impose a lasting effect on the area.

4. NOCONA

The City of Nocona is served by two wastewater treatment plants. The West Plant is receiving 36 percent of the Nocona wastewater flow, and the South Plant is receiving 64 percent of the flow. Both plants consist of a bar screen, one lift station, an Imhoff tank, a trickling filter, a final clarifier, a flow measuring device, chlorination with a contact chamber, and sludge drying beds.

Presently, both plants are hydraulically overloaded and cannot produce an effluent compliant with the permit requirements. The City is currently modifying the facilities of both plants to

Table F-2

Estimated Alternative Costs
For The Community of Montague

	Technical Alternative 2 Package Plant
Collection System	
Capital Cost	$ 356,500
O&M Cost	2,600
Treatment Plant	
Total Labor Cost	7,000
Total Energy Cost	3,900
Total Chemical Cost	100
Construction Cost	145,300
Land Acquisition Cost	100
O&M Cost	12,300
Capital Cost	145,400
Total Capital Cost	501,900
Present Worth	661,800
Total Annual Cost	61,800
Monthly Charge per Connection	31.00
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	125,500
Present Worth	285,400
Total Annual Cost	26,600
Monthly Charge per Connection	13.30

include an oxidation ditch, final clarifier, sludge pumps, and another sludge drying bed. These modifications should expand and upgrade the facilities to serve the needs of Nocona throughout the planning period.

5. RINGGOLD

(a) General: Ringgold is an unincorporated community located in the northwestern corner of Montague County, approximately 13 miles west of Nocona on U.S. Highway 82 and U.S. Highway 81. The City is served by the Chicago, Rock Island and Pacific Railroad. Ringgold has an estimated population of 340, and is expected to experience a modest growth. The areas of growth in recent years have been westerly along U. S. 82 and southwesterly along U.S. 81, and this trend may continue.

The area has moderate topographic relief, with the highest point in the southeastern and central portion of the area, and with an overall variation in elevation of about 20 feet. The general direction of drainage is northward and northwestward toward Beaver Creek, a tributary of Red River. The soils of the area are of the Renfrow-Chickasha-Kirkland group which consists of a fine sandy loam to clay loam surface 6 to 12 inches thick. This soil group has low permeability and is generally unsuitable for septic tank absorption fields.

The population of the area is projected to increase to 390 by the year 2000. The land use for the area is generally characterized by scattered residential development and a concentration of commercial and public facilities along the major thoroughfares in the central areas of the town. The economic base of the area is primarily agricultural with no existing or anticipated industrial contribution.

The residents of Ringgold do not have access to a central wastewater facility. Currently, septic tanks are used for the disposal of wastewater. Because of the poor soil absorption rate, problems of septic tank overflow and contamination of the water supply source have been reported. Therefore, a central wastewater facility is very desirable both from a public health viewpoint and in meeting the Federal and State pollution regulations.

An alternative wastewater treatment would be to continue the use of septic tanks under the control of a strictly enforced septic tank control ordinance. This alternative

does not appear to be acceptable because of the severe limitations of the soils for use as septic tank filter fields. This limitation or inadequacy is magnified by the fact that many of the lots are too small for adequate filter fields. Several reported problems of septic tank overflows and water supply source contamination indicate that septic tanks are not a viable treatment method and should not be considered.

(c) Technical Alternative:

(1) Technical Plan: This plan employs the construction of a collection system and a package plant to treat the wastewater of Ringgold. The proposed wastewater collection system, as shown in Figure F-4, consists of 18,500 feet of sewer line. This system uses gravity flow, and no lift stations or force mains are required.

A package plant is recommended for the wastewater treatment scheme. This method of treatment combines a clarifier, a contact tank, a stabilization tank, and a digester in a small, self contained unit. Chlorination is also performed in the plant.

A schematic diagram of this treatment system is shown in Figure F-5. The effluent of the plant will discharge into an unnamed branch of Beaver Creek.

(2) Financial and Managerial Considerations: The estimated capital cost for the treatment plant will be $145,000 and for the collection system will be $252,000. The total capital cost of this alternative will be $397,000. Its present worth and total annual cost will be $552,000 and $50,600, respectively, based on 6-5/8 percent interest rate for twenty years. The average monthly charge per connection, assuming three persons per connection, will be $32.40. If 75 percent Federal funding is available through PL 92-500, the monthly charge per connection will be $14.90. These costs are presented in Table F-3.

Since the Ringgold area is unincorporated, a management entity must be designated to oversee the construction of a facility and to receive funding. The three most likely entities for managerial control are listed below:

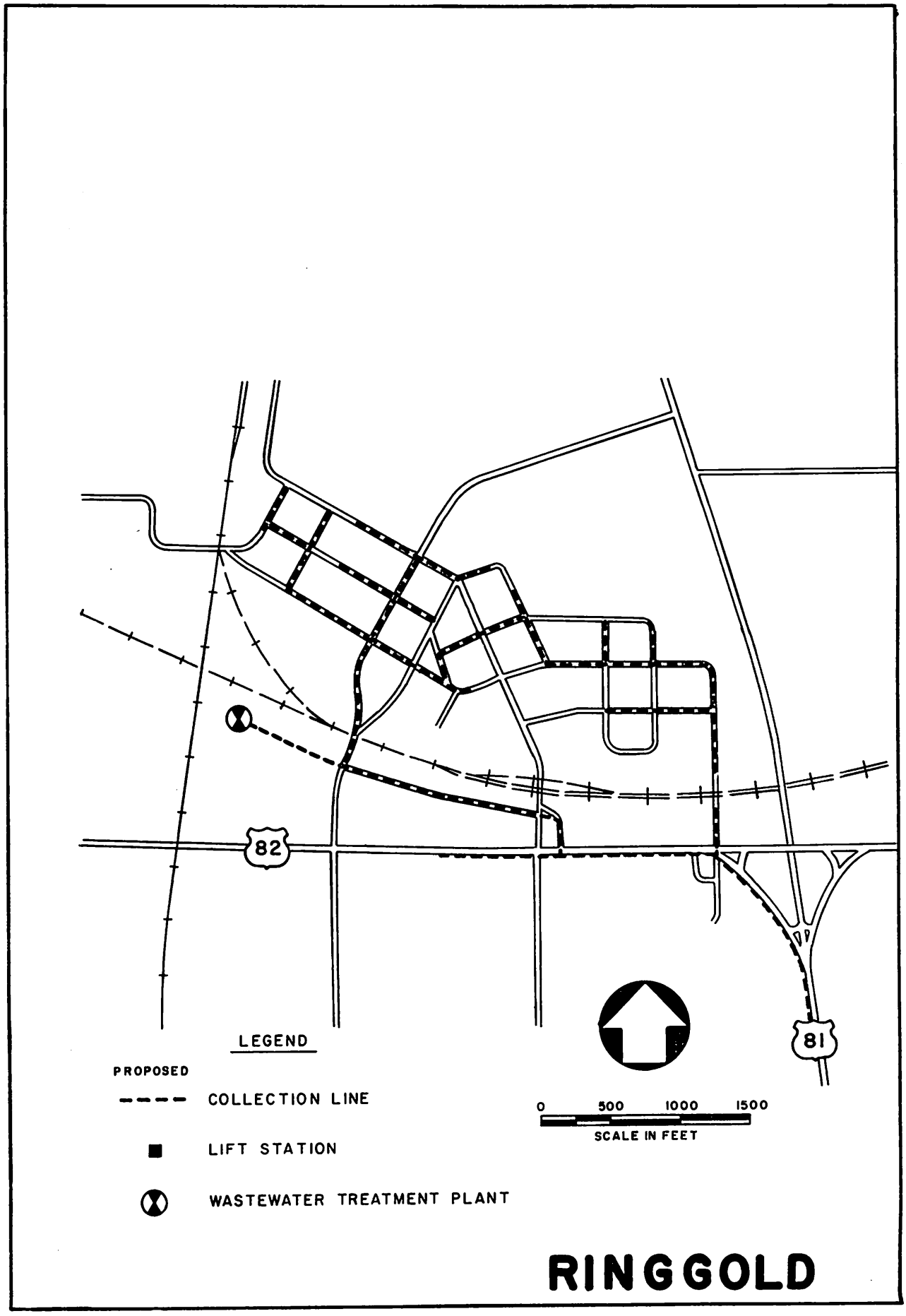
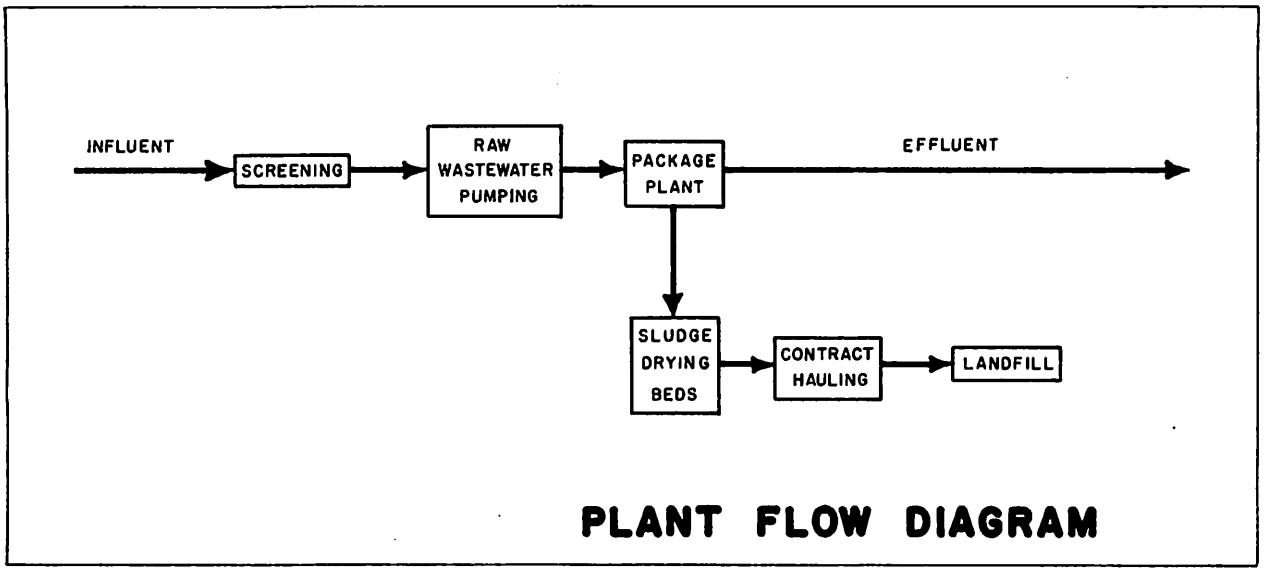


Figure F-4. Proposed Collection System for Ringgold

WASTEWATER TREATMENT PLANT DIAGRAM AND DESIGN DATA FOR RINGGOLD



PLANT FLOW DIAGRAM

Alternative: Construct Package Plant

Design Population: 390
Design Flow
Average: - 0.05 MGD
Peak: - 0.14 MGD

Effluent Requirement:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: An unnamed branch of Beaver Creek

Wasteload Projections for Ringgold

Planning Year	Population	Flow (MGD) Average	Peak
1975	363	-	-
1983	370	0.04	0.12
1990	380	0.04	0.13
2000	390	0.05	0.14

NO EXISTING FACILITY

Figure F-5

Table F-3

Estimated Alternative Costs
For The Community of Ringgold

	Technical Alternative Package Plant
Collection System	
Capital Cost	$252,000
O&M Cost	1,800
Treatment Plant	
Total Labor Cost	7,000
Total Energy Cost	3,900
Total Chemical Cost	100
Construction Cost	145,300
Land Acquisition Cost	100
O&M Cost	12,300
Capital Cost	145,400
Total Capital Cost	397,500
Present Worth	552,000
Total Annual Cost	50,600
Monthly Charge per Connection	32.40
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	99,000
Present Worth	254,000
Total Annual Cost	23,300
Monthly Charge per Connection	14.90

1) The can could establish a Utilities District to handle all the management requirements. This will require, however, the hiring of personnel to carry out the administrative responsibilities.

2) The County can be relied upon as a management agency; however, they again do not presently maintain adequate staff to manage the sewerage planning.

3) The Red River Authority (RRA) of Texas can be designated as the management agency for this area. One advantage to this arrangement is that the RRA currently operates several facilities in the study area, and they have established personnel who are experienced in managing facilities. The RRA also has an established revenue base for initiating such plans.

The Red River Authority will be the most likely agency for management. The Texas Department of Water Resources should be the enforcement agency.

(3) Impacts: The most direct benefit of having a central wastewater treatment facility is the abatement of pollution sources, thus improving the existing water quality. The local economy should be stimulated through the construction of a collection and treatment system. Also a wastewater treatment facility tends to improve the environment so that residents as well as business establishments are attracted, thus increasing the growth potential.

The customer charge for this facility is substantial and probably excessive for the average household to handle. Without additional funding in excess of a 75 percent grant, the customer charge will have a drastic, negative economic impact on a community the size of Ringgold.

The adverse environmental impacts of constructing a plant will be temporary and should not impose a lasting effect on the area.

CHAPTER G

SEGMENT 205

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 205 consists of approximately 65 river miles between the Wichita River confluence to the Pease River confluence. This segment has a drainage area of 410 square miles and includes portions of Clay, Wichita, and Wilbarger Counties. This segment is ranked 17th in the Study Area, in regard to water quality, but the water is not considered suitable as a domestic raw water supply because of the high salt concentrations of the river. In addition, violations of the stream standards for fecal coliforms have occurred in the past, as measured at the TDWR monitoring station 205.01, located northeast of Burkburnett. The salinity is attributable to the upstream flows from the Pease River.

There is only one existing facility located within this segment. The City of Burkburnett has a new oxidation ditch plant and is currently converting its old Hayes process plant into a conventional activated sludge type system. The effluent meets the established permitted limits.

(b) Non-point Source Assessment: Land use in this segment is divided between dry cropland and rangeland. This segment is not experiencing any water quality problems and is classified as Category I. Non-point sources due to hydrographic modification, silviculture, agriculture, construction activities, disposal activities, and urban runoff are not considered to be significant as contributors of pollutants to the waters of the segment. The salinity of the water is due to natural salt sources upstream and to some abandoned brine deposits which originated from oil field operations north and west of Burkburnett along the Red River. The quantity of brine pollution from these fields has not been measured; however, an examination of water quality data from sampling stations indicates that the contributions are not great when compared to the upstream loads. These oil field brines result from formerly used disposal practices, which are no longer allowed by law. The brine emissions from the old disposal areas should lessen as the residual brines from these areas are washed out. No other control measures are believed to be necessary at this time.

CHAPTER H

SEGMENT 206

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 206 of the Red River Study area encompasses approximately 1,200 square miles of drainage area which contributes to approximately 65 river miles between the Pease River confluence and the Prairie Dog Town Fork of the Red River and includes the drainage area of Buck Creek that lies in Texas. This segment is ranked 8th in the Study Area in regard to good water quality, but has extremely high total dissolved solids. Several violations of the chloride concentration standard of 12,000 mg/l have been recorded in the past.

There are eight waste control facilities in this segment of which three discharge effluent into tributaries of the Red River. There are currently no water quality problems attributable to these facilities. The City of Quanah has a new contact stabilization plant which is in excellent shape and discharges an effluent of good quality. The City of Wellington has a relatively new Imhoff tank-oxidation pond system which normally does not discharge to the stream.

The Cities of Childress, Chillicothe, and Electra operate Imhoff tank-oxidation pond systems. The effluent from Chillicothe's plant is used for irrigation.

West Texas Utilities operates a steam-electric generation station at Lake Pauline, a company owned reservoir. All liquid wastes are retained in this reservoir so that the plant does not discharge. Georgia-Pacific Corporation's Acme Plant manufactures wall board, joint compounds, and plaster products. This discharger is complying with the permit requirements established by the Texas Department of Water Resources, although the effluent is high in sulfates because of the gypsum used in processing. The Fort Worth and Denver Railroad has a diesel repair shop located in Childress. All wash-water is retained on site in evaporation ponds. In the past, there have been complaints concerning odors from this operation.

Agri Services of Childress operates a poultry and live-stock feeding operation about two miles south of Childress.

Effluent and runoff are disposed of by evaporation, irrigation, and land spreading. There is no discharge from the property.

In order to preclude the creation of undesirable water quality conditions in the segment, the City of Childress will require an immediate improvement of its existing treatment works. The Chillicothe and Electra facilities will require repair or replacement before the end of the planning period and should be closely scrutinized in subsequent updates of this Report.

(b) Non-point Source Assessment: Segment 206 is a Category II segment and has no major contamination problems due to point sources located within the segment. Land use in the segment consists of over 60 percent rangeland, with cropland - both dry and irrigated - comprising almost all of the remaining land area. The water quality of the area is greatly affected by chlorides and sulfates, which originate mainly from natural sources located upstream of this segment. Although no salt sources have been identified in segment 206, the incoming flows are highly saline. These incoming flows, as well as those of the tributaries to the Red River in this segment, flow through major deposits of gypsum and anhydrite which increases the sulfate concentration. These sulfate loads will be difficult to control due to the nature of their origin; however, these loads may be reduced somewhat by salt alleviation measures used upstream on the Prairie Dog Town Fork of the Red River.

2. CHILDRESS

(a) General: The City of Childress is located in Childress County near where the Red River becomes the boundary between Texas and Oklahoma. The City's present population is estimated to be approximately 5,200 persons, and the population is expected to increase throughout the planning period.

Commercial and retail land uses are primarily concentrated in the central business district and along U.S. Highway 287. The residential growth is primarily on the northwestern and southern perimeter of the City, as well as in underdeveloped lots within the built-up area.

The area is underlain by St. Paul and Carey soils which have moderate limitations with regard to septic tank use.

The topography of the area is gently sloping from west to east. Drainage is primarily into Scatterbranch Creek and North Groesbeck Creek.

The City's wastewater treatment needs are served by an Imhoff tank-trickling filter system which discharges into four oxidation ponds. The Imhoff tank and trickling filter are showing significant structural deterioration. The four oxidation ponds were added in recent years, but the discharge effluent contains algal concentrations exceeding the permitted TSS limitations. Subsequently, since the plant may not be structurally functional throughout the planning period and does not consistently produce a good quality effluent, it should be replaced. Two alternative systems are presented in this report.

Growth in the City is occurring primarily in the northwestern section, and several sewer extensions are proposed for that area (Figure H-1).

(b) Technical Alternative 1:

(1) Technical Plan: Alternative 1 proposes to replace the existing plant with an extended aeration facility. The plant flow diagram is shown in Figure H-2. This treatment scheme would call for continued discharge.

(2) Financial and Managerial Considerations: As illustrated in Table H-1, the total capital cost of this alternative is estimated to be $741,800. Based on an amortization of twenty years and an interest rate of 6-5/8 percent, the total annual cost will be $102,100, and the present worth in 1980 will be $1,112,900. Assuming three persons per connection, the monthly charge per connection would, therefore, be $4.30. With a 75 percent grant under PL 92-500, the monthly charge per connection will be $2.20.

Since the existing facility is managed by the City, the new facility should be managed similarly.

(3) Impacts: Economically, Alternative 1 is reasonable. Either charge, $4.30 or $2.20 is within the revenue base of the City.

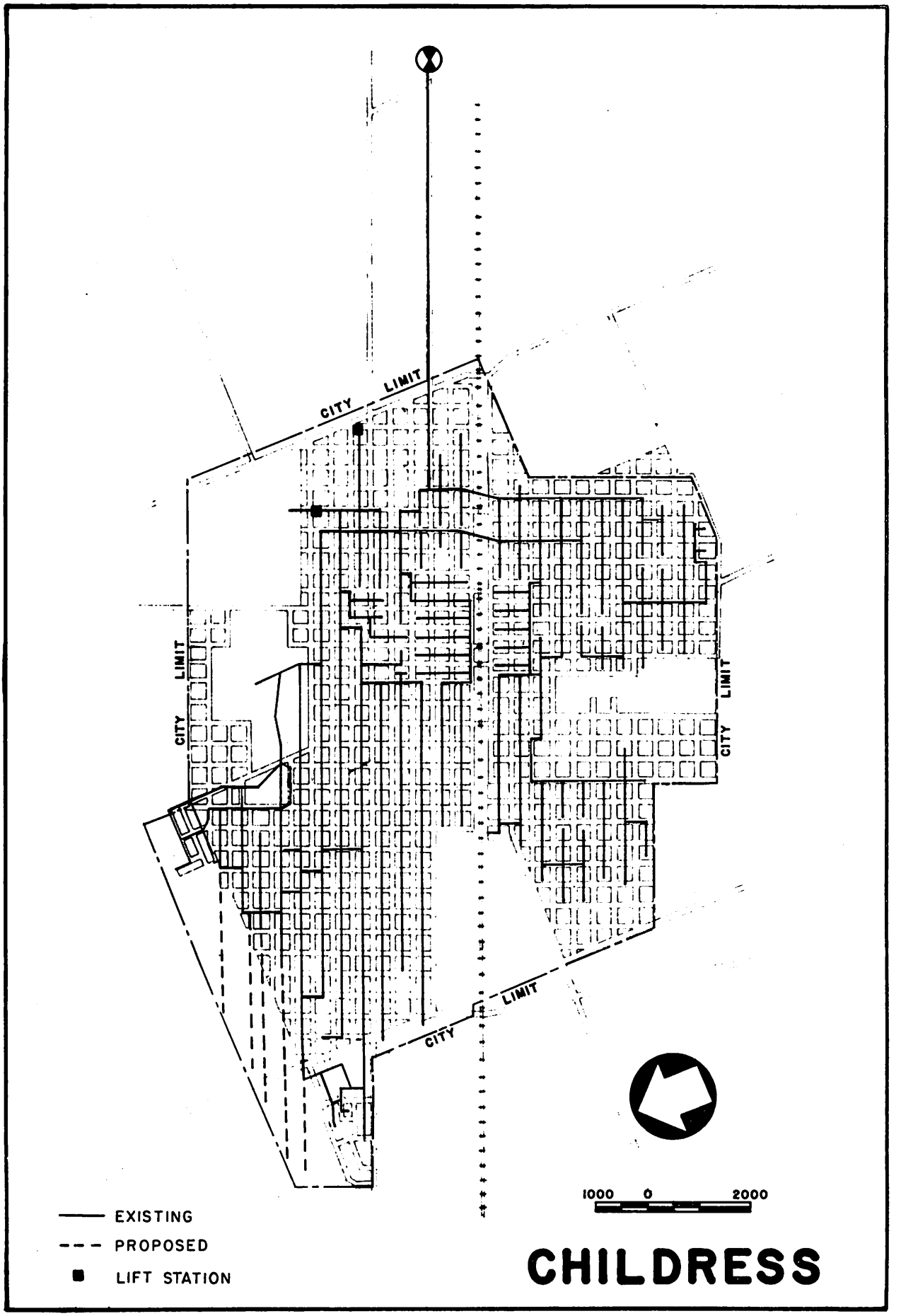
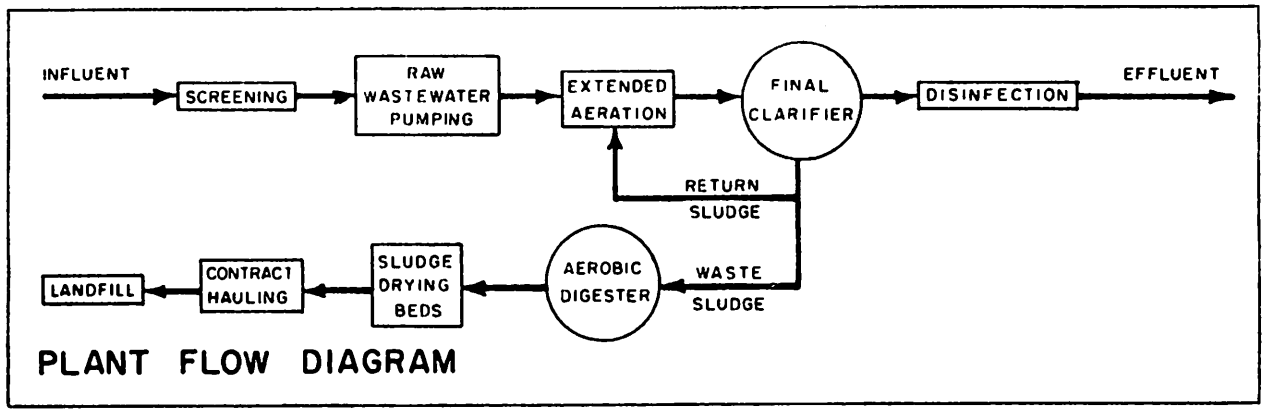


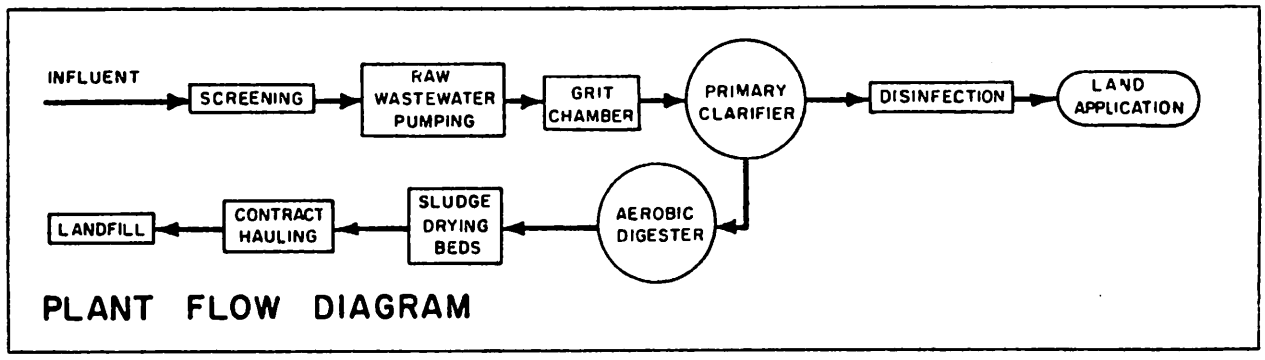
Figure H-1: Existing and Proposed Collection System for the City of Childress.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF CHILDRESS



PLANT FLOW DIAGRAM

Alternative 1: Abandon existing facility - construct extended aeration plant.



PLANT FLOW DIAGRAM

Alternative 2: Abandon existing facility - implement land treatment.

Design Population: 5,900
Design Flow:
Average - 0.27 MGD
Peak - 0.52 MGD

Effluent Requirements (Alt. 1)
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: North Groesbeck Creek (Alt. 1)

Wasteload Projections for the City of Childress

Planning Year	Population	Flow (MGD) Average	Peak
1975	5,404	0.18	0.22
1983	5,550	0.21	0.42
1990	5,700	0.24	0.46
2000	5,900	0.27	0.52

EXISTING PLANT CAPACITY: 0.5 MGD

Figure H-2

Table H-1

Estimated Alternative Costs For The City of Childress

	Technical Alternative 1 Abandon Existing Plant Construct Extended Aeration Plant	Technical Alternative 2 Abandon Existing Plant Implement Land Application
Collection System		
Capital Cost	$ 371,000	$ 371,100
O&M Cost	2,600	2,600
Treatment Plant		
Total Labor Cost	20,100	21,500
Total Energy Cost	6,600	4,400
Total Chemical Cost	600	1,500
Construction Cost	368,200	*1,071,300
Land Acquisition Cost	2,500	2,100
O&M Cost	31,400	33,400
Capital Cost	370,700	1,073,400
Total Capital Cost	741,800	1,444,500
Present Worth	1,112,900	1,808,500
Total Annual Cost	102,100	165,800
Monthly Charge per Connection	4.30	7.00
WITH FEDERAL GRANT IN AID:	(75 PERCENT)	(85 PERCENT)
Total Capital Cost	185,500	253,800
Present Worth	555,200	639,500
Total Annual Cost	51,100	59,700
Monthly Charge per Connection	2.20	2.50

*Purchase of land used for irrigation is included in construction cost.

No significant adverse social impact is forseen since Childress has had a centralized collection and treatment system for many years.

The effluent from the new facility should meet a 20/20 effluent set in regard to BOD_5/TSS. This improvement in water quality above that now discharged will improve the water quality in the receiving stream.

(c) Technical Alternative 2:

(1) Technical Plan: An alternative solution to the wastewater treatment needs for the City of Childress is to implement land treatment under a "no discharge" permit. The plant flow diagram of such a facility is illustrated in Figure H-1. This alternative would allow the plant effluent to be used for irrigation of crops or landscapes.

(2) Financial and Managerial Considerations: The total capital cost for this alternative is estimatd to be $1,440,500, as illustrated in Table H-1. This cost assumes that the land used for land treatment (irrigation) must be purchased by the City and is not currently available. This figure also does not assume a value for the benefits derived from using the effluent as a source of water. Therefore, the present worth will be $1,808,500 in 1980 (the construction year), and the total annual cost will be $165,800. Thus, the resultant monthly charge per connection, assuming three persons per connection, will be $7.00 With a 85 percent grant in aid under PL 92-500, the resultant monthly charge per connection will be $2.50.

Under this alternative, the City should be the managerial body since it must have control over the land being used and over the operation of the facility.

(3) Impacts: Alternative 2 has the substantial benefit of providing a continuous source of water in a semi-arid area. Water rights of downstream users could be affected adversely however, and must be given careful consideration before implementation of this alternative.

If the plant is operated and maintained properly, no odors should be evident nor should the effluent pose a health hazard.

Financially, this alternative could impose a burden on the City unless Federal grant monies are available.

CHAPTER I

SEGMENT 207

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 207, the Prairie Dog Town Fork of the Red River, is the largest segment in the study area, draining over 6,570 square miles of the Texas Panhandle.

It extends from near Childress to the Texas-New Mexico border. The primary water quality problem within the segment is dissolved solids. The presence of salt areas, plus the effects of gypsum outcrops, gives rise to a natural environment conducive to high total dissolved solids, chlorides, and sulphates concentrations. Major salt producing areas exist on the Prairie Dog Town Fork itself, in addition to areas on the Little Red River, Salt Creek, and Jonah Creek, all tributaries to the Prairie Dog Town Fork. The Corps of Engineers is developing plans for salt alleviation projects in these areas, and once the projects are complete, the chemical concentrations are expected to be reduced considerably.

There are 65 treatment facilities located in this segment, 40 of which are feedlot operations. Only two of these facilities, the municipal wastewater treatment plants for the Cities of Canyon and Estelline, discharge into tributaries of this fork. At the present there are no water quality problems attributable to these dischargers.

Two of the facilities in this segment, the Cities of Estelline and Friona, may require upgrading or construction of a new facility within the next five years, based on wasteload projections and available inventory information. The Lake Tanglewood area, located south of Amarillo, may need to construct new facilities to handle projected wasteloads and prevent possible health problems resulting from overloaded septic tank absorption fields.

The San Jose Community, located southwest of Hereford, has a severe need for sewerage planning in order to alleviate existing health problems.

The City of Canyon has applied for 201 Construction Grant monies to construct a new interceptor and lift station but has not yet received funding.

(b) Non-point Source Assessment: The effect of non-point pollutant sources on the waters of this segment are greatly reduced because of the area's semi-arid climate. Because the annual evaporation is much greater than the annual rainfall for this area, the transportation mechanism by which these pollutants are carried to water sources is only effective during irregular flood events. The high evaporation rate is used by some faciliites, particularly industrial sites, as a means of final disposal of effluent. In the western-most portions of the segment, the use of playa lakes for evaporation ponds is common. For disposal activities that apply effluent or solid waste to the ground, the probability of percolation, infiltration, or overland flow to water sources is low. For the same reason, pollution from agricultural activities, which utilize approximately two-thirds of the land area of the segment, is not considered to be significant.

The major water quality problem in the segment does originate from a non-point source. Natural salt sources are the major contributors to the salinity of the water which flows through this segment. The sources for the majority of the chloride loadings have been identified, and pollutant loadings have been estimated for each of these sources. In Segment 207, salt sources have been located at Jonah Creek and Salt Creek near the Prairie Dog Town Fork of the Red River, along the Little Red River, and along the Prairie Dog Town Fork itself in Briscoe and Armstrong Counties. Another source located at Estelline Spring has successfully been controlled by a Corps of Engineers experimental project. The total load from these sources, excluding the 300 tons of chlorides per day which are estimated to originate at Estelline Spring, is estimated to be approximately 930 tons per day. In addition to the chloride loads, sulfates also contribute to the salinity of the waters of the segment. The sulfates are the result of groundwater flows which have been in contact with gypsum outcrops that cover the eastern end of the segment. The Corps of Engineers has prepared a plan to control the chlorides which originate from the salt areas. This project is expected to reduce the total load of chlorides which reach Lake Texoma by 45 percent. These same alleviation measures may also reduce the sulfate load a small degree. The sulfate loads, unlike the chloride loads, cannot be attributed to several specific points of origin and, therefore, cannot be as easily controlled.

2. ESTELLINE

The City of Estelline is served by an Imhoff tank-aerated oxidation pond plant. The plant is owned and operated by the Red River Authority and appeared to be one of the best maintained facilities visited. Estimated flows reported in the self-monitoring reports indicate that the average flow exceeds the permit level, but the plant is operating within its design capacity and meets the BOD_5 levels established.

3. FRIONA

(a) General: The City of Friona is located in northern Parmer County about 20 miles east of the Texas-New Mexico State border. The City is the largest in the county and serves as an agricultural center. Friona's current population is estimated to be approximately 3,600 persons and is projected to increase throughout the planning period, reaching 4,700 persons by the year 2000.

The commercial districts are located primarily along U. S. Highway 60 and Main Street. Residential areas are currently evenly distributed, although most of the City's residential growth is on the western side. Commercial and industrial growth appears to be minimal at this time.

The area is underlain primarily by Pullman soil which is severely limiting for septic tank utilization due to slow percolation.

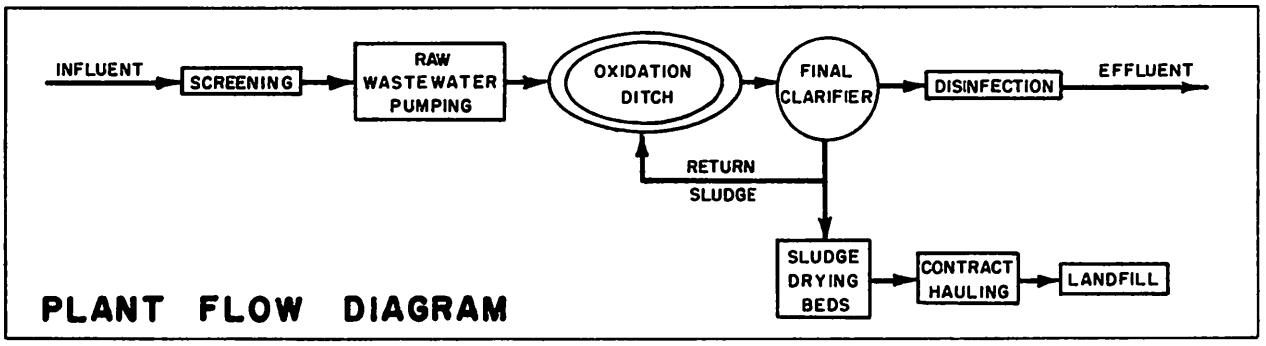
The City of Friona operates an Imhoff tank-oxidation pond treatment plant, from which 160 acres of grain crops are irrigated. The plant has a capacity of 0.21 MGD, and there has been some concern that the plant may be overloaded.

Wasteload projections indicate that the plant will be severely overloaded by the year 1983. The existing plant was built in 1960 and is structurally sound. The plant will need to be expanded to twice its present capacity by the planning year 2000.

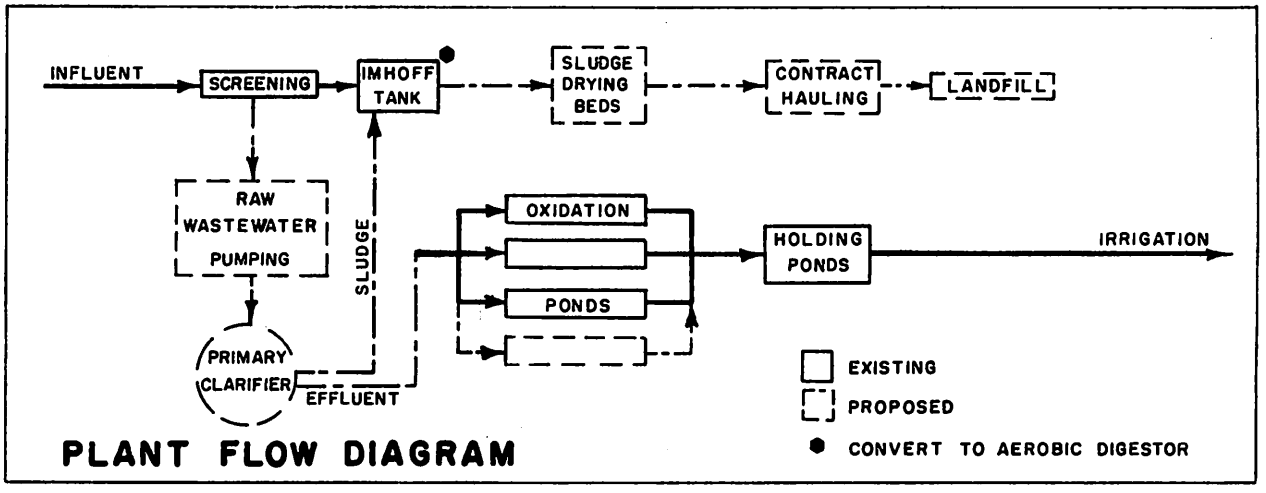
(b) Technical Alternative 1:

(1) Technical Plan: Alternative 1 proposes to abandon the existing facility and construct a new oxidation ditch facility. The plant flow diagram is illustrated in Figure I-1.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF FRIONA



Alternative 1: Abandon existing facility - construct oxidation ditch.



Alternative 2: Upgrade existing facility - continue irrigation.

Design Population: 4,700
Design Flow
Average - 0.51 MGD
Peak - 1.05 MGD

Effluent Requirement (Alt. 1)
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Playa Lake

Wasteload Projections for the City of Friona

Planning Year	Population	Flow (MGD) Average	Peak
1975	3,166	No Data Available	
1983	3,850	0.40	0.85
1990	4,200	0.45	0.93
2000	4,700	0.51	1.05

EXISTING PLANT CAPACITY: 0.21 MGD

Figure I-1

(2) Financial and Managerial Considerations: The total capital cost of this alternative is estimated to be $857,000 with a present worth of $1,373,000 and a total annual cost of $126,000. The resultant monthly charge per connection, assuming three persons per connection, will be $6.70. If 75 percent Federal funds through PL 92-500 are available, the total capital cost will be $343,400, and the monthly charge per connection will then be approximately $4.20. These costs are presented in Table I-1.

The City of Friona presently operates the existing wastewater treatment facility, and since significant new service areas outside of the City's jurisdiction are not proposed (Figure I-2), there is no reason to suggest an alternative management authority on the local level. It is proposed that the Texas Department of Water Resources continue in its role of regulation and enforcement of water quality in the area.

(3) Impacts: There are no long-term adverse environmental impacts associated with the construction of an oxidation ditch type plant at the site of the existing facility. A positive aspect of this type of treatment is that in the event that the City should decide to discharge their effluent, this would increase the quantity of water available for reuse downstream. There should be no significant social impact since the City currently has a central collection and treatment system.

With Federal funding, the economic impact should not be adverse since the cost per connection is reasonably low.

(c) Technical Alternative 2:

(1) Technical Plan: The City should expand and upgrade the existing facility and continue to irrigate as illustrated in the plant flow diagram in Figure I-1. The Imhoff tank and oxidation ponds are in good condition and, therefore, can continue to be used. The Imhoff tank can be converted to an aerobic digestor, and primary treatment and sludge handling facilities should be constructed.

(2) Financial and Managerial Considerations: The cost estimates for this alternative assume that new

Table I-1

Estimated Alternative Costs For The City of Friona

	Technical Alternative 1 Abandon Existing Plant- Construct Oxidation Ditch	Technical Alternative 2 Upgrade Existing Plant- Continue to Irrigate
Collection System		
Capital Cost	$ 134,600	$134,600
O&M Cost	1,000	1,000
Treatment Plant		
Total Labor Cost	27,400	21,100
Total Energy Cost	12,400	6,300
Total Chemical Cost	1,100	0
Construction Cost	716,500	*481,300
Land Acquisition Cost	5,900	3,200
O&M Cost	46,500	33,300
Capital Cost	722,400	484,500
Total Capital Cost	857,000	619,100
Present Worth	1,373,600	991,800
Total Annual Cost	126,000	91,000
Monthly Charge per Connection	6.70	4.80
WITH FEDERAL GRANT IN AID:	(75 PERCENT)	(85 PERCENT)
Total Capital Cost	343,400	106,300
Present Worth	858,100	473,500
Total Annual Cost	79,000	44,200
Monthly Charge per Connection	4.20	2.35

*Purchase of land used for irrigation is not included in construction cost.

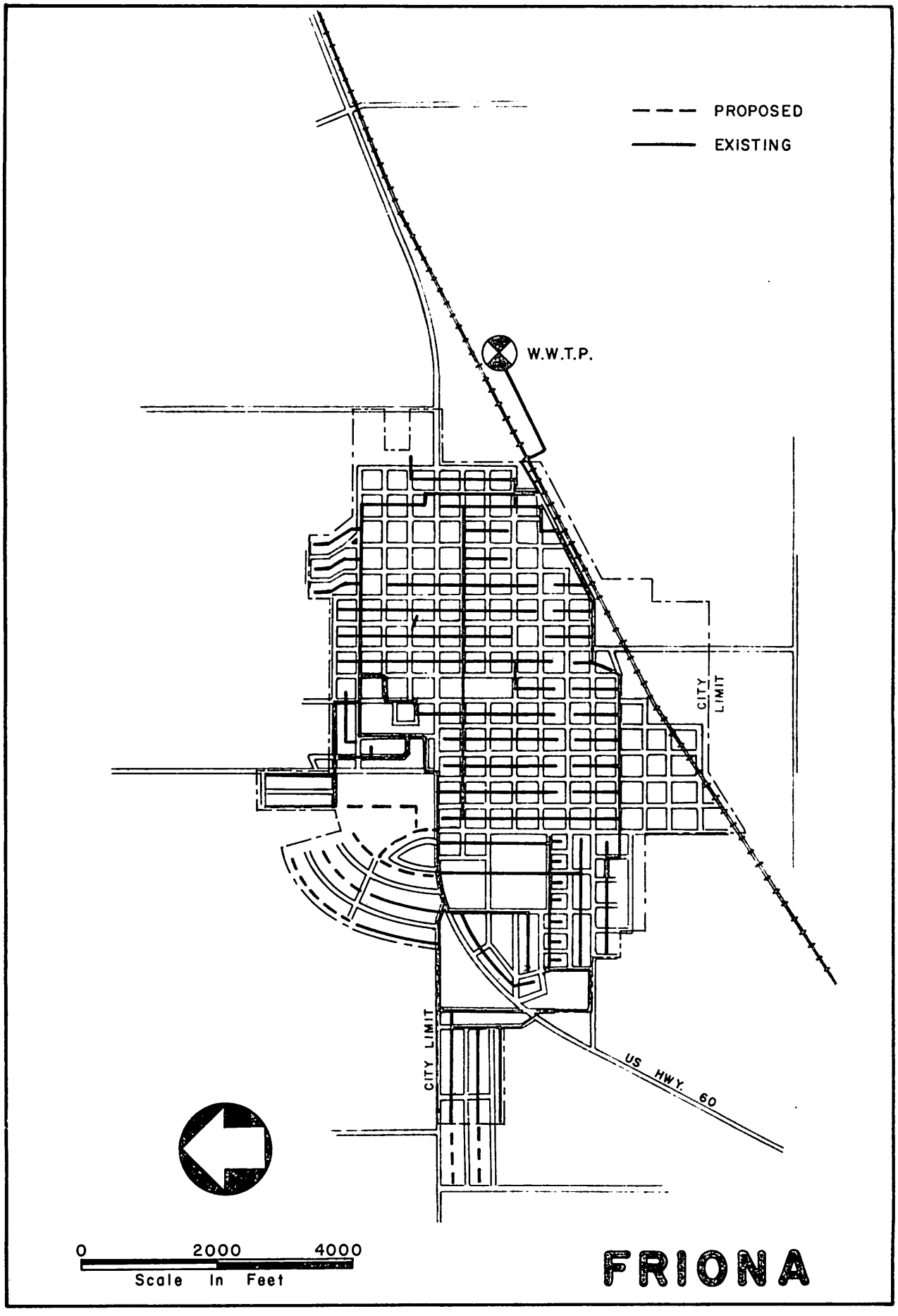


Figure I-2: Existing and Proposed Collection System for the City of Friona

primary treatment, sludge handling facilities, and additional oxidation ponds will be constructed. Considerations are also made for converting the Imhoff tank to an aerobic digestor. It is also assumed that Friona has managerial control, or can obtain it, over the land used for irrigation.

Thus, the total capital cost of this alternative is estimated to be $619,100, with a present worth of $991,800, and a total annual cost of $91,000. The resultant monthly charge per connection, assuming three persons per connection, will be $4.80. If Federal monies are available for an 85 percent construction grant, the monthly charge per connection will be $2.35.

Of the two alternatives presented, the land treatment alternative is the least expensive and should serve the growing City throughout the planning period.

Under a land treatment alternative, the City will be required to have control over the land used for irrigation, either through ownership or by long-term lease.

(3) Impacts: No adverse social or environmental impacts are anticipated under this alternative since the City has been utilizing essentially the same type of treatment for 20 years.

The addition of sludge handling facilities should prevent pollution of water quality in the area by preventing runoff contamination.

Economically, this alternative presents minimal impact. The $2.30 estimate should not represent a major burden to the revenue base for the growing City.

4. HEREFORD

(a) General: The City of Hereford lies approximately 48 miles southwest of Amarillo and is the county seat of Deaf Smith County. The City serves as the agri-business center for the surrounding area.

The City is growing rapidly and is projected to reach a population of 21,000 by the year 2000.

Currently, the City operates a wastewater treatment plant consisting of a primary clarifier, a trickling filter, an oxidation pond, an anaerobic digestor, and sludge drying beds. The effluent is used for irrigation under a "no discharge" permit. The primary clarifier was built in 1967. The irrigation system was installed in 1971 on approximately 3000 acres of City-owned land.

Inspection reports indicate that the facility is currently overloaded, and waste load projections indicate that it will be significantly overloaded by 1983 (Figure I-3). To prevent surface or ground water pollution, the Hereford wastewater treatment facility should be expanded immediately.

(b) Technical Alternative:

(1) Technical Plan: The City of Hereford should expand its existing system to accommodate the present overloading flows and the projected flows. An expansion scheme is presented in Figure I-3.

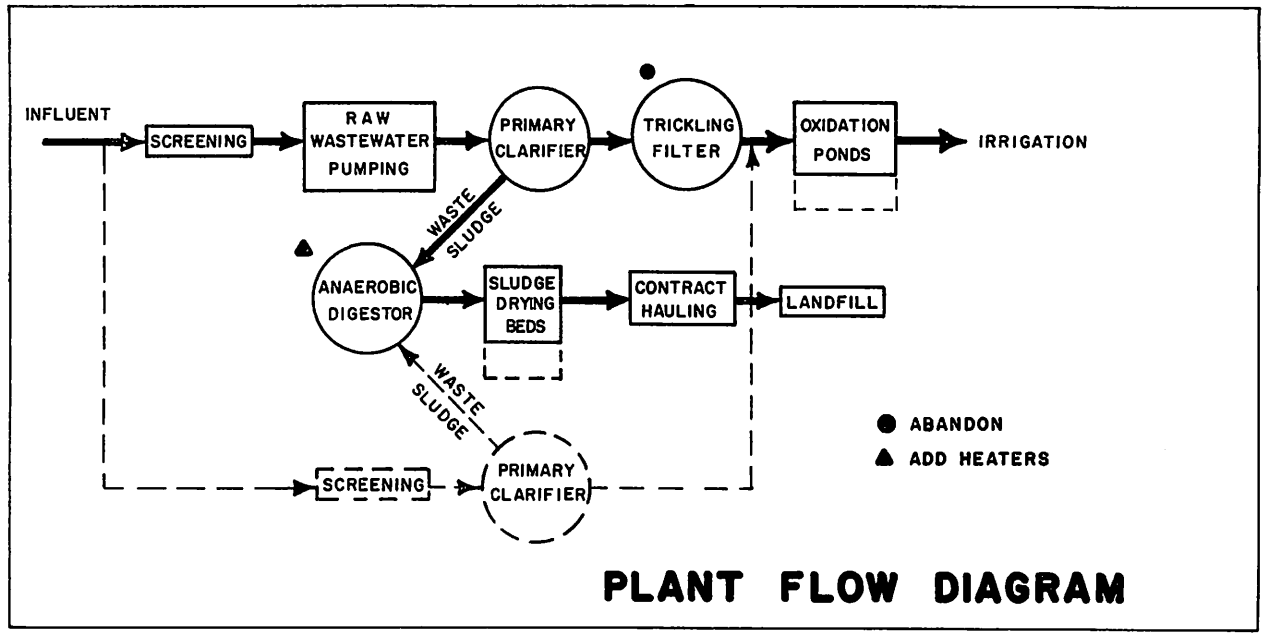
(2) Financial and Managerial Considerations: The proposed expansion will have several costs, as delineated in Table I-2. The total capital cost and present worth are estimated to be $1,094,000 and $1,728,400, respectively. The additional monthly charge per connection, assuming three persons per connection, will be $1.90. If 85 percent Federal funding is available under PL 92-500, the total capital cost will be $164,200, and the additional monthly charge per connection will be approximately $0.90.

The City of Hereford should manage the expanded facility. The Texas Department of Water Resources should continue as the enforcement agency.

(3) Impacts: There should be no long-term adverse environmental impacts from expansion of the facility. In contrast, the threat of contamination to ground and surface waters will be substantially reduced.

No adverse social impacts are expected since the City currently utilizes a centralized collection and treatment system.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF HEREFORD



Alternative: Expand existing facility - continue to irrigate.

Design Population: 21,000

Design Flow
Average - 2.10 MGD
Peak - 3.53 MGD

Effluent Requirements:

Primary Treatment

Receiving Water: NO DISCHARGE

Wasteload Projections for the City of Hereford

Planning Year	Population	Flow (MGD) Average	Peak
1975	14,160	No Data Available	
1983	16,800	1.68	2.89
1990	19,000	1.90	3.23
2000	21,000	2.10	3.53

EXISTING PLANT CAPACITY: 1.5 MGD

Figure I-3

Table I-2

Estimated Alternative Costs
For the City of Hereford

	Technical Alternative Expand Existing Facility Continue to Irrigate
Collection System	
Capital Cost	No Additions
O&M Cost	Proposed
Treatment Plant	
Total Labor Cost	$ 30,700
Total Energy Cost	18,000
Total Chemical Cost	0
Construction Cost	* 1,087,500
Land Acquisition Cost	7,300
O&M Cost	58,300
Capital Cost	1,094,800
Total Capital Cost	1,094,800
Present Worth	1,728,400
Total Annual Cost	158,500
Monthly Charge per Connection	1.90
WITH 85 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	164,200
Present Worth	795,500
Total Annual Cost	73,200
Monthly Charge per Connection	0.90

*Purchase of land used for irrigation is not included in construction cost.

5. LAKE TANGLEWOOD

(a) General: Lake Tanglewood is a newly incorporated community located approximately 12 miles northeast of Canyon in Randall County. The community is built around the shores of Lake Tanglewood which is formed by an earthen dam on Prairie Dog Town Fork of Red River within the walls of Palo Duro Canyon.

The area has steep topographic relief and slopes from both walls of the canyon to the Lake. The general direction of drainage is toward the Lake through several short, steep, rapidly flowing creeks. The soils underlying the area are of Wansker-Berda-Potter types which have low permeability and, thus, pose severe limitations as septic tank absorption fields.

Lake Tanglewood is a closed community with only 600 memberships permitted. The area is presently at one-third of its potential development with approximately 390 permanent residents and 300 seasonal residents. The population is projected to increase to 700 permanent residents by year 2000. Projected growth is expected to occur along the shoreline and in the areas within the canyon available for construction. Land use for the area is primarily residential and recreational with a few commercial usages.

The water for Lake Tanglewood is supplied by eight wells, each of 20-30 GPM capacity. These wells, located on the canyon rim surrounding the community, have ground storage and are furnishing adequate supply except in times of extreme drought.

The residents of Lake Tanglewood do not have access to a central wastewater facility. Currently, septic tanks are used for the disposal of wastewater. The soil is unfavorable for septic tank filter fields, and many of the lots are too small for disposal fields. These conditions indicate that there is a potential for septic tank effluent surfacing or draining into the lake. Therefore, a central wastewater treatment facility is very desirable.

The continued use of septic tanks, even under a strictly enforced ordinance, does not appear to be an acceptable alternative due to the severe limitations of the soils to be used for septic tank filter fields. This limitation is magnified by the projected population growth and the fact that many of the lots are too small for septic tank filter fields.

(b) Technical Alternative:

(1) Technical Plan: This alternative will utilize a wastewater collection system as shown in Figure I-4. The wastewater will be transported to a treatment plant located west of the City, beyond the canyon. It consists of 9.8 miles of service line, 6,000 feet of force main, and 10 lift stations.

A "no-discharge" method of applying wastewater to the land will be used. After primary treatment and disinfection, the effluent will be used for crop or landscape irrigation. The recommended primary treatment is a series of physical processes including a screen, a grit chamber, and a clarifier to remove the settleable solids. A schematic diagram of this treatment system is shown in Figure I-5.

(2) Financial and Managerial Considerations: The estimated capital cost for the treatment plant will be $493,000, and for the collection system will be $881,600. The total capital cost of this alternative will be $1,374,000. Its present worth and total annual cost would be $1,657,000 and $152,000, respectively, based on a 6-5/8 percent interest rate for twenty years. The average monthly charge per connection, assuming three persons per connection, will be $54.30. If 85 percent Federal funding is available through PL 92-500, the monthly charge will be $19.20 per connection. These costs are presented in Table I-3.

The City should manage this facility. The Texas Department of Water Resources would assume the regulatory and enforcement role.

(3) Impacts: This alternative will maintain the existing water quality successfully since the effluent will not make its way into the stream without a long period of travel. On the other hand, without funding in excess of PL 92-500, this alternative will impose a economic burden on the local residents, since a typical monthly customer charge could be as high as $16.20.

Nevertheless, preliminary examinations of other options (such as a package plant, a pressurized sewage collection system, and the use of honey wagons) indicate that land application is the least costly alternative.

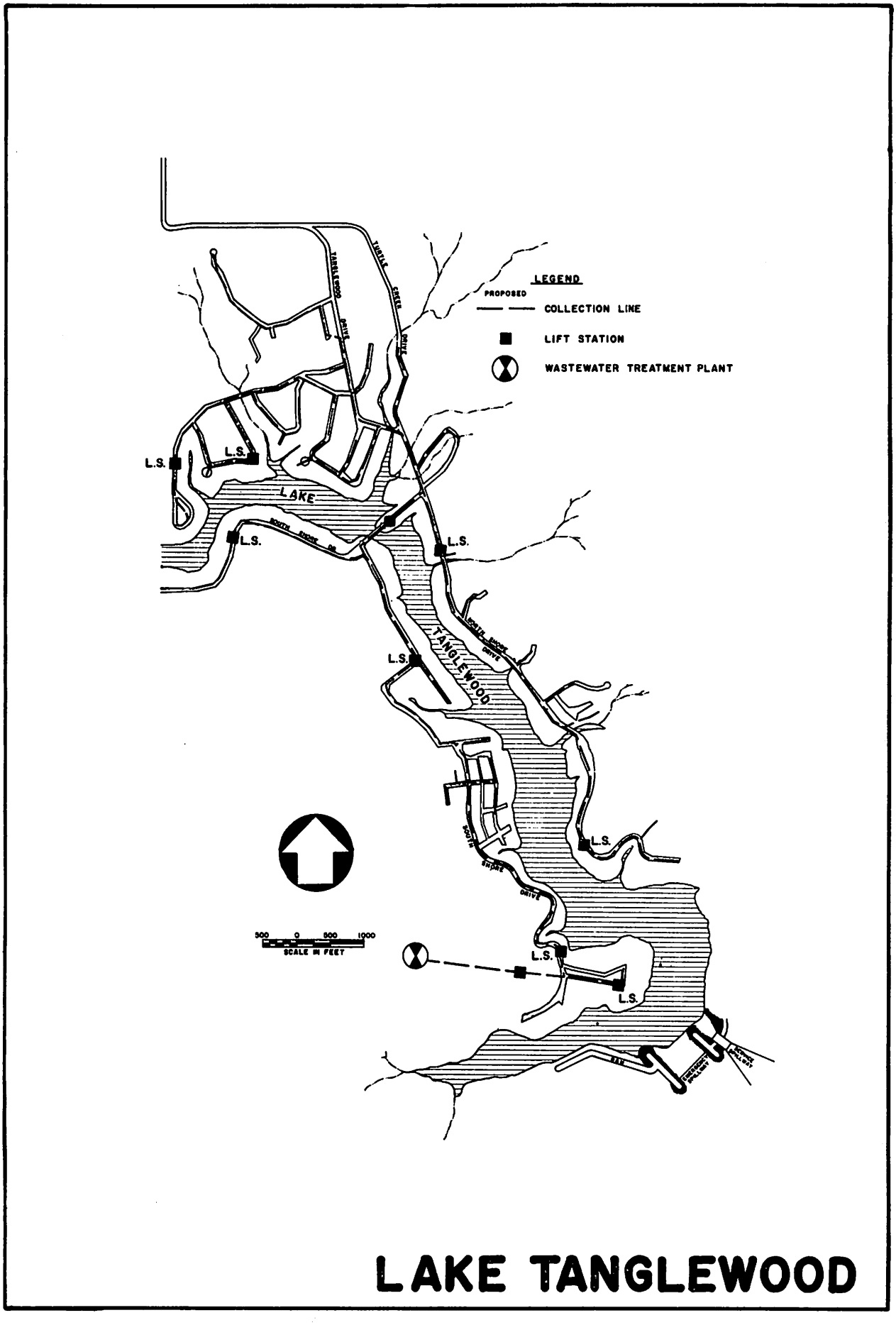
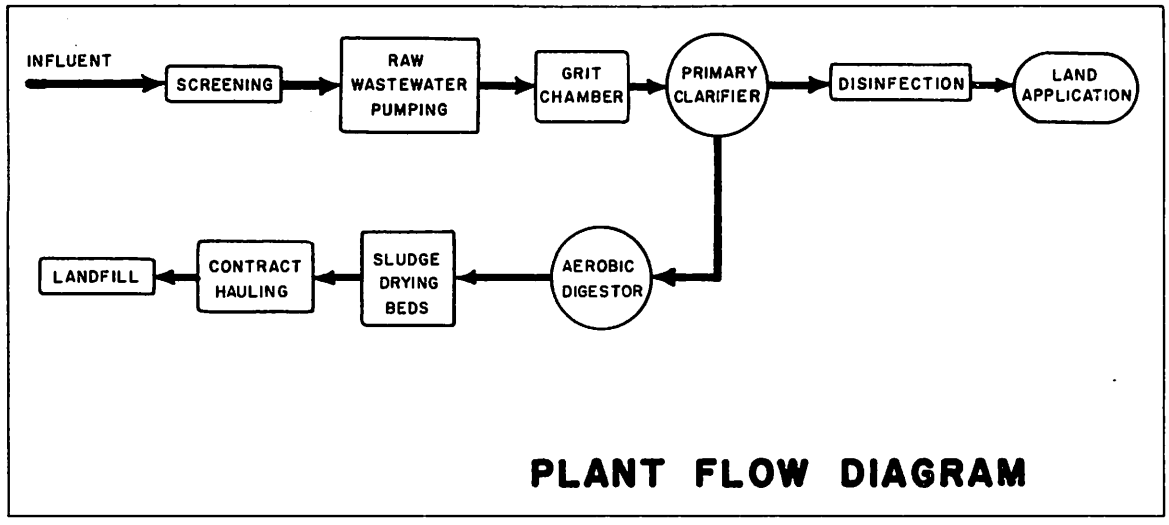


Figure I-4. Proposed Collection System for Lake Tanglewood

WASTEWATER TREATMENT PLANT DIAGRAM AND DESIGN DATA
FOR THE CITY OF LAKE TANGLEWOOD



Alternative: Implement Land Treatment

Design Population: 700
Design Flow:
Average - 0.07 MGD
Peak - 0.19 MGD

Effluent Requirement
Primary Treatment

Receiving Water: No Discharge

Wasteload Projection for the City of Tanglewood

Planning Year	Population	Flow (MGD) Average	Peak
1975	390	-	-
1983	600	0.06	0.16
1990	650	0.06	0.17
2000	700	0.07	0.19

NO EXISTING FACILITY

Figure I-5

Table I-3

Estimated Alternative Costs
For the City of Lake Tanglewood

	Technical Alternative Land Application
Collection System	
Capital Cost	$ 881,600
O&M Cost	9,700
Treatment Plant	
Total Labor Cost	11,500
Total Energy Cost	1,800
Total Chemical Cost	400
Construction Cost	*492,000
Land Acquisition Cost	1,200
O&M Cost	16,700
Capital Cost	493,200
Total Capital Cost	1,374,000
Present Worth	1,657,000
Total Annual Cost	152,000
Monthly Charge per Connection	54.30
WITH 85 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	294,400
Present Worth	577,900
Total Annual Cost	53,900
Monthly Charge per Connection	19.20

*For land Application, the purchase of land needed for irrigation is included in construction cost.

6. SAN JOSE COMMUNITY (HEREFORD)

(a) General: Immediately southwest of Hereford, between U.S. Highway 385 and U.S. Highway 60, lies an unincorporated community of approximately 700 persons. The area was a Japanese P.O.W. detention center during World War II, and present housing consists of temporary government buildings erected in the early 1940s. The area is now privately owned, and the majority of the dwellings (approximately 70 percent) qualify as "poor" housing. The median income of the families in the community is below the poverty income level.

Water is supplied through a centralized system from groundwater wells. Presently, this system is extremely inadequate, both in capacity and in operation.

Wastewater treatment and disposal is either non-existent or inadequate. The wastewater flows are run onto the ground, dumped into bore holes, or treated in antiquated septic tanks. Within the last year, at least two confirmed cases of shigellosis have occurred within the community.

Immediate action should be undertaken to alleviate the water and wastewater treatment needs in the community.

The population of the community is projected to remain relatively stable (Figure I-6) throughout the planning period.

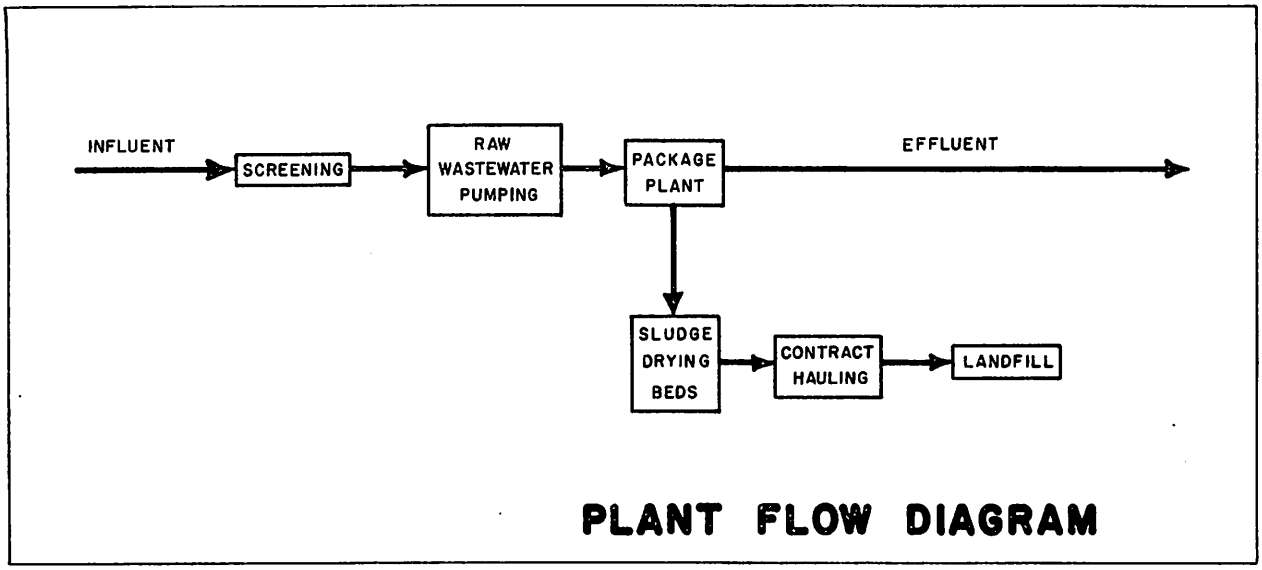
(b) Technical Alternative 1:

(1) Technical Plan: As a first alternative, the community could incorporate or form a Utilities District so that the area would have a mechanism with which to receive Federal funding. The County could also be designated as the management agency.

The community should then construct a package plant to treat its wastewater flows (Figure I-6). A possible collection line layout is also illustrated in Figure I-7.

(2) Financial and Managerial Considerations: If the treatment plant and collection system are constructed as described, the total capital cost of the alternative is estimated to be $312,000 (Table I-4).

WASTEWATER TREATMENT PLANT DATA FOR THE COMMUNITY OF SAN JOSE



PLANT FLOW DIAGRAM

Alternative 1: Construct package plant

Design Population: 700
Design Flow:
Average - 0.07 MGD
Peak - 0.19 MGD

Effluent Requirements:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Tierra Blanca Creek

Wasteload Projections for the Community of San Jose

Planning Year	Population	Flow (MGD) Average	Peak
1975	690	-	-
1983	700	0.07	0.17
1990	700	0.07	0.18
2000	700	0.07	0.19

NO EXISTING FACILITY

Figure I-6

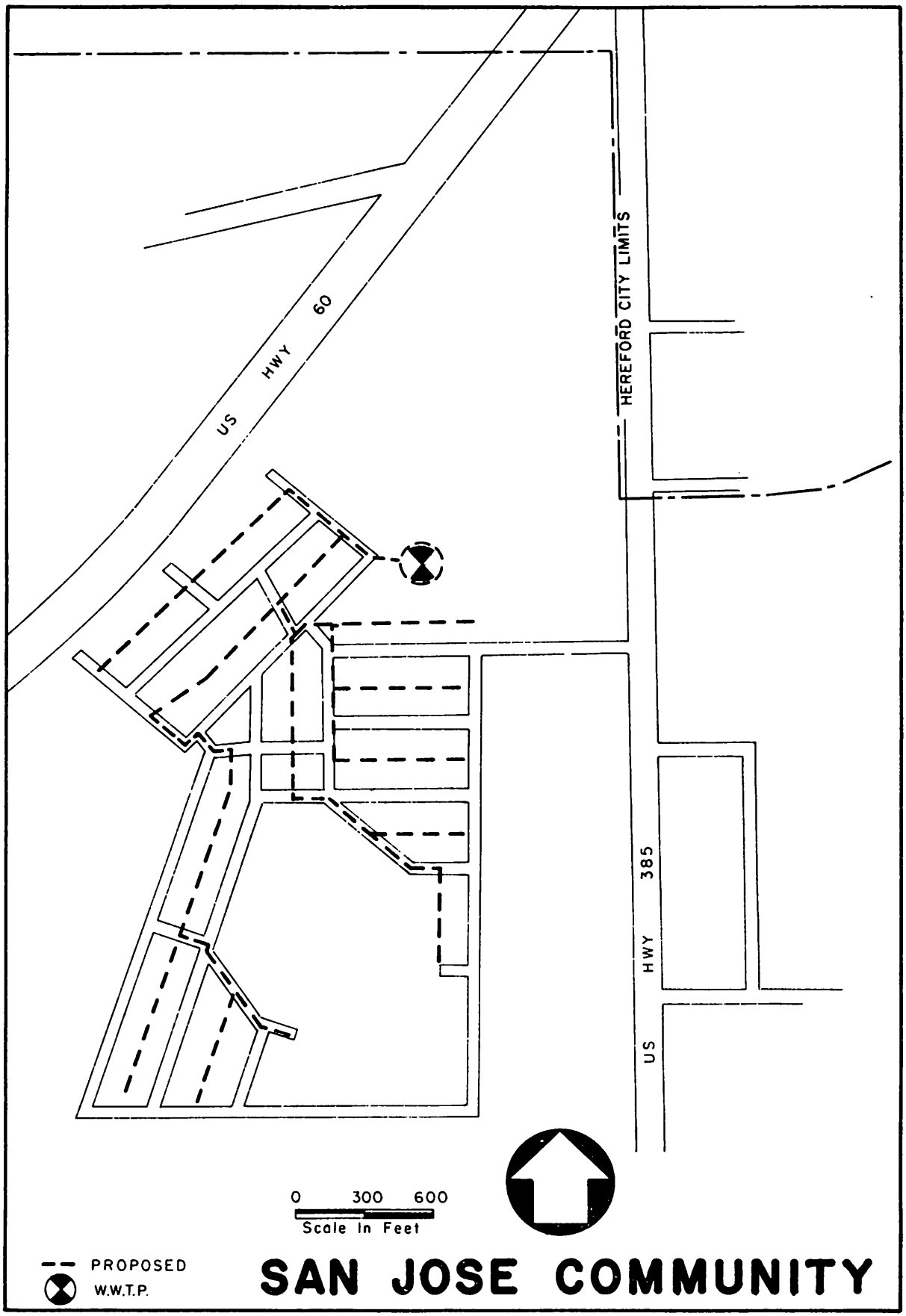


Figure I-7: Proposed Collection System for the San Jose Community

Table I-4

Estimated Alternative Costs
For The Community of San Jose

	Technical Alternative 1 Package Plant
Collection System	
Capital Cost	$147,700
O&M Cost	1,100
Treatment Plant	
Total Labor Cost	9,400
Total Energy Cost	4,900
Total Chemical Cost	200
Construction Cost	164,200
Land Acquisition Cost	200
O&M Cost	16,100
Capital Cost	164,400
Total Capital Cost	312,000
Present Worth	499,200
Total Annual Cost	45,800
Monthly Charge per Connection	16.40
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	78,000
Present Worth	264,500
Total Annual Cost	24,300
Monthly Charge per Connection	8.70

Its present worth and total annual cost would be $499,200 and $45,800, respectively, based on 6-5/8 percent interest rate for twenty years. The average monthly charge per connection, assuming three persons per connection, will be $16.40.

If 75 percent Federal funding is available through PL 92-500, the monthly charge per connection will be $8.70.

Since the County is presently managing water improvements for the area, it should also be designated as the managerial agency for wastewater treatment facilities.

(3) Impacts: Economically, this alternative is unfeasible without additional grant monies above 75 percent.

However, such a facility will substantially improve the water quality in the area. The health problems that are now attributable to unsanitary wastewater disposal will be eliminated.

(c) Technical Alternative 2:

(1) Technical Plan: Another alternative for treating the waste flows from San Jose Community is to centrally collect these flows and transport them to the treatment system presently available in the City of Hereford.

The San Jose Community lies within one-fourth mile of the city limits of Hereford. The City of Hereford can annex the community and provide sewer service to the area. Alternately, the community can form a utilities district and contract with the City of Hereford for needed sewer services. The County can also contract with the City of Hereford.

However, the wastewater treatment plant for the City of Hereford is currently overloaded and will need additional capacity to meet the needs of both the City of Hereford and of the San Jose Community.

The Hereford plant can be expanded as discussed in Section 4 of this Chapter.

(2) Financial and Managerial Considerations: The incremental increase in the cost of expanding the

Hereford facility to also include capacity to treat flows from the San Jose Community will be minimal.

However, unless the City of Hereford annexes the area, the San Jose Community will need to construct a collection system (Figure I-8). These lines will cost approximately $200,000. The community itself cannot support such a project and will need financial assistance to do so.

(3) Impacts. Central collection and subsequent transportation of the wastewater flows will effectively eliminate the public health problems attributable to the current lack of facilities.

Even with 75 percent funding under PL 92-500, this alternative is not economically feasible for the community. Additional funds will be necessary.

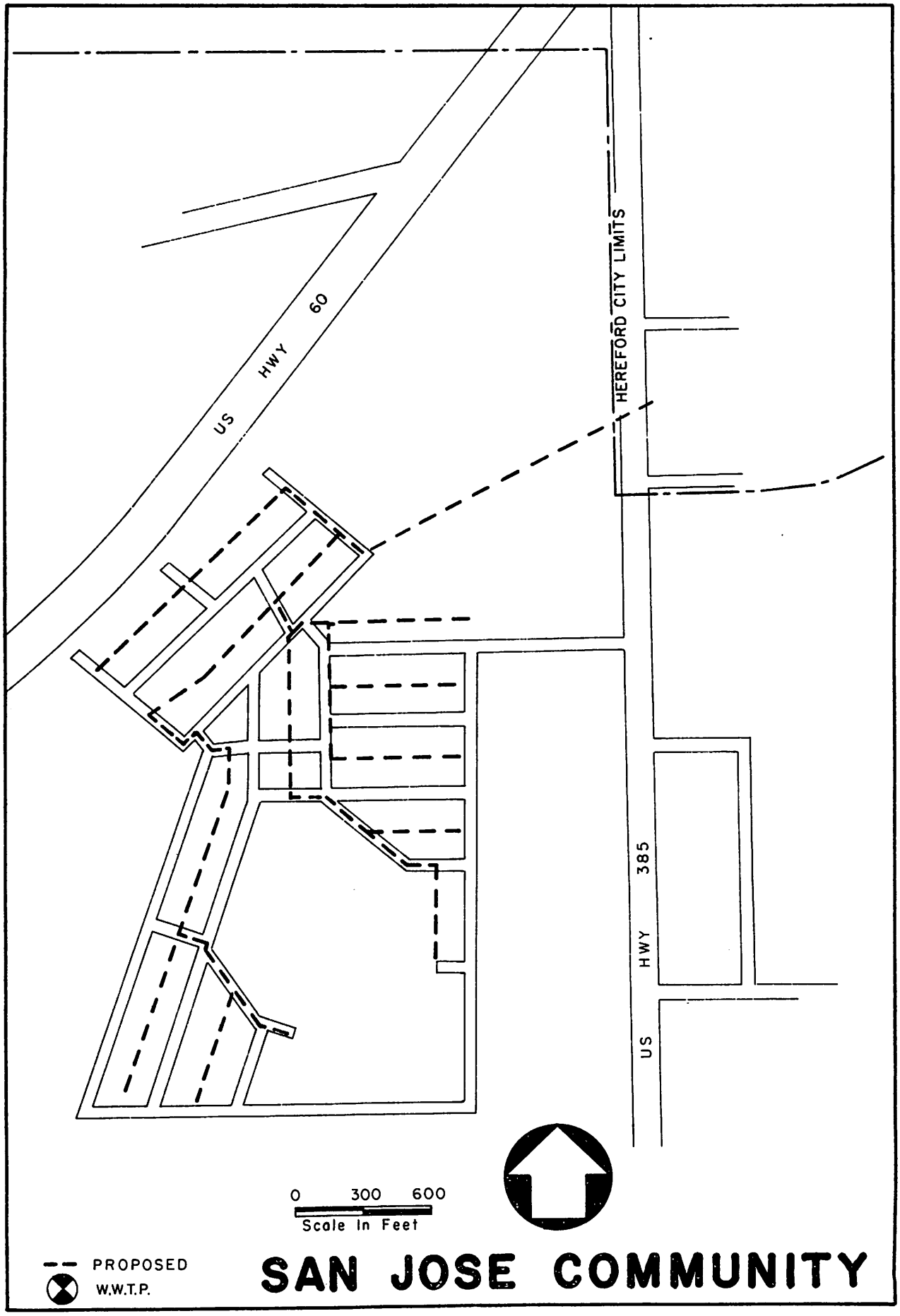


Figure I-8: Proposed Collection System for Transport of Flows to City of Hereford System

CHAPTER J

SEGMENT 208

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 208 encompasses the Lake Crook drainage area of approximately 45 square miles located in Lamar County. Water quality in the segment is good, and no violations of water quality standards have been recorded. There are no treatment facilities located within the segment.

The one potential area of concern is future residential and recreational land use developments around the lake. To minimize potential degradation of the lake from anticipated development, the Lake Crook watershed is protected by a TDWR ordinance to regulate the installation and operation of private sewage facilities.

(b) Non-point Source Assessment: Most of the 46 square miles included in this segment are used for dry cropland, with some forest lands near Lakes Crook and Gibbons. This segment is classified as Category I and has not experienced any significant water quality problems. Lake Crook has a problem with siltation which has reduced the lake capacity by approximately 1500 acre-feet since the lake was constructed in 1923. There are no other major non-point sources of contamination in this segment.

Although siltation is a natural process in lake development, control measures can help slow the process. Land use in the immediate area surrounding the lake is as forest land. In general, this area should produce minimal siltation loadings.

Land use in the remainder of the drainage area is primarily dry cropland. The primary cause of sediment production from these areas is sheet erosion. Various types of soil conservation measures for erosion reduction have been developed for specific soil, cover, slope, and rainfall complexes. These measures include soil improvement, proper tillage methods, strip cropping, terracing, and crop rotation.

Of all the conversion measures available, cover control is perhaps the most effective and easiest. Conversion of farming practices to include terracing of row crops where needed and planting of fallow land with small grains, meadow grasses, or other cover crops should effectively reduce the soil loss.

CHAPTER L

SEGMENT 210

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 210 comprises approximately 90 square miles of drainage area which contribute to the waters of Farmers Creek Reservoir (Nocona Lake) located in Montague County. The quality of the water in the Reservoir is excellent, and no violations of the stream standards have been recorded. There are no municipalities or point dischargers in the area.

(b) Non-point Source Assessment: The water quality of this Category I segment is excellent, and it is not anticipated that this will be significantly changed by non-point contributions. Over 50 percent of the land use for this segment is for rangeland, and there are no known areas of significant disposal activities located within the watershed.

CHAPTER M

SEGMENT 211

1. SEGMENT SUMMARY

(a) General: Segment 211 is comprised of the Little Wichita River from its confluence with the Red River to Lake Arrowhead. A summary of permitted dischargers are as follows:

Description	No. of Dischargers	No. of Non-Dischargers
Municipal WWTP	2	1
Non-Municipal WWTP	0	3
Municipal WTP	0	0
Industrial Operations	0	0
Feedlot Operations	0	0

According to TDWR data, values outside the standards have been recorded for DO, pH, and fecal coliform counts.

The City of Henrietta is currently participating in the PL 92-500 Construction Grant program and plans to replace their present systems. The City of Petrolia operates an Imhoff tank-oxidation pond system that has a "no discharge" permit. The plant presently does not discharge but has been known to discharge occasionally in the past. A program of irrigation has been implemented to correct this situation.

There are three non-municipal wastewater treatment facilities located in this segment. Jolly Truck Stop, Inc., on U.S. Highway 287, maintains a septic tank-oxidation pond system to treat wastes from their service facilities. The plant does not discharge, but it is reported to be in poorly maintained. The Red River Authority operates an extended aeration plant that serves Arrowhead Ranch Estates property. Though it is permitted to discharge, at present it does not do so. The Texas Parks and Wildlife Department has an extended aeration plant that serves Lake Arrowhead State Park. The effluent is used for irrigation purposes.

There are no water treatment plant discharges or industrial discharges located within this segment.

(b) Non-point Source Assessment: Land use in this segment consists primarily of rangeland and dry cropland. This segment generally has water of good quality; however, recent monitoring data indicates the possibility of water quality problems in the Little Wichita River. Non-point pollutant sources were examined as a possible contributors to these water quality problems. This survey indicates that there are no significant pollutant contributions which may be attributed to agriculture, silviculture, mining, hydrographic modification, natural salts, or construction activities. Urban runoff and disposal activities are two activities which could contribute to water quality problems.

There is little farming in Segment 211, and thus no non-point contribution from this activity. Agriculture activities in the segment are not great, and the estimated sediment loadings from the segment are not indicative of potential problem areas. Construction activities in the segment are minor in nature and should not increase the sediment load of area streams measurably. Mining in the segment consists primarily of petroleum production, with some mining of sand and gravel. The major pollutant which results from oil production is brine. Water quality data for the segment do not indicate that brines are a problem in the segment, and no oil fields in the segment have been specifically identified as brine contamination areas.

Henrietta is the only major urban area within the segment. The urban runoff from this City drains into the Little Wichita River and then into the Red River. This runoff is estimated to be 500 acre-feet annually and to contain approximately 13,000 pounds of BOD_5, 826,000 pounds of suspended solids, 3,100 pounds of nitrogen, and 680 pounds of phosphorus. After these loads are diluted by the flows of the Little Wichita River, the resulting concentrations are 0.266 mg/l BOD_5, 16.2 mg/l TSS, 0.06 mg/l nitrogen, and 0.013 mg/l phosphorus. The estimation of final coliform concentration in the Little Wichita River after an average urban runoff event is 8,000 coliforms/100 ml. According to the Texas methodology for the evaluation of urban runoff, these concentrations are indicative of possible water quality problems. Resulting impacts to the Little Wichita River could include the eutrophication of downstream water and turbidity or sedimentation problems. In addition, the water could become undesirable for raw water supply and for contact and non-contact recreation.

The average flow of the Red River at the confluence of the Little Wichita River is more than 1.6 million acre-feet; thus, the dilution factor for this urban runoff is greater than 3,000. Therefore, the runoff from Henrietta will impose very insignificant water quality impacts on the Red River after mixing.

Disposal activities in this segment consist of a sanitary landfill, septic tank concentration areas, and land application areas. The sanitary landfill, located near Henrietta, is a forty-acre site which, according to the water balance method of evaluation, should have a minimal leachate production and, thus, no significant impact upon the water quality of the segment. The City of Henrietta is currently considering the alternatives of building a levee around the remaining 22 acres of the site, which lie in the flood plain of the adjacent stream or of abandoning the site and opening a new sanitary landfill. These actions would further reduce the potential for leachate production from the landfill.

Four areas of septic tank concentrations have been identified and examined as potential sources of non-point contamination. The raw loading from the septic tanks are given in Table M-1. The soils in these areas would appear to be capable of effectively assimulating loads of this magnitude. However, rapid growth of the Jolly and Dean areas could necessitate the re-examination of these areas as sewerage planning areas in the future. At the present, the housing along the highways is not very dense. Soils of this area are, in general, not suitable to handle large loads of septic tank effluent, and an increase in population density could create disposal system problems.

The land application systems in this segment include the Jolly Truck Stop and the Texas Parks and Wildlife system which serves Lake Arrowhead State Park These facilities are not large and, if properly maintained, should not contribute a significant pollutant load to the waters of this segment.

2. HENRIETTA

The City of Henrietta operates two wastewater treatment plants. The North plant has a bar screen, an Imhoff tank, a trickling filter, a clarifier, a chlorine contact basin, and three sludge drying beds. The South plant has a pumping station, a bar screen and grit chamber, an oxidation ditch

Table M-1

Wasteloads From Septic Tank Concentration Areas in Segment 211

City	Population	Flow (MGD)	Wasteloads (lbs/day)					
			TSS	BOD_5	Phosphates	Organic N	NH_3N	Coliforms
Joy	150	0.015	6.63	13.4	2.51	1.38	2.51	53
Bluegrove	125	0.012	5.53	11.2	2.09	1.15	2.09	44
Jolly	200	0.020	8.84	17.8	3.34	1.84	3.34	70
Dean	200	0.020	8.84	17.8	3.34	1.84	3.34	70

with Magna Rotor aerator, a final clarifier, and two sludge drying beds. Neither plant produces an effluent that meets permit requirements.

The City of Henrietta is currently participating in the PL 92-500 Construction Grant Program to improve its wastewater treatment system. The proposed plant is an "Air-Aqua" oxidation system which consists of two lagoons with aeration equipment placed within the lagoons. This new system will upgrade and replace portions of the North plant and the entire South plant.

CHAPTER N

SEGMENT 212

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 212 is comprised of Lake Arrowhead and its watershed, which is located in Clay and Archer Counties. This area consists of approximately 550 square miles of range land and dry crop land. The reservoir has excellent quality water and serves as a municipal supply source for the City of Wichita Falls and many of the surrounding communities. No water quality problems have been experienced in this segment.

Four facilities with TDWR permits are located within the segment, only two of which discharge. The wastewater treatment facility owned by the City of Archer City consists of an Imhoff tank-trickling filter-oxidation pond system. The City of Windthorst holds a discharge permit for the new facility which is to be constructed as part of the 201 planning process.

Other areas which are expected to have wastewater disposal problems in the future are the City of Scotland and the areas of residential development around the northern side of the reservoir. These areas may need new facilities to handle projected wasteloads and to prevent possible health problems resulting from overloaded septic tank absorption fields.

(b) Non-point Source Assessment: Land use in this Category II segment is comprised of approximately 72 percent rangeland and 24 percent cropland. Water quality is good, and no problems are foreseen which could result from non-point sources. Control measures have been considered in this Plan for both areas with septic tank concentrations. These measures should adequately protect the quality of water in the segment. The area around Archer City has been identified as an area in which brine pollution from oil fields has been a problem; however, there are no water quality data by which these contributions of brine may be measured. In general, the salt loads from oil fields are diminishing as the result of laws which prohibit the disposal practices which produced these brine areas, and no additional control measures should be required.

2. SCOTLAND

(a) General: The City of Scotland is a newly incorporated community of approximately 300 residents located in the eastern part of Archer County, 18 miles south of Wichita Falls on U. S. Highway 281 along the upper reaches of Lake Arrowhead. The City is experiencing fairly rapid growth. Most of the residential development is in the northeastern quadrant of the town and eastward along F.M. Road 172 toward the lake.

The City has moderate topographic relief and slopes from south to north. The general direction of drainage is toward the north to Little Wichita River and Lake Arrowhead. The City is underlain by Renfrow-Kirkland type soils which have low permeabilities and, thus, pose severe limitations for the use of septic tanks.

The population of Scotland is projected to increase to 625 by the year 2000. Projected growth is expected to occur along F.M. Road 172 toward Lake Arrowhead and in the presently vacant sites within the developed area. Land usage is primarily residential with commercial usage mainly along U.S. Highway 281. The economic resource base is primarily agricultural and mineral-recovery activities, with no existing or anticipated industrial contribution.

The residents of Scotland do not have access to a central wastewater facility. Currently, septic tanks are used for wastewater disposal. Because the soils have severe limitations to the use of septic tanks and because of the expected growth of the City, a central wastewater facility is desirable.

The population and wasteload projections are shown in Figure N-1. These wasteloads are from domestic flows and infiltration and inflow only since there is currently no industrial contribution to be considered.

Presented below are two alternatives to the present method of wastewater treatment in the area. In addition, a central package plant and its collection system were evaluated in Interim Report 1, but were found to cost $12.00 per connection and were, therefore, considered too costly.

(b) Technical Alternative 1:

(1) Technical Plan: In order for septic tanks to be considered as a viable alternative, it will be necessary to institute a stringent septic tank control ordinance. Due to the severe limitations of area soils for utilization of septic tanks, as expressed in the SCS Soil Survey, septic tanks appear to be a potential health problem. To date, however, there have been no reported problems, and if septic tanks are properly installed and maintained, they could perform satisfactorily despite the limitation on filter fields.

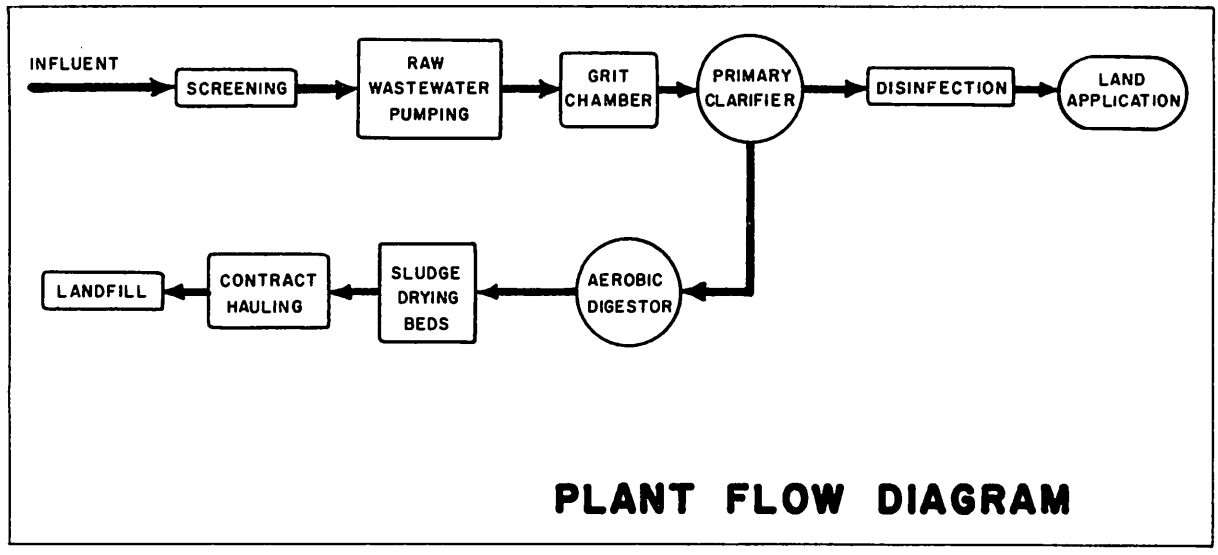
(2) Financial and Managerial Considerations: Part of the cost of a septic tank control ordinance will be in fulfilling the legal and institutional requirements required to pass and enforce the ordinance. Other costs will be those required for qualified personnel to inspect these systems during construction and while in operation and for the clerical work involved with this process. If many of the existing systems are found to be inadequate, the owners of these unsuitable systems can be faced with the cost of installing new septic tanks and/or absorption field systems to replace the systems they are now using. These costs are further delineated in Appendix F.

The City of Scotland is an incorporated municipality and is a logical choice for the management agency.

(3) Impacts: This alternative will have fairly significant impacts on the area even though septic tanks will be maintained as a means of treatment. In order to achieve the minimum required treatment level, it will be necessary to inact a strictly enforced control order. This order may allow the area to maintain stream quality; however, with available data this is difficult to determine. This order, on the other hand, can conceivably have a significant economic impact, since evaluation of existing systems will be necessary and residents may need to replace or upgrade their existing tanks or filter fields.

Economic impacts will also be encountered in the management and enforcement of the septic tank control

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF SCOTLAND



Alternative 2: Implement Land Treatment

Design Population: 625
Design Flow:
Average - 0.08 MGD
Peak - 0.20 MGD

Effluent Requirements:

Primary Treatment

Receiving Water: No Discharge

Wasteload Projections for the City of Scotland

Planning Year	Population	Flow (MGD) Average	Peak
1975	300	-	-
1983	410	0.05	0.13
1990	500	0.06	0.16
2000	625	0.08	0.20

NO EXISTING FACILITY

Figure N-1

order. The cost of this activity is difficult to determine; however, for an area without prior experience and personnel, it can be considerable.

(c) Technical Alternative 2

(1) Technical Plan: In the event that septic tanks prove to be unacceptable, and a centralized collection and treatment system is needed, this alternative is proposed. This alternative will employ a collection system and a "no-discharge" method for ultimate wastewater disposal. A possible collection configuration is shown in Figure N-2. The wastewater will be transported to a treatment plant located north of the City.

A "no-discharge" method utilizes the wastewater, after primary treatment and disinfection, for crop or landscape irrigation. The primary treatment is a series of physical processes including a screen, a grit chamber, and a clarifier to remove the settleable solids. Chlorination is recommended for disinfection to prevent the spread of waterborne diseases. A schematic diagram of this type of treatment system is shown in Figure N-1.

(2) Financial and Managerial Considerations: The estimated capital cost for the treatment plant is $572,000 and for the collection system is $172,000. The total capital cost of this alternative will be $744,000. Its present worth and total annual cost will be $946,000 and $86,800, respectively, based on 6-5/8 percent interest rate for twenty years. The average monthly charge per connection will be $34.80. If 85 percent federal funding is available through PL 92-500, the monthly charge will be $12.60 per connection. These costs are presented in Table N-1.

The City should manage this facility. The Texas Department of Water Resources should assume the regulatory and enforcement role.

(3) Impacts: This alternative will maintain the existing water quality since the effluent will not make its way into the stream without a long period of travel. On the other hand, this alternative will be a financial burden on the local residents.

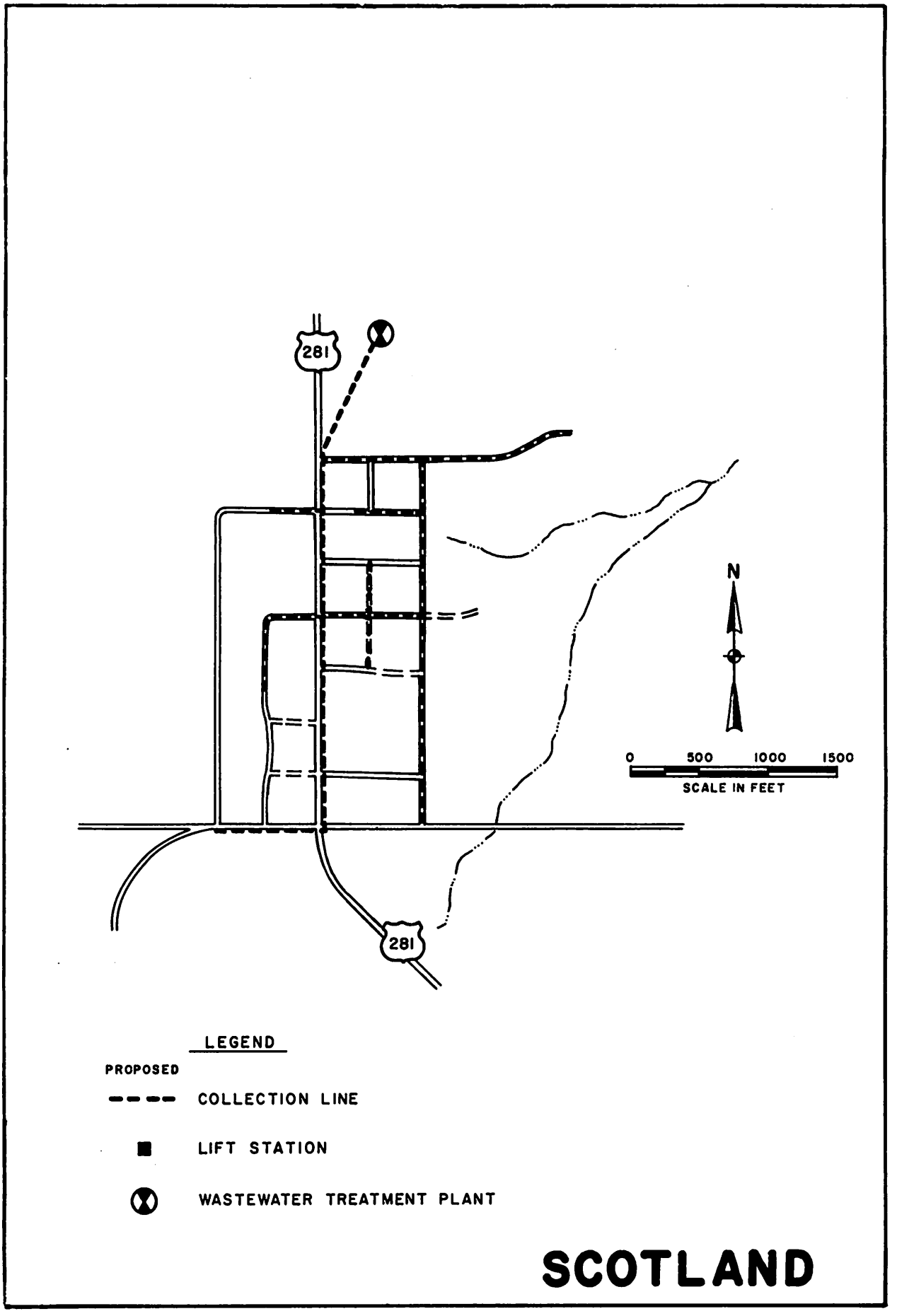


Figure N-2. Proposed Collection System for Scotland

Table N-1

Estimated Alternative Costs For
The City of Scotland

	Technical Alternative 2 Land Application
Collection System	
Capital Cost	$172,000
O&M Cost	1,300
Treatment Plant	
Total Labor Cost	12,600
Total Energy Cost	1,800
Total Chemical Cost	400
Construction Cost	*570,400
Land Acquisition Cost	1,200
O&M Cost	18,200
Capital Cost	571,600
Total Capital Cost	743,700
Present Worth	946,000
Total Annual Cost	86,800
Monthly Charge per Connection	34.80
WITH 85 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	128,700
Present Worth	337,700
Total Annual Cost	31,500
Monthly Charge per Connection	12.60

*For Land Application, the purchase of land needed for irrigation is included in construction cost.

A typical monthly customer charge will be $11.00. Additional funding in excess of PL 92-500 funding will be necessary to make the alternative economically feasible for the City of Scotland. However, a land treatment system could cost less if the land area needed for irrigation is presently owned by the City, or can be obtained with a long-term lease.

3. WINDTHORST

The City of Windthorst is presently participating in the PL 92-500 Construction Grant Program. The City is currently serviced only by septic tanks but is building a new centralized wastewater treatment plant. The new plant will consist of a bar screen, a surface-aerated lagoon, polishing ponds, and chlorination facilities. The plant is designed for long detention times which should take shock loadings effectively. The solids will remain in the pond and are scheduled to be removed at approximately ten-year intervals.

4. LAKE ARROWHEAD

(a) General: Lake Arrowhead is located in Archer and Clay Counties approximately 10 miles southwest of Henrietta and 13 miles southeast of Wichita Falls, on the Little Wichita River, and is owned and operated by the City of Wichita Falls for municipal water supply. At present, there are about 320 permanent residences, recreation homes, and mobile homes on both the eastern and western sides of the lake, just south of the Lake Arrowhead Dam, with a total population of approximately 860. This area has experienced steady population growth since it was first founded. The growth is mainly due to its lakeside location and its proximity to Wichita Falls. The population around Lake Arrowhead is projected to increase to 1,200 by the year 2000.

The lots around the lake are leased from the City of Wichita Falls. Land usage is primarily residential and recreational. The topography of Lake Arrowhead has moderate relief and slopes toward the Lake. The general drainage direction is also toward the Lake. This area is underlain by Renfrow-Kirkland type soils which have low permeabilities and, thus, pose severe limitations to the use of septic tanks.

Housing and development of land surrounding the Lake is controlled by permits issued by the City of Wichita Falls. Construction is subject to City inspection, including soil percolation tests as a prerequisite for septic tank installation.

The residents of Lake Arrowhead do not have access to a central wastewater treatment system, and septic tanks are currently used for the individual disposal of wastewater. Though no specific septic tank problem in the area is known, nearby Arrowhead Ranch Estates has had problems severe enough to merit construction of a wastewater treatment facility. The density of housing and its proximity to the lake also indicate the potential of septic tank health hazards and water contamination.

(b) Technical Alternative: Of all the treatment alternatives considered within the methodology, centralized collection and land treatment of the wastewater flows is the least expense.

(1) Technical Plan: This system will incorporate two separate treatment systems and will utilize a collection system as shown in Figure N-3. It will employ a "no-discharge" method for ultimate wastewater disposal. Following primary treatment and disinfection, the wastewater will be applied to land for crop or landscape irrigation.

The proposed primary treatment is a series of physical processes including a screen, a grit chamber, and a clarifier to remove the settleable solids. Chlorination is recommended for disinfection. Both east and west treatment plants will have the same treatment schemes and are shown in Figures N-4 and N-5.

(2) Financial and Managerial Considerations: The total capital cost of this alternative is $1,070,000 for the east treatment system. This consists of $572,000 for the collection system and $498,000 for the treatment plant. The present worth and total annual cost for the treatment system will be $1,300,000 and $119,000, respectively, based on 6-5/8 percent interest rate for twenty years. The average monthly charge per connection will be $49.60. If 85 percent Federal funding is available through PL 92-500, the monthly charge will be $17.50 per connection. These costs are presented in Table N-2.

For the west treatment system, the total capital cost is $814,000. This consists of $316,000 for the collection system and $498,000 for the treatment plant. The present worth and total annual

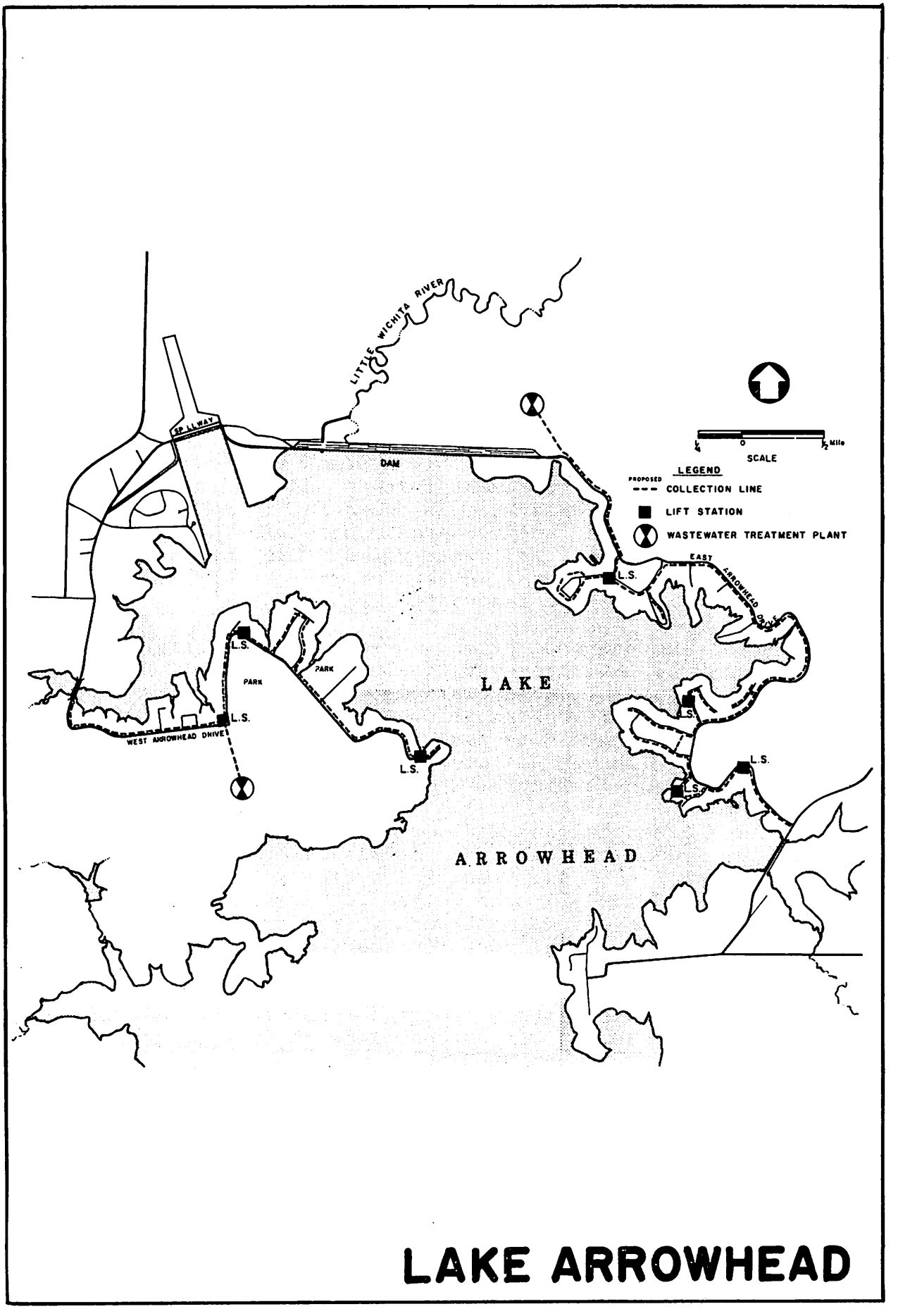
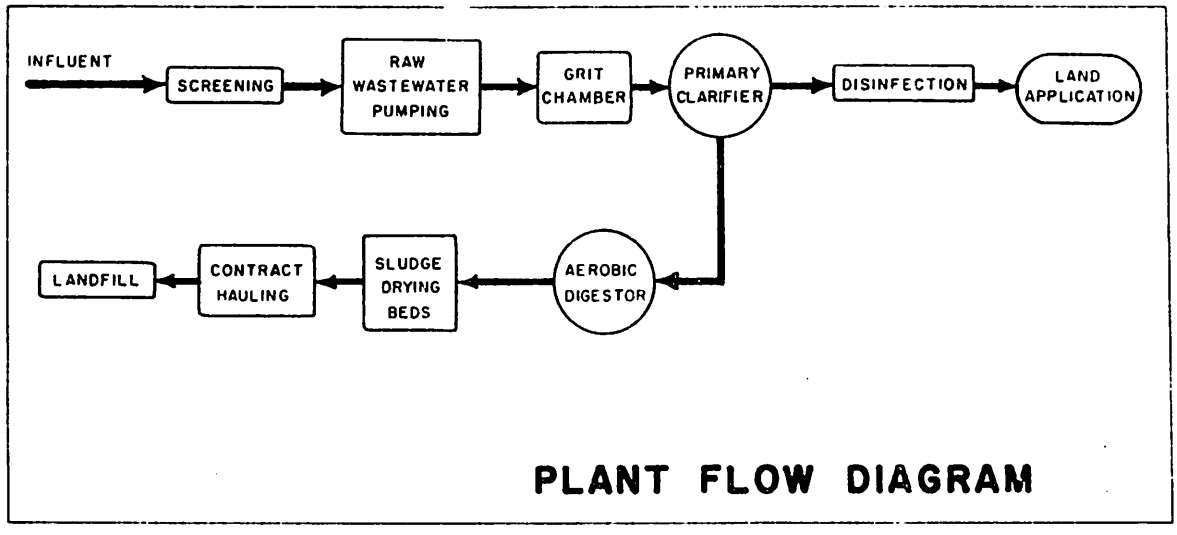


Figure N-3. Proposed Collection System for Lake Arrowhead

WASTEWATER TREATMENT PLANT DIAGRAM AND DESIGN DATA
FOR THE LAKE ARROWHEAD WEST PLANT



Alternative: Implement Land Treatment

Design Population: 600
Design Flow
Average - 0.06 MGD
Peak - 0.15 MGD

Effluent Requirement

Primary Treatment

Receiving Water: NO DISCHARGE

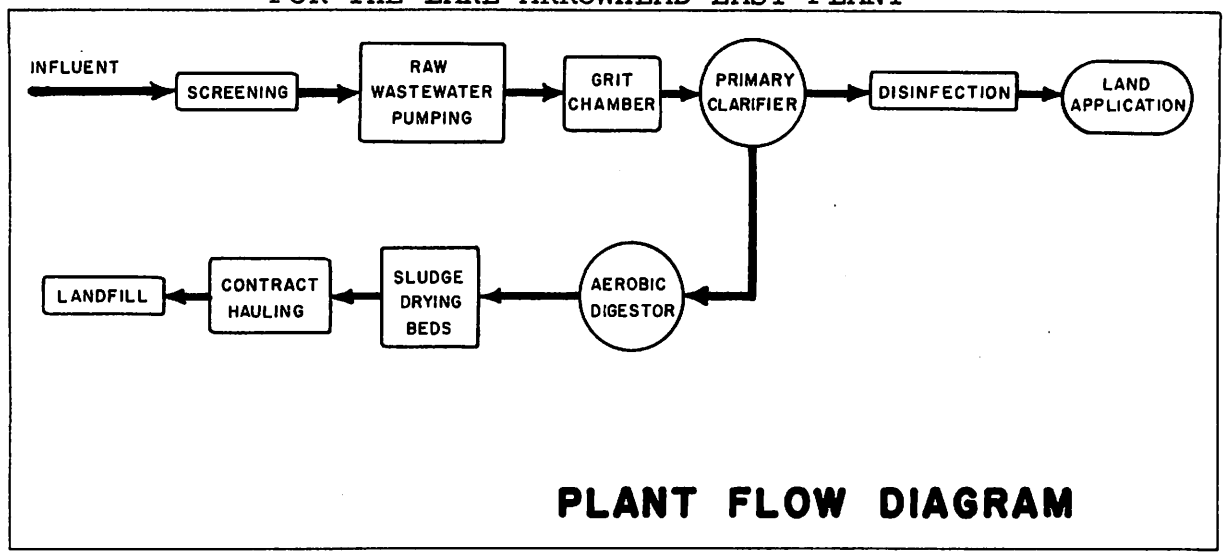
Wasteload Projections for the Lake Arrowhead West Plant

Planning Year	Population	Flow (MGD) Average	Peak
1975	430	-	-
1983	500	0.05	0.13
1990	550	0.06	0.14
2000	600	0.06	0.15

NO EXISTING FACILITY

Figure N-4

WASTEWATER TREATMENT PLANT DIAGRAM AND DESIGN DATA
FOR THE LAKE ARROWHEAD EAST PLANT



Alternative: Implement Land Application

Design Population: 600
Design Flow:
Average - 0.06 MGD
Peak - 0.15 MGD

Effluent Requirement:

Primary Treatment

Receiving Water: NO DISCHARGE

Wasteload Projections for the Lake Arrowhead East Plant

Planning Year	Population	Flow (MGD) Average	Peak
1975	430	-	-
1983	500	0.05	0.13
1990	550	0.06	0.14
2000	600	0.06	0.15

NO EXISTING FACILITY

Figure N-5

cost for the treatment system will be $1,020,000 and $93,600, respectively, based on 6-5/8 percent interest rate for twenty years. The average monthly charge will be $39.00 per connection. If 85 percent Federal funding is available through PL 92-500, this charge will be reduced to $12.60. These costs are presented in Table N-2.

The Lake Arrowhead development is not an incorporated municipality and has no mechanism for carrying out the management of this alternative. Several options are open to the residents of the area, including the following:

1) The area can establish a Utilities District to handle all the management requirements. This will require the hiring of personnel to carry out the administrative responsibilities.

2) The City of Wichita Falls can continue to act as the management agency. They presently have a Public Works Department which manages the septic tanks around the Lake.

3) The Red River Authority (RRA) of Texas can be designated as the management agency for this area. One advantage to this arrangement is that the RRA currently operates several facilities in the study area, and they have established personnel who are experienced in managing such facilities. The RRA also has an established revenue base for initiating such plans.

The Texas Department of Water Resources should be the enforcement agency.

(3) Impacts: This land treatment alternative will effectively eliminate the pollution problems threatening the Lake and provide a safe method for disposal of the wastewater flows. This method of disposal will provide a source of irrigation water not previously available.

Unless additional funding in excess of PL 92-500 is available, this alternative will pose a substantial economic burden on the residents.

Table N-2

Estimated Alternative Costs For Lake Arrowhead

	West Plant Technical Alternative Land Application	East Plant Technical Alternative Land Application
Collection System		
Capital Cost	$ 316,000	$ 572,000
O&M Cost	3,800	6,000
Treatment Plant		
Total Labor Cost	11,100	11,100
Total Energy Cost	1,400	1,400
Total Chemcial Cost	300	300
Construction Cost	*497,000	*497,000
Land Acquisition Cost	1,200	1,200
O&M Cost	15,800	15,800
Capital Cost	498,000	498,000
Total Capital Cost	814,000	1,070,000
Present Worth	1,021,000	1,300,000
Total Annual Cost	93,600	119,000
Monthly Charge per Connection	39.00	49.60
WITH 85 PERCENT FEDERAL GRANT IN AID:		
Total Capital Cost	153,700	217,700
Present Worth	363,700	451,300
Total Annual Cost	31,500	42,100
Monthly Charge per Connection	14.10	17.50

*For Land Application, the purchase of land needed for irrigation is included in the construction cost.

CHAPTER O

SEGMENT 213

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 213 encompasses approximately 260 square miles of drainage area which contribute to the waters of Lake Kickapoo in Archer County. Land use in this area is primarily range land, with dry crop land in the upstream portions of the drainage area. The quality of the water in the lake is excellent, and no water quality problems have been reported. There are no treatment facilities located in this segment, and any contamination originates from non-point sources.

Two areas within this segment have been designated as sewerage planning areas since they are potential sources of water quality problems. These are the City of Megargel, which is currently experiencing problems with septic tank systems, and the residential developments along the shores of Lake Kickapoo.

(b) Non-point Source Assessment: This segment has been classified as Category II because of the potential for contamination of the reservoir by septic tank concentrations along the shores of Lake Kickapoo and in the City of Megargel. Both of these areas are considered in greater detail in this plan. In addition, the area around Megargel on the Little Wichita River has, in the past, been identified as an area of oil field brine contamination. There are no data available, however, which would allow for an estimation of the salt loads from these brine disposal areas. Although inadequate disposal methods for these oil field wastes are no longer allowed, the residual brines may continue to contribute salinity for some time. Since these saline contributions should decrease with time and the present water quality is good, no further control measures should be required.

2. LAKE KICKAPOO

(a) General: Lake Kickapoo is located in the western half of Archer County on the North Fork of the Little Wichita River and 10 miles northwest of Archer City. It is owned and operated by the City of Wichita Falls for municipal water supply. At the present time, there are residential

developments on both the northern and southern sides of the eastern end of the lake. The 249 lots around the lake are leased from the City of Wichita Falls for a 25-year period. Currently, all of the 138 lots on the north and approximately 80 percent of the south side lots are leased. These lots are located on unpaved roads branching off F. M. 368. The lots are, in general, for weekend and summer uses, with only an estimated 100 full time residents. This area is projected to increase to 150 permanent residents by the year 2000.

Land usage around Lake Kickapoo is primarily residential and recreational with a small number of commercial developments consisting of marinas and small stores. This area has moderate topographic relief and slopes toward the lake. The underlying soils are of Vernon-Weymouth types which have low permeabilities and, thus, pose severe limitations for use as septic tank absorption fields.

The residents of Lake Kickapoo do not have access to a central water supply or to wastewater treatment facilities. Domestic water supply is on an individual or private basis. Some residents treat raw lake water by package treating units. Others (estimated about 55) purchase water from the Wichita Valley Water Supply Corporation, which is a private water company. Wastewater disposal is by individual septic tanks. Though no specific septic tank problem in this area is known, the type of soil and the proximity of the houses to the lake suggest the possibility that problems with septic tanks may eventually cause a degradation of the water quality in the lake.

Housing and development of land surrounding the lake is controlled by permits issued by the City of Wichita Falls. Construction is subject to City inspection, including soil percolation tests as a prerequisite for septic tank installation.

In Interim Report I, centralized collection and treatment systems were evaluated and costed. This type of system will cost approximately $15.00 per connection. Due to the excessive costs of a centralized collection and treatment system, such a system is not recommended at this time.

Wichita Falls should continue to closely scrutinize the septic tanks around Lake Kickapoo. Should populations around the Lake increase more rapidly than projected (Table O-1) alternate methods of disposal should be considered.

Table O-1

Population Projections for Lake Kickapoo

Planning Year	Population South Side	Population North Side
1975	50	50
1983	50	50
1990	75	75
2000	75	75

3. MEGARGEL

(a) General: The town of Megargel is located in southwestern Archer County about 20 miles from Archer City. Population of the area is estimated to be approximately 480 and is projected to remain relatively constant throughout the planning period.

The commercial land found in Megargel lies in the central part of the town, one block north of S.H. 114. The majority of the residential development is north of S.H. 114, although there are a few residences along S.H. 210. Very little residential development is expected in the future.

The area is underlain by Abilene-Hollister and Renfrow-Kirkland soils, which severely limit septic tank utilization due to slow percolation. The Texas Department of Health reports that the area has many problems with the septic tank systems now used, including wastewater infiltration into water lines.

Megargel is located on a ridge, and drainage of the southern portion is primarily into Spring Creek, while the northern section drains into the Wagon Branch of Kickapoo Creek.

The City of Megargel has applied for 201 Construction Grant monies to build sewerage facilities for its residents. As yet, no funds have been allotted to Megargel.

Presented below is an alternative treatment method to alleviate the wastewater problems in the City. This alternative includes installing a collection system for the City and treating the collected wastewater at a central facility. Continued septic tank use should not be considered due to the problems previously mentioned.

(b) Technical Alternative:

(1) Technical Plan: To adequately treat wastewater flows, the City of Megargel should install gravity lines, where needed, to collect and centrally treat its wastewater at a newly constructed package plant. Figure O-1 illustrates a possible collection system layout and location for the treatment facility. Figure O-2 illustrates the plant flow diagram.

(2) Financial and Managerial Considerations: As indicated in Table O-2, the total capital cost for this alternative is estimated to be $500,000 with a present worth of $689,500 and total annual cost of $63,300. The resultant monthly charge per connection, assuming three persons per connection, will be approximately $33.00. If a 75 percent Federal grant is obtained under PL 92-500, the total annual cost will be $26,400. The resultant monthly charge per connection will then be $13.70.

Since Megargel is an incorporated entity, the most probable management agency will be the City. However, qualified personnel will need to be retained to properly operate and maintain the system.

(3) Impacts: The construction of a centralized collection and disposal system will do much to improve the environmental quality of the City of Megargel. The current method of disposal is inadequate, and more problems are foreseen as the existing septic tank systems deteriorate with age. The proposed treatment scheme will be an effective means of preventing the contamination of ground water and surface water supplies and of eliminating a health nuisance for the citizens. The construction of a facility can stimulate growth within the City and will provide a more healthful atmosphere for the area.

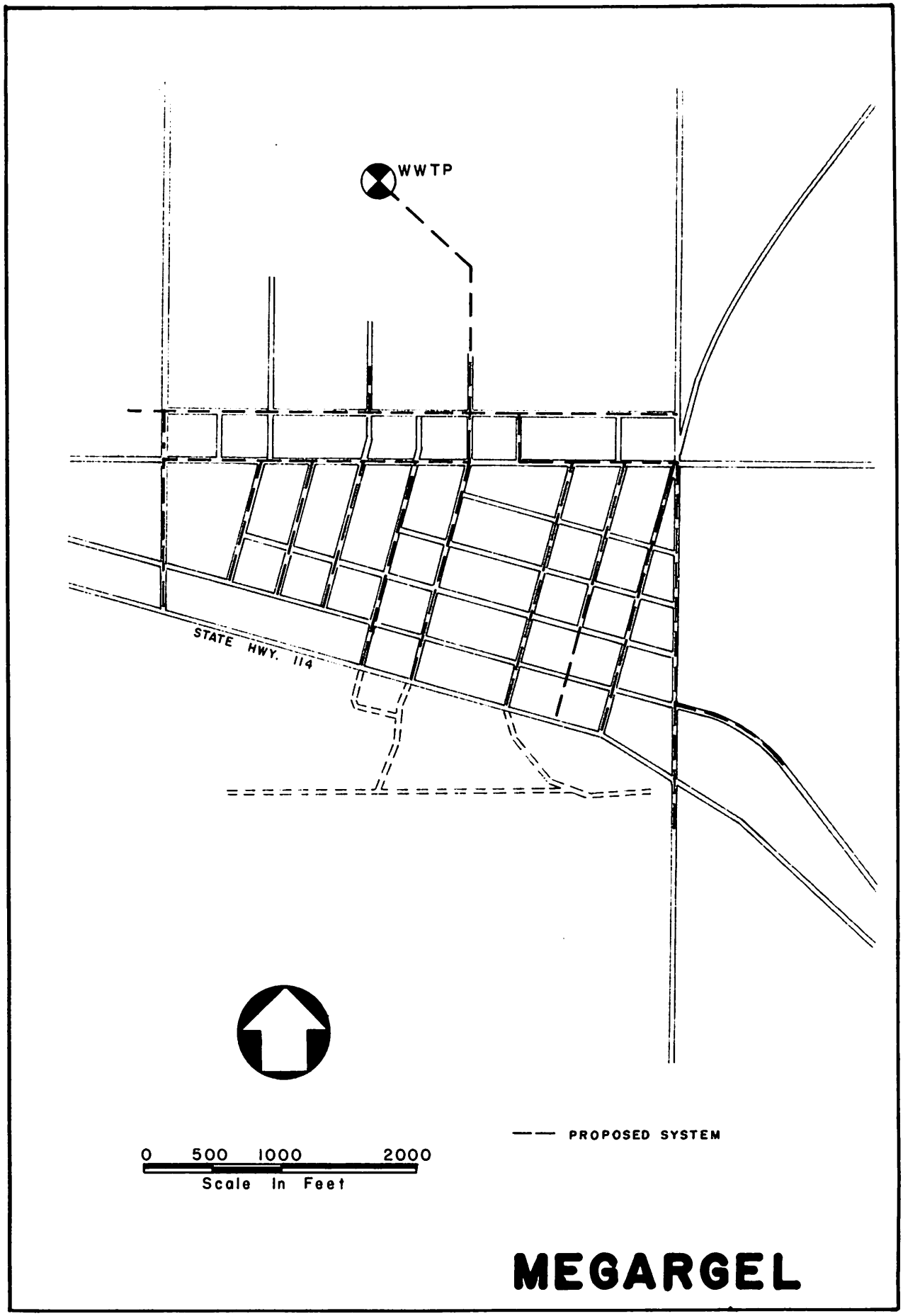
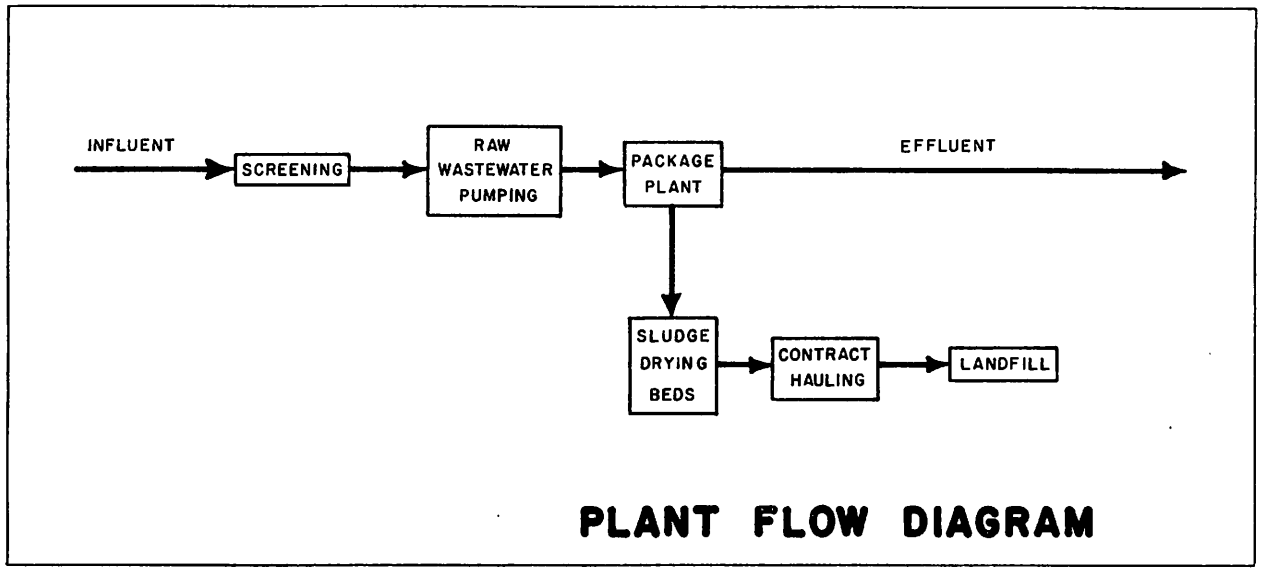


Figure O-1. Proposed Collection System for Megargel

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF MEGARGEL



PLANT FLOW DIAGRAM

Alternative 1: Construct package plant

Design Population: 480
Design Flow:
Average: 0.06 MGD
Peak: 0.16 MGD

Effluent Requirement:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Kickapoo Creek

Wasteload Projections for the City of Megargel

Planning Year	Population	Flow (MGD) Average	Peak
1975	475	-	-
1983	480	0.05	0.15
1990	480	0.06	0.16
2000	480	0.06	0.16

NO EXISTING PLANT

Figure O-2

Table O-2

Estimated Alternative Costs For
The City of Megargel

	Technical Alternative Construct a Package Plant
Collection System	
Capital Cost	$344,000
O&M Cost	2,500
Treatment Plant	
Total Labor Cost	8,700
Total Energy Cost	4,500
Total Chemical Cost	100
Construction Cost	156,000
Land Acquisition Cost	100
O&M Cost	14,900
Capital Cost	156,000
Total Capital Cost	500,000
Present Worth	690,000
Total Annual Cost	63,300
Monthly Charge per Connection	33.00
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	125,000
Present Worth	288,000
Total Annual Cost	26,400
Monthly Charge per Connection	13.70

The economic impact of this alternative will be adverse unless adequate funding is available to sufficiently reduce the monthly charge per connection. Various funding is available to supplement PL 92-500 grant monies. If 100 percent funding is obtained, the cost to the City will be based on operating and maintenance charges and will be approximately $14,900 per year or a monthly charge per connection of $7.80.

CHAPTER P

SEGMENT 214

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 214 includes the Wichita River from its confluence with the Red River to Diversion Dam. This area covers approximately 1,160 square miles of drainage area and includes approximately 50 river miles. High fecal coliform concentrations have been recorded in Segment 214 and are believed to be attributable to sources located within the Wichita Falls area. For this reason, Wichita Falls, which is included in this segment, has been designated as an intensive planning area. Because of these high coliform counts and the relatively high chloride levels, this water is not deemed to be desirable for contact recreation or for use as a domestic raw water supply in the stream standards for the segment.

TDWR data also report that the pH, DO, chloride, and sulfate standards have not been met on several occasions.

There are a total of 12 wastewater treatment facilities located in this segment. Of these, three are municipal water treatment plants, four are industrial operations, and one is a feedlot operation. All five of the municipal wastewater treatment facilities in this segment discharge their effluent into the Wichita River or its tributaries. The Wichita Falls water treatment plant discharges high suspended solids during filter backwashing operations, but is currently studying alternative methods of meeting effluent requirements.

The City of Electra operates an Imhoff tank-stabilization pond wastewater treatment system. Present effluent does not meet permit requirements for either BOD or suspended solids. A site visit and data from TWQB inspections indicate that poor operation and maintenance practices are major contributors to the effluent violations. The City is apparently trying to correct some of these problems. There also appears to be a severe infiltration/inflow problem, since the plant floods during heavy rains. It appears that with adequate maintenance and repair work, the plant could meet the BOD requirement with the present system.

(b) Non-Point Source Assessment: Segment 214, which includes the Wichita River from Diversion Dam to its confluence

with the Red River, has had records of high fecal coliforms. It is believed that these high readings are attributable to sources located within the Wichita Falls SMSA. Because of this, the portion of Segment 214 east of the western edge of Iowa Park has been designated as an intensive planning area. A survey of the non-point sources of contamination indicates that there are no significant contributions from agriculture, natural salts, silviculture, hydrographic modifications, or construction activities. Although agriculture is a primary activity in the eastern portion of the segment, sediment loadings for this segment are not indicative of potential problem areas, according to the methodology used for the analysis of these activities. Construcruction activities of significance in the segment are the construction and repavement of approximately 16 miles of F-M roads and other road construction within the Wichita Falls urban area. With the proper use of the sediment control techniques normally specified in these construction projects, the production of significant sediment loads should be avoided.

There should be no significant contribution to the non-point source pollutants from this segment as a result of disposal activities. These activities include several sanitary landfills and septic tank concentration areas. The sanitary landfills located near the Cities of Crowell, Electra, and Wichita Falls were all examined for potential to produce leachate, which transports contaminants from the sites. Utilizing the simplified water balance method of evaluation prescribed in the Texas methodology for disposal activities, it was determined that no significant quantities of leachate will be produced. This favorable condition is attributable to the semi-arid climate of the area. The septic tank concentration areas of the segment include the communities of Harrold, Kamay, Pleasant Valley, and Lakeside. Two of these communities, Pleasant Valley and Lakeside, have been designated as sewerage planning areas and are discussed in greater detail in this report. The only land application facility in the segment is a feedlot operation which disposes of its runoff by irrigating adjacent cropland. There should be no significant contribution of pollutants from this source.

Segment 214 has the only major source of non-point pollution due to mining activity within the study area. The additional chloride loads which result from the poor brine disposal practices previously used in the

oil fields in the area serve to accentuate naturally occurring salinity from sources located in the upstream portions of the river. Because of these upstream sources, it is difficult to estimate the loads which originate from these man-made brine sources. The Red River Authority, with the Texas Railroad Commission, has been active in the past in stopping these illegal disposal practices. It has been estimated that 40 percent of the chlorides in the stream at one time originated from oil fields. Since the Railroad Commission issued regulations restricting oil field disposal pits, this contribution is estimated to have decreased to 30 percent. These oil field loads are most readily identified when streams not affected by naturally occurring brines, such as Beaver Creek and Buffalo Creek, periodically have shown effects of oil field drainage. These contributions can be expected to decrease as the salt mounds that were built up in disposal pits are leached out. Studies of the chloride contamination of the Red River have all been directed toward the identification and control of naturally occurring salt sources, since these were considered the most significant. Since the Railroad Commission regulations concerning brine disposal appear to have made a positive step in alleviating the loads from these sources, no other control is proposed.

Electra, Iowa Park, and Wichita Falls are the urban areas within this segment. Every year approximately 24,200 acre-feet of urban runoff containing 655,000 pounds of BOD and 40 million pounds of suspended solids is discharged into the receiving waterways. Wichita Falls, the most significant urban area, contributes more than 93 percent of the total runoff. The runoff of Wichita Falls drains into the Wichita River which has an average yearly discharge of 210,000 acre-feet. Therefore, the resulting concentrations of pollutants added to the Wichita River are estimated to be approximately 1.08 mg/l BOD, 65 mg/l suspended solids, 0.25 mg/l total nitrogen, 0.05 mg/l total phosphorus, and 3.2×10^4 coliforms/100 ml.

According to the criteria presented in the methodology for the evaluation of urban runoff, the high nutrient concentration could cause the eutrophication of the Wichita River. In addition, turbidity or sedimentation problems could result from the large load of suspended solids. The river has had problems with high fecal coliform counts, which has made the use of these waters undesirable for contact recreation. This preliminary

evaluation of urban runoff indicates that high fecal coliform counts probably result from this runoff.

A high rate disinfection and sedimentation facility, with a lime coagulation system, could be utilized for the control of this urban runoff pollution. This system should have the capacity of treating the runoff caused by a 5-year frequency, 12-hour storm, and should have a 45 to 65 percent efficiency for removing BOD, 90 percent efficiency for removing suspended solids, 45 to 90 percent efficiency for removing nutrients, and 99 percent efficiency for removing fecal coliforms.

The control system would consist of 23 high rate disinfection units - each with 99 MGD design flow, 8 sedimentation basins - each with 285 MGD design flow, and 8 lime feeding systems - each with 9000 pounds per hour capacity. The total capital cost for this system would be $64,900,000, and the annual O&M cost would be $1,990,000.

The methodology used to evaluate the impacts of urban runoff has several limitations and allows for only a preliminary analysis of the impacts that urban runoff may cause. The quantities of runoff, and the pollutant loads, are based upon average urban runoff characteristics, and not those peculiar to the Wichita Falls urban area. The possibility that this runoff could be collected at a point for treatment is uncertain. The stream impact would depend upon the water quality in the receiving waters, and this also has not been determined to date. Because of the relatively high cost involved and the uncertainties associated with the evaluation method, it is recommended that more data be gathered before a control strategy is decided upon.

2. WICHITA FALLS INTENSIVE PLANNING AREA

The Wichita Falls Intensive Planning Area covers about 275 square miles of land draining into the Wichita River. The area stretches from just west of the City of Iowa Park to the convergence of the Red and Wichita Rivers. There are four municipal wastewater treatment facilities located in the Intensive Planning Area, and another facility is being planned.

The City of Iowa Park has a relatively new contact stabilization plant which produces effluent of good quality. The City is in need of new collection lines to replace existing trunk lines

which are flowing near capacity. The City is currently in the process of making the necessary improvements, and therefore no planning is required.

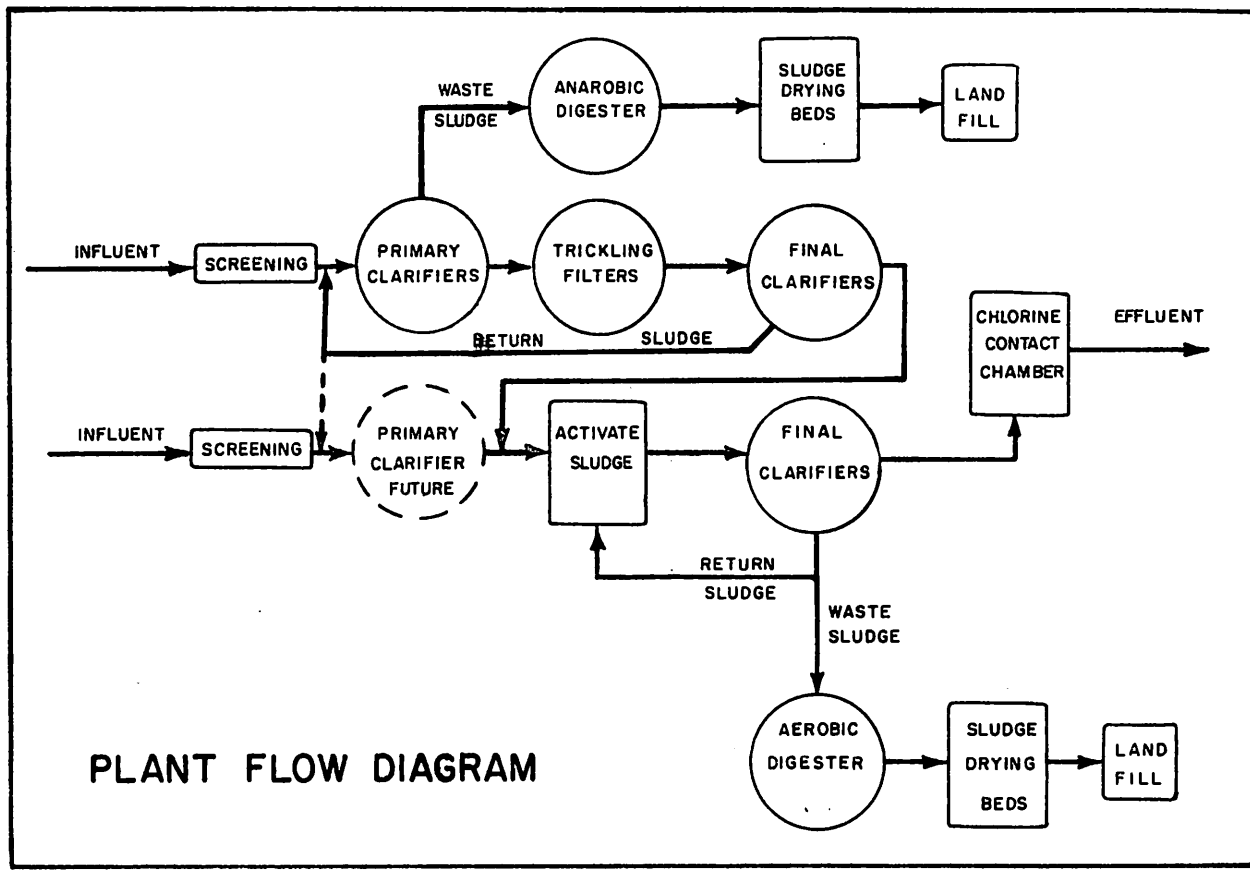
The City of Byers operates an oxidation ditch plant to treat its municipal wastewaters. The City has approximately 60 residences that are still presently served by septic tanks. The houses are located along the periphery of the City and are farm-type residences. City policy is that if septic tank problems develop, the user is induced to tie onto the central system. Some operation and maintenance problems have been experienced; however, a new operator has been retained, and no additional problems are forseen. The City is growing at a moderate rate, and the present effluent is within the permitted requirements for quality.

A. CITY OF WICHITA FALLS

The City of Wichita Falls has two discharge permits for its wastewater treatment activities. The City has three trickling filter,plants, built in 1925, 1950, and 1963, respectively. A new activated sludge facility went on line in 1976. The effluent from the older units is routed to the head of the new activated sludge system. All of these units are on one site, and the City currently only discharges from one point. The performance of the older plants is poor, and the effluent entering the activated sludge system is often septic and of poor quality. This has caused some upsets in the operation of the activated sludge portion of the plant. The 1963 plant has been closed for the last year for repairs and renovation. Limited manpower has been indicated as a source of the maintenance problems. Overall data indicate that the effluent is of good quality, although at times permit requirements have not been met. A schematic of this treatment facility is shown in Figure P-1.

The City of Wichita Falls is having collection system problems, especially on the northern side of the Wichita River (Figure P-2). New growth and infiltration/inflow problems are causing many of the present trunk lines to flow near capacity. The City is currently preparing a plan to alleviate this problem and to prepare for future waste flows anticipated from new industrial and residential growth along Central Freeway. In this plan, a lift station is to be constructed in the vicinity of Airport Drive (F-M 890), which would divert these flows to the treatment facility at Sheppard Air Force Base (See Figure P-3). The City would take over the operation of this facility, which would continue to service the southern portion of the Base. This action would reduce the quantity of flow in both the trunk lines and give the

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF WICHITA FALLS



Existing Wichita Falls Wastewater Treatment Facility

Design Population: 110,100
Design Flow:
Average:
Peak: No Expansion Required

Effluent Requirement:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Wichita River

Wasteload Projections for Wichita Falls

Planning Year	Population	Flow (MGD) Average	Peak
1975	95,008	13.89	17.65
1983	97,360	14.53	21.28
1990	102,400	15.18	21.26
2000	110,100	16.18	22.65

EXISTING PLANT CAPACITY: 17.0 MGD

Figure P-1

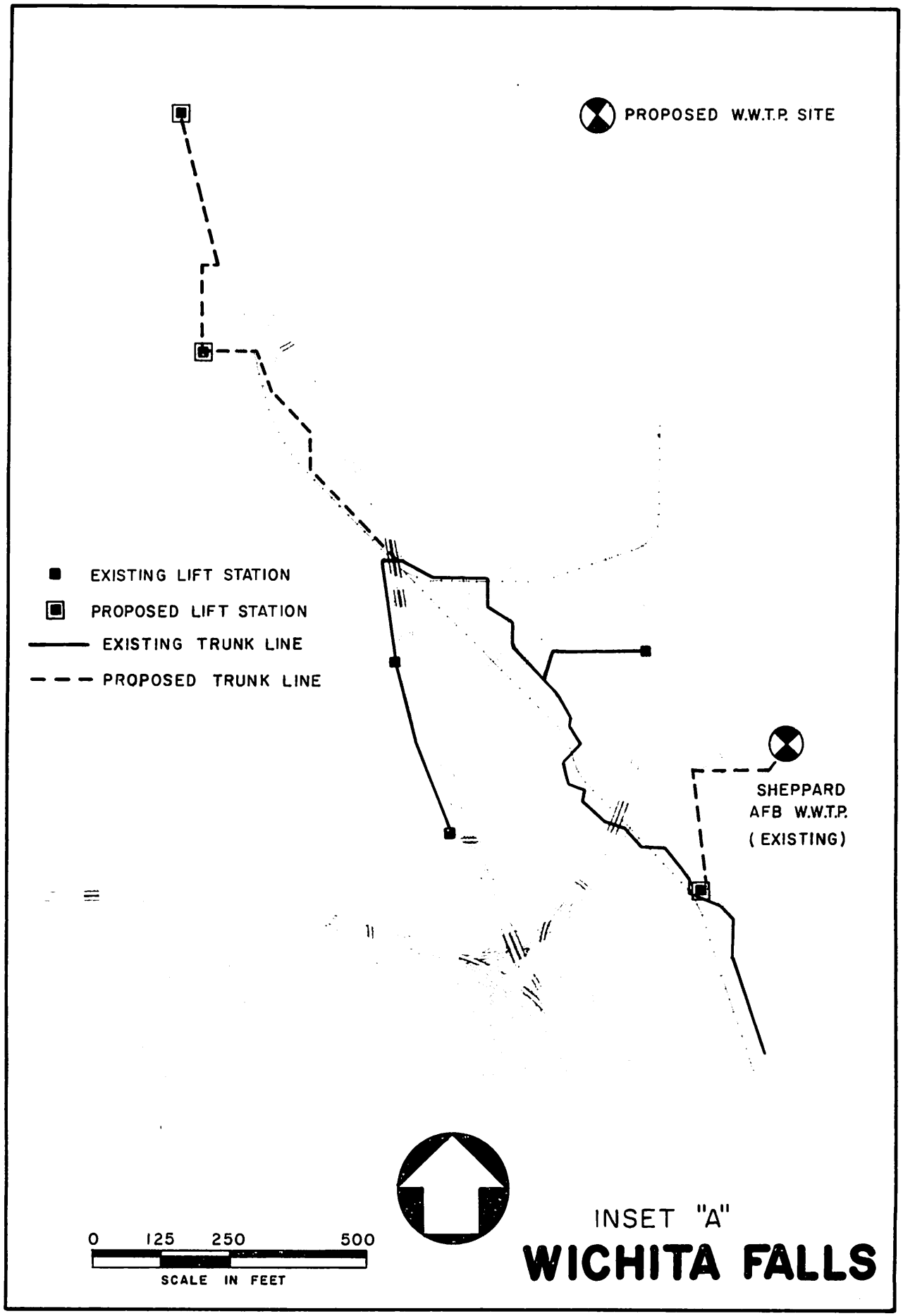


Figure P-3: Proposed Interceptors and Treatment Facilities for the Northern Wichita Falls Area.

additional treatment capacity back to the Wichita Falls treatment plant. The treatment facility at Sheppard AFB is a trickling filter type plant with a design capacity of approximately 2.3 million gallons per day. This facility is currently operating at an average flow of 1.3 million gallons per day, and it is estimated that the City will increase this flow by approximately 0.5 million gallons per day when the interceptors are connected. The capacity of this plant may be increased in the future as required by wasteloads. Figure P-4 illustrates the existing and projected land use for the City of Wichita Falls.

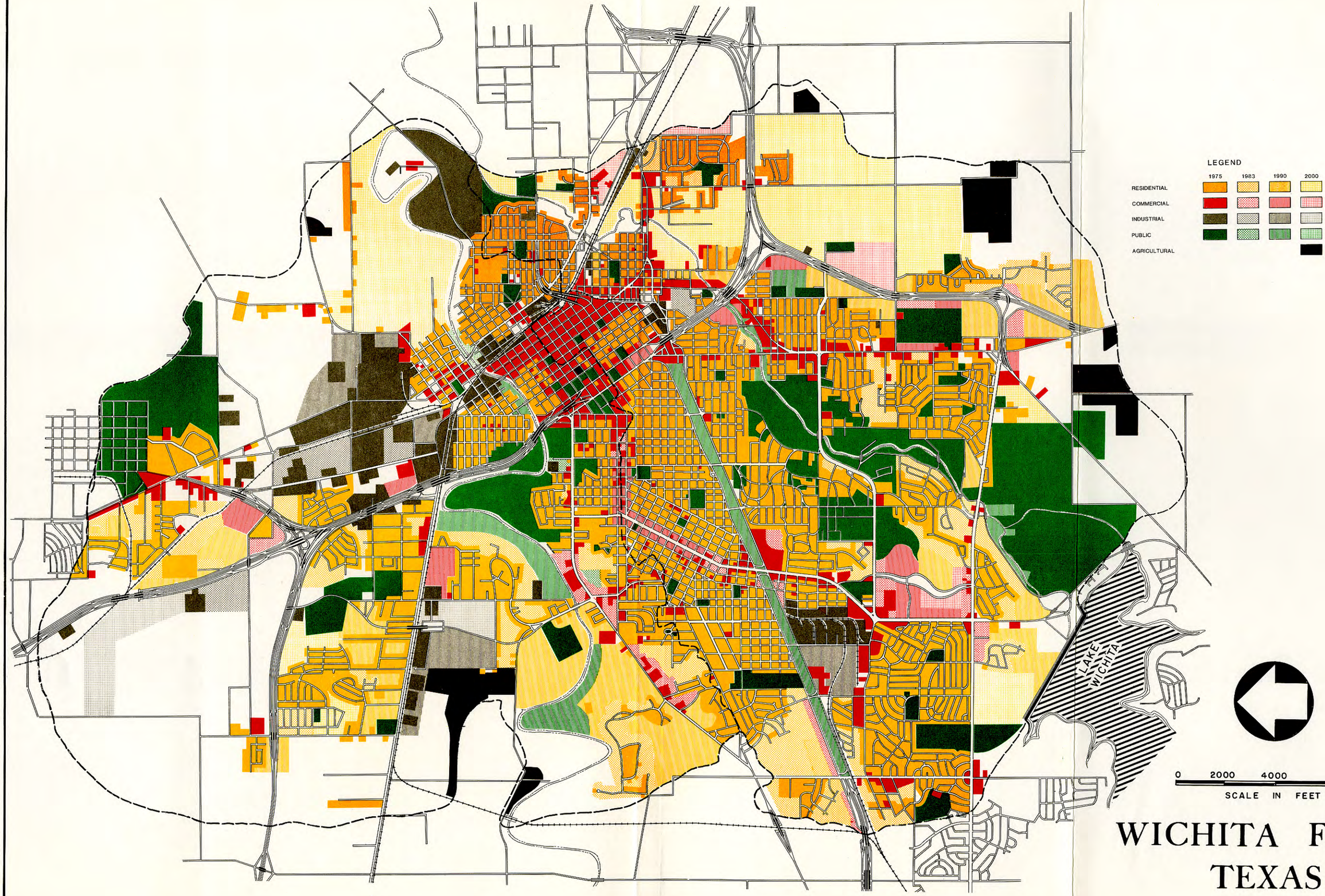
In addition to the construction of this lift station, the City is also planning to construct a new treatment facility at the northern corner of Sheppard AFB. This new facility would serve the northern portion of that Base and the new industrial growth along the Central Freeway. The plant should be designed so that its capacity can be increased to serve the residential growth which is anticipated for the area between Wichita Falls and Burkburnett. The location of this facility is shown in Figure P-3. In order to more efficiently enforce the effluent requirements for the facility, the two existing Waste Control Orders should be reviewed by the TDWR and subsequently consolidated into one permit to discharge.

B. PLEASANT VALLEY

(a) General: Pleasant Valley is a small community located in central Wichita County just west of Wichita Falls on U. S. Business Highway 287 (Old Iowa Park Road). Population is currently estimated to be approximately 375 persons and is projected to increase to 500 by the year 2000. The incorporated area of the City encompasses approximately 1,400 acres.

Residential housing is basically along Highways U.S. 287, F.M. 367, F.M. 369, and Huntington Road. Projected growth is expected to occur in the southeastern portion of the incorporated city limits and along the highways. A few commercial establishments lie along U.S. 287. No industry is located in the City.

The City has moderate topographic relief and slopes from north to south. The general direction of drainage is southward toward the Wichita River. The City is underlain by Winter-Deandale type soils which are unsuitable for septic tank system drainage fields due to the slow rate at which water percolates through them.



WICHITA FALLS
TEXAS

The City of Pleasant Valley purchases water from Wichita Falls and distributes it to the residents. The community does not have access to a central wastewater treatment facility. The current method of wastewater disposal is by the utilization of septic tank systems. Due to the low permeability of the soils, some problems with existing septic tank systems have been reported.

Alternatives considered for improvement of the City's wastewater disposal methods include:

1) Continued use of septic tank systems after the enactment of a septic tank control order.

2) Use of a land treatment wastewater treatment system under a "no discharge" permit.

(b) Technical Alternative 1:

(1) Technical Plan: This alternative considers the continued use of septic tank systems for wastewater disposal after establishment of a septic tank control ordinance limiting the number of septic tanks that may be utilized per specified area. Certain entities may license or regulate septic tank use for their areas after applying to the State for a control ordinance. The soils underlying the area are not suitable for dense utilization of septic tank systems. However, the community is spread along several highways and, therefore, has a density low enough to allow the required area needed for spacing of the septic tank filtration fields.

(2) Financial and Managerial Considerations: The continued use of septic tank systems has several costs involved (Appendix F). Establishment of a septic tank control ordinance necessitates some administrative and enforcement costs. Users expenses will include fees for licensing, inspection, registration, and percolation tests. If some of the existing systems are found to be inadequate, the owners can be faced with the cost of installing new septic tank filtration field systems to replace the unsuitable ones.

Several entities can serve as the managing agency for such a control order. These include the city government, the county government, and the Red River Authority. The City is the most probable managing agency.

(3) Impacts: Environmental impacts resulting from this alternative are dependent upon strict enforcement of the septic tank control ordinance.

Effective enforcement will be the most important factor in maintaining a healthy environment in the City of Pleasant Valley. The social impacts of this alternative will result from the increased land requirements for these systems. Properly designed systems can require larger lot sizes than are presently being used, thus having the effect of spreading the population and possibly limiting growth.

Adverse economic impacts in the area could result if growth is limited by the requirement of a minimum lot size.

(c) Technical Alternative 2:

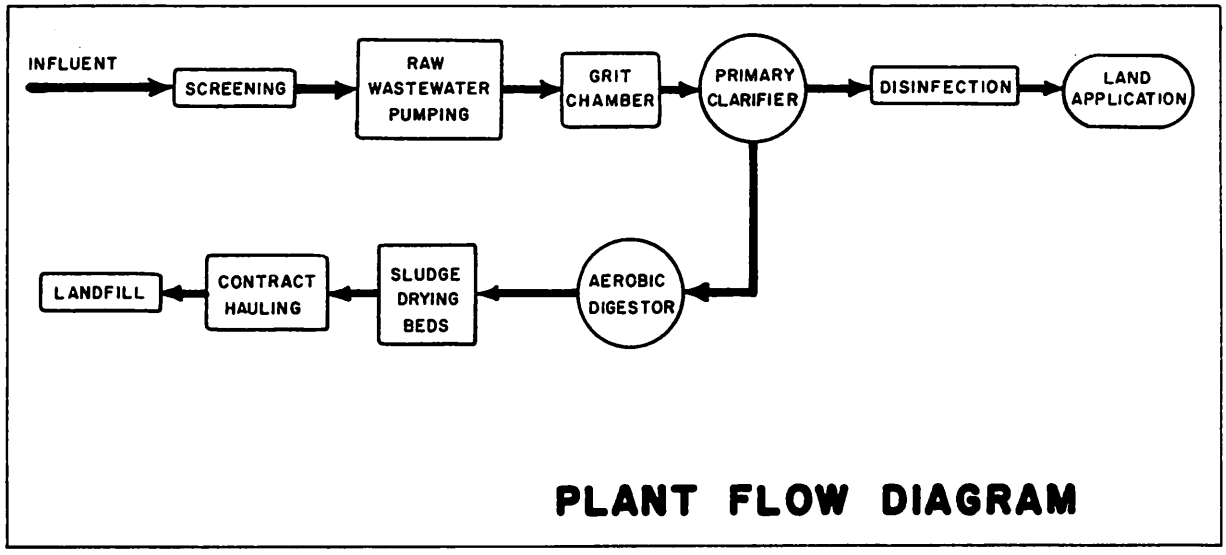
(1) Technical Plan: This alternative considers using a "no-discharge" treatment scheme to service the City of Pleasant Valley's wastewater disposal needs. This method calls for primary treatment of influent and land application of treated wastewater effluent. The treatment scheme for this facility is shown in Figure P-5. The collection system for this alternative, as shown in Figure P-6, consists of 6.10 miles of pipe and two lift stations.

(2) Financial and Managerial Considerations: The estimated capital cost for this treatment facility and collection system would be $839,900. The present worth will be $1,067,000, and the total annual cost will be $99,600. The average monthly charge per connection, assuming three persons per connection, will be approximately $49.80. If 85 percent Federal funding is available through PL 92-500, the total annual cost will be reduced to $37,600, and the average monthly bill per connection will then be $18.80. These costs are presented in Table P-1.

The City of Pleasant Valley is an incorporated municipality and is a logical choice for the local management agency. The Texas Department of Water Resources should assume the regulatory and enforcement role.

(3) Impacts: The construction of a centralized collection and disposal system will do much to improve the environmental quality of the City of Pleasant Valley. The current method of disposal utilizing

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF PLEASANT VALLEY



Alternative 2: Implement Land Treatment

Design Population: 500
Design Flow
Average - 0.06 MGD
Peak - 0.17 MGD

Effluent Requirement:
Primary Treatment

Receiving Water: No discharge

Wasteload Projections for the City of Pleasant Valley

Planning Year	Population	Flow (MGD) Average	Peak
1975	375	-	-
1983	450	0.05	0.14
1990	470	0.06	0.15
2000	500	0.06	0.17

NO EXISTING FACILITY

Figure P-5

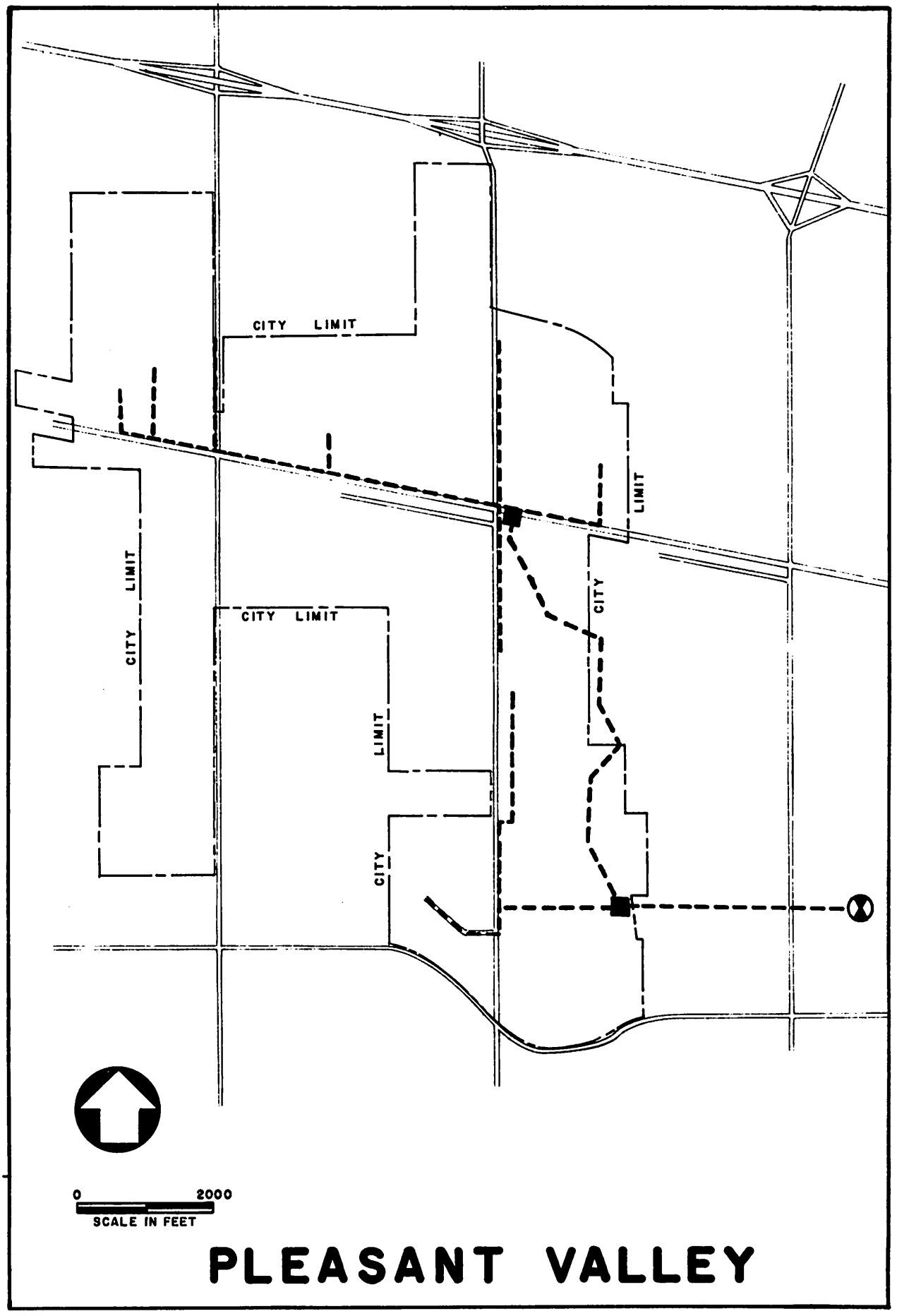


Figure P-6. Proposed Collection System for Pleasant Valley

Table P-1

Estimated Alternative Costs For
The City of Pleasant Valley

	Technical Alternative 2 Land Application
Collection System	
Capital Cost	$499,500
O&M Cost	7,200
Treatment Plant	
Total Labor Cost	9,300
Total Energy Cost	1,600
Total Chemical Cost	300
Construction Cost	*339,200
Land Acquisition Cost	1,200
O&M Cost	14,000
Capital Cost	340,400
Total Capital Cost	839,900
Present Worth	1,067,000
Total Annual Cost	99,600
Monthly Charge per Connection	49.80
WITH 85 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	175,900
Present Worth	403,100
Total Annual Cost	37,600
Monthly Charge per Connection	18.80

*Land used for irrigation is included in the construction cost.

septic tank systems has had some problems reported. The proposed treatment scheme will be an effective means of preventing possible contamination of ground water and surface water, as well as eliminating a health hazard for the citizens. The construction of a facility could stimulate growth for the City and create a more healthful atmosphere for the area.

This treatment alternative is the least expensive of the systems analyzed within the Texas methodology. However, connection costs are excessive for a community the size of Pleasant Valley. Additional funding, in excess of PL 92-500 funds, will be needed to sufficiently reduce the monthly connection charge to an affordable level.

C. LAKESIDE

(a) General: The City of Lakeside is located in the northeast corner of Archer County and borders the southern shore of Lake Wichita. The community extends along approximately ten miles of shoreline and has a population of about 250 persons. The City is expected to grow steadily throughout the planning period, and the population is projected to be 830 persons by the year 2000.

Residential land usage is primarily along the shoreline. As these prime lots are sold, the interior areas should be developed. Some commercial establishments are located near State Highway 79.

The topography of the City is gently sloping from south to north toward Lake Wichita, and drainage is primarily into the lake. The area is underlain by Foard-Wichita type soils which have very low permeabilities and thus are severely limiting to septic tank use.

Lakeside's wastewater disposal needs are currently served entirely by septic tank systems. Due to the low permeabilities of the soils and the City's proximity to the lake, the area is included as a sewerage planning area.

Alternatives considered for improvement of the City's wastewater disposal methods include:

1) The continued use of septic tank systems after establishment of a septic tank control order containing stringent requirements for installation and maintenance.

3) The use of a "no-discharge" wastewater treatment scheme using a land application process for the wastewater after primary treatment.

(b) Technical Alternative 1:

(1) Technical Plan: This alternative considers the continued use of septic tank systems for wastewater disposal after establishment of a septic tank control ordinance limiting the number of septic tanks that may be utilized per specified area. Certain entities may license or regulate septic tank use for their areas after applying to the State for a control ordinance. The soils underlying the area are not suitable for dense utilization of septic tank systems. Most residences currently are spread along the shoreline; and there should be enough area, at present, for suitable use of septic tank systems. However, due to the proximity of the community to both Wichita Falls and Lake Wichita, the City is anticipated to show rapid growth. Future density problems with regard to septic tank use are probable.

(2) Financial and Managerial Considerations: The continued use of septic tank systems has several costs involved (Refer to Appendix F). Establishment of a septic tank control ordinance necessitates some administrative and enforcement costs. Users expenses will include fees for licensing, inspection, registration, and percolation tests. If some of the existing systems are found to be inadequate, the owners can be faced with the cost of installing new septic tank filtration field systems to replace the unsuitable ones.

Several entities can serve as the managing agency for such a control order. These include the city government, the county government, and the Red River Authority.

(3) Impacts: Environmental impacts resulting from this alternative are dependent upon strict enforcement of the septic tank control ordinance. Effective enforcement will be the most important factor in maintaining a healthy environment in the City of Lakeside. The social impacts of this alternative will result from the increased land

requirements for these systems. Properly designed systems can require larger lot sizes than are presently being used, thus having the effect of spreading the population and possibly limiting growth.

Adverse economic and social impacts in the area can result if growth is limited by the requirement of a minimum lot size.

(c) Technical Alternative 2:

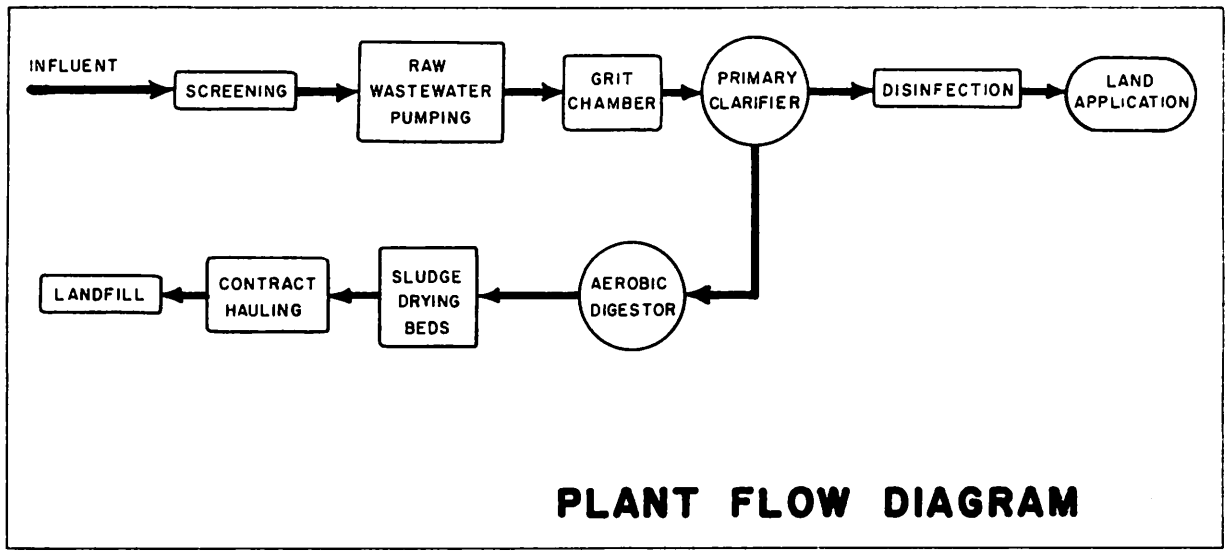
(1) Technical Plan: This alternative considers using a "no-discharge" treatment scheme to service the City of Lakeside's wastewater disposal needs. This method calls for primary treatment of influent and for land application of treated wastewater effluent. The treatment scheme for this facility is shown in Figure P-7. The collection system for this alternative, as shown in Figure P-8, consists of 5.11 miles of pipe and four lift stations.

(2) Financial and Managerial Considerations: The total estimated capital cost for the treatment facilites and collection system will be $1,110,000. The present worth will be $1,408,000, and the total annual cost will be $129,100. The average monthly charge per connection will be approximately $38.90. If 85 percent Federal funding is available through PL 92-500, the total annual cost will be reduced to $48,400, and the average monthly bill per connection will then be about $14.60. These costs are presented in Table P-2.

The City of Lakeside is an incorporated municipality and is a logical choice for the local management agency. The Texas Department of Water Resources should assume the regulatory and enforcement role.

(3) Impacts: The construction of a centralized wastewater collection and disposal system will do much to improve the environmental quality of the City of Lakeside. The current method of disposal utilizing septic tank systems can cause problems in future years. The proposed treatment scheme will be an effective means of preventing possible contamination of groundwater and surface water, as well as eliminating a health hazard for the citizens. The construction of a facility can also stimulate growth for the City.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF LAKESIDE



Alternative 2: Land Treatment

Design Population: 830

Design Flow:
Average - 0.10 MGD
Peak - 0.27 MGD

Effluent Requirement:
Primary Treatment

Receiving Water: Unnamed creek draining into Lake Wichita

Wasteload Projections for the City of Lakeside

Planning Year	Population	Flow (MGD) Average	Peak
1975	250	-	-
1983	400	0.05	0.13
1990	630	0.08	0.20
2000	830	0.10	0.27

NO EXISTING FACILITY

Figure P-7

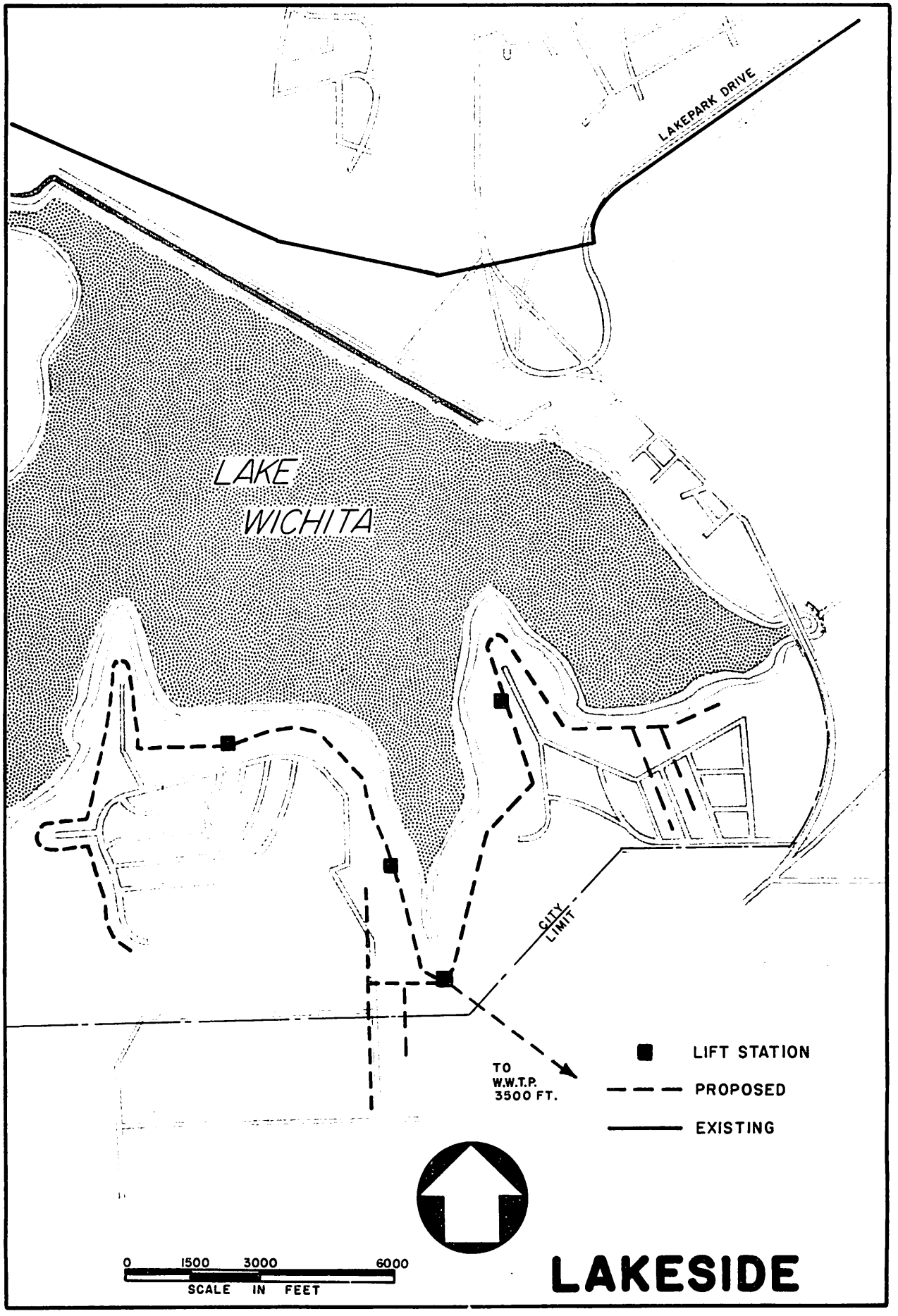


Figure P-3: Proposed Collection System for the City of Lakeside - Package Plant

Table P-2

Estimated Alternative Costs For
The City of Lakeside

	Technical Alternative 2 Land Application
Collection System	
Capital Cost	$ 463,400
O&M Cost	7,800
Treatment Plant	
Total Labor Cost	13,900
Total Energy Cost	2,500
Total Chemical Cost	500
Construction Cost	*645,500
Land Acquisition Cost	1,300
O&M Cost	20,700
Capital Cost	646,800
Total Capital Cost	1,110,000
Present Worth	1,408,000
Total Annual Cost	129,100
Monthly Charge per Connection	38.90
WITH 85 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	212,900
Present Worth	518,400
Total Annual Cost	48,400
Monthly Charge per Connection	14.60

*Land used for irrigation is included in the construction cost.

The economic impact will be adverse unless adequate funding is available to sufficiently reduce the monthly charge per connection to an affordable level. A positive economic impact will be the increase in the value of land for the area.

D. WICHITA FALLS IPA - REGIONAL PLAN

(a) General: The cities in the Intensive Planning Area which are in need of sewerage planning are the City of Pleasant Valley and the City of Lakeside. Although the City of Lakeside is actually located in Segment 219, it has been included in the Intensive Planning Area because of its proximity to the City of Wichita Falls. Because both of the communities are located at the city boundaries of the City of Wichita Falls, a regional plan involving the construction of collection lines in each community and treating the wastewater at the Wichita Falls treatment plant should be considerd.

(b) Technical Alternative: In order for the City of Pleasant Valley to tie into the collection system of Wichita Falls, it will be necessary to have a collection main with adequate additional capacity to carry the flows generated by Pleasant Valley. An examination of the existing collection system of Wichita Falls indicates that there are no trunk lines which can handle this additional flow. An alternative to tying into the existing system would be to construct a separate trunk line to the Wichita Falls wastewater treatment plant. Because of the construction costs and necessary right-of-way acquisitions for such a line, this alternative does not appear to be economically feasible. With these considerations, it appears that the regional concept of wastewater treatment is not a viable alternative for Pleasant Valley.

In order for the City of Lakeside to tie into the existing collection system of Wichita Falls, it will be necessary to construct a trunk line around Lake Wichita to the trunk line at Lake Park Drive (See Figure P-9). This line is believed to have the capacity to adequately convey its existing flow as well as the flow anticipated from Lakeside. These additional flows should not make it necessary to expand the existing wastewater treatment facility of Wichita Falls.

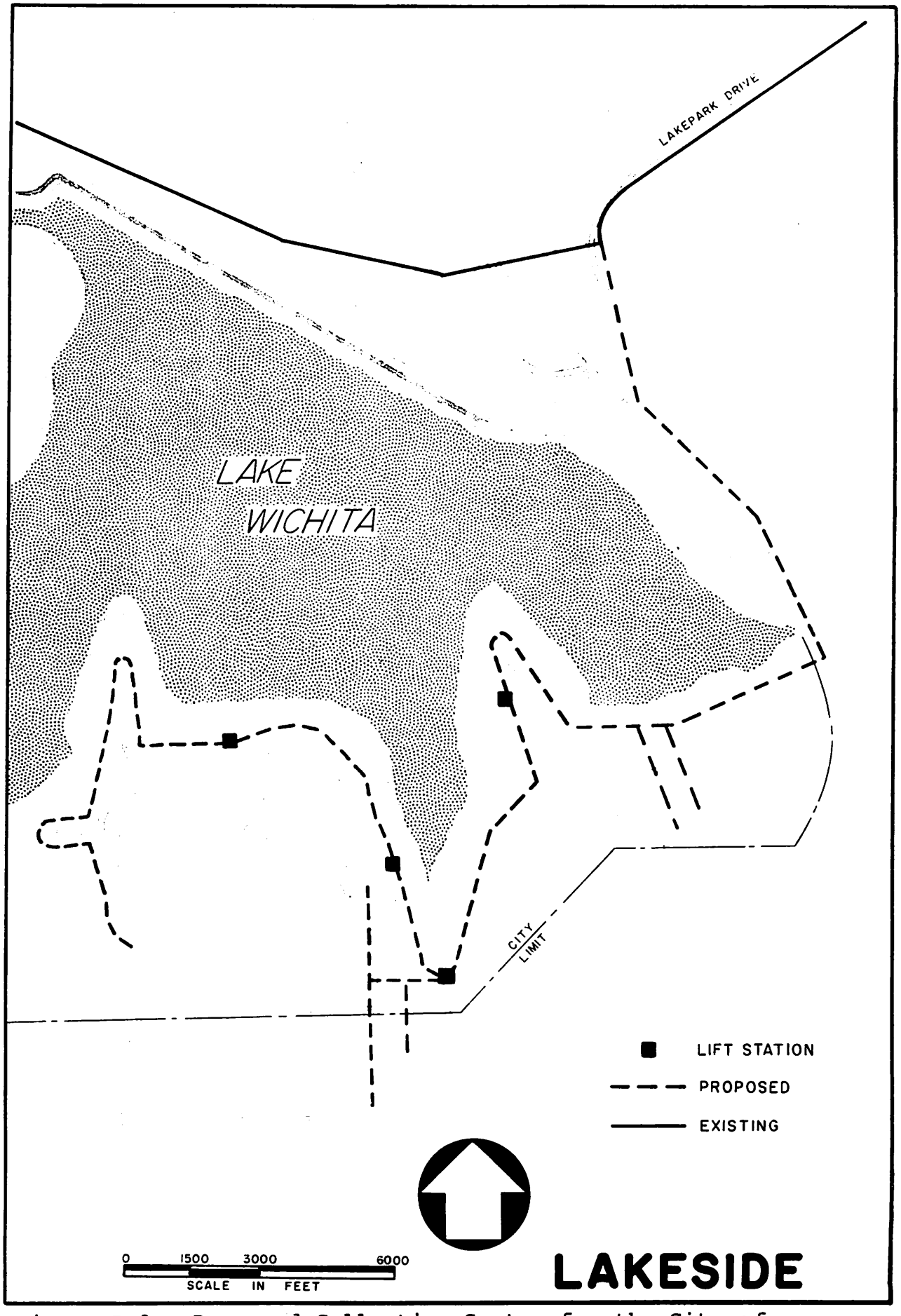


Figure P-9: Proposed Collection System for the City of Lakeside with Trunk Line Connection to Wichita Falls System.

Table P-3

Wasteload Projections For the Regional Alternative (Lakeside and Wichita Falls)

Planning Year	Population	Flow (MGD) Average	Peak
1975	95,258	13.89	17.65
1983	97,760	14.85	21.41
1990	103,030	15.26	21.46
2000	110,930	16.28	22.92

EXISTING PLANT CAPACITY: 17.0 MGD

(c) Financial and Managerial Considerations: The costs for implementing a regional plan for the City of Lakeside and the City of Wichita Falls will be those required for the construction of a collection system for the City of Lakeside and for the construction of an interceptor line to connect with the Wichita Falls system. Table P-3 delineates these costs. The collection system and interceptor will cost approximately $596,200 to construct. The present worth of the system will be $679,000, and the total annual cost will be $62,300. The resulting monthly charge per connection, assuming three persons per connection, will be $18.80. With 75 percent Federal funding under PL 92-500, the monthly charge per connection will be $6.40.

Lakeside is incorporated and, therefore, can assume the responsibilities of providing wastewater collection service and contracting with the City of Wichita Falls for treatment services.

(d) Impacts: Collection of wastewater from Lakeside, with treatment at the Wichita Falls facility, will do much to improve the environmental quality of the area. The current method of disposal utilizing septic tank systems can cause problems in future years. This alternative prevents the possibility of groundwater and surface water contamination, as well as eliminating a health hazard for the citizens. Federal funding will be necessary to make this alternative feasible.

Table P-4

Estimated Alternative Costs For
The City of Lakeside

	Technical Alternative Transport to Wichita Falls
Collection System	
Capital Cost	$596,200
O&M Cost	8,700
Treatment Plant	
Capital Cost	0
O&M Cost	0
Total Capital Cost	596,200
Present Worth	679,000
Total Annual Cost	62,300
Monthly Charge per Connection	18.80
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	149,000
Present Worth	231,200
Total Annual Cost	21,300
Monthly Charge Per Connection	6.40

U.S. HIGHWAY 82

TEXAS & PACIFIC RR

SOUTHERN PACIFIC R.R.

US HIGHWAY 75

LEGEND

	1975	1983	1990	2000
RESIDENTIAL				
COMMERCIAL				
INDUSTRIAL				
PUBLIC				
AGRICULTURAL				
UTILITY EASEMENTS				
PROPOSED TRANSPORTATION				

0 500 1000 2000

SCALE IN FEET

SHERMAN TEXAS

CHAPTER Q

SEGMENT 215

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 215 consists of the approximately 50 square miles of drainage area which contributes to the flow of Lake Diversion in Archer and Baylor Counties. Land use in this segment is range land. The water has a relatively high salinity concentration which appears to be from natural sources. Because of this salinity, water in this segment is not considered to be desirable as a domestic raw water supply. The lake is eutrophic, with approximately 86 percent of the nitrogen loading and approximately 94 percent of the phosphorus loading attributable to non-point sources.

No treatment facilities are located in this segment.

(b) Non-point Source Assessment: Only 2 percent of the land in this segment is not covered by either Lake Diversion or rangeland. This segment is classified as Category I, and the water quality is not greatly affected by the activities of man. Septic tank concentration areas exist along the shores of the lake and are discussed in greater detail in following paragraphs. The major water quality problem in this segment is that of high chloride concentrations. These chlorides originate in the upstream waters of the Wichita River and are concentrated in the reservoir. Chloride concentrations should be lowered after the salt alleviation project of the Corps of Engineers is completed. Eutrophication studies, conducted on the lake in 1977, attribute 99 percent of the phosphorus entering the lake to non-point sources. The survey concluded, however, that although the lake was eutrophic, there is little or no impairment of the designated beneficial uses of the lake.

2. LAKE DIVERSION

(a) General: Lake Diversion is located in Baylor and Archer Counties on the Wichita River, 20 miles downstream from Lake Kemp Dam, 25 miles southwest of Wichita Falls, and is owned and operated by the City of Wichita Falls and Wichita County Water Control and Improvement District

No. 2 for municipal water supply. Residential development on the lake is primarily located along the north and south shores, just west of the dam, on lots leased from the Wagner Estate. The lots are generally for weekend and summer uses, with an estimated 50 full time residents. The area population is projected to increase to 150 permanent residents by the year 2000.

The land use for Lake Diversion is primarily residential and recreational, and the few commercial developments consist of marinas and small stores typical of lakeside communities. The topography of this area has moderate relief and slopes toward the lake. The area is underlain by Vernon-Tillman type soils which have low permeabilities, posing severe limitations to the use of septic tanks.

The residents of Lake Diversion do not have access to a central water supply or wastewater treatment system. Drinking water for the area is hauled by the leasees or by contractors who fill small storage tanks for individual residents. Wastewater disposal is by individual septic tanks or cesspools. Although no specific problems with the treatment system have been reported, the density of the existing housing suggests that the area could experience treatment problems during the high occupancy periods.

(b) Technical Alternative:

(1) Technical Plan: In order for septic tanks to be considered as a viable alternative it will be necessary to institute a stringent septic tank control ordinance. Due to the severe limitations on septic tanks, as expressed in the SCS Soil Survey, they would appear to be a potential health problem. To date, however, there have been no reported problems; and if septic tanks are properly installed and maintained, they could possibly perform satisfactorily despite these limitations.

All cesspools in the area should be immediately replaced with properly designed and maintained septic tank systems. The existing septic tanks should be inspected, and any problems should be corrected immediately.

(2) Financial and Managerial Considerations: General information about cost estimates for the implementation of the alternative is presented in

Appendix F. The cost of a septic tank control ordinance would be in fulfilling the legal and institutional requirements needed to pass and enforce the ordinance. Funds will also be required for qualified personnel to inspect these systems during construction and while in operation, and for the clerical work involved with this process. If any of the existing systems were found to be inadequate, the owners of these unsuitable systems could be faced with the cost of installing new septic tank absorption field systems to replace those now in service.

The County, in conjunction with the City of Wichita Falls, should be designated as the managerial authority. Immediate repair or replacement of inadequate wastewater treatment systems is recommended.

The area should also be closely scrutinized in future updates of this Report, to evaluate population growth around the lake and to ascertain the effectiveness of the septic tanks.

(3) Impacts: This alternative will have fairly significant impacts on the area even though septic tanks will be maintained as a means of treatment. In order to achieve the minimum required treatment level, it will be necessary to inact a strictly enforced control order. This order should allow the area to maintain stream quality. On the other hand, it could conceivably have a significant economic impact, as evaluation of existing systems would be necessary, and residents might have to replace or upgrade their existing septic tanks and filter fields.

Economic impacts would also be encountered in the management and enforcement of the septic tank control order.

CHAPTER R

SEGMENT 216

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 216 encompasses approximately nine river miles of the Wichita River between the headwaters of Lake Diversion to Lake Kemp Dam. This approximate area of 70 square miles has high chloride concentrations which are derived from natural sources. No municipalities or other facilities are located in this segment.

(b) Non-point Source Assessment: Land use in this segment is entirely rangeland, with no municipalities or other developed areas within the drainage area. This segment is classified as Category I, with no existing or projected water quality problems. The salinity of the water is derived from natural sources upstream of Lake Kemp. The quality and quantity of flow in this segment is controlled by the releases from Lake Kemp.

CHAPTER S

SEGMENT 217

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 217 consists of the Lake Kemp drainage area. The area encompasses approximately 160 square miles of range land. This lake has high chloride concentrations which are believed to be due to natural sources upstream from Lake Kemp on the Wichita River. With the exception of the high chlorides, the water quality of the segment is generally good. Although survey data indicate that the lake is eutrophic in nature, no nuisance conditions are believed to exist. No dischargers are located in this segment, and the only potential area of concern is the residential development along the shores of Lake Kemp. Due to the potential for water contamination from the individual disposal systems, the development in this area has been designated as a sewerage planning area.

(b) Non-point Source Assessments: Approximately 132 of the 162 square miles in this segment are rangeland. This area is a Category I segment and, with the exception of the chlorides, generally has water of good quality. The shoreline developments on Lake Kemp utilize septic tanks as a method of disposal and have been examined further in this plan as a potential non-point source of contamination. The chloride concentration of the water is derived from upstream sources of natural salts. The Corps of Engineers has developed a control strategy for these salt sources that, when implemented, will prevent an estimated 163 tons per day of chlorides from entering the reservoir. A eutrophication study has found Lake Kemp to be eutrophic, but not seriously enough to impair the designated beneficial uses of the lake.

2. LAKE KEMP

(a) General: Lake Kemp is located in north central Baylor County on the Wichita River, approximately 8 miles north of Seymour, and is owned and operated by the City of Wichita Falls and Wichita County Water Improvement District No. 2 for water supply and for irrigation. The present population is spread along the lakeside with the largest concentration along the southern edge of

lake on lots leased from the Wagner Estate. Most of the housing in the area is the recreational "cabin" type, or trailers, and is generally for weekend and summer uses. Based upon an average of one person per housing unit, this area is estimated to have an average population of 600. This population is projected to remain relatively constant through the year 2000.

The land use of the area is primarily residential and recreational. The small amount of commercial development consists of marinas and small stores typical of lakeside communities. The Lake Kemp area has moderate topographic relief and slopes toward the lake. This area is underlain by Owens-Vernon soil groups which have low permeability and are generally unsuitable for septic tank absorption fields.

The residents of Lake Kemp do not have access to a central water supply or wastewater treatment system. Drinking water for the area is hauled by the leasees, or by contractors who fill small storage tanks for the residents. Wastewater disposal is by individual septic tank or cesspool. Though no specific problem in the area is known, the density of the existing housing suggests that the area could experience problems with the existing septic tanks during high use periods.

(b) Technical Alternative:

(1) Technical Plan: In order for septic tanks to be considered as a viable wastewater treament alternative, it will be necessary to institute a stringent septic tank control ordinance. Due to the severe limitations on septic tanks, as expressed in the SCS Soil Survey, they would appear to be a potential health problem. To date, however, there have been no reported problems; and if septic tanks are properly installed and maintained, they could perform satisfactorily despite the limitation on filter fields.

All cesspools in the area should be abandoned and closed, and replaced by adequately constructed and maintained septic tank systems (refer to Appendix F).

(2) Financial and Managerial Considerations: The cost of a septic tank control ordinance will be in fulfilling the legal and institutional requirements to pass and enforce the ordinance. Funds will also be required for qualified personnel to inspect

these systems during construction and while in operation, and for the clerical work involved with this process. If many of the existing systems are found to be inadequate, the owners of these unsuitable systems will be faced with the cost of installing new septic tank absorption field systems to replace the systems they are now using.

The County, in conjunction with the City of Wichita Falls, should be designated as managerial agents in implementing a septic tank order. The area should also be closely scrutinized in future updates of this Report in order to evaluate population growth around the lake and to ascertain the effectiveness of the septic tank systems.

(3) Impacts: This alternative will have fairly significant impacts on the area even though septic tanks will be maintained as a means of treatment. In order to achieve the minimum required treatment level, it will be necessary to inact a strictly enforced control order. This order should allow the area to maintain stream quality. The order, on the other hand, could conceivably have a significant economic impact, since evaluation of existing systems will be necessary, and residents may need to replace or upgrade their existing tanks or filter fields.

Economic impacts will also be encountered in the management and enforcement of the septic tank control order.

CHAPTER T

SEGMENT 218

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 218 encompasses the drainage area of the Wichita River, from the headwaters of Lake Kemp to the headwater of the river, including the North, Middle, and South Forks. The area has approximately 1,900 square miles and includes parts of 6 counties. Land use in this segment is primarily range land, with some dry crop land and forest land. No man-made pollution problems are in evidence in the segment, and the high chloride concentrations are believed to be due to the existence of salt areas and possibly due to gypsum outcrops. The salt alleviation projects of the Corps of Engineers should reduce these concentrations.

TDWR records report that various parameters in Segment 218 have not been met over past years. The chloride standard has been exceeded on numerous occasions; the pH, temperature, and fecal coliform standards have been exceeded occasionally.

Of the four facilities located in the segment, only one discharges its effluent. This wastewater treatment facility, owned by the City of Crowell, has a new oxidation ditch plant which produces good effluent. Only one area of this segment is considered to present a potential source of water contamination. The City of Paducah has an older plant which is in need of improvement and is considered to be a sewerage planning area.

(b) Non-point Source Assessment: The quality of water in this segment is greatly controlled by the chloride contributions of salt springs and seeps located along the Wichita River and its tributaries. These salt loads have been estimated to be approximately 525 tons/day and do not include the loads which are derived from flows through outcrops of gypsum and anhydrite located in the area. It is believed that over 80 percent of this salinity can be controlled by alleviation measures designed by the Corps of Engineers. Such a reduction is necessary if water of a usable quality is to be available in Lake Kemp.

2. CROWELL

The City of Crowell is located in Foard County and serves as the county seat and as an agribusiness center. The City has recently constructed a new oxidation ditch treatment plant that should serve its wastewater treatment needs throughout the planning period. However, sewage collection lines do not presently serve the southeastern portion of the City. The area should be sewered immediately to prevent surface and groundwater contamination.

The City has made application for grant monies to sewer this area but, as yet, has not received funding.

3. PADUCAH

(a) General: The City of Paducah is in Cottle County and is the County Seat. The City is the commercial center for the surrounding ranch and farm lands. The current population within the City is approximately 2,200 people and is not expected to increase significantly throughout the planning period.

The soils in the area are friable, sandy loams that are well suited to septic tank use or land treatment systems.

Paducah is in Water Quality Segment #218 which is designated as a Category I segment. This designation indicates that there are no problems within the segment; nevertheless, both wasteflow projections and inspection reports indicate that the City's wastewater treatment facility is hydraulically overloaded.

The City currently operates an older plant consisting of an Imhoff tank and oxidation ponds. The effluent is used for irrigation, but the facility occasionally discharges.

(b) Technical Alternative 1:

(1) Technical Plan: As a first alternative the City could construct additional oxidation pond capacity to alleviate the immediate need for more holding ponds.

(2) Financial and Managerial Considerations: The total capital cost of building additional oxidation ponds and sludge handling equipment for 0.13 MGD will be $223,000. Amortizing the capital cost and maintenance costs over 20 years, the annual

cost will be approximately $33,900. The additional charge per connection, assuming three persons per connection, will be approximately $3.90.

(3) Impacts: This alternative will alleviate the immediate needs for the City of Paducah. However, this alternative is a temporary measure and its effectiveness depends on the usability of the remainder of the plant as assessed by a detailed engineering study.

(c) Technical Alternative 2:

(1) Technical Plan: The City of Paducah could construct new primary treatment facilities and continue irrigation under a "no-discharge" permit. A plant flow schematic is included in Figure T-1.

(2) Financial and Managerial Considerations: The total capital cost of the proposed land treatment system is estimated to be $347,000, with a present worth of $613,000 and a total capital cost of $56,200. The resultant monthly charge per connection, assuming three persons per connection, will be $6.20. These costs assume that no additional land will be needed for irrigation. Also, since the existing plat currently uses its effluent for irrigation and the City will not grow substantially, no additional irrigation equipment or collection system is assumed needed. If 85 percent Federal grant monies are available under PL 92-500, the monthly charge per connection will be $3.40, as delineated in Table T-1.

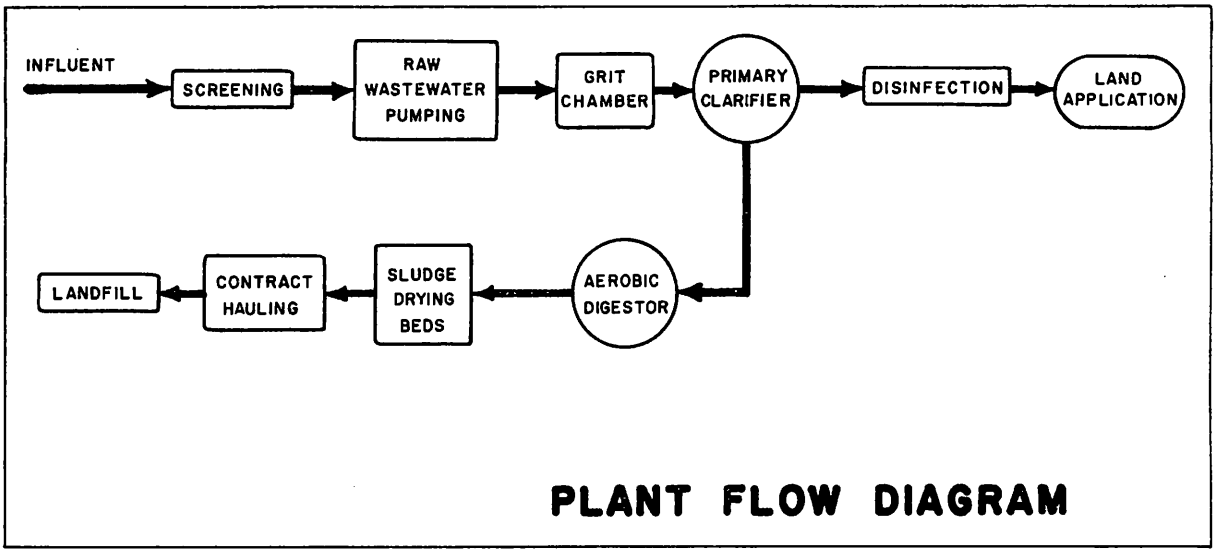
The City of Paducah should manage the new system.

(3) Impacts: No adverse social impacts should result from this alternative since it is similar to the existing system.

Economically, this alternative should not impose a substantial burden on the City of Paducah if Federal funds are available to lower user charges.

This alternative effectively prohibits any pollution contribution to surface waters and, properly operated, should pose no threat to groundwater resources.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF PADUCAH



Alternative 2. Abandon existing facility - continue land application.

Design Population: 2,160 Effluent Requirement:
Design Flow:
Average - 0.23 MGD Primary Treatment
Peak - 0.51 MGD

Receiving Water: No Discharge

Wasteload Projections for the City of Paducah

Planning Year	Population	Flow (MGD) Average	Peak
1975	2185	No Data Available	
1983	2160	0.23	0.51
1990	2040	0.22	0.49
2000	1910	0.21	0.48

EXISTING PLANT CAPACITY: 0.10 MGD

Figure T-1

Table T-1

Estimated Alternative Costs For
The City of Paducah

	Technical Alternative 2 Abandon Existing Plant Implement Land Treatment
Collection System	
Capital Cost	No Additions
O&M Cost	Proposed
Treatment Plant	
Total Labor Cost	$ 15,200
Total Energy Cost	4,200
Total Chemical Cost	500
Construction Cost	*345,000
Land Acquisition Cost	1,600
O&M Cost	24,400
Capital Cost	347,600
Total Capital Cost	347,600
Present Worth	612,000
Total Annual Cost	56,200
Monthly Charge per Connection	6.50
WITH 85 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	52,100
Present Worth	317,350
Total Annual Cost	29,200
Monthly Charge per Connection	3.40

*Purchase of land used for irrigation is assumed not necessary, and therefore not included in the Construction Costs.

CHAPTER U

SEGMENT 219

1. SEGMENT OF SUMMARY ANALYSIS

(a) General: Segment 219 consists of the drainage area for Lake Wichita which includes Holliday Creek. Only one treatment facility is permitted to discharge in this segment. The City of Holliday, which owns this wastewater treatment plant, is currently participating in the PL 92-500 Construction Grant Program to improve its system. The community of Lakeside, located on the south shores of Lake Wichita, is another area of interest. The residential growth in this area has been so rapid that concerns of pollution from septic tanks are growing. This area has thus been designated a sewerage planning area.

(b) Non-point Source Assessment: Land use in this Category I segment is roughly divided between rangeland and cropland. The water quality in Holliday Creek is generally of good quality; however, there is some concern about potential contamination of Lake Wichita. Lake Wichita is eutrophic in nature, and there is concern that residential development on the southern side of the lake is contributing to this problem. This development is currently utilizing septic tanks, and the density of this concentration is projected to increase. This area has been designated as a sewerage planning area and is discussed in greater detail in following paragraphs. Chlorides for this segment are also relatively high. The chlorides are probably the result of oil field brines which were improperly disposed of in the past. This area of oil field contamination, located south and west of the City of Holliday, possibly still contribute to the salt loads of the area, even though these disposal practices have ceased. Water flows through the residual brines in old disposal pits into the tributaries of the creek and into Lake Wichita. These salt contributions should diminish with time, providing no new deposits are formed. A potential for chloride contamination due to irrigation in the area exists and should be investigated thoroughly in the future.

2. HOLLIDAY

The City of Holliday has a twenty-year old wastewater treatment plant consisting of a bar screen, an Imhoff tank, oxidation ponds, and sludge drying beds. This system is

currently operating at its design capacity, and the City's population is growing. The present effluent quality does not meet the permitted levels of BOD_5 and total suspended solids.

The City is participating in the PL 92-500 Construction Grant Program to improve its wastewater treatment system. The proposed system will include a grit chamber, a comminutor/ bar screen, flow measurement, an oxidation ditch, a final clarifier, a chlorinator, and sludge drying beds.

3. LAKESIDE

The City of Lakeside is located within this segment; however, due to its proximity to Wichita Falls, the proposed facility has been included in Segment 214 in conjunction with the Wichita Falls Regional Plan.

CHAPTER V

SEGMENT 220

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 220 is made up of the drainage area of the Pease River, from its confluence with the Red River to the headwaters of the North Fork of the Pease River. This segment covers approximately 2,460 square miles and is the second largest segment within the basin. Land use in this segment includes rangeland, cropland, and some forestland. The chlorides in this segment are very high, sometimes ranging to 15,000 mg/l. Summer water temperatures consistently exceed the standard.

Only two of the eight facilities located within the segment discharge their effluent. One of these facilities, owned by the City of Vernon is experiencing some problems and has been designated as a sewerage planning area.

The other facility which discharges is owned by the City of Cillicothe and was designated as a sewerage planning area during the inventory phase of Volume I. Upon more detailed examination of the facility, it was determined that though it has some problems, it would be adequate for the next five years. It has, thereore, been deleted as a sewerage planning area and included in the next plan.

(b) Non-point Source Assessment: The major water quality problem in the Pease River is that of high chloride concentrations. These chlorides result from natural salt sources located on the North Pease River and the Middle Pease River (Segment 221) in Cottle County. The combined daily load from the salt seeps of this area is estimated to be 340 tons. The flow of these waters through gypsum outcrops and deposits of anhydrite contributes to its salinity as well. The Corps of Engineers has recommended that a system of shallow collection wells be developed in the future to collect the brine for disposal in a brine lake to be located near Crowell.

2. VERNON

(a) General: The City of Vernon lies in Wilbarger County on U. S. Highways 287 and 283 (Figure V-1). The City serves as the county seat and as an agricultural and

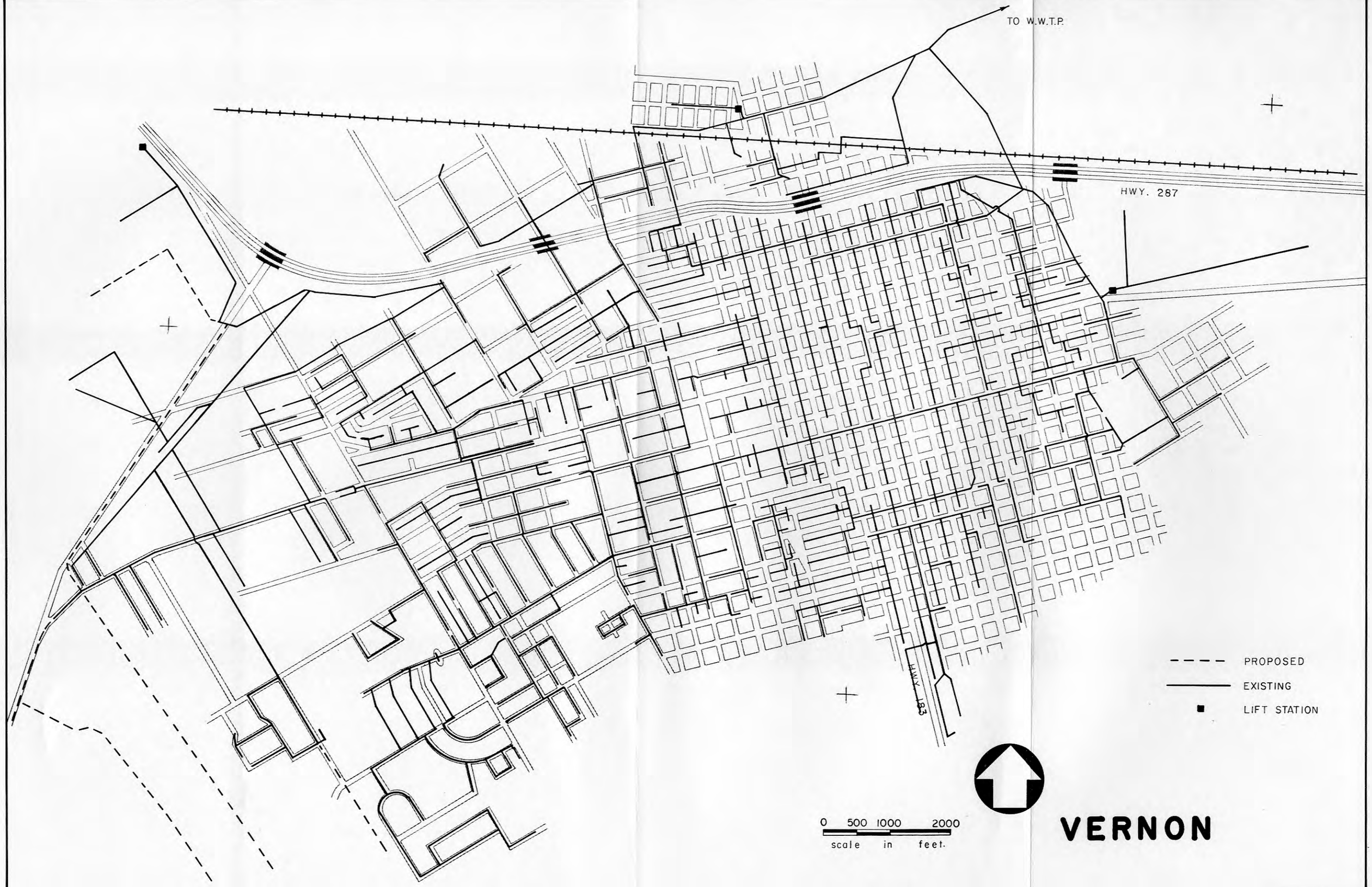

TO W.W.T.P.
HWY. 287
HWY. 183
PROPOSED
EXISTING
LIFT STATION
0 500 1000 2000
scale in feet.
VERNON

Figure V-1

oil center for the surrounding area. The population of the City is approximatley 12,500 persons and is projected to increase throughout the planning period. The commercial development is primarily along old U. S. Highway 287 and in the center of town. Newer commercial development is along the new route of U.S. Highway 287, particularly along the outskirts of town. Considerable residential growth is occurring on the western and southwestern perimeters of the City. The presence of the Vernon Regional Junior College, Wilbarger General Hospital, and the Texas Department of Mental Health and Mental Retardation facility on the western side of town appears to be a great economic stimulus toward growth on this side of town. Most other areas of the City are relatively stable or declining in population and growth.

The City currently operates an upgraded wastewater treatment plant consisting of an oxidation ditch system (1.0 MGD capacity) in parallel with an Imhoff tank-trickling filter system (0.98 MGD capacity). Inspection reports indicate that the plant is currently treating flow quantities just below its design capacity and is in need of additional sludge drying beds. The projected wasteloads for the service area indicates that the plant will be overloaded by 1983.

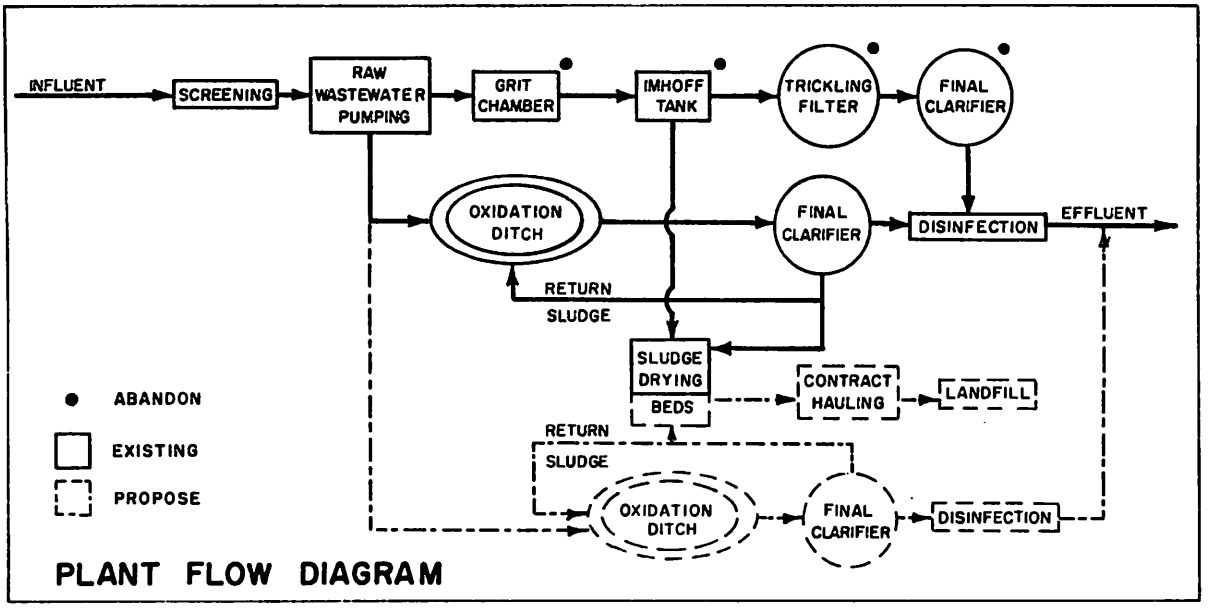
Consequently, the plant should be expanded as soon as possible.

(b) Technical Alternative 1:

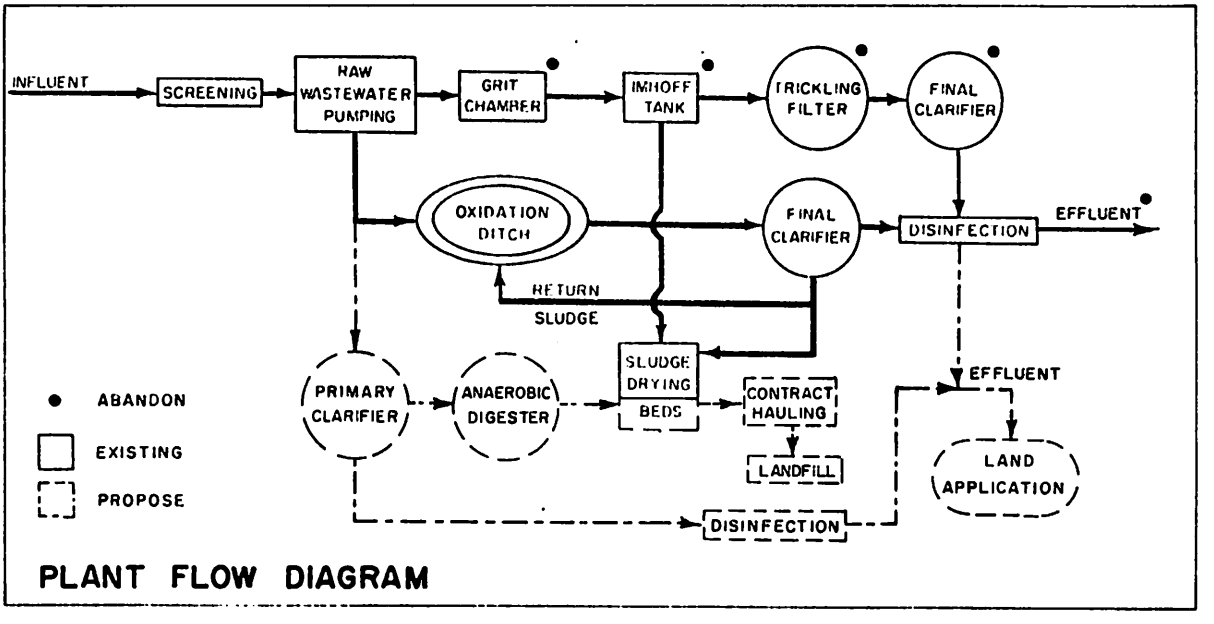
(1) Technical Plan: Alternative 1 proposes to expand and upgrade the Vernon Wastewater Treatment Plant as illustrated in Figure V-2. The Imhoff tank and trickling filter will be abandoned, and another oxidation ditch system will be built in parallel to the existing ditch. The existing sludge drying beds will be expanded. The collection system will be expanded as illustrated in Figure V-1.

(2) Financial and Managerial Considerations: As delineated in Table V-1, this alternative is estimated to have a total capital cost of $1,728,700. The present worth and total annual cost will be $2,749,700 and $252,100, respectively. The resultant monthly charge per connection assuming three persons per connection will be $3.90. If 75 percent Federal grant monies are available under PL 92-500, the additional monthly charge per connection will be $2.00.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF VERNON



Alternative 1: Expand and Upgrade Existing Plant - Continue to Discharge



Alternative 2: Expand Plant - Implement Land Treatment

Design Population: 16,300
Design Flow:
Average - 2.12 MGD
Peak - 3.66 MGD

Effluent Requirements: (Alt. 1)
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

EXISTING PLANT CAPACITY: 1.98 MGD

Wasteload Projections for the City of Vernon

Planning Year	Population	Flow (MGD) Average	Peak
1974	11,528	1.50	1.80
1983	14,000	1.82	3.20
1990	15,000	1.95	3.40
2000	16,300	2.12	3.66

Figure V-2

Table V-1

Estimated Alternative Costs For The City of Vernon

	Technical Alternative 1 Expand and Upgrade Existing Facility - Continue to Discharge	Technical Alternative 2 Expand Existing Facility Implement Land Treatment
Collection System		
Capital Cost	$ 376,800	$ 376,800
O&M Cost	2,000	2,000
Treatment Plant		
Total Labor Cost	51,200	74,200
Total Energy Cost	21,800	9,400
Total Chemical Cost	2,400	2,400
Construction Cost	1,340,400	*4,711,300
Land Acquisitom Cost	11,600	4,200
O&M Cost	91,900	100,800
Capital Cost	1,352,000	4,716,000
Total Capital Cost	1,728,700	5,092,300
Present Worth	2,749,700	6,001,000
Total Annual Cost	252,100	550,300
Monthly Charge per Connection	3.90	8.40
WITH FEDERAL GRANT IN AID:	(75 PERCENT)	(85 PERCENT)
Total Capital Cost	432,200	801,600
Present Worth	1,449,400	1,903,700
Total Annual Cost	133,300	177,600
Monthly Charge per Connection	2.00	2.70

*Purchase of land used for irrigation is included in construction cost.

The new facility should continue to be managed by the City as is the existing facility.

(3) Impacts: With Federal grant monies, this alternative is within the economic base of the City. The costs of this alternative would be added to existing charges.

No adverse social impacts are foreseen since Vernon already treats its wastewater at a centralized location. An expanded, efficient treatment plant could encourage both residential and industrial development.

An expanded and upgraded facility will rectify the environmental impacts of the existing facility. The sludge disposal problem that now exists will be corrected, and the plant will be able to treat the increased flows projected.

(c) Technical Alternative 2:

(1) Technical Plan: Alternative 2 proposes to convert the existing facility to a land treatment facility under a "no discharge" permit, as illustrated in Figure V-2. The old Imhoff tank, trickling filter, and final clarifier will be abandoned. The newer oxidation ditch system will be retained to treat its capacity of 1.0 MGD and primary treatment facilities will be added to treat flows in excess of 1.0 MGD. Additional sludge drying beds will also be constructed.

(2) Financial and Managerial Considerations: As delineated in Table V-1, the total capital cost of this alternative is estimated to be $5,092,300 with a present worth of $6,001,000 and total annual cost of $550,300. The resultant monthly charge per connection, assuming three persons per connection, will be $8.40.

If 85 percent Federal funds are available under PL 92-500, the monthly charge per connection will be $2.70. These estimates assume that the land used for irrigation must be purchased and is not currently available to the city. Installation of the necessary irrigation system is also assumed. No value is placed on the benefits derived from using the effluent as a source of water.

The land treatment system should be managed by the City.

(3) Impacts: If the system is operated and maintained properly, no adverse social impacts are expected. Odors and health problems can be controlled by disinfection.

This system will provide a source of irrigation water that may be difficult to obtain elsewhere. However, this alternative may effect water rights downstream of Vernon since the facility discharge will no longer contribute to stream flows. The downstream flow from the plant would be decreased by approximately 2.0 MGD. As the stream frequently has periods of little or no flow above the facility this decrease could be significant. The impact on water rights should be assessed in detail in the facility plan. With Federal funding, the additional charges that will be added to existing charges are relatively low and should be within the economic base of the City.

CHAPTER W

SEGMENT 221

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 221 is comprised of the Middle and South Forks of the Pease River, from their confluence with the North Fork to their headwaters. Land use for this segment, which extends over approximately 1,250 square miles, consists of rangeland with some cropland and forestland. Although no manmade pollution problems are in evidence in this segment, chlorides are relatively high, as reflected in the allowable stream standard values. During the summer, the temperature standard is also exceeded occasionally. Two non-discharging wastewater treatment facilities are located in the segment. The facility owned by the City of Matador is projected to require improvements and has been designated as a sewerage planning area.

(b) Non-point Source Assessment: Segment 221, which consists of the South and Middle Forks of the Pease River, have been classified as a Category I Segment. The water quality has relatively high chlorides. These chlorides originate from seeps along the Middle Pease in Cottle County. It has been estimated that the seeps along the Middle Pease and those along the North Fork (Segment 220) produce approximately 340 tons/day of salt. The Corps of Engineers has developed a plan to control these chloride loads by collecting the brines with a system of shallow wells and transporting them to a brine storage reservoir to be located near Crowell. This alleviation measure is expected to control approximately 60 percent of the brines from this source.

2. MATADOR

(a) General: Matador is located in Motley County at the intersection of U.S. Highways 70 and 62, F. M. 94 and State Highway 70. The City is the County Seat and serves as an agricultural center for the area. The population at present is approximately 950 persons and is not expected to grow significantly.

Most of the commercial land development is along U. S. Highways 62 and 70. The most dense residential section lies to the south of U.S. Highways 62 and 70. No commercial or residential development is expected during the planning period.

Matador is underlain by Miles-Springer soils which have only slight limitations with regard to septic tank utilization or land treatment systems.

The topography of the area slopes gently to the east and drainage is primarily into Ballard Creek and Hackberry Draw.

The City of Matador operates a fifty-year-old Imhoff tank-oxidation pond wastewater treatment system. Inspection reports indicate that the Imhoff has deteriorated significantly, and its usability by 1983, and particularly throughout the planning period, is questionable.

In addition, wasteload projection, based on A Methodology to Evaluate Municipal Wastewater Collection and Treatment Needs, indicates the plant is overloaded. Therefore, a new facility should be constructed.

(b) Technical Alternative

(1) Technical Plan: The City could abandon the existing facility and construct an extended aeration plant. The plant flow diagram is illustrated in Figure W-1.

(2) Financial and Managerial Considerations: The total capital cost of this alternative, as illustrated in Table W-1, is estimated to be $260,000 with a present worth of $474,400 and a total annual cost of $43,500. The resultant monthly charge per connection, assuming three persons per connection, will be $11.20. If 75 percent PL 92-500 grant monies are available, the monthly charge per connection will be $6.60.

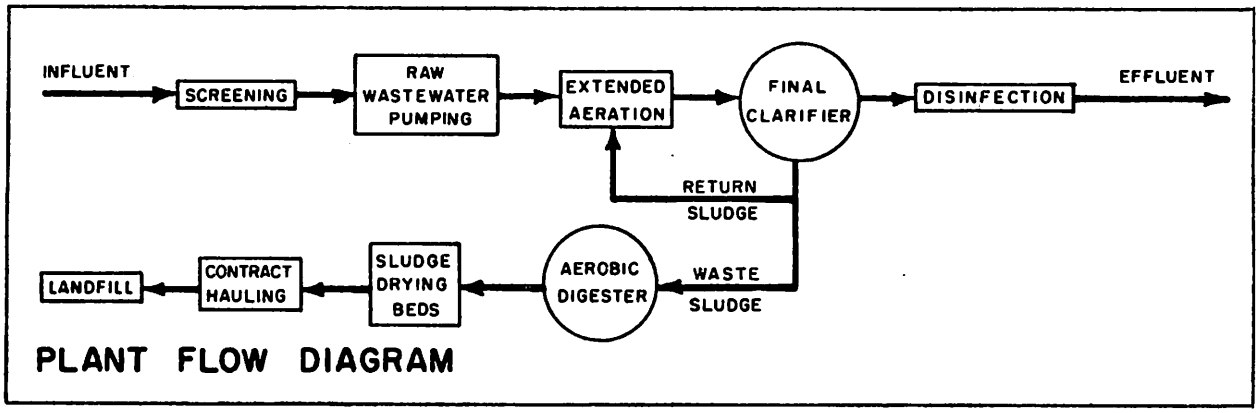
The City should manage this new facility.

(3) Impacts: Economically, this alternative could have an adverse effect on the City of Matador. Unless Federal funding is available to the City, the monthly

connection charge of $11.20 would discourge growth and impose a burden on residents. In contrast, construction of a new efficient system could encourage industrial and residential growth in the City.

Any danger of polluting surface waters as the old plant deteriorates and becomes less efficient will be alleviated by the new facility.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF MATADOR



Alternative 1: Abandon existing facility - construct extended aeration plant

Design Population: 970
Design Flow:
Average - 0.10 MGD
peak - 0.27 MGD

Effluent Requirements:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Hackberry Creek

Wasteload Projections for the City of Matador

Planning Year	Population	Flow (MGD) Average	Peak
1975	943	No Data Available	
1983	970	0.10	0.27
1990	900	0.10	0.25
2000	900	0.10	0.26

EXISTING PLANT CAPACITY: 0.06 MGD

Figure W-1

Table W-1

Estimated Alternative Costs For
The City of Matador

	Technical Alternative Abandon Existing Plant Construct Extended Aeration Plant
Collection System	
Capital Cost	No Additions Proposed
O&M Cost	
Treatment Plant	
Total Labor Cost	$ 13,200
Total Energy Cost	3,900
Total Energy Cost	200
Construction Cost	258,800
Land Acquisition Cost	1,200
O&M Cost	19,700
Capital Cost	260,000
Total Capital Cost	260,000
Present Worth	474,400
Total Annual Cost	43,500
Monthly Charge per Connection	11.20
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	65,000
Present Worth	278,200
Total Annual Cost	25,600
Monthly Charge per Connection	6.60

CHAPTER X

SEGMENT 222

1. SUMMARY OF SEGMENT ANALYSIS

The Salt Fork of the Red River from the Oklahoma State Line to Greenbelt Reservoir and its drainage area of approximately 950 square miles make up Segment 222. Over 70 percent of the land in this segment is rangeland, with dry cropland comprising an additional 21 percent of the remaining acreage. The quality of water in the segment is generally good, although the stream standards for sulfates are relatively high. The high sulfate levels may result from flows through outcrops of gypsum and anhydrite located in the eastern portion of the segment, and occasionally the sulfate standard is exceeded.

2. HEDLEY

The City of Hedley operates an Imhoff tank-oxidation pond system. The WCO permit requires a 30/30 effluent quality in regard to BOD_5/TSS. The average effluent quality has been 32/68. These problems are primarily the result of inherent characteristics of this type of treatment system. The City is working to correct these problems. However, a portion of the City is not presently serviced by the centralized collection system. Problems with the septic tanks in the area have been numerous. Consequently, this area should be sewered immediately.

CHAPTER Y

SEGMENT 223

1. SUMMARY OF SEGMENT ANALYSIS

Greenbelt Reservoir and its watershed form Segment 223 on the Salt Fork of the Red River. This segment covers about 390 square miles of the Texas Panhandle. Land use in this area is basically rangeland with some cropland in its upper reaches. The quality of the water in this segment is excellent, and no violations of the segment water quality standards have been recorded.

Two areas of the segment may require improvements to the existing wastewater disposal systems and have been designated as sewerage planning areas. These areas include the City of Claude and the City of Howardwick. The City of Claude may need to replace their existing system which is considered to be inadequate. The City of Howardwick is located on the shores of Greenbelt Reservoir and due to its growth may require an alternative method of waste disposal.

2. CLAUDE

(a) General: The City of Claude is located in northern Armstrong County on U. S. Highway 287 and F. M. 1151. It serves as the County Seat and as an agricultural center for the surrounding area. The City's population is approximately 980 and is projected to increase to 1000 persons by the year 2000.

The commercial district lies along U. S. Highway 287, and there is little new commercial development expected. The residential areas are most dense in the southwestern section of the City. Little residential development is expected in the future.

The City is underlain by Pullman soils which are severely limiting to septic tank utilization due to slow percolation.

Topography of the Claude area is relatively flat and drainage is primarily into several surrounding playa lakes.

The City of Claude operates a wastewater treatment plant consisting of an Imhoff tank that discharges into a playa lake. The plant is currently under a "no discharge" status; but according to wasteload projections based on A Methodology to Evaluate Municipal Wastewater Collection and Treatment, the facility is treating average flows that are almost twice its design capacity.

The plant should be either expanded and upgraded, or completely replaced, to efficiently treat the waste flows generated. No additions to the existing collection system are proposed.

(b) Technical Alternative:

(1) Technical Plan: The City should abandon the existing facility and construct an extended aeration plant at the site. The plant flow diagram is illustrated in Figure Y-1.

(2) Financial and Managerial Considerations: This alternative is estimated to have a total capital cost of $268,000 with a present worth of $489,600 and a total annual cost of $44,900 (see Table Y-1). The resultant monthly charge per connection, assuming three persons per connection, will be $11.20. If 75 percent Federal grant monies are available through PL 92-500, the total capital cost of this alternative will be $67,000 and the monthly charge per connection will be $6.60.

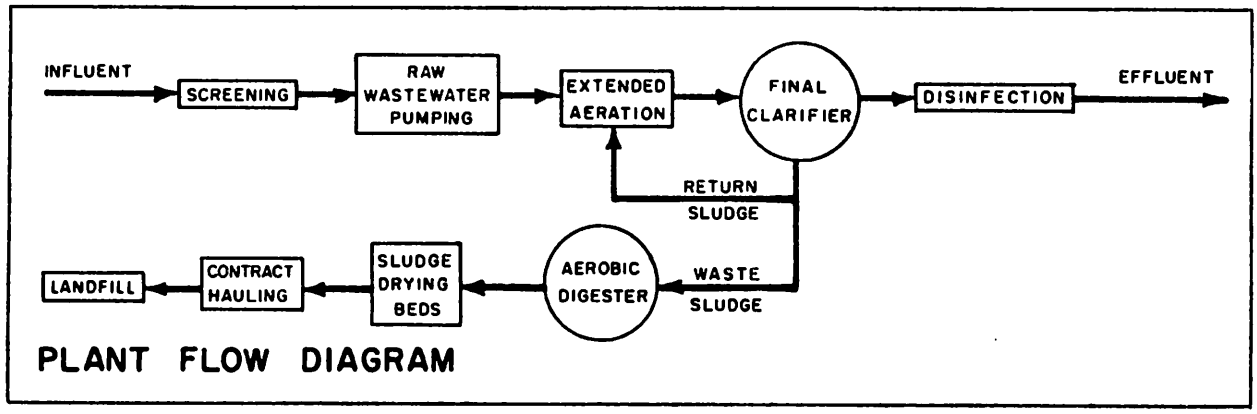
This new facility should be managed by the City.

(3) Impacts: Unless Federal grant monies are available, this alternative will impose a significant financial burden on the City. Construction of the new plant could stimulate the economy temporarily by providing several jobs. In addition, new industry could be attracted to the City if an efficient, reliable system is available.

3. GREENBELT RESERVOIR

(a) General: Greenbelt Reservoir is located in Donley County about four miles north of the City of Clarendon. Surrounding the reservoir are several lakeside developments, the largest of which is the recently incorporated town of Howardwick. Howardwick covers an area of about 820 acres on the northern side of Greenbelt Reservoir and is the only

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF CLAUDE



PLANT FLOW DIAGRAM

Alternative: Abandon existing facility - Construct extended aeration plant

Design Population: 1,000
Design Flow:
Average - 0.11 MGD
Peak - 0.29 MGD

Effluent Requirements:
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Nearby playa lake

Wasteload Projections for the City of Claude

Planning Year	Population	Flow (MGD) Average	Peak
1975	974	No Data Available	
1983	1,000	0.11	0.27
1990	1,000	0.11	0.28
2000	1,000	0.11	0.29

EXISTING PLANT CAPACITY: 0.07 MGD

Figure Y-1

Table Y-1

Estimated Alternative Costs For
The City of Claude

	Technical Alternative Abandon Existing Plant Construct Extended Aeration Plant
Collection System	
Capital Cost	No Additions Proposed
O&M Cost	
Treatment Plant	
Total Labor Cost	$ 13,700
Total Energy Cost	3,800
Total Chemical Cost	200
Construction Cost	267,700
Land Acquisition Cost	1,300
O&M Cost	20,300
Capital Cost	269,000
Total Capital Cost	269,000
Present Worth	489,600
Total Annual Cost	44,900
Monthly Charge per Connection	11.20
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	67,000
Present Worth	286,900
Total Annual Cost	26,400
Monthly Charge per Connection	6.60

significant development on that shore. Its current population is estimated to be approximately 300 persons, and projections indicate approximately 1,500 persons by the year 2000. Other developments extend along about 2.5 miles of the southern shore of the reservoir. Population is estimated to be about 100 persons on that side and is anticipated to reach 500 by the year 2000.

Land usage in the area is predominantly residential. Some of the usual commercial establishments attracted by lakes are scattered about the reservoir. Residential development on the southern shore will continue to follow the trend of first building along the lake front and later filling the inner areas. The northern section of Howardwick is anticipated to receive most of the residential development on the northern shore of the lake. Due to the rapid development of the area, more commercial growth should take place in the future. Plans have already been made for construction of a shopping center and medical care facility on the eastern side of Howardwick.

The topography of the area rises and falls sharply, and drainage is directly into Greenbelt Reservoir. The area is underlain by Berthoud-Potter-Mansker soils which have only slight limitations with regard to septic tank use.

The current method of wastewater disposal is utilization of septic tank systems. However, the Texas Water Development Board has issued a Waste Control Order establishing a regulated area within the drainage area of Greenbelt Reservoir. The reservoir is an important source of water for municipal and industrial use and is also utilized for recreational purposes. Therefore, the Waste Control Order specifies that persons within the defined regulated area must apply to the Greenbelt Municipal and Industrial Water Authority for a license if they wish to install a septic tank system. The Waste Control Order also requires that installation of the systems follow the guidelines set by the latest edition of Construction Standards for Private Sewage Facilities which is published by the Texas Department of Health.

The City of Howardwick and the Greenbelt Municipal and Industrial Water Authority have authorized the RRA to oversee the construction of centralized sewerage collection and treatment facilities for both Howardwick and for the development on the southern shore of the Reservoir.

(b) Technical Alternative 1:

(a) Technical Plan: This alternative proposes to construct a wastewater treatment facility and central collection system on the northern and southern sides of the lake. Proposed collection systems are illustrated in Figure Y-2.

These wastewater facilities will consist of primary treatment, with subsequent sludge handling, followed by an oxidation pond (Figure Y-3 and Y-4).

(2) Financial and Managerial Considerations: Tables Y-2 and Y-3 delineate the costs of these two facilities. The total capital cost of the North Plant, including its collection system, is estimated to be $933,100. The total annual cost will be $120,700. Assuming three persons per connection, the monthly charge per connection will be $20.10. If 75 percent grant monies are obtained under PL 92-500, the monthly charge per connection will be $9.40.

The Southside facility will have a total capital cost of $533,000 and a total annual cost of $63,900. The resultant monthly charge per connection will be $32.00. With 75 percent funding, the charge per connection will be $13.70.

These costs are amortized over 20 years at 6-5/8 percent interest.

Since both areas have entered into contracts with the RRA to have the RRA provide sewerage facilities, the RRA will be the managerial agency for both facilities. The Texas Department of Water Resources should continue as the enforcement agency.

(3) Impacts: Only favorable environmental impacts are anticipated as a result of the construction of wastewater treatment facilities and collection systems for each side. Social impacts also have only positive aspects as growth of the area will be encouraged, and development will be of a more permanent type of residence.

The economic impact of this alternative could be adverse. Monthly bills will be about $13.00 per connection. Positive economic aspects will be an increase in the value of land and in the new economic activity for the area that will result from the development's growth.

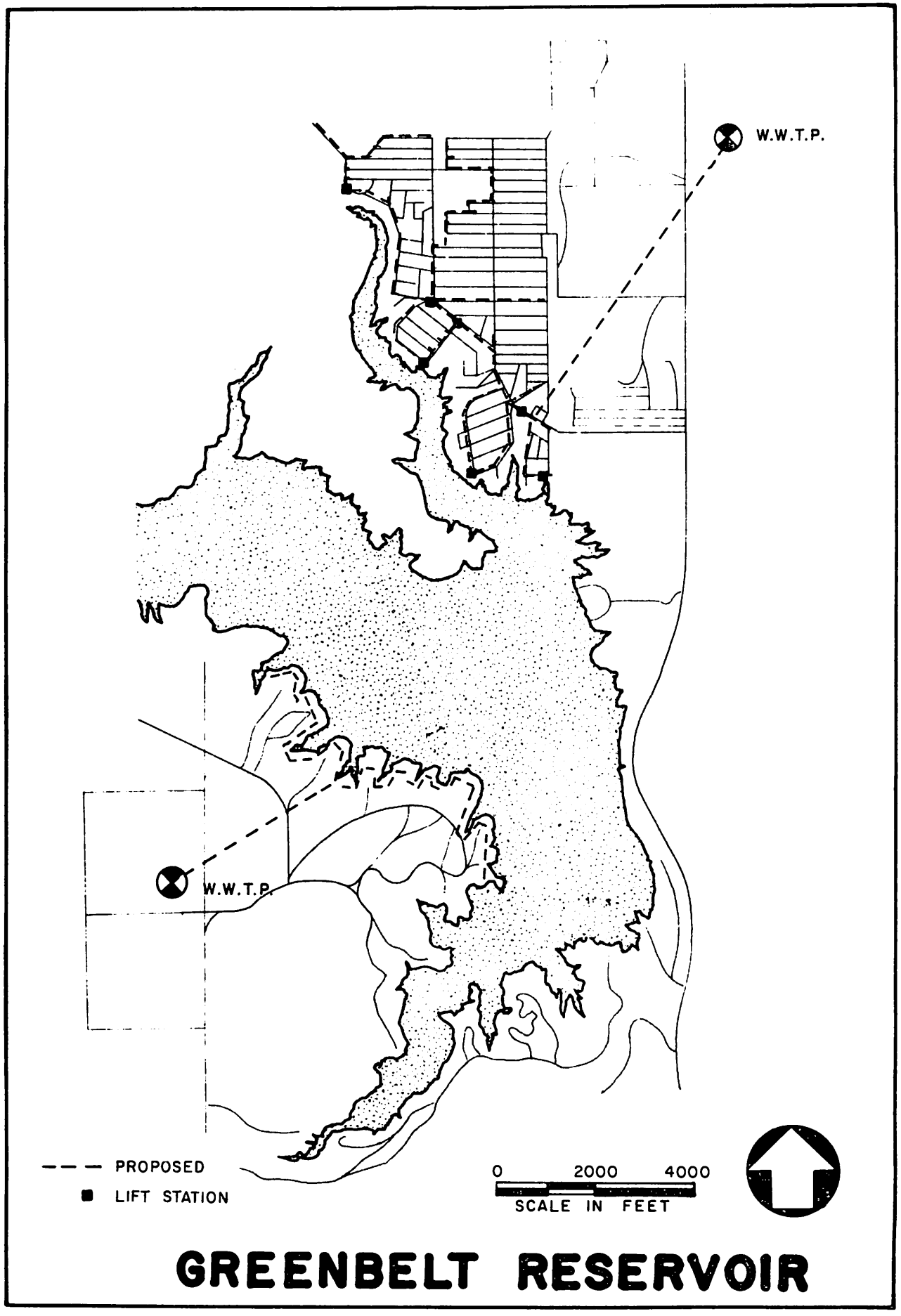
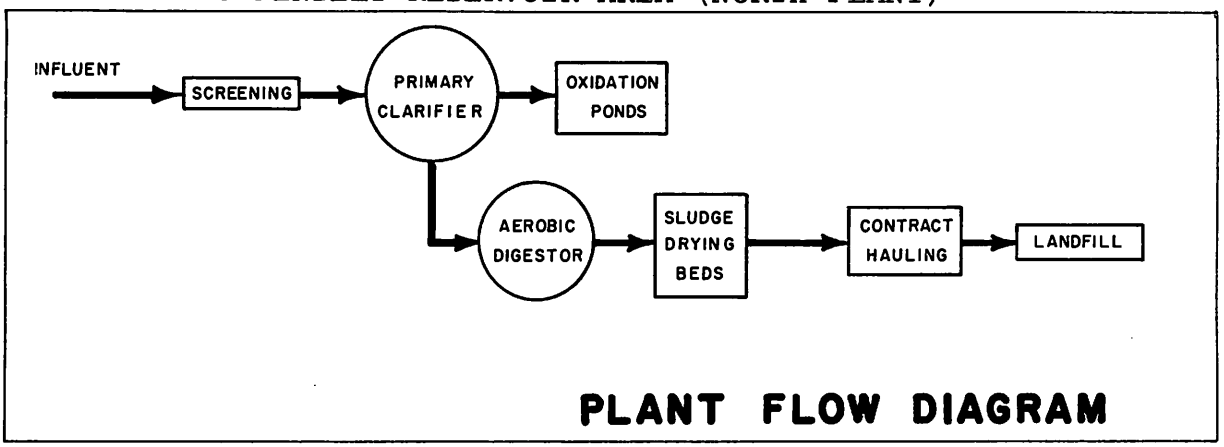
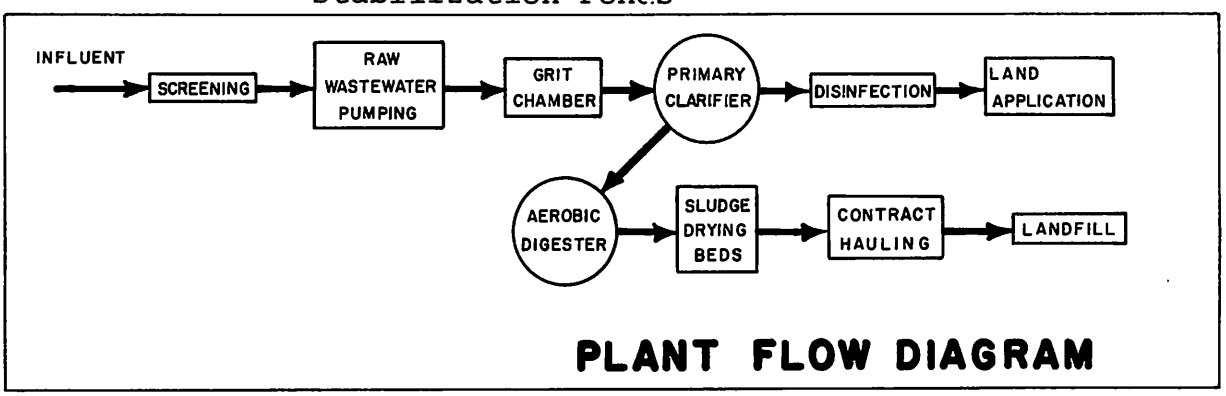


Figure Y-2: Proposed Collection Systems for Greenbelt Reservoir

WASTEWATER TREATMENT PLANT DATA FOR THE
GREENBELT RESERVOIR AREA (NORTH PLANT)



Alternative 1: Construct Primary Clarifier and Stabilization Ponds



Alternative 2: Implement Land Treatment

Design population: 1,500
Deisgn Flow:
Average - 0.15 MGD
Peak - 0.32 MGD

Receiving Water: No Discharge

Effluent Requirement

Primary Treatment

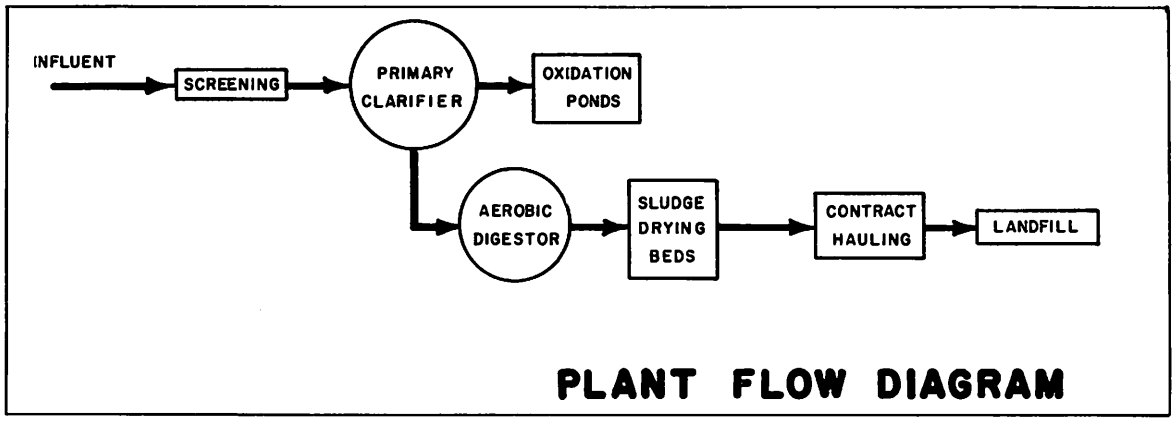
Wasteload Projections for the Greenbelt Reservoir Area
(North Plant)

Planning Year	Population	Flow (MGD) Average	Peak
1975	300	-	-
1983	600	0.06	0.13
1990	950	0.10	0.21
2000	1,500	0.15	0.32

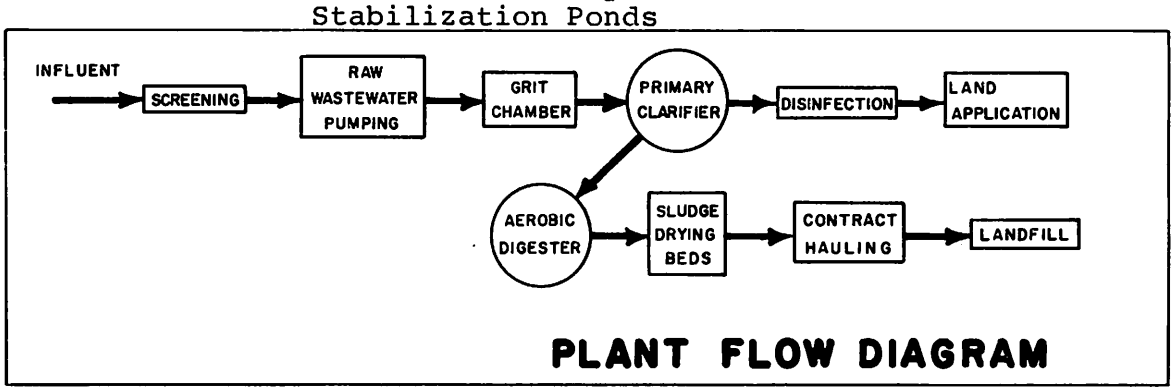
NO EXISTING PLANT

Figure Y-3

WASTEWATER TREATMENT PLANT DATA FOR THE
GREENBELT RESERVOIR AREA (SOUTH PLANT)



Alternative 1: Construct Primary Clarifier and Stabilization Ponds



Alternative 2: Implement Land Treatment

Design Population: 500
Design Flow
Average - 0.05 MGD
Peak - 0.11 MGD

Effluent Requirement:

Primary Treatment

Receiving Water: No Discharge

Wasteload Projections for the Greenbelt Reservoir Area
(South Plant)

Planning Year	Population	Flow (MGD) Average	Peak
1975	50	-	-
1983	180	0.02	0.04
1990	300	0.03	0.07
2000	500	0.05	0.11

NO EXISTING PLANT

Figure Y-4

Table Y-2

Estimated Alternative Costs For The
Greenbelt Reservoir Area (North Plant)

	Technical Alternative 1 Oxidation Pond System	Technical Alternative 2 Land Application
Collection System		
Capital Cost	$ 532,800	$ 532,800
O&M Cost	14,000	14,000
Treatment Plant		
Total Labor Cost	13,800	16,100
Total Energy Cost	3,300	3,100
Total Chemical Cost	0	800
Construction Cost	398,200	*724,700
Land Acquisition Cost	2,000	1,400
O&M Cost	21,100	24,300
Capital Cost	400,200	726,100
Total Capital Cost	933,100	1,259,000
Present Worth	1,316,300	1,662,100
Total Annual Cost	120,700	152,400
Monthly Charge per Connection	20.10	25.40
WITH FEDERAL GRANT IN AID:	(75 PERCENT)	(85 PERCENT)
Total Capital Cost	233,300	242,100
Present Worth	615,000	652,700
Total Annual Cost	56,600	60,900
Monthly Charge per Connection	9.40	10.15

*Land used for irrigation is included in the construction cost.

Table Y-3

Estimated Alternative Costs For The Greenbelt Reservoir Area (South Plant)

	Technical Alternative 1 Oxidation Pond System	Technical Alternative 2 Land Application
Collection System		
Capital Cost	$ 289,200	$289,200
O&M Cost	3,400	3,400
Treatment Plant		
Total Labor Cost	8,700	10,000
Total Energy Cost	1,100	1,100
Total Chemical Cost	0	300
Construction Cost	242,800	*427,000
Land Acquisition Cost	1,000	1,200
O&M Cost	11,700	14,100
Capital Cost	243,800	427,000
Total Capital Cost	533,000	716,300
Present Worth	696,900	901,600
Total Annual Cost	63,900	82,700
Monthly Charge per Connection	32.00	41.40
WITH FEDERAL GRANT IN AID:	(75 PERCENT)	(85 PERCENT)
Total Capital Cost	133,300	136,400
Present Worth	296,600	323,800
Total Annual Cost	27,300	30,200
Monthly Charge per Connection	13.70	15.10

*Land used for irrigation is included in the construction cost.

(d) Technical Alternative 2:

(1) Technical Plan: This alternative considers using two "no-discharge" facilities for servicing the developments around the reservoir. The method calls for primary treatment of influent and land application of treated wastewater effluent. The treatment scheme for the facility on the north side of the reservoir is shown in Figure Y-3, and the scheme for the south side is shown in Figure Y-4. The collection system for this alternative is shown in Figure Y-2.

(2) Financial and Managerial Considerations: The costs for the treatment plant and collection system proposed in Alternative 2 are summarized in Tables Y-2 and Y-3.

The north side plant will have a total annual cost of $152,400, resulting in a monthly charge per connection, assuming three persons per connection, of $25.40. With 85 percent Federal funding under PL 92-500, the monthly charge per connection will be $10.15.

The south side plant will have a total annual cost of $82,700. The monthly charge per connection will be $41.40. With 85 percent Federal funding, the monthly charge per connection will be $15.10.

The management options for this alternative will be the same as Alternative 1.

(3) Impacts: Only favorable environmental impacts are anticipated as a result of the construction of wastewater treatment facilities and collection systems for each side. Social impacts also have only positive aspects as growth of the area will be encouraged and development will be of a more permanent type of residence.

The economic impact of this alternative is quite significant since monthly bills will be about $12.00 per connection. Positive economic aspects would be an increase in the value of land and new economic activity for the area that will result from the developments' growth.

CHAPTER Z

SEGMENT 224

1. SUMMARY OF SEGMENT ANALYSIS

(a) General: Segment 224 comprises the part of the North Fork and Elm Fork of the Red River which lies in Texas. This segment which covers over 2,160 square miles is used primarily for the growing of crops and for rangeland. Water quality in this area is generally good, and no problems are known to exist. Several cities in this segment may require improvements to their existing treatment facilities and have been designated as sewerage planning areas. These cities are Panhandle, White Deer, and Wheeler.

(b) Non-point Source Assessment: This Category II Segment has not experienced any major water quality problems, although the stream standards for sulfates are relatively high. These high sulfate levels result from stream flows through gypsum and anhydrite outcrops located in Wheeler County.

2. PANHANDLE

(a) General: The City of Panhandle lies in central Carson County about 25 miles northeast of Amarillo. The City serves as the county seat and as an agricultural and oil production center for the area. The population in Panhandle is approximately 2,300 and is projected to increase throughout the planning period to 2,650 persons by the year 2000.

The commercial development of the City lies along U. S. Highway 60, Main Street, and the Santa Fe Railraod tracks which cross the southern edge of the City. Residential areas are most dense on the western side of the City, and little commercial development is anticipated in future years.

The area is underlain primarily by Pullman soils which are severly limiting to septic tank utilization due to slow percolation.

The topography of the Panhandle area is relatively flat, and drainage is primarily into several surrounding playa lakes.

The City of Panhandle operates a wastewater treatment plant consisting of an Imhoff tank, trickling filter, and sludge drying beds. The plant, although under a "no-discharge" status, is hydraulically overloaded. The existing Imhoff has a design capacity of 0.16 MGD and is showing indications of structural deterioration. The existing collection system is shown in Figure Z-1.

(b) Technical Alternative 1

(1) Technical Plan: As illustrated in Figure Z-2, this alternative proposes to abandon the existing facility and to construct a contact stabilization system.

(2) Financial and Managerial Considerations: As delineated in Table Z-1, the total capital cost of this alternative is estimated to be $941,800 with a present worth of $1,301,100 and a total annual cost of $119,300. The resultant monthly charge per connection, assuming three persons per connection, will be $12.50. If 75 percent Federal funding is available through a PL 92-500 grant, the monthly charge per connection will be $5.70.

The City should manage the new facility since it presently manages the existing plant.

(3) Impacts: No adverse social impacts are foreseen for the City, since a central wastewater treatment system has been utilized for many years.

Without supplemental funding from either PL 92-500 or other sources, this alternative will place an excessive economic burden on the City and could adversely affect growth and development in the City.

Any threat to surface or ground water quality will be effectively eliminated by this Alternative.

(c) Technical Alternative 2

(1) Technical Plan: Alternative 2 proposes to abandon the existing facility and implement a land treatment system. The plant flow diagram is on Figure Z-2.

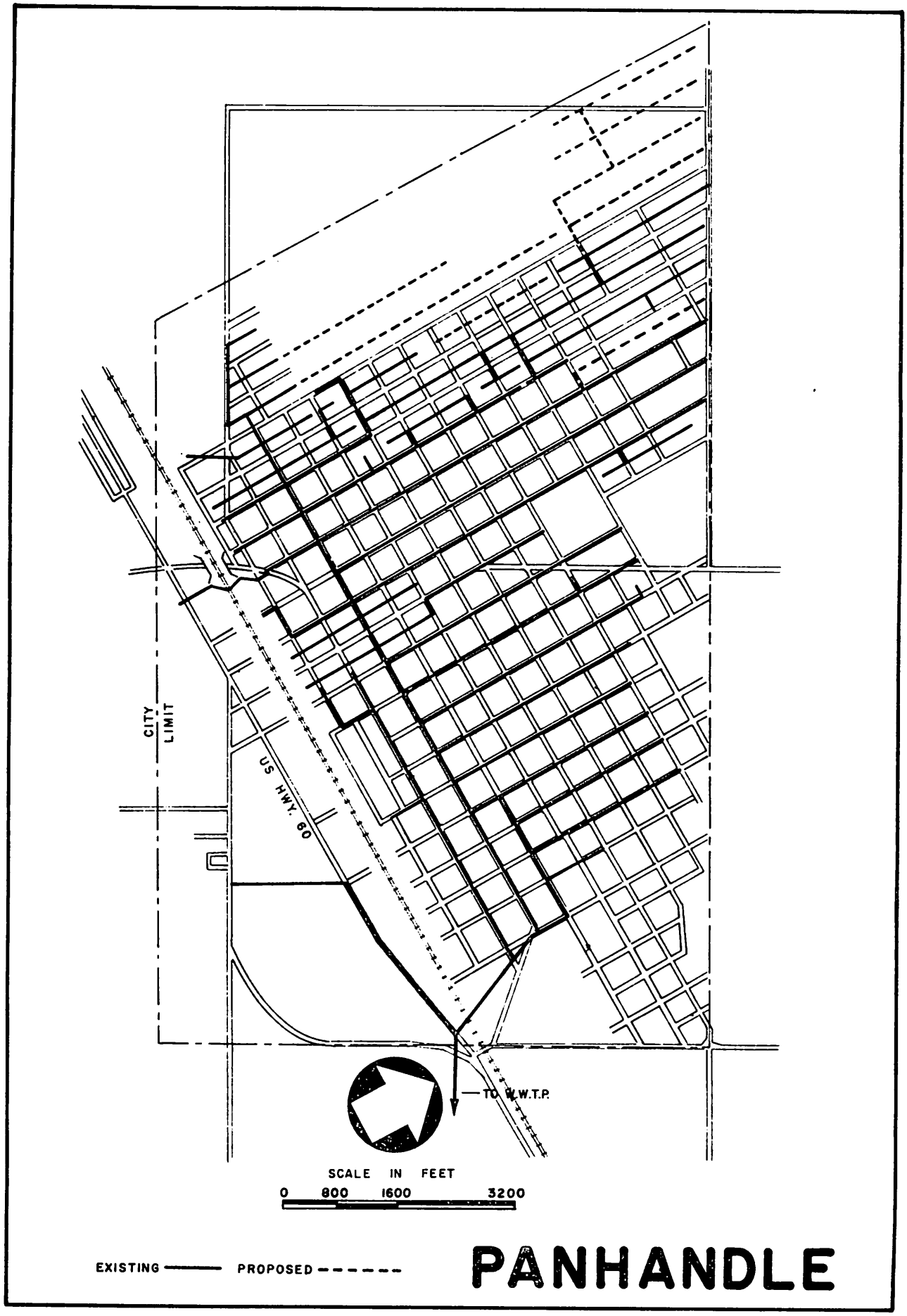
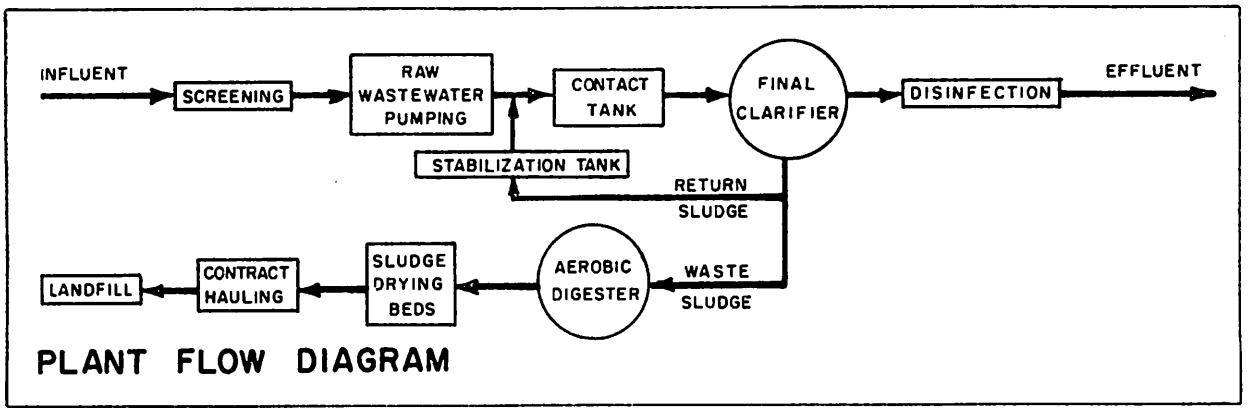
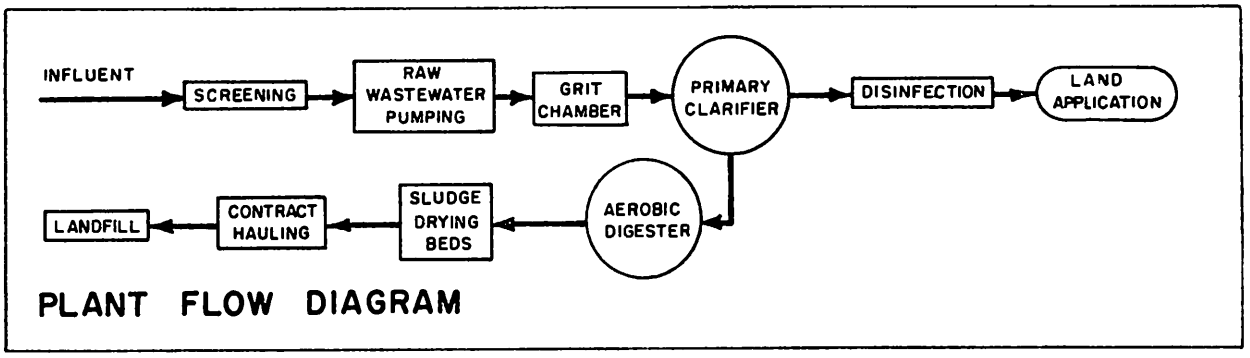


Figure Z-1: Existing and Proposed Collection System for the City of Panhandle.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF PANHANDLE



Alternative 1: Abandon existing facility - Construct contact stabilization plant



Alternative 2: Abandon existing facility - Implement land treatment

Design Population: 2,390
Design Flow:
Average - 0.26 MGD
Peak - 0.58 MGD

Effluent Requirements: (Alt. 1)
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Playa Lake (Alt. 1)

Wasteload Projections for the City of Panhandle

Planning Year	Population	Flow (MGD) Average	Peak
1975	2,237	No Data Available	
1983	2,300	0.24	0.54
1990	2,350	0.25	0.56
1000	2,390	0.26	0.58

EXISTING PLANT CAPACITY: 0.16 MGD

Figure Z-2

Table Z-1

Estimated Alternative Costs For The City of Panhandle

	Technical Alternative 1 Abandon Existing Plant Construct Contact-Stabiliation Plant	Technical Alternative 2 Abandon Existing Plant Implement Land Treatment
Collection System		
Capital Cost	$ 335,900	$ 335,900
O&M Cost	2,400	2,400
Treatment Plant		
Total Labor Cost	19,200	20,600
Total Energy Cost	6,100	4,800
Total Chemical Cost	600	1,400
Construction Cost	604,300	*964,000
Land Acquisition Cost	1,600	1,700
O&M Cost	30,600	32,600
Capital Cost	605,900	965,700
Total Capital Cost	941,800	1,301,500
Present Worth	1,301,100	1,659,600
Total Annual Cost	119,300	152,200
Monthly Charge per Connection	12.50	15.90
WITH FEDERAL GRANT IN AID	(75 Percent)	(85 Percent)
Total Capital Cost	235,500	228,800
Present Worth	593,500	604,000
Total Annual Cost	54,600	56,400
Monthly Charge per Connection	5.70	5.90

*Purchase of land used for irrigation is included in construction cost.

(2) Financial and Managerial Considerations: As delineated in Table Z-1, the total capital cost of this alternative is estimated to be $1,301,500, with a present worth of $1,659,600 and a total annual cost of $152,200. The resultant charge per connection, assuming three persons per connection, will be $15.90. These costs assume that land for irrigation must be purchased by the City and that the necessary piping and equipment must be purchased and installed.

If 85 percent Federal grant monies are available under PL 92-500, the monthly charge per connection will be $5.90.

Should the City be able to obtain a long-term lease on the land needed for irrigation instead of purchasing the land, the costs for this land treatment alternative will be substantially reduced.

The City should manage this system since it now manages the existing system.

(3) Impacts: Unless funding is available, this alternative will pose a financial burden to the City of Panhandle. The City must have managerial control over the irrigated land; therefore, this alternative assumes the land will be purchased and is not currently available. The City could substantially reduce its cost by obtaining a long term lease on a parcel of land.

Implementing a land treatment system will not adversely affect the water quality of the surface waters or ground waters and will provide a source of irrigation water not previously available. Since the City currently discharges into a playa lake, this alternative should not affect existing water rights.

No adverse social impacts due to implementation of this alternative are foreseen since the City currently has a centralized collection and treatment system. If the plant is operated and maintained properly, no odors or health problems will occur.

A new facility with increased design capacity will be capable of serving the needs of the increasing population.

3. WHEELER

(a) General: The City of Wheeler is in central Wheeler County about 18 miles east of the Oklahoma-Texas border. It serves as the county seat and as an agricultural center.

Residential land use is most dense in the southern, southwestern, and western areas of the City. These areas are also expected to be the sites of any new development. The major commercial areas lie along U.S. Highway 83, along State Highway 152, and in the downtown "square" area.

The area is underlain principally by Grandfield soils, which have only slight limitations with regard to septic tank use. The topography of the area slopes to the north, and drainage is primarily into Silver Creek.

The City of Wheeler operates an older Imhoff tank-oxidation pond wastewater treatment facility under a "no-discharge" permit. The facility is currently treating flows in excess of its design capacity and needs more holding pond area. Therefore, the facility should be expanded and upgraded, or replaced. No additions to the existing collection system are proposed.

(b) Technical Alternative 1

(1) Technical Plan: As a first alternative, the City could construct additional oxidation pond area to alleviate immediate needs.

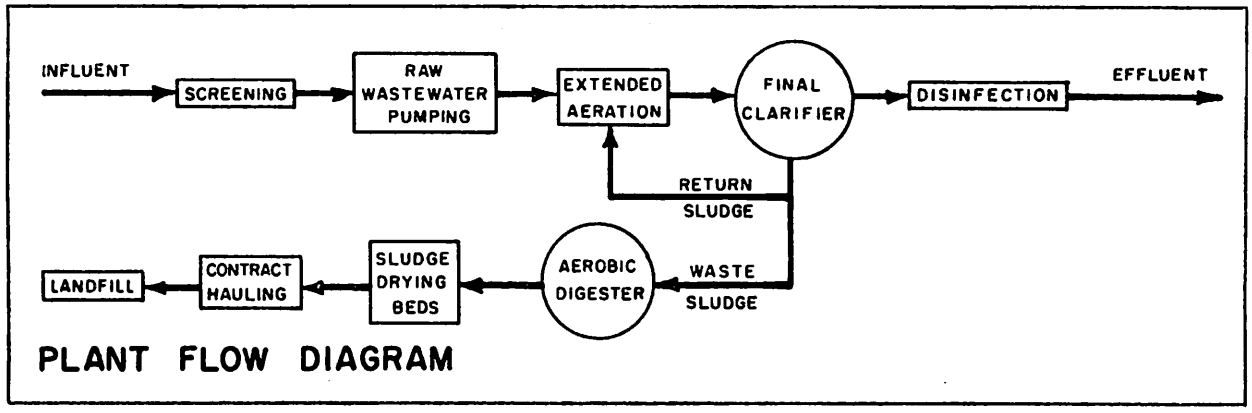
(2) Financial and Managerial Considerations: This immediate remedy will have a total capital cost of $53,200.

(3) Impacts: This alternative will provide immediate relief for the wastewater treatment needs in the City. However, this alternative is a temporary measure, and its effectiveness depends on the usability of the remainder of the plant, as assessed by a detailed engineering study.

(b) Technical Alternative 2

(1) Technical Plan: Alternative 2 proposes to abandon the existing facility and to construct an extended aeration facility at the existing site. The plant flow diagram of such a facility is shown on Figure Z-3.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF WHEELER



Alternative 2: Abandon existing facility - Construct extended aeration plant

Design Population: 1,070
Design Flow:
Average - 0.11 MGD
Peak - 0.28 MGD

Effleunt Requirement: (Alt. 2)
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Holding Ponds

Wasteload Projections for the City of Wheeler

Planning Year	Population	Flow (MGD) Average	Peak
1975	1,154	No Data Available	
1983	1,070	0.11	0.28
1990	1,000	0.11	0.28
2000	1,000	0.11	0.28

EXISTING PLANT CAPACITY: 0.07 MGD

Figure Z-3

(2) Financial and Managerial Considerations: As illustrated in Table Z-2, the total capital cost of constructing an extended aeration facility at the existing site is estimated to be $269,900. The present worth and total annual cost will be $491,100 and $45,000, respectively. The resultant monthly charge per connection, assuming three persons per connection, will be $10.50. If Federal grant monies are available under PL 92-500, the monthly charge per connection will be $6.20.

The City of Wheeler should manage the new facility since it is presently the managing entity of the old system.

(3) Impacts: No adverse social or political impacts are foreseen since the City currently operates a centralized collection and treatment system. A new extended aeration facility would provide efficient wastewater treatment and could attract industrial growth.

Without supplemental funding from either PL 92-500 or other sources, this alternative will place an excessive economic burden on the City and could adversely affect growth and development within the City.

4. WHITE DEER

(a) General: The City of White Deer lies in the eastern part of Carson County about 12 miles northeast of Panhandle and about 38 miles northeast of Amarillo. The City serves as an agricultural and petroleum center.

Population is estimated to be approximately 1,060 persons and is projected to decline to about 1000 persons by the year 2000.

The most dense residential areas are in the southern part of the City. The main commercial development lies along U. S. Highway 60 and along two blocks of Main Street. Any new establishments will probably locate in the Main Street area.

The area is underlain primarily by Pullman soils, which are severely limiting with regard to septic tank utilization. The topography is relatively flat and drainage is primarily into several surrounding playa lakes.

Table Z-2

Estimated Alternative Costs For
The City of Wheeler

	Technical Alternative 2 Abandon Existing Plant Construct Extended Aeration Plant
Collection System	
Capital Cost	No Additions Proposed
O&M Cost	
Treatment Plant	
Total Labor Cost	$ 13,800
Total Energy Cost	3,800
Total Chemical Cost	200
Construction Cost	268,600
Land Acquisition Cost	1,300
O&M Cost	20,300
Capital Cost	269,900
Total Capital Cost	269,900
Present Worth	491,100
Total Annual Cost	45,000
Monthly Charge per Connection	10.50
WITH 75 PERCENT FEDERAL GRANT IN AID:	
Total Capital Cost	67,500
Present Worth	287,800
Total Annual Cost	26,500
Monthly Charge per Connection	6.20

The City of White Deer currently operates a twenty-five year old Imhoff tank wastewater treatment plant, with stabilization ponds and sludge drying beds. The plant has a "no-discharge" permit because treated wastewater is released into a nearby playa lake. The facility has a design capacity of 0.085 MGD and is slightly overloaded at this time.

(b) Technical Alternative 1:

(1) Technical Plan: Alternative 1 proposes to abandon the existing facility and construct an extended aeration plant at the site of the present facility. The proposed plant's flow diagram is illustrated in Figure Z-4.

(2) Financial and Managerial Considerations: This alternative is estimated to have a total capital cost of $273,900 with a present worth of $502,900 and a total annual cost of $46,100. The resultant monthly charge per connection, assuming three persons per connection, will be $10.80. If 75 percent Federal funds are available under PL 92-500, the monthly charge per connection will be $6.40. These costs are delineated in Table Z-3.

The new facility should be managed by the City.

(3) Impacts: Unless Federal grant monies are available, this alternative will impose a financial burden upon the citizens of the City.

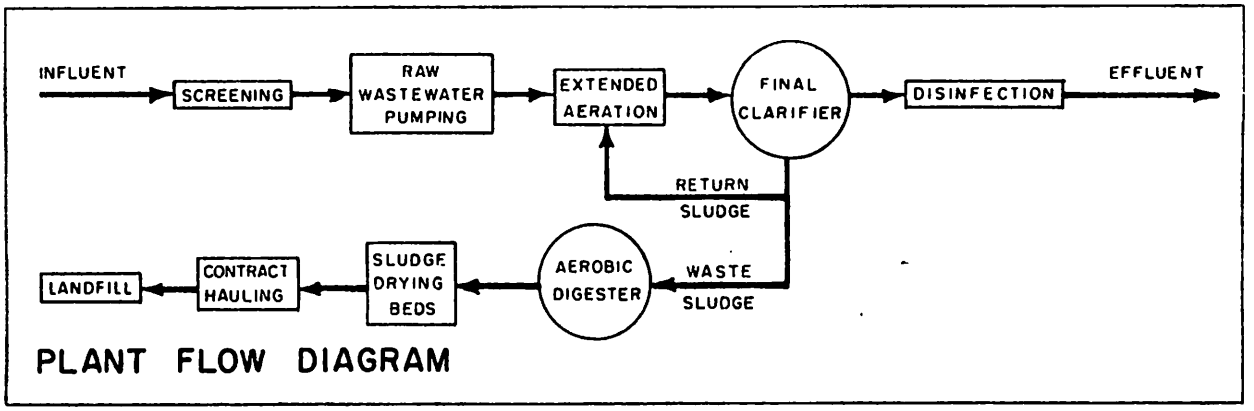
Construction of the new plant could stimulate the economy temporarily by providing several new jobs.

An extended aeration facility would not adversely affect the environmental quality of the area and would pose less of a threat than the existing facility.

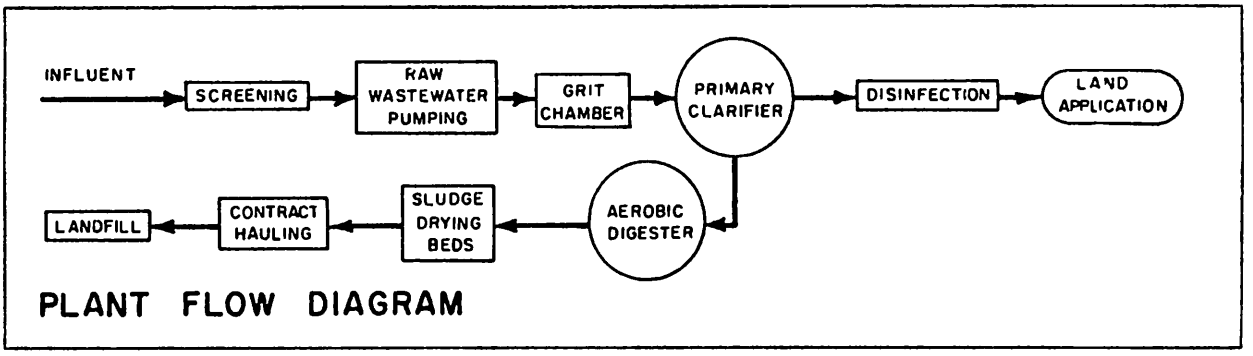
(c) Technical Alternative 2

(1) Technical Plan: Alternative 2 proposes to abandon the existing facility, replacing it with a primary treatment plant using land application for disposal of treated wastewater. This treatment scheme is illustrated in Figure Z-4.

WASTEWATER TREATMENT PLANT DATA FOR THE CITY OF WHITE DEER



Alternative 1: Abandon existing facility - Construct extended aeration plant



Alternative 2: Abandon existing facility - Implement land treatment

Design Population: 1,070
Design Flow
Average - 0.12 MGD
Peak - 0.28 MGD

Effluent Requirement (Alt. 1)
BOD_5 (mg/l) - 20
TSS (mg/l) - 20

Receiving Water: Playa Lake (Alt. 1)

Wasteload Projections for the City of White Deer

Planning Year	Population	Flow (MGD) Average	Peak
1975	1,054	No Data Available	
1983	1,070	0.12	0.28
1990	1,000	0.11	0.28
2000	1,000	0.11	0.29

EXISTING PLANT CAPACITY: 0.085 MGD

Figure Z-4

Table Z-3

Estimated Alternative Costs For The City of White Deer

	Technical Alternative 1 Abandon Existing Plant Construct Extended Aeration Plant	Technical Alternative 2 Abandon Existing Plant Implement Land Treatment
Collection System		
Capital Cost	NO ADDITIONS PROPOSED	NO ADDITIONS PROPOSED
O&M Cost		
Treatment Plant		
Total Labor Cost	$ 14,200	$ 14,400
Total Energy Cost	4,000	2,600
Total Chemical Cost	300	600
Construction Cost	272,600	*627,000
Land Acquisition Cost	1,300	1,300
O&M Cost	21,000	21,600
Capital Cost	273,900	628,000
Total Capital Cost	273,900	628,000
Present Worth	502,900	853,000
Total Annual Cost	46,100	78,200
Monthly Charge per Connection	10.80	18.30
WITH FEDERAL GRANT IN AID:	(75 Percent)	(85 Percent)
Total Capital Cost	68,500	94,200
Present Worth	296,400	318,000
Total Annual Cost	27,300	29,300
Monthly Charge per Connection	6.40	6.90

*Purchase of land used for irrigation is included in construction cost.

(2) Financial and Managerial Considerations: This alternative is estimated to have a total capital cost of $627,000 with a present worth of $853,000 and a total annual cost of $78,200. The resultant monthly charge per connection, assuming three persons per connection, would be $18.30. If 85 percent Federal funding were available under PL 92-500, the monthly charge per connection will be $6.90. These costs are presented in Table Z-3.

The new facility should be managed by the City.

(3) Impacts: Unless Federal grant monies are available, this alternative will impose a financial burden upon the citizens of the City.

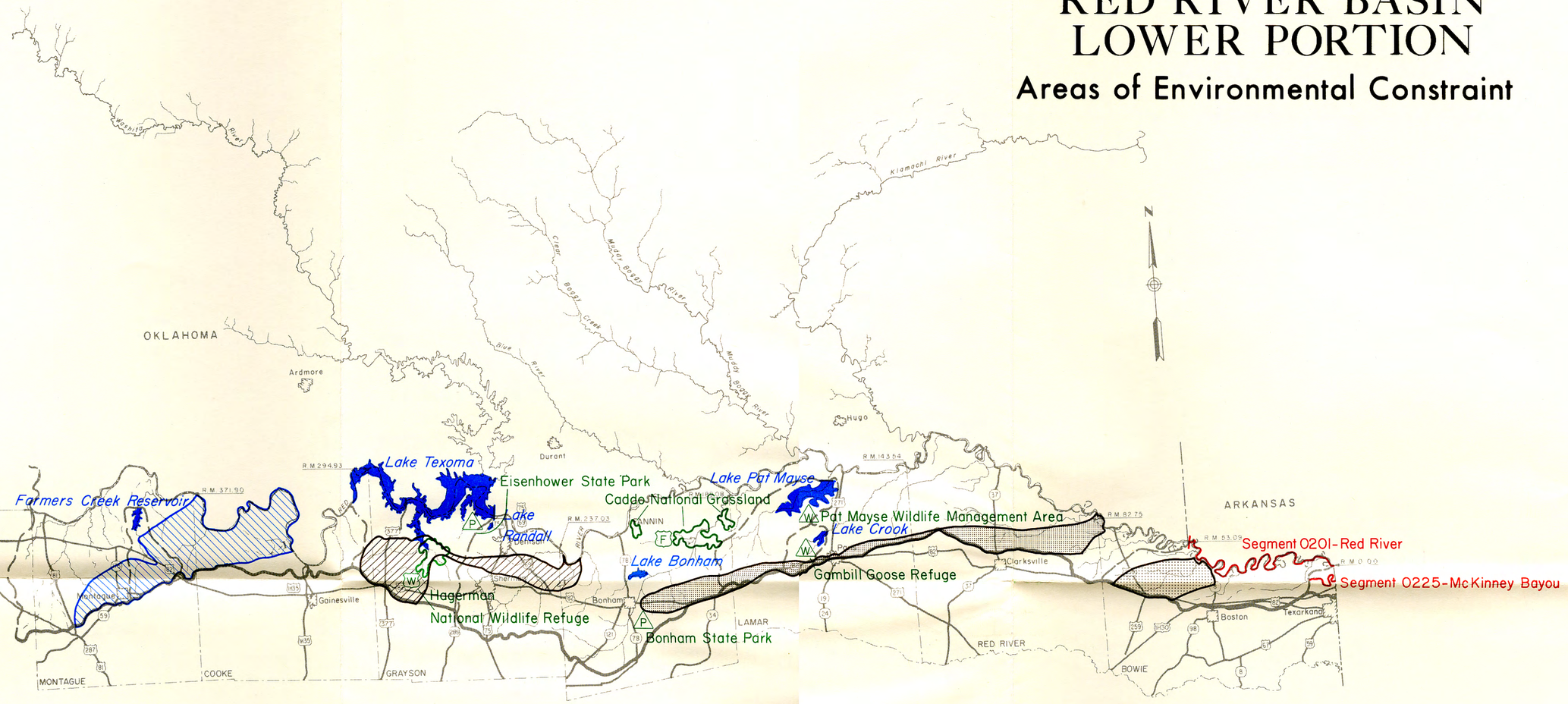
Construction of the new plant could stimulate the economy temporarily by providing several new jobs.

The land application method of wastewater disposal would not adversely affect the environmental quality of the area and would pose less of a problem than the existing facility.

Plate 6

RED RIVER BASIN
LOWER PORTION

Areas of Environmental Constraint



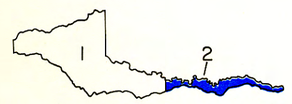
LEGEND

AQUIFER RECHARGE ZONES

- Trinity Group
- Blossom Sand
- Nacatoch Sand
- Woodbine

- Segment Drainage Area Boundary
- Basin Boundary
- R.M. - 0.00 River Mile
- Existing Reservoir
- (W) State Wildlife Management Area
- (P) State Parks
- (F) National Forest
- (W) National Wildlife Refuge
- Water Quality Segment
- Water Supply Reservoir

0 10 20 30 Miles



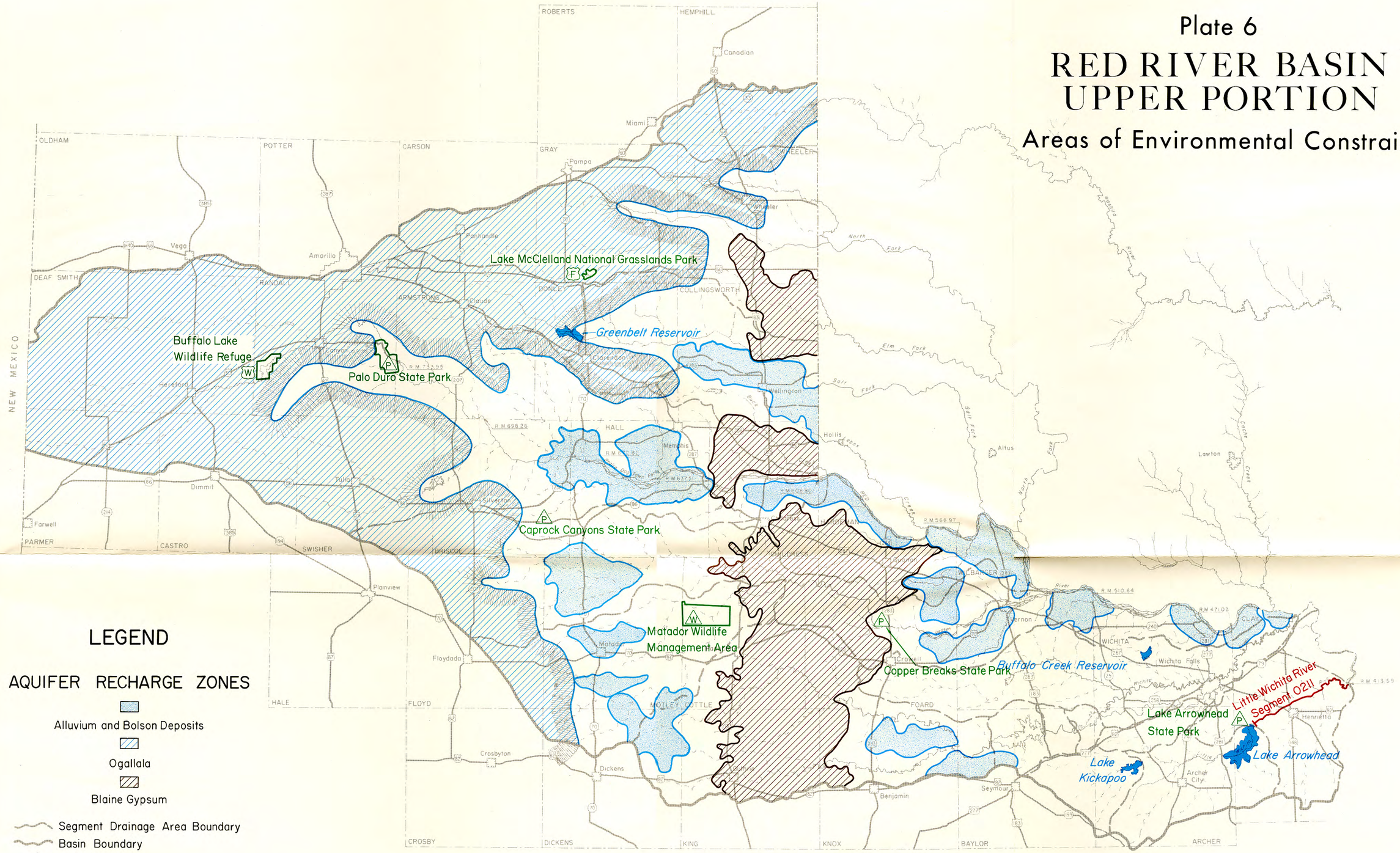
Sheet 2 of 2

Texas Department of Water Resources
January 1978

Plate 6

RED RIVER BASIN
UPPER PORTION

Areas of Environmental Constraint

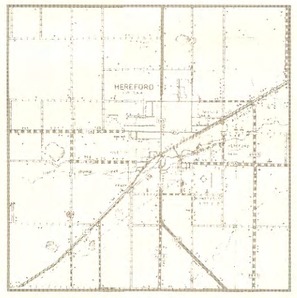


LEGEND

AQUIFER RECHARGE ZONES

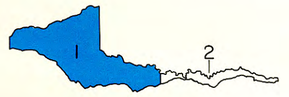
- Alluvium and Bolson Deposits
- Ogallala
- Blaine Gypsum

- Segment Drainage Area Boundary
- Basin Boundary
- River Mile (R.M. - 0.00)
- Existing Reservoirs
- (W) State Wildlife Management Area
- (P) State Parks
- (F) National Forest
- Water Supply Reservoirs
- Water Quality Segment
- (W) National Wildlife Refuge



INSET

0 10 20 30 Miles



Sheet 1 of 2

Texas Department of Water Resources
January 1978

PLATE 7(C)

WATER IMPACT ACTIVITIES

RED RIVER BASIN
UPPER PORTION

SEPTIC TANKS, FEED LOTS, SOLID WASTE SITES

EXPLANATION

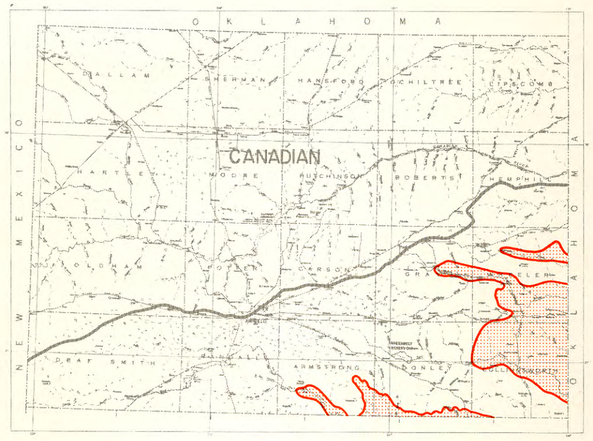
- R.M.-0.00 RIVER MILE
- BASIN BOUNDARIES
- SEGMENT DRAINAGE AREA BOUNDARIES
- EXISTING RESERVOIRS
- SEPTIC TANK AREA
- INDUSTRIAL SOLID WASTE SITE
- MUNICIPAL SOLID WASTE SITE
- FEED LOT

INSET

Texas Water Quality Board

0 10 20 30 MILES

1977



LEGEND

- Principal Lignite Deposits
- Operating Lignite Mine(s) (Strip Mining)
- Closed Lignite Mine(s) (Strip Mining)
- Principal Bituminous Coal Deposits
- Closed Shaft Mine
- Principal Sulfur Deposits
- Operating Sulfur (Frasch Method) and Processing Plant
- Closed Sulfur Mine (Frasch Method)
- Salt Domes
- Principal Gypsum and Anhydrite Deposits
- Operating Strip Mine(s)
- Principal Uranium Ore Deposits
- Operating Uranium Mine
- Potential Oil-Shale Deposits
- Operating Flourite Mine(s)
- Known Flourite Deposit
- Operating Talc Mines and Processing
- Principal Iron Ore Deposits
- Operating Iron Ore Mines

MINING ACTIVITIES MAP BIBLIOGRAPHY

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0 10 20 30 40 Miles

Plate 7(A)

Water Impact Activities

Mining Activities

1976